

Report on the Medical and Sanitary Departments / Government of the Gold Coast.

Contributors

Gold Coast. Medical Department.

Publication/Creation

Accra, Gold Coast : Government Press, [1930]

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GOLD COAST COLONY.

REPORT

ON THE

Medical and Sanitary Department

FOR THE YEAR

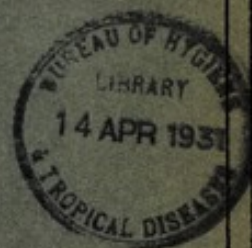
1929-1930.

GOLD COAST:

*Printed by the Government Printer at the Government Printing Office, Accra.
To be purchased from the Government Printing Office (Publications Branch),
Accra, Gold Coast Colony, and from the Crown Agents for the Colonies,
4, Millbank, London, S.W.1.*

1930.

Price—Four Shillings.







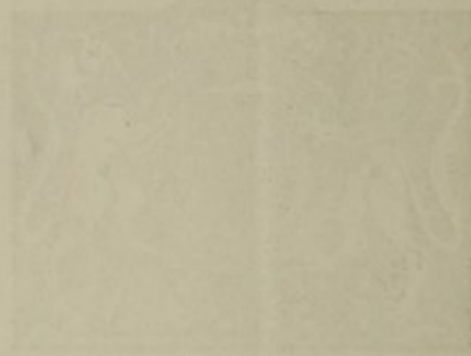
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1930.



GOVERNMENT OF CANADA

REPORT

Department of
Medical and Sanitary

1930-1931

Printed by the Queen's Printer, Ottawa, 1931.

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SUMMARY OF FEATURES.

I.—MEDICAL BRANCH REPORT.

This summary is merely a pointer to the main features of the report. I have avoided a prolixity which might give the reader an excuse for not reading the body of the report which must be read if the contents are to be fully appreciated.

A list of the contents is first given from which reference may be made to all the particular features of interest.

1. Administration, showing appointments, transfers, promotions amongst Europeans and Africans during the year.

A list of the staff is followed by ' Ordinances affecting Public Health ' and a statement of finances.

The subject of Public Health is then reached.

A perusal of the tables will show the most noteworthy contents in the different diseases treated.

For a complete list of diseases treated reference must be made to ' In and Out-Patients ' contained in Table V.

The health of the Europeans and Africans has been satisfactory. The steady increase of patients noted is not due to any increase of diseases but to a better appreciation by the whole community of modern treatment.

On page 11 attention is drawn to a 'special scheme of training Dispensers in increasing numbers in order that the Medical Service may be extended more widely.'

Time must be the test, but excellent results are confidently anticipated.

Amongst communicable diseases Malaria holds the first place. Human trypanosomiasis has attracted more attention than in previous years, and a greater number of cases are recorded, but it would be entirely premature to conclude that it is on the increase. In all probability the correct explanation is that greater facilities have occurred for observing the disease which for generations has been endemic in certain areas on the Gold Coast.

No case of yellow fever was reported during the year (p. 13).

Under infectious diseases it will be noted that there was a severe outbreak of smallpox during the last three months of the year. Cases under the enteric group of diseases have increased: a warning signal showing that anti-typhoid inoculation for newcomers should be adopted.

Statistics on Tuberculosis show a slight increase of cases treated, but no increase when compared with a percentage of all cases treated.

Venereal diseases show a decline in the number of cases treated.

The report on Leprosy (p. 15 of report, and Appendix D,) shows what valuable work has been done and how hopeful the results of treatment have been and that the Leprosy Campaign is proving a success, especially in the Leper Settlement at Ho.

The prevailing treatment and nature of Yaws—one of the most formidable and widespread of all tropical diseases—is described briefly on page 16 of the report, and very fully in Appendix D of the report of the Director of Medical Research Institute, where very interesting observations are made on the relation of Yaws to Syphilis.

Attention is drawn to the importance of ulcers, a disease responsible for a vast amount of distress and disablement amongst the population.

One case of hydrophobia is recorded—the third which has ever been reported on the Gold Coast (p. 17).

On pages 17 to 21 will be found statistics regarding the cause of invaliding—deaths amongst European and African officials.

On page 22 is a table of considerable interest showing births, deaths and infant mortality rates amongst the African population from 1926 to 1930.

Pages 51 to 59 are taken up with an account of the existing European and African hospitals, a list of which will be found in Appendix A.

The number of patients and average cost per diem of treating each patient, European and African, are given on page 53.

It will be noticed (a) that great improvements have been carried out at the European Hospital, Accra.

(b) The European Hospital at Sekondi has been converted into an African hospital, all Europeans in the Sekondi area now being taken to Takoradi for treatment.

The statistical table on page 54 shows the steady increase of work year by year at the Gold Coast Hospital, Accra.

Attention is drawn to the training of Dispensers and Nurses which is chiefly carried out at the Gold Coast Hospital.

A brief account of the Maternity Hospital, Accra, appears on page 55—a very full and interesting account of the work which is being done there will be found in Appendix F.

The construction of new hospitals at Axim and Sunyani and the addition of new wards to the hospitals at Cape Coast and Nsawam will be noted.

The work of the Travelling Dispensaries is referred to on page 56. Reference should also be made to Appendix D which gives an interesting account of work done especially in connection with Leprosy.

The useful work of mission dispensaries is recorded on pages 57.

The new hospitals in course of erection are referred to on page 59; then follow the reports of the X-ray and Electro-Therapeutic departments, the Venereal Clinic, the Dental Clinic, Prisons and Asylums and the Central Lunatic Asylum, Accra.

Meteorological figures will be found on page 70 and the report of the Analytical Chemist on pages 167 and 168.

II.—HEALTH BRANCH REPORT.

HYGIENE AND SANITATION.

Mosquito and insect-borne diseases are first considered—A record is given of anti-malarial work done (pp. 23–24).

There were no cases of yellow fever during the year, but an interesting table showing the incidence of the disease during the last ten years is given. The necessity of maintaining a large sanitary staff to combat this disease is stressed.

Under Infectious Diseases (pp. 26–34) cerebro-spinal meningitis, dysentery, the enteric group, plague, smallpox, leprosy, anthrax, relapsing fever, tuberculosis and yaws are reviewed.

There was no serious outbreak of cerebro-spinal meningitis. 865 cases of dysentery with 158 deaths were reported. The number of cases

of enteric reported is small, but for reasons given which should be studied Europeans coming to the Colony are advised to become protected by inoculation.

No plague was reported—preventive measures, especially the destruction of rats, were steadily persevered in.

Under smallpox an interesting account of a somewhat severe outbreak is given.

Brief reports on leprosy from different centres are given.

As anthrax is fairly common a stock of fresh Sclavo's serum is always kept ready for its treatment.

There was no serious outbreak of relapsing fever. Measures taken for the prevention of the disease, including the opening of a 'refuge' at Kumasi, are described.

Tuberculosis is briefly discussed and a short report from the Tuberculosis Medical Officer stationed at Tarkwa is given. Figures given by the Medical Officer, Winneba, show a great increase in the cases of pulmonary tuberculosis treated, but he is not prepared to accept the figures as a sure index of the increasing prevalence of the disease.

Tuberculosis in other centres. The increased number of pulmonary tuberculosis returned from several of the larger centres should probably be put down to the increasing number of cases of pulmonary tuberculosis coming into these centres for treatment and would appear to be increasing *pari passu* with the increased number of general patients applying for treatment. If this is the case the outlook is hopeful, for the general sanitation of the country is improving year by year. The most hopeful lines of prevention are discussed.

YAWS.

The importance of yaws and the methods of combating the disease are discussed.

"Next to malaria, yaws is the biggest factor in the immediate health problem to be faced in the Gold Coast" nearly one fourth of the total cases presenting themselves for treatment at the infant welfare centres being due to this disease.

(Refer to Director of Medical Research Institute's papers on yaws and syphilis in his report.)

Helminthic diseases are discussed on pages 34–35.

Under animal diseases small outbreaks of rinderpest and anthrax are noted and contagious pleuro-pneumonia involving 17 head of cattle.

An unusually high percentage of sheep and goats were found to be infected with pseudo-tuberculosis (Priesz-Nocard). Tables showing the seasonal prevalence of diseases are then given.

Under general measures of sanitation pp. 37–41 come (a) Sewage disposal, (b) Refuse disposal, (c) Drainage, (d) Water supplies, (e) Offensive trades, (f) Clearing of bush and undergrowth, (g) Sanitary inspection and prosecutions.

Under (a) cheap septic latrines are drawn attention to; a most interesting account of the construction and methods of use will be found in Appendix D. (b) Destructible refuse is disposed of in brick-built incinerators. In Accra, a high temperature refuse destructor costing approximately £7,000 will soon be in use.

(c) All the large centres have progressed with their main drainage schemes.

In Accra a special scheme has been elaborated which will soon be working (for details, *vide* report).

(d) Good progress has been made during the year. The Kumasi scheme has been sanctioned and is about to proceed. This will be a sanitary improvement of the first order.

Scarcely less important is the Tamale scheme for pipe-borne water which is being worked out.

The water supplies throughout Ashanti generally have been greatly improved.

Bacteriological examination of the Accra, Sekondi and Takoradi water supplies are made weekly with good results, especially in Accra, where the water supply is excellent.

An interesting account of the construction of the Ashanti wells is given.

(e) Offensive trades are briefly referred to.

(f) The importance of clearing bush and undergrowth is dwelt on.

(g) House-to-house inspection for larvae, and insanitary conditions, are recorded and results given showing the number of sanitary convictions.

III.—School Hygiene. Medical officers in charge of Welfare centres examine all children on commencing school life.

Tables are given summarising the defects found, and the attendance for minor ailments at four of the principal schools.

IV.—Labour Conditions. (p. 43.) Conditions are briefly described and the poverty stricken condition of many of those seeking work alluded to.

V. Housing and Town Planning. (p. 44.) Considerable progress has been made in Accra during 12 months, and throughout Ashanti generally good progress has been made where 150 Ashanti villages are working on their layout.

VI.—Food in relation to Health and Disease. (p. 45.) Attention is drawn to the radical changes—apparently without ill results—in the dietary of large sections of the community during recent years. This is somewhat at variance with the views expressed by the Surgeon Dentist in an earlier section of the report.

Remarks regarding inspection and control of markets and slaughter houses, aerated water factories, bakeries and fishstores appear on page 46.

On pages 47 and 47 measures taken to spread the knowledge of hygiene are recorded and the training of sanitary personnel explained.

Recommendations for future work are to be found on pages 47 and 48.

III.—PORT HEALTH WORK AND ADMINISTRATION.

The Port Health Officer gives information regarding boarding of vessels, inspection of passengers, precautions taken against rats, and other details.

Maternity and child welfare are dealt with in section V, pp. 50–51.

Figures are given showing how rapidly the number of patients that attend the maternity hospital is increasing.

The ante-natal clinics are a great success, as is especially evidenced at Kumasi.

Propaganda work has gone a long way towards popularizing both ante-natal and infant welfare work.

Table XV shows a great increase of work at the welfare centres during 1929–30.

During the year a new infant clinic and welfare centre was built at Cape Coast.

A welfare centre was opened at Koforidua.

The most potent predisposing factors in infant child mortality and morbidity are given.

The chief actual factor is undoubtedly malaria in its various forms.

Prevention should first take the form of general anti-malarial work, which prepares the ground for successful welfare work.

Maternal welfare will be greatly promoted by trained midwives who are being slowly but steadily provided.

An ordinance to regulate the number and status of midwives is being drafted.

IV.—MEDICAL RESEARCH INSTITUTE REPORT.

A voluminous report with much valuable matter contained under the headings I.—General Remarks. II.—Report of the Routine Division.

III.—Report on various special investigations.

IV.—Tables of Statistics.

Under I, the work of the different laboratories is briefly outlined and the general organisation and cost of the various branches referred to.

II. The report of the routine division contains some valuable remarks under malaria, such as the suggestion that malaria is not a common cause of death *per se* and that a distinction must be drawn between the carriers of disease and those who really suffer from it.

The types of malaria in Africa and India are contrasted in favour of Africa: the remarks refer to the native population, not the European.

A very full account is given of a case of blackwater occurring in a Swiss subject in which death took place in less than 48 hours after the onset.

Some most interesting deductions are drawn under the heading of yaws, syphilis and gonorrhoea (13).

The presence of enteric fever has been more actually corroborated during the last ten years than at any time previously.

Under dysentery (15) it is remarked that 'there is very little doubt that bacillary dysentery is the more prevalent type.'

16. Relapsing fever continues to supply a low number but a regular series of cases.

18. *Tuberculosis*.—Little can be gathered from laboratory statistics. The last paragraph of this section gives one a graphic picture of a native habit which leads to the dissemination of the disease. "Education over a period of many decades is probably the only hope of reducing the prevalence of this disease for spitting is the delight, and the hand is both the handkerchief and the spoon in the communal feeding bowl."

20. *Schistosomiasis*.—The disease, whether intestinal or vesical, is much more prevalent than is generally supposed.

21. *Trypanosomiasis*.—A special report will be found.

22. Yellow fever.—Under this heading two very interesting cases labelled 'toxic jaundice' are reported.

23, 24, 25. Under these headings are mentioned blood chemistry, cell counts and cerebro-spinal fluid examinations and histological examinations, procedures which grow more and more important every year.

26. *Post-mortem examinations*.—A brief but interesting record—reporting amongst others the findings in a case of heat stroke which occurred in a European.

27. Under medico-legal examinations an interesting report of a poison obtained from a spear-head is given.

28. Bacteriological examinations of drinking water record the routine examinations of drinking water, and gives most satisfactory results.

29. *Animal examinations and inoculations.*—The results of trypanosome and tuberculosis inoculations are recorded and the examination of various animals described.

III. Reports on various special investigations are briefly summarised and explained.

Appendix A contains preliminary observations on relapsing fever and gives details of four cases—the diagnosis of relapsing fever may have to be made from a variety of details and by the exclusion of other diseases if *Spirochaetes* are not found.

There is no one lesion, or group of lesions, or symptoms, which are invariably present.

It is generally accepted that relapsing fever is louse-borne.

Spirochaetes were frequently found in the stomach contents of lice which were examined.

The constancy in the types of *Spirochaetes* found is drawn attention to, and the suggestion is made that the vaccination of contacts might be a practical proposition, and that the serological diagnosis of internal cases might be applied with advantage.

Interesting accounts are given of experiments made in animals and spirolysins, i.e., substances contained in the serum of rats which have recovered from relapsing fever, which are capable of destroying that type of spirochaete with which the rat was infected.

Appendix B gives a final survey on some plague experiments with conclusions drawn therefrom.

Appendix C contains a most interesting paper on malaria in parturient women which is continued from the previous annual report.

Appendix D discusses a most important but little understood subject the relation of yaws to syphilis.

