Annual report of the Department of Public Health / Union of South Africa.

UNION OF SOUTH AFRICA

ANNUAL REPORT

OF THE

PARTMENT OF PUBLIC HEALTH

Year Ended 30th June, 1931

PUBLISHED BY AUTHORITY

Price 2s. 6d.

THE GOVERNMENT PRINTER, PRETORIA
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DEPARTMENT OF PUBLIC HEALTH.

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Department of Public Health.

REPORT FOR THE YEAR ENDED 30TH JUNE, 1931.

TO THE HONOURABLE THE MINISTER OF PUBLIC HEALTH,

PRETORIA.

I have the honour to submit the Report of the Department of Public Health for the year ended 30th June, 1931.

I.—INTRODUCTORY.

In view of the financial depression the activities of the Department have had to be restricted in several directions during the year, and no extension has been possible, the only new departure being the stationing of an Assistant Health Officer at Johannesburg, especially in connection with the supervision of native health matters on the Mines, but who will also be available for any Health duty throughout the Union.

The most noteworthy occurrences during the year have been the visit of Professor N. H. Swellengrebel, Professor of Parasitology at the University of Amsterdam, and a member of the Malaria Committee of the League of Nations, to investigate Malaria in the Union and advise on the measures which should be taken in connection with that disease; the closure of the Robben Island Leper Institution and the transfer of its inmates to the Pretoria Institution; and the holding at Pretoria of a conference to consider the shortage of nurses and midwives in the Union, and the steps that should be taken to remedy it.

Dr. Mitchell was invited by the League of Nations Health Organisation to attend a meeting of its Leprosy Commission at Bangkok, Siam, in December, 1930, to be held in conjunction with the triennial Congress of the Far Eastern Association of Tropical Medicine. He was further invited by the Committee of the Leonard Wood Memorial for the Eradication of Leprosy to attend a Conference of leprologists at Manila, Philippine Islands in January, 1931. With the approval of and as representing the Government of the Union, he attended the meeting of the Commission at Bangkok, but was prevented by illness from attending the Conference at Manila; he returned to South Africa direct from Singapore at the end of January, and was on leave on grounds of ill-health to the end of July, 1931. During his absence from duty, Sir Edward Thornton, K.B.E., Senior Assistant Health Officer and Director of Medical Services (Defence), was appointed to act as Secretary for Public Health and Chief Health Officer for the Union.

Dr. F. C. Willmot, at the request of the Natal Provincial Executive, acted as member of the Commission appointed by that Body to investigate and report on the question of the extension of the boundary of the Borough of Durban, under the chairmanship of Mr. J. H. Hofmeyr, M.P. This Commission, after consultation with and with the concurrence of the local authorities concerned, recommended the extension of the boundary to include the whole of the peri-Durban area excepting Pinetown and certain outlying portions of Mayville and Sydenham and comprising, with these exceptions, the health board areas of South Coast Junction, Umhlatuzana, Malvern, Mayville, Sydenham and Greenwood Park. An Ordinance (No. 16 of 1931), giving effect to these recommendations was passed by the Natal Provincial Council to come into effect on 1st August, 1932. This large extension constituting a "Greater Durban" will facilitate solution of many of the health and local government problems of the area.

II.—VITAL STATISTICS.

The following table summarizes the salient features of the vital statistics of the European population for each calendar year since 1920 :—

TABLE A.—UNION OF SOUTH AFRICA: SUMMARY OF VITAL STATISTICS OF EUROPEAN POPULATION, 1920–1930.

Calendar Year.	European Population (estimated).	Birth Rate per 1,000 of Population.	Death Rate per 1,000 of Population.		Death Rate per 100,000 of Population from				Percentage of Total Deaths, the Cause of which was Medically Certified.	Infantile Mortality Rate (Deaths of Infants under One Year per 1,000 Live Births Registered).	Maternal Mortality Rate (Deaths of Mothers in connection with Pregnancy or Childbirth per 1,000 Live Births Registered.)	Survival Rate or Rate of Natural Increase. (Excess of Births over Deaths per 1,000 of Population).
			Actual or Crude.	Standardized.*	Diseases of Heart and Circulatory System.	Pneumonia and Bronchitis.	Cancer.	Tuberculosis (all forms).§				
1920.....	1,499,911	28·97	11·09	12·15	95·67†	113·87†	58·94†	46·00†	79·78	90·07	4·10†	17·88
1921.....	1,519,488‡	28·44	10·41	11·43	102·91	136·15	69·09	58·26	80·76	77·09	4·94	18·03
1922.....	1,556,241	27·52	9·48	10·41	97·99	127·24	70·88	47·74	82·96	72·91	5·21	18·04
1923.....	1,579,733	26·70	9·77	10·65	108·50	120·72	78·94	46·46	82·77	74·42	5·22	16·93
1924.....	1,610,774	26·29	9·62	10·44	123·92	123·79	76·36	51·59	84·74	73·73	4·75	16·67
1925.....	1,637,472	26·51	9·39	10·15	128·86	97·04	72·86	52·70	86·45	68·39	5·62	17·12
1926.....	1,676,660‡	26·16	9·59	10·28	127·21	113·44	71·18	53·41	87·76	64·82	4·56	16·57
1927.....	1,708,955	25·95	9·73	10·34	122·76	110·42	73·20	50·50	89·93	70·62	4·80	16·22
1928.....	1,738,937	25·77	10·15	10·69	133·53	127·72	77·52	50·95	89·93	70·49	4·98	15·62
1929.....	1,767,719	26.15	9.51	9.98	127·11	104·04	77·44	45·37	90·19	64·22	5·26	16·64
1930.....	1,798,647	26·43	9·68	‖	132·33	112·87	82·62	46·76	91·04	66·81	5·24	16·75

* The rate which would have obtained had the age and sex distribution of the population been the same as that of England and Wales at the 1901 census, the standard usually taken for international comparisons.

† Medically certified deaths only. Rates for subsequent years calculated on total deaths registered.

‡ Actual (per census).

§ Includes Miners' Phthisis combined with Pulmonary Tuberculosis.

‖ Figures not yet available.

It will be seen that the birth rate has increased during the past three years from 25·95 per 1,000 of population in 1927 to 26·43 in 1930; previous to that year there had for many years been a fairly continuous fall in the rate. The crude death rate for 1930 is somewhat higher than for 1929. This is accounted for by increased mortality from circulatory and respiratory diseases, and a higher infantile mortality rate. The death rate from cancer shows a considerable increase. The maternal mortality rate continues very high, although slightly lower than the previous year.

The following information and comparisons with other countries supplied by the Director of Census and Statistics are of special interest :—

Population of the Union.—European (according to the preliminary figure of the census taken in May, 1931) 1,827,166; Bantu, 5,357,800; Asiatic, 186,300; Mixed and other coloured, 582,700; (non-European figures are estimated on basis of census enumerations of 1921 and 1926).

Birth Rate.—European, per 1,000 of population, 26·4.

Other Countries.—Russia, 41·0; Portugal, 31·6; Lithuania, 28·8; Canada, 23·2; Holland, 22·8; United States, 19·7; New Zealand, 19·0; Scotland, 19·0; France, 18·2; Germany, 17·9; England and Wales, 16·3; Sweden, 15·2.

Death Rate.—European, per 1,000 of population "Crude" 9·7; "Standardized" (i.e. corrected for sex and age distribution so as to correspond with the international "standard" population in these respects) 1929, 9·98 (figure for 1930 not yet available).

Other Countries.—New Zealand, 8·8; Australia, 9·5; Holland, 10·7; Canada, 11·4; United States, 12·1; Germany, 12·6; England and Wales, 13·4; Scotland, 14·5; France, 16·5; Spain, 18·0; Russia, 21·7.

Infantile Mortality Rate.—(i.e. deaths of European infants under one year per 1,000 births): 1929, 64·22; 1930, 66·8. The figure for 1929 was the lowest rate on record, in 1911 it was 96.

Other Countries.—New Zealand, 34; Switzerland, 52; Australia, 53; Holland, 59; Sweden, 60; United States, 68; England and Wales, 74; France, 83; Scotland, 87; Canada, 93; Germany, 96; Italy, 120; Spain, 123; Lithuania, 146; Hungary, 182.

Survival Rate or Rate of Natural Increase.—(i.e. excess of European Births over deaths per 1,000 of the European population per annum): 16·8.

Other Countries.—Russia, 19·3; Egypt, 17·1; Holland, 12·1; Australia, 11·8; Canada, 11·8; Spain, 10·9; Italy, 10·3; New Zealand, 10·2; United States, 7·6; Germany, 5·3; Scotland, 4·5; England and Wales, 2·9; France, 1·7.

As regards non-Europeans, the available vital statistics of the Union are very incomplete. Notification of births and deaths is compulsory only in urban areas, and in many of these, owing to the large proportion of non-European male adults temporarily resident as labourers and to other circumstances, computations of death rates and similar statistics are useless or misleading.

It is greatly to be regretted that owing to lack of funds it was not possible to enumerate the non-European population at the last census. The only reliable figures available for the non-European population are those of the decennial census enumerations, the last of which took place in 1921, when the figures were: Bantu, 4,697,813; Asiatic, 165,731; mixed and other coloured, 545,548; total, 5,409,092. The estimated non-European population of the Union at 30th June, 1931, based on the 1921 census and the previous rates of natural increase were: Bantu, 5,519,500; Asiatic, 191,400; mixed and other coloured, 592,400; total, 6,303,300.

III.—ADMINISTRATIVE MATTERS.

1. *Staff.*—The organisation and functions of the Department and its principal personnel as at 30th June, 1931, is shown in the accompanying chart.

The principal changes during the year were :—

Dr. F. O. Fehrsen, Assistant Health Officer, Head Office, transferred to post of District Surgeon, Capetown, which he subsequently resigned to take up the post of Assistant Medical Officer of Health to the Capetown Municipality; Dr. F. W. P. Cluver, Senior Medical Officer, Roberts Heights, transferred from the S.A. Medical Corps to the post of Assistant Health Officer vacated by Dr. Fehrsen; Dr. D. H. S. Annecke (previously Senior Government Pathologist, Durban, temporarily seconded for Malaria duty), appointed to the newly-created post of Medical Inspector (Malaria); Dr. B. F. Sampson appointed Senior Pathologist, Durban, the post vacated by Dr. Annecke; Dr. F. A. Donnelly, Assistant Pathologist, Capetown, resigned and was replaced by Dr. R. H. Mackintosh.

2. *Council of Public Health.*—A meeting of the Council was held at Pretoria on the 15th and 16th October, 1930.

The following resolutions were passed :—

(1) " In view of the difficulty experienced in obtaining nursing staffs at certain institutions under the Public Health Department, consideration should be given to the advisability of increasing emoluments."

(2) " In view of the present inadequate facilities for general and maternity nursing, especially in rural areas, and the high maternal death-rate for the Union, this Council considers that the matter calls for the serious and urgent consideration of the Government and Parliament with a view to devising effective remedial measures."

(3) " This Council welcomes the proposal of the Minister of Public Health to convene a round table conference of representatives of the Provincial Administrations and hospital authorities, the South African Medical Council, the Trained Nurses' Association, and the Union Health Department, to consider the curriculum and requirements for the training of nurses and midwives to be embodied in the regulations under Act No. 13 of 1928."

Amongst the other matters discussed were the following :—

(1) *International Health Matters.*—Inspection and deratization of vessels; correspondence with International Office d'Hygiene Publique. Proposed International Regulations *re* Health Supervision of Aircraft.

(2) *Medical and Health Services.*—Arrangements in rural areas.

(3) *Health Publicity and Educative Work.*—Measures taken and contemplated.

(4) *Adulteration and Misdescription of Food, Drugs and Disinfectants.*—Administration and enforcement of new Act and Regulations.

CHART OF DEPARTMENT OF PUBLIC HEALTH *as at 30th June*, 1931.

Minister of Public Health (HON. D. F. MALAN).

Council of Public Health — Minister (Chairman.); Secretary and Chief Health Officer (Deputy Chairman); Mrs. S. B. Broers; Messrs. W. J. O'Brien, M.P., and L. C. Serrurier; Drs. C. Porter, K. Bremer, M.P., H. J. Steyn, and Sir Spencer Lister.

Leprosy Advisory Committee — Secretary and Chief Health Officer (Chairman); Sir Spencer Lister; Professors A. W. Falconer and O. K. Williamson; Drs. A. Pijper, F. C. Willmot, G. W. Robertson, A. J. Orenstein, K. Bremer, M.P., and G. A. Park Ross.

Secretary and Chief Health Officer (Dr. J. A. Mitchell).

Head Office Establishment:

2 Assistant Health Officers. (Sir E. N. Thornton† and Dr. W. A. Murray).

1 Chief Clerk (A. de V. Brunt).

1 Accountant (L. J. Hatch).

2 Principal Clerks. (C. N. Millard and A. Stuart).

2 Senior Clerks, 31 Clerks, Typists, etc.

Sections.

Assistant Health Officers (Detached).	Inspection and Field Staff.	Pathological Laboratories.	Port Health Officers.	District Surgeons.	Housing.	Leprosy Institutions.	Venereal Diseases Hospitals.	Malaria.	Tuberculosis.	Epidemic and Infectious Diseases (Plague, Typhus, Smallpox, etc.), and Vaccination.	Food and Drugs Adulteration; Habit-forming Drugs.	Local Authorities.	Other Bodies.
petown : Dr. F. C. Willmot) rban : Dr. G. A. Park Ross) hannesburg : Dr. E. H. Cluver) ngwilliamstown : Dr. L. Fourie)	Two Assistant Health Officers : (Drs. A. J. van der Spuy and F. W. P. Cluver). Five Inspectors (4 plague and 1 typhus).	Capetown, and Vaccine Institute, Rosebank: (Dr. W. F. Rhodes, Dr. R. H. Mackintosh, assistant). Durban : (Dr. B. Sampson). *South African Institute for Medical Research, Johannesburg.	Capetown : (Dr. J. M. Bosman). Durban : (Dr. G. A. Batchelor). Port Elizabeth : (Dr. H. W. A. Kay). East London : (Dr. R. V. S. Stevenson). Simonstown : (Dr. A. B. Bull). Knysna : (Dr. T. B. Newman). Mossel Bay : (Dr. F. T. Waldron). Port St. Johns : (Dr. T. M. Querney).	8 Whole-time. 3 Whole-time. (jointly). 311 Part-time. 322 Total.	Central Board—Sir E. N. Thornton (Chairman), Sir J. G. van Boeschoten, Messrs. F. W. Jameson, J. L. Hall, R. S. Gordon (Member & Secretary)	Pretoria : (Drs. J. W. de Vos, J. J. du Pr- le Roux and H. J. F. Wood). Emjanyana : (J. A. Macdonald, and Dr. A. R. Davison). Mkambati : (H. C. Bellew and Dr. F. S. Drewe). Amatikulu : (F. J. Roach and Dr. G. D. Stoute). Bochem : (J. H. Franz and Dr. H. C. Franz).	Rietfontein, Johannesburg : (Dr. J. Daneel). Kingwilliamstown *Bochem. *Elim. *Jane Furse Memorial. Several smaller hospitals.	Medical Inspector: (Dr. D. H. S. Annecke). Inspectors and Assistants.	Nelspoort Sanatorium : (Dr. P. Allan). *Holy Cross Medical Mission.	Field Staff. District Surgeons. Local Authorities. Magistrates, etc.	Inspectors, Customs, Police, etc. Chemical work done in chemical laboratories of Department of Agriculture at Capetown & Johannesburg.	222 Municipalities. 90 Village Management Boards. 37 Local Boards. 32 Village Councils. 41 Health Committees. 10 Local Administration and Health Boards. 92 Divisional Councils. 1 Health Board. 152 Magistrates. 5 Mining Commissioners. 682 Total.	South African Medical Council. South African Pharmacy Board. Rand Water Board.

* Receives Grant-in-Aid. † Is also Director of Medical Services (Defence).

(5) *Leprosy* and the closing-down of Robben Island Leper Institution.

(6) *Malaria.*—General policy of Government and appointment of special staff; visit of Sir Malcolm Watson; arrangements for investigation by Professor Swellengrebel.

(7) *Nurses and Midwives.*—Draft Regulations *re* Midwives under Public Health Amendment Act, No. 15 of 1928.

(8) *Supervision of Importation and Manufacture of Vacines, Sera, and other Therapeutic Substances.*—Draft regulations under Medical, Dental and Pharmacy Act, No. 13 of 1928.

(9) Bilharziasis, cancer, enteric fever, plague, rabies, smallpox and vaccination, tuberculosis, typhus fever, venereal diseases, housing and improvement of unhealthy areas, child and maternity welfare.

3. *Legislation affecting Public Health.*—No such legislation was introduced during last session of Parliament.

4. *District Surgeons.*—During the year additional district surgeoncies were established at Alicedale and Barrydale (Cape), and a District Surgeoncy at Buchuberg (Cape).

TABLE B.—DISTRICT SURGEONCIES AND ADDITIONAL DISTRICT SURGEONCIES AS AT 30TH JUNE, 1931.

Province.	Whole-time.	Whole-time, but jointly with local authority or public body.	Part-time.			Total.
			On inclusive annual salary.		On annual salary with certain supplementary fees and allowances.	
			District Surgeons.	Additional District Surgeons.		
Cape.....	3	3	1	7	138	152
Natal.....	3	—	—	1	39	43
Transvaal.....	2	—	7	8	52	69
Orange Free State..	—	—	—	11	47	58
UNION.....	8	3	8	27	276	322

The eight whole-time officers are those at Capetown, Durban (3), East London, Port Elizabeth, and Pretoria (2); the three whole-time officers appointed jointly with ocal authorities or public bodies are those at Grahamstown, Queenstown and Wynberg.

In December, 1929, following on representations by the District Surgeons' Group of the South African Medical Association (B.M.A.), the revision of the form of Agreement between the Government and part-time district surgeons (which has been in use since 1920) was decided on, and other Government Departments, Provincial Administrations, magistrates and others concerned were circularized on the subject. The revision was completed in December, 1930, and came into force on 1st January, 1931.

5. *Local Authorities and their Health Staffs.*—The numbers of the various classes of local authorities under the Public Health Act as at 30th June, 1931 are shown in Table "C."

TABLE C.—LOCAL AUTHORITIES UNDER THE PUBLIC HEALTH ACT (1919), AS AT 30TH JUNE, 1931.

Province.	Municipalities.	Village Management Boards.	Local Boards.	Village Councils.	Health Committees.	Local Administration & Health Boards.	Magistrates.	Divisional Councils.	Board of Health.	Mining Commissioners.	Total.
Cape.....	127	83	20	—	—	—	29	92	1	1	353
Natal.....	9	—	17	—	8	10	44	—	—	—	88
Transvaal.....	25	—	—	32	33	—	41	—	—	3	134
Orange Free State	61	7	—	—	—	—	38	—	—	1	107
UNION.....	222	90	37	32	41	10	152	92	1	5	682

Whole-time Medical Officers of Health are employed by nine of these, namely, the Municipalities of Bloemfontein, Capetown, Durban, East London, Johannesburg, Pietermaritzburg, Port Elizabeth and Pretoria, and the Divisional Council of the Cape. The Kimberley Board of Health, jointly with the Kimberley Municipality, has a medical officer who devotes some of his time to laboratory work at the Kimberley Hospital, but does no private practice. At Grahamstown and Queenstown there are whole-time officers who carry out the combined duties of District Surgeon and Health Officer to the Municipal and Divisional Council.

On the 30th June, 1931, the local authorities employing certificated sanitary inspectors or/and health visitors devoting the whole of their time to sanitary work were 82 in number, namely, 37 in the Cape, 10 in Natal, 12 in the Orange Free State, and 23 in the Transvaal. The total numbers of such persons are: Sanitary Inspectors, 219; Health Visitors, 18.

IV.—WORK OF THE DEPARTMENT.

1. *Inspections, Investigations and Field Work.*—The following is a summary of the activities of the medical officers of the Department during the year :—

TABLE D.—FIELD INSPECTIONS AND INVESTIGATIONS BY MEDICAL OFFICERS OF THE DEPARTMENT OF PUBLIC HEALTH DURING THE YEAR ENDED 30TH JUNE, 1931.

Particulars	*J. A. Mitchell.	Sir E. N. Thornton.	F. C. Willmot.	G. A. Park Ross.	W. A. Murray.	§E. H. Cluver.	A. J. van der Spuy.	L. Fourie.	W. F. Rhodes.	B. F. Sampson.	F. O. Fehrsen.	F. W. P. Cluver.	Total.
Systematic General Inspections of Local Authority Area...	1	—	2	3	4	17	—	30	—	—	33	12	102
Mines	1	—	—	—	—	93‡	—	—	—	—	—	—	94
Factories and Works (including "Offensive Trade" premises)	—	—	1	28	—	2	—	—	—	—	—	9	40
General and Chronic Sick Hospitals under Provincial Administration	—	5	5	3	—	3	21	2	—	—	1	6	46
Mental Hospitals and Other Institutions under Department of Interior	—	—	—	2	—	3	—	—	—	—	—	—	5
Leper Institutions, Venereal Diseases Hospitals, Tuberculosis Sanatoria, etc	4	1	8	2	—	4	3	1	2	—	—	—	25
Prisons, Reformatories and other Institutions	—	20	1	4	—	1	2	—	5	—	—	—	33
Schools and Orphanages	—	—	—	6	—	—	—	1	—	—	—	—	7
Nursing and Maternity Homes and Private Hospitals	—	—	—	7	8	21	8	1	—	—	40	11	96
Water Supplies	—	—	3	5	1	7	—	4	3	1	1	—	25
Drainage and Sewerage	—	2	—	9	3	11	1	3	1	—	—	—	30
Housing (including Industrial Housing) and Overcrowding, Nuisances and Insanitary Conditions	—	1	2	9	—	7	—	7	—	—	2	—	28
Departmental Enquiries under Public Health or other Act	—	—	—	—	—	1	—	—	—	—	—	—	1
Formidable Epidemic Diseases: Plague, Smallpox, Typhus, etc	—	—	10	5	1	8	—	8	—	1	3	7	43
Other Communicable or Preventable Diseases	—	—	—	55	1	30	—	21	1	2	—	1	111
Other Inspections, Investigations and Field Work	4	1	8	9	1	8	3	8	—	—	—	1	43
TOTAL	10	30	40	147	19	216	38	86	12	4	80	47	729
Distances Travelled (approximate) in connection with Inspections, Investigations, etc—													
Rail	1,420	8,000	5,700	2,036	3,000	2,813	5,597	2,146	500	292	2,051	2,101	35,656
Road	366	1,800	2,600	7,060	500	7,106	254	8,658	—	512	890	1,017	30,763
TOTAL	1,786	9,800	8,300	9,096	3,500	9,919	5,851	10,804	500	804	2,941	3,118	66,419
Days Absent from Office in connection with Inspections, Investigations, etc	14	79†	53	84	26	179	50	210	5	8	100	40	848

* Left Durban on 20th October, 1930, *en route* to India and Siam to attend meeting of Leprosy Commission of League of Nations and Congress of Far Eastern Association of Tropical Medicine at Bangkok in December, 1930. Returned to Union at end of January, 1931. On leave, owing to ill-health, to end of June, 1931.

† Includes 49 days spent in Uganda and on return trip therefrom.

‡ Includes 46 compounds, 13 locations, 29 hospitals, 5 underground inspections.

§ 13th–27th August, 1930: Attended, as representing the Union Department of Public Health, International Silicosis Conference in Johannesburg, convened by the International Labour Office, Geneva.

¶ During the year, Dr. D. H. S. Annecke carried out numerous inspections in connection with Malaria in the Transvaal and Zululand. These are not included in the Table.

2. *Addresses, Published Papers and Special Investigations by Members of the Staff :—*

Sir E. N. Thornton, *Assistant Health Officer*—

"A Report on an Investigation into Plague in the Protectorate of Uganda" (Uganda Government Publication, 6870-80, 16th October, 1930).

Dr. G. A. Park Ross, *Assistant Health Officer*—

"A Medical and Nursing Service for Natives in South Africa." (Journal of the Medical Association of South Africa, 13th September, 1930).

"The Routine and Treatment and Prophylaxis of Malaria." (Journal of the Medical Association of South Africa, 14th March, 1931.

"Malaria." Lecture with film. Arthur Smith Hall and Town Hall, Durban, during Health Week, January, 1931.

Dr. W. A. Murray, *Assistant Health Officer*—

"Hygiene in a Native Environment." Lecture, Native Welfare Association, Pretoria, September, 1930.

"Mothercraft and Infant Welfare." Lecture, Alexandra Township, Johannesburg, during Health Week, 27th October, 1930.

"Native Welfare." Lecture, World Service Exhibition, Johannesburg, 6th May, 1931.

Dr. E. H. Cluver, *Assistant Health Officer*—

"The International Silicosis Conference." (Journal of the Medical Association of South Africa, 27th September, 1930.)

"Anti-malarial Measures in the Union of South Africa." (British Medical Journal, 27th December, 1930.)

"Personal Hygiene in Hot Climates." Broadcast address, Durban Rotary Club, 6th January, 1931.

"Combating Venereal Diseases in South Africa." Address, Durban Health Week, 16th January, 1931.

"The Development of Western Medicine in the Native Territories." Address, World Service Exhibition, Johannesburg, 5th May, 1931.

"Malaria Prevention." Propaganda lectures in Natal and Zululand, January and February 1931.

"Heat Stroke in Deep Level Mines."

Dr. L. Fourié, *Assistant Health Officer*—

"Plague and its Prevention." Addresses in Heilbron, Vredefort, Bothaville and Uitenhage Districts.

3. *Health Publicity and Educative Work.*—The following pamphlets and leaflets have been prepared, published, and distributed by the Department to date. Pamphlets or leaflets of which revised editions have been published are omitted from the list :—

"Senecio Disease." (Warning Notice). No. 166 (Health).

"Food and Health." No. 194 (Health).

"Directions for the Prevention and Treatment of Malaria." No. 198 (Health).

"Anthrax." No. 239 (Health).

"Venereal Diseases : Their Prevention and Treatment." No. 248 (Health).

"Instructions to Persons suffering from Gonorrhoea." No. 249 (Health).

"Instructions to Persons suffering from Syphilis." No. 250 (Health).

"Poisoning by 'Stinkblaar' or Thorn Apple (*Datura stramonium and Datura tatula*)". (Warning notice). No. 256 (Health).

"Sleeping Sickness." (Warning Notice). No. 262 (Health).

"Smallpox : Duties and Powers of Local Authorities under Public Health Act, and procedure to be followed in dealing with outbreaks." No. 276 (Health).

"Directions for the Performance of Public Vaccination." No. 279 (Health).

"Dagga Smoking and its Evils." No. 289 (Health).

"Plague : A Brief Account of its Symptoms, Clinical Diagnosis, Morbid Anatomy and Treatment." (Drs. D. C. Rees and J. A. Mitchell). No. 293 (Health).

"Measures against Plague." No. 306 (Health).

"Plague : Its Control, Eradication and Prevention." No. 316 (Health).

"Plague and its Cause and Prevention." No. 317 (Health).

"Rodents : Description, Habits, and Methods of Destruction." (W. Powell). No. 321 (Health).

"Fly-proof Latrines for Coloured Persons." (Dr. G. A. Park Ross). No. 334 (Health).

"Houseflies : Their Life-history, Destruction, and Prevention, and their Influence on Sanitation and Health." No. 335 (Health.)

"Bilharzia (Human Redwater) Disease." No. 339 (Health).

"Snake-bite and its Treatment." No. 348 (Health).

"First Measures in Malarial Prevention for Farmers and Settlers," together with illustrated wall-poster: "Danger of Mosquitoes." (Drs. G. G. Hay and G. A. Park Ross.) Published jointly with the South African Red Cross Society (Transvaal). No. 356 (Health).

"Instructions to Native Patients suffering from Syphilis or Gonorrhoea." (In Zulu, Sixosa, Sesuto, and Sechuana.) No. 258 (Health).

"Malaria Catechism." No. 360 (Health).

"Influenza." No. 363 (Health).

"Typhoid or Enteric Fever: Its Causes, Spread, and Prevention in South Africa." No. 365 (Health.)

"Care of the Teeth and Prevention of Dental Disease in Children." No. 368 (Health).

"Leprosy in the Transkei." No. 372 (Health).

"Catechism about Typhoid or Enteric Fever." No. 378 (Health).

"The Teeth: How to Prevent Decay." No. 379 (Health).

"Plague Danger in Cape and South-Western Districts: Measures and Procedure in Event of Outbreak." No. 380 (Health).

"The Cause and Prevention of Simple Goitre." No. 394 (Health).

"Typhus or Louse Fever." No. 417 (Health).

"Consumption, its Causes, Prevention and Treatment." No. 439 (Health).

"The Control of Malaria by Larvicidal Methods." No. 435 (Health).

The following cinema films have been purchased by the Department and are available to local authorities and public bodies for exhibition purposes:—

"The Rat Menace."

"Swat that Fly."

"Fly Danger."

"Your Mouth."

"The Story of John McNeil" (tuberculosis).

"The War on the Mosquito."

"How to Live Long and Well."

"One Scar or Many" (vaccination).

"In His Father's Footsteps" (insanitary farm-typhoid).

"The Long versus the Short Haul" (dirty milk).

"Bringing it Home" (child welfare).

"Bilharziasis."

"Malaria" (in Hollands).

A set of small models, specially made for the Department by a health inspector who is also a clever handyman, is stocked by the Department's health officers at Pretoria, Capetown, and Durban for loan to local authorities and other bodies for demonstrations during "health weeks" and on similar occasions, and for illustrating lectures on hygiene. Each set includes a model for illustrating:—

(1) methods of rodent-proofing buildings;

(2) an "open-air" room for home segration of a tubercular patient;

(3) Baber's maggot-traps;

(4) Russell's modified maggot-trap;

(5) Russell's modified box fly-trap;

(6) Squatting closet for native use.

The Department has purchased an up-to-date epidiascope with portable electric generator for its propagandist campaign—also three magic-lanterns. Lantern slides are now on order. It is hoped to increase educative work in connection with campaigns against malaria, plague, bilharzia, and fly-borne disease and general insanitation, so as to ensure the co-operation of an enlightened public.

4. *Laboratories and Medical Research.*—(*a*) *Laboratories.*—The work done by the Government Laboratories at Capetown and Durban and that carried out at the cost of the Government at the South African Institute for Medical Research, Johannesburg and at Port Elizabeth is shown in Table "E."

TABLE E.—PATHOLOGICAL LABORATORIES: ANALYSES AND EXAMINATIONS, YEAR ENDED 30TH JUNE, 1931.

Particulars.	Laboratories.		South African Institute for Medical Research.	
	Capetown.	Durban.	Johannesburg.	Port Elizabeth Branch.
Specimens Examined for—				
Government Departments—				
Agriculture	17	6	—	—
Customs and Excise	152	—	17	—
Defence	348	27	1,237	—
Interior (Mental Hospitals, etc.)	695	181	209	59
Justice	—	156	1,467	4
Justice (Prisons)	774	359	367	—
Mines and Industries (including Miners' Phthisis)	—	—	11,747	—
Posts and Telegraphs	105	—	—	—
Public Health (including Leper Institutions)	8,111	3,754	27,904	4,323
Public Works	4	3	—	—
South African Railways and Harbours	165	67	—	—
Other Government Work	295	182	700	19
General Hospitals (Provincial)	1,699	8,207*	28,791	2,006
Local Authorities	16,756	3,163	4,091	2,964
Medical Practitioners	8,788	16,101	11,933	1,383
Department of Education (Provincial)	—	—	—	—
Other Governments or Administrations	1	2	72	—
Others	—	590	453	20
TOTAL	37,910	32,798	88,988	10,778
Manufactures and Issues—				
Autogenous Vaccines...c.c.	625	740	36,050	7,875
Bacterial Vaccines (stock)...c.c.	—	—	638,279	Included in Johannesburg figures.
Tuberculin Dilutions...c.c.	—	—	420	
Sera (various)...c.c.	—	—	500,596	
Anti-rabic Vaccine...c.c.	24,000	—	—	
Bulgarian Milk Cultures...bottles	—	—	367	
Insulin...tubes.	—	—	3,652	
Chaulmoogra Oil Preparations...litres	—	—	—	—
Smallpox Vaccine—Calf Lymph (prepared at Vaccine Institute, Rosebank)..tubes	1,404,600	—	—	150
Attendances at Courts of Justice by Members of Staff	16	16	1	—
Total Days' Absence entailed by such attendances	16	21	2	—

* A proportion of this work was in connection with the Addington Hospital, Durban, and is done in conjunction with Dr. F. R. Johnstone, bacteriologist to the hospital.

(*b*) *Poor White Research.*—Owing to unforseen delays the Research Committee appointed under the terms of the Carnegie Trust Grant have not yet been able to complete its report. It is expected that the report will be ready for publication by the end of 1931.

(*c*) *Tuberculosis.*—The report of the Tuberculosis Research Committee is now complete and is being published by the South African Institute for Medical Research.

(*d*) *Malaria.*—Professor Swellengrebel's investigation is dealt with in the section on malaria. His general report is printed in the annexure. The scientific and technical report on his researches, prepared jointly by Professor Swellengrebel, Mr. Botha de Meillon of the South African Institute for Medical Research and Dr. D. H. S. Annecke, Medical Inspector in this Department, is being published by the South African Institute for Medical Research.

5. *Port Health Administration.*—The following table summarizes health work at the ports of the Union during the year :—

TABLE F.—PORTS OF THE UNION: HEALTH MEASURES DURING THE YEAR ENDED 30TH JUNE, 1931.

Particulars.	Capetown.	Durban.	Port Elizabeth.	East London.	Mossel Bay.	Knysna.	Port St. Johns.	Simonstown.	Port Nolloth.	Total.
Vessels dealt with	1,120	1,302	806	625	202	28	20	96	69	4,268
Cases of infectious or communicable diseases dealt with	179	369	—	—	—	—	—	—	—	548
No. of Vessels involved	82	102	—	—	—	—	—	—	—	184
Disinfections—										
Vessels	32	3	—	—	—	—	—	—	—	35
Consignments second-hand clothing and other articles	35	129*	35	—	—	—	—	—	—	199
Bales of mixed articles	—	24	35	—	—	—	—	—	—	59
Deratizations under International Sanitary Convention—										
No. of Vessels Deratizod and Certificates Issued	1	96	—	—	—	—	—	—	—	97
No. of Exemption Certificates Issued	11	33	—	—	—	—	—	—	—	44
Rats Destroyed on Vessels and on Shore	2,833	5,080	1,921	711	180	—	—	—	—	10,725

* In addition, the personal effects of 1,727 Indian and Coloured passengers were disinfected.

No cases of *smallpox* occurred on ships arriving at any of the Union ports during the year. The s.s. "Umzumbi" which arrived in Port Natal on the 15th February was reported to have landed two cases of smallpox at Colombo. As the Master reported all well on arrival, fourteen days after leaving Colombo the ship was given full pratique after medical examination of the crew and passengers.

Careful *anti-rodent measures* continue to be adopted at all ports to obviate the possibility of plague being introduced from ships. At Durban rat-proof hurdles were used extensively during the mealie season, making it possible to deal effectively with each stack of bagged grain as it was removed from the dock area for shipment. Large numbers of rodents were poisoned or trapped at the various ports. Very successful deratization even in loaded ships is being carried out with Zyklon B. Thus the s.s. "Choyo Maru" which arrived at Durban in May having previously called at Vladivostock, Miike, Beira and Lourenco Marques was found on inspection to be badly rodent-infested although it carried a deratization certificate issued at Miike, Japan, on the 29th of December, 1930, sulphur having been the fumigant used. Deratization with Zyklon B was therefore carried out on the day of the arrival. Subsequent examination of the holds revealed a total of 83 rats killed by the cyanide gas.