The argument goes to show that yaws which is closely related to a type of syphilis, is a protection against that type of syphilis which if uncontrolled means slow, but sure, race destruction.

Appendix E describes a search by a new method for a precipitation test for malaria.

Appendices F, G and H, which are prefaced by a few remarks by the Director of Medical Research Institute indicating the trend of the contents, contain the results—entomological and pathological—of experimental bush clearings made in the northern section of the cattle route in the Gold Coast and must be fully read to be appreciated.

They discuss the anti-Tsetse measures which have been taken and give most interesting details regarding both human and cattle *trypanosomiasis* and the manner in which they are being dealt with.

Appendix I. The Dick test in the Tropics.

Appendix J. Some preliminary observations before commencing an investigation on schistosomiasis.

Appendix K. Acknowledgment.

The report is completed by a list of statistical returns from the routine divisions.

G. HUNGERFORD.

*Acting Director of Medical and
Sanitary Services.*

April, 1930.

Report on the Medical and Sanitary Department for the Year 1929-1930.

1. ADMINISTRATION.—MEDICAL AND HEALTH BRANCHES.

(a) STAFF.—MEDICAL BRANCH.

Table I (page 169) shows the actual staff of the Medical and Health branches of the Medical Department, and also the staff of the Medical Research Institute existing on the 1st April, 1929. Changes throughout the year in the Medical and Health branches are shown below :—

I.—EUROPEAN.

Appointments, transfers, promotions, etc., during the year.

Promotions :—

Miss M. G. Le Bas was promoted Senior Nursing Sister on the 1st April, 1929.

Appointments :—

Dr. F. MacLagan was appointed Alienist Officer during the year.

Drs. D. W. Seth-Smith, S. A. Maclean and P. B. Wilkinson were appointed Medical Officers during the year.

Drs. Mary K. Lawlor and Jane Grace E. F. Cummins were appointed Women Medical Officers during the year.

The Misses Violet M. V. Luscombe, Edith G. B. Archer, E. M. A. G. Bennett, P. T. Evans and V. E. Kirby were appointed Nursing Sisters during the year.

Other changes in the Staff during the year :—

Dr. A. J. R. O'Brien, C.M.G., Surgical Specialist, retired on pension on the 21st September, 1929.

Dr. T. R. Robertson, Medical Officer, retired on pension on the 5th August, 1929.

Dr. Patrick Walsh, Medical Officer, resigned his appointment on the 29th May, 1929.

Dr. J. E. Moffatt, Senior Medical Officer, was transferred to Nigeria on promotion as Assistant Director of Medical Service, on 31st August, 1929.

Dr. A. C. Paterson, Medical Officer, was transferred to Sierra Leone on promotion as Senior Medical Officer, on the 6th March, 1929.

Dr. K. B. Allan, Senior Medical Officer, was transferred to the Gold Coast from the Gambia on the 9th October, 1929.

Dr. W. J. McClintock, Medical Officer, was transferred to the Gold Coast from Nigeria on promotion as Senior Medical Officer on the 15th December, 1929.

Dr. William Chisholm was transferred to the Health branch as Medical Officer of Health on the 1st October, 1929.

Drs. G. F. T. Saunders and M. Jackson were transferred to the Medical Research Institute as Pathologists on the 25th May, 1929, and 28th January, 1930, respectively.

Dr. H. M. Boston, Medical Officer, had his appointment terminated on the 16th March, 1930.

Miss Jessie D. Veitch, Nursing Sister, resigned on the 28th June, 1929.

II.—AFRICAN.

Promotions :—

Dr. H. Mercer-Ricketts was promoted to be an African Medical Officer on the 1st August, 1929.

Mr. S. K. Ollennu, 1st Division Dispenser, was promoted to be a Chief Dispenser on the 1st April, 1929.

Mr. J. Bart-Plange, 2nd Division Dispenser, was promoted to be a 1st Division Dispenser on the 1st April, 1929.

Mr. F. K. George, 2nd Division Dispenser, was promoted to be a 1st Division Dispenser on the 8th May, 1929.

Messrs. J. A. Rhule, A. Williams and E. B. Turkson, 2nd Division Nurses were promoted to be 1st Division Nurses on the 1st April, 1929.

Mr. E. I. A. Adams, 2nd Division Nurse, was promoted to be a 1st Division Nurse on the 1st August, 1929.

Mr. J. K. Mensah, Mental Nurse, was promoted to be an Assistant Attendant on the 13th February, 1930.

Appointments :—

The Misses Susuana Quartey-Papafio Coker, Amy Susuana Bentil and Elizabeth Odonkor were appointed Midwife-Probationers on the 3rd May, 1929, 11th July, 1929, and 11th July, 1929, respectively.

Dr. Agnes Yewande Savage was appointed to be a Junior African Medical Officer on 19th February, 1930.

Other changes in the Staff during the year :—

Mr. David Laryea, 2nd Division Clerk, transferred to the Medical Department from the Health branch on promotion as a 1st Division Clerk, on the 1st September, 1929.

Mr. H. J. Smith, 2nd Division Clerk, was transferred to the Health branch of the Medical Department on the 11th November, 1929.

Mr. J. Tcherko-Nartey, 1st Division Clerk, retired on pension on the 1st September, 1929.

Messrs. T. A. King, 1st Division Dispenser and J. D. Kinphul, 1st Division Nurse, retired on pension on the 8th May, 1929, and the 1st August, 1929, respectively.

Messrs. M. P. Baningo and Molie Karamara, Attendants at the Lunatic Asylum, retired on pension on the 5th November, 1929, and the 1st February, 1930, respectively.

Mr. J. H. Sawyer, 2nd Division Dispenser, retired on pension on the 10th August, 1929.

Miss Ellen A. Atiemoh and Mr. B. Graves, 2nd Division Nurses, resigned their appointments on the 1st April, 1929, and the 15th July, 1929, respectively.

Messrs. Robert A. Annum, Bernard Antwi, William Bart-Plange, Alexander F. Reimmer, Adolphus Doku, Waldo S. C. Ofori, Arthur Sampram and Theophilus K. Sakyi, Nurses-in-Training, resigned their appointments on the 8th June, 1929; 1st October, 1929; 3rd June, 1929; 8th July, 1929; 6th February, 1930; 1st January, 1930; 1st January, 1930, and the 30th January, 1930, respectively.

Misses Augusta O. Anoff, Josephus F. Brown, Elizabeth Osafo, Ophelia G. Asare, Kate M. Adadey, Juliana A. Fiankoh, Lilly Comfort

Bunna, Margaret B. Rhule, Nicholina K. Amartey, Elizabeth M. Sagoe and Mary Lokko, Nurses-in-Training, resigned their appointments on the 1st April, 1929 ; 13th July, 1929 ; 1st April, 1929 ; 23rd December, 1929 ; 16th October, 1929 ; 15th August, 1929 ; 10th July, 1929 ; 1st May, 1929 ; 24th March, 1930 ; 19th October, 1929, and the 8th March, 1930, respectively.

Messrs. S. K. Allotey, Charles N. Kotey, James Lomotey, William M. Apaloo ; James Amuah and Daniel T. Carnor, Nurses-in-Training, had their appointments terminated on the 5th July, 1929 ; 1st April, 1929 ; 1st August 1929 ; 1st December, 1929 ; 9th October, 1929 ; and the 8th August, 1929, respectively.

Mr. William Y. Ocquaye, Attendant, Lunatic Asylum, resigned his appointment on the 1st August, 1929.

Misses Clara F. O. Marke and Eudisia O. Reynolds had their appointments terminated on the 15th December, 1929, and the 21st August, 1929, respectively.

Madam Sophia Kwashiwah, Attendant, Lunatic Asylum, had her appointment terminated on the 1st May, 1929.

Messrs. Hayford B. Adu, 2nd Division Nurse, and William Nikue, Assistant Chief Attendant, Lunatic Asylum, were dismissed from the service on the 11th November, 1929, and the 13th February, 1930, respectively.

Mr. Albert K. Fiadjoe, Miss Henrietta Brew, Nurses-in-Training, and Miss Mary Amartey, Attendant, Lunatic Asylum, died on the 15th May, 1929 ; 25th December, 1929, and the 25th March, 1930, respectively.

(b) STAFF.—HEALTH BRANCH.

I.—EUROPEAN.

Appointments, transfers, promotions, etc.

Promotions :—

Dr. P. S. Selwyn-Clarke, A.D.S.S.

Dr. J. M. MacKay, A.D.S.S., on transfer from Sierra Leone.

Dr. H. C. E. Quin, S.S.O.

Appointments :—

Dr. W. Chisholm, M.O.H.

Dr. S. P. Wilson, M.O.H.

Dr. R. Stuart, M.O.H.

Dr. A. D. Cust, M.O.H.

Dr. B. A. S. Russell, W.M.O.

Dr. C. D. Williams, W.M.O.

Mr. J. Taylor, S.S.I.

Mr. P. J. Shannon, S.S.I.

Mr. F. E. Levermore, S.S.I.

Other changes in the staff during the year :—

Dr. W. G. Watt, A.D.S.S., retired on pension.

Dr. P. S. Selwyn-Clarke, was seconded for duty to the Federated

Malay States.

Dr. R. D. Reid was transferred to the Medical Research Institute.

Dr. Alice M. A. Downing and Dr. Jean Rae Mason, Woman Medical Officers, had their appointments terminated on marriage.

Mr. J. F. L. Sawyer, S.S.I., had his appointment terminated.

II.—AFRICAN.

Appointments :—

Two Nurse-Midwives.

Seven Second Division Clerks.

One Assistant Disinfector Mechanic.

Fifteen Sanitary Inspectors-in-Training.

Two Vaccinators.

One Storekeeper.

Four Nurses-in-Training.

One Dispenser-in-Training.

One Village Overseer.

Two Cadbury Health Visitors.

Other changes in the Staff during the year :—

Two Vaccinators were dismissed.

One Female Sanitary Inspector retired on pension.

Four Nurses-in-Training resigned.

One Sanitary Inspector-in-Training dismissed.

One Sanitary Inspector-in-Training had his appointment terminated.

One Assistant Disinfector Mechanic and one Cadbury Health Visitor died.

(b) ORDINANCES AFFECTING THE PUBLIC HEALTH.

1. The provisions of the Towns and Public Health Ordinance were applied, among others, to the towns of Enchi, Bebianiha, Duakwa, Takoradi town and Adukrom.

2. The Births, Deaths and Burials Ordinance 1929 (No. 10 of 1929) of the Northern Territories, came into operation on the 22nd of June 1929, and was subsequently applied to Tamale and Salaga.

The Births, Deaths and Burials Ordinance (Chapter 11) of the Gold Colony was applied to Oda, *Gazette* No. 14 of 1930 (page 203).

3. The most important enactment of the year, from the health standpoint, was Order in Council No. 14 of 1929, under the Vaccination Ordinance, making the vaccination of children compulsory throughout the Colony.

4. Order No. 4 of 1929 under the Mosquitoes Ordinance applied the provisions of this Ordinance to several important towns in Ashanti.

5. Order No. 30 of 1929 under the Diseases of Animals Ordinance (*Gazette* No. 80 of 1929) declared Accra an infected area owing to an outbreak of rabies.

6. Various places and areas were declared infected owing to the outbreak of infectious diseases, chiefly small-pox, during the year under review.

The majority of these Orders had been revoked by the end of 1929-30.

(c) FINANCE.

Estimated Expenditure for the year 1929-30.

(a) PERSONAL EMOLUMENTS.

Medical.

	£	s.	d.
Administrative Officers	5,600	0	0
Specialists	4,000	0	0
Senior Medical Officers	6,900	0	0
Medical Officers (European and African)	39,917	0	0
Dental Surgeons	1,521	0	0
European Nursing Staff	13,344	0	0
African Nursing Staff and Dispensers	28,747	0	0
Clerical Staff	3,826	0	0
Various items, allowances, etc.	22,202	0	0
Estimated Total Personal Emoluments	126,057	0	0
Actual Total Personal Emoluments	117,475	11	10

Health.

	£	s.	d.
Administrative Officers	2,700	0	0
Senior Health Officers and Medical Officers of Health	15,588	0	0
European Sanitary Inspectors	10,383	0	0
African Sanitary Inspectors	14,426	0	0
Various items, allowances, etc.	18,601	0	0
Estimated Total Personal Emoluments	61,698	0	0
Actual Total Personal Emoluments	58,253	19	1

Medical Research Institute.

	£	s.	d.
European Staff	11,776	0	0
African Staff	1,510	0	0
Estimated Total Personal Emoluments	13,286	0	0
Actual Total Personal Emoluments	12,271	2	7

(b) OTHER CHARGES.

Medical.

	£	s.	d.
Passages, transport, etc.	17,722	0	0
Hospital equipment, drugs, medical appliances, surgical instruments, etc.	25,806	0	0
Diets, medical comforts	13,200	0	0
Other Items	14,733	0	0
Contributions	0	0	0
Estimated Total	71,501	0	0
Actual Expenditure	75,206	18	11

Health.

					£	s.	d.
Passages, transport, etc.	...	...	...	...	11,782	0	0
General health votes	...	...	...	...	49,366	0	0
Scavengers and labourers	...	...	...	...	42,082	0	0
Estimated Total	...	...	...	...	103,230	0	0
Actual Expenditure	...	...	...	...	97,183	11	8

Medical Research Institute.

					£	s.	d.
Passages, transport, etc.	...	...	...	...	2,883	0	0
General research votes	...	...	...	...	3,391	0	0
Estimated Total	...	...	...	...	6,274	0	0
Actual Expenditure	...	...	...	...	4,816	7	5

					£	s.	d.
Estimated total expenditure, Medical Department (all branches)	...	...	...	...	382,046	0	0
Actual total expenditure, Medical Department (all branches)	...	...	...	...	365,207	11	6

Revenue earned by Medical Branch :—

					£	s.	d.
(a) Hospital fees	...	...	...	...	7,737	14	4
(b) Sale of drugs in private practice	...	...	...	...	237	11	6
(c) Re-imbursement by Railway Department and Takoradi Harbour	...	...	...	...	2,600	0	0
Total	...	...	...	...	10,575	5	10

Revenue earned by Health Branch :—

					£	s.	d.
(a) Fines for sanitary offences	...	...	...	...	9,351	9	9
(b) Market and slaughter house fees	...	...	...	...	4,816	13	5
(c) Poundage Fees	...	...	...	...	300	19	11
(d) Births, deaths, and burials	...	...	...	...	744	9	0
(e) Re-imbursement by Railway Department and Takoradi Harbour	...	...	...	...	4,315	0	0
Total	...	...	...	...	19,528	12	1

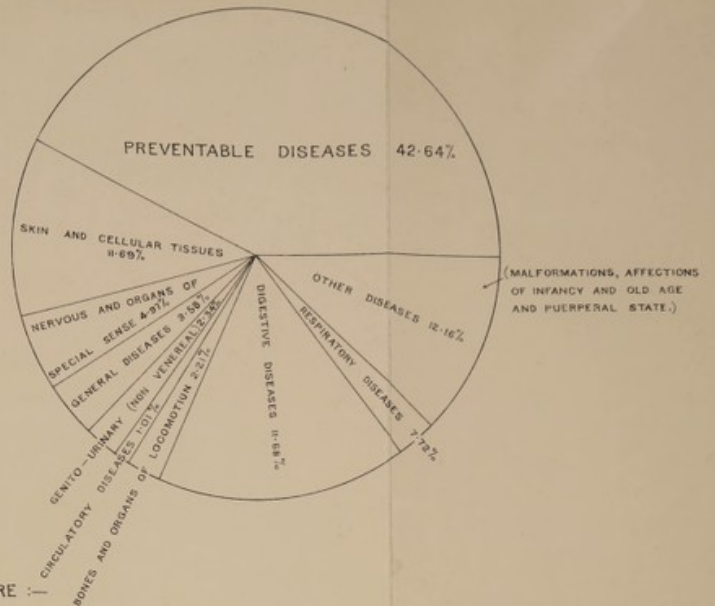
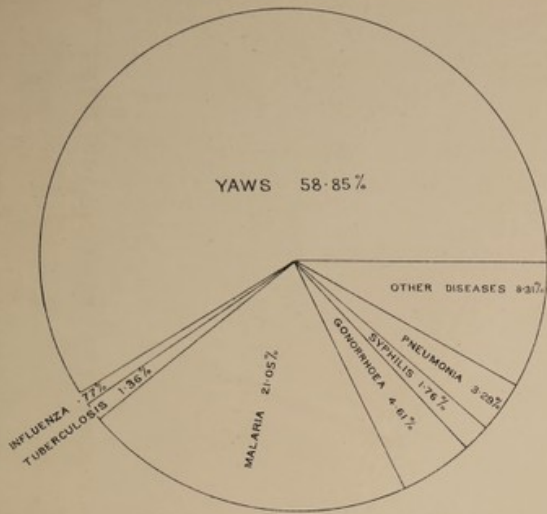
					£	s.	d.
Total Expenditure for the Colony (excluding extra-ordinary or special expenditure)	...	...	...	...	2,692,011	0	0
Total Expenditure Medical Services (Medical, Health and Research branches)	...	...	...	...	365,208	0	0

(This figure is exclusive of the cost of buildings, e.g. hospitals, dispensaries, etc., and other public health works, such as water supplies, town improvements, etc.)

The ratio of total expenditure on medical services to the total expenditure for the Colony was therefore 13.56 per cent.

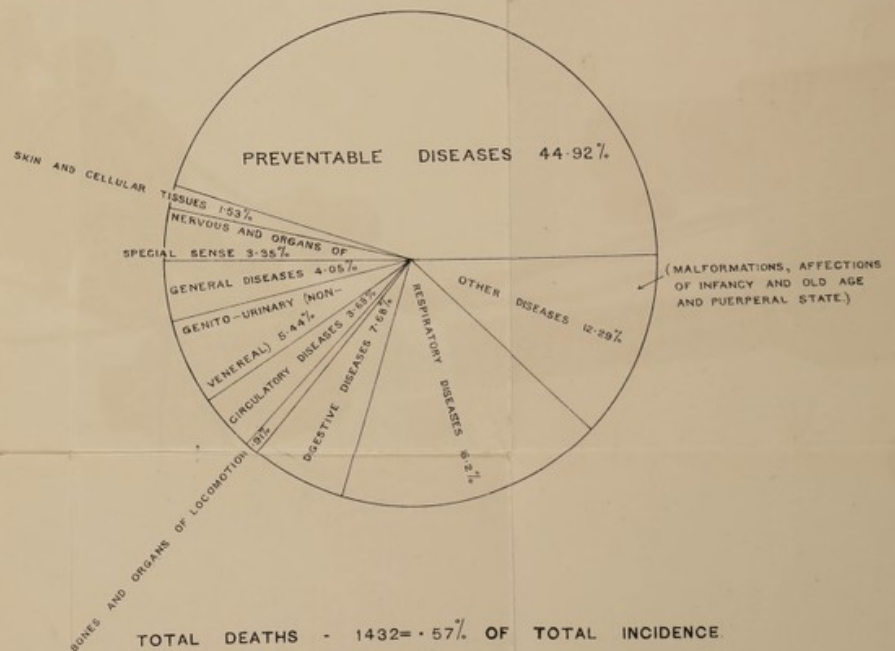
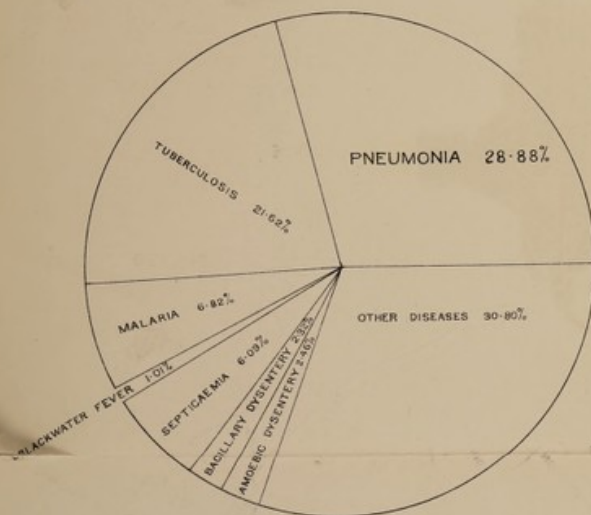
INFECTIVE DISEASES TOTAL INCIDENCE 90,006.

GENERAL SYSTEMIC AND PREVENTABLE DISEASES TOTAL INCIDENCE 248,320.



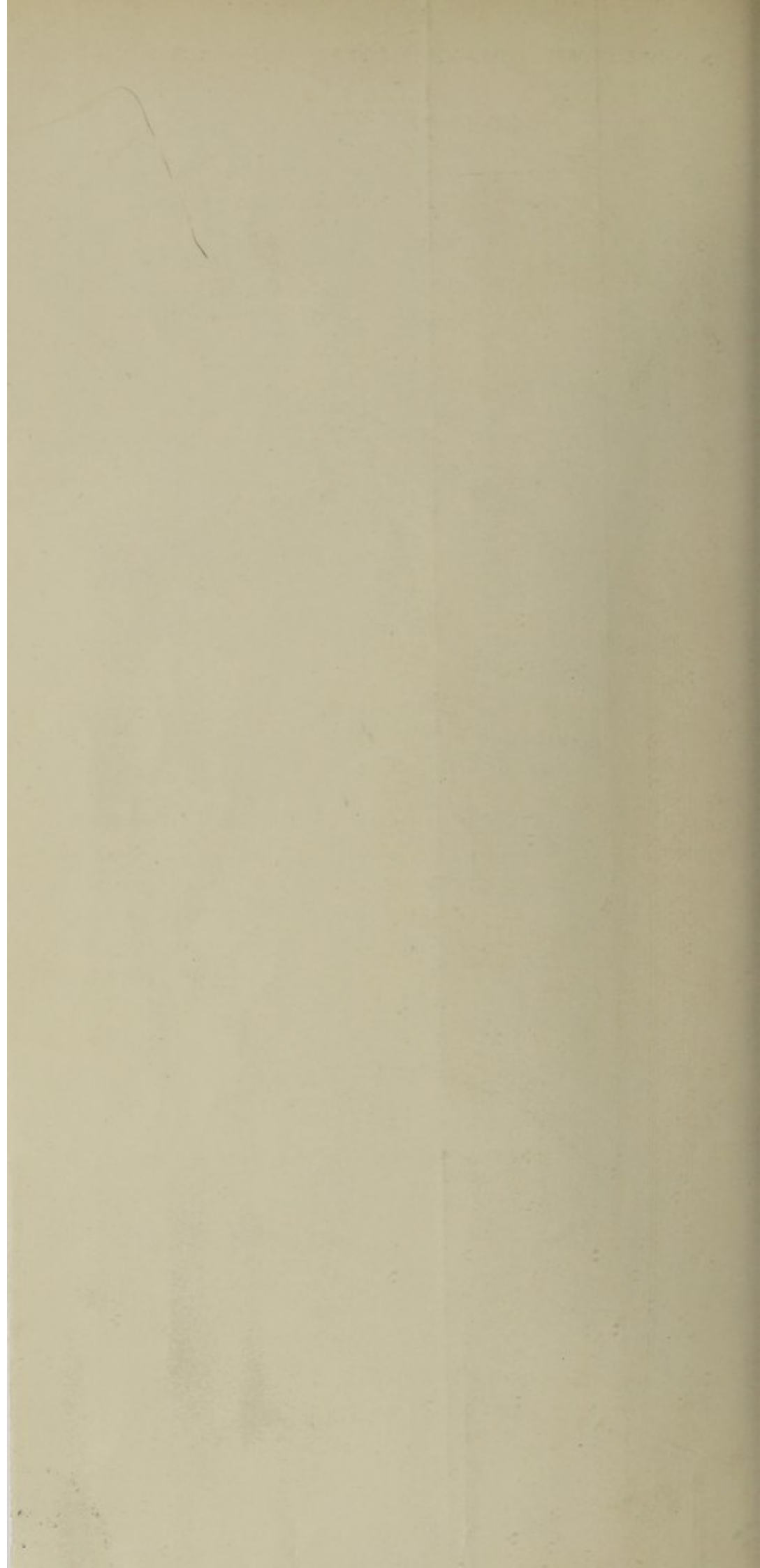
PREVENTABLE DISEASES ARE :-

- (1) INFECTIOUS DISEASES.
- (2) INTOXICATION AND POISONS.
- (3) SCABIES AND TINEAE.
- (4) HELMINTHS.
- (5) AFFECTIONS PRODUCED BY EXTERNAL COURSES.



TOTAL DEATHS - 689 = .76% OF TOTAL INCIDENCE.

TOTAL DEATHS - 1432 = .57% OF TOTAL INCIDENCE.



II.—PUBLIC HEALTH.

(a) GENERAL REMARKS.

The following table shows the most noteworthy contrasts in the returns of diseases treated by the Medical branch only during the years 1927-28, 1928-29, and the period under review.

Diseases.	1927-28.	1928-29.	1929-30.
Small-pox	5	26	7
Varicella (Chicken-pox)	171	488	235
Dysentery :—			
(a) Amœbic	550	1,125	1,006
(b) Bacillary	130	304	209
(c) Undefined or due to other causes	328	199	335
Enteric Group :—			
(a) Typhoid Fever	19	47	39
(b) Para-typhoid A	2	6	4
(c) Para-typhoid B	7	8	1
(d) Type not defined	2	3	7
Influenza	452	863	695
Malaria :—			
(a) Tertian	2,706	2,422	1,264
(b) Quartan	14	532	45
(c) Aestivo-autumnal	3,102	4,718	6,395
(d) Cachexia	704	1,034	221
(e) Blackwater	16	13	24
(f) Unclassified	2,429	1,283	2,613
Measles	53	136	219
Pneumonia :—			
(a) Broncho-Pneumonia	209	421	1,378
(b) Lobar Pneumonia	614	988	1,227
(c) Unclassified	153	151	103
Trypanosomiasis (Sleeping Sickness)	59	94	121
Whooping Cough	116	265	250
Alcoholism	19	46	19
Yellow Fever	45	2	—
Tuberculosis :—			
(a) Pulmonary and Laryngeal	682	856	939
(b) Other forms	228	295	236
Plague :—			
(a) Bubonic	—	—	—
(b) Pneumonic	—	—	—
(c) Septicæmic	—	—	—
(d) Undefined	—	—	—
Ankylostomiasis	275	365	147

COMPARATIVE FIGURES FOR FOUR YEARS 1926-27, 1927-28, 1928-29
1929-30, FOR ALL PATIENTS TREATED IN HOSPITALS AND DISPENSARIES
OF THE MEDICAL BRANCH.

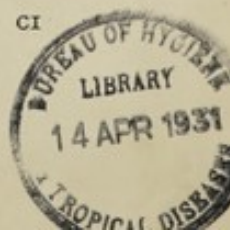
Year.	Remaining in hospital.	Total cases treated (in and out-patients).	Deaths.	Remaining in hospital.	Percentage of deaths to total patients treated.
1926-27 ..	489	105,300	700	626	.88
1927-28 ..	626	133,069	980	601	.66
1928-29 ..	601	177,594	1,009	678	.57
1929-30 ..	678	184,424	1,156	849	.63

HEALTH OF EUROPEAN COMMUNITY.

OFFICIALS AND NON-OFFICIALS.

The health of officials and non-officials was fairly good throughout the year. A definite indication of improving health is shown in the following table for officials :—

	1926-27.	1927-28.	1928-29.	1929-30.
Percentage of sick to average number resident ..	2.39	2.30	2.20	2.19
Average sick time to each resident	8.72	8.41	8.14	8.02



During the year separate records of invalidings and deaths were kept for Class "A" and Class "B" officials. The results are shown below. The death-rates are based on so few figures that a reliable conclusion can scarcely be drawn from them alone.

CLASSES "A" AND "B" EUROPEAN OFFICIALS.
INVALIDING RATE FOR 1929-30.

CLASS "A."				CLASS "B."			
Average No. resident.	Invaliding.	Rate per 1,000.	Rate per cent.	Average No. resident.	Invaliding.	Rate per 1,000.	Rate per cent.
698	28	40.11	4.01	274	21	76.64	7.66

CLASSES "A" AND "B" EUROPEAN OFFICIALS.
DEATH RATE FOR 1929-30.

CLASS "A."				CLASS "B."			
Average No. resident.	Deaths.	Death rate per 1,000.	Death rate per cent.	Average No. resident.	Deaths.	Death rate per 1,000.	Death rate per cent.
698	2	2.86	.28	274	3	10.94	1.09

The invaliding-rates are based on larger figures and a conclusion drawn from them is more reliable. Generally speaking, it may be said that the figures indicate clearly that Class "A" officials enjoyed better health throughout the year than those of Class "B." This is what would naturally be expected, as they are better paid, probably exercise more care and intelligence in their general mode of life and are less subject to various forms of exposure to illness.

Below are tables for officials and non-officials showing over a ten year period from 1920 to March, 1930, the percentage of invalidings and deaths as compared with the numbers resident.

TABLE SHOWING INVALIDING AND DEATH-RATES OF EUROPEAN OFFICIALS IN THE TEN-YEAR PERIOD SINCE 1919, BASED ON THE AVERAGE NUMBER RESIDENT.