The only cases of *typhus* on ships entering Union ports occurred on the s.s. "Eliane L.D." which arrived at Durban direct from the port of Rotterdam. Two members of the crew were removed to the Infectious Diseases Hospital suffering from the disease. In both cases the laboratory examination by the Weil-Felix test was positive. Disinfestation of the clothes, bedding and apartments occupied by the patients was carried out. No further cases occurred.

For obviating the possibility of introducing *psittacosis* into the Union the restrictions against importation of birds of the parrot family were further extended by proclamation (No. 211 of 1931) to include lovebirds and budgerigars, since doubt has been expressed whether they belonged to the psittacidae.

6. *Health Supervision of Air-Craft.*—The grave risk of the introduction of formidable epidemic diseases into the Union by means of aircraft have been pointed out in previous annual reports. The regulations framed in consultation with the Civil Air Board in conjunction with the existing provisions of the Public Health Acts and Regulations have hitherto been fairly adequate for dealing with the small amount of aerial traffic entering or leaving the Union. There is, however, prospect of great development of this traffic in the near future. Definite routes have recently been laid down and a bi-weekly service to England *via* Egypt, where it will connect with the existing service from India and the East is contemplated. The African route of the Imperial Airways will have aerodromes or landing places at the following places :—

Egypt.—Alexandria, Cairo, Assiut, Luxor, Assouan, Wadi Halfa.
Sudan.—Kareima, Khartoum, Kosti, Malakal, Shambe, Juba.
Uganda.—Butiaba, Port Bell.
Kenya.—Kisumu, Nairobi.
Tanganyika.—Moshi, Dodoma, Mbeya.
Northern and Southern Rhodesia.—Mpika, Broken Hill, Salisbury, Bulawayo.
Union.—Pietersburg, Germiston, Kimberley, Victoria West, Beaufort West, Touws River, Kraaifontein, Capetown.

The disease against the introduction of which we have particularly to guard is Yellow Fever which is endemic along the coast of tropical West Africa. The insect carrier of this disease, the stegomyia mosquito, occurs throughout the Union. Infection might therefore conceivably be introduced by a passenger disembarking at a Union Aerodrome who is actually suffering from or incubating the disease. There is the further risk of conveyance of the infection to the East Coast of Africa and to India and the East.

The route above indicated presents no serious danger since it passes through no area in which Yellow Fever is endemic, but the French Aero-Postal Company proposes to establish in the near future a Trans-African service from France to Madagascar. The proposed route will be from Oran in Morocco across the Sahara to Miamey, thence to Lake Chad and Coquilhatville whence the Belgian air route to Elisabethville will be followed. From Elisabethville the service will be continued to Broken Hill, where it will connect with the Imperial Airways Route and thence to Beira. There is, therefore, the possibility of passengers who may have come from Yellow Fever country transferring at Broken Hill from the French service to Imperial Airways. Apparently no direct service to the Union down the West Coast of Africa is as yet contemplated, but the possibility of flights apart from regular services must always be borne in mind.

The Office International d' Hygiene Publique, on the Permanent Committee of which the Union is represented by Col. P. G. Stock, C.B., C.B.E., considered during the year a Draft of the proposed International Convention for the Sanitary Control of Aircraft. This draft was not considered entirely satisfactory by this Department, mainly because it placed sole reliance on precautions to be carried out or enforced by the authorities of the country of departure and, whatever the circumstances, did not provide for a period

of quarantine or detention and observation in the country of arrival. Col. Stock was instructed to press for amendments at the May session when the Draft was discussed. He did so very effectively with the result that it is understood that the revised Draft, which is now being prepared for consideration by the different Governments, has been amended in such a way as should enable the Union to subscribe to it. These amendments allow of special safe-guards in the case of persons landing in the Union from an area where Yellow Fever is endemic or epidemic. There is some possibility that the League of Nations will in the near future arrange for a meeting of the various Medical Directors and Chief Health Officers in Africa to discuss this and analagous problems.

7. *Adulteration or False Description of Food, Drugs and other Articles.*—The Food, Drugs and Disinfectants Act, No. 13 of 1929, and the regulations thereunder, came into force on the 1st April, 1930. The following table shows the samples taken for examination or analysis under that Act during the year, and the results:—

TABLE G.—SAMPLES TAKEN FOR EXAMINATION OR ANALYSIS UNDER ACT NO. 13 OF 1929 DURING YEAR ENDED 30TH JUNE, 1931 AND THE RESULTS.

Place.	Total Taken.	No. Analysed or Examined.	No. found Adulterated or Incorrectly or Falsely Described.	Prosecutions.	Convictions.	Remarks.
Ports of Union.....	725	668	284	—	—	20 consignments detained pending relabelling. 3 consignments reshipped or destroyed.
Cape Province.....	1,721	1,673	383	35	29	
Natal Province.....	368	368	37	18	18	1 conviction quashed on appeal to Supreme Court.
Transvaal Province..	639	638	40	33	30	
Orange Free State Province.....	106	105	7	7	5	
TOTALS.....	3,559	3,452	751	93	82	

Imported Articles dealt with at Ports of the Union (including Inland Customs' Ports of Entry).—This work is carried out by this Department with the co-operation and assistance of the Department of Customs and Excise. The total of 668 samples shown in the foregoing statement as analysed or examined included a large variety of articles, of which 48 were found on analysis to be below the standards laid down, 20 consignments were detained and the agents or importers called upon to re-label the articles in conformity with the requirements of the Act or the Regulations, and 3 consignments which were refused admittance were either destroyed or re-shipped in terms of Section 11 (4) of the Act. Warning notices were issued in respect of 261 samples found to be below standard or not correctly labelled.

Perishable articles, flour, meal and bread (whether sold in sealed packages or not)—also other articles of food not packed or sold in sealed packages.—Where the Minister has delegated powers under Section 2 (3) of the Act, enforcement is carried out by the Local Authority; elsewhere it falls to be dealt with by this Department. During the period under review a total of 1,114 samples (including 1,008 milks) were purchased by and analysed on behalf of the 21 Local Authorities to which the necessary powers have been delegated (these include all the larger Local Authorities except the Capetown Municipality which has not so far requested any such delegation); 92 samples were found to be adulterated and prosecutions were instituted in 55 instances. The arrangement in force entitled each such Local Authority to the examination or analysis, free of charge in a Government laboratory, of a number of samples annually, calculated on the basis of four samples per thousand of the European population at the last Census. In the other areas where, with the co-operation of the Police, sampling is undertaken by this Department, a total of 1,077 perishable articles (including 1,062 milks) were procured for analysis, of which 244 were found to be adulterated, and prosecutions were instituted in 24 instances.

Articles manufactured in the Union and packed or sold in sealed packages.—All such articles are dealt with by this Department, with such assistance as the Local Authority may render, and include the articles to which certain provisions of the Act were applied in terms of Government Notice No. 574 of 1930, namely, any ointment, cream, powder or similar substance for application to or use for the human skin or hair, soap, tobacco, cigars, cigarettes, snuff and chewing-gum. Action has so far been mainly directed to enforcing the observance of the labelling provisions of the Act and regulations. Inspectors

are going over their areas systematically, visiting manufacturers, wholesalers and distributors, and obtaining sample labels; these are carefully scrutinised and, as a result of the irregularities detected, a very large number of warning notices have been issued or interviews arranged. The policy of the Department is, as far as possible, to avoid causing manufacturers and distributors needless expense or inconvenience, and to allow the temporary use of adhesive labels or other makeshift devices so long as it is clear that labels in strict accordance with the Act and Regulations will be brought into use as soon as is reasonably practicable. The work of label inspection and correction is nearly completed and steps are now being taken to ensure that the contents of packages are in accordance with the labels; 617 such samples were purchased and prosecutions instituted in 13 cases, including 8 fruit syrups, 3 chicories, 1 confectionery and 1 honey.

Drugs and Disinfectants.—Twenty-six samples of drugs were purchased and four (all eucalyptus oil) were found to be adulterated or not up to standard. All disinfectants are examined by the Government Pathologist in the Department's pathological laboratory at Capetown, 77 samples having been taken during the year from consignments detained at the ports. 46 warning notices were issued in respect of disinfectants found to be incorrectly labelled. In scrutinizing disinfectant labels regard has also to be had to the labelling requirements of the Medical, Dental and Pharmacy Act, No. 13 of 1928, in respect of poisons.

General Warranties.—Applications for the Registration of general warranties, in terms of Section 28 of the Act, are only entertained in the case of essential food articles. Up to the 30th June, 1931, a total of 21 such warranties were registered, the majority being in respect of coffee and coffee mixtures.

All analytical work under the Act, with the exception of that performed in the municipal laboratories at Pretoria and Durban, has been carried out in the Government Chemical Laboratories at Capetown and Johannesburg administered by the Department of Agriculture. The Chief of the Division of Chemistry in that Department at Pretoria has given invaluable advice and assistance from the chemical side and, with the staff of the two laboratories mentioned, has cordially assisted and co-operated in every way. Inadequacy of the staff at the Johannesburg Chemical Laboratory has considerably restricted the activities of this Department and the Local Authorities to which powers have been delegated under Section 2 (3) of the Act, in the taking and submission of samples for analysis. Owing to the resignations of members of the chemical staff and other causes, and to vacancies not having been filled, the Laboratory is much below its normal complement of qualified analysts. The position was such that at the beginning of 1931, it became necessary to circularise the Local Authorities served by this Laboratory, restricting the samples which they could submit for analysis to milks only, and to limit the number of such samples. This restriction has entirely prevented the taking and submission of samples of other foodstuffs which, under normal conditions, would have been effected. Some of the Municipalities concerned have expressed their dissatisfaction at this curtailment of their activities, which in some cases has reduced the number of samples which they are entitled to submit by nearly half. It is hoped that before long the position will be remedied and full activities resumed.

The working of the Act has undoubtedly led to much improvement as regards correct labelling and the prevention of false or misleading descriptions, has greatly reduced adulteration and the use of preservatives in food-stuffs, has effectively checked or stopped the manufacture, importation or sale of spurious or sophisticated coffee, honey, pepper and other articles and has thus benefited both the comsuming public and the honest manufacturer, producer and trader. It is gratifying to be able to record that the assistance and co-operation extended to the Department in connection with the framing and bringing into force of the Act and Regulations by Chambers of Commerce, Manufacturing Associations and similar bodies and the leading firms of importers, producers, and manufacturers of foodstuffs have been continued, and that with very few exceptions their lead has been followed by shopkeepers and retailers generally.

8. *Health of Natives on the Witwatersrand Gold Mines.*—Systematic inspections of mine hospitals, compounds and locations were again carried out. An Assistant Health Officer of the Department (Dr. E. H. Cluver) is now stationed in Johannesburg; it is therefore possible to carry out inspections on a more extensive scale and to make more detailed enquiry into particular problems of mining hygiene.

On most mines the standard of hygienic efficiency continues high. Mine Managements in general readily co-operated with the Department in effecting improvements where such were considered necessary.

Plans for new compounds and hospitals or extensions or alterations to these are submitted to the Departments of Native Affairs and Public Health for approval. The existing regulations dealing with these matters are old and in several respects unsatisfactory. Although Mining Companies have in the past conformed to this arrangement it was considered wise to bring the existing regulations into line with modern public health

knowledge. These regulations were drafted after joint meetings with representatives of the two Departments and the Gold Producers Committee. Limitation of the number of natives in the compound rooms and adequate separation of the sleeping boys will, amongst other things, be required by these regulations.

Several compounds were found to be dangerously overcrowded. This is to be ascribed chiefly to the plethora of Native labour available on the gold mines during the present period of general depression. This excessive supply is presumably of a temporary nature and the mines are therefore justifiably loth to provide increased accommodation. Nevertheless the overcrowding was in certain instances too gross to allow of its continuation for any length of time without grave danger of the outbreak and spread of epidemic disease. In such cases steps were taken for the provision of increased accommodation.

Typhoid incidence among the native labourers continues to be unsatisfactory; according to notifications it is about 4 per 1,000 per annum. This is high for an industry which is able to select all its native employees by careful medical examination and is in a position to supervise them very completely in regard to feeding and housing. Various avenues for improving matters have been investigated. As the result of recommendations made by the Department the mine sanitary removal services of all the Reef Municipalities have been brought up to a high standard; where conservancy is in vogue the dual pail system has in all cases been adopted. Only a few mines have sewerage, the most satisfactory system. In new mines with a probability of long life this system is being strongly urged in preference to conservancy.

Difficulties still arise in regard to suitable dietaries; this is almost unavoidable with a large mass of primitive native labourers content to subsist almost exclusively on a limited and badly balanced dietary seriously deficient in vitamins. The necessary foods accessory to mealie meal are provided by all the mines, but unless there is careful supervision many natives will not utilize them. This no doubt accounts for the not infrequent cases of scurvy which crop up and is probably an important factor in the high incidence of pneumonia.

Heat Stroke.—As pointed out in last Annual Report, the increasing depth at which mining is being carried out on the Witwatersrand is resulting in physiological strains due to increasing underground atmospheric temperatures. The first recorded death from heat injury on these mines occurred in November, 1924. Three more deaths from this cause were recorded in 1925, and in 1926 there were 17. Up to the end of June of this year the total number of deaths was 91. All these were among the native labourers employed underground. This is directly associated with the fact that they do the strenuous work in the hot places and are therefore more likely to succumb to the low atmospheric cooling powers than the underground European employees whose work is essentially supervisory. In addition to these fatal cases numerous non-fatal cases of injuries due to heat have occurred among both European and Natives.

Owing to the continual increase in these cases the Government Mining Engineer found it necessary to approach this Department with a view to investigation of the problem and the devising of more effective measures of prevention. The Assistant Health Officer stationed in Johannesburg has, with the co-operation of officers of the Department of Mines and Industries, commenced an enquiry into the matter.

The air temperatures at the deep levels, though high, would not be excessive from the physiological standpoint if it were not for the high degree of humidity. The anti-silicosis measures now being carried out involve the copious use of water for laying the dust. The air in the stopes where the hard work is done is usually near saturation point, there being seldom more than a degree or two difference between the wet and dry bulb thermometric readings. Whether the amount of water used for laying the dust can with safety be lessened is a controversial point which requires careful investigation. At these depths the danger from heatstroke will tend to become relatively graver, and measures to combat miners' phthisis may have to be modified.

Unless very free air-movement is provided, wet bulb temperatures of 86° F. or over throw a great strain on the cooling mechanism of the body, and heat stroke readily occurs as the result of strenuous work by unacclimatized natives. As the result of a survey made underground, it was ascertained that some 14,000 natives are at present employed in atmospheres with wet bulb temperatures of 86° F. and over. This may be looked upon as the population which is constantly running the risk of serious heat injury.

Using this as the population at risk, the tribal distribution of the heat stroke fatalities was analysed with a view to ascertaining whether there is any tribal susceptibility to heat injury. Expressing the total heat-stroke deaths in rates per 10,000 of the *present* tribal population of the hot zone, we arrive at the following relative distribution:—

Basutoland	86
Eastern Cape (Xosa, Pondo, Fingo, Baca)	76
Mozambique (Shangaan, Tonga, Nyambaan Mchopi)	57
Other tribes	33

These figures suggest that of the three main recruiting areas for the Gold Mines, natives from Portuguese territory are least susceptible to heat injury; the Transkeian territories come next; the Basutos reared in the cold dry climate of Basutoland show the greatest susceptibility. This apparent influence of the home climatic condition was somewhat unexpected. It had been variously suggested that natives harbouring parasites such as those of malaria and hookworm disease would be more likely to suffer from break-down of the heat regulating mechanism; the Mozambique natives are to a very considerable extent infested with such parasites. These figures are of interest in connection with the controversy regarding the desirability of recruiting natives from north of latitude 22° South. Whatever the dangers such tropical natives would be exposed to on the Gold Mines, it would appear that at deep levels they would have an advantage over those recruited further south because of their greater resistance to heat injury.

The work most likely to result in heatstroke is lashing. The relative distribution as regards nature of work of the heat-stroke fatalities among the population of the hot zone is as follows :—

Lashing	110
Tramming	80
Machines	10
Other work	29

Local acclimatization to underground conditions plays a very important part in the incidence of the condition. Most of the fatal cases have occurred among new boys, generally during their first or second shift in a hot place. In some cases this temporary acclimatization appears to have been lost as the result of a period spent away from the zone, e.g., in hospital.

The investigation will concern itself with the practicability of improving underground conditions and the methods of assuring adequate acclimatization previous to strenuous work at dangerous levels.

V.—INFECTIOUS, COMMUNICABLE AND PREVENTABLE DISEASES.

1. *Notifications.*—The following table shows the notifications of infectious diseases by medical practitioners during the year, the totals for the previous year being inserted for comparison. It must be borne in mind that many cases of such diseases, particularly in natives, are never seen by a medical man, and consequently are not notified :—

TABLE H.—NOTIFICATIONS OF DISEASES BY MEDICAL PRACTITIONERS DURING THE YEARS ENDED 30TH JUNE, 1930 AND 30TH JUNE, 1931.

Disease.	Year Ended 30th June, 1930.	Year Ended 30th June, 1931.											
	Union.	Union.	Cape Province, excluding Transkei.		Transkei.		Natal.		Orange Free State.		Transvaal.	
	Total.		European.	Non-European.	European.	Non-European.	European.	Non-European.	European.	Non-European.	European.	Non-European.
Anthrax	40	29	7	6	—	1	2	2	2	—	6	3
Diphtheria	1,434	1,629	569	222	10	19	214	37	129	61	337	31
Encephalitis, Infective	18	16	4	7	—	—	—	—	—	2	2	1
Enteric or Typhoid Fever	3,775	4,793	752	898	8	37	161	251	279	471	611	1,325
Erysipelas	243	305	101	46	1	1	24	2	11	10	86	23
Glanders	—	—	—	—	—	—	—	—	—	—	—	—
Leprosy	98	77	1	13	—	4	—	20	—	2	—	37
Malta Fever	8	3	2	1	—	—	—	—	—	—	—	—
Meningitis, Epidemic Cerebro-spinal	609	404	29	145	—	4	2	5	6	15	39	159
Ophthalmia, Gonorrhoeal	61	60	5	34	—	—	2	5	1	4	4	5
Ophthalmia Neonatorum	240	386	66	251	1	1	1	5	9	14	25	13
Plague (for complete list of cases and deaths, see Table L)	29	25	6	9	—	—	—	—	3	7	—	—
Poliomyelitis, Acute	30	25	5	4	—	—	1	1	5	1	6	2
Puerperal Fever, including Puerperal Sepsis	329	309	54	91	1	3	6	18	9	21	74	32
Rabies	1	3	1	1	—	—	—	—	1	—	—	—
Scarlatina or Scarlet Fever	1,637	1,464	587	47	6	—	79	—	143	1	594	7
Smallpox	41	31	—	5	—	1	—	—	—	13	3	9
Trachoma	83	25	4	13	—	—	1	5	—	1	1	—
Tuberculosis	6,305	6,148	419	2,977	—	558	89	572	28	111	81	1,313
Typhus Fever (for complete list of cases and deaths, see Table O)	1,312	823	24	109	3	532	19	16	2	29	—	99
Lead Poisoning	10	7	3	2	—	—	—	—	—	1	1	—
TOTALS	16,303	16,502	2,636	4,881	30	1,161	601	939	628	764	1,870	3,059

2. *Ankylostomiasis* (*Hookworm Disease*).—A large proportion of mine labourers recruited in Mozambique continue to arrive on the Witwatersrand infected with hookworm. Their danger to other underground workers has been very greatly reduced as a result of the prophylactic measures that have been adopted on all the mines affected. This is indicated by the further fall of 30 per cent. in the number of European Miners who were found infected and applied for compensation.

3. *Bilharziasis* (*Schistosomiasis*).—The Transvaal Bilharzia Committee's activities were continued with excellent results. "Camps" were held at Zeerust and Nelspruit during July attended by 39 and 50 European children respectively, and at Louis Trichardt at the turn of the year attended by 28 European and 15 Native children. Re-examination of the children by laboratory methods three months after the conclusion of treatment showed again a satisfactorily high percentage of cures. These camps are conducted by School Medical Officers of the Transvaal (or under their supervision) assisted by trained nurses of the School Medical Staff. At one camp 50 per cent. of the children were treated with "Fouadin" by intramuscular injection; the remainder receiving the usual intravenous injections of tartar emetic solution. The medical officers in charge considered that fouadin treatment compared very favourably with the older method in regard to ease of administration, length of treatment, after-reaction and curative results. It is, however, a very expensive mode of treatment; and it is essential that the drug be administered exactly as prescribed by the manufacturers.

The Department is continuing to support this Committee which is carrying out extremely useful educative work in addition to the curative work above outlined. During the year at the request of this Committee a circular was drawn up describing the dangers of the disease and the necessity for preventive measures. This was distributed to all Local Authorities in whose areas the disease is endemic. Similar information was contained in a minute on swimming baths circulated to all Local Authorities in the Union.

Considerable use for propaganda purposes was made during the year of the Department's Cinema Film on bilharzia. It was shown among other places at the three camps; at several places in the Rustenburg district, and at Durban during Health Week. Everywhere it is much appreciated and is undoubtedly doing much good.

A number of neat metal plates with the warning inscription in both languages: "Bilharzia—It is dangerous to swim here or to use this water" was bought by the Transvaal Bilharzia Committee at wholesale rates; they are available for sale at low cost to local authorities or others concerned who wish to erect such warning notices at infected streams or pools in their area or vicinity.

4. *Diphtheria.*—The number of cases of this disease notified during the year was 1,629, i.e., 195 more than last year. The Cape Province was again responsible for nearly half of the cases (791); outbreaks occurred in Capetown throughout the year, the total in that city being 341 (225 European and 116 non-European).

5. *Enteric or Typhoid Fever.*—This disease the prevalence of which is generally accepted as reflecting fairly accurately the degree of insanitation in a community continues to be unduly prevalent in the Union, particularly in smaller urban centres, an indication of the amount yet remaining to be done before the sanitary conditions in such places can be considered to be reasonably satisfactory. The number of cases notified during the year was considerably in excess of that for the previous year. The notification during the last five years was as follows:—

1926–27	4,018
1927–28	5,787
1928–29	4,963
1929–30	3,775
1930–31	4,793

The actual incidence of the disease is probably very much higher than these figures indicate because of imperfect notification, particularly among natives, and the fact that the causative bacillus not infrequently produces a condition which is not recognisable apart from special laboratory tests as the disease typhoid. It is probable that among Bantus the classical clinical picture is more often than not absent. It is probable therefore, that many cases of typhoid are missed in areas where modern laboratory facilities are not available or utilized.

Several sharp outbreaks were dealt with during the year by an official of the Department working in conjunction with local authorities. The following table shows the local authority areas in which the prevalence of the disease was unduly high :—

TABLE J.—ENTERIC OR TYPHOID FEVER—NOTIFICATIONS AND INCIDENCE IN CERTAIN LOCAL AUTHORITY AREAS DURING THE YEAR ENDED 30TH JUNE, 1931 (ARRANGED IN ORDER OF INCIDENCE RATE)—EXCLUDING CASES RETURNED AS "IMPORTED."

Place.	Notifications.			Incidence per 1,000 of Population.		
	European.	Non-European.	Total.	European.	Non-European.	All Races
Heilbron.....M.	3	54	57	2·07	35·13	19·08
Fouriesburg.....M.	1	15	16	1·67	36·06	15·78
Paul Roux.....M.	5	7	12	9·28	29·54	15·46
Excelsior.....M.	9	1	10	17·34	4·50	13·50
Adelaide.....M.	5	29	34	3·55	20·97	12·19
Fraserburg.....M.	9	6	15	11·89	12·30	12·05
Clocolan.....M.	1	23	24	0·84	27·64	11·86
Vrede.....M.	15	23	38	9·43	13·91	11·72
Sterkstroom.....M.	7	11	18	6·49	10·55	8·49
Bethlehem.....M.	13	52	65	2·68	17·44	8·30
Springfontein.....M.	11	—	11	19·30	—	8·15
Lady Grey.....M.	5	9	14	5·55	10·70	8·04
Edenburg.....M.	—	15	15	—	19·61	8·03
Zastron.....M.	18	5	23	9·32	4·92	7·80
Dewetsdorp.....M.	5	7	12	5·01	9·56	6·94
Ladybrand.....M.	15	11	26	6·26	6·82	6·49
Alberton.....H.C.	6	5	11	3·68	33·33	6·18
Goodwood.....V.M.B.	19	3	22	7·30	2·99	6·10
Kroonstad.....M.	9	51	60	1·74	10·11	5·87
Alice.....M.	—	13	13	—	7·75	5·46
Boksburg.....M.	74	131	205	5·30	5·12	5·19
Springs.....M.	10	101	111	1·30	6·77	4·92
Caledon.....M.	6	9	15	3·43	6·78	4·88
Cradock.....M.	18	16	34	4·99	4·53	4·76
Queenstown.....M.	7	60	67	1·06	7·86	4·70
Somerset East.....M.	11	13	24	4·73	4·48	4·59
Utrecht.....M.	1	9	10	1·45	5·83	4·48
Nigel.....M.	2	14	16	1·45	6·33	4·45
Volksrust.....M.	6	10	16	2·40	9·10	4·45
Aliwal North.....M.	4	25	29	1·50	6·49	4·44
Roodepoort.....M.	8	81	89	0·98	4·78	3·55
Heidelberg (Tvl.).....M.	2	9	11	1·03	6·80	3·37
Brakpan.....M.	5	89	94	0·45	5·07	3·27
Germiston.....M.	33	80	113	1·69	4·80	3·12
Somerset West.....M.	4	6	10	2·23	4·07	3·06
Robertson.....M.	10	4	14	3·53	2·16	2·98
Ladysmith.....M.	12	9	21	3·28	2·53	2·91
Krugersdorp.....M.	9	52	61	0·66	4·77	2·49
Uitenhage.....M.	22	15	37	2·35	2·34	2·35
Bloemfontein.....M.	63	31	94	2·69	1·34	2·02
Potchefstroom.....M.	20	10	30	2·02	1·93	1·99
Oudtshoorn.....M.	9	12	21	1·61	2·32	1·95
Johannesburg.....M.	196	432	628	0·98	2·97	1·82
George.....M.	6	5	11	1·41	2·66	1·80
Worcester.....M.	9	8	17	1·88	1·69	1·78
Benoni.....M.	13	70	83	0·74	2·05	1·60
Paarl.....M.	13	6	19	1·67	0·90	1·32
Port Elizabeth.....M.	61	9	70	1·72	0·42	1·23
Innesdale.....V.C.	13	—	13	1·50	—	1·13
Kimberley.....B. of H.	17	24	41	0·98	1·12	1·06
Cape Town.....M.	126	130	256	0·92	1·14	1·02
Pretoria.....M.	23	38	61	0·49	1·33	0·81
Randfontein.....M.	2	13	15	0·60	0·72	0·70
Pietermaritzburg.....M.	6	17	23	0·29	0·96	0·60
Durban.....M.	46	20	66	0·75	0·42	0·60
East London.....M.	8	7	15	0·39	0·39	0·39

M. = Municipality. V.M.B. = Village Management Board.
V.C. = Village Council. B. of H. = Board of Health.
H.C. = Health Committee.

All European Rates calculated on Population as at Census, 1931.
Non-European Rates calculated on Population as at Census, 1921, except Capetown, Port Elizabeth, East London, and Bloemfontein which are calculated on Population as at Census, 1926.

6. *Lead Poisoning.*—As a result of a case of lead poisoning in the Government Printing Works, Pretoria, an Assistant Health Officer enquired into the conditions prevailing there, and at other printing establishments.

In the course of this investigation six operatives employed in handling type metal at the Government Printing Works were selected for detailed examination. Blood smears and excreta were examined, and although these workmen showed no clinical

evidence of plumbism, a chemical examination of their urine and faeces showed that in every case lead was being excreted. It was apparent, therefore, that a certain amount of lead was being absorbed by the workers, but this amount was apparently not sufficient to give rise to a clinically recognisable condition of plumbism.

It is apparent that a more rigid control is essential in the conduct of printing establishments if the risks of lead poisoning are to be avoided, and a higher standard of cleanliness in regard to workshops and workers is necessary. Methods need to be adopted to eliminate lead dust as far as possible and to protect the workers from absorbing the dust.

This investigation served a useful purpose in drawing attention to the desirability of framing specific regulations for preventing lead poisoning occurring in factories and workshops where lead or its compounds are used, apart from the general regulations governing the control and management of factories.

7. *Leprosy.*—The Secretary left Pretoria on the 18th October, 1930, to attend the League of Nations Leprosy Commission at Bangkok, Siam. En route he investigated certain matters of public health interest and visited various institutions in India and Malaya including the Gobra Leper Institution, Calcutta, and the Leper Institution at Penang. The conference of the Far Eastern Association of Tropical Medicine commenced at Bangkok on December 7th and was attended by 162 medical men—mostly engaged in the Preventive or Research side of medical work—drawn from all over the Far East, with several from Europe and America.

The Leprosy Commission began its sittings on 8th December. Members of the latter comprised—Professor B. Nocht of Germany, President; Dr. E. Burnet of the League of Nations Health Organisation, Geneva, Secretary; Major-General J. D. Graham, and Dr. E. Muir, India; Professor Ohta, Japan; Dr. H. W. Wade, Culion Leper Colony, Philippines, and Chief Field Officer Leonard Wood Memorial; Dr. N. E. Wayson, Director, United States Leprosy Investigation, Hawaii, and Dr. C. D. de Langen, Dutch East Indies. This was the first meeting of the Commission; it had before it a report by Dr. E. Burnet of a tour made by him in Europe, South America and the Far East during 1929 and early part of 1930, giving a useful bird's eye view of the world position regarding leprosy, and indicating the matters calling specially for consideration by the Commission.

The Commission sat from 8th to 11th December with the Far Eastern Association of Tropical Medicine, and on 12th December had a joint sitting, when leprosy was the sole subject discussed and at which the Commission furnished an advance copy of its Report to the League. The salient features of the Report may be summarised as follows:

Leprosy is an infectious disease and the chief—and as far as is known, the only—cause is contagion from a previous case in man.

The disease is to a large extent curable, especially if treatment is begun early.

The best treatment so far available is by oils of the chaulmoogra group and their derivatives, together with suitable dietetic and hygienic measures.

Prevention or prophylaxis is all-important, but for this to be successful, curative treatment is essential.

Isolation of cases in an infective stage is a necessary measure, but is not sufficient as the sole means of prophylaxis. It should be applied only to infectious cases and its drawbacks (tendency to concealment and delay in notification) should be mitigated by other measures applied concurrently.

The best policy of isolation, whether voluntary or compulsory, to be followed in any given country, depends on local circumstances and conditions. Ignorance and prejudice should be combated and active education and propaganda carried out amongst the general public and especially amongst the sections and classes chiefly affected by the disease.

In countries where the disease is prevalent, special steps should be taken to train the medical profession in its early diagnosis and recognition. Further scientific research is also badly needed.

The Governments of the countries where the disease is prevalent should co-operate and undertake a new international crusade against leprosy.

After the sitting of the Commission and the special Session of the Far Eastern Association of Tropical Medicine, an excursion to the north of Siam, with a visit to the leper institution at Chiengmai, was arranged for and was attended by practically all the members interested in leprosy. It lasted from 14th to 19th December, and, following on the sittings of the Commission, afforded the members ample opportunities for personal discussion. The visit to Chiengmai institution was also of great interest. Its inmates number some 400, all but a few being Siamese. The institution is administered and largely financed by the American Medical Mission. The Superintendent, Dr. J. W. McKean, is a keen and experienced Leprologist and has been in charge of the Institution since its inception some ten years ago. It is run on purely voluntary lines. Asked, in the presence of some of the Indian representatives on the Commission, as to how the scheme was working, Dr. McKean replied that of necessity it only touched the fringe of the Leprosy problem in Northern Siam, that only a small percentage of the cases in the country could be dealt with, that in most of the cases admitted the disease had already

been going on for four or five years without precautions or treatment of any kind, and that many cases refused to remain in the institution long enough for effective treatment, but left after a few months, or even less, and whilst still in an infectious condition. Asked as to the immediate cause of most of the admissions, Dr. McKean stated that admissions of patients not seriously ill or incapacitated were usually the result of pressure by relatives, or complaints by neighbours. The fact that a patient could leave the institution whenever he wished seriously hampered treatment, both as regards duration and methods used. If a patient got tired of treatment or found it painful or irksome he generally left the institution even though still infectious and perhaps making good progress.

It was evident that the " voluntary " system is by no means free from some of the drawbacks of the " compulsory " system (such as tendency to concealment and delay of notification) and has in addition certain grave drawbacks which are obviated under the last-mentioned system.

Following on the Bangkok Conference it had been arranged that the members of the Commission, with a number of other members of the Far Eastern Association of Tropical Medicine, should proceed to the Philippines, visit and inspect the leper settlement at Culion and various other institutions and thereafter re-discuss the whole subject with special reference to matters referred to the Manila meeting by the League of Nations Commission. The party was to travel to the Philippines by steamer from Singapore. Unfortunately, after leaving Siam, the Secretary had an illness which necessitated his returning to South Africa direct from Singapore. He arrived in Durban on the 26th January.

Experience during the trip, the Bangkok Conference, and subsequent discussions justify the following views and conclusions :—

(*a*) The general policy regarding leprosy which the Department has been steadily pursuing since it took over the administration of leprosy matters and institutions in 1924 is in accord with that advocated by the League of Nations Commission and is that best adapted for the Union. It comprises compulsory segregation of infectious cases, so long only as they are considered infectious and a danger to health, but the law is administered liberally and sympathetically and always from the standpoint of the public health and the social interests of the community.

(*b*) The chaulmoogra treatment for leprosy still holds the field, but minor improvements as regards preparations and technique, notably the intradermal method of administration by multiple puncture, the use of the blood sedimentation test for detecting complications and conditions reducing the patient's resistance to the disease and as a guide to treatment and dosage, and the use of diathermy in the treatment of certain nerve complications have been introduced. Steps are being taken to bring these innovations to the notice of medical officers of our leper institutions. The results of treatment at our institutions as guaged by the discharge rate compare favourably with those obtained in any other country.

(*c*) By far the more important aspect of treatment is that, apart from the benefit to the patient treated, it encourages sufferers to come forward voluntarily and in an early stage of the disease and thus gives invaluable assistance to prophylaxis and prevention. The indirect effects of successful treatment in the Union are seen in the rapid increase of voluntary admissions and of admissions of children and early cases.

(*d*) Suitable diet, exercise and hygienic measures, the diagnosis and treatment of any concurrent disease and the general improvement of the patient's health and resistance to disease infections are quite as important as any specific anti-leprotic treatment at present available.

(*e*) The chief directions in which policy and practice in the Union can be improved are that greater attention should be paid to general educative and propaganda work amongst the Natives—the section of the population chiefly affected ; an improved system of supervision and periodical examination of intimate contacts, especially members of infected families ; and the improvement of the agencies and facilities for early discovery. The institution and organisation of a system of native health visitors or inspectors working under medical direction and supervision, each with general training in sanitary and health matters and with some special training in the recognition of leprosy in its early stages, who would act as educative and advisory agents regarding, not only leprosy, but other preventable and infectious diseases and health matters in general, is urgently necessary. The term " leprosy inspector " should be avoided and while their duties should include the recognition and discovery of cases of leprosy with a view to removal and segregation, this part of their work should not be emphasised, and they should be encouraged to aim rather at securing the confidence of the Natives and acting as health helpers and advisors with a view to securing the voluntary admission of fresh or previously undiscovered cases, especially in the early stages, and to assist in the supervision of cases which have been returned to their homes as " arrested."