Year.	Average number resident.	Total invalided.	Percentage invalided.	Total died.	Percentage died.
1920	620	30	4.83	7	1.13
1921	612	38	6.20	14	2.28
April, 1922-March, 1923 ..	719	30	4.17	6	.83
1923-24	689	32	4.65	10	1.45
1924-25	680	58	8.52	7	1.02
1925-26	761	59	7.75	8	1.05
1926-27	783	49	6.26	3	.38
1927-28	835	39	4.67	6	.71
1928-29	881	50	5.67	4	.45
1929-30	972	49	5.04	5	.51
Average for the period ..	735.2	43.4	5.77	7.0	.98

Note on the foregoing table. In 1921 the death-rate appears high, but the majority of the deaths were due to non-tropical ailments. Five out of 14 only could be assigned to purely tropical diseases.

Similarly in 1923-24 only four out of the ten could be assigned to tropical diseases.

In 1924-25 one death was due to dysentery and three (one doubtful) to yellow fever. The other three were non-tropical.

In 1927-28 only one (blackwater fever) out of the six could be called tropical.

In 1928-29 two (one blackwater fever and one yellow fever) out of the four were purely tropical.

In 1929-30 of the five deaths, one only could be attributed to conditions peculiar to the tropics.

In order to compare the health of European officials with that of non-officials, two tables are given below :—

EUROPEAN OFFICIALS.—PERCENTAGE OF INVALIDINGS AND DEATHS TO TOTAL NUMBER RESIDENT.

Year.	Total number resident.	Invaliding percentage.	Deaths percentage.
1920	775	3.87	.90
1921	768	4.94	1.82
1922-23	979	3.06	.61
1923-24	994	3.21	1.00
1924-25	846	6.85	.82
1925-26	994	5.93	.80
1926-27	1,046	4.68	.28
1927-28	1,202	3.24	.49
1928-29	1,280	3.90	.31
1929-30	1,323	3.70	.37
Average for the period	1,020.7	4.38	.74

EUROPEAN NON-OFFICIALS.—PERCENTAGE OF INVALIDINGS AND DEATHS TO TOTAL RESIDENTS.

Year.	Total number resident.	Invaliding percentage.	Deaths percentage.
1920	2,043	3.23	1.22
1921	2,171	2.44	.82
1922-23	2,019	2.27	1.23
1923-24	2,049	2.68	.68
1924-25	2,020	3.26	.59
1925-26	2,110	3.12	.66
1926-27	2,435	2.66	.94
1927-28	2,375	2.02	.88
1928-29	2,328	1.33	.94
1929-30	2,370	2.11	.80
Average for the period	2,192	2.51	.87

Malaria was, as in previous years, the most frequent individual cause of illness. The following table shows the relative position of malaria as a cause of time lost through sickness by European officials during the year and as compared with recent years :—

Year.	Average No. resident.	Total sick days.	Total days on sick list for malaria.	Total days on sick list for other diseases.	Percentage of days lost through malaria to total days lost.	No. of days lost through malaria for the year per 100 residents.
1924-25	680	8,614	1,746	6,868	20.26	256
1925-26	761	6,108	1,547	4,561	25.32	203
1926-27	783	6,847	1,204	5,643	17.58	153
1927-28	835	7,023	1,530	5,493	21.81	183
1928-29	881	7,177	1,661	5,516	23.14	188
1929-30	972	7,795	1,920	5,875	24.63	197

HEALTH OF AFRICAN OFFICIALS.

The health of African officials was not unsatisfactory and compares favourably on the whole with the record of previous years. An inspection of the table given below under "Vital Statistics" shows that little change in the figures given for previous years took place.

GENERAL AFRICAN COMMUNITY.

The health of the general African community throughout the year was, generally speaking, and as compared with previous years, fair. The term fair is used purely in a comparative sense, for the Gold Coast is no exception to the well-known fact that the health of Africans in Africa is really much poorer than that of Europeans in Europe. High infantile mortality, diet deficiencies, with low resistance to infection and high mortality, parasitic diseases of various kinds which sap vitality, prevail everywhere. Some parts are worse off than others.

The lack of good water supplies in the Northern Territories and in certain areas of the Eastern Province of the Gold Coast is a serious handicap in many respects to the health of the people in those parts. The improvement of public health is not merely a problem of treating diseases but is bound up with the whole problem of raising the standard of living all round.

As bearing on the general health of the population the results of an investigation by the Government Dental Surgeon into the state of the teeth and mouths of school children was made during the early part of the year in Kumasi, Tamale, Gambaga, Navrongo and Wa. The findings were noteworthy. The conditions at Kumasi resembled those found at Accra, Sekondi and Cape Coast. Dental caries was extensive and mouths were in a neglected condition. Acute gingivitis and ulcerative stomatitis were common. Older boys showed early pyorrhoea and chronic periodontoclasia. On the other hand, beyond the Volta where modern methods of living, altered habits and diet, the use of imported food and other similar factors attendant on the advance of our civilisation have not as yet penetrated, the teeth of the children were remarkably well preserved, little dental caries was found and the supporting and nourishing tissues of the mouth were comparatively sound. The problem is one of nutrition in its widest sense. There is little doubt that the composition of the diet is of the profoundest significance in forming and maintaining good teeth and preserving the general health and a considerable amount of research will yet have to be done on African diets before it will be possible to indicate with any approach to accuracy wherein the diet of any section of the population may be defective and to take steps to remedy it.

Meanwhile our efforts must largely resolve themselves into the treatment of end-results, although much can be done by early and systematic care, and instruction in the practice in oral hygiene to control destructive processes.

Yellow fever was happily completely absent.

An outbreak of small-pox of a severe type and with a high mortality rate occurred in the Eastern Province.

This is fully dealt with in section III under the head of Hygiene and Sanitation.

The increase in the total number of patients treated by the Medical branch referred to in the annual reports of recent years was maintained.

The following table will show this clearly :—

	Total cases treated in hospitals and dispensaries by Medical branch only.	Percentage increase on previous years.
1924-25	82,476	—
1925-26	97,910	18.5 per cent.
1926-27	105,300	7.5 per cent.
1927-28	133,069	26.42 per cent a—remarkable year.
1928-29	177,594	32.65 per cent a—remarkable year.
1929-30	184,424	3.84 per cent.

In order that medical services may be extended even more widely than at present, a scheme of training dispensers in increasing numbers in such a manner as to render them suitable for posting to places in the bush lying outside the stations ordinarily served by a medical officer has been worked out, and it is hoped to make a commencement during the ensuing year.

It should be pointed out that the figures given in the above table are exclusive of the figures of attendances at the Child and Maternal Welfare (ante and post-natal) Centres of the Health branch. The Health branch figures for these services for 1928-29 were 37,646 and in the year under review these figures were 49,869—a remarkable increase in these services alone of almost 32½ per cent.

In the remarks given below the figures are taken from the returns provided by the Medical branch only. These differ in places from the figures of the Sanitation branch owing to the fact that treatment is often given by the latter branch in contagious diseases hospitals, temporary isolation huts, camps, villages, etc.

(I)—GENERAL DISEASES.

There is little that calls for comment under this head as these diseases, as a rule, are not a more common cause of ill-health in the tropics than they are in temperate climates. In the report for 1928-29 it was noted that out of 177,594 cases treated there were 181 cases of cancer, namely .10 per cent. In 1929-30 the figures were 202 cases out of 184,424 cases, namely .10 per cent. A note will be made in future reports of this figure in order to form an estimate whether an increase is or is not taking place.

Uncommon diseases, or diseases such as encephalitis lethargica, which, if the diagnosis could be confirmed, would cause anxiety are occasionally reported by Medical officers. The differential diagnosis between encephalitis lethargica and certain cases of trypanosomiasis and cerebral syphilis might be very difficult in a bush station. An example of such a case of (?) Encephalitis lethargica appears in Appendix G.

(II)—COMMUNICABLE DISEASES.

(a) MOSQUITO OR INSECT-BORNE.

These cause a considerable part of the ill-health from which the community suffers.

MALARIA.

STATISTICS OVER THE FIVE-YEAR PERIOD 1925-30.

	1925-26.	1926-27.	1927-28.	1928-29.	1929-30.
Total treated	6,574	6,444	8,955	10,002	10,562
Percentage of all diseases treated	6.71	6.12	6.72	5.63	5.73

The incidence is practically the same from year to year. The value of quinine, especially for young children, becomes more widely appreciated every year.

BLACKWATER FEVER.

The following table shows the incidence of blackwater fever in Europeans during the year under review and during the previous year; it also allows a comparison to be made of the two five-year periods 1917-21 and 1923-28 :—

	Percentage of cases in Europeans to total European residents.	Percentage of deaths to cases.
Five-year period 1917-21	.89	35.3
Five-year period 1923-28	.47	23.7
1928-29	.16	16.6
1929-30	.40	13.33

The case incidence remained below the average of the five-year period 1923-28; it is satisfactory to note that the case mortality is steadily dropping.

The following table showing the incidence and deaths from blackwater fever in each race for the past two years, is of interest :—

	1928-29.		1929-30.	
	Cases.	Deaths.	Cases.	Deaths.
Europeans	6	1	15	2
Syrians	3	2	5	2
Indians	2	1	2	0
Africans	2	2	3	2

TRYPANOSOMIASIS.

The incidence and case mortality during the past five years is shown in the table below which has been compiled from the Medical branch records of in and out-patients :—

	Cases.	Deaths.	Incidence per 10,000 of all cases treated.	Percentage of Deaths to cases.
1925-26	37	5	3.77	13.5
1926-27	67	11	6.36	16.42
1927-28	59	4	4.43	6.78
1928-29	94	18	5.29	19.14
1929-30	121	23	6.56	19.00

It is not possible from these figures to say if there is a true increase in the incidence of the disease. A slight increase certainly appears in the figures for the past three years. This may be a true increase; on the other hand it may be that more sufferers are coming forward for treatment or that more cases are being diagnosed.

In previous reports it was pointed out that the disease on the Gold Coast was of a very chronic type from which a very large number of people recover by natural resistance and was fortunately not the urgent problem it was elsewhere. It was also pointed out that it not infrequently happens that the disease is accidentally discovered in a patient who is being examined for some other ailment, which would indicate that a closer search would probably reveal many more cases, and that it is more prevalent than the above figures would show. In any case the position does not at present seem one to cause alarm.

YELLOW FEVER.

It is very satisfactory to record that no cases of yellow fever were reported during the year. The two cases which occurred in 1928-29 were purely laboratory infections. For the past two years therefore the Gold Coast has been free from naturally occurring yellow fever.

RELAPSING FEVER (sp. *Obermeieri*).

This disease, an outbreak of which occurred during the past year in Accra, comes chiefly under the notice of the Health branch, to the report of which the reader is referred. The last serious outbreak of the disease took place in Kumasi in 1927 amongst Zabrama labourers who come from French Senegal and Niger.

It is a matter for congratulation that no outbreak appeared to take place during the year in the Northern Territories. This is once more a "lucky escape" and a cause of some surprise, as a stream of lousy labourers from French territory strolls leisurely through the Northern Territories annually to the forest belt in search of work on the cacao farms.

(e) INFECTIOUS DISEASES.

SMALL-POX.

During the last quarter of the year under review an epidemic which caused the Health branch some anxiety and required strenuous efforts to control broke out in the Colony. A high case-mortality occurred, but fortunately the outbreak was brought rapidly under control. A record of it will be found in the report of the Health branch in section III.

DYSENTERY.

One thousand five hundred and fifty-two cases were recorded as compared with 1,008 for the previous year. There were 38 deaths.

TABLE.

	Case incidence. Percentage of all cases.	Case mortality.
1926-27	.80 per cent.	.048 per cent.
1927-28	.76 per cent.	.042 per cent.
1928-29	.92 per cent.	.029 per cent.
1929-30	.84 per cent.	.024 per cent.

The case incidence does not appear to vary much. It is satisfactory, however, to observe a continuing decline in the case-mortality.

The case mortality of the bacillary form remains high, 7.7 per cent. as compared with 1.7 per cent. for the amoebic form. The value of emetin in the amoebic form is clearly revealed by these figures.

ENTERIC GROUP OF DISEASES (TYPHOID, PARATYPHOID A AND PARATYPHOID B).

Fifty-one cases (Accra 33) with 12 deaths were recorded during the year. It is probable that these diseases prevail much more extensively than the above figures would appear to indicate. The recommendation with regard to anti-typhoid inoculation of the Deputy Director of Health Service in his report that newcomers should be inoculated is therefore essentially very sound. The value of inoculation is fully established and its risks are really negligible.

PNEUMONIA.

Cases recorded were 2,708, with 165 deaths.

The case-incidence per cent as compared with all cases and the case-mortality per cent are shown below :—

	Incidence per cent.	Mortality per cent.
1926-27	.75	9.5
1927-28	.73	10.32
1928-29	.87	11.3
1929-30	1.47	6.1

The figures are peculiar. A marked rise in the incidence appears with a marked drop in the mortality. Was the disease more infectious but less virulent? Were patients more anxious for hospital treatment, and by early admission better results were obtained? It is difficult to say.

TUBERCULOSIS.

The table submitted in the report for 1928-29 is here reproduced and the corresponding figure for 1929-30 is inserted.

	Cases.	Percentage of all cases treated.
1923-24	411	.53
1924-25	414	.50
1925-26	571	.58
1926-27	698	.66
1927-28	910	.68
1928-29	1,151	.65
1929-30	1,175	.64

The above table does not support the view that tuberculosis is a very urgent problem, or that expensive experiments should be undertaken. With close attention to general sanitation and especially to housing conditions it is believed that the disease can be kept under control. The building of an additional half-block to the Gold Coast Hospital was further deferred but a special tuberculosis officer was appointed and assumed duty during the year.

Further remarks under the head of tuberculosis appear in the report of the Acting Deputy Director of Health Service.

A detailed report on the results of treatment of all kinds of tuberculosis at the Gold Coast Hospital during the year is included at appendix E.

VENEREAL DISEASES.

The cases treated during the year and during the three previous years are shown in the following table :—

	1926-27.	1927-28.	1928-29.	1929-30.
Gonorrhœa	3,769	3,356	4,809	4,110
Syphilis	1,277	1,802	3,434	1,553
Chaneroid	246	295	419	431

The report of the Venereal Clinic, Accra, will be found under a special section elsewhere.

The following interesting table shows the percentage of gonorrhœa, syphilis, and yaws amongst the total of all diseases treated in the hospitals and dispensaries of the Medical branch as compared with all other diseases over a five-year period :—

	1925-26.	1926-27.	1927-28.	1928-29.	1929-30.
Gonorrhœa	6.11	3.65	2.65	2.85	2.24
Syphilis	4.03	1.32	1.33	1.58	.86
Yaws	18.29	16.49	19.19	24.68	22.82
All other diseases	71.57	78.54	76.83	70.89	74.18

These figures point to a decline in incidence of cases treated in Government Institutions.

LEPROSY.

At appendix D will be found the report of Dr. Dixey, Medical Secretary to the Gold Coast Branch of the British Empire Leprosy Relief Association. The work of surveying the position and of coming to an accurate estimate of the prevalence of leprosy in the various parts of the Colony continues. From reports received up to date it would appear that areas differ considerably in the incidence of the disease in them. It is prevalent in the Northern Territories and, generally speaking, amongst poorer tribes who live in regions where water is scarce, the quality of the food poor, and sanitation primitive. From this fact the conclusion is obvious that the problem of leprosy is largely secondary to the much wider problem of raising the whole standard of living of the tribes residing in such areas.

Although modern methods of treatment by drugs, especially in early cases, has certainly considerably improved the outlook for sufferers, it is difficult to secure in the ordinary out-patients' department of the hospitals of the Colony that prolonged attendance which is so necessary to ensure results. Best results are undoubtedly obtained in permanent settlements where regular treatment under cheerful and healthy conditions can be given. Moreover, the value of such settlements in preventing the spread of the disease amongst the healthy cannot be over-estimated. When a reliable survey is complete it will be possible to select sites for further settlements where they are most needed and can do most good. A note bringing up-to-date the record of the work being done at the Ho Settlement will be found at appendix C.

ANKYLOSTOMIASIS.

Cases recorded were 147, with five deaths. These were probably all severe cases. The parasite is found everywhere, but grave anæmia due to its presence seems relatively uncommon. The Axim district still remains the chief area in which heavy infestations with serious results occur.

ASCARIASIS.

Prevails everywhere and is a source of much ill-health, especially amongst children.

Many Medical officers therefore make it a routine practice to administer anthelmintic treatment to every case they admit to hospital.

SCHISTOSOMIASIS.

Cases treated were 453, with no deaths. This was .24 per cent of all cases treated, as compared with .12 per cent for the preceding year. This represents an increase of 100 per cent and is probably due to the fact that the modern treatment of the parasite by antimony is highly efficacious, encouraging more sufferers to come forward.

DRACONTIASIS.

Guinea-worm is exceedingly common in the Northern Territories and in other dry parts where water is scarce from April till the end of the rains, and at times, causes prolonged disablement. The protection and improvement of water supplies is the method of prevention of choice.

But owing to the extent of the affected areas, and the peculiar conditions prevailing in them, it is impracticable to apply the method to more than limited portions and a specific for the affection has unfortunately not yet been discovered.

YAWS.

From the table submitted above under the heading of venereal diseases it will be seen that in 1928-29, 24.68 per cent of all cases treated by the Medical branch were yaws. This figure dropped in 1929-30 to 22.82 per cent.

In the report for 1928-29 the following remark appeared: "Certain Medical officers definitely note a decrease in the number of yaws cases in their areas and attribute this to the results of treatment. This is a most encouraging observation and augurs well for the future."

Twenty-two decimal eighty-two per cent of all cases treated in the Colony is a high figure, but that it is a drop from the previous year's figure is worth noting. The following analysis would appear to support the view that the disease is being controlled:—

Year.	Total number of out-patients treated by both branches and in prisons.	Total number of yaws cases.	Percentage of yaws to all cases.
1928-29	202,032	54,206	26½ per cent.
1929-30	233,163 (a 15½ per cent increase).	52,619	22½ per cent.

Thus an absolute and a relative drop took place in the number of cases of yaws treated.

In the Northern Territories yaws was, as before, the chief disease treated and constituted 45.62 per cent of all cases seen there. The disease is still rife both there and in "bush" parts of the Colony everywhere. An idea of its prevalence may be gained from the fact that on a recent journey made by the Medical Officer, Tarkwa, into the Aowin district (which is thinly populated, hitherto little known or visited and difficult of access) he reported that 72 per cent of the total number of cases seen by him in all the villages he visited were due to yaws!

A long time must yet elapse before yaws is fully controlled, and much research, especially on the subject of treatment is still required; one of the chief obstacles, from the point of view of the Medical branch chiefly, in the attainment of control, is the high cost of the organic compounds of arsenic which are so far the most effective of all drugs used in treatment. As to the efficacy of bismuth, which is certainly cheap, the evidence collected so far is conflicting and a much more exact knowledge of its value is needed.

It is hoped in the ensuing year to test out on the Gold Coast under controlled conditions and to estimate as accurately as possible the relative value of a series of compounds of bismuth in order that the compound which renders the maximum number of cases non-infective in the shortest time may be determined.

ULCERS.

During the year 11,683 cases were dealt with, comprising no less than 6½ per cent of all cases treated. As in other parts of the tropics ulcerative conditions of the skin are exceedingly common everywhere. They are frequently neglected by sufferers who allow long intervals of time to elapse before seeking treatment.

Much time is given in out-patient work to dealing with such conditions which are a cause of considerable distress and disablement for long periods to numbers of individuals.

RABIES.

The third case of undoubted hydrophobia to be reported on the Gold Coast occurred during the year at Accra in an African boy aged about seven. The child was bitten on the 17th July, 1929, in Christiansborg, Accra, by a dog and its wounds were cauterized the same day at the Christiansborg Infant Clinic. The owners of the dog gave no history of the dog being "mad" but destroyed it immediately after the child

had been attacked in order to prevent it from biting others. The child was brought to the Gold Coast Hospital on the 8th September with unmistakable symptoms of hydrophobia. The history was then obtained that the dog was "mad." The child died the following day. The necessary steps to prevent spread were taken jointly by the Health branch and the Veterinary Department.

It is unfortunate in this case that the parents gave no history of the dog having been "mad," as in February, 1929, every medical practitioner in the Colony had been circularized on the subject of rabies, dog bites, etc. Since January, 1929, a supply of active carbolized anti-rabic vaccine, obtained from the Ministry of Health, England, has been constantly kept in stock on ice in Accra and is regularly renewed so that since that date efficacious anti-rabic treatment could have been given at once to any individual bitten by a dog or other animal suspected to be suffering from rabies.

The first record of a case appeared in the Annual Medical and Sanitary Report for the Gold Coast for 1912. It appeared in the return of in-patients as one admission, no death, and not remaining in hospital at the end of the year. In the body of the report the case is referred to without comment. The patient was probably removed by relatives and died outside hospital.

The second case was reported to the Director of Medical Research Institute by Dr. Saunders, Pathologist, who on the 6th September, 1929, at Salaga, did a post-mortem on a patient who was alleged to have been bitten by a mad dog three months previously. A guinea-pig was inoculated with material, died the following month and Negri bodies were found in its brain.

(b) VITAL STATISTICS.
GENERAL EUROPEAN POPULATION.

	1927-28.	1928-29.	1929-30.
(i) Government officials	1,202	1,280	1,323
(ii) Employees of trading firms	1,737	1,712	1,723
(iii) Employees of Mining companies	486	457	467
(iv) Missionaries	152	159	180
Total	3,577	3,608	3,693

An increase of 43 Government officials over the previous year took place and an increase of 42 non-officials.

(I).—EUROPEAN OFFICIALS.

TABLE SHOWING SICK, INVALIDING AND DEATH RATES.

	1927-28.	1928-29.	1929-30.
Total number of officials resident	1,202	1,280	1,323
Average number resident	835	881	972
Total number on the sick list	792	846	912
Total number of days on sick list	7,023	7,177	7,795
Average daily number on sick list	19.24	19.6	21.3
Percentage of sick to average number resident	2.30	2.22	2.19
Average number of days on sick list for each patient	8.86	8.48	8.54
Average sick time to each resident	8.41	8.14	8.02
Total number invalided	39	50	49
Percentage of invalidings to total residents	3.24	3.90	3.70
Percentage of invalidings to average number residents	4.67	5.67	5.04
Total deaths	6	4	5
Percentage of deaths to total residents	0.49	0.31	0.37
Percentage of deaths to average number of residents	0.71	0.45	0.51
Number of cases of sickness contracted away from residence	Not available.	Not available.	Not available.

EUROPEAN OFFICIALS.—INVALIDINGS AND DEATHS 1929-30.
TABLE SHOWING SEX OF OFFICIALS.

	No.	Deaths.	Invalided.	Death rate per 1,000.	Invaliding rate per 1,000.
Officials { Males ..	1,256	5	45	3.98	35.82
{ Females ..	67	—	4	—	59.70
Totals ..	1,323	5	49	3.77	37.03

NUMBER OF DAYS ON SICK LIST.

	1927-28.	1928-29.	1929-30.
Tropical diseases	2,368	2,241	2,462
Non-tropical diseases	4,655	4,936	5,333
Total	7,023	7,177	7,795

CAUSES OF INVALIDING OF EUROPEAN OFFICIALS.

Psychasthenia 2; pneumonia and pleurisy 1; fracture of skull and concussion 1; mental depression and physical debility 1; hydronephrosis 1; lacerated wound of right wrist 1; compound fracture of frontal and nasal bones 1; persistent headaches 1; blackwater fever 1; depressive psychosis 1; acute pyelitis (*B. Coli*) 1; aortic disease 1; myocardial degeneration 1; malaria and sub-acute appendicitis 1; mental depression 1; pulmonary tuberculosis 1; gastro-enteritis 2; typhoid fever 1; neurasthenia 2; visceroptosis 1; debility 6; amoebic dysentery 2; anæmia 1; jaundice 1; depressed and nervous state 1; nervous debility 1; bacillary dysentery 1; internal hæmorrhoids with hæmorrhage 1; defective vision 1; wrenched knee 1; dermatitis 1; chronic appendix and neuralgia 1; scalp wounds and concussion 1; insomnia 1; malaria 1; anorexia and insomnia 1; insomnia and tachycardia 1; enteritis 1; cerebral malaria 1; subtertian malaria 1. Total 49.

Of the 49 officials invalided none were military.

CAUSES OF DEATHS OF EUROPEAN OFFICIALS.

Heart failure with broncho-pneumonia 1; heart failure and pneumonia 1; heart failure 1; pneumonia and cardiac disease 1; heart stroke and acute dilatation of heart 1. Total 5.

Of the five officials who died one was military.

EUROPEAN OFFICIALS.—INVALIDINGS.
ANALYSIS OF RESIDENTIAL SERVICE.

Serving under the	Residential Service.						Total.
	Under 6 months.	6 but under 9	9 but under 12	12 but under 15	15 but under 18	18 months and over.	
Old leave regulations ..	1	—	—	1	—	—	2
New leave regulations	3	4	10	14	15	1	47
							49

FIVE-YEAR PERIOD, 1925-30, INVALIDING AND DEATH RATES.

Invaliding rate per 1,000.

1925-26	...	...	...	59.35	} average—4.29 per cent.
1926-27	...	...	...	46.84	
1927-28	...	...	...	32.44	
1928-29	...	...	...	39.06	
1929-30	...	...	...	37.03	

Death rate per 1,000.

1925-26	...	...	...	8.04	} average—0.45 per cent.
1926-27	...	...	...	2.87	
1927-28	...	...	...	4.99	
1928-29	...	...	...	3.12	
1929-30	...	...	...	3.77	

EUROPEAN MORTALITY AND INVALIDING RATES FOR THE YEAR.

	No.	Deaths.	Invalidings.	Death rate per 1,000.	Invaliding rate per 1,000.
Officials	1,325	5	49	3.77	37.03
Non-officials	2,370	19	50	8.01	21.09

(II)—EUROPEAN NON-OFFICIALS.

TABLE SHOWING INVALIDING AND DEATH RATES.

1927-28.	No.	Deaths.	Invalidings.	Death rate per cent.	Invaliding rate per cent.
Merchants	1,737	16	30	0.92	1.72
Mining companies	486	—	16	—	3.29
Missionaries	152	5	2	3.28	1.31
Totals	2,375	21	48	0.88	2.02
1928-29.					
Merchants	1,712	16	22	0.93	1.28
Mining companies	457	6	8	1.31	1.75
Missionaries	159	—	1	—	.62
Totals	2,328	22	31	.94	1.33
1929-30.					
Merchants	1,723	15	24	0.87	1.38
Mining Companies	467	3	24	0.64	5.13
Missionaries	180	1	2	0.55	1.11
Totals	2,370	19	50	0.80	2.11

EUROPEAN NON-OFFICIALS.—INVALIDINGS AND DEATHS 1929-30.

TABLE SHOWING SEX OF NON-OFFICIALS.

	No.	Deaths.	Invalided.	Death rate per 1,000.	Invaliding rate per 1,000.
Merchants .. { Males ..	1,313	12	24	9.13	18.27
{ Females ..	410	3	—	7.31	—
Mining companies { Males ..	451	3	24	6.65	53.21
{ Females ..	16	—	—	—	—
Missionaries .. { Males ..	112	—	1	—	8.92
{ Females ..	68	1	1	14.70	14.70
Totals	2,370	19	50	8.01	21.09

CAUSES OF INVALIDING OF NON-OFFICIAL EUROPEANS.

Malaria and debility 4 ; malaria and congestion of liver 1 ; blackwater fever 6 ; typhoid fever 1 ; pyrexia of unknown origin 1 ; pulmonary tuberculosis 3 ; chronic bronchitis 2 ; acute nephritis 1 ; appendicitis 2 ; boils (and ulcers) 1 ; chronic gastritis 1 ; duodenal ulcer 1 ; peri-rectal abscess 1 ; debility and hæmorrhoids 1 ; gonorrhoea 1 ; septic condition of legs 1 ; non-venereal bubo 4 ; inguinal hernia 2 ; peripheral neuritis 1 ; heart disease 1 ; paralysis of lower extremity 1 ; alcoholism 1 ; eczema 1 ; anæmia 1 ; hysteria 1 ; fractured leg 1 ; injuries following motor-cycle accident 1 ; eye disease 1 ; causes unknown 3 ; loss of vision following nervous debility 1 ; general debility 1 ; syphilis 1. Total 50.

CAUSES OF DEATH OF NON-OFFICIAL EUROPEANS.

Typhoid 1 ; typhoid and pneumonia 1 ; pulmonary tuberculosis 1 ; malaria (subtertian) 2 ; malaria (unclassified) 1 ; blackwater fever 3 ; lobar pneumonia 1 ; pneumonia (unclassified) 1 ; chronic nephritis 1 ; heart failure 3 ; drowning 2 ; sunstroke 1 ; effects of the administration of anti-hookworm treatment in the form of carbon tetrachlor. m.20 and oil of chenopodium m.10, 1. Total 19.

III.—AFRICAN OFFICIALS.

TABLE SHOWING SICK, INVALIDING AND DEATH RATES.