Leprosy in the Union.—The subjoined tables show the measures taken during the year and the position at its close. The number of native cases admitted to institutions was again large, namely 524; last year it was 541 and the year before 414. This is a gratifying result of propaganda in the native territories and more effective measures in detecting and removing lepers. With these measures it is to be hoped that there will continue steady progress in reducing the large accumulation of undiscovered native cases in the Union with a corresponding decrease of the amount of infective persons at large. The policy of probationally discharging patients who are considered by a Board to be no longer infective is proving most satisfactory; patients no longer have the fear of life-long detention and the number of inmates in institutions is reduced. The knowledge that arrest and even cure of the disease is possible has spread among the natives with gratifying results. Inmates of our institutions are now hopeful of cure and readily cooperate with the medical and nursing staff in carrying out treatment, even if tedious or irksome.

The Robben Island Institution was closed down at the end of March and all the remaining patients namely 11 European and 108 Coloured and Native were removed to West Fort Institution, Pretoria, where additional accommodation was provided, including special accommodation for the mixed coloured patients. Special facilities have also been provided for relatives and friends from afar to visit these patients. The transfer to Pretoria was effected smoothly and without incident and all the patients have settled down contentedly, reflecting great credit on the Medical Superintendent (Dr. de Vos), and all concerned in the move. The transfer has already been fully justified on both medical and financial grounds; the more suitable climatic conditions and the improved facilities for hospital and operative treatment have produced results beyond expectation whilst the very large annual saving anticipated promises to be fully realized.

TABLE K (i).—LEPER INSTITUTIONS: ADMISSIONS DURING THE YEAR ENDED 30TH JUNE, 1931.

Institution.	First Admissions.								Re-admissions.								Transfers from other Institutions.								Total.		
	European.		Native.		Mixed Coloured.		Asiatic.		European.		Native.		Mixed Coloured.		Asiatic.		European.		Native.		Mixed Coloured.		Asiatic.				
	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	Persons.
Robben Island*..	—	1	—	1	6	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	6	3	9
Pretoria.....	9	5	109	52	16	6	3	—	5	4	10	12	1	—	—	—	6	5	12	—	71	37	—	—	242	121	363
Mkambati.....	—	—	54	28	—	—	—	—	—	—	8	6	—	—	—	—	—	—	8	—	—	—	—	—	70	34	104
Emjanyana.....	—	—	96	81	—	—	—	—	—	—	21	5	—	—	—	—	—	—	27	1	—	—	—	—	144	87	231
Amatikulu.....	—	—	54	27	—	—	—	3	—	—	18	7	—	—	2	—	—	—	6	2	—	—	—	—	80	39	119
Bochem.....	—	—	17	5	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	18	5	23
TOTAL.....	9	6	330	194	22	7	3	3	5	4	58	30	1	—	2	—	6	5	53	3	71	37	—	—	560	289	849

* For period 1st July, 1930, to closure of the Institution on 14th February, 1931.

TABLE K (ii).—LEPER INSTITUTIONS: DEATHS OF PATIENTS DURING THE YEAR ENDED 30TH JUNE, 1931.

Institution.	European.		Native.		Mixed Coloured.		Asiatic.		Total.		
	Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.	Persons.
Robben Island*	—	—	1	—	5	1	—	—	6	1	7
Pretoria	5	—	45	33	5	—	—	—	55	33	88
Mkambati	—	—	12	10	—	—	—	—	12	10	22
Emjanyana	—	—	33	20	—	—	—	—	33	20	53
Amatikulu	—	—	43	13	—	—	—	—	43	13	56
Bochem	—	—	6	5	—	—	—	—	6	5	11
TOTAL	5	—	140	81	10	1	—	—	155	82	237

* For period 1st July, 1930, to closure of the Institution on 14th February, 1931.

TABLE K (iii).—LEPER INSTITUTIONS: DISCHARGES, ESCAPES, TRANSFERS, ETC., DURING THE YEAR ENDED 30TH JUNE, 1931.

Institution.	Probationally Discharged as "Arrested and Non-Infective."									Discharged as Non-Leprous.									Escaped.									Transferred to Other Institutions.								
	E.*		N.		M.C.		A.		Total.	E.		N.		M.C.		A.		Total.	E.		N.		M.C.		A.		Total.	E.		N.		M.C.		A.		Total.
	M.	F.	M.	F.	M.	F.	M.	F.		M.	F.	M.	F.	M.	F.	M.	F.		M.	F.	M.	F.	M.	F.	M.	F.		M.	F.	M.	F.	M.	F.	M.	F.	
Robben Island‖	—	1	—	—	3	1	—	—	5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	6	5	5	5	66	32	—	—	119
Pretoria	—	5	67	37	2	6	—	—	117	1	—	10	5	3	—	—	—	19	1	—	5	12	—	—	—	—	18	—	—	50	4	—	—	—	—	54
Mkambati	—	—	38	20	—	—	—	—	58	—	—	—	1	—	—	—	—	1	—	—	6	1	—	—	—	—	7	—	—	—	—	—	—	—	—	—
Emjanyana	—	—	52	44	—	—	—	—	96	—	—	—	1	—	—	—	—	1	—	—	26	—	—	—	—	—	26	—	—	12	—	—	—	—	—	12
Amatikulu	—	—	27	21	—	—	1	—	49	—	—	1	—	—	—	—	—	1	—	—	9	2	—	—	1	—	12	—	—	1	—	—	—	—	—	1
Bochem	—	—	6	4	—	—	—	—	10	—	—	1	4	—	—	—	—	5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
TOTAL	—	6	190	126	5	7	1	—	335	1	—	12	11	3	—	—	—	27	1	—	46	15	—	—	1	—	63	6	5	68	9	66	32	—	—	186

*E. = European. N. = Native. M.C. = Mixed Coloured. A. = Asiatic.

‖ For period 1st July, 1930, to closure of the Institution on 14th February, 1931.

TABLE K (iv).—LEPROSY: PATIENTS PROBATIONALLY DISCHARGED FROM INSTITUTIONS OR CLASSIFIED AS "ARRESTED AND NON-INFECTIVE," AND NUMBER OF SUCH PATIENTS SINCE RE-ADMITTED AS RECRUDESCENT.

	Probationally Discharged from Institution.					Classified as "Arrested and Non-infective" but remaining at Institutions at end of year.					Probationally Discharged Patients who have been re-admitted to Institutions as recrudescent.				
	European.	Native.	Mixed Coloured.	Asiatic.	Total.	European.	Native.	Mixed Coloured.	Asiatic.	Total.	European.	Native.	Mixed Coloured.	Asiatic.	Total.
Year ended 30th June, 1923.....	11	468	23	1	503	3	40	—	—	43	—	8	—	—	8
Year ended 30th June, 1924.....	6	217	29	2	254	1	10	—	—	11	—	2	—	—	2
Year ended 30th June, 1925.....	6	94	5	—	105	—	10	—	—	10	—	2	—	—	2
Year ended 30th June, 1926.....	3	62	5	—	70	1	28	1	—	30	1	4	—	—	5
Year ended 30th June, 1927.....	2	166	3	—	171	—	59	2	—	61	4	12	2	—	18
Year ended 30th June, 1928.....	3	217	5	—	225	—	57	5	—	62	1	23	1	1	26
Year ended 30th June, 1929.....	10	236	7	—	253	6	137	7	—	150	—	19	2	—	21
Year ended 30th June, 1930.....	10	296	15	—	321	4	63	3	—	70	—	33	—	—	33
Year ended 30th June, 1931.....	6	316	12	1	335	2	121	10	—	133	6	30	—	1	37
TOTAL.....	57	2,072	104	4	2,237						12	133	5	2	152

TABLE K (v).—LEPER INSTITUTIONS: PATIENTS THEREIN ON 30TH JUNE, 1931.

Institution.	European.		Native.		Mixed Coloured.		Asiatic.		Total.		
	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	Persons.
Pretoria	70	35	454	320	81	45	5	1	610	401	1,011
Mkambati	—	—	135	105	—	—	—	—	135	105	240
Emjanyana	—	—	356	243	—	—	—	—	356	243	599
Amatikulu	—	—	193	121	—	—	5	3	198	124	322
Bochem	—	—	60	52	—	—	—	—	60	52	112
TOTAL	70	35	1,198	841	81	45	10	4	1,359	925	2,284

TABLE K (vi).—LEPROSY: CASES REMAINING IN THEIR OWN HOMES ON 30TH JUNE, 1931.

	Certified and Awaiting Removal to Leper Institution.	Home Segregated.	Probationally Discharged from Leper Institutions.		Total.
			Still under Surveillance.	Released from Surveillance.	
Cape (Province proper)	2	1	139	120	262
Transkei	14	6	406	156	582
Transvaal	1	2	297	138	438
Natal	16	2	322	95	435
Orange Free State	—	—	74	32	106
UNION	33	11	1,238	541	1,823

TABLE K (vii).—CERTIFIED CASES OF LEPROSY (EXCLUDING TRANSFERS AND RE-ADMISSIONS) REMOVED TO LEPER INSTITUTIONS DURING THE TWENTY-ONE YEAR PERIOD 1910 TO 1930 INCLUSIVE.

Area	Race.	1910.		1911.		1912.		1913.		1914.		1915.		1916		1917.		1918.		1919.		1920.		1921.		1922.		1923.		1924.		1925.		1926.		1927.		1928.		1929.		1930.		Total.		Grand Total.
	*	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	
Cape.....	E.....	2	1	5	1	7	1	1	1	3	2	3	1	6	2	1	3	1	2	7	2	2	2	2	3	—	1	1	1	2	2	1	1	3	—	—	2	1	1	3	1	52	30	82
	M.C.....	14	13	12	10	12	8	12	7	15	7	14	6	17	5	15	6	5	3	8	7	6	4	12	4	12	4	9	5	7	8	1	4	2	9	3	8	1	2	1	4	6	1	204	108	312
	N.....	2	—	1	—	—	—	2	—	—	—	3	1	1	—	5	—	3	1	3	—	1	—	3	—	—	—	3	—	—	—	1	1	—	—	1	1	—	—	1	—	—	1	30	5	35
	A.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	1
	TOTAL...	18	14	18	11	19	9	15	8	18	9	20	8	24	7	22	9	9	6	18	9	9	6	17	7	12	5	13	6	8	9	4	2	11	3	12	2	3	5	8	5	9	3	287	143	430
	COMBINED TOTAL...	32		29		28		23		27		28		31		31		15		27		15		24		17		19		17		6		14		14		8		13		12		430		
Transkei.....	E.....	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	3	—	3
	M.C.....	1	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	1	—	3	2	5
	N.....	41	48	25	17	79	77	27	29	32	25	28	12	99	74	54	9	65	30	26	19	34	37	33	34	51	56	51	43	70	64	94	61	74	48	90	65	112	65	76	65	88	60	1,249	938	2,187
	A.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	TOTAL...	42	48	26	17	79	77	27	29	32	25	28	12	100	74	54	9	65	30	26	19	34	37	33	34	52	56	51	43	70	64	95	61	74	49	90	65	112	65	76	66	89	60	1,255	940	2,195
	COMBINED TOTAL...	90		43		156		56		57		40		174		63		95		45		71		67		108		94		134		156		123		155		177		142		149		2,195		
Ciskei	E.....	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	1	2	—	—	—	—	—	—	1	—	—	—	—	—	—	—	1	—	—	—	3	—	3
	M.C.....	—	—	3	2	3	1	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	8	8	16
	N.....	15	22	15	20	16	15	12	14	8	3	25	6	20	5	18	14	6	11	10	15	32	25	8	6	26	16	18	18	6	8	28	12	20	12	26	7	19	13	13	15	24	14	365	271	636
	A.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	TOTAL...	15	22	18	22	19	16	14	14	8	3	25	6	20	5	18	15	6	11	10	15	32	25	9	8	26	16	18	18	6	8	29	12	20	12	26	7	19	13	14	16	24	15	376	279	655
	COMBINED TOTAL...	37		40		35		28		11		31		25		33		17		25		57		17		42		36		14		41		32		33		32		30		39		655		
Other Districts.. (Cape Province)	E.....	2	2	2	—	—	1	2	1	1	1	—	—	2	2	1	—	1	—	—	—	1	—	—	—	2	1	3	—	1	1	—	—	—	—	—	—	—	1	—	—	—	—	19	10	29
	M.C.....	8	5	11	4	8	5	7	2	6	—	2	—	5	4	1	3	3	—	—	—	2	1	2	1	3	3	3	1	2	2	1	—	—	1	—	—	2	3	—	—	1	1	67	36	103
	N.....	20	13	14	6	9	8	6	3	12	4	16	1	9	5	21	12	15	2	11	4	2	5	8	9	7	8	9	7	6	1	9	6	7	4	6	3	3	—	10	5	23	22	223	128	351
	A.....	—	—	1	—	—	—	1	—	—	—	—	—	1	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	4	—	4
	TOTAL...	30	20	28	10	17	14	16	6	19	5	18	1	17	11	24	15	19	2	11	4	5	6	10	10	12	12	15	8	9	4	10	6	7	5	6	3	5	4	11	5	24	23	313	174	487
	COMBINED TOTAL..	50		38		31		22		24		19		28		39		21		15		11		20		24		23		13		16		12		9		9		16		47		487		

* E. European. M.C. Mixed Coloured. N. Native. A. Asiatics.

Cape Area.—Bredasdorp, Caledon, Calitzdorp, Ceres, Clanwilliam, George, Hopefield, Knysna, Ladismith, Malmesbury, Montagu, Mossel Bay, Oudtshoorn, Paarl, Piketberg, Port Nolloth, Riversdale, Robertson, Simonstad, Somerset West, Stellenbosch, Swellendam, Tulbagh, Van Rhynsdorp, Wellington, Wynberg, Worcester.

Ciskei.—Cathcart, East London, Fort Beaufort, Glen Grey (Lady Frere), Keiskama Hoek, Kingwilliamstown, Komgha, Peddie, Queenstown, Stockenström, Stutterheim, Victoria-East.

TABLE K (vii)—(*continued*).

Area.	Race.	1910.		1911.		1912.		1913.		1914.		1915.		1916.		1917.		1918.		1919.		1920.		1921.		1922.		1923.		1924.		1925.		1926.		1927.		1928.		1929.		1930.		Total.		Grand Total.
		M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	
Transvaal.....	E.....	6	3	7	4	7	2	6	4	8	3	9	5	4	4	6	1	3	3	4	5	5	3	4	6	7	3	9	4	7	2	7	3	3	2	4	—	5	2	4	3	5	4	120	66	186
	M.C.....	1	—	—	—	—	—	2	1	—	—	4	2	—	—	—	—	—	—	1	—	1	1	4	4	1	1	3	—	1	1	1	1	—	3	—	1	1	—	2	5	1	2	24	17	41
	N.....	192	63	132	40	167	74	139	19	119	32	168	67	108	36	130	36	122	50	93	21	71	35	108	44	132	69	97	50	94	47	89	30	80	52	97	43	105	51	94	58	103	56	2,440	973	3,413
	A.....	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	1	—	2	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	6	—	6
	TOTAL...	200	66	139	44	174	76	147	24	127	35	181	74	112	40	136	37	125	53	99	26	77	39	116	50	142	72	111	54	102	50	97	34	83	57	101	44	111	53	101	66	109	62	2,590	1,056	3,646
	COMBINED TOTAL...	266		183		250		171		162		255		152		173		178		125		116		166		214		165		152		131		140		145		164		167		171		3,646		
Orange Free State	E.....	—	—	—	—	2	1	1	1	2	—	2	—	3	—	1	—	—	2	1	2	1	1	3	—	2	1	—	1	1	—	—	—	1	—	—	1	3	3	—	2	3	—	1	—	27	15	42
	M.C.....	—	—	—	1	—	—	3	—	—	—	—	—	1	—	—	—	—	—	2	—	2	—	—	1	—	—	1	1	—	—	—	—	—	1	—	—	—	1	—	1	—	—	2	2	11	7	18
	N.....	—	—	3	2	18	3	19	12	14	5	22	7	21	14	24	8	20	8	11	7	23	11	13	16	31	10	18	16	14	8	12	3	27	21	12	22	21	18	21	12	26	16	370	219	589
	A.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	TOTAL...	—	—	3	3	20	4	23	13	16	5	24	7	25	14	25	8	20	10	14	9	26	12	16	17	33	11	19	18	15	8	13	3	27	22	15	26	21	21	24	12	29	18	408	241	649
	COMBINED TOTAL...	—		6		24		36		21		31		39		33		30		23		38		33		44		37		23		16		49		41		42		36		47		649		
Natal.....	E.....	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1	—	1	—	—	—	—	—	—	—	—	—	—	—	1	1	—	—	—	—	—	—	—	1	—	—	—	1	5	6
	M.C.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	3	—	1	—	—	—	2	—	1	—	8	—	8
	N.....	1	1	1	1	2	1	1	—	2	—	16	3	16	7	15	5	44	32	68	34	50	28	43	25	70	56	56	28	51	37	56	30	37	34	66	43	51	22	47	26	47	18	740	431	1,171
	A.....	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1	—	2	—	—	1	1	1	—	—	—	1	—	1	—	2	—	1	—	—	1	6	1	17	4	21
	TOTAL...	1	1	1	1	3	1	1	—	2	—	16	4	16	7	15	6	44	33	69	35	51	28	45	25	71	57	57	28	51	38	58	30	41	34	69	43	52	22	49	28	54	19	766	440	1,206
	COMBINED TOTAL...	2		2		4		1		2		20		23		21		77		104		79		70		128		85		89		88		75		112		74		77		73		1,206		
Zululand.....	E.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	M.C.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	N.....	—	—	—	—	—	—	—	—	—	—	1	1	2	4	—	—	—	1	15	6	2	—	10	7	4	4	4	5	5	1	3	—	2	4	9	4	10	8	5	5	10	2	82	52	134
	A.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	—	2	2
	TOTAL...	—	—	—	—	—	—	—	—	—	—	1	1	2	4	—	—	—	1	15	6	2	—	10	7	4	4	4	5	5	1	3	—	2	4	9	4	10	8	5	5	10	4	82	54	136
	COMBINED TOTAL...	—		—		—		—		—		2		6		—		1		21		2		17		8		9		6		3		6		13		18		10		14		136		
	GRAND TOTALS.	306	171	233	108	331	197	243	94	222	82	313	113	316	162	294	99	288	146	262	123	236	153	256	158	352	233	288	180	266	182	309	148	265	186	328	194	333	191	288	203	348	204	6,077	3,327	9,404
	COMBINED GRAND TOTALS..	477		341		528		337		304		426		478		393		434		385		389		414		585		468		448		457		451		522		524		491		552		9,404		

CHART K (*a*).—CERTIFIED CASES OF LEPROSY, EUROPEAN, MIXED COLOURED, AND ASIATIC, REMOVED TO LEPER INSTITUTIONS DURING THE TWENTY-ONE-YEAR PERIOD 1910 TO 1930 INCLUSIVE.

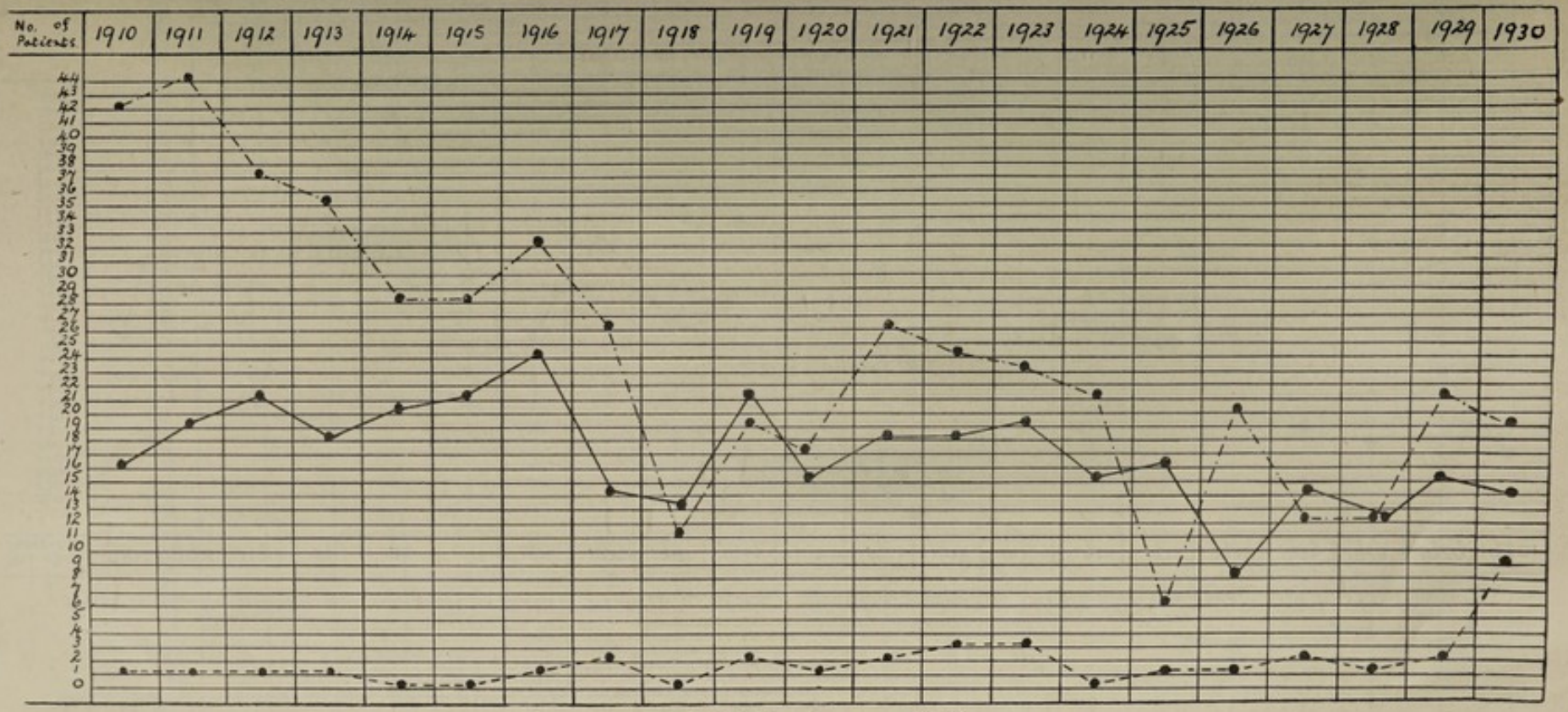


CHART K (*b*).—CERTIFIED CASES OF LEPROSY IN NATIVES REMOVED TO LEPER INSTITUTIONS DURING THE TWENTY-ONE-YEAR PERIOD 1910 TO 1930 INCLUSIVE.

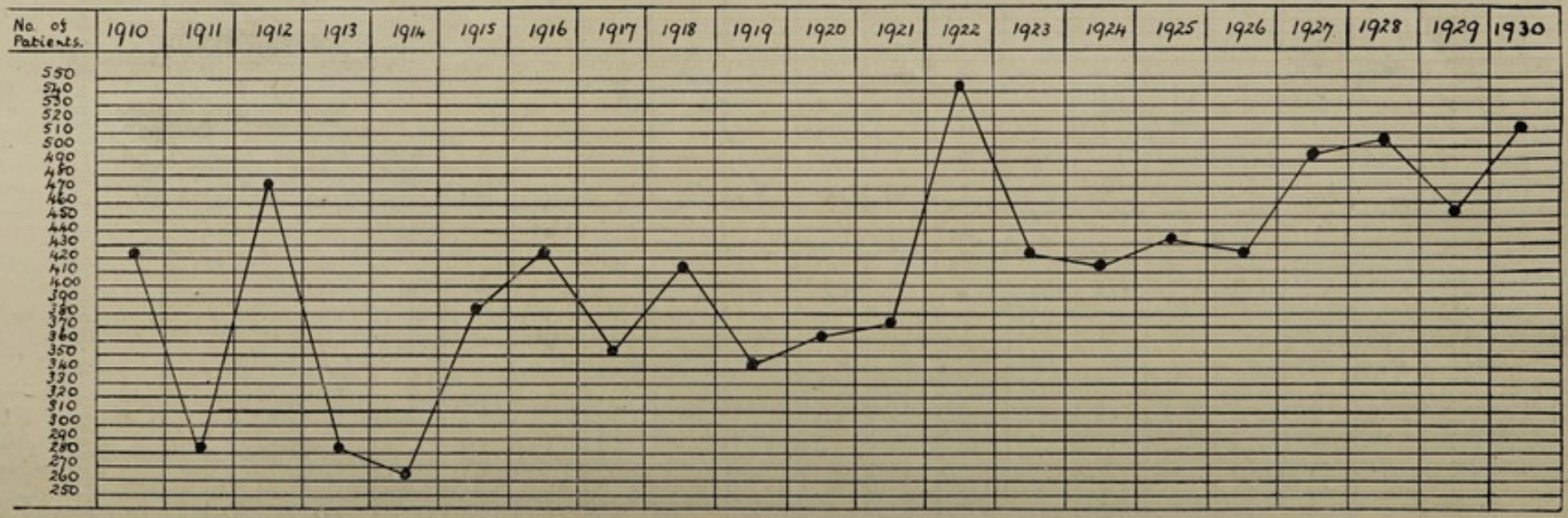
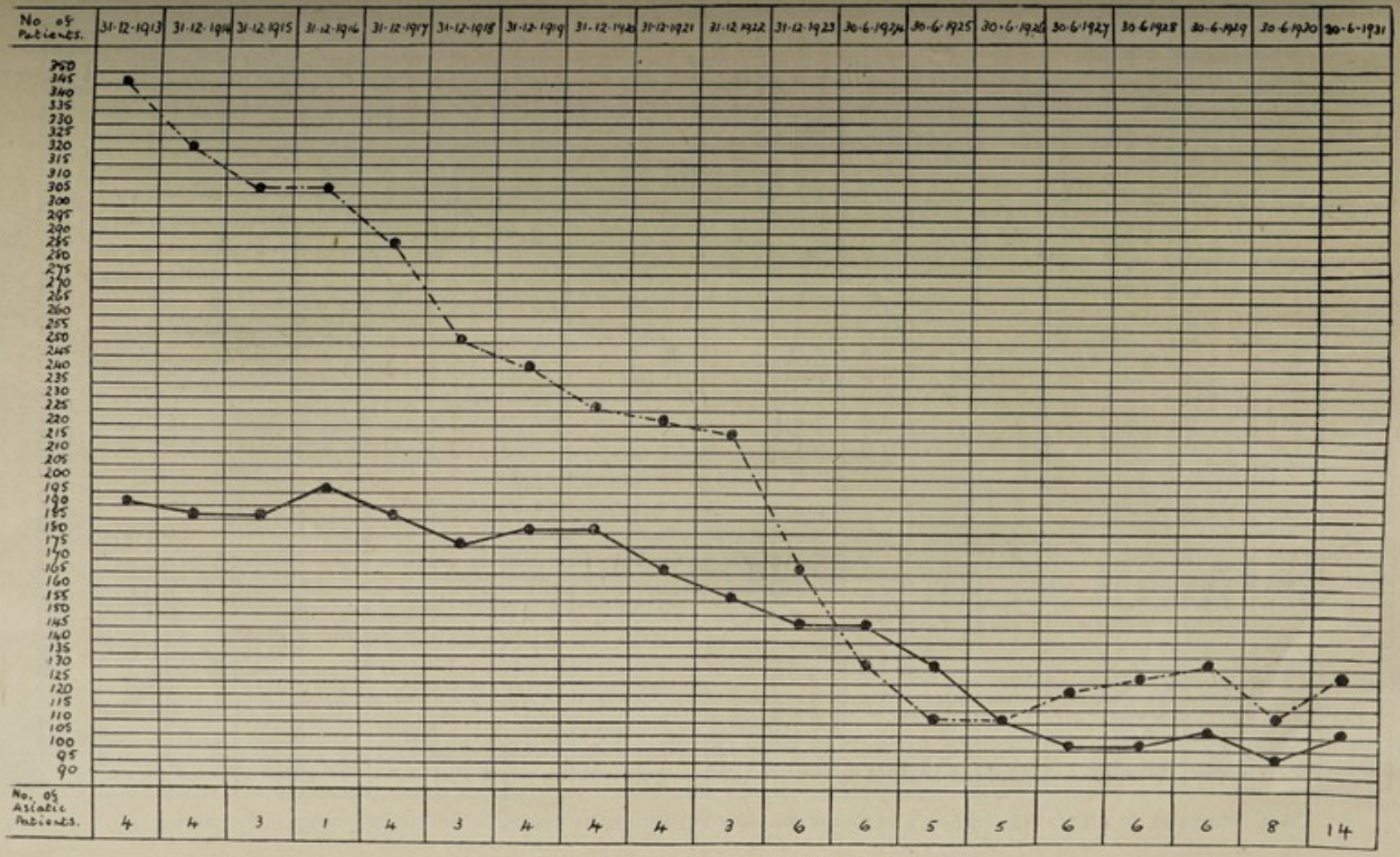
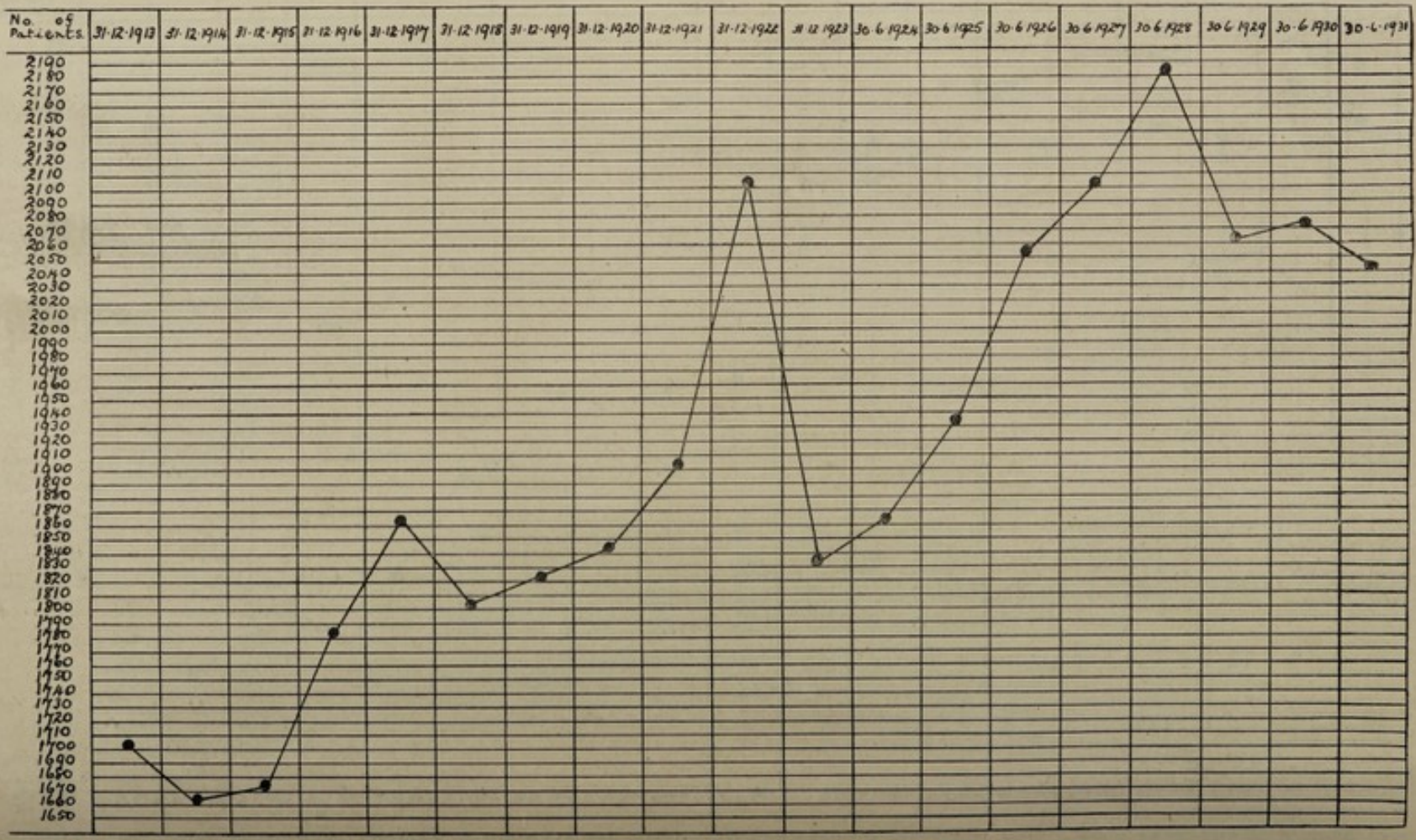


CHART K (c).—LEPER INSTITUTIONS: NUMBER OF EUROPEAN AND MIXED COLOURED PATIENTS THEREIN AT END OF EACH YEAR, 1913 TO 30 JUNE, 1931.



European ———. Mixed Coloured —·—·—

CHART K (*d*).—LEPER INSTITUTIONS: NUMBER OF NATIVE PATIENTS THEREIN AT END OF EACH YEAR, 1913 TO 30TH JUNE, 1931.



8. *Malaria—Transvaal.*—The seasonal incidence in the northern and eastern areas was this year considerably below the average. The same arrangements as in previous years were made for the distribution of quinine in the various magistracies, with sub-depôts in outlying parts.

Natal.—The incidence was considerably lower than during the two previous seasons. Outbreaks confined to small areas occurred throughout the coastal area and extended far south of the Natal border into Pondoland. New infections of this kind occurred as low down as Port St. Johns. The disease occurred in the valleys of most of the larger rivers from Port St. Johns northwards. This distribution is probably to be associated with the exceptionally dry summer; the river beds dried up, leaving the puddles unprotected by vegetation, which forms the ideal breading-places for Anopheles costalis. Although no spread of the disease in epidemic form occurred, there were numerous small outbreaks on sugar estates after the early rains in December. Again after the April rains there was a general rise in incidence over the whole coastal belt. On neither of these occasions did the disease spread inland along the river beds as in the previous season.

As in previous years, an attempt was made to assess the number of deaths caused by malaria; this is estimated at 844, which figure includes 23 European deaths. Of the 744 deaths, 373 are stated to have occurred in the Lower Tugela district with a native population of 46,000.

In the inland areas the disease did not show anything like last season's prevalence. Thus the Msinga district which includes Weenen and Muden and has a population of some 54,000 is stated to have had only 19 deaths. There were none in Nkandhla district. On the other hand Pietermaritzburg town had 14 deaths; and on the Umgeni the incidence was higher than last year. In the Harding district, where the disease is not endemic, 46 deaths occurred, presumably among infected natives returning home.

Native malaria assistants again prove very useful. Some of those employed last year were again engaged and given a refresher course. In addition two new classes were trained. Their training included clinical knowledge sufficient to recognise fever and enlarged spleens and they are able to take blood specimens for laboratory examination and to treat the alarming symptoms of the disease; they can identify larvae, and recognise and eliminate their breeding-places. Twenty of these native malaria assistants were continuously employed. Three European Sanitary Inspectors were engaged entirely on malaria preventive work.

Professor Swellengrebel's Investigation.—Professor N. H. Swellengrebel of the University of Amsterdam, member of the Malaria Committee of the Health Organisation of the League of Nations, arrived in the Union at the end of October 1930; he completed his investigation and returned to Holland at the end of May, 1931. His report is printed as an Annexure.

Great importance is attached to the probability that of the twenty species of anopheles mosquitoes in the Union only two are of importance as Malaria vectors, namely, *Anopheles costalis* and *Anopheles funestus*. The habits of these two anophelines were carefully studied. They appear to be so definite that anti-larval work for Malaria control becomes a practicable measure, since it can effectively be carried out on a vastly smaller scale than was previously supposed. Costalis larvae are mainly confined to small rain-water pools that are free from vegetation and thus freely exposed to sunlight such as road puddles and hoof-marks; These breeding places disappear if there is no rain within seven days. They may also breed in drying up river beds, edges of swamps, seepages from furrows, and similar sunlit situations. Funestus on the other hand is a stream breeder, its larvae occurring in the grassy shaded edges of back-waters of hill streams; it is not directly dependent on rain or its persistence.