	1927-28.	1928-29.	1929-30.
Total number of officials resident	3,771	3,983	4,474
Average number resident	3,460	3,655	4,154.22
Total number on sick list	744	1,252	1,260
Total number of days on sick list	7,463	11,955	13,176
Average daily number on sick list	20.44	32.66	36.09
Percentage of sick to average number resident ..	0.59	0.89	0.86
Average number of days on sick list for each patient	10.03	9.54	10.45
Average sick time to each resident	2.15	3.27	3.17
Total number invalided	29	25	34
Percentage of invalidings to total residents ..	0.58	0.62	0.75
Percentage of invalidings to average number resident	0.64	0.68	0.81
Total deaths	20	21	19
Percentage of deaths to total residents	0.53	0.52	0.42
Percentage of deaths to average number resident ..	0.57	0.57	0.45
Number of cases of sickness contracted away from residence	Not available.	Not available.	Not available.

CAUSES OF INVALIDING OF AFRICAN OFFICIALS.

Mental degeneration 1 ; pulmonary tuberculosis 5 ; tuberculosis of the spine 1 ; debility following amœbic dysentery 1 ; endocarditis and arterio-sclerosis 1 ; premature senility 1 ; unsound mind 1 ; cataract 1 ; chronic nephritis and chronic periostitis 1 ; tabes dorsalis 1 ; purulent conjunctivitis with loss of vision 1 ; urinary perineal fistulæ 1 ; defective vision 1 ; gonorrhoea 1 ; homicidal mania 1 ; chronic interstitial myocardi-tis 1 ; neurasthenia 1 ; secondary anæmia 1 ; mental dullness and apathy 1 ; mental delusions and obsessions 1 ; diabetes 1 ; dementia præcox 1 ; cystitis 1 ; neurasthenia with inguinal hernia and rectal fistula 1 ; diabetes mellitus 1 ; pulmonary tuberculosis and gastric ulceration 1 ; chronic articular rheumatism 1 ; neurasthenia, asthenopia and failing memory 1 ; valvular disease of the heart 1 ; psycho-neurosis 1. Total—34.

CAUSES OF DEATH OF AFRICAN OFFICIALS.

Peritonitis 1 ; pyrexia of unknown origin 1 ; pneumococcal septicæmia 1 ; uræmia 1 ; mitral regurgitation 1 ; incised wound of neck (self-inflicted) 1 ; lobar pneumonia 2 ; pulmonary tuberculosis 1 ; motor accident 1 ; perineal abscess and septicæmia 1 ; collapse following salpingitis 1 ; peritonitis secondary to diverticulitis 1 ; heart failure

following appendicitis 1 ; nephritis 1 ; tuberculosis and gastric ulceration 1 ; rupture of an aortic aneurysm 1 ; typhoid fever 1 ; valvular disease of heart 1. Total 19.

IV.—GENERAL AFRICAN POPULATION.

For the sake of comparison with previous years particulars are given below of births, deaths and infant mortality rates at six of the principal centres of population in the Colony and Ashanti. During 1929-30, births and deaths registered at the twenty-six registry offices numbered 7,985 and 5,590 respectively, as compared with 5,827 and 5,109 in 1928-29.

Town.	Deaths.				Births.			Infant mortality rate.			
	1926-27.	1927-28.	1928-29.	1929-30.	1926-27.	1927-28.	1928-29.	1926-27.	1927-28.	1928-29.	1929-30.
Accra ..	1,130	1,233	1,276	1,300	2,095	2,030	1,925	124	128	150	140
Kumasi ..	436	524	561	682	550	474	679	110	142	88	141
Cape Coast ..	315	325	343	322	306	273	303	124	124	99	62
Sekondi ..	375	324	280	287	242	235	215	61	68	51	123
Koforidua ..	239	215	197	317	173	187	488	196	176	181	131
Tarkwa ..	190	190	122	118	72	34	66	152	382	51	129
Total ..	2,685	2,811	2,779	3,026	3,438	3,233	3,676	—	—	—	—

III.—HYGIENE AND SANITATION.

A.—GENERAL REVIEW OF WORK DONE AND PROGRESS MADE.

I.—MOSQUITO AND INSECT-BORNE DISEASES.

(a) MALARIA

Malaria still continues to be the greatest predisposing factor in the mortality and morbidity rates among the children, in loss of efficiency of labour, and it apparently complicates every pathological process from birth to old age.

A lot of good work has been done in various stations during the year under review and much progress has been made.

In Accra progress has been made in the production of a straight, well-defined edge to the eastern margin of Korle Lagoon. One mile of wall has been completed and many of the worst breeding-places filled in. The new out-fall is controlling the flooding of the lagoon surroundings and makes possible the reclaiming of the Adabraka and Agblosshie marshes at no distant date. The definition of the lagoon edge and the controlling of the height of the lagoon water will be a big factor in promoting the health of Accra.

Extensive work has been done in Kumasi. The filling of the Ejissu road swamp has been begun and now about one-third of the area is firm ground.

The permanent drainage of the swamp between the residential area and the Residency to the west of the Residency road has been begun.

About 380 yards of concrete drain has been completed and the requisite lateral filling done.

A lot of "rough-training" of waterways and the provision of "herring-bone" collaterals has been completed in the area of the Prince of Wales Park and in the New Asafu swamp.

The latter has been a big undertaking necessitating the cutting of a large earth drain for the distance of at least one mile. A lot of filling has been done in the vicinity of Cadbury Hall parallel to the railway. During the year 21 deaths certified due to malaria only were registered in Kumasi giving a percentage of 3.08 to the total number of deaths registered. In 1928-29 the percentage was 6.9.

The filling of the swampy Brobo Valley has now been finished and is permanently drained by 1,000 feet of concrete gutter.

In Koforidua, the malaria menace looms very largely.

The town itself lies in a depression and to the west, south-west and north-west still lower lying ground produces ideal anopheline-breeding areas.

During the year much good work has been done in the north-west area by canalising, "herring-boning" and raising levels, by packing-in indestructible refuse and covering with a thick layer of well-rammed earth.

The Medical Officer of Health, Koforidua, writes "although much has been done, unfortunately it has not gone far enough to be of much benefit."

The problems to be faced in such towns are well summed-up by the Medical Officer of Health, Nsawam. He writes as follows:—

"In the rainy season, whether the Densu overflows its banks or not, many acres beside the river are water-logged and cannot be drained owing to lack of fall. Surface water drainage is no cure; rather what has been done in the higher part of the town may accentuate malarial conditions by running more water into lowlying areas from which there is no outlet."

Good work has also been carried out in Cape Coast, Sekondi, Tamale, Kintampo and Axim.

Mr. Pomeroy, the Medical Entomologist, has given much help with regard to malaria prevention in the Korle Lagoon area of Accra and has started a mosquito survey of the Takoradi area where considerable trouble has been experienced by the inhabitants of certain bungalows.

Paris Green has been extensively used and on the whole has been well reported on; crude-oil, however, is still the favourite anti-larval agent with several workers.

In Ashanti, several villages are rebuilding their houses on specially selected sites far removed from their present malarious surroundings.

TABLE I.

Towns.	Percentage of enlarged spleens.	
	1928-29.	1929-30.
Accra	18.9	40.2*
Koforidua	46.8	49.5
Kumasi	27.5	35.3
Sekondi	22.8	31.3

* Increase largely due to extension of examination to scholars of Labadi and Teshi Schools; *vide* Section III.

During an outbreak of malaria among the European officials living in the residential area at Kintampo, quinine was distributed daily by the Medical officer to the African children in the cantonments with very good effect.

The prevailing wind in Kintampo blows from a low-lying marshy area across the cantonments and on to the residential area approximately a quarter of a mile away.

Active anti-mosquito work in the marsh, coupled with the daily administration of quinine to the "line-children," speedily brought this outbreak to an end.

Anti-malarial measures adopted consist of steady continuation of the main drainage systems in the large centres, and the drainage of low-lying, marshy areas by means of graded earth drains fed by open, or sub-soil, collateral 'herring-bone' gutters.

Other low-lying areas of limited extent have been filled with indestructible rubbish and covered over with a thick layer of hard rammed earth.

The margins of natural waterways are "rough-trained" and kept free of vegetation.

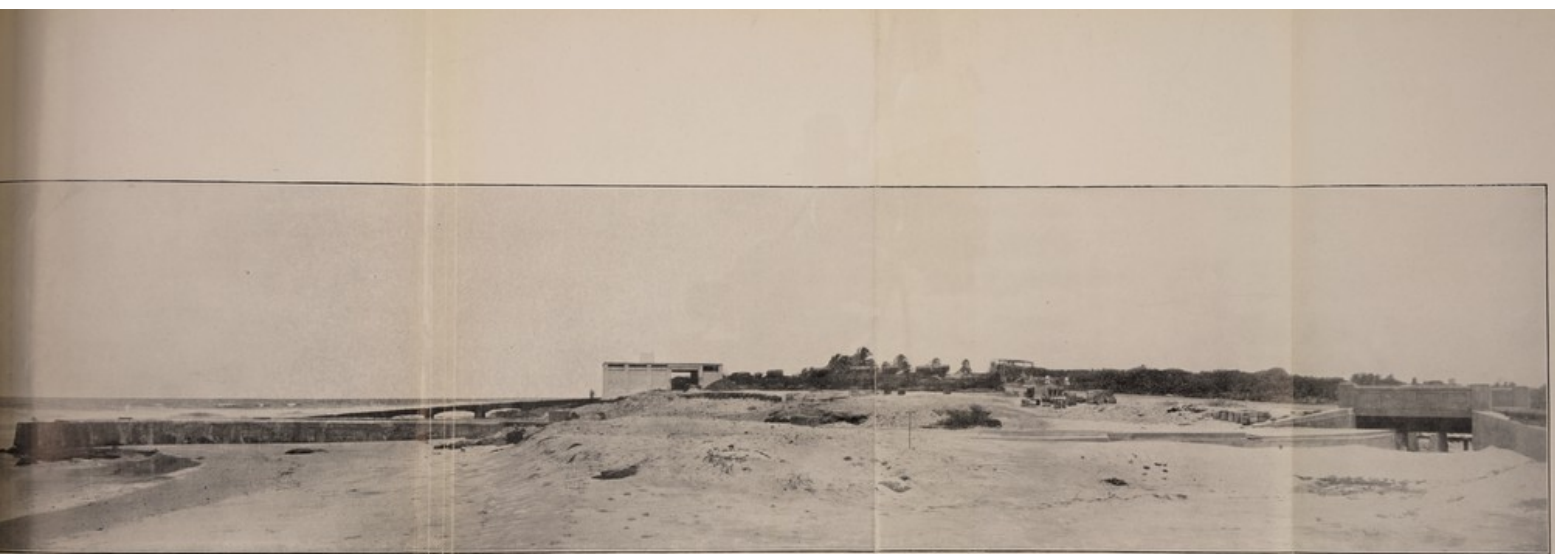
Low-lying swamps incapable of being drained, and ponds and small lagoons, have been treated with Paris Green or crude oil.

Stocking of collections of water incapable of being drained, with fish of the top-minnow species, has been undertaken in many areas with good results.

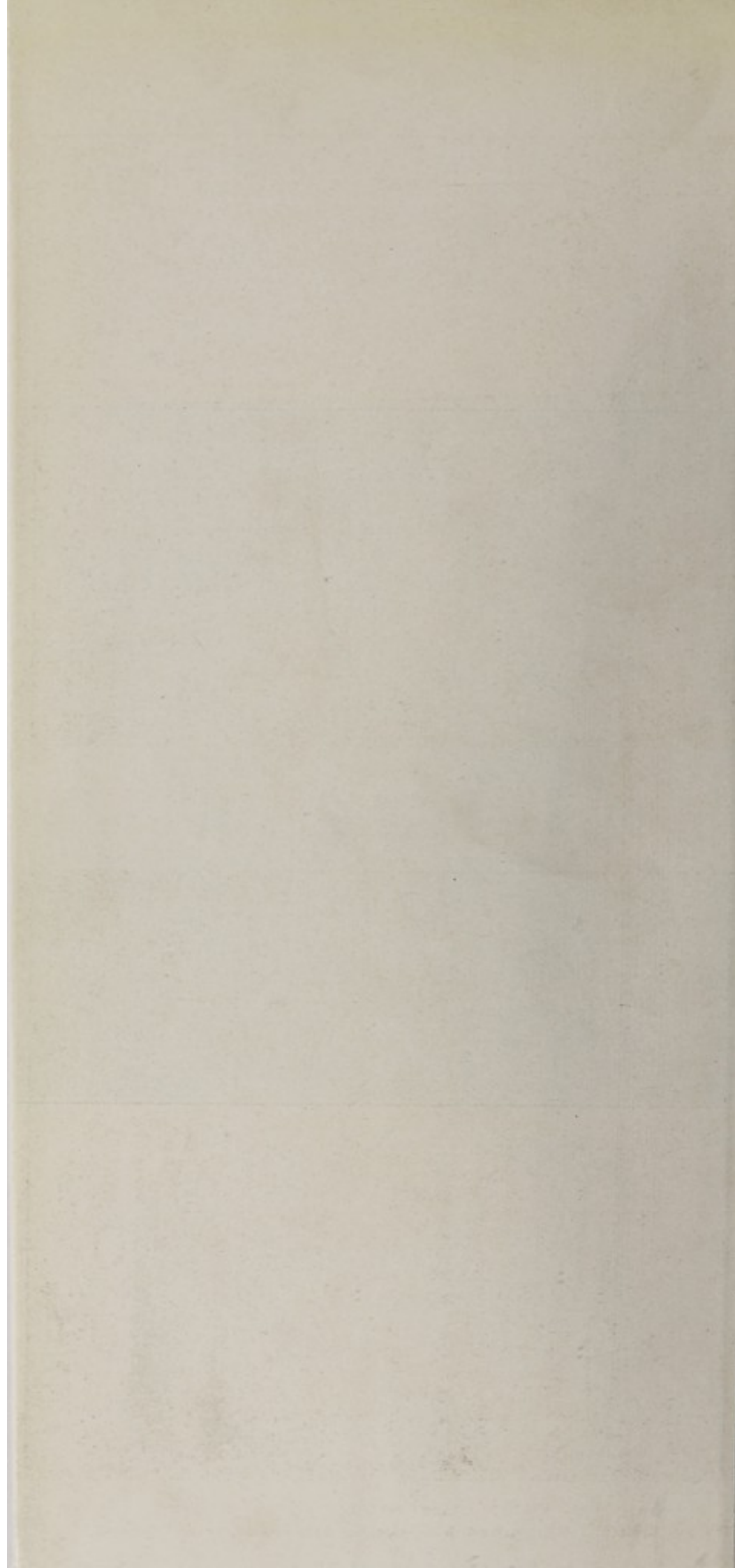
(b) YELLOW FEVER.

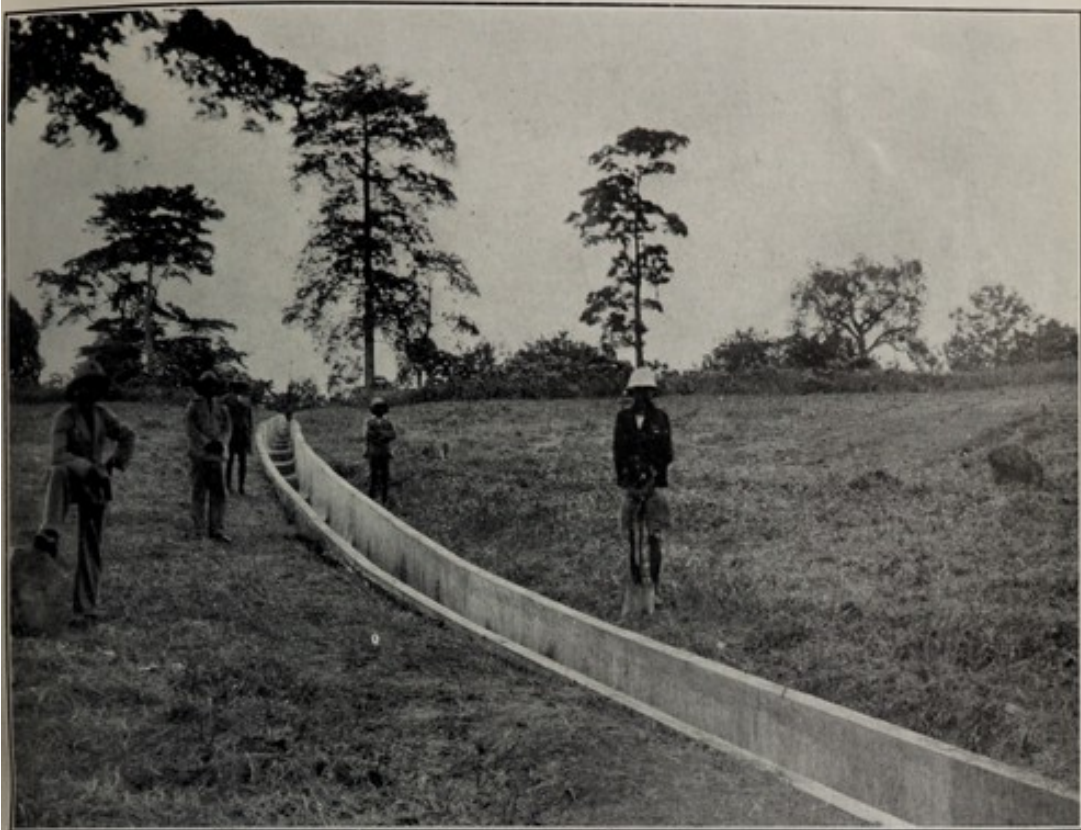
It is pleasant to be able to record that during the year under review no case of yellow fever occurred.

Table II gives the incidence of this disease in the last decennial period.



ACCRA.
Korley Lagoon Reclamation Scheme, New outlet.

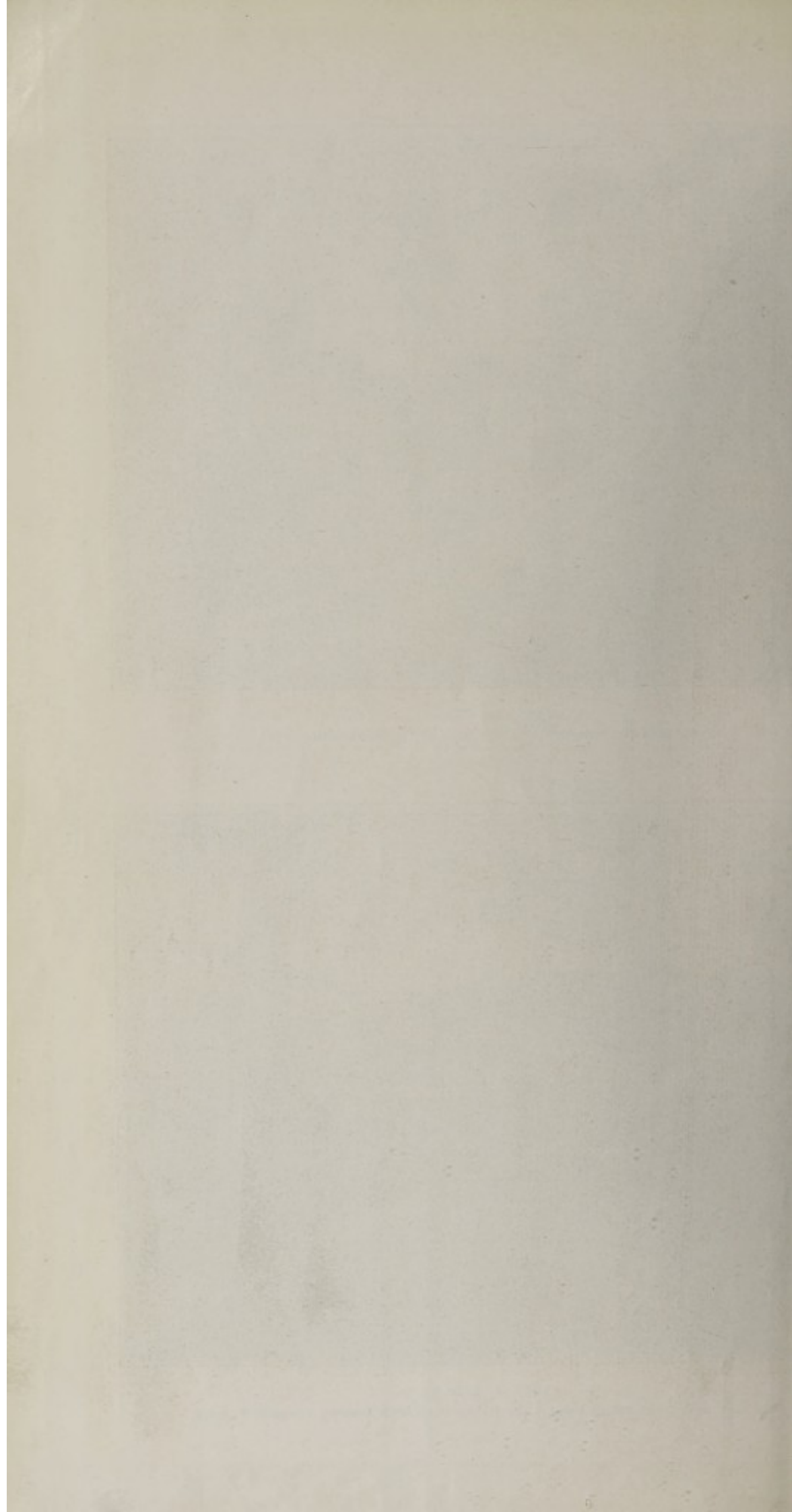




KUMASI, 1929-30.
Source of the new drain at the back of the Residential Area.



KUMASI, 1929-30.
The new drain and filling behind the Residential Area looking towards Patossi.





KUMASI, 1929-30.
Part of the swamp behind the Residential Area filled in. (Note the proximity of bungalows).



KUMASI, 1929-30.
Anti-malarial work. New Asafu Swamp cutting.

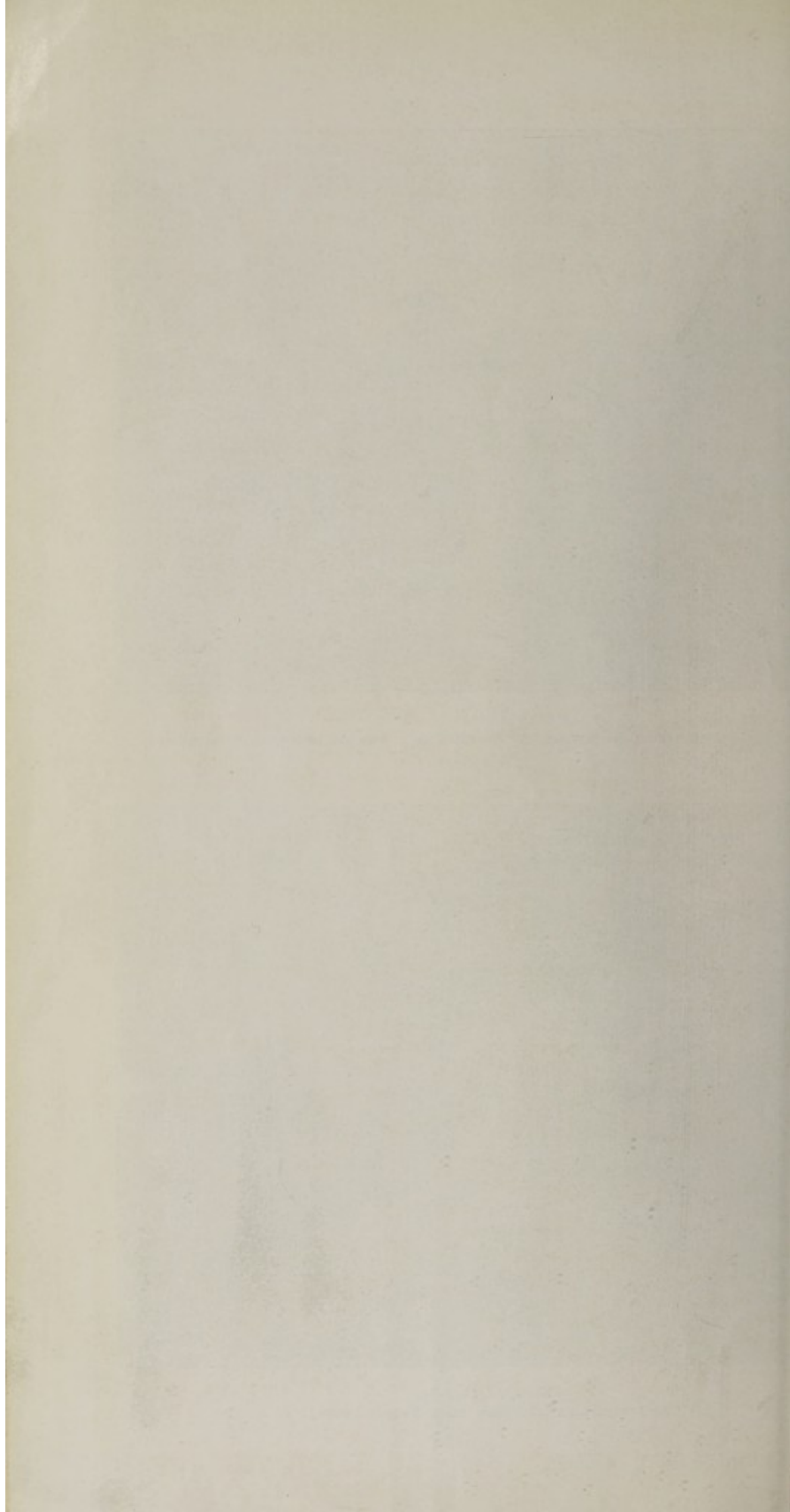


TABLE II.—YELLOW FEVER.

Year.	Cases.	Deaths.	Percentage mortality.
1920	2	1	50.0
1921	4	4	100.0
1922	10	8	80.0
1923	19	16	84.2
1924	8	6	75.0
1925	7	4	57.1
1926	65	18	27.6
1927	107	40	37.3
1928	2	2	100.0
1929	Nil.	Nil.	Nil.

It will be seen, therefore, that the period under review is the only twelve-monthly period during the last 10 years in which yellow fever has made no appearance.

This is most satisfactory and well justifies the increase in sanitary staff which has been placed in the suspected endemic area.

Any reduction of the sanitary staff in these districts must be viewed with much misgiving for the future.

The larval indices for the towns and villages in these areas on the whole were satisfactory.

TABLE III.

Station.	Domiciliary visits.		Instances of larvæ.		Larval index.	
	1928-29.	1929-30.	1928-29.	1929-30.	1928-29.	1929-30.
Accra	168,405	158,741	1,202	1,389	0.7	0.87
Koforidua	39,545	32,393	254	201	0.6	.64
Cape Coast	54,251	53,635	539	640	0.9	1.2
Sekondi	48,530	50,871	274	241	0.5	0.47
Kumasi	61,850	56,140	895	731	1.4	1.30

The total figures for the whole of the Colony, Ashanti and the Northern Territories are as under :—

Total inspections.	No. of houses with larvæ.	Index.
840,725	8,829	1.5

The highest return for the year 1929-30 was from Anyinam with a larval index of 4.73, the lowest from Wa with an index of nil. Recent research work on yellow fever makes most difficult the question of what vaccine, if any, should be stocked by the Health branch.

The advice of the chief adviser to the Secretary of State and of the Director of the Rockefeller Commission, Lagos, has been sought on the above important question.

The chief safeguard against yellow fever is unremitting, well-supervised house-to-house inspection.

(c) FILARIASIS.

This disease in the Gold Coast is of no very great importance. Axim reports six cases with no deaths. The Medical Officer, Zuarungu, reports "quite a number of cases in the district." The Medical Officer of Health, Kumasi, states it is rarely seen. The vast majority of stations give nil returns.

Filariasis would appear to indicate the requirement of no special preventive measures.

(d) TRYPANOSOMIASIS.

This disease does not occupy a very prominent position in the Gold Coast, but we cannot afford to lose sight of its importance. The highest figures were returned from Kumasi which shew 58 cases with 17 deaths. Tamale reports eleven cases with two deaths.

The Medical Officer of Health, Kumasi, stresses the point that all these cases occurred in immigrants from the north and that no indigenous cases arose in Kumasi during 1929-30. He also states that tsetse-flies are being seen every year in fewer numbers owing to the steady clearing of the surrounding forest and bush. They are, however, still too numerous to the west of the residential area.

In no part of the Gold Coast does trypanosomiasis constitute a menace, but it is considered that a survey of both the north and south banks of the river Volta in the Kete Krachi, Mampon and Eastern Gonja districts would be useful and interesting and would probably reveal an infection rate of from 2 to 3 per centum of the population.

Prevention resolves itself into keeping a sufficient clearing of the bush round villages, towns and fords on main traffic routes.

2.—INFECTIOUS DISEASES.

(a) CEREBRO-SPINAL MENINGITIS.

There was no occurrence of any serious outbreak of cerebro-spinal meningitis during the period under review. One case was reported from Kumasi. This case died.

Formerly, cases were regularly reported in small numbers from Ashanti.

In 1928-29, four cases with three deaths were returned.

Owing to the large number of well laid-out villages springing-up in Ashanti comprising houses of good type, this disease, it is thought, will play an increasingly smaller part in the future in this area of the Gold Coast.

(b) DYSENTERY.

Cases reported were 865 with 158 deaths in the weekly infectious diseases telegraphic returns during the year 1929-30.

These figures, of course, cannot be considered as even approximately representing the actual incidence of this disease owing to the comparatively small number of reporting stations, but they do furnish figures of some comparative value.