Because of these clearly defined habits it is usually unnecessary, for purposes of Malaria control, to carry out extensive and costly drainage or oiling schemes for marshes. Such vleis may almost always be left severely alone. The Professor, however, insists that further research is necessary into the habits of these mosquitoes, and into the possibility of an ubiquitous breeder like *A. pretoriensis* proving to be an important vector of Malaria.

"Species sanitation," i.e., operating against a particular anopheline species, will render it possible for farmers in endemic areas to carry out effective anti-larval work themselves, with a little expert guidance as to the dangerous collections of water.

The Professor's views regarding white settlement in highly malarious areas are very guarded, and hinge mainly on the intelligence and reliability of the people concerned; unless these can be relied upon to carry out intelligently, carefully and continuously precautions against malaria, experiments of this kind had better be avoided. Where settlements of "poor whites" are contemplated, they should not be on the usual South African lines, i.e., scattered farms each with its own homestead, but all dwellings should form one closely-built village or, if the area is very extensive, two or three such villages, so that the workers can go out to their fields in the morning and return home before sundown. The village must not be in a funestus area. There must be a sanitary inspector for each village, but the permanent and recurring anti-larval work must be carried out by the villagers themselves. All houses must be screened, the screening being done

by the villagers under the supervision of the sanitary inspector. Screening must be supplemented by regular killing of mosquitoes inside the houses every morning, and the houses should be constructed with whitewashed walls and ceilings, so as to avoid dark corners and render search for mosquitoes easy. Medical treatment should be ensured by a resident doctor provided with a dispensary, and his salary should be wholly or partly paid by contributions of the villagers to a sick fund; no natives should be allowed to pass the night in or near the settlement.

Labour in the sugar-belt of Natal, it is recommended, should be recruited as far as possible from areas of high malarial endemicity. Adults from such areas show considerable tolerance to malaria and are not a source of infection for mosquitoes; as a rule they show little in the way of after-effects of the fever they suffered from during childhood. In view of these facts Professor Swellengrebel is not in favour of general quininization in Native Reserves with high malarial endemicity. Apart from its costliness, such a procedure would be difficult to carry out and would interfere with the natural process of immunization. In areas where Malaria occurs irregularly in epidemic form, intensive quininization is approved of. The system of using native malaria assistants for such areas, both for diagnostic purposes and for quinine distribution, is approved of. The extension of the system is recommended, and if it continues to work well it is recommended also for the Native Locations in the epidemic areas of the Northern and Western Transvaal.

With regard to the personnel for Malaria control in the future, the following recommendations are made for the Transvaal:—

(1) A Malaria control unit under the administrative direction of an Assistant health Officer, consisting of a Medical Malaria Inspector, 3 sanitary inspectors and 3 native assistants.
(2) A field research station conducted by the South African Institute for Medical Research.
(3) Periodic special courses for District Surgeons in affected areas.
(4) District Nurses of the health visitor type to co-operate with the District Surgeons, particularly in educative work.
(5) Special training for school teachers in Malaria areas.

For Natal the Professor recommends that the existing staff of European Sanitary Inspectors and Native Assistants for the Reserves should be maintained and that groups of sugar estates be organised into local health authorities, who would provide the staff for carrying out anti-malarial measures under the general guidance of the Department of Public Health.

For the South African Railways he recommends that an Assistant Health Officer be seconded to ensure proper sanitary supervision on open lines and new construction; where necessary, anti-larval measures should be carried out round stations; the importation of non-immune native labour into malarious areas should be prohibited.

The Department is taking the necessary steps to carry out Professor Swellengrebel's recommendations, and is hopeful that other Departments will act on recommendations affecting themselves.

9. *Meningitis—Epidemic Cerebro-Spinal.*—There was a further drop in notifications of this disease to 404, as against 609 last year and 747 the year before. Most of the cases were again among natives, only 76 Europeans being affected. The incidence was heaviest in the Transvaal which accounted for 39 of the European and 159 of the Non-European cases. In the Cape Province there were 29 European and 149 non-European cases reported.

10. *Pellagra.*—No cases were reported from prisons or other institutions during the year. Occasional isolated cases have occurred, usually among very poor natives. In such cases it was generally evident that the patient had subsisted for long periods on a low diet restricted almost entirely to maize.

11. *Plague.*—During the year 71 cases of plague, 44 of which were fatal were reported. The distribution of these cases is set out in the following table:—

TABLE L.—PLAGUE CASES AND DEATHS IN THE UNION DURING THE YEAR ENDED 30TH JUNE, 1931.

Province.	Number of Districts in which Outbreaks Occurred.	European.		Coloured or Native.		Total.	
		Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
Cape	5	6	2	13	8	19	10
Natal	—	—	—	—	—	—	—
Transvaal	—	—	—	—	—	—	—
Orange Free State	6	7	5	45	29	52	34
UNION	11	13	7	58	37	71	44

Rodent surveys have been systematically carried out during the year in the Transkei and other parts. A considerable extension of the area in which veld rodents are affected was discovered in July when a reported mortality among these animals in the Prince Albert, Laingsburg and Beaufort West districts was proved by laboratory examination of carcases to have been due to plague. The first human case reported from this area occurred a month later near Gamka Railway Siding in the Beaufort West District; the victim was a coloured man who died of plague. This case was followed by a few further cases.

Rodent infection has advanced somewhat towards Capetown, to near Touws River on the Karroo side and to within 40 miles of Olifants River on the coastal side. In spite of this spread towards Capetown and the grain areas of the Western Province local authorities, with the exception of those of the Cape Peninsula, are remaining dangerously apathetic and little anti-rodent work is being done by them.

Serious outbreaks occurred in Heilbron and Kopjes spreading later to Petrus Steyn and Lindley. Plague in the Heilbron and Petrus Steyn areas was unusually virulent; none of the cases recovered and the interval between onset of symptoms and death was invariably very short.

Doornhoek location which adjoins the town of Uitenhage was again responsible for an outbreak, seven native inmates contracting the disease. A European in the town was found to be suffering from plague. Cases also occurred in the District, at Summerville in Sunday River Valley.

Cases were also reported from Vredefort, Aliwal North and Bloemfontein districts.

All outbreaks were investigated by officers of the Department and precautionary measures taken in conjunction with local authorities. From these investigations interesting data illustrating the necessity for continual vigilance often emerge.

Thus the infection in three apparently sporadic cases in the Heilbron District were eventually traced to a flea-infested hut remote from the three "stads" in which the cases actually occurred. There had been no noticeable rodent mortality in the immediate vicinity of any of these "stads."

Enquiry as to the previous movements of the three patients revealed the fact that they had formed part of a labour gang of five natives which had been engaged a week previously in another part of the district to mow teff lands. At the end of the day's work the three natives who subsequently developed plague decided to spend the night in a disused hut nearby. The remaining two (married) natives walked back to their own "stads." The three bachelors complained of having spent a very bad night because of fleas. The two survivors stated that they had noticed dead rodents near the hut. The work was finished next day and all returned to their huts. Subsequently symptoms of virulent bubonic plague occurred in the three bachelors and all died after an illness lasting two, three and six days respectively. Enquiry revealed that the flea-infested hut had not been occupied during the previous year.

12. *Rabies.*—During the year under review three cases of this disease were notified, all fatal. These cases serve as a reminder of the fact that rabies is enzootic among certain veld carnivores in a considerable part of the Union. Children on farms need to be warned of the danger of capturing animals that probably because of sickness are unable to escape. In two of the cases the biting animal was a skunk, in the third a dog. The victims were two European males aged 20 and 12 and a coloured male aged 14 years. The intervals between the bite by the rabid animal and the onset of symptoms were two, four and six weeks respectively. In each case death occurred three or four days after the onset of symptoms.

Stocks of anti-rabic vaccine are kept at the Government Health Laboratory, Capetown, and at the South African Institute for Medical Reaserch, Johannesburg. This vaccine is a very reliable preventive if used soon after the individual is bitten by the rabid animal. If its use is delayed until symptoms of rabies develop neither this vaccine nor any other known method of treatment will avail to prevent death.

13. *Scarlet Fever.*—The incidence of this disease has fallen considerably. For the year under review there were 1,464 notifications, the previous year there were 1,637 and the year before that 2,996. Of the cases notified this year 1409 were European and only 55 non-European. The low non-European figure may be attributed to some extent to very imperfect notifications from native areas rather than a low incidence of the disease. It must, however, be remembered that scarlet fever is a disease of urban rather than rural communities and of Europeans rather than of Natives; so that a low prevalence in rural Native areas is to be expected.

14. *Smallpox and Vaccination.*—Small outbreaks of smallpox occurred in three of the provinces. The total number of cases reported was 37, of which only one proved fatal. They were distributed over 21 districts; the largest number of cases was reported from Nelspruit—4, all Europeans.

Of the 37 cases that occurred, 24 had not previously been vaccinated. The remaining cases had mostly been vaccinated many years previously.

The active enforcement of vaccination legislation had continued to have satisfactory results, as is revealed in the subjoined tables (M I, II and III).

Table M (i).—Public Vaccinations during the Year Ended 30th June, 1931.

Province.	Number of Centres at which Public Vaccinations were held.		Number of Visits of Public Vaccinators to Centres.		Numbers Vaccinated.				
					Europeans.		Non-Europeans.		Total.
	Urban.	Rural.	Urban.	Rural.	Primary.	Re-Vaccination.	Primary.	Re-Vaccination.	
Cape	199	1,680	1,227	1,773	12,655	561	98,644	63,523	175,383
Transvaal	92	533	1,939	545	17,411	2,785	65,488	142,493	228,177
Natal	49	361	327	373	1,293	708	33,764	2,025	37,790
Orange Free State	56	243	983	286	6,453	609	10,771	1,384	19,217
Total	396	2,817	4,476	2,977	37,812	4,663	208,667	209,425	460,567

TABLE M (ii).—VACCINATION OF INFANTS AND CHILDREN IN THE CLASSES OF THE POPULATION WHICH REGISTER BIRTHS, YEAR ENDED 30TH JUNE, 1931.
(THESE FIGURES DO NOT INCLUDE RE-VACCINATION OF 12-YEAR-OLD CHILDREN.)

Particulars.	Cape.		Transvaal.		Natal.			Orange Free State.	Union.
	Cape District.	Remainder of Province.	Rand Area.	Remainder of Province.	Durban.	Pietermaritzburg.	Remainder of Province.		
Births Entered in Vaccination Register	11,383	33,541	9,267	10,832	2,095	608	2,110	5,520	75,356
Successfully Vaccinated	4,341	3,808	4,922	6,049	1,000	370	1,298	3,530	25,318
Insusceptible to Vaccination	3	4	45	38	31	16	50	12	199
Vaccination Postponed owing to Illness	106	211	383	434	316	75	405	497	2,427
Previously had Smallpox	5	1	—	—	—	—	—	—	6
Deaths of Infants under Two Years Registered	2,843	3,090	744	666	168	42	153	365	8,071
Exempted under Section 10, Act 15 of 1928	32	75	100	115	107	24	44	48	545
Ratio Percentage of Vaccinations Registered to Births Registered during the Year (after allowing for deaths of infants under two years)	50·8	12·6	57·7	59·5	51·9	65·4	66·3	68·5	37·6

TABLE M (iii).—RE-VACCINATION OF TWELVE-YEAR-OLD EUROPEAN CHILDREN IN NATAL, YEAR ENDED 30TH JUNE, 1931

Particulars.	Durban.	Pietermaritzburg.	Remainder of Province.	Total.
Registration of twelve-year-old European children	1,121	424	1,278	2,823
Successfully vaccinated	659	289	903	1,851
Insusceptible to vaccination	108	32	114	254
Vaccination postponed owing to illness	45	15	76	136
Previously had smallpox	—	—	—	—
Rates percentage of vaccinations to twelve-year-old registrations	72·4	79·23	85·52	79·38

15. *Tuberculosis.*—Cases of human tuberculosis notified during the year numbered 6,148. This figure is, however, of little value as indicating the prevalence of the disease, as a large proportion of the cases, particularly among the non-European population, are not notified.

The position in the Union regarding tuberculosis in dairy cattle has long been unsatisfactory. A campaign to improve matters was undertaken by the Department of Agriculture in September commencing with a proclaimed area in Durban which was believed to be badly infected. Intradermal tuberculin tests of all bovines in that area are being carried out. Valuable information has been gained as a result, including the fact that a far larger percentage of animals was infected than had been anticipated. It is hoped as a result of this initial work that during the coming year the Department of Agriculture will be in a position to decide on a definite policy to deal with the problem throughout the Union.

Nelspoort Sanatorium.—The following table summarises the work of the institution during the year :—

TABLE N.—ADMISSIONS, DISCHARGES, AND DEATHS DURING THE YEAR ENDED 30TH JUNE, 1931.

	Total.	European.			Non-European.		
		Male.	Female.	Total.	Male.	Female.	Total.
In Sanatorium on 1st July, 1930	81	30	27	57	17	7	24
Admitted during year	260	100	80	180	40	40	80
TOTAL	341	130	107	237	57	47	104
Died during year	5	1	1	2	1	2	3
Discharged during year	239	95	78	173	38	28	66
TOTAL	244	96	79	175	39	30	69
In Sanatorium on 30th June, 1931	97	34	28	62	18	17	35

The patients admitted during the year were in the following stages of the disease :—

Race.	*Stage I.*	*Stage II.*	*Stage III.*
European	19·4 per cent.	56·6 per cent.	24·0 per cent.
Non-European	18·7 per cent.	52·5 per cent.	28·8 per cent.

Of the 260 admissions during the year 211 were free, half their cost being paid by the local authority and half from the Department's vote, 26 were part-paying or contributing, and 23 were full-paying patients.

The average stay of patients in the institution was : Europeans, 108 days ; non-European, 106 days.

Of the 239 patients discharged, 109 were noted as "much improved," 105 as "improved," 24 as "stationary," and 1 as "worse."

In addition to routine sanatorium treatment, nine patients had artificial pneumothorax treatment successfully, and in four others the treatment had to be discontinued for various reasons. Courses of Sanocrysin were given to eight patients, and in four of these the sputum entirely disappeared. Various new remedies were tried. In a case which appeared to be gangrene of the lung, very excellent results were obtained ; a specimen of sputum was sent to the Government Pathologist, who reported that the organisms could not grow on culture although various media were tried ; "Transpulmin" was given and improvement was immediate ; the case cleared up altogether and the patient left in excellent health. "Santuben" was tried on three patients, with improvement; in two cases stomatitis developed, which was attributed to the Guaiacol in the tablets.

16. *Typhus Fever.*—Total cases notified was 1,541 as compared with 1,782 for 1929–30. The death rate was, however, slightly higher, there being 216 deaths as against 212 last year. The distribution of the cases over the four provinces is shown in Table "O."

TABLE O.—TYPHUS FEVER: CASES AND DEATHS REPORTED DURING THE YEAR ENDED 30TH JUNE, 1931.

Province.	Number of Districts in which Outbreaks Occurred.	European.		Non-European.		Total.	
		Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
Cape	48	26	—	843	95	869	95
Natal	10	21	1	41	19	62	20
Orange Free State	8	3	1	50	9	53	10
Transvaal	5	3	—	554	91	557	91
UNION	71	53	2	1,488	214	1,541	216

As usual the bulk of the cases occurred in the native territories of the Cape although the totals from those areas were considerably lower than in the previous year. Outbreaks occurred in various parts of these territories throughout the year. The poorest regions, notably Glen Grey district, again suffered most, bringing out again the close association between bad economic conditions and a high typhus incidence.

The high incidence in the Transvaal is accounted for by the serious outbreaks among natives living in squalid conditions on the various alluvial diggings. The first outbreak occurred in the Ventersdorp district whence it spread to the Lichtenburg diggings. Considerable difficulties were at first encountered because of strong objection of the natives to personal disinfestation. Cases also occurred among natives on farms in the neighbouring districts of Potchefstroom and Rustenburg.

Many sporadic cases occurred in various parts of the Union, e.g., in Natal, Capetown and East London. The origin of such cases is often difficult to trace, but the outbreaks are as a rule easily suppressed.

17. *Venereal Diseases.*—The following table summarises the work done during the year in connection with venereal diseases by district surgeons, local authorities and institutions :—

TABLE P.—VENEREAL DISEASES: CASES TREATED AND ATTENDANCES, YEAR ENDED 30TH JUNE, 1931.

Locality.	In Hospital.						Outdoor Attendances.*					
	Syphilis.		Gonorrhoea and Other Venereal Diseases.		Total.		Syphilis.		Gonorrhoea and Other Venereal Diseases.		Total.	
	European.	Non-European.	European.	Non-European.	European.	Non-European.	European.	Non-European.	European.	Non-European.	European.	Non-European.
(1) *By District Surgeons.*												
Cape	38	1,314	28	277	66	1,591	360	12,066	230	2,087	590	14,153
Natal	5	293	17	85	22	378	80	1,980	50	372	130	2,352
Transvaal	7	1,030	5	143	12	1,173	286	7,477	128	313	414	7,790
Orange Free State	—	13	5	4	5	17	217	4,858	185	1,108	402	5,966
	—											
(2) *At Institutions and Clinics.*												
Barberton	—	301	—	2	—	303	—	—	—	—	—	—
Belfast	—	—	—	—	—	—	—	6	—	—	—	6
Bethlehem	—	33	—	7	—	40	—	—	1	—	1	—
Bloemfontein	7	178	7	41	14	219	363	531	153	3	516	534
Bochem	—	407	—	6	—	413	—	538	—	2	—	540
Capetown	37	103	56	40	93	143	6,599	10,395	5,062	2,705	11,661	13,100
Cradock	—	149	—	—	—	149	—	—	—	—	—	—
Durban	32	530	48	71	80	601	1,034	1,061	4,955	1,144	5,989	2,205
East London	—	—	—	—	—	—	400	1,208	495	306	895	1,514
Elim	5	651	—	19	5	670	—	95	—	—	—	95
Johannesburg	—	—	—	—	—	—	5,099	—	4,168	—	9,267	—
Kimberley	13	233	1	57	14	290	8	1,526	25	75	33	1,601
Kingwilliamstown	1	121	2	2	3	123	13	42	—	—	13	42
Kroonstad	—	—	—	—	—	—	—	883	—	—	—	883
Krugersdorp	—	—	—	—	—	—	40	39	64	17	104	56
Kuruman	—	31	—	—	—	31	—	371	—	—	—	371
Marianhill	—	6	—	—	—	6	—	195	—	—	—	195
Mphalele	—	72	—	1	—	73	—	650	—	34	—	684
Olifantshoek	—	—	—	—	—	—	69	149	17	—	86	149
Oudtshoorn	—	—	—	—	—	—	31	212	—	—	31	212
Pretoria	—	—	—	—	—	—	833	4,310	320	169	1,153	4,479
Port Elizabeth	7	37	5	7	12	44	896	4,766	1,303	1,222	2,199	5,988
Potchefstroom	—	—	—	—	—	—	86	3,400	—	—	86	3,400
Port St. Johns	—	—	—	—	—	—	—	64	—	6	—	70
Pietermaritzburg	—	31	—	—	—	31	70	645	74	134	144	779
Rietfontein	85	2,456	186	680	271	3,136	4,796	17,994	—	—	4,796	17,994
Sekukuniland (Jane Furse Memorial)	—	86	—	1	—	87	29	4,546	—	2	29	4,548
Stellenbosch	—	33	—	—	—	33	—	1,040	—	—	—	1,040
Strand	3	11	—	—	3	11	33	44	28	5	61	49
Swellendam	—	24	—	—	—	24	—	—	—	—	—	—
Uitenhage	4	74	—	—	4	74	164	1,544	4	2	168	1,546
Victoria West	—	—	—	—	—	—	—	16	—	—	—	16
Vryburg	—	117	—	—	—	117	—	337	—	—	—	377
TOTAL	244	8,334	360	1,443	604	9,777	21,506	82,988	17,262	9,706	38,768	92,694

* Attendances only: Patients attend three times on an average.

In spite of the fact that financial resources have been limited the total number of cases and treatments have increased.

VI.—GENERAL.

1. *Sanitation*—(*a*) *Septic Tanks.*—Urban local authorities continue to experience difficulty regarding the desirability of permitting the installation by residents of septic tanks. The attitude adopted by this Department is that, although a water-carriage sewerage system has great hygienic advantages over the pail or pit disposal method, no local authority should sanction the installation of septic tanks unless the local and general conditions are favourable and every precaution is taken to obviate nuisance. The proposed site, type, and size of tank, number of persons using the system, size of premises, character of surface and sub-soil, distance from existing wells, as well as proposed site and method of disposal of effluent are all matters which need careful consideration in each individual application, and often require a personal visit and inspection by an experienced health officer. This Department willingly assists local authorities needing advice on these matters.

(*b*) *Hygiene of Swimming Baths.*—The measures adopted by local authorities for safe-guarding the public health by ensuring reasonable purity of swimming bath water have been further investigated. In many places reasonably satisfactory conditions have been attained ; the general sanitation of the premises and the special measures for constantly purifying the water are satisfactory. In others where conditions were unsatisfactory this Department's advice and suggestions for improvement have willingly been acted on or the assurance has been given that they will be acted on before the coming summer season. Many local authorities have sought advice as to the best types of purification and aeration plants, which have subsequently been installed. Where water is cheap and plentiful reliance is being placed on frequent changes of water—two or three times weekly. In a few places conditions are still unsatisfactory, but in general there has been a marked advance since the matter was first taken up by the Department.

(*c*) *Rural Pleasure Resorts.*—Last year attention was called to the insanitary conditions at many rural pleasure resorts entailing danger to the visiting public. Owing to the absence of constituted rural local authorities outside the Cape Province the securing of effective remedial measures is usually very difficult. Only by the establishment of suitable local government institutions throughout the Union can permanent general improvement be effected.

During the year steps have been taken by the Cape and Transvaal Provincial Administrations to control sanitation and preserve amenities at certain rural pleasure resorts by the publication of simple sanitary regulations. This is a commendable forward step. The Department has drawn up a set of simple suggestions for the guidance of members of camping parties and how to avoid endangering their own or the public health. It is proposed to distribute copies of these for general information to local authorities, the press, boy scouts, girl guides, hiking clubs and other similar organisations.

2. *Housing.*—Full details of the working of the Housing Act, No. 35 of 1920, from the date of its commencement, are contained in the report of the Central Housing Board for the calendar year 1930—which was laid, in typescript, on the Tables of Parliament. The following table summarizes the position as at 30th June, 1931 :—

TABLE Q.—HOUSING ACT, NO. 35 OF 1920: WORKING FROM PROMULGATION (16TH AUGUST, 1920) TO 30TH JUNE, 1931.

Province.	Loan Applications Approved.			Loan Issues.	Number of Houses.					
	European.	Non-European.	Total.		Completed.	Under construction.	Approved, but not yet commenced.	Total.	Total for European occupation.	Total for non European occupation.
(A) *Economic Housing.*	£	£	£	£						
Cape	1,165,497	599,586	1,765,083	1,621,385	5,749	144	417	6,310	1,884 (*a*)	4,426 (*b*)
Natal	516,915	52,134	569,049	555,214	687	—	16	703	502	201 (*c*)
Orange Free State	477,471	22,910	500,381	464,761	1,127	300	392	1,819	563	1,256 (*d*)
Transvaal	767,092	223,230	990,322	956,125	2,745	31	293	3,069	951	2,118 (*e*)
TOTAL	2,926,975	897,860	3,824,835	3,597,485 (*f*)	10,308	475	1,118	11,901	3,900	8,001
(B) *Sub-Economic Housing.*										
Cape	72,000	232,176	304,176	3,963	26	50	850	926	300	626
Transvaal	9,400	—	9,400	—	—	—	25	25	25	—
TOTAL	81,400	232,176	313,576	3,963	26	50	875	951	325	626
TOTAL (A) AND (B)	3,008,375	1,130,036	4,138,411	3,601,448	10,334	525	1,993	12,852	4,225	8,627

(*a*) Includes a hostel to accommodate 86 persons.
(*b*) Includes 1,329 single rooms in blocks and 60 flats in four blocks.
(*c*) Includes 3 barracks and 16 single rooms in blocks.
(*d*) Includes 24 single rooms in blocks, the balance of 1,232 representing the approximate number of dwellings to be built out of a total loan of £22,110 made to three local authorities for use exclusively in purchasing materials to be advanced to coloured persons and natives building their own homes.
(*e*) Includes 303 single rooms in blocks, 3 compounds and 13 hostels.
(*f*) Includes £556,082 re-issued out of repaid capital.

It will be noted that the foregoing statement differentiates between economic housing and sub-economic housing, the latter being a new phase of activity initiated during the year under review by the Government under the Housing Act, for the purpose of assisting Local Authorities with the problem of the housing of the very poor who are unable to pay economic rentals, and the improvement of unhealthy areas, subject to special conditions, of which the more important are :—

(*a*) that the houses be built solely for letting purposes ;
(*b*) that the rentals be fixed at a figure which will involve the Local Authority in a loss on the scheme at least equal to the loss to the Government in making the money available at 3 per cent. rate of interest instead of at the economic rate of 5 per cent.
(*c*) that the Local Authority will, *pari passu* with the carrying out of the scheme of new construction, actively proceed with measures for the reduction and prevention of overcrowding, the repair or the closure and demolition of dilapidated, insanitary and unfit dwellings, and the improvement and removal of slums in unhealthy areas ; and
(*d*) that in calling upon owners of unfit dwellings to have their premises demolished, an endeavour be made for the order of demolition to coincide with the provision of dwellings under the sub-economic housing schemes, and that the new dwellings be reserved as far as possible for persons vacating insanitary and overcrowded premises.

The principles under which sub-economic loans may be issued were only finally sanctioned by the Treasury in July, 1930, after which Local Authorities desiring to avail themselves of the facilities under the scheme had to carry out careful investigations regarding slum conditions in their areas precedent to the granting of a loan. For these reasons only the small sum of £3,846 was drawn out of the £100,000 provided during the financial year 1930–31 as a first instalment of the £500,000 which the Government agreed to make available at 3 per cent. rate of interest for sub-economic housing. A further contributing cause of the slow progress was the temporary hold-up of work on the large Capetown municipal scheme for Coloured persons at Bokmakirie Township, pending the granting of approval by Parliament—which was obtained in March, 1931—to the waiving of certain restrictive conditions attached to the grant of the land. The indications are that the bulk of this year's provision of £150,000 should be drawn by the close of the current financial year, for payment of work done and services rendered in connection with approved sub-economic schemes.

Four Local Authorities have so far participated in the Government's loan scheme for sub-economic housing. At Capetown, the Municipality, in addition to its own scheme at Bokmakirie—embracing the erection of 492 dwellings at an estimated cost of £200,000—is also assisting, by way of housing loans granted under Section 6 of the Housing Act the financing of two schemes embarked upon by the Capetown Citizens' Housing League Utility Company—the one for Coloured persons at Crawford on the Cape Flats, embracing the erection of 26 dwellings at an estimated cost of £8,450, and the other for Europeans at Koeberg Road, Maitland, embracing the erection of 300 dwellings at an estimated cost of £90,000. The Port Elizabeth Municipality is proceeding apace with its scheme for Coloured persons at North End, embracing the erection of 100 dwellings at an estimated cost of £24,266, and work is about to be commenced by the Pretoria Municipality on a European housing scheme estimated to cost £9,400 and embracing the erection of 25 dwellings. The Mossel Bay Municipality has also been granted a small loan for providing eight almshouses in the Location, to be occupied rent-free by indigent Coloured persons.

Among other Local Authorities which have displayed interest in the Government's proposals for sub-economic housing is the Kimberley Municipality, in the area of which is what is known as the Malay Camp with its deplorable conditions of housing calling for early remedy ; the Council originally made application for an allocation of £50,000 out of loan funds set aside for sub-economic housing, and it came as a disappointment to learn that the Council, after months of deliberation, had recently decided not to proceed with a scheme, owing, it was stated, to insuperable difficulties facing them—the chief of which, it is understood, being the Council's inability to purchase ground at a reasonable figure. The Bloemfontein Municipality also recently cancelled its application for an allocation of £50,000—in explanation of which it was mentioned that "owing to the present financial depression and the consequent fall in rent values, there is not so great a demand for sub-economic housing." Mention is also to be made of the decision of the Kingwilliamstown Municipality not to proceed with a sub-economic European housing scheme, for which a loan of £10,000 had been sanctioned to cover the cost of erecting 24 cottages.

With regard to economic housing, a further instalment of £200,000 was provided on the Loan Estimates for the financial year 1931–32 out of the additional £1,000,000 of new money carrying interest at 5 per cent. which the Government agreed in 1928–29 to make available under the Housing Act for assisting over a period of years the housing of persons in receipt of small wages or salaries, leaving a balance of £380,000 still to be provided. Of this balance approximately £67,000 is still available for allotment and represents portion of the £200,000 deducted from the original allocation made to the Capetown Municipality, of which particulars are noted in the following paragraph.

Out of the £1,000,000 of new money for economic housing referred to in the preceding paragraph, the Capetown Municipality were allotted in 1928–29 a share of £600,000 which, during the year under review, was reduced to £400,000—this reduction of £200,000 having been decided upon as a result of the delay on the part of the Council in formulating and submitting for approval proposals for expending the money. The schemes so far submitted and approved involve loans totalling £286,000, which thus leaves out of the £400,000 allotment a balance of £113,000 still available for financing further schemes which the Council may decide to embark on. While stressing the point that it is the accepted policy of the Council to proceed as speedily as possible with schemes of this nature, the fact was emphasised in explanation of the delay which had occurred, that the serious depression obtaining must very naturally retard the progress through the Committee and the Council of more than one scheme at a time.

Reference is also to be made to the sum of £50,000 which for the past three years has been ear-marked for improving the housing conditions of Indians in and around Durban, and has not so far been utilized. In 1929 the Durban Corporation decided that an area of land which it owned at Cato Manor be laid out in plots of suitable size to be offered for sale to Indians, with a promise of assistance to purchasers towards the erection of buildings on a standard specification to be framed by the Corporation. This proposal, which it was the intention to finance cut of the £50,000, was strongly opposed by the Natal Indian Congress, mainly on the score that it savoured of segregation, but also because the site was outside the Borough area and the Council would accordingly not be able to exercise any rights over it as a Local Authority, thus raising the fear that the community would be likely to be neglected in the matter of provision of roads and other essential services—which would thus tend to the creation of slum conditions. In view of this opposition no further steps were taken by the Council. A change in the outlook of the position has, however, recently taken place as a result of the report bearing date the 24th October, 1930, of the Commission appointed in 1929 by the Natal Provincial Executive to consider and report upon the extension of the boundaries of the Durban Borough. One of the conclusions come to by the Commission was that a satisfactory solution of Durban's very pressing problem of non-European housing in certain of its aspects cannot be found apart from an extension of the boundaries of the Borough. A similar conclusion was arrived at by the Central Housing Board as a result of the special enquiry into the housing of Indians in and around Durban which it conducted in October, 1928, as an outcome of one of the conclusions at the Round Table Conference on the Indian question in South Africa, held in Capetown during 1926, and in terms of which the Government expressed its willingness to appoint a Committee to investigate the matter. Based on the recommendations of the Commission, the Provincial Council at its last Session passed Ordinance No. 16 of 1931, extending the boundaries of the Borough—the date of incorporation to have effect from the 1st August, 1932; the extension includes the site at Cato Manor and at the instance of the Council discussion has recently been re-opened with the Natal Indian Congress on the general question of housing accommodation for Indians with a view to arriving at some agreement.

The prevailing depression is undoubtedly acting as a brake in the launching of fresh housing schemes, there being three recent instances of Local Authorities deciding to postpone for the time being the carrying-out of schemes which had been approved. Unemployment is to be found in a greater degree among the class which such schemes are intended to serve, and Local Authorities are naturally proceeding cautiously in carrying out their building programmes, with the object of safeguarding themselves from possible financial loss.

3. *Town Planning.*—Satisfactory machinery for supervising and controlling town planning and the laying out of new townships exists in the Cape, Transvaal and Orange Free State. In the Transvaal an Ordinance amending the laws relating to the establishment of townships and extensions of existing townships and providing for town planning and all incidental matters was gazetted in June, 1931. The unsatisfactory position previously reported on in Natal has been somewhat improved by the passing of the Natal Provincial Council of Ordinance No. 14 of 1930 which provides for the establishment, compulsory where necessary, of a simple form of local authority with elected or nominated members. This ordinance was published in September, 1930, and immediate steps were taken to bring it into operation. Eight health committees have already been formed under this ordinance, namely, those of Tongaat, Gingindhlovu, Southern Umlazi, Lennoxton-Fairleigh, Scottburgh, Umhlanga Rocks, Umhloti and Ixopo.

4. *Child Welfare.*—The national and local organisations referred to in last report continue to carry out very excellent work on behalf of mothers and children needing their help. Annual grants were as usual made for this work.

The Moedersbond Hospital Committee, Pretoria, is at last in a position, with the aid of a Government contribution, to erect a large suitable building in which the Mothercraft and Child Welfare side of its work will be considerably extended.

Registration of births and deaths and infantile mortality rates for European infants in each Province during the past year and the preceding eleven years are shown in the following table:—

TABLE R.—EUROPEAN INFANTS: BIRTHS AND DEATHS UNDER ONE YEAR REGISTERED AND INFANTILE MORTALITY RATE, I.E. DEATH RATE PER 1,000 BIRTHS, 1919-1930.

Year.	Cape.			Natal.			Transvaal.			Orange Free State.			Union.		
	Total European Births Registered.	Deaths of European Children under One Year.	Death-rate per 1,000 Births.	Total European Births Registered.	Deaths of European Children under One Year.	Death-rate per 1,000 Births.	Total European Births Registered.	Deaths of European Children under One Year.	Death-rate per 1,000 Births.	Total European Births Registered.	Deaths of European Children under One Year.	Death-rate per 1,000 Births.	Total European Births Registered.	Deaths of European Children under One Year.	Death-rate per 1,000 Births.
1919.....	16,749	1,351	80·66	2,910	191	65·64	15,338	1,326	86·45	4,727	382	80·81	39,724	3,250	81·81
1920.....	18,425	1,654	89·77	3,256	235	72·17	16,768	1,576	93·99	4,996	448	89·67	43,445	3,913	90·07
1921.....	18,062	1,382	76·51	3,370	203	60·24	16,582	1,374	82·86	5,288	379	71·67	43,302	3,338	77·09
1922.....	18,248	1,294	70·91	3,294	180	54·64	16·370	1,292	78·92	4,920	357	72·56	42,832	3,123	72·91
1923.....	18,296	1,353	73·95	3,229	197	61·01	15,619	1,261	80·74	5,037	328	65·12	42,181	3,139	74·42
1924.....	18,730	1,296	69·19	3,410	273	80·06	15,287	1,171	76·60	4,919	382	77·66	42,346	3,122	73·73
1925.....	18,366	1,343	73·12	3,509	206	58·71	16,348	1,059	64·78	5,188	361	69·58	43,411	2,969	68·39
1926.....	18,675	1,196	64·04	3,588	189	52·68	16,304	1,186	72·74	5,309	273	51·42	43,876	2,844	64·82
1927.....	18,537	1,293	69·75	3,435	166	48·32	17,050	1,359	79·71	5,325	314	58·97	44,347	3,132	70·63
1928.....	18,032	1,240	68·77	3,514	184	52·36	17,949	1,370	76·33	5,318	365	68·63	44,813	3,159	70·49
1929.....	19,008	1,169	61·50	3,650	177	48·49	18,227	1,342	73·63	5,334	280	52·49	46,219	2,968	64·22
1930*.....	19,468	1,331	68·37	3,643	159	43·65	19,108	1,386	72·54	5,317	300	56·42	47,536	3,176	66·81

* Preliminary Figures.

5. *Opium and other Habit-forming Drugs.*—In co-operation with the Police, Commissioner of Customs and Excise, and Postmaster-General, the enforcement of the regulations regarding opium, dagga, and other habit-forming drugs has been actively continued during the year. The following table shows the prosecutions and convictions :—

TABLE S.—SHOWING PROSECUTIONS AND CONVICTIONS UNDER LAWS RELATING TO HABIT-FORMING DRUGS DURING THE PERIOD 1ST JULY, 1930 TO 30TH JUNE, 1931.

Province.	European.		Native.		Asiatic.		Other Coloured.		Total.	
	Prosecutions.	Convictions.	Prosecutions.	Convictions.	Prosecutions.	Convictions.	Prosecutions.	Convictions.	Prosecutions.	Convictions
Cape	24	19	638	593	17	15	899	866	1,578	1,493
Natal	1	—	1,483	1,434	54	48	41	37	1,579	1,519
Transvaal	18	17	1,385	1,332	33	29	94	91	1,530	1,469
Orange Free State	6	6	315	307	—	—	35	34	356	347
UNION	49	42	3,821	3,666	104	92	1,069	1,028	5,043	4,828

Of the total of 5,043 prosecutions, 5,036 were in respect of dagga and 7 of opium ; 5 lb. 13½ ozs. of opium and large quantities of dagga were seized and confiscated.

The total quantities of these drugs imported into the Union during the year ended 30th June, 1931, were : Opium 653 lb. 2,803 grs. ; morphine 44 lb. 737 grs. ; cocaine 27 lb. 6,052 grs. ; heroin 1Clb. 1,589 grs. ; cannabis indica 14 lb. 1,852 grs.

The following habit-forming drugs were exported from the Union during the year ended 30th June, 1931 : Opium, 7 lb. 2,432 grs. ; morphine, 5 lb 13 grs. ; cocaine, 1 lb. 685 grs. ; heroin, 597 grs. ; cannabis indica, 6,232 grs.

The permit for the cultivation of dagga for export purposes issued to a farmer in the Koster area, Rustenburg District, Transvaal, was renewed for the calendar year 1931.

Apart from dagga-smoking by natives and coloured persons and opium-smoking by a few Chinese addicts, the illicit use of habit-forming drugs in the Union is comparatively trifling.

6. *Nurses and Midwives.*—The serious shortage continues. The position was discussed at the October meeting of the Council of Public Health and a resolution was passed urging serious consideration of the matter by the Government and Parliament with a view to devising effective remedial measures. Approval was also expressed of the proposal to convene a conference of representatives of the Provincial Administrations and hospital authorities, the South African Medical Council, the Trained Nurses Association, and the Union Health Department, to consider the curriculum and requirements for the training of nurses and midwives to be embodied in the regulations under Act. No. 13 of 1928.

This conference was duly called in April and was opened, in the unavoidable absence of the Minister, by the Administrator of the Transvaal. It was attended by representatives of the Union Health Department, Provincial Administrations, South African Medical Council, Medical Association of South Africa, Afrikaanse Christelike Vroue Vereniging, C.P., Transvaal Vroue Federasie, O.V.S. Vroue Federasie, Transvaal Branch of the S.A. Red Cross Association and the South African Trained Nurses Association. With one dissentient the conference agreed as to the definite shortage of trained European nurses and midwives for both public hospitals and rural areas. The draft regulations of the Medical Council as regards minimum age, period of training and educational standard were approved. In view of the difficulty experienced in obtaining nursing staffs at Government institutions and small local institutions, and the present inadequate facilities for general and maternity nursing and the high maternal death rate for the Union, the serious consideration of the Government and Parliament was urged ; it was unanimously agreed that the Government should initiate an educational campaign in the rural districts showing the advantage of engaging trained midwives ; the conference expressed itself unanimously as convinced of the great shortage of trained nurses and midwives for non-Europeans in the Union, and of the need for greater provision of facilities for training Indian, Coloured and Native Nurses. Many other important matters were also discussed.

As a result of the resolution of the conference the draft regulations of the Medical Council have been approved by the Minister. Owing to lack of funds it was not possible to act immediately on the other recommendations. The whole position is, however, being explored with a view to arriving at concrete proposals, for submission at a later date, for the provision of a greater output of trained nurses.

7. *Nursing and Maternity Homes.*—The system of registration and inspection described in previous reports has been continued. The following table summarizes the work done during the year :—

TABLE T.—NURSING AND MATERNITY HOMES: INSPECTIONS DURING THE YEAR ENDED 30TH JUNE, 1931.

Place.	Total Number.	Number Inspected.	
		By Medical Officer of Local Authority.	By Government Health Officer.
Cape Province—			
Capetown	29	29	—
East London	7	9	—
Port Elizabeth	10	—	—
Elsewhere	64	6	9
Natal Province—			
Durban	23	2	—
Pietermaritzburg	6	—	—
Elsewhere	22	—	15
Transvaal Province—			
Johannesburg	35	35	—
Pretoria	16	—	—
Elsewhere	47	—	31
Orange Free State—			
Bloemfontein	5	—	—
Elsewhere	20	—	6
UNION	284	81	61

During the year an additional Regulation (G.N. 1698-1930) was promulgated providing for the issue and display in the Home of a Certificate of Registration by this Department, the object being to facilitate the detection of unregistered homes.

The form of application for the registration of nursing homes was amended to include particulars aiming at more hygienic and better equipped institutions. This provision together with the enforcement of the legal provisions regarding the qualifications of the persons in charge of nursing homes and the increased number of inspections have had a salutary effect in bringing into existence a better class of nursing home generally than has hitherto been the case.

Under the powers conferred by law the Minister has during the year removed three nursing homes from the Register kept in this Department.

8. *Inyangas or Native Herbalists in Natal and Zululand.*—The policy of gradually discouraging inyanga practice in favour of trained native personnel has been continued. The number licensed had dropped at the end of June, 1931 to 827. The previous June there were 1,001 and in June, 1929, the number was 1,352. During the year under review there were 41 applications for new licenses; of these the issue of 6 only were authorized by the Minister under special circumstances.

The present inyangas are distributed over 43 magisterial districts. The largest numbers are in Nqutu with 96, Ingwavuma with 66, Melmoth, Nongoma and Ubombo with 39 each, Mahlabatini with 37 and Ndwedwe with 36.

Much unlicensed practice is being carried on by inyangas and witch doctors in Zululand and also in the Transkei and Native areas in other parts of the Union where there is no licensing system. The total number of inyangas, medicine men, herbalists and witch doctors in the Union has been estimated by medical men familiar with the position as probably considerably over 3,000.

9. *General Hospitals.*—The system of annual inspection on behalf of the Provincial Administrations of the State-aided and kindred institutions in the Cape Province, Orange Free State and the Transvaal was continued during the year. As before, the hospitals on the Reef and in Pretoria were inspected by the members of the Hospital Advisory Council of the Transvaal while twenty-nine hospitals and aided charitable institutions were inspected and reported on by different Assistant Health Officers in this Department as opportunity arose. Owing to a temporary shortage of staff and the necessity to reduce travelling to a minimum, it was found impracticable to carry out the same number of inspections as during the year before. It is anticipated, however, that the remaining institutions will be inspected next year. During the year under review the Provincial Administration of the Transvaal appointed a Departmental Committee on Hospital Subsidies with Sir Edward Thornton, Senior Assistant Health Officer in this Department,

as a member, to report generally on the system of subsidies to public hospitals under the provisions of Ordinance No. 18 of 1928. As the result of the recommendations of this Committee an Ordinance to amend the Public Hospitals Ordinance, 1928, in certain respects, was submitted to the Administration as a schedule to the Committee's report. This proposed amendment to the Ordinance had not yet been passed by the Provincial Council at the end of the period under review.

The Provincial Administration of the Orange Free State appointed a Hospital Inquiry Commission of which Dr. A. J. van der Spuy, Assistant Health Officer in this Department w s a member, to investigate and report on the internal organisation of the hospitals and other general matters associated with the general functions and conduct of the hospitals under the control of that administration.

Though the Commission's report was submitted about six months ago, no action appears to have been taken as yet regarding it. In previous reports the unsatisfactory position of the general hospitals in the Union outside the Transvaal was commented upon and it is satisfactory to note that considerable progress has been made towards meeting the shortage of beds and generally improving the conditions of the institutions under the control of the Cape and the Orange Free State Provincial Administrations.

In the Cape Province building operations in connection with the new Central Hospitals at Capetown and East London have been commenced. During the year the new Peninsula Maternity Home, the non-European section of the Victoria Hospital, Wynberg, Grey's Hospital, Kingwilliamstown, and the new hospital at Middelburg were completed and brought into use. Work on schemes of extension to existing hospitals are proceeding at the Provincial Hospital, Port Elizabeth; Frontier Hospital, Queenstown; the Sir Henry Elliott Hospital, Umtata; the Uitenhage Hospital; the Malmesbury Hospital and the Usher Memorial Hospital, Kokstad. Plans for a hospital at Calvinia have been prepared and accepted by the Hospital Board and it is expected to commence building operations in the near future. The scheme for the establishment of a State-aided hospital at De Aar appears to have made no further progress. The two Convalescent Homes under the control of the Cape Hospital Board have been extended and brought thoroughly up-to-date while the scheme for the establishment of the Princess Alice Home of Recovery for children requiring prolonged institutional treatment has reached an advanced stage.

In the Orange Free State the new Central Hospital, Bloemfontein, and the extensive additions to the Northern Free State Hospital, Kroonstad, are nearing completion and, it is anticipated, will be ready for occupation during the next financial year. During the year new hospitals were completed and brought into use in Bethlehem and Senekal, extensions to the Jagersfontein Hospital were completed and plans for extensions to the Harrismith Hospital were passed.

The Hospitals in the Natal Province are not inspected by the Medical Officers of this Department, but it is understood that a new block at the Addington Hospital, originally intended for non-Europeans, was completed and is now being used to accommodate European patients while a scheme for erecting a new non-European hospital at Congella is being prepared. A new Hospital was also opened at Dundee.

In the Transvaal satisfactory progress in the construction of the new Pretoria Hospital has been maintained and it is expected that the institution will be ready for occupation some time next year. A new hospital was opened at Witbank and plans for a hospital at Volksrust have been passed. At the Krugersdorp Hospital the new non-European block was completed and occupied, while schemes for extension to existing hospitals are proceeding at Barberton, Standerton, Rustenburg, Johannesburg and Springs.

Chronic Sick Hospitals.—The very unsatisfactory position in regard to chronic sick hospitals in the Union was commented upon in previous reports and the position remains practically unchanged. The proposal to purchase the Alexandria Hospital from the Department of the Interior has been abandoned by the Cape Provincial Administration and the scheme to provide a new institution on the Cape Flats appears to have made no further progress.

10. *Vaccines, Sera, Pathogenic Cultures, etc.*—Under the regulations made under Sections 36 and 134 of Act No. 36 of 1919, nine permits were issued during the year, all being to bacteriologists conducting laboratories.

The series of regulations framed by the South African Medical Council under Section 83 of the Medical, Dental and Pharmacy Act. No. 13 of 1928, have not yet been promulgated owing to the difficulties previously referred to regarding arrangements for the carrying-out of laboratory testing work in connection therewith.

11. *Goitre.*—Yet another area has been found with a collection of cases of simple goitre. This is in a valley among the Rustenburg hills. It is being dealt with on the lines of previously reported goitrous areas.

By arrangement with the Government Division of Veterinary Research an investigation is being carried out regarding the condition in the Uniondale district. Possible local causes such as iodine deficiency in water, food or soil are being enquired into.

12. *Dietetics.*—The drawbacks of a limited dietary were pointed out in the section on Health of Natives on the Witwatersrand Gold Mines. Those natives have mealie meal as their staple article of diet; but it is supplemented by meat, vegetables, germinated beans, etc., so that, provided the native makes use of these additional substances, a reasonably balanced diet adequately supplied with vitamins is obtained.

There can be no doubt, however, that if mealie meal with its necessarily long period of cooking is eaten to the virtual exclusion of all other food substances very unsatisfactory conditions result in the human body. This unfortunately occurs to a considerable extent in the native territories, in the native compounds and locations of many industries other than the Transvaal Gold Mines, and among a large section of the European population which has become impoverished from various causes. The effect of this on the Bantu is clearly brought out when he is put on to hard work. In the Territories the male lives an indolent life, with his skin freely exposed to air and sunlight, and the effect of a qualitatively inadequate diet may not be immediately obvious. When, however, he is recruited for work on the mines he is liable to succumb to disease if special precautions are not taken. If he is put on to hard work immediately, scurvy and/or pneumonia are likely to occur. This is well recognised by employers of mine labour. The usual procedure is to allow him all the food he can manage and to keep him on light work during the first week or two. A similar reaction to hard work was found to be occurring in the Durban Prison Command two years ago. The disease Pellagra was found to be occurring extensively in new prisoners brought in from Zululand. The evidence again pointed to the fact that it was the hard work immediately on arrival in gaol which brought out the pellagra in a badly nourished native.

A consideration of the composition of mealie meal will immediately make it clear that if used as the only food it cannot support healthy mammalian life. It consists of 77·4 per cent. starch, 9·9 per cent. protein and 2·1 per cent. fat; vitamins A and B are present in it, but not C and D. If a considerable amount of mealie meal is used in a dietary it becomes imperative to add substances specially rich in the necessary proteins, fats and vitamins.

Mealies and mealie-meal are, however, a useful source of starch and if the above considerations are borne in mind, they can be used extensively in dietaries as cheap and nutritious food substances.

I have the honour to be,

Sir,

Your obedient servant,

J. ALEXANDER MITCHELL,

Secretary for Public Health and Chief Health Officer

Department of Public Health,
Union Buildings,
Pretoria, 21st September, 1931.

ANNEXURE "A."

UNION OF SOUTH AFRICA.

DEPARTMENT OF PUBLIC HEALTH,
PRETORIA,
16TH MAY, 1931.

THE ACTING SECRETARY FOR
PUBLIC HEALTH AND CHIEF HEALTH OFFICER,
UNION BUILDINGS,
PRETORIA.

SIR,

I have the honour to submit to you my report on malaria in the Union and the recommendations I feel justified to make in order to deal with this disease.

The measures I recommend have been selected as the best under the existing circumstances. But my choice was also influenced by the fact that experience had been gained already with regard to their methods of application and the results which may be expected from them.

Measures of personal prophylaxis (quinine, screening) have been carried out with such promising results, in some places at least, that no objections to their use could deter me from recommending them, once my investigations had taught me that the results obtained were real and measurable ones.

Making use of malaria-tolerant labour, likewise a measure which is being applied with great success, found my whole-hearted support when the result of my research made it evident that this method was founded on a scientific basis and offered no risk to public health.

Measures to promote rural sanitation (district nurses of the health visitor type, native malaria assistants) are so obviously necessary to ensure the success of measures of personal prophylaxis that there could be no doubt in my mind as to my obligation to recommend them with the greatest emphasis.

And so it is with all other recommendations except for anti-larval measures. Here I was in much doubt as to whether I should recommend them or not in the Transvaal, because the demographical conditions render their application a very difficult undertaking.

What finally decided me was the fact of the extreme selectiveness of the two main malaria-vectors rendering possible the application of "species sanitation." This means a great simplification and less expenses. This fact by itself would not, however, have decided me to recommend anti-larval measures, had I not known that you were convinced with me that these measures, for the present, will have to be applied tentatively, on a limited scale and continuously guided by research.

For Natal conditions are different, as everything was in readiness for anti-larval measures and only awaited their being shaped so as to render their application a practical proposition.

But I want to point out to you that anti-larval measures, although indispensable for the eradication of malaria, should not be considered as a *conditio sine quâ non* for malaria control in this country and that there is no reason to feel discouraged if further experience should prove the impossibility of their general application.

I have the honour to be,
Sir,
Your obedient Servant,

(Signed) N. H. SWELLENGREBEL.

REPORT ON INVESTIGATION INTO MALARIA IN THE UNION OF SOUTH AFRICA, 1930-1931, BY PROFESSOR N. H. SWELLENGREBEL.

INTRODUCTION.

In this report I am going to recommend a definite line of action which, I feel confident, is justified by the evidence of past experience and of my investigations during the malaria season 1930-31.

Still I ought to emphasize the fact that this evidence is far from complete even with regard to the most essential points. As an instance: I am going to make a statement to the effect that certain types of "vleis" may be disregarded as a source of dangerous anopheline breeding. This is a most important one; anti-larval work under the conditions existing in the Union (scattered individual efforts) would be impossible for all practical purposes if vleis required serious consideration. For this reason and the fact that I never found harmful Anopheles in vleis I feel justified in recommending leaving all vleis alone, the more so as tampering with them often results in rendering them dangerous. But it is quite possible there exist conditions, at present unknown to me, allowing of malarial-vectors breeding in vleis. The same applies to another one of my theses: the harmlessness of one of the South African Anophelines, viz., *Anopheles pretoriensis*. Here again it is a question of the to be or not to be of individual anti-larval measures *A. pretoriensis* being too ubiquitous to be dealt with successfully. As there is every reason to assume this species to be harmless, the recommendation to disregard it completely is amply justified. But I know by experience that such a course with regard to an apparently harmless Anopheline mosquito may quite unexpectedly lead to an outbreak of malaria.

For these reasons it should clearly be understood that my recommendations are based on our present knowledge only. The serious malaria conditions in the Union fully warrant taking action according to this knowledge, which is carefully collected and well-founded. But it should always be borne in mind that it is far from perfect and that solid facts are patched together by assumptions, highly probable ones no doubt, but still assumptions and not facts.

Consequently, continued research, with the object to substitute facts for assumptions, is an essential and absolutely indispensable part of malaria control in this country. We should have the courage to be guided by our present knowledge only, in carrying out anti-malarial measures, without awaiting the results of further investigations. But we should do so with our eyes open to the likelihood of our making mistakes, and to the necessity of constantly adjusting our practical measures to the results of these investigations.

FIRST SECTION.

SOME GENERAL NOTIONS ON THE EPIDEMIOLOGY OF MALARIA IN THE UNION.

I. Social, epidemiological and entomological aspects of malaria in the Union.

II. Periodicity of malaria in the Union.

III. The life-habits of S.A. Anopheles in relation to malaria.

IV. Where does Anopheles infect man and man Anopheles?

I.—SOCIAL, EPIDEMIOLOGICAL AND ENTOMOLOGICAL ASPECTS OF MALARIA IN THE UNION.

A. Social Types of Malaria.

For practical purposes it is essential to carefully distinguish between *Farm-malaria* and *Estate-malaria*. There is no pathological difference between the two, the insect vector concerned is the same, so is the principle underlying the control of the disease. But the different social milieux in which it occurs render the handling of it so entirely different in detail that it would mean endless confusion and misunderstanding not to keep them apart from the very first.*

In "*Estate-malaria*," the fever amongst the native labour force is the main problem in so far as labour is recruited from other non-malarious portions of the Union. Compared to this the disease amongst the white population is of minor importance.

In "*Farm-malaria*," on the contrary, the problem wholly concerns the white population. The fever amongst the natives may be wide-spread, but it does not affect the labour-supply and so it does not interfere with the farming operations.

"*Estate-malaria*" affects the intensive, big-scale cultivation of valuable crops and so causes serious financial losses. In farm-malaria the financial losses involved may be of much less importance, but the fever saps the strength of the white rural population and prevents (or, at least, seriously interferes with) white settlement of some areas of the Union, which otherwise would seem to be highly appropriate for this purpose.

Estate-malaria scares away fresh capital and decreases the available funds. Farm-malaria scares away any new white settlers and deteriorates the settled white population. The one is mainly an economic problem, the other a demographic one.

Let me finish this paragraph illustrating the difference between the two types of malaria by giving an account of a visit to a sugar planter on the Natal coastal belt and to a farmer on the "Ofcolaco" settlement in the Letaba district of the N.E. Transvaal.

The *sugar-planter* hardly mentions the malaria amongst his family. Why should he? Malaria occurs during the "off-season" of the sugar-growing operations and he often succeeds in staying away from the dangerous area during the larger part of the fever season. But when he returns he may find his "native compound" (the place where his native labourers live) depopulated, some having died of fever and the others having returned home. When he tries to get a fresh supply he finds that his usual method of voluntary recruitment fails as his place has got a bad name owing to the prevalence of sickness and death and so he has to apply to the recruiting agencies, to pay capitation fees and to accept what they send him, which, more often than not, is nothing more than the "dregs of the mines," i.e., natives disqualified for several reasons for work in the gold mines. He may deem himself lucky if the fever season is not a late one, otherwise he may see the whole new lot going down with fever within three weeks of their arrival, his cane fields left

* It should be clearly understood, that "farm-malaria" and "estate-malaria" are names only, applied for the sake of shortness and not because the one only occurs on ordinary farms and the other nowhere but on estates with intensive cultivation of one valuable crop, worked by a large labour-force.

uncut and the neighbouring sugar-mill having to work half-speed owing to shortage of cane cut. He would not care a bit for malaria if it was not for his cane left uncut and uncrushed.

One preceives this plainly when comparing the conditions of our planter to that of one living at the northern end of the Natal sugar belt. That part of it is really more malarious than anywhere else in the sugar-belt and still the planters here will tell you that malaria does not affect them seriously, simply because they have no labour troubles owing to the fact that they employ a type of labour suffering little from malaria.*

The Ofcolaco farmer tells you quite a different story. He is living in an area more intensely and continuously malarious than the Natal planter was ever called upon to live in. Still he has no labour difficulties, for the same reason as the planter at the northern end of the sugar belt. What he complains of is that his area has got such a bad name for fever that he cannot get others to come and settle there. He maintains that the place is not such a bad one, but at the same time he admits that it is not an area for women and children to live in, although it is all right for bachelors, and he finds no answer to the question whether he does believe a country where one does not dare to import women and children can ever satisfy the requirements for white settlement.

B. Epidemiological Types of Malaria.

In the malarious areas of the Union we may distinguish between the ones where there is a high incidence of the disease every malaria season without any interruption and others where malarious periods alternate with a longer or shorter succession of years in which malaria is scarce or wholly absent. The former we may call "*endemic areas*", the latter "*epidemic areas*".

There is no difficulty in finding out the epidemic areas. The white population will lose no time to tell you when an epidemic occurs, especially so if it is one of "estate-malaria". But even on the common farms the people are sufficiently scared by the unwonted morbidity to raise a great outcry and to clamour for government help.

The epidemic areas are very easy to overlook. The present malaria season (1930-31) is considered a mild one in the Transvaal. This really means that the epidemic areas were singularly free of malaria. But the endemic areas were not: as a matter of fact I cannot imagine how the incidence of the fever and the chances to become infected could have been higher than we actually found them in the areas we examined, and still no reports on fever were returned.

So one arrives at this unexpected conclusion that the more continuous, i.e., annually recurring, fever there is in a locality the less one hears of it.

What is the reason of this?

The fact is that in the malarious areas of the Union I visited, the harm done by the fever to the European population, and, accordingly, the popular opinion regarding the seriousness of the disease, very much depends on the individual precautions against it, notably screening and quinine. As far as my experience goes, these precautions are much more generally practised in regions of endemic than of epidemic malaria.

Take, as an instance, the districts of Potgietersrust (epidemic malaria) and Letaba (endemic malaria). That there is much more quinine supplied to the latter than to the former stands to reason as the Tzaneen districts show a much higher and much more continuous malaria incidence. But whereas in Potgietersrust only 4 per cent. of the quinine issued is paid for by the population, in Letaba 82 per cent. is bought at the Magistrate's offices. This marks the greater popular interest in preventing or curing the disease. The same applies to screening, only it cannot be put so readily into figures.

This, I take it, is one of the reasons, perhaps the main reason, why, comparatively, so little of malaria is heard in the worst fever areas in the Union. By dire necessity and partly also by the able teaching of some district surgeons (unfortunately not all) the people have learnt to deal with malaria, not altogether effectively or radically, but still in a way so as to render life bearable. Also why, in these fever-areas we note such marked differences in the effect of malaria on farms not differing at all as to site, but very much so as to the types of inhabitants.

C. Costalis and Funestus Malaria.

I have referred already to distinctions we have to make between malaria and malaria: (*a*) from a social (*b*) from an epidemiological point of view. Now I still have to make a third distinction based on the habits of the insect-vector.

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* The meaning of this will be explained later on.

Amongst the twenty species of anopheles mosquitoes inhabiting the Union there are only two which are of primary importance for the transmission of malaria, viz.: *Anopheles costalis* (*gambiae*) and *Anopheles funestus* referred to hereafter as "*costalis*" and "*funestus*". They are both equally good carriers, but their life-habits are entirely different and this has a marked influence on the malaria they transmit.

Costalis is almost entirely dependent on local rains for the breeding-places of its larvae. No matter how many inviting-looking marshes, pools and sluggish streams there are where plenty of anophelines breed, one will not find costalis, unless it has been raining recently, and then one does not find its larvae where, I myself, going on the experience I acquired in other countries, would look for them, viz.: clear ponds with much aquatic vegetation. They are, however, to be found, in the most unseemly *muddy puddles, provided they are exposed to sunlight, contain no vegetation at all and are continuously refreshed by rain water.* If the rain stops and does not recommence within seven days at the utmost, the costalis breeding places disappear and no (or only very few) adults of the species are to be found in the area. Still they are there, be it in very small numbers, for as soon as fresh rains come on costalis will be found breeding again in the roadside puddles. But it will be of no purpose unless the rains continue off and on with intervals of at least a week.

In Letaba district we have witnessed this year three definite attempts of costalis to establish itself. All three failed, the two first ones because shortage of rain at the right moment destroyed a very promising brood, the third one because the larvae did not thrive owing to a sudden drop of temperature in the second half of April; the rains had come at last but too late to save the situation (from costalis' point of view).

In the township of Tzaneen, where malaria is entirely dependent on the presence of costalis ("costalis malaria") there was no malaria this year. Generally speaking: *costalis malaria is dependent on local rains.* In a year when little rain falls, or, more correctly, when it is not evenly spread so as to leave long gaps of drought between the rainy spells, areas with costalis malaria will experience a low fever incidence or have no fever at all.

Funestus is also dependent on rain; of course its larvae are aquatic animals and a very intensive long continued drought doing away with all water, will destroy it. But an ordinary dry year, like the present one, does no harm to funestus at all. For it is a stream-breeder, its larvae are found in the grassy edges of back-waters of quickly running hill streams and rivers. So long as they contain water (as they will do, provided rain falls up in the hills, no matter how dry it is down below) funestus will thrive. Malarious areas where funestus is the main or only fever carrier ("funestus malaria") are for their malaria independent of rain for all practical purposes.

Here again the Letaba area is a very good example. The township and the adjoining farm complex known as Tzaneen estates have costalis malaria and were practically free of fever this year, but lower down Letaba way, where it is all funestus-malaria the fever incidence was very high.

Consequently the opinion that an ordinary drought tends to lower the incidence of malaria only holds for costalis malaria and not for funestus malaria. A further consequence is that areas with funestus malaria are more likely to be visited by malaria every year than areas with a pure costalis malaria and there exists the greater likelihood to find the endemic regions amongst the former.

There is another difference between costalis and funestus malaria to which I can offer no explanation.

The occurrence, in a place, of costalis in any appreciable number invariably carries malaria in its wake, the only condition being that the breeding places exist long enough to produce adults.

Not so with funestus. There are localities where hill streams are full of funestus larvae and the neighbouring huts swarming with adults; there are others with breeding places as prolific but without adults in the houses and no malaria. Tzaneen is an example; hardly any malaria this year (owing to the absence of costalis), no mosquitoes in native huts right on the banks of the Letaba and still funestus breeding in the Letaba; and at the same time, less than 10 miles away, nothing but the heaviest funestus malaria. Various places in Natal offer the same problem so strikingly that I was at one time inclined to doubt the importance of funestus as a malarial-vector in the Union, until the Letaba district cruelly undeceived me.

Out of a practical point of view the position is like this: If you meet a costalis breeding place have a go at it without any further enquiry. In the case of a funestus breeding place you had better make sure whether it is worth your while to do away with it.

II.—PERIODICITY OF MALARIA IN THE UNION.

A. Secular Periodicity.

1. *Cause of Malaria Epidemics and their Forecast.*

Epidemics of malaria, i.e., a sudden and considerable increase of its incidence in areas where the fever was previously scarce or practically non-existent, followed by its decrease or disappearance after a period of variable length, are of common occurrence in many countries all over the world. I emphasize this point because many people believe that what happened in Rustenburg district in 1928 and in Natal in 1929 and 1930 is something quite out of the common.

Our ignorance of the causes of such epidemics is in striking disaccordance with their frequent occurrence. In Holland for instance we have a malaria epidemic every 18-20 years, but we have not the slightest notion as to its cause, we only know that the Anopheline vector is present all the time also in the non-epidemic years, and that malaria is never wholly absent.

In South Africa the cause of the epidemics seems, on the whole, to be fairly obvious. It has been known for a long time that bad malaria years are closely associated with much rain, especially when a spell of rainy weather is followed by a hot period. This I believe is correct; only I should add that the rain should continue during the hot period with intervals not exceeding seven days.

The fact is that these epidemics are entirely dependent on *costalis* as a carrier and that Anopheles, as I have already explained, is entirely dependent on rains of the kind just mentioned. The fundamental investigations of Mr. de Meillon in the district of Rustenburg, proving the absence of costalis in non-epidemic years and its high prevalence during epidemics have given us the clue to the situation. This dry year we have had ample opportunity indirectly to confirm his observations by finding neither malaria nor costalis in areas where both were present in previous years and also directly by the outbreak of malaria in Pietermaritzburg coinciding with the appearance of costalis, which had never been found there before by Ingram and de Meillon.

I shall not enter here into a discussion how costalis succeeds in establishing itself in an area where it was absent during previous years. But I believe the facts we know at present amply justify the conclusion that epidemics of malaria in the Union are mainly if not entirely caused by an unwonted increase of Anopheles costalis owing to an uncommon extension of its breeding area as a consequence of rainy periods succeeding each other at short intervals.

A practical problem of the highest importance in connection with the occurrence of epidemics of malaria is their forecast. Areas affected by epidemic malaria are in many ways much more difficult to handle than those where the fever incidence is high every season. The difficulties increase proportional to the length of the inter-epidemic periods. It may be possible to keep both government officials and inhabitants on the alert for a year or two by warning them of the threatening danger of fever, but if nothing unusual happens year after year, the population cannot fail to become slack and a new epidemic is bound to find them unprepared. Then there is a great outcry, a system of excellent measures is speedily established; by the time this begins to take effect the epidemic comes to an end, and one is lucky if it does not stop too soon to allow one to give at least some credit to the measures taken in bringing it to a successful issue.

I believe that the mechanism by which malaria epidemics arise in the Union allows of a fairly simple and reliable forecast based on the rains or, better still, on the development of costalis. It will allow the authorities a space of three weeks to take the necessary measures.

A point of interest in connection with the mechanism by which epidemics of malaria are caused arises from an opinion very prevalent in Natal that they are due to the endemic malaria in the far north from where Anopheles travel by train and start the epidemics in the south. Similar opinions are held in the Transvaal where the occasional occurrence of malaria in Pretoria is ascribed to mosquitoes travelling by train from Komatipoort.

All this is theory. The fact is that in epidemic areas *Anopheles costalis* is present all the time even in non-epidemic years, as we had occasion to observe this year (see technical part of this report) but it occurs in numbers

too small to start an epidemic. So it is with malaria, which remains present in small insignificant foci. But these foci spread and become the starting point of new epidemics so soon as the local Anopheles is allowed, by plentiful rains, to breed vigorously. All this happens through the action and change of local conditions—local rains, local Anopheles and local foci of malaria—quite independent of the existence of malaria in remote areas.

2. *Alleged Decrease or Disappearance of the Fever in formerly Highly Malarious Areas.*

In areas of costalis malaria I can readily understand that a permanent decrease of the annual local rainfall will be succeeded by a permanent reduction in the annual amount of malaria. Whether or not such an event is occurring in any part of the Union is a question to which an answer can be given only after the solution of the much discussed problem whether or not the annual rainfall in the Union is decreasing.

But there is no doubt in my mind that in many cases, pointed out to me as typical instances of a gradual decrease of the malariousness of a given area, malaria has not decreased at all amongst the majority of the population, i.e. the native portion. All that has happened is that the minority, i.e. the European population, by their mode of living, have gradually protected themseves against new infections.

I will give one typical instance of this which will fully explain many similar cases.

The Ofcolaco settlement of British army officers near Leydsdorp, established shortly after the war in an area considered to be so unhealthy that the new settlers were foretold an absolute failure and a speedy death, is now, after 10 years, a thriving colony. All inhabitants believe the place is fairly healthy and that it is a shame it is marked "red" on the malaria map: it should be "blue" or "green." There is no malaria to speak of (according to them) amongst the native squatters, for the adult males rarely fail to turn up at roll-call every morning, except after a thorough beer-drink in the maroola season, and the general mortality is low (17 per cent.). The Europeans suffer from fever occasionally, especially the children (who are few in the settlement—10 against 45 adults), but not seriously. If it were not for blackwater fever they would not bother about it at all. During the first years of the settlement fever was much worse but since that time it has become of less and less importance every year, a fact ascribed to the ever-extending cultivation of formerly waste land.

Now out of all these statements one may extract as correct ones—

(1) That the natives rarely are off-duty owing to fever;
(2) that the mortality amongst the native squatters is fairly low;
(3) that the fever does not worry the Europeans over much but that it did so during the first year or so of the settlement.

All the rest is wrong.

For the malaria incidence amongst the native squatters is an extremely high one; 78 per cent. of the children and 37 per cent. of the adults are parasite carriers and more than a third of the children are in a state able to infect Anopheles mosquitoes, of which 25 per cent. are found to be infected. The cultivation of the soil has in no way reduced malaria. On the contrary, it has made it worse because of the system of irrigation which allows of the breeding of costalis even during dry years. So the chances of infection in that locality are extremely high and if nothing out of the common is happening there this can only be explained by the facts that—

(1) all the settlers are living in fairly well-screened houses and not in grass huts as they did the first year;
(2) contrary to their custom during the initial period they now look well after themselves (the amount of quinine used is 350 grains per season per person):
(3) the native labour are all either squatters or from the neighbouring highly malarious locations;
(4) foreign labour is extremely rare.

One of the farmers who had resided for some time in the Federated Malay States was very much astonished when I told him that Ofcolaco was much more malarious than the former country. He could not believe that and pointed out to me the high sick and death rate amongst coolies on the rubber plantations, which offer such a striking difference with the labour conditions at Ofcolaco. My answer to this was: "Import a few hundred Madrassi into this country and if you live to tell the tale let me know." I

could say so with confidence because I knew of several attempts at importation of foreign (Basuto or Xosa) labour in these parts which had all ended in signal and speedy failure.

Summarizing, my opinion is that many, if not all, the instances of so-called disappearance of the fever from highly malarious areas* are explained by the Europeans gradually adjusting themselves to local conditions in a country where there occur little or no changes in the native population and where influx of settlers is scarce. But the equilibrium established is an unstable one and every native imported from non-malarious or little-malarious areas is a potential danger to the community, Such an unstable equilibrium is apt to give an unfounded feeling of security and may even invite new settlement or the importation of foreign labour without it being realized that to take liberties in a country of such a stamp is courting disaster unless very stringent precautions are established. To point this out was the main reason I went at some length into the matter of the so-called disappearance of malaria.

B. Annual Periodicity of Malaria.

Malaria is seasonal throughout the greater part of the fever areas of the Union. The fever season commences by the end of December and lasts till the end of April. In the sub-tropical parts of Natal new infections (among imported labour) may occur as late as June.

As far as costalis-malaria is concerned this position is easy to understand as the fever season practically coincides with the rainy season Very late rains have no more effect as the development of the larvae is too much retarded. This, at least, is the case in the N.E. Transvaal. In the hotter Natal it may be different and this may account for the late outbreaks or the prolonged continuance of fever in that country.

With regard to funestus-malaria it is not so obvious why there should exist an " off-season," as this species is supposed to breed all the year round and as suitable breeding places are never wholly absent. Still I think a combination of the observations of this and the previous year shows there is a lull in the breeding of funestus lasting from June till August. Moreover, the cold season as we are experiencing it now (April) reduces the degree of infection to a considerable extent. All this holds for the N.E. Transvaal only. In the extreme north of Zululand (Tongaanland) where funestus-malaria likewise exists anl where malaria is supposed to be continuous without an off-season, conditions may be different owing to the higher temperature in winter.

C. Note on the Methods Employed in the Union to Estimate the Amount of Malaria in a Given Area.

It is of the highest practical importance to make a fairly reliable estimate of the incidence of malaria in an area. As a matter of fact such an estimate is indispensable to fix the climatic allowance and, more important still, to give well-founded advice to settlers and to decide which areas should be selected for Government settlement schemes.

The easiest and surest way to arrive at such an estimate is by examining a portion of the native population to determine the spleen-rate, i.e. the percentage of children between 2-10 years showing enlargement of the spleen. Natives under the care of mission stations should be excluded as medical treatment greatly influences the spleen-rate. This way of estimating the malariousness of an area only gives the condition at the moment of examination. This is of no consequence in endemic areas, where the spleen-rate is subject to little variation. But in epidemic areas it may vary very considerably according to whether the examination is done within or outside an epidemic year. Therefore, the Public Health Department has chosen to rely mainly on the observations from medical men and others over a period of 20 years in collecting the data to draw up the well-known malaria map at present in use.

The Union is a white man's land and so it is logical to gauge the importance of malaria by its effect on the white population. But if we desire to know what are the chances for a white man to contract the fever when he is going to settle in a particular area, either as a farmer or an official, it is not the white but the whole population, acting as a virus reservoir, which contributes to decide this point. Now the black population out-numbers the whites by three to one and so it is clear that we can never make an estimate of the importance of malaria in a given area without considering the native population.

* I am not writing here of the areas which were supposed to be malarious but which probably never were so any more than they are now. Instances of that kind one may gather by the score from old settlers with experience of many years, holding the opinion that malaria is best treated with purgatives.

Moreover, there are the circumstances already related tending to underrate the importance of malaria in endemic areas. We see the consequences in the malaria map where the foothills of the Drakensbergen in the N.E. Transvaal (an area of high endemicity) and the region between the Umfolosi and Umhlatusi in Natal (an area with little malaria except for epidemic years) are both coloured red.

The Transvaal Provincial Department of Education also bases its estimate of the incidence of malaria on the conditions found among Europeans but it does not rely on information given by the inhabitants but on the spleen rate found among school children. This seems to be a much more accurate estimate than the one followed by the Department of Public Health; but the schools examined always contain children from malarious and non-malarious localities and if the school is a small one the absence of a few children may make a great deal of difference. Moreover the quininization regularly practised in some schools tends to make conditions look better than they really are.

Consequently I believe that an estimate of the malariousness of the various parts of the Union had best be supplemented by the result of the spleen examination of the native population living under tribal and kraal conditions, at the end of the non-malarious season (October) in an ordinary year without any notable outbreak of malaria. This will show us the situation of all areas of high endemicity, which at present are not brought out with sufficient clearness on the malaria map.

III.—REMARKS REGARDING THE HABITS OF SOUTH AFRICAN ANOPHELES IN RELATION TO MALARIA.

A. The Importance of the various South African Species of Anopheles as Malarial Vectors.

I have referred to *Anopheles costalis* and *Anopheles funestus* being practically the only malaria carriers in the Union out of the 20 species of this mosquito genus. The evidence to support this statement, collected by Hill and Haydon in Natal, by Ingram and de Meillon in the Transvaal and by the investigations related in the technical part of my report need not be discussed now. But I wish to point out the practical consequences here.

Take as an instance one of the farmers of the Ofcolaco settlement. When discussing the possibilities of anti-larval control on his farm, he will take you round and show you all the collections of water he has there. You pass an extensive vlei where you collect Anopheles larvae, you come along to several pools with grass and reeds growing in it and there again you collect larvae. The same is repeated while visiting an extensive seepage area where water oozes out of the hillside forming numberless small puddles between the grass; while examining a standing irrigation furrow which looks particularly dangerous as it is quite full of larvae; finally, quite near the homestead, a series of small muddy puddles, each not larger than a saucer, which you had almost missed as your host, who otherwise is remarkably well aware of the existence of any permanent collection of water, had quite overlooked it. "Oh, that is only leakage from the furrow; it will disappear in a few days" he will tell you quite casually when asked about its cause, and you feel satisfied the thing is of no importance, although you collected quite a number of larvae there. On your return home your host enlarges upon the extent of vleis, seepage areas, lowlying spots, and winds up by the question "Now, what is the good of my oiling a tank or a few roof-gutters if all these other breeding places which I cannot possibly deal with remain?"

To this question you remain dumbfounded.

Now you examine the catch of the day. It appears that in the vlei you got nothing but an anopheline called *Anopheles mauritianus*; the seepage at the hillside yields a little more varied lot; the bulk is *Anopheles pretoriensis*, but also *A. Maculipalpis* and *A. marshalli*. The standing furrow, so rich in larvae, shows a similar result except that a few *Anopheles rufipes* are added to it. Finally the almost overlooked leakage from the furrow shows again a very uninteresting result: all larvae belong to one species: *Anopheles costalis*.

The next day you examine the native huts next to your host's farm. They are swarming with Anopheles but not with *A. pretoriensis*, so plentiful in most of the breeding places, nor with *A. mauritianus* from the vlei which caused your host so much apprehension; only *Anopheles costalis* is found in the huts and on examining them no less than 25 per cent. are found to be

infected with malaria parasites. Where all the other species of Anopheles do hide you have not the slightest notion except for *A. pretoriensis*, the most plentiful of all in the shape of larvae, which you find roosting in large numbers in clefts between rocks along the banks of a little stream quite near the native huts. But none of them is infected.

This piece of experience I have related here in detail, which is repeated at every turn with the only difference that in areas with funestus-malaria it is not costalis but funestus you find infected inside the human habitations, teaches us a few things:—

(1) Only two Anophelines enter into such close contact with man that they not only enter houses, but stay there or, at least, return there continuously.

(2) Others may enter houses occasionally, but the contact established between human beings and Anopheles is not close enough to cause the mosquito to become infected to an appreciable extent.

(3) The greater part of the collections of water around human habitations breed anopheles, but only the minority breed those kinds which satisfy the condition mentioned in (1). The majority breed various other species of Anopheles, interesting to the entomologist but not to the sanitary officer.

(4) The problem of anti-larval control, to which the undiscerning layman looks as a hopelessly costly proposition, reduces itself (in the case mentioned here in detail) to the dealing with a few pools and puddles easily abolished by paying moderate care to the system of irrigation.

(5) This simplification of anti-larval control is rendered possible by the facts (*a*) that only two species are malaria vectors (*b*) that both these species are highly selective in the choice of their breeding places, discarding the majority where other Anophelines gladly breed, many of them looking much more favourable to the uninitiated eye than the ones costalis and funestus actually select.

(6) The position would be infinitely more difficult, in fact quite hopeless under the special conditions prevailing in the Union, if, instead of costalis and funestus, pretoriensis and mauritianus happened to be the principal malaria vectors. Even as conditions are now the position is far from easy as funestus, breeding in hill-streams, is much more difficult to handle than costalis.

B. Important and Unimportant Breeding Places.

Breeding places of importance requiring measures and those not of importance have already been dealt with. The reason why I recur to this subject is that I wish to enumerate certain breeding places generally supposed to require dealing with and which, according to my opinion, it is perfectly useless and sometimes even dangerous to try to control.

The misconceptions on this point partly arise from erroneous application of experience gained in other countries under entirely different conditions. I will summarize them briefly.

Tanks.—In Bombay and some other Indian cities where a purely urban malaria exists the malaria vector, *Anopheles stephensi* breeds in cisterns under and in closed water tanks at the top of the houses. It requires no sunlight to breed. This Anopheline species does not exist in this country, nor any species with similar habits. Still *rain water tanks* are supposed to breed Anopheles and people are recommended to oil them or to mosquito-proof them. This is perfectly useless as such tanks breed no Anopheles at all* for all practical means and purposes.

Tins, Pots, Roof-Gutters.—In Jerusalem and some other Palestine towns, where malaria is also urban, the fever carrier is *Anopheles bifurcatus*. It breeds in underground cisterns. It may breed occasionally in earthern-ware pots filled with water and lying about in the courtyard. This species does not exist in this country nor any other coming near to it in habits. Quite a different genus of mosquito, in fact not an Anopheles at all and therefore never acting as a malaria vector, but nevertheless of the greatest importance to some countries as it transmits yellow fever, *Aedes Aegypti* by name, breeds in tins, broken earthenware pots and other receptacles able to contain water and left about near the house. This mosquito occurs in South Africa but as it does not transmit malaria and as yellow fever does not exist here it can

* Ingram and de Meillon have twice found breeding of costalis in open tanks. They have mentioned these findings because they are so rare. If they had mentioned the hundreds of tanks they examined and where they found no anopheline breeding they would have reduced this finding to its correct practical proportions.

only be of any sanitary importance at all to localities where another disease, dengue by name, occurs (as in Durban). For malaria control such receptacles are of as little importance as the tanks as they breed no anopheles.* In fact, drawing people's attention to that kind of breeding places and enjoining them to oil or empty the same, does more harm than good by diverting their attention from the real issues and making them believe they have done something useful in the way of malaria control when they have done nothing at all. The same applies to roof-gutters; I do not remember ever having heard them mentioned as breeding places of Anopheles in any country (other mosquito larvae may be plentiful there); in this country they are of no importance as such.

Tree-Holes.—There are certain species of Anopheles breeding in water collected in tree-holes, like *A. plumbeus* in Europe and *A. baraniensis* in India, none of them malaria carriers. Others, like *A. lutzi* in S. America breed in the water collecting between the leaves of plants belonging to the family of the Bromeliaceae (like the pineapple). Anopheles of similar habits may exist here. We do not know them. At any rate there is not the slightest reason to suppose these kinds of collections of water have anything to do with malaria. Still some people hold that Maroola trees are a cause of malaria because of the anopheline breeding-places in the holes of their trunk and that Baobab trees are dangerous because of the water collecting between the branches. No evidence, not even a rare find, exists to support this view.

Swamps, Marshes, etc.—Swamps and marshes are important breeding places in many countries although the unfortunate name of " swamp " or " marsh fever " has led to overstress their importance. Still there was every reason to suppose them to be of some importance in this country. Especially the large papyrus swamps in N. Zululand looked to me very formidable and reminded me of the dangerous papyrus swamps of Hule in N. Palestine. But these swamps do not breed anything at all, neither within the papyrusbelt, nor in the central open pond, overgrown with the most promising looking horizontal aquatic vegetation where I often spent an inordinately long time in trying to collect larvae as I could not bring myself to believe they were absent; and still they were. Compared to these the ordinary " vlei " or swampy areas at the bottom of a valley through which a rivulet slowly winds its way look comparatively innocuous. Here again no breeding occurs at all except along the edges where one may find some of the harmless Anopheles.

But beware of touching these swamps as it is the easiest thing in the world to render them dangerous! The smaller they are the easier. I have seen little swamps overgrown with reeds where this vegetation has disappeared in parts leaving the soil uncovered; not even short grass was present. Water collecting there bred costalis, but it did nowhere where the reeds were thick. Trampling down of the reeds by cattle (cattle will never attempt this unless the swamp is a shallow one) may be already sufficient to breed costalis. But the surest way to render even a large swamp dangerous is to drain it and not to take care that the drainage furrows are either full or empty. Puddles in the otherwise empty furrow, as they collect after rains, are almost sure to breed costalis, especially if the furrow is kept clear of vegetation.

Cutting down of Vegetation.—Although not exactly belonging to this subect I wish to add a few words in this connection on " clearing," i.e. cutting down of vegetation of any description as an anti-malaria measure.

The idea underlying the recommendation of this measure is that Anopheles seek shelter within the vegetation and that, by destroying this shelter, it will be prevented from entering houses. Whether this idea is correct or not I cannot say, but at present it is theory as based on too scanty facts. For the only places where we see Anopheles take shelter in large numbers is either inside houses or in clefts between moist rocks.

So the advantage of this measure is problematic, but the danger attached to it is sure; for clearing takes away both vegetation and shade which often are the only hindrances in the way of costalis establishing itself on the spot. The only instance where clearing away of vegetation is useful is along the edges of hillstreams to reduce the chances of breeding of funestus.

C. Malaria in Relation to Site.

1. *Rivers and Malaria.*

Rivers in this country are generally supposed to be a source of malaria for the people living near them. And indeed rivers *are* a danger, at least they may be.

* Ingram and de Meillon once found costalis breeding in wedgeshaped railway carriages (used for carrying sand, ore, etc.), containing water and once in a Kerosene tin. To this the same remark applies as to the footnote on the preceding page.

Of course, one thinks here of *funestus* before anything else because funestus is a stream breeder and actually occurs as larvae in the larger rivers like the Letaba and its main tributaries. Still my impression, gained by observations in the Transvaal, is that they are not nearly so dangerous as the smaller streams. Why this should be so I do not know—it is one more of the mysteries in the relations between funestus and malaria to which I referred in another section. So I do not believe it is the breeding of funestus which causes the special danger of the rivers.

It is not in wet seasons this danger is especially apparent. On the contrary—in the district of Potgietersrust I was told that malaria in a wet year arises in the " middleveld " and that the riverain tracts are not affected till later on in the season. But in dry years like the present one, I have seen myself that there is little malaria except near the rivers. At one mile's distance their influence is gone already.

The fact is that rivers in dry areas act by raising the level of the sub-soil water. Alongside the actual stream in their otherwise dry sandy bed a number of small clear pools are maintained exposed to sunlight, without any trace of vegetation and breeding costalis. In the dry spruits running into the main stream, the high level of the sub-soil water maintains, near their mouth, small pools of the same kind. In a rainy year all these breeding places are washed away, but then they reappear in the middleveld, further away from the rivers in the shape of the usual breeding places of costalis: the rain-water puddles. Only later on when the heavy rains have stopped costalis is allowed to reappear in the riverain tracts.

In mountainous areas the valleys of the large rivers and their more important tributaries are again the places where costalis can establish itself most conveniently. Not, in this case, because of the lack of water anywhere else, but because the riverain tracts afford the flat area necessary for the maintenance of the standing puddles, which costalis requires to breed in. This explains the well-known fact that in Natal, when malaria gains the interior, it always does so crawling upstream along the main rivers (the Tugela and its tributaries) whereas on the coastal flats the association between malaria and rivers is much less apparent or wholly absent.

2. *Altitude and Malaria.*

When one proceeds from Leydsdorp westward to the Drakensbergen one experiences a remarkable change in malaria conditions coinciding with a rise of about 1,500 feet. First, when still in a flat country with only a few fairly large streams and otherwise dry spruits, one is in an area of almost pure costalis-malaria. After this one enters the foothills, small hill streams become plentiful, dry spruits holding standing rainwater disappear, road puddles (unless it is a dry year) dry quickly; in short, one enters an area of pure funestus-malaria. Still higher, at an altitude of about 3,000 ft. and over, the hillstreams are still there, they still breed numerous Anopheles larvae, but no longer Anopheles funestus; other, harmless, stream-breeding Anopheles have taken its place. At the same time, malaria which was very prevalent within the costalis and funestus zone has considerably decreased at this altitude.

At first sight it seems strange that funestus should be affected so much by such comparatively slight increase in altitude in no way harming the other stream breeding Anopheles. But when one observes how seriously funestus is influenced even in Tzaneen by a drop in temperature like the one we experienced by the end of April (the digestion of blood retarded for at least 24 hours and the length of life much shortened) then its disappearance at higher altitude becomes easier to understand. The curious part of the influence of lower temperature is that (within the limits of our observation) it in no way affected costalis. So altitude to get away from malaria is not to be relied upon if costalis can establish itself (e.g. on plateaux). This may account for the fact that Ingram and de Meillon found it breeding in Pietersburg and that malaria occurs there and even in Pretoria.

IV.—WHERE DOES ANOPHELES INFECT MAN AND WHERE DOES MAN INFECT ANOPHELES?

Man becomes infected with malaria wherever there exists a sufficiently great chance to be bitten by any Anopheles which, about a fortnight previously bit a person with the right kind of parasites in its blood. It is obvious, therefore, that this chance must be greatest in those places where Anopheles collects to feed, where it stays after having fed and to which it returns to get a fresh meal.

Are there such places and where do we actually find adult Anopheles?

Let me say first where we do not find them. We do not observe them in thickets and bush. The swarms of insects we occasionally disturb there are not Anopheles, usually not even mosquitoes. We do not usually find them roosting on the leaves or the stem of long grass as we do ticks. We do not notice them between the roots or in the hollows of trees. We do find them, as stated before, in rock clefts alongside the banks of small streams, but they are not of the right kind and they are not infected. But where we find them invariably—and infected with malarial parasites at that—is inside human habitations, both European and native, but more in the latter.

This observation, repeated over and over again, justifies, I believe, the statement that in this country one becomes infected inside human habitations and not in the open. Personally, if I had the choice, I would prefer to sleep in the open than to pass the night in a native hut or even in many a European farm I know of. I know by making this statement I am disagreeing with firmly established opinions in this country. Still I have not the slightest doubt I am right and that most of those people who pretend to have acquired malaria by sticking in a drift while passing a river, by going fishing after sundown, etc., really got their infection at home and there at night, for neither costalis nor funestus bite *during the day* under natural conditions.

It is obvious that all the costalis and funestus in Africa could never give one malaria by their bite unless they previously fed on a person carrying malaria parasites of a peculiar kind (so-called gametes) in his blood. Now we may ask, where does Anopheles find such a person while staying on a farm? Are there so many "gamete carriers" amongst the members of a farmer's family? As far as my own observation goes there are not, as a rule, at least not in the heavily infected district of Letaba. I found a few exceptions, but they all occurred among families neglecting every precaution against malaria, especially quinine, but such families, fortunately, are rare in that part of the country.

Where then does Anopheles get infected? The best answer to this is describing the situation on a farm in a very malarious spot in the Letaba district. Notwithstanding that all measures of personal prophylaxis are carried out with great care, the family find it necessary to take quinine regularly. Next to the house is a native hut where four native girls live, of about 10-14 years of age; all of them are infected with malaria parasites; one is a gamete carrier. The hut is full of funestus. Among 36 caught eight are infected.

This example shows the source of infection for Anopheles in an endemic area is the native population and the place of infection the native hut. If Anopheles always strictly kept to one shelter and after leaving it to lay its eggs always returned to the same spot the danger for Europeans to become infected with malaria would be minimized. But, as there always is a certain amount of interchange between the Anopheline inmate of neighbouring human habitations, the European house is sure to get Anopheles from the servants' quarters, and if these servants are gamete carriers, some of these insects are bound to be malaria carriers.

This source of danger arising out of native quarters in the neighbourhood of European dwellings has been recognized since Stephens and Christophers first drew attention to it. So what I am telling here is nothing new and only serves to show the danger is far from imaginary in this country. This, however, is not altogether superfluous, as I met farmers lodging their native labourers in an unscreened room of their own house.

I should add that the foregoing only applies to cases where the native population is heavily infected, as it is in endemic areas and that in such areas native children are a much greater danger than adults.

SECOND SECTION.

CONTROL OF MALARIA IN THE TRANSVAAL.

CONTROL OF MALARIA IN THE TRANSVAAL.

I. GENERAL SURVEY OF THE POSITION.

There are conditions rendering the prevention of malaria in the Transvaal an easier problem than in any other country I know of and others which make it the most difficult I have ever seen. The former relate to the insect-vector the latter to the human carrier.

With regard to the insect-vector the stream-breeder (*funestus*) offers the greatest difficulties for its control. But still how insignificant they are compared to those one has to face when undertaking to control stream-breeders in other countries like listoni in India, maculatus in Malaya or aconitus in Netherlands India where one has not only to deal with the actual streams but also with extensive seepage, swamps caused by streams, rice fields, etc.

The puddle breeder (*costalis*) by its high selective habits, its avoiding shade and vegetation and breeding consequently in exposed easily accessible collections of water, moreover, by its almost complete dependence on local rains, is an ideal subject for malaria prevention by anti-larval control, unequalled by any other species I know of.

Coming to the human carrier one has unfortunately quite a different tale to tell.

First of all the *white population*.

The great difficulty one always meets, whatever one wishes to accomplish, is the population scattered all over the country, living on isolated farms miles and miles apart connected by very indifferent roads often impassable during the rainy season. There are only a few centres of habitation with a small and unstable population.

By the control of malaria there only, a small minority of the inhabitants of the whole area would profit.

How different this is in Italy, Bulgaria or almost any other country I know of. There by anti-larval control around the village one practically protects the whole population. There, like in this country, the place where one becomes infected is the house and so long as that is protected against mosquitoes it really does not matter how much breeding is going on in the fields outside the area under treatment.

Practically the same amount of work and expenses necessary to protect a whole village are required in the Transvaal to protect one single farm.

The same difficulties become apparent with regard to medical assistance. In Bulgaria, in Bengal (I specially mention countries not remarkable for sanitary progressiveness) every group of 4-5 villages employs a medical man at a retaining fee provided with a simple but adequate dispensary within easy reach of all the villages of the group.

To reach a farm population in the Transvaal less numerous than that in one of these villages a medical man has to travel long distances and in the rainy season (i.e. the malaria season) he is lucky if he reaches his destination at all.

So both preventive and curative measures have to be carried out on a highly uneconomic basis among a population which on an average is far from well to do.

There are also advantages attached to the isolated farms. If a farmer wishes to carry out anti-malarial measures he need not be prevented by his neighbours not choosing to follow his example. Malaria on a neighbouring farm will in no way affect him. All measures of personal prophylaxis, screening, daily killing of mosquitoes inside the house, taking quinine regularly to prevent attacks of fever, thorough cure by quinine if such an

attack occurs, are no more difficult to carry out on a farm than in a village, and in the case of the " quinine prophylaxis " they may be even more effective because one has not to fear the untreated cases in one's neighbour's house.

The *native population*, the great unknown from which arises the malarial infection. That is the way people often look at it in this country, and they add that it is no good for them to do anything so long as the Government does not provide for malaria prevention amongst the natives.

In endemic areas there is an appearance of truth in this saying, for undoubtedly the native population is heavily infected and the children are a real source of danger, as they are the ones infecting the Anopheles mosquitoes.

But we should not overstress this point. After all for a farmer living, say on the Ofcolaco Settlement the neighbouring Native location of Mohlaba is no danger at all and he may get rid of his malaria without any action being taken in Mohlaba. His danger are the Natives living on his farm and particularly near his house, in connection with the Anophelines breeding on his own farm. He can work out his own salvation without worrying in the least what Government does at Mohlaba. As a matter of fact whatever is done there would not help him a bit.

For after all malaria is a local disease to be dealt with by local efforts.

Here one may raise an objection: That the farmer does not only employ his local squatters but also men from Mohlaba, living in his native compound but returning home every week. Have they not got the " malaria in their system ", are they not " full of germs " and are they not a real danger which would be obviated if Government prevented malaria in the location?

No, they are not in endemic areas. I have mentioned already casually that the children are the danger because they are the gamete carriers and the gametes only count for the infection of mosquitoes. The adults are not, as will be more fully explained in the technical part of this report.

Consequently, unless one is living right within a native location one has nothing to fear of it and from the point of view of preventing malaria among the white population in endemic areas there need arise no difficulty out of the heavy infection amongst the natives within their locations.

II. MALARIA CONTROL IN THE TRANSVAAL BY INDIVIDUAL PROPHYLAXIS.

A. Past Achievements.

In this paragraph I do not propose to give a summary of all the anti-malaria work carried out in the malarious areas in the Transvaal; I am limiting my survey to the localities I visited at some length, i.e., the highly endemic area at the E. slope of the Drakensbergen in the District of Letaba and the epidemic area in the N. of the District of Potgietersrust.

Prophylactic Quinine.—The so-called prophylactic quininization (i.e. taking quinine regularly every day in doses of 5-10 grains from the end of December till the middle of May to prevent the outbreak of fever) in the district of Letaba is the most hope-inspiring anti-malarial measure I have seen in the Transvaal as it is supported by the whole-hearted collaboration of the farmers.

I call it collaboration because, as already mentioned, many farmers pay for their quinine—82 per cent. of the drug issued is sold (3s. 6d. per 500 grains). For the whole of the Transvaal this percentage is 24; for the whole of Natal (including the sugar belt) 29 per cent.

We visited a number of farmers in this endemic area to know what their attitude was towards quinine; we examined the farm houses and their inhabitants and finally received from the Magistrate's office the information regarding the quantities of quinine sold to them.

In this way we found on 33 farms with a population of 168 white persons (93 adults and 75 children) a consumption of 11,875 5-grain tablets (season 1929-1930) i.e., a consumption per person of 353 grains during one fever season. When one remembers that the Russian Government during the fever years 1922-23, when no more than a few grammes of quinine per head of the population were available, considered that malaria control would be fixed on a safe base if only 20 grammes per capita per year were available, the 23 grammes (=353 grs.) consumed by these farmers and their families appears in quite a new light, especially when remembering they were bought and

cost each family on an average 12/7d. per fever season. However, considering that most of these farmers affirmed they practised prophylactic quininization, the position is not quite so satisfactory as it looks at first sight, for they should have used 450 grs. in four months (January-April) instead of the 353 they actually consumed. The fact is that among these farmers there were a number who were slack in taking quinine and others where the adult males, including the father, revolted against the female rule (who usually strongly supports the quinine prophylaxis) and in consequence only the children and the adult female portion of the family took quinine regularly. These dissentients have lowered the average consumption.

Amongst the families refusing to take quinine regularly the percentage of enlarged spleens (" spleen-rate ") was—

77 per cent. amongst 39 children
71 per cent. amongst 14 adults.

In families where prophylactic quininization was practised more or less regularly the " Spleenrate " was—

52 per cent. amongst 52 children
36 per cent amongst 62 adults.

It is difficult to say whether this difference is due to quininization only, for I noticed that farmers careful about their quinine were also careful in seeing that the house was fairly well screened.

I wish to emphasize particularly that this result was obtained among simple Afrikander farmers, not among the highly educated class of the Ofcolaco settlers. Amongst the latter the consumption of quinine (as far as Government quinine is concerned) is not greater (350 grs. per person) than among the ordinary farmers.

Screening.—The other anti-malarial measure which likewise seems to work in a highly satisfactory way and which I mention in the second place solely because I do not feel so surprised that it is working well as I do in the case of quinine prophylaxis, is screening.

Screening is very widely practised in the Letaba area, but there are a sufficient number of farms without screening to render a comparison possible.

In 11 unscreened farms we caught 43 Anopheles (mostly funestus), an average of about four per house. In 12 screened farms we found five Anopheles funestus, or 1.4 per house, i.e. ten times less.

In the unscreened farms the " spleen rate " was—

88 per cent. amongst 26 children.
58 per cent. amongst 31 adults.

In screened ones the spleen rate was—

44 per cent. amongst 16 children.
10 per cent. amongst 29 adults.

A difference, consequently, even more striking than in the case of quinine prophylaxis.

I should add that the screening, as a rule, was far from perfect; although not actually out of repair there still remained a sufficient number of cracks to let in any number of Anopheles, and still it acted as a protection. This bears out Boyd's experience in America that bad screening is better than no screening.

This short summary of the result of our visits to the various farms sufficiently shows that the people are taking an active part in the struggle, not, perhaps, to get rid of malaria but to minimize its worst effect and, moreover, that they are paying for this themselves.

Influence of District Surgeon.—How have these encouraging results been brought about? Partly through a course of lectures Dr. Labuschagne gave to the farmers some years ago which greatly impressed them and is still gratefully remembered. But I doubt whether the effect would have lasted so long if the remembrance had not been constantly refreshed by the admonitions of the local district surgeon, who loses no opportunity in impressing upon the people the necessity of taking quinine regularly, making their children (not excluding infants) take it, and of screening their houses.

On his rounds he visits farmers who did not call him in and he does not fail to repeat his injunctions there. He teaches the people how to treat an uncomplicated case and in this way he renders the population more or less independent from himself, an indispensable thing in a country where three guineas is a very moderate doctor's fees for an outlying farm.

No Similar Results in Epidemic Areas.—I have already mentioned the different mental attitude towards malaria in endemic and epidemic fever areas. This was very noticeable when visiting the north of Pietpotgietersrust after the foothills of the Drakensbergen. Although there was not much

fever about owing to the drought causing scarcity of costalis, still there was enough of it along the rivers. Quinine was issued, most of it free of charge, only 4 per cent. being paid for, but there was no system in using it. Various methods were followed, always on the advice of some neighbour, and all of them wrong. Doubts were expressed whether it can cure the fever, fears that it will cause blackwater. The same persons applying for quinine free of charge did not hesitate in spending money on " Esanofele " and " Levens-essence," while the bottle with Government quinine was left unopened. Screening in these parts is rare and where it exists it is supremely bad.

A similar mental attitude one also encounters in endemic areas among people staying there only for a comparatively short time, like railway officials.

In all these cases I believe the reason of the slackness of taking precautions is the discontinuity of the fever giving insufficient incitement to the people to exert themselves and to the district surgeons to inculcate the right notions to the people under their care.

B. Principles Suggested for the Future.

The results of the measures of personal prophylaxis by the efforts of the population are so encouraging that it should be our first care to render them still more effective where they are so already (Letaba district), and to raise them to the standard, which we know now it is possible to attain, in epidemic areas.

The last problem is the most difficult, because the great taskmaster, teaching the population that they must use quinine in the correct way, and that they must screen their houses, viz., malaria itself, is too often absent. His training cannnot be taken over by the Department's pamphlets, however clear and interesting they may be, for it is part of human nature not to read pamphlets. Public lectures may be found useful. Dr. Labuschagne's are there to prove it. But they are so only when somebody else is available to repeat over and over again what the lecturer told once. As a matter of fact, the " somebody else " being present we can do very well without the lecturer, but not *vice versa*.

This " somebody else " at present available is either the district surgeon or the schoolmaster. Besides these two other agents play a prominent part in personal prophylaxis, viz., the housewife and the Government. We will discuss the task of each of them.

1. *The District Surgeon.*

At present there are some district surgeons who believe they have accomplished their duty when they attend to the patients, meeting them on their monthly or fortnightly visits to pre-arranged centres in the out-lying areas of their district. This may be sufficient in healthy areas, it is not in those where important preventable diseases occur which the population is called upon to deal with by their own efforts, as is the case with malaria.

Abuse of Intramuscular Injections.—In malaria it is the first duty of the District Surgeon to teach the people how to cure the disease themselves. To attain this end the first condition is that the population should know that they *can* do so. At present some district surgeons are doing just the reverse by making the people believe that the only correct way of administering quinine is by intramuscular injection and that oral administration is useless in an acute attack.*

The population takes readily to this belief and even when using quinine regularly by mouth as a prophylactic, are firmly convinced that they need an injection when fever gets hold of them. They instinctively feel that the injection is the only thing which distinguishes the district surgeon's action from their own. For they can make out for themselves whether they have fever or not. The district surgeon could do more by confirming the diagnosis by blood examination, but unfortunately this is rarely done,† which is a serious omission in such a protean disease as subtertian. There exists an ever-growing tendency to call any fever malaria which is not evidently something else, even if it does not respond to quinine, and the natural consequence is that people lose their faith in this drug as a remedy for malaria.

* One district surgeon writes: " There is no doubt that during the ' attack ' there is only one method which has any effect worth mentioning and that is by injection preferably of quinine ". Another writes: " The primary attacks take the form of a 4-7 days continuous or continuous-remittent type ending with a crisis, resistant to oral quinine, but responding, after the first few days to intramuscular treatment ".

† Where it is done this way of confirming the diagnosis is looked upon as an interesting curiosity, not a sure guide for diagnosis. One doctor writes: " Of about 20 examinations half are negative " without, however, concluding that his diagnosis was wrong in at least a portion of the negative cases.

The right way to follow in an area where malaria is likely to be prevalent would be for the district surgeon to point out to the people—

(1) That every malaria patient has fever, but that not every fever patient has malaria.

(2) That there are cases in which the district surgeon is as little able to make sure in the beginning whether a fever is malaria or not as the patient and his family.

(3) That in subtertian malaria the great thing is to bring quinine into the blood circulation as quickly as possible and that this can be done by oral administration provided the various directions are followed, enumerated in the departmental pamphlets which the district surgeon will repeat and explain.

(4) That in an area where much malaria is about it is safe to treat any fever as if it were malaria. But quinine is a specific remedy for malaria and for malaria only. So if the fever does not disappear within a week by the correct use of quinine the conclusion should not be that quinine is of no use in malaria, but that the fever was not malaria at all and needed some other kind of treatment. That is the time to call in the district surgeon's advice, as is the case likewise if severe vomiting or other complications absolutely prevent oral administration. Otherwise the treatment should be left in the hands of the patient's family.

I would never recommend such a course in a country where medical assistance in rural areas is readily available to all classes. But in this country where one often has the choice between no treatment at all or lay-treatment, I prefer to encourage the latter, if it can be done without serious danger to the patient. For this reason I condemn the habit of lay-people giving quinine-injections, which, however, can never be prevented unless the district surgeon makes it clear to the people that injections are a mode of administering quinine only to be applied under certain circumstances and that, as a general rule, a case of malaria can be cured without taking recourse to this method. On the same grounds I also condemn the custom of some district surgeons to leave plasmochin or plasmochin-compound in the hands of their patients without very detailed instructions and without the possibility of regularly observing the effect of the drug.

All directions of the kind mentioned above should always be given explicitly and in full detail, every time there is an occasion to do so. Otherwise cases will happen like the one I came across the other day of a man having fever on Monday, being told by the doctor to use quinine, interpreting this prescription by taking 10 grains on Monday and stopping on Tuesday, because he felt all right again, and finding himself in hospital on Friday.

Hygenic Influence of District Surgeon.—I could not feel quite satisfied even with a district surgeon going with his instruction to the length mentioned above. His duty is not to promote the right notions on malaria treatment only but on malaria control likewise. I am not thinking here in the first place of anti-larval measures as carried out by the farmers themselves, but more of screening and killing of mosquitoes inside the house. There his advice can be very useful, the more so, the more he gains the confidence of the people.

Even that is not sufficient. In the malarious areas I visited there is more amiss with regard to health conditions than malaria alone, and I believe that even in highly malarious areas other sanitary matters should be given the necessary attention. I will mention only one which struck me as most important, viz., the unbalanced diet.

Much has been said already on the diet of many of the inhabitants of malarious (and probably also non-malarious) areas, showing a deficiency in green vegetables and fresh fruit. In the present state of our knowledge it is impossible to prove that such an insufficient diet renders malaria conditions worse, but as it very well may do so and as it is an undesirable condition from a general hygenic point of view, it fully deserves out attention; the more so as it is not a condition to be found amongst the poor people only. I suspect that it is not so much the physical inability to select the right food as a lack of insight into what is the well-balanced diet. It is a part of the district surgeon's hygenic duties to make the people gain this insight.

How can the District Surgeon perform this task?—The question arises whether the district surgeon is qualified and has time to perform all these duties, for it means to him seeking contact with the population and visiting them at their homes on his rounds, as I have seen some district surgeons actually do, even if his medical services are not required.

As to his being qualified, that point I understand has already obtained the attention of the sanitary authorities and they have tried to render the

district surgeons better able to perform their task by offering them the opportunity to follow a refresher course every two years. I believe this to be an excellent measure and I am very eager to recommend that it should be continued. The importance of the district surgeon as the dispenser, not only of medical aid but also of hygienic knowledge, in a country where so many sanitary duties have to be performed by each individual, which in other countries are in charge of trained sanitary officials, cannot be over-estimated, and this importance is growing every day. I, therefore, should like to go one step further and to provide not only for the present district surgeons but also for the future ones, in the shape of a course of lectures to be attended by any medical man wishing to obtain the qualification required for a nomination as district surgeon.

As to his having time to perform his duties, everyone knowing the huge districts under his charge with a scattered population and bad roads, combined with the necessity of keeping up a private practice to raise his income, will be very doubtful on this point. I think he should receive the help of a certain number of *district nurses of the health visitor type*. I cannot insist enough on the necessity of carrying out this plan. With the help of these nurses the district surgeon's sanitary and medical influence in the district could be doubled and trebled, and once one has realized what this influence means in relation to malaria, one feels that the additional training of the district surgeon and his influence being multiplied by district nurses is one of the most promising anti-malarial measures in the Transvaal that could be recommended.

2. *School Teachers and Schools.*

Part of the beneficial influence I expect from the district surgeons can be exercised by the teachers and that on a human material much easier to mould—the children.

I understand that school teachers at present follow a course of elementary hygiene during training. It would seem doubtful, however, whether they are sufficiently qualified at present to inculcate into the school children the necessary sanitary principles and practical applications.

I believe much more attention might be paid to this branch of the teacher's education. In malarious areas they supervise the prophylactic quininization of the children. In some places I visited the teacher believed it was sufficient to begin the prophylaxis by April and when I advised him to begin in January pleaded that his stock of quinine was insufficient for such a prolonged course of prophylactic treatment. But he admitted that he never had tried to get a larger supply. Another teacher limited the prophylaxis to the children living in the hostel attached to his school and believed the other children should ask for it at home, although he should have known that they would never get it there. All this I should add applies to epidemic areas. I never had experience of this kind in endemic ones.

Hostels.—Here is the place to say a few words about hostels in relation to malaria. These have greatly outgrown their primary importance and for children from malarious areas some have become real sanatoria of great utility. They serve a threefold purpose of keeping the children out of the way of infection, giving them a well-balanced diet and an adequate treatment. Many a European country would be proud of such a number of sanatoria and those affirming that in the Transvaal nothing is done against malaria, evidently have forgotten their existence. I strongly recommend that more use should be made of the hostels for this purpose.

The children needing them most, i.e., poor children from highly malarious areas, are in the minority, because the parents cannot pay the board.

The principal of the school acts more or less as the school health-officer. He cannot call in the district surgeon if he knows the parents are unable to pay the fee and still are not entitled to free medical care. He knows of many of his children suffering from splenic enlargement not responding sufficiently to quinine treatment without being able to help them under present conditions. This should be remedied.

Many of the children living in the hostel go home every week-end. All do during the vacations, one of which occupies the greater part of the month of January and the other the beginning of April. These week-ends and holidays in the malarious season very often destroy much of the improvement in health obtained during the children's stay in the hostel. This is a matter for the serious consideration of the Government.

3.—*The Housewife.*

The following case will give a sufficient idea of what the wife of a simple Afrikander farmer living in a highly malarious area can do in the way of malaria control.

When visiting the Letsitele-valley we came first to three farms where most of the white inhabitants had huge spleens. The farms were not screened and had many funestus. No prophylactic quinine was taken, still one had a bottle of pure plasmochin which is a dangerous drug in the hands of laymen.

Next we came to a farm which was screened—without mosquitoes—and where the farmer's wife told us what she did to prevent malaria apart from screening and using prophylactic quinine. The furniture was put a little way from the wall in order to be able to use the flit-spray behind it, as she had noticed mosquitoes were in the habit of roosting there. All shelves, the underside of tables and dark corners were daily wiped with a cotton swab soaked in paraffin because she noticed mosquitoes would no longer settle down there after that operation. All mosquitoes happening to find their way indoors were regularly killed. The only road of attack still open to malaria was to be closed, by lodging the native servants in a screened room attached to the house, instead of in the unscreened native hut they were occupying now.

That all these measures outstrip any teaching the district surgeon could offer this farmer's wife and that the whole is an exception, goes without saying. But that something of the solid commonsense exemplified here is found in many of her sisters is equally true, as is shown by their being the main props of prophylactic quininization.

At any rate this example shows what *can* be accomplished and what should be aimed at. This, however, is no work for the Department of Public Health nor for any local authority, but for the South African National Council of Women and its affiliated societies, which, I understand are already doing much in the way of education of farmers' daughters and which no doubt could be of great help in this matter if approached on the subject.

4. *Government.*

Amply free quinine should certainly be issued to people genuinely unable to pay for it but wherever payment is possible it should be demanded and the quinine sold as near cost price as possible. Unless this is done distribution is apt to be indiscriminate and the public loses a sense of its value even to the extent of buying other so-called remedies instead of using the quinine.

Furthermore a cheaper substitute for the very expensive compounds like flit, komo, etc., could be found. In Holland we succeeded in doing so and I think the formula would work here. It is rather important to have a cheap insecticide of this kind, especially in the case of costalis-malaria as Anopheles costalis often remains in large numbers (and infected) in human habitations, long after the breeding places have dried up or the larvae killed by larvicides. In such a case killing of the adults is a very necessary supplement to anti-larval measures. In carrying out housewifely duties it is also indispensable.

Finally I believe more than at present could be achieved by screening if the sanitary inspectors, whom I shall recommend to be employed to give advice on anti-larval measures, were to be instructed likewise to see that a farmer who wishes to screen his house gets sound advice how to avoid the most obvious mistakes, what kind of wood and wiregauze to use, etc.

III. MALARIA CONTROL BY ANTI-LARVAL MEASURES IN THE TRANSVAAL.

A. Past Achievements.

The success of anti-larval meaures in the Transvaal should not be judged by the result obtained up to date as I did in the case of quinine prophylaxis and screening.

I shall allude to the work which has been carried out by the Railway Administration at Komatipoort in the section of this report devoted to the Railways. Messina, however, seems to be an example of successful anti-larval control. Can it teach us how to approach the problem, I do not say on farms, but in a township like Tzaneen? Evidently not, the anti-larval control was much too costly in Messina and only warranted by the great number of people (1,000 Europeans and 2,500 Natives) concentrated within an area of 8 square miles. The initial outlay of £7,000 spent within two years and the annual expense of £200 would far out-reach the financial capacity of an ordinary Township. But there is not the slightest reason why we should follow Messina's example. The system they adopted is highly uneconomical as it does not profit by the opportunity South African Anophelines offer us in such a marked degree, viz.: the opportunity of "*species*

sanitation," i.e., operating against one species of Anopheles while leaving alone all the others in a particular locality. The possibility of applying species sanitation results from the facts already related, from which it is also made clear what a difference it makes in expenditure when this system is applied.

To my mind there can be no doubt that wherever one wishes to take anti-larval measures to control malaria in the Union the only practical way of carrying them out is by species sanitation. Of course I understand that in urban areas it is desirable to abate the whole mosquito nuisance.

For rural areas the only practical policy is to limit oneself to species sanitation.

B. Principles to be Followed in Future.

1.—*On Farms in Endemic Areas.*

The farms are too few and far apart and the farmers are too poor to allow them to co-operate in employing a trained sanitary inspector with a gang of natives to carry out the work.

So each farmer will have to do or at least to supervise the work himself. If all the advice he gets is telling him to oil or spray all collections of water he finds on his farm, within a radius of half a mile from his house, he will do nothing.

But if you go round his farm with him, make a rough sketch of it, indicating all collections of water (the farmer will be a great help to you in this survey as he knows, as a rule, remarkably well where water of any kind is to be found), marking the ones which need treatment and if, moreover, you show him how he should treat these collections of water (of course without any costly pumps or sprays he cannot afford) and what the effect is on the larvae you find in them, then (according to leading farmers in the Letaba district to whom I explained the position) a certain number of farmers (one half to three quarters of them, according to various estimates) will be found willing to undertake this kind of work. Whether they are going to do it themselves or leave it to a native and only supervise the work may be left to their own discretion, if only they realize that native work is no good unless closely and uninterruptedly supervised.

The farmers unwilling to collaborate had best be left alone. They will conveniently serve as controls and will fall in later on, if the work is successful among the others.

I said just now that these others are found willing to undertake the work, i.e., oiling or parisgreening (of course they should be taught either the one or the other) once a week for 4 months (January-April) all collections of water indicated on the sketch map of their farm. They will continue to do so for a few weeks and then, unless the danger of malaria is particularly threatening, they will grow slack. The only way to prevent them leaving off altogether after a few more weeks, is periodic visits and earnest persuasions to go on with it. Even in this way it will be found impossible to keep all of them to the work and many will go and swell the ranks of the controls, but some at least will be persuaded to continue till the end of the season and it will largely depend on the results being such as to satisfy them (they may not satisfy you) whether they will be willing to continue next year. If they do, others will follow as the work then is growing into a habit.

So the first year is largely an experiment and should be undertaken on a comparatively small scale. The scheme I propose here falls in with the policy of the department that the individuals should themselves pay the expenses of the control work, but the Government should contribute in giving the detailed advice and the exhortations to continue the work which I mentioned above, and by making arrangements for the farmers to obtain anti-malarial oil at the lowest possible price.

This advice and exhortation should be given by a sanitary inspector trained in this kind of work. But in the initial stages of this effort the Malaria Medical Inspector of the Department of Public Health should be given necessary time to do the work himself and to closely watch its results. In this he should be accompanied by the sanitary inspectors to be employed in the areas selected. Three Sanitary Inspectors should be employed to commence with and this number increased later. One inspector should have the rank and emoluments of a Chief Sanitary Inspector.

The whole malaria unit for the Transvaal should be placed under the administrative control of an Assistant Health Officer in Pretoria specially detailed for the purpose.

This experiment should be undertaken in an area where one may be practically sure there is much malaria every year, i.e., in the district of Letaba. In order to allow the malaria medical inspector and the sanitary

inspectors to obtain as much experience as possible in the first year, areas should be selected where both costalis and funestus malaria occur. For the former the Ofcolaco Settlement is quite appropriate, for the latter the farms in the Letsitele valley and north of the Letaba, between that river and Modjadje's and Mamitwa's locations.

I do not believe it would be wise to take a larger area, as all depends on the work being well done the first year so as to establish a standard custom. In the long run, when a certain nucleus of well-instructed farmers has been formed it will be found possible, I believe, to give more general advice, as the type of dangerous breeding places will become generally known. It will not be absolutely essential for the sanitary inspector to identify the larvae, if only he is taught to identify the breeding places. Of course they will make mistakes, occasionally taking a *pretoriensis* breeding place for a costalis one, or a *longipalpis* breeding place for a funestus one, but this does not really matter, so long as they know to distinguish between the right and wrong type of breeding places. But to start with these simplifications would, I believe, render the whole scheme a failure. The farmers, even the well educated ones, have at present such wrong notions about the nature of dangerous breeding places that they need the most detailed advice.

2.—*On Farms in Epidemic Areas.*

What I have seen of farmers in epidemic areas makes me very doubtful whether the scheme mentioned above will at present work there. As, however, the costalis-breeding places (the only ones one has to deal with in these areas) are limited to the rivers in non-epidemic years it would be of advantage to advise the farmers to live at least half a mile from the river banks. This in an area like the West of Potgietersrust would at any rate result in very little fever occurring in non-epidemic years, whereas at present there still exists a good deal, dependent on the costalis breeding places in the river beds.

In epidemic years this measure would be of very little help, but even then useful work could be done by advising the farmers to spray with oil or paris green (1) the edges of their dams and of " pans ", there where the banks are not steep but flat and muddy and dotted all over with hoof prints from the cattle coming there to drink; (2) the rain water pools forming in the otherwise dry spruits; (3) the road and roadside pools left after rains that do not dry completely within a week. These three kinds of possible breeding places to be treated every week within a radius of half a mile around the farmhouse, between January 1st and April 30th.

This is not the precise kind of work I advocated in section 1 but at any rate it will bring about the killing off of a certain number of costalis. Moreover the work is much easier there, as one has to deal with costalis only.

It would be necessary to arrange for a supply of oil to be available for the use of farmers in those years which, by their amount of rain are likely to become fever ones.

3.—*In Townships Governed by a Local Board.*

As far as my experience goes (viz.: in the township of Tzaneen) carrying out anti-larval control is somewhat easier. The actual work can be taught to a native but the difficulty is in the supervision as the work is quite useless without that. In Tzaneen this difficulty has been solved by training a police constable to recognize Anopheline larvae. The spraying was done by a native prisoner who accompanied the police constable. In this case we had ourselves mapped out exactly the site of the various breeding places and decided which one to treat and which not. In other cases that would have to be done by a Government sanitary inspector. The general supervision, to see that the gang was going on its usual round at the appointed day, was done in Tzaneen by various members of the health board in turn, but this arrangement must be left to the discretion of each local authority provided this kind of supervision is carried out.

IV. THE FUTURE OF NEW SETTLEMENT IN HIGHLY MALARIOUS AREAS.

I have been in a position to form a judgment on this point by visiting the farms Toul and Lorraine, at one time proposed as a settlement for poor whites, and by observing the conditions among the farmers living in the neighbourhood both of highly cultured (Ofcolaco) and of simpler class. As I have pointed out repeatedly both types can do very well in this area where the native population is infected to such a surprisingly high extent. But all depends on the mode of living, i.e. the amount of precautions taken. So much so that it is almost possible to gauge by the look of a farmhouse how many big spleens one will find there, quite independent of the site of the farm.

So it seems that no amount of endemic malaria need prevent European Settlement, provided the necessary personal precautions are taken, viz.: prophylactic quinine, screening, regular killing of mosquitoes inside the house and segregation of natives; and I have observed how people not accustomed to live in this country, like Railway Officials and a certain low type of farmers refusing to take these precautions (especially quinine), are brought very low.

At present popular opinion is erring in two directions.

On the one hand there exists that abject fear of the lowveld, deeming it a place unfit for Europeans to live in. Such a fear leads to despairing conclusions like that of Anthony Trollope that " South Africa is a country of black men and not of white men—it has been so, it is so and it will be so " and it prevents the carrying out of many a promising scheme of irrigation, along the only rivers (so I am told) still allowing of economic irrigation, viz.: the Olifants, Crocodile and Pongola.

On the other hand there is the equally unwarranted tendency of making light of the situation, under the false impression that malaria is gradually disappearing. I have already referred to this, pointing out the errors underlying it. I also mentioned there the danger of disturbing the equilibrium established in such a seemingly healthy community by importing non-tolerant native labour and new settlers.

The fact that occasional attempts are made to import Cape labour shows how little the precarious state of affairs is realized and we may be thankful that such attempts up till now have always been nipped in the bud.

The fact that white families, who from the very first may be expected to lack the insight necessary to induce one to take the constant, never ending precautions to live well in highly malarious areas, are encouraged by responsible authorities to settle there, makes me believe that these authorities do not sufficiently realize how very malarious these areas are. Their mistake is that they take the publications of the Department of Public Health, meant to settle questions regarding climatic allowances, but not going into details as to the malariousness of every single locality, as a guide to decide which spot to select for settlements.

The fact that the authorities do not take sufficient notice of the malaria position in some parts of the lowveld, makes me very doubtful about recommending schemes of settling poor whites in these areas. So long as it is not clearly realized that such an attempt will invariably end in failure, unless one is prepared to go to any length to take the most stringent precautions, such experiments with human beings had better be avoided.

But as soon as this mental attitude changes, and it is clearly understood that establishing a poor-white settlement on Toul and Lorraine, or on an irrigated area alongside the Pongola is a very serious thing, then I believe the time is ripe to point out to the authorities in charge that such a scheme can be a success from a sanitary point of view, if the following points are observed.

The settlement must not be on the usual South African lines, i.e., each farm with its own homestead and, consequently, all the human habitations scattered over the place, but united into one closely built village or, if the area of settlement is very extensive, into two or three villages, so as to allow the farmers to go out to their fields in the morning and to return home before sundown.

The site of the village must be outside a funestus area.

There must be a sanitary inspector for each village, but the permanent or recurring anti-larval work must be carried out by the villagers themselves.

All the houses must be screened. The keeping up of the screening must be done by the villagers under the supervision of the sanitary inspector. The screening must be supplemented by regular killing of mosquitoes inside the houses every morning, and the houses should be build in a way so as to render this an easy task (white-washed walls and ceilings, no unnecessary dark corners). Medical treatment should be ensured by a resident doctor provided with a dispensary, whose salary is partly or wholly paid by contributions of the villagers to a sick fund. No natives of any description are allowed to pass the night in or near the settlement.

Regulations should give legal powers to enforce any sanitary measures without lengthy juridical procedure.

THIRD SECTION.

MALARIA CONTROL IN THE SUGAR-BELT OF NATAL.

I. General survey of the position.
II. Malaria control by anti-larval measures.
III. Malaria control by personal precautions and indirect measures.
IV. Malaria control by providing the sugar-belt with labour tolerant to malaria.
V. Organization of the forecasting of epidemics.

MALARIA CONTROL IN THE SUGAR-BELT OF NATAL.

I. GENERAL SURVEY OF THE POSITION.

A. From an Administrative Point of View.

The sugar estates and sugar mills are situated in a way and are of a sufficiently small size to allow of their collaborating into groups which would be formed into administrative units of a simple kind and Health Committees under Ordinance No. 14 of 1930.

The townships and villages interspersed between the estates are on the North Coast largely inhabited by Indians and Natives and have constituted or are to constitute themselves into local authorities under Natal Ordinances.

On the South Coast there are residential seaside areas with sugar estates adjoining which have since the beginning of the year taken on local government and are now in a position to deal effectively with their own problems.

B. From a Demographic Point of View.

The population in the sugar belt is partly composed of the *European planters* (owners or managers) living on *estates* the size of which is often less than a fourth of an average lowveld farm. They live there together with their *native labourers*, much outnumbering by 5 to 1 or more those actually employed on an ordinary farm. These labourers live close together in a compound and are not scattered all over the place in squatters' kraals.

Another part are the *European direction and employees* of the sugar mills, living together with a numerous group of native and indian labour collected into a closely built village.

Finally there is an insignificant minority of Europeans living in these villages mainly occupied by Indians and Natives.

On one or both sides the sugar belt is fringed with native reserves.

The Native labourers on the estates and mills are largely recruited from outside Natal from Transkei and other non-malarious areas (foreign labour). Many of the men recruited are rejects from the mines. They usually serve a contract of six months and during that time they live in compounds without their families and without going home.

A certain number of natives from the neighbouring reserves come to work in the sugar belt (" local labour ") without taking their families with them. They often spend week-ends at home and absent themselves if unwell.

At the northern end of the sugar-belt (Umfolosi flats) " local labour " is largely employed. This term has, however, an entirely different application than farther south. It means labour from everywhere north of the Umfolosi and largely from the districts of Ingwavuma and Ubombo (" Tongaans "). They come to work without their families and are most of them too far away from home to return there every week. Portuguese and Nyasaland labour (" Portuguese boys ") have been found employed in this area, a rare occurrence further south. On the other hand highveld recruited labour is almost entirely absent.

On the sugar mills, besides the labour enumerated above, large numbers of *Indians* are employed except in Zululand. Contrary to what is customary with the natives, the Indians live there with their families.

In the villages natives and Indians live with their families. It need not be emphasized that the distribution of the population in the sugar belt, its

density and the fact of its being collected into smaller and larger centres, was a great aid in bringing about the administrative organization mentioned in A.

C. From an Epidemiological Point of View.

In a great portion of the area the malaria falls under the heading of "Estate-malaria" where the fever among the labour force is the main trouble and, as we have seen in B, this labour force is living in definite centres of habitation.

Except in the north (Umfolosi Flats) where there exists *endemic malaria* of moderate intensity, the fever in the sugar belt assumes the epidemic type amongst the native population living in the reserves. The same applies to the native and European population in the estates and mills, with this curious difference, however, that the malaria among the native labour in the Umfolosi Flats is of very little consequence.

The malaria in the sugar-belt is at present almost wholly *costalis-malaria*. There is some doubt whether funestus-malaria exists there at all, as there are parts in Natal where breeding places of funestus are common enough and where malaria has been negligible since 1926—although fever abounded all around.

On the other hand the close relation between costalis and malaria is quite striking, especially this year, when the fever occurred in a localised way only where costalis had become prevalent. It disappeared again when the breeding places had dried up and adult costalis were no longer found in the native huts.

D. From an Economic Point of View.

This is really implied in the statement already made that the fever in the sugar-belt is "Estate-malaria" and in the explanation given of this term later on. I may point out, however, that the losses caused to the sugar industry as a consequence of malaria among their labour force arise from—

1. Capitation fees and all other expenses consequent upon recruiting fresh labour to replace the recruited or local labour that died, became disabled or went home and refused to return.
2. Retarded cutting and crushing of cane. It is true that this should not weigh so heavily as these operations do not begin until the month of May is well advanced, when the malaria season is coming to an end. But in Natal fresh cases of fever may occur as late as June (showing in the newly recruited foreign labour, usually arriving at the time the cutting season commences) and moreover there are the relapses to count with.
3. Neglect of the cane fields during the weeding season. This coincides with the malarious season and so weeding is seriously affected by a malaria epidemic. The weeding season is usually called the "off-season," as no cutting and crushing is going on; the labour force is much reduced and the planter often takes his holiday at that time; still, from an agricultural point of view, it is an all-important season, as neglected weeding does great harm to the next year's crop.
4. Expenses for quinine to cure the labourers. In some instances where I got exact information this amounted to 14s.-18s. 5d. per season per labourer on an ordinary sugar estate (300-500 acres) employing 30-50 natives. It should be noted, however, that no Government quinine is used and that planters buy the drug, so I was informed, at a rate of 5s. 6d. a hundred 5 grs. tablets.
5. Expenses for medicines other than quinine used in the treatment of malaria, and for hospitalization, not including the retaining fee to the local medical man.

Except for the last two it is very difficult to asses these losses in £.s.d., partly because they have regard to future crops, partly also owing to insufficient keeping of records, especially on the estates. Still this short summary will be sufficient to show that the difficulties besetting the Natal planter as a consequence of a malaria epidemic on his estate are entirely different from the ones a farmer of a similar standing has to face in an endemic area of the Transvaal.

E. From a Point of View of "Estate Sanitation."

By "Estate sanitation" I mean a complex of preventive and curative measures with the object to maintain or to restore the good health of a labour-force collected from other parts and brought to live close together on

an estate (to carry out agricultural or industrial work) under conditions more or less foreign to the home customs of the labourers. These conditions, especially when implying a bachelor life, are fraught with danger for the labour group thus collected, even in an otherwise healthy country with a temperate climate and especially so in a semi-tropical country like Natal periodically overrun by epidemics of malaria.

The principles of estate sanitation are: A complete knowledge of the prevalent preventable diseases occurring on an estate, by accurate diagnosis, only obtainable under hospital conditions. All cases of illness lasting for longer than three days should be treated under hospital conditions with facilities for modern diagnosis. According to the result of the hospital diagonsis special sanitary measures are taken besides the general ones regarding food-supply, housing, water-supply and sewage disposal. A thorough medical examination, not by an official dependent on the recruiting agencies, precedes new labourers being accepted and on arrival in the country where they are to be employed they are quarantined before being distributed over the various estates. This system in relation to recruitment, of course, implies a good deal of organized collaboration between the various estates, as no single one could bear the expenses attached to it.

Such a scheme of estate sanitation cannot be made general without some Government aid. Not in the way of financial help, but by instituting labour inspection and by seeing to it that the sanitary measures which are deemed necessary are carried out. Such an inspection is always necessary because there are always some planters unwilling to collaborate.

I have looked in vain for any vestige of a scheme approaching the one outlined above. True there are large combinations of sugar estates and mills with their own hospital and full-time medical officer, but it was not clear that this organization was serving preventive medicine by guiding the sanitary efforts on the estate, where nothing in the way of sanitation goes on except for malaria control. Another such a property showed me how sanitary efforts, not guided by the hospital records showing what diseases require special attention, go astray and run to seed; £88 was spent annually on the control of malaria, a disease of no importance in that locality, but there was no money available to provide the place with a borehole in order to get a safe water supply for a population among whom amoebic dysentery is very prevalent.

It would be unfair not to mention that one meets planters who are looking after the well-being of their labourers, who see to it that the compound is clean and roomy, the sanitary arrangements kept in a state fit to be seen, the water supply plentiful and safe, the diet well-balanced, quinine (if necessary) regularly taken. But such efforts require a great deal of personal sacrifice to the planter and his wife, and, unfortunately, such efforts are rare.

They also require the native compound to be erected close to the planter's house. For otherwise the indispensable personal supervision becomes impossible. The principle of segregation of natives already mentioned, so necessary for Europeans living among a native population in a highly endemic area (like in some parts of the Transvaal where this principle should be applied, but is neglected) should be discarded here (at some risk to the health of the planter, no doubt) in favour of the requirements of a successful health supervision.

F. Cause of Malaria Epidemics in the Sugar Belt.

According to many planters the mechanism by which malaria epidemics arise in the sugar belt is entirely different from that in other parts of the Union. It is not the sudden increase in numbers of Anopheles, never wholly absent, which kindles the smouldering fire of fever represented by the small foci of malaria always to be found outside epidemic years, but it is the malaria centre in the far north sending down its mosquitoes by rail, which causes all this evil. My reply to this argument has already been given in discussing the same point for the Transvaal.

Another point of view is that the sugar industry itself is responsible for the epidemics. Here again I disagree, as I cannot see that any of the factors necessary to start an epidemic are not present among that part of the population not belonging to the sugar industry.

I admit that the sugar industry has introduced a new factor into the epidemiological situation by the yearly recurring importation of large numbers of natives from non-malarious areas, usually of low physique. This crowd, highly susceptible to malaria, which they have great difficulty in shaking off even if they are well treated, is a greater danger to their surroundings than a similar number of local natives and is better able than these to keep epidemics going. The same, to a certain extent, applies to the Indian population. Many of these foreign labourers return home sick and are certainly responsible for starting up outbreaks in middle veld areas and on the South Coast, where the malaria vector is present.

II.—MALARIA CONTROL BY ANTI-LARVAL MEASURES IN THE SUGAR BELT.

By the preponderating importance of *Anopheles costalis* as a malaria carrier anti-larval control on the principle of species sanitation should prove to be a comparatively easy matter, especially now that the efforts of the Public Health Department and the Provincial Administration have succeeded in creating an organization ready to take over the supervision of the work. This organization I consider the clue to the whole position and it should be maintained and extended at all costs. A co-operative executive organization is not yet in being as the various estates have not yet combined, but I hope that this will be the case before the onset of next fever season.

Taking for granted that executive local organizations are established, the principle of the anti-larval activity will be to concentrate upon the eradication of costalis around the complex of European establishment and native compound on every estate which I assume to be close together as they should be. All collections of water should be dealt with, either by filling in with sand or by oiling (for these small breeding places I do not think Paris-green is necessary), which are likely to breed costalis within half a mile around the complex. These collections of water, clear or muddy standing pools or puddles, exposed to sunlight with little or no upright or floating vegetation, are especially to be found in or alongside roads, the bed of spruits, dongas, irrigation or drainage furrows and at drifts. If any doubts arise whether any special puddle can breed costalis, approach it with care so as not to allow one's shadow to touch the water and, if the water is muddy, look carefully for pale-coloured Anopheles larvae; if it is clear stir the water by hand to make it muddy. Otherwise it is better to treat all suspicious-looking breeding places without leaving it to the man in charge to decide whether to treat them or not. In this way all difficulties regarding identification of larvae are eliminated from the ordinary routine work.

Of course, quite a number of breeding places selected in this way will be found not to breed costalis but pretoriensis. But here, at anyrate, I agree with the man who said that it did not matter whether one killed a few innocent mosquitoes.

But this principle must not be carried too far, otherwise the whole system, which is based on the comparative simplicity of the task will be wrecked. This system admits the principle that anti-larval work cannot be left to natives except for the actual manual operations (provided the utensils he uses are fool-proof and he knows exactly what to do). But its simplicity allows of one health committee inspector supervising quite a number of estates. For the preliminary survey he goes over the premises, accompanied by the farmer who shows him the spots where water is likely to collect after rains, and followed by a native carrying a number of sticks suitably marked to be easily recognisable. A stick is planted at every suspicious collection of water and at every spot where water may collect and that native is told that he should oil these places if there is water. The planter provides the native, a spraying pump, oil, and the sticks, and he does part of the supervision in seeing that the native is on his round on the day ear-marked for it. The sanitary inspector (who, on his first round has mapped out the position of the sticks) inspects the premises once a week, perhaps less after long droughts, perhaps more after rains, to see whether new pools have formed and always accompained by the oil man.

The present organization of these sanitary inspectors working under the direction of the Assistant Health Officer stationed in Natal, apears to provide a sufficient supervisory staff (other than the native staff to be dealt with later), but one of these sanitary inspectors should be given the rank and emoluments of Chief Sanitary Inspector.

These sanitary inspectors of the Department of Public Health enter into this system as general supervisors of the work of the inspectors of the health committee. They should be able to identify larvae and on their visits they will be able to give occasionally useful hints as to better selection of the places to be oiled. But by their superior knowledge they will be able to guard against painful surprises, e.g. by finding out that a place is affected by funestus malaria or that costalis is breeding where no one suspected it to breed, or (God guard us for that!) that pretorinesis is playing havoc somewhere. The simplified system advocated here renders such a supervision of a higher order very necessary.

Such mishaps being provided for and the ordinary supervision being guided by traces of oil left on the standing water, the only thing to be guarded against is closing the stable when the horse is gone, in other words, doing anti-larval work when costalis is already about in numbers transmitting malaria. That should be provided for by commencing the work as soon as the Government sanitary inspectors report breeding of costalis in numbers anywhere in the sugar belt.

And if such a thing should occur (as it undoubtedly will now and then) no time should be lost in oiling the breeding places still in existence (they may be all dry by that time). They can wait for a time. The oil man becomes a flit man, the sanitary inspector will break his ordinary round to be on the spot and the whole compound is thoroughly sprayed with flit, komo or a cheaper substitute.

III.—MALARIA CONTROL IN THE SUGAR BELT BY PERSONAL PRECAUTIONS AND INDIRECT MEASURES.

The main point in personal prophylaxis (among the labourers) is European supervision, which implies a native compound near the planter's house and his presence during the malarial season in epidemic years.

Quininization, as far as the consumption of quinine goes in the sugar belt, is sufficiently advanced to need no further comment. All that is wanting on many farms is again the personal supervision of the planter and, moreover, his own belief that quinine *is* a remedy against malaria.

I have said enough about the deficiencies of estate sanitation to feel the need to enter again upon this subject. The best I can recommend is that the plan of centralised medical attendance be unearthed as soon as possible and that in the meantime the planters make it a point of following the example of their few colleagues who deem it worth while to pay special attention to the general welfare of their labourers.

Finally, I recommend that the planters association organize a system of medical examination by a medical man appointed by themselves to examine all labourers offered by the recruiting agencies before the contract is signed.

IV. MALARIA CONTROL BY PROVIDING THE SUGAR BELT WITH LABOUR TOLERANT TO MALARIA.

The composition of the labour forces of the Umfolosi co-operative sugar mill has changed considerably since 1926. In that year there were about two-thirds foreign labour and one-third local labour (i.e., from the highly malarious areas of Tongaanland), among the former there was an average monthly sick-rate of 45 per cent., and of 10 among the latter. Since that year the mill has employed nothing but " local " labour and other from similarly malarious areas and the sick-rate has remained just as low (or even lower) although the area is permanently malarious. Similar experience all the planters round about have had, and so have the planters who were lucky to obtain this sort of labour further down south in Zululand. But they are few in number, for this kind of labour is scarce and on coming south to seek for work are practically all absorbed by the planters of the Umfolosi Flats.

Serious objections have been raised against employing labour from highly malarious areas in the sugar belt; conditions would be rendered worse because these people's blood is " full of malaria germs ", they were sure to infect the local anopheles and so start fresh epidemics.

We have gone carefully into this matter by examining large numbers of these people in their native homes both in Tongaanland and in the Transvaal (Letaba district). The detailed results of this investigation will be found in the technical part of my report, but I may state here that they confirmed the opinion ascribing to the adults of these populations a high degree of tolerance with regard to malaria. The children are very dangerous to their surroundings, but the adults (and more especially the male adults from 16 years and older) are not. They could be employed in the sugar belt without danger and with great advantage, provided care is taken to select them from really highly malarious areas. Tongaanland, for instance, as a whole, offers widely different conditions and one cannot expect a man from the Lebombo range (where malaria is rare except during epidemics) to show the same resistance as a man from the flats at the foot of that range. The same applies to the Transvaal where there is a great difference in tolerance between the various locations, those higher up in the hills being much more susceptible to fever than those lower down, but still within the area of funestus malaria, whereas further east, in the real lowveld (costalis malaria) there is again a rise in susceptibility.

Consequently, I recommend that the sugar industry should be granted every facility to acquire labour from areas of high malarial endemicity. The areas already known by experience to yield an adult population of proved malaria resistance need no special survey, but if new sources are to be utilized careful prospecting is desirable, in the interest both of the planters and the labour employed.

But planters and millers employing this labour should clearly understand one thing—these natives' resistance to malaria is not an immutable thing. It can be lost and a sure way to do so is by bad food and bad sanitation. Whether it will ever be advisable to slacken the precautions against malaria even when all native labour employed are of the tolerant type, I very much doubt. There always remain the Indians and Europeans to be protected. But the general estate sanitation should never be neglected and to assure this I further recommend that Government, when going to offer its assistance in recruiting tolerant labour, will make it a condition that every mill or planter employing such labour shall comply with the requirements of the Public Health Department as to food, size of compound, housing and sanitary requirements, together with any other detail the Department may deem necessary.

V. ORGANIZATION OF THE FORECASTING OF EPIDEMICS.

Recommendations how to organize forecasting of epidemics apply both to the Transvaal and Natal.

The forcasting should be based on meteorological and entomological findings and on evidence of illness in native locations.

1. *Rain gauges* are to be found everywhere and it only behoves to make the right use of their results; heavy rains followed by showers repeating themselves with intervals of less than a week are to be considered as dangerous, unless they occur late in April in areas at an altitude showing a considerable drop in temperature in that season. In Natal this type of rain may be found to cause *costalis* breeding when occurring as late as May. If no other data are available the Public Health Department will issue warnings on the strength of meteorological data alone (1) *to the Magistrates* to have their stock of quinine replenished; (2) *to the district surgeons* to give emphatic notice to the farmers to start quinine prophylaxis, to have their screening prepared, to oil suspicious pools; (3) *to the principals of schools and school hostels* to start prophylactic quininization among the children.

But if more reliable data can be obtained, it is preferable to use them, as the machinery to set into action is rather complicated and as often repeated false alarms might create contempt of the Department's forecasts.

2. Therefore, I rocommend that this forecast, wherever possible, should be based on *costalis* being found breeding in fair numbers. The forecast based on such a finding should be regional, i.e., it should take account of the local rainfall, so as not to alarm a region where little rain fell by the *costalis* breeding in an area of much rain. The warning should be like this: "All localities with a rainfall of so much within last fortnight are given notice that *costalis* has started breeding and are recommended . . ., etc."

With regard to the staff employed to spot the breeding of costalis, there exist no difficulties in *Natal*, as I am told. The Department's sanitary inspectors and the native malaria assistants are quite able to carry this out, and in the areas where health committees exist the time employed in spotting will be greatly reduced by the local knowledge of the sanitary inspectors and spotters employed by these committees.

In the *Transvaal* the large area and the limited staff I recommend to begin with, render this method of forecasting a more difficult matter, the more so as I expect this staff to concentrate on endemic areas, at least to begin with. However, in the event of predisposing rains in Pietpotgietersrust, Nylstroom, Rustenburg districts or north of the Zoutpansberg, I have no doubt it will be found possible as a rule to send one of the three sanitary inspectors with a native malaria-assistant round to investigate. In this way little time need be lost to give warning to local officials and the results of rain observations will decide whether this warning should be general or local.

In the foregoing I have taken it for granted that at the offices of the Public Health Department in Pretoria and Durban meteorological data are always available and closely watched. Otherwise it would be desirable to ask, in this matter, for the collaboration of the meteorological service of the Union and to take notice of the forecasts issued by this service.

No mention has been made here of breeding of *funestus* for the following reasons: *funestus* malaria, as far as I know, is always endemic and so needs no forecasting; *Funestus* breeding is too little dependent on local rains to render meteorological data of any use; *Funestus* breeding and malaria are phenomena showing an insufficiently close connection to allow of predicting the latter by the occurrence of the former.

3. The evidence of illness due to malaria as collected by the native malaria assistants in Natal chiefly by their bloodslides, to be mentioned

later on, is of the highest importance, to be forewarned against an oncoming epidemic, although strictly speaking this does no longer belong to forecasting, as the epidemic may be there already, only not yet among the European community.

In Natal this intelligence service exists already and needs no change to serve this purpose.

In the Transvaal my recommendation regarding the training and employing of native malaria-assistants of the Natal type may be fitted to serve the same purpose.

Finally I need not emphasize of how much help a system of birth and death registration would be in this matter.

FOURTH SECTION.

MALARIAL CONTROL ON THE SOUTH AFRICAN RAILWAYS.

I. Transvaal.
II. Natal.

MALARIA CONTROL ON THE SOUTH AFRICAN RAILWAYS.

I. TRANSVAAL.

The Union Railways are seriously affected by malaria in the fever districts. This year in Komatipoort, reported to have little fever owing to the drought, there had been 17 cases up till 5th April among a European staff o. 28. As practically every fever patient there is sent to hospital in Barberton, where they stay for one to three weeks, it is easy to imagine what the loss of working days will be in a fever year.

In stations in a funestus area conditions are even worse and it is rare for a stationmaster to stay there for a year; within that time he is probably away on sick leave for quite a considerable time. All these transfers of personnel must cost the Railway Administration a good deal.

Still a considerable sum of money is already spent on malaria control, notably on screening. But the effect, at least in an area of funestus malaria, where the station *is situated in a native location* of high endemicity, seems to be very slight and far inferior to that observed on the surrounding farms. This may be due to the site inside the location, where no farms exist, but more so, I take it, to the fact that the railway officials have not learnt how to live in a malarious area, more especially how to use quinine. I did not gather from what I was told, that they get much detailed advice from the railway medical officers, which they nevertheless need very much.

Of course, there always remains the chance of infection at night during out-door duty (which I have discussed elsewhere), in trains (Mr. de Meillon occasionally observed costalis and funestus entering railway carriages), and in the railway offices (they are screened, but all the cases and shelves offer a wonderful opportunity for mosquitoes to hide and the door at night is opened so often). But in the cases I met, the family of the railway officials were as often ill as the husband, although not exposed to these infections.

Not all stations in malarious areas are exposed to such heavy infection as the one in the Letaba Valley I am referring to, and I dare say screening in less heavily infected areas proves more satisfactory.

I found that officials being sent to that station were given no special advice as to what precautions to take. Still they are eager for it and grateful when somebody takes the trouble to give it them.

I therefore recommend that the railway medical officers should give special instructions to the officials about to be sent to the small stations on the Selati line, pointing out to them the precautions that are necessary. Of course, the treatment in the hospital in Barberton is excellent, but if my experience is not very exceptional, I am sure the hospital days (paid for, it may be added, by the Railway Sick Fund, to which all officials contribute)

could be greatly reduced if the employees had some ideas about the right use of quinine and were induced to put them into practice. The " ticket moderateur " of some European sick funds might work wonders here.

Furthermore, I recommend that stations situated within native locations or for other reasons unusually exposed to infection, be the first to be protected by anti-larval measures, within half a mile around the station. But these measures should be extended to all malarious stations along the Selati line and the Komatipoort-Waterval Onder line. For each line a sanitary inspector and two natives will be required, instructed in spotting and marking both funestus and costalis breeding places, the actual oiling being done by a native employee of each station. There will be no anti-larval control along the line between the stations, but around them the half mile radius will be observed, whether the area treated is railway property or not. Anti-malarial oil and a spraying pump ought to be present at every station requiring anti-larval measures.

I think that, for the proper health supervision of the Railways, an Assistant Health Officer should be allocated by the Minister of Public Health, who is the responsible local authority under the existing law. While this officer should remain an official of the Department of Public Health, his whole time should be given to railway problems and it would be reasonable for his salary and travelling expenses to be refunded by the Administration. He should be given control *inter alia* of the sanitary inspectors of the Railway Administration.

These recommendations do not imply that I am unaware of the fact that much anti-larval work has been done at one of the stations along the lines mentioned above, viz., at *Komatipoort* and it would be a sign of little appreciation of highly laudable efforts if I were to pass over this station in silence. These efforts have not been unsuccessful, as I am told there is much less blackwater at that station than there was in former years. This certainly shows a definite improvement in treatment of cases of malaria.

Still I have seen, by examination of the natives in the immediate vicinity of the town along the river, that malaria still shows a high endemicity although, being mainly costalis malaria, it was somewhat lessened by the drought. Consequently vigilance is still necessary. Moreover, anti-malarial control at Komatipoort is an example of occurrences very common in the history of malaria control in most countries and to which I especially drew attention in the introduction to this report, viz., the measures now and then requiring a certain amount of revision and readjustment to the results of advancing research. There can be no doubt that the anti-larval measures taken at Komatipoort at present do not give full justice to Anopheles costalis as principal carrier there. I am not in a position to give detailed advice as to what should be done at present as I saw the place in a year of very little rain. But even at that time costalis was breeding alongside the Komati River at no great distance from the town. I may add that costalis is often little affected by drainage as it does not breed in swamps but preferably in rain water pools anywhere where there is little or no vegetation. Cutting down grass may, therefore, encourage breeding of costalis.

II.—NATAL.

The problems malaria on railways offers in Natal are of late years different from those in the Transvaal because, firstly, many miles of new line have been constructed both in endemic and epidemic areas; secondly, anti-larval activity in many parts of the sugar belt where the railway passes through, made the call for co-operation of the railway an urgent one.

A. Construction of Railways in Endemic or Epidemic Areas.

Construction of new lines requires importation of labour. If it is" foreign labour " like that employed in the sugar belt, and if the area it is imported into is one of moderate endemicity, the immigrants themselves will not only suffer seriously, but they will also become a serious menace even to the only insufficiently immunized original native inhabitants and *a fortiori* to the settled immigrants. This is what happened in 1926 during the construction of the Matubatuba-Gollel railway; a heavy outbreak of malaria all over the place followed the importation of labour for the railway construction and there is nothing astonishing in the fact that now that demographic conditions have become restabilized malaria incidence has dropped considerably.

Similar conditions obtained during the railway construction in the N'Kwaleni Valley by importation of foreign labour in an epidemic area during a fever year.

Another variety of the same type of occurrences is a railway gang developing fever (acquired elsewhere) in a locality on the South Coast, non-malarious but breeding costalis and so starting an epidemic in this and neighbouring places.

Apart from the heavy losses they cause to the railway administration, such outbreaks are a serious menace to the surrounding European and native population, which to prevent is the bounden duty of the Railway Administration. It should be assisted in that endeavour by allowing it to make use of malaria-tolerant labour in endemic or epidemic fever areas, but it should be obliged to import no labour from fever areas into regions free or usually free from fever, nor to employ locally recruited labour which it knows comes from such regions.

The supervision and correlation of anti-malarial activities in connection with new construction work should form an important part of the duties of the Assistant Health Officer whose secondment for railway work is recommended.

B. Anti-Larval Activity along the Railways.

At present anti-larval work is being done along the railway as it passes the whole length of the sugar belts. I inspected some of this work in December and January and found it unsatisfactory. That the principle was followed to treat collections of water just as far as they lie within the railway property may be correct as to form; it becomes absurd when such measures are intended to protect two labour camps on the Tugela, with any amount of costalis breeding along the banks of that river.

To ensure a proper working of anti-larval control along the railways it is first of all necessary that the authorities should be thoroughly convinced that this work is really of importance and not to be treated *en bagatelle*. Secondly, sanitary inspectors employed by the railways should be at least as well trained as those of the local authorities in the sugar belt, and they should simplify their work according to larval findings just as the latter do. Thirdly, each inspector should be given no larger area to work than one can reasonably expect to cover in one week. The gangs actually doing the work should have their base at the stations and work the line from there. Each station or labour camp needing protection should have its full half-mile radius of anti-larval control be this on railway property or not. Finally, further from the station where the line passes through private property, it is desirable carefully to establish which breeding places require treatment and who should treat them, railways or owners. Until an Assistant Health Officer is allocated to the Railways, disputes in regard to the above could be settled by the sanitary inspectors of the Government under the control of the Assistant Health Officer in Natal.

FIFTH SECTION.

MALARIA AMONGST THE NATIVE POPULATION IN THE RESERVES.

I. General survey of the position.
II. Treatment of malaria.
III. Malaria control by anti-larval measures.
IV. On the possibility of recording births and deaths in native reserves.

MALARIA AMONG THE NATIVE POPULATION IN THE RESERVES.

I. General Survey of the Position.

It is the duty of the Union Government to promote by any means in its power the material benefit of the native population. One portion of this duty is to improve the health conditions by medical and sanitary measures. I always was under the impression that improvement of health conditions and

of economic conditions are identical. But there seems to exist a different view amongst the Native Affairs Department as exemplified by the following statement:—

> "It is the policy of the Department not to sanction any further expenditure on medical services from the development account, intended to promote the material benefit of native communities and . . . cannot be used for public health purposes."

The absurdity of this statement will become even more apparent by adding that the main source of income of the particular native community to which this statement refers are the wages of the male adults going to work elsewhere for periods of six months. These wages had been considerably reduced owing to an epidemic of malaria and the "further expenditure on medical services" was intended to prevent similar epidemics in future.

Taking it for granted that the above statement does not represent a general accepted opinion and leaving alone all questions regarding providing general medical and sanitary assistance to the native population, I will limit myself in this section to malaria control amongst natives living in areas with endemic and with epidemic malaria.

A. Endemic Areas.

Quite apart from the question of duty, is malaria control amongst the natives in endemic areas not an indispensable part of malarial control amongst Europeans? Have I not made a statement to the effect that it is in the native hut where most infected *Anopheles* are found and that the native child is the main source of danger to Europeans living it its close proximity? Certainly these statements have been made, but it does not follow that there is any need to eradicate malaria amongst the native population living under tribal and kraal conditions. Such a measure would undoubtedly greatly reduce the risk of infection for Europeans, but it is not the only way to obtain this end.

After all it is only the minority of the native population coming into close contact with Europeans which offers any danger and although, in endemic areas, there is little hope of curing them, being constantly reinfected in their kraals, it is possible to avoil the danger of their becoming the source of infection on European farms either by Anopheles control on that farm or by preventing mosquitoes becoming infected, by making the natives pass the nights they stay on the farm in a screened room.

It would be another thing if the European and native population were inextricably mixed up. But, at least in rural areas, the "segregation of natives" is sufficiently far advanced to render further precautions possible.

All this refers to endemic areas, peculiar by the fact that it is practically only the child population which infects mosquitoes.

B. Epidemic Areas.

In epidemic areas the position is different. Either there is little or no fever about and then of course no danger is to be apprehended from the side of the natives, or a malaria-epidemic is amongst them, in which case conditions are worse than in endemic areas, both for the natives themselves and for the Europeans living among them. For among the natives the morbidity and mortality due to malaria are much higher than in endemic areas. Moreover the ability to infect mosquitoes is not limited to the children, but likewise common among adults.* Consequently, the chances of infection for the Europeans, in serious epidemics amongst the natives, are greatly enhanced. In an endemic area adult house-servants are fairly harmless, only the young kitchen-girls are a danger, but during an epidemic every native servant is.

Still, even under these circumstances malaria control among Europeans is not dependent on that among natives and the same that has been said in the preceding paragraph applies here.

I may add that essentially the same conditions as those found among a native population during a fever epidemic obtain in groups of natives from non-malarious areas imported into endemic areas, even if the endemicity is moderate, a point I referred to already in the chapter on railways.

It also should be pointed out that epidemic fever has more chance to spread to hitherto uninfected districts than endemic malaria, as adults are likely to infect anopheles during epidemics, and adult male natives naturally travel about more than children.

So, on the whole, epidemic malaria among natives offers a more acute danger to the whole population than does endemic malaria.

* This is the case in other countries. I assume it is the case here, but I have not seen an epidemic.

But in none of them can it be maintained that malaria control among the Europeans (or native in their service) is dependent on that in the native reserves. So whatever is done for the natives there, must be for their own good, the benefit for the Europeans arising out of it being a side-issue.

II. TREATMENT OF MALARIA AMONG THE NATIVE POPULATION.

A. In Areas of High Endemicity.

It is with some hesitation that I am going to put forward my opinion on this matter, but I know I have the support of two men of great name, viz. Professor Schüffner and Col. Christophers.

In 1917 when we were examining together the native population of the highly endemic district of Mandailing (Sumatra) Professor Schüffner frequently explained to me his views that he did not believe it advisable to carry out regular quininization amongst a population constantly exposed to malaria infection and developing at the same time a definite degree of immunity towards the disease, measurable by accurate methods. He apprehended that this process of immunization, evidently beneficial to the people, would be hindered by quininization. Moreover these people are not at all eager or thankful for quinine and if they take it, they comport themselves in a way as if they were conferring, not receiving, a favour. In 1929 when we were in Karnal (Punjab) Colonel Chistophers expressed similar views with regard to various aboriginal tribes in India, showing an even higher degree of immunization than the people in Sumatra.

We have carefully gone into this matter and we found that the native population in the various highly endemic areas we examined (Tongaanland. Foothills of Drakensberg) shows undoubted signs of a highly developed tolerance towards malaria in adults, and, to a certain extent, even in children. I cannot go here into technical details which will be set forth in the technical part of my report, but the most important points are that:—

1. The children, although heavily infected, do not suffer nearly so much as European or Indian children do and, in the few cases we were able to ascertain this, the mortality amongst them was comparatively low.
2. The adults, in the majority of the cases shake off the effects of the infantile fever and, on the whole, appear to enjoy good health. At any rate they are excellent workers, much appreciated both at the Rand and in the Natal Sugar belt.
3. The adults when working in fever areas suffer from malaria occasionally, but they often get well again without any specific treatment. If they take quinine, small doses, quite insufficient to cure a European, an Indian or a native from a non-malarious area, will set them right in a very short time.
4. We are not at all sure that the same result would be obtained if the process of immunization were disturbed by distributing quinine on a large scale among such a population, and I actually deem this inadvisable unless one is prepared to go to the full length of a thorough campaign of malaria eradication in the locations with a high malarial endemicity. It has not been tried out there by the Health Department, which has for other reasons confined its quinine activities to the epidemic areas. This remark does not imply that I recommend these people to be left to their fate on the strength of the scanty information as to their health conditions I could offer here. It is necessary to continue and to extend research on malaria amongst natives in highly malarious areas in order to ascertain to what extent they and their children suffer from it.
5. As has been explained already, these natives are no danger to Europeans unless the latter live amongst them or unless these natives emigrate with their whole family, children included, to European settlements where malaria transmission is possible. Importation of adult males from such endemic areas offers no danger to the community where they go to work.

B. In Epidemic Areas.

The objection I raised against intensive quininization in endemic areas does not hold here. Moreover lives are to be saved here and the population is grateful for the help offered and ready to profit by it. They are scared into submission by the unwonted sickness and death they observe around them.

At present an organization exists in Natal; native " malaria assistants " are trained to acquire an elementary clinical knowledge sufficient for them to recognize a fever, the presence of an enlarged spleen, to take a blood preparation (thick film) and to treat malaria and distressing symptoms accompanying this disease. Moreover, they acquire a knowledge of the basic facts of the epidemiology of malaria; they can recognize Anopheles larvae, they know where they breed, and how to kill them by larvicides.

During epidemics they initiate the treatment of malaria in the reserves and give the people directions how to take the quinine, available at the numerous depots. In some cases they take blood-slides, especially if it is essential to know if an epidemic reported to be due to malaria is really caused by blood parasites. There are already some instances on record where the data collected by the malaria assistant have shown the reported malaria epidemic to be non-existent.

The diagnostic powers of the malaria-assistants is no doubt limited. But, as far as malaria goes, they are the most valuable source of information. As a whole these men are of the same or even a slightly better type than the quinine distributors I know in some parts of South-East Europe. So long as the habit is strictly adhered to not to accept their (or anybody else's) statement of the occurrence of a malaria epidemic somewhere, without the evidence from the bloodslides they themselves collect, they can not only not go far wrong, but they will prevent other people from doing so. Of course, once the presence of an epidemic is established, they must be given a free hand if they are to do any good, and they are sure to make many people take quinine who do not need it. But I cannot see any great difference in this situation compared to that in any other native community in the grip of a malaria epidemic. On an emergency one has always to employ lay-assistance and the native malaria assistants are certainly above that type.

As conditions are now, I hold the view that the native areas subjected to epidemic malaria are much better provided for than the European population in the Northern and Western Transvaal. That, of course, does not mean that I advocate to send the native assistants out to distribute quinine among the farmers. That would, I fear, be worse than useless.

The question arises whether the native assistants should be employed in the epidemic areas outside the fever years. Probably wastage of quinine will then be worse than ever. Still my opinion is that they should, as they act as an intelligence service by reporting unusually numerous deaths and by sending in their blood slides. One pays for that by a certain amount of medicines misused. But what one gets: a knowledge of anything unusual happening in the domains of " vital statistics " and a fairly accurate knowledge about the doings of malaria, is well worth it, especially in a country where the complete absence of any records on deaths renders the native reserves a complete blank, from a point of view of public health.

This organization might be used for the betterment of the health conditions in general of the native reserves, and it would assist the district surgeon to know beforehand that whatever the rampant disease may be it is not malaria.

I cannot finish this section without a word of appreciation for what some mission stations are doing by way of malaria treatment. The best tribute I can give to the effect of this treatment is that we were always careful to keep away from mission stations after we had found out once or twice that they completely spoiled our spleen rates.

I conclude by recommending that the Natal system be continued and extended. Refresher courses should be given to the malaria assistants employed, preferably yearly, and if the system continues to work well, it might prove useful too for the native locations in the epidemic areas of the Northern and Western Transvaal.

In the meantime steps should be taken in the Transvaal to give training to native assistants of a similiar type as the Natal ones, except for the entomological knowledge of the latter which I do not think is necessary here.

III. MALARIA CONTROL BY ANTI-LARVAL MEASURES IN NATIVE RESERVES.

The quinine distribution mentioned in the preceding paragraph is entirely paid for by the Government, but there is one native reserve I have visited (M'singa in the Tugela Valley) where the " local tax," amounting to £6,000 annually, is available for the development of the reserve and at the disposition of the native district council (composed of nine tribal chiefs and presided over by the magistrate) under the control of the Department of Native Affairs. The " poll-tax," amounting to £16,540, is not available for local purposes, as it is claimed by the central government.

The malaria epidemic of 1930, which caused a mortality of 100 per cent. during the first half of that year, induced the native district board to commence anti-larval measures by Paris-greening the rich Anopheles breeding places in the numerous tributaries of the Tugela. It is difficult to ascertain the results as the epidemic was over by the time the measures were fairly started. Judged by the number of larvae still found later on in the year (belonging to harmless species) they were not altogether successful, partly due to defects in the spraying apparatus for Paris-green.

I am, therefore, not in a position to give an opinion on the possibility of carrying out anti-larval work by natives without constant European supervision. But I believe the experiment is of sufficient importance to have it continued with oil instead of Paris-green under the control of a sanitary inspector employed by the native district board and supervised by one of the Public Health Department's sanitary inspectors.

What I have seen of anti-larval measures in another native reserve with local self-government clearly shows that such efforts should only be undertaken with the detailed advice of the Department of Public Health.

IV. ON THE POSSIBILITY OF RECORDING BIRTHS AND DEATHS IN NATIVE RESERVES.

At present no records are available of the number of deaths occurring in native reserves, and all data on the mortality caused by malaria epidemics or in endemic areas are either mere approximations or ascertained with the utmost difficulty, unless very small communities are concerned like squatter kraals where the farmer and his induna practically know every inmate. So one feels completely in the dark and is apt to doubt any statement on excessive mortality as not only the number of the dead, but also of inhabitants, is a mere guess.

To one accustomed to the birth and death registration in India by the Chaukidar and in Netherlands India by the Modin-system, it is at first difficult to believe that a similar system could not be introduced among the natives of this country. But when one perceives that there are no villages, as exist in the two countries mentioned above, but that small kraals are scattered all over the place, one realizes the difficulties that attempts at registration of births and deaths meet with in this country.

Notwithstanding this, I have been told that numerical registrations of births and deaths (i.e. without the number of inhabitants being known with sufficient accuracy to establish a birth and death rate, but still of the highest importance if one may assume that the population remains fairly stable) was usual in Natal prior to Union. Registration was done by the " Public Witness " (sub-Induna or Meli) twice a week at the magistrate's office; this custom was abolished for the sake of economy. Others told me that registration of births and deaths had proved a failure even in the highly developed native communities of the Transkei, but my informant admitted that numerical registration might prove feasible.

In view of the high importance attached even to a numerical registration, the least I can do is to recommend this matter to the serious consideration of the authorities.

SIXTH SECTION.

RESEARCH AND INSTRUCTION.

I. Research.
II. Situation and staffing of the field station for malaria control.
III. Instruction.

CONCLUSIONS.

RESEARCH AND INSTRUCTION.

In the introduction to my report I have made it clear why research on malaria must be considered an essential part of the system of malaria control in the Union. So I can refer to that and pass to the question how research could be organized and what are the subjects needing special consideration.

I believe we have passed the stage when malaria investigation was carried on along the lines followed by zoological expeditions. These investigations were absolutely necessary and they have been very useful; their results will even grow in value while we get on. But what we need at present is a closer co-ordination of the entomological and epidemiological findings that the more purely entomological research allowed of.

This change implies a change in methods. The field of research at first was the whole malarious area of the Union requiring incessant travelling about; it was extensive. What we want now is intensive research, continued for a long time on the same spot. Up till now we only got a snapshot of the condition at a certain moment. Now we want to know the changes of these conditions throughout the year.

The question which immediately arises is how to select such a suitable spot. For one will be tied down to it for some time to come and on the choice

Is it necessary to make this choice at all? Would it not be much better not to be tied down to one place, but to combine the mobility of the older form of research to the stability I wish for, by equipping a motor lorry as a field laboratory and caravan combined, drive it to whatever place one wants to investigate and stay there as long as is deemed necessary, a whole year if nothing less will do. This establishment would have the great advantage, moreover, of causing no expenses in winter and of serving the whole fever area of the Union and not one district only, however malarious it may be.

I realide the advantages of this plan, which is not mine, and if the alternative I propose is impossible to carry out, I will have to be satisfied. But it can neither serve the purpose I have in view. Moreover, it will strengthen the idea that something should be done for every fever-area, whereas the only right principle is to do no more than can be *well* done.

The reason why the plan mentioned here cannot serve my purpose is—

(1) that I have more than research in view, viz., instruction;
(2) that the research I consider necessary is difficult to carry out while one stays in a motor lorry and tents, especially in the rainy season;
(3) that there are problems requiring observations throughout a whole year or specially in winter;
(4) that it is not only malaria control I have in mind, but the whole domain of rural sanitation.

I.—RESEARCH.

What I want, and honestly believe necessary, is a " field station for malaria control "—presumably under the South African Institute for Medical Research—as a centre to refresh and keep up, by practical application of various methods of control on a farm selected as an object of experiment, the knowledge necessary for the medical malaria inspector so as to remain a real guide to the farmers he is called upon to give advice to. During this experimental malaria control and visits to farms numerous questions will spring up ranging from small technical details up to fundamental problems, all requiring to be dealt with by research. By " research " I mean the scientific handling of practical problems and by " scientific " nothing should be understood but that which renders a merchant or an engineer successful in his line, i.e. the spirit enquiring into what is actually happening (and not what the general public believes) and what changes are actually brought about by controlled and spontaneous change of conditions.

I do not want to go into any detail as to what this research should consist of, as I am disinclined to tie the hands of those responsible for the work. All I want to impress upon them is that so much remains to be done, that they should always consider the practical side of a subject they want to study and leave it alone unless convinced this side is of sufficient importance.

II.—SITUATION AND STAFFING OF THE FIELD STATION FOR MALARIA CONTROL.

I recommend that this station be situated in Tzaneen (district of Letaba) for the following reasons:—

(1) Situation on railhead between Selati and Koedoe's River on the low veld.
(2) Highly malarious surroundings, including varied epidemiological conditions.
(3) In the neighbourhood of (1) Ofcolaco Settlement, very promising for individual efforts, which will serve as object lesson to others and, (2) a type of farmers a good percentage of whom may be expected to be willing for collaboration.

(4) Probable great future agricultural development in this area.

(5) Within fairly easy reach of epidemic regions: Waterberg, Zoutpansberg, Rustenburg.

(6) Large native population at varying altitudes showing varying degrees of malariousness.

The field station should provide accommodation for the entomologist and his assistant together with adequate laboratory facilities for these officers and the Malaria Medical Inspector.

The staff should consist of the entomologist, his European assistant, one of the spotters, all working in conjunction with the malaria unit of the Department.

Ample provisions for motor transport are essential as it is out of the question to work the area without it.

III. INSTRUCTION.

The instruction to be given at the station will embrace the following parts:—

A. Training of staff to be employed in anti-malaria control.

B. Lectures and field instruction to a limited number of district surgeons, health visitors (district nurses) and school teachers.

A. The Training of Personnel.

I had better state what this staff consists, or is recommended to consist, of and what are its functions:—

1. *In Natal.*—Three Government sanitary inspectors, one with the rank and emoluments of chief sanitary inspector, under control of the Assistant Health Officer for Natal for general supervision and for advice on malarial control to local authorities, etc.

(1) "*Spotters,*" *i.e. native malaria assistants* specially trained to locate breeding places and collect larvae for identification.

(2) *Sanitary inspectors, and native spotters* of local authorities, Railway Administration, mills, etc., responsible for carrying out anti-larval control.

Of these three groups, 1 and 2 are already in existence. Group 1 still needs a training in identification of anopheles larvae for which I recommend Mr. de Meillon, Acting Entomologist, South African Institute for Medical Research, be asked to undertake this work. Most of the training must be done in the field and on living larvae.

Group 3 needs practical training, not so much in larval identification, as in the kind of collections of water they come across and the criteria which should decide whether these need treatment or not.

2. *In the Transvaal.*—Under the administrative control of an Assistant Health Officer detailed off for this duty—

(1) *The Medical Malaria Inspector*: His task is two-fold (*a*) carrying out (by way of experiment) malaria control by anti-larval measures and supervising and encouraging the efforts of individual farmers and local authorities, to begin with on a limited scale; (*b*) research on problems related to practice in close co-operation with the Field Control Station; some of these problems may require to be worked out in Natal or other parts of the Union.

For executive field work are required:—

(2) *Three sanitary inspectors*, one of them with the rank and emoluments of a chief sanitary inspector. They should be trained by the medical malaria inspector and the Field Control Station; their number to be increased later on as required.

(3) *Four "Spotters"* also to be trained like the former group; their number to be increased later on as required.

(4) *Sanitary inspectors* or *spotters* which may be employed in future by the Railways and by local authorities.

B. Instruction to District Surgeons, Health Visitors and School Teachers.

I recommend that to the refresher courses attended by district surgeons should be added a "stage" to be spent at the field station for malaria control by a selected group of district surgeons who are most likely to profit by it. The time at the station should primarily be spent on work in the field to teach the district surgeons the practical aspects of malaria control, in order to

enable them to give really useful and practical advice to the farmers in their districts. Moreover, to demonstrate to them how farmers in highly endemic areas carry out measures of personal prophylaxis. I take it that most of the district surgeons spending this stage have their districts in epidemic areas, where at preent little can be done. But this instruction will give much help in rendering the experience gained at the station useful over a larger field. This will especially be the case, if, as I further recommend, the malaria unit keeps in touch with the district surgeons having spent a stage there, by letter, occasional visits and, if possible, by sending over one of the sanitary inspectors, if local work permits, to give advice. Of course everything will depend on the interest shown by the district surgeons, to decide whether this intercourse is worth while keeping up or had better be dropped.

A similar course of instruction I recommend for a limited number of health visitors who, I believe, had best be selected from the districts where the district surgeon has passed a stage at the station and has shown a lasting interest in the matter. As one of the main functions of the health visitors is to bring home to the population practical notions on sanitation in household affairs, questions regarding personal prophylaxis are of greatest importance to them.

School teachers equally in limited numbers, and likewise to be selected from districts where sound notions on malaria control have got some foothold through the district surgeon, should follow a similar course of training which might be combined with that mentioned above, and which should enable them to give to the school children what the health visitors are giving their elders at home.

CONCLUSION.

I believe I have made it amply clear in this report that no amount of malaria need prevent European settlement in any part of the Union, otherwise suitable for this purpose. Whether such settlement is possible depends on the settlers themselves. The conditions of settlement on land obtained through Government should embody an obligation to observe injunctions laid down by Government regarding siting and general construction of houses, screening, and control of mosquito breeding as in furrows, etc. On the whole educated settlers have done better than those of the bywoner type not because of race or wealth but because among the former we find men prepared to carry out essential hygienic measures; or rather, having had a lesson that neglect means malaria, are prepared to benefit from that error and take care.

The low veld is not for the rich only as against the poor. But it certainly will be the heritage of those prepared to take care and it is not for those who are careless of its risks.

To summarize my recommendations I have advocated:

I. For the Transvaal.

1. *A unit for malaria control and research* under the administrative control of an Assistant Health Officer detailed off for that duty, consisting of a medical malaria inspector, 3 sanitary inspectors (one of them with the rank and emoluments of a chief sanitary inspector) and 4 native assistants-inspectors and assistants being specially trained for their task by the medical inspector in conjunction with:

2. *A field station for malarial control* in an area of high malarial endemicity, fitted out for research, for practical application in the shape of experimental malaria control, for training of staff and for instruction of persons not attached to the malaria section of the Department, but still directly or indirectly taking part in malaria control, viz., district surgeons, district health visitors and school teachers.

3. The malaria organization here should be prepared to—

(*a*) survey farms (to begin with in a definite area), spotting the dangerous breeding places, advising the farmers how to deal with them and visiting those willing to do so repeatedly to keep up their interest and correct mistakes;

(*b*) carry out anti-larval control on one suitable farm to obtain personal experience of the difficulties and the best way to meet them;

(*c*) keep records of the incidence of malaria and anopheles on suitably selected controlled and uncontrolled farms;

(*d*) advise the farmers on matters of personal prophylaxis and general hygiene, including those unwilling to collaborate in anti-larval measures;

(*e*) advise local boards how to carry out malaria control;

(*f*) collect data on the breeding of costalis in non-endemic areas considered by headquarters to be threatened by epidemics;

(*g*) undertake research on problems requiring solution from a practical point of view;

(*h*) train staff employed in malaria control in the Transvaal and—if the Assistant Health Officer for Natal should judge this advisable —also for Natal;

(*i*) give instruction on malaria prevention to district surgeons, health visitors, and school teachers.

4. The *district surgeons* are to keep in touch with the population by teaching them to treat malaria themselves, to practice quinine prophylaxis, and practical knowledge of general hygiene including dietetics.

They are to be given the opportunity of keeping up their knowledge of rural medicine and sanitation by refresher courses once in two years and out of those appointed in malarious areas some should be allowed each year to follow a course on personal malaria prophylaxis and treatment in the field station mentioned above.

5. *District nurses of the health visitor type* are to assist the district surgeons in their task, especially in that of instructing the population. Among those stationed in malarious areas some are to follow the course mentioned above.

6. *School teachers* should receive, during the course of their training, instruction in the principles of hygiene and its practical application, the programme of this instruction, being elaborated to the satisfaction of the Health Department and specially including personal prophylaxis of malaria and anti-larval control. Some of them should be detailed off every year to follow the course mentioned above. They should, moreover, receive explicit instructions as to quinine prophylaxis and the period during which it is to be carried out.

7. *School hostels* should be made to serve the three purposes, in relation to malaria, for which they are meant.

8. *Medical treatment of the children in the hostels* should be provided for.

9. *Instruction of future farmers' wives* in the principles of hygiene and its practical application in the rural household and especially in personal prophylaxis of malaria should be promoted, in collaboration with associations existing in this country aiming at similar ends.

10. *The sale of quinine by Government should be promoted* without, however, in the least encroaching upon the right of the Public Health Department to issue it free of cost, by selling as near to cost price as possible.

11. *Natives in epidemic areas* to be trained to initiate treatment in the native reserves and to promote knowledge of malaria, as in Natal.

II. For Natal.

1. *Organization of health committees* or similar administrative units in groups of sugar estates which can be held responsible and shall provide the staff for carrying out anti-malarial measures, along similar lines as those followed at present in villages, suburban and residential areas. They will be guided by the advice of the Dapartment of Public Health. As to the amount which an estate could reasonably be expected to expend on anti-malarial work, I consider quarter per cent. of the annual gross income to represent a minimum for an ordinary normal year.

2. *Estate sanitation to be put on a better basis*, which can be worked out in the form of Health Committee regulations and supplement the existing Housing Regulations, which a Health Committee would be well to enforce.

3. *A centralized medical and hospital service* for the whole sugar belt on the plan outlined some years ago by the Assistant Health Officer stationed in Natal and the Sugar Association.

4. *A System of medical examination* of recruited labour before acceptance by medical men employed by the combined planters' and millers' associations in the sugar belt, to be elaborated with the advice of the Department of Public Health.

5. *Providing the sugar belt with malaria-tolerant* labour by the help of the Government, on condition all other recommendations are executed to the satisfaction of the Department of Public Health.

6. *Assuring an adequate quinine distribution* among the native reserves in epidemic areas and continuing the system whereby native malaria assistants give health talks and advice on malaria, advice as to kraal sites, etc., initiate treatment where such is desirable and keep up the closest touch between the people and the authorities in malarial matters.

7. The present system of *instruction on malaria in native schools* to be continued and every effort made to train native teachers to give such instruction.

8. *Education of recruited labour* in malarial matters by native lecturers as lately inaugurated.

III. For both Provinces.

Seriously to consider the possibilities of birth and death registration in native reserves and locations, if not otherwise possible on a numerical basis only.

IV. South African Railways.

1. The South African Railways should have to undertake the responsibility *of protecting their staff against* malaria by carrying out, where necessary, anti-larval measures around the stations and by having the staff well and repeatedly instructed how to take personal precautions.

2. They should be prohibited from causing or increasing the danger of malaria infection by the importation of non-immune *foreign labour* to malarious areas. To carry out this obligation facilities should be given the Administration to recruit malaria-tolerant labour.

3. They should be prohibited from importing labour from an area where there is malaria into areas liable to become infected.

4. In the sugar belt of Natal they should collaborate in carrying out *anti-larval control* on the same footing and with the same methods as the local authorities and private bodies.

5. Lastly, an Assistant Health Officer should be allocated for service with the railway to ensure proper sanitary supervision on open lines and new construction.

N. H. SWELLENGREBEL.

Pretoria,
May 16th, 1931.