Again it must be remembered the reporting stations in the Colony greatly out-number those in Ashanti and the Northern Territories.

TABLE IV.

	Colony.		Ashanti.		Northern Territories.		Total.	
	1928-29.	1929-30.	1928-29.	1929-30.	1928-29.	1929-30.	1928-29.	1929-30.
Cases ..	727	681	127	56	68	128	922	865
Deaths ..	112	134	17	8	1	16	130	158

(c) ENTERIC GROUP.

The number of cases of enteric reported in the Gold Coast is still small.

The greatest number of cases was reported in Accra.

This is hardly to be wondered at when the greater facility for laboratory diagnosis at that centre is considered.

A total number of 51 cases was reported with 12 deaths as compared with 28 cases and 5 deaths in the previous 12-monthly period. Of the total cases, 27 were reported in Accra.

Eighteen of these cases were in Africans and six deaths occurred. There were nine European cases with no deaths.

One fatal European case occurred in Ashanti.

It is considered the case incidence is not increasing, but improved diagnostic methods will show a steady rise in the yearly figures.

Few even of the large centres are yet in possession of pipe-borne water supplies, and when the amount of travelling done by the average official and member of the mercantile community is considered, a European would be very well advised to become protected by inoculation before coming to the Colony for the first time, and to be reinoculated when in the United Kingdom on leave.

Preventive measures resolve themselves into steady improvement of water supplies, continual care in the disposal of night-soil, and the efficient disposal of all organic refuse.

(d) PLAGUE.

No case of plague was reported during 1929-30.

No plague-positive rat was reported, and no epizootic was noticed as occurring in the rat population.

Rats were caught as under in seven large stations :—

Kumasi	...	...	...	...	19,809
Koforidua	...	...	...	...	10,722
Winneba	...	...	...	...	5,126
Nsawam	...	...	...	...	3,144
Tarkwa	...	...	...	...	12,060
Cape Coast	...	...	...	...	10,020
Accra	...	...	...	...	12,685
Total	...	...	...	...	73,566

Ships moored to the leeward breakwater in Takoradi harbour were required to take all precautionary measures in preventing the landing of rats.

It is felt that plague menaces the Gold Coast to a considerable degree owing to the continuation of plague in Lagos, the Canary Islands and Senegal.

The mooring of ships to the breakwater in Takoradi harbour brings in a new factor, with regard to the possibility of the entrance of plague, which did not exist when ships lay out in the roadsteads at the various older ports.

Prevention can be summed up as follows :—The regular trapping of and examination of rats ; steady insistence on rat-proofing of premises ; the layout of townships and improvement in the housing conditions of the people.

(e) SMALLPOX.

Towards the end of 1929 an outbreak of smallpox occurred in the Eastern Province of the Colony which at one time appeared likely to reach dangerous proportions :—

TABLE V.

	Colony.		Ashanti.		Northern Territories.		Total.	
	1928-29.	1929-30.	1928-29.	1929-30.	1928-29.	1929-30.	1928-29.	1929-30.
Cases	8	236	53	17	15	27	76	280
Deaths	Nil.	101	Nil.	3	Nil.	1	Nil.	105

The first case arose at Tafo on the 11th of November, 1929.

The case was that of a young child who was being carried about the district by his mother, a petty trader.

The mother was supposed to have landed at Accra on the 1st of November having come from Lagos, but no proof of this was forthcoming.

Wherever she came from, she left a trail of infection behind her and was undoubtedly the cause of the outbreak.

The infection was an extremely virulent one.

The energy and powers of organisation displayed by the Medical Officers of Health of Nsawam and Koforidua and the Medical Officer, Kibi, succeeded in limiting the spread of the infection, and in rapidly bringing the epidemic under control.

By the end of March, 1930, the outbreak was at an end.

42.8 per cent of the total cases were fatal.

Small outbreaks occurred in the Winneba, Mpraeso and Tarkwa districts and in the Obuasi district of Ashanti during the larger epidemic, but were speedily got under control.

The cases for the most part did not occur in the large centres of population, but among the Northern Territories labourers employed in the cacao farms.

These cases were scattered over a very wide area which made the control of the infected areas most arduous and difficult.

The number of vaccinations performed is given below :—

TABLE VI.

	1927-28.	1928-29.	1929-30.
Total number vaccinated	232,300	274,795	413,745
Number verified successful	82,004	65,146	82,973
Percentage successful	35.3	27.7	20.05

It must be borne in mind that when vaccinations are performed over a large area it is most difficult to see the vaccinated people a second time in order to verify the result.

This is especially so in an epidemic when the vaccinators, having completed one area, move on at once to another sphere of activity.

Lanolinated lymph from the Lister Institute was used throughout with uniform success.

A feature of the outbreak was the extraordinary manner in which the chiefs and people cried out for vaccination.

This demand did not cease on the cessation of the epidemic and many areas are still demanding vaccination.

These areas are being dealt with as rapidly as possible.

Twelve vaccinators are employed at the ports and other points of strategic importance such as the Western Province of Ashanti, the Yeji ferry over the Volta river, and the northern frontier of the Northern Territories.

(f) LEPROSY.

The Specialist Medical Officer appointed in connection with the Empire-wide anti-leprosy campaign is still proceeding with his survey of the country.

Reports from various medical officers and Medical Officers of Health of widely separated areas are as follows :—

Lawra district :—" A few scattered cases occur throughout the district but from the available data do not appear to be common."

Axim district :—" Eight cases seen."

Tarkwa district :—" Ten cases have been seen during the year."

Kintampo district :—" Is prevalent, 49 cases were treated during the year. The natives do not seem to regard it as a dangerous disease nor realise the danger of contagion.

For example, one of my hospital nurses—a local man—had for boon-companion a leper in an advanced stage of the disease who lived in his compound " . . . " modern treatment is not popular, due probably to slow results."

Bekwai district :—" The elders say there have always been one or two lepers in every village."

Wa district :—" This is very common owing to the patients refusing to stay for any prolonged course of treatment."

In many districts in the Colony the reporting officer omits to mention this disease.

It is considered, however, that the local prevalence varies fairly widely in different districts.

On the whole it is most difficult to sum up the position, and the Specialist's report must be consulted for further exact information.

The number of lepers treated at the various settlements is shown in the following table :—

TABLE VII.

Station.	Cases.	Deaths.
Tarkwa	10	Nil.
Kumasi	24	3
Accra	51	Nil.
Ho	562	5
Sekondi	6	1
Total	653	9

In passing, it is most encouraging to note that the number of cases treated at the Colonial Hospital, Tamale, has increased from nine in 1928-29 to 223 in 1929-30.

This would seem to indicate that modern methods of treatment are being recognised and appreciated by the people.

Towards the end of the year the advisability of providing a central leper settlement for the whole of Ashanti in the vicinity of Kumasi was under discussion and a provisional report was rendered by the Senior Health Officer.

The most hopeful methods of combating the disease are by educating the sufferers in the early stages of the disease to come up for and persist in their treatment (this latter requirement is by no means easy to obtain) and the starting of voluntary farm settlements at other centres should be considered and, whenever practicable, brought into being.

(g) ANTHRAX.

Anthrax is not infrequently met with in sheep and cattle throughout the Colony and Ashanti.

It occurs in sporadic form all over the Northern Territories among live stock.

During 1928-29 three fatal cases were reported from Kintampo in Ashanti; during the 12 months under review no human case was reported from the Colony, Ashanti or the Northern Territories.

Preventive measures undertaken consist of control of the cattle traffic in the large centres, inspection of cattle before slaughter, strict meat inspection and the proper sanitary care of slaughter houses and cattle kraals.

A supply of fresh Sclavo's serum is always kept in stock for the treatment of this disease if cases arise.

(h) RELAPSING FEVER.

No serious outbreak of this disease occurred during the year. Seventy seven cases with ten deaths were reported from the Colony; none were reported from Ashanti or the Northern Territories.

It is interesting to note that since the "Refuge" for the destitute was opened at Kumasi no case of relapsing fever has been reported from this populous centre.

A detailed description of this "Refuge" is given under section IV of this report.

Previous to the opening of this "Refuge," every year several cases were reported and on occasion this disease assumed epidemic proportions.

Measures taken for the prevention of relapsing fever chiefly take the form of control of the wandering labouring classes. These people have no fixed homes but wander from centre to centre and crowd as lodgers into insanitary houses in the different Zongos.

They are invariably 'lousy,' and it is extremely difficult to keep them under proper supervision unless a town provides some means of housing them temporarily. If this can be done as in Kumasi, an opportunity is offered for the disinfestation of the worst of them on their first arrival.

These wandering labourers invariably come from the Northern Territories and the disease usually starts among the Zaberrimas and Gawos, which are tribes from French territory.

(i) TUBERCULOSIS.

For many years, Tarkwa, as the centre of the mining industry, has returned by far the highest percentage of cases of pulmonary tuberculosis

of any station in the Gold Coast. A Medical officer specially trained in tuberculosis is now in residence there. He writes as follows :—

“ This disease continues to be a very serious problem, the measure of which is not indicated by the number of cases diagnosed amongst out-patients.

The victim rarely reports until his symptoms are severe, and then probably is most unwilling to enter hospital although he may be febrile, wasted and with extensive involvement of at least one lung.

The housing conditions in the district are largely such as to assist the spread of the disease, especially in the villages formerly belonging to the mines which have since ceased work.”

He advocates the provision of a six-bed pavilion attached to the hospital, adding—“ if this idea could be carried out it would be of much value from the public health standpoint although no dramatic cures would be likely to result.”

In discussing the utility of tuberculin he states, “ It could hardly make the disease more rapidly progressive while the African love of injections is such that it might tend to keep him under closer observation and treatment.”

During the year 130 total deaths were registered in Tarkwa, of which 35 were certified as being due to pulmonary tuberculosis.

The Medical Officer of Health, Kumasi, writes :—

“ Although the number of deaths from pulmonary tuberculosis is slightly in excess of last year the death percentage is lower. The disease is still fairly prevalent and the mortality rate is high. From 84 reported cases there were 62 deaths.”

The Medical Officer of Health, Winneba, reports :—

“ Tuberculosis would appear to be on the increase. Seventy-two cases were reported during the year and of these 69 were due to the pulmonary type.”

The case incidence of pulmonary tuberculosis for the last four years is as follows :—

1926-27	...	...	...	...	...	8
1927-28	...	...	...	...	...	16
1928-29	...	...	...	...	...	34
1929-30	...	...	...	...	...	69

He concludes :—

“ It would be unwise to accept these figures as a sure index of the increasing prevalence of pulmonary tuberculosis.”

TABLE VIII.

EXTRACTS FROM TABLE A : REPORT OF PRINCIPAL REGISTRAR OF DEATHS FOR 1928 AND 1929.

	Accra.				Cape Coast.				Sekondi.				Tarkwa.				Koforidua.				Kumasi.			
	1928.		1929.		1928.		1929.		1928.		1929.		1928.		1929.		1928.		1929.		1928.		1929.	
	No.	per cent.	No.	per cent.	No.	per cent.	No.	per cent.	No.	per cent.	No.	per cent.	No.	per cent.	No.	per cent.	No.	per cent.	No.	per cent.	No.	per cent.		
Pulmonary Tuberculosis	63	4.8	95	7.3	27	7.4	34	10.9	54	17.1	43	15.4	46	38.9	34	27.6	17	8.2	13	5.1	65	11.7	50	7.7

In the above table the number signifies the total deaths due to pulmonary tuberculosis ; the percentage is that of deaths due to pulmonary tuberculosis to the number of total deaths registered.

The years 1928-1929 referred to are calendar years.

The increased number of cases of pulmonary tuberculosis returned from several of the larger centres should probably be put down to the increasing number of cases of pulmonary tuberculosis coming in to these centres for treatment and would appear to be increasing *pari passu* with the increased number of general patients applying for treatment.

If this is the case the outlook is hopeful, for the general sanitation of the country is improving year by year.

The most hopeful lines of prevention are education in matters relating to general hygiene, the care of the infant and school-child, the extension of layout schemes particularly to the smaller towns and villages and replacement of the older existing types of houses with modern, light, well-ventilated dwellings. One of the biggest factors in the spread of pulmonary tuberculosis here, as elsewhere, is the open infectious type of case. Every effort is made to attract these cases in to the various contagious diseases hospitals, but this is only possible as a rule in the later stages and when the patient is destitute and starving.

(j) YAWS.

Next to malaria, yaws is the biggest factor in the immediate health problem to be faced in the Gold Coast, nearly one-fourth of the total cases presenting themselves for treatment at the Infant Welfare centres being due to this disease.

The number of children suffering from yaws seen casually in the streets of the larger centres is comparatively few. In towns, such as Kumasi, a few years ago, many such children could be seen ; to-day they are few and far between. Most of the cases treated at the infant welfare centres come from the outlying districts.

In Ashanti, the people living in the newly laid-out villages say fewer cases occur now than formerly.

Of all diseases yaws would appear to be one of the most easily influenced by general sanitary improvement of a child's surroundings.

The Medical Officer, Kintampo, writes :—

“ The villages are permeated with yaws; I have never seen so great a mass infection in any other district . . . modern treatment is efficient, popular and cheap.”

The Medical Officer, Keta, in an interesting report, writes :—

“ The only general disease in the district is yaws. Keta itself is free from it. General living conditions are not at all good in the villages near Keta, but yaws among them is uncommon. Yaws is rife in the hinterland.”

He adds—“ *Spironema pertenu* probably does not thrive in the salty strip of sand between the lagoon and the sea.”

He concludes by expressing his belief that yaws is a “ soil-infection.”

The methods adopted to combat the problem of yaws are general sanitation in the widest meaning of the term with particular reference to rubbish and night-soil disposal, housing and the prevention of overcrowding, and the treatment of cases.

In the measures taken to prevent the spread of yaws, "cure" of infective stages of the condition is a most important factor.

3.—HELMINTHIC DISEASES.

(a) ANKYLOSTOMIASIS.

Ankylostomiasis cannot be considered a menace in any district of the Gold Coast.

In the Axim district 18 cases were treated with two deaths.

From Tarkwa, the centre of the mining industry, no cases are reported.

Kumasi reported six cases with three deaths.

Three cases with no deaths were reported from Tamale.

In itself ankylostomiasis cannot be considered as playing an important part in the health problems of the country, but at the same time a good deal of minor infestation does exist, and it quite possibly plays a not altogether unimportant part in predisposition and in lowering resistance to other diseases.

Efforts are made to dispose of night-soil either by sea-disposal or trenching in the larger centres in as satisfactory a manner as possible; in the smaller centres by the provision of an adequate number of salga-pit latrines.

(b) DRACONTIASIS.

This is an important disease from the standpoint of labour efficiency.

It is chiefly met with in the Northern Territories.

It is reported as very common in Wa and Zuarungu.

One hundred and five cases were treated in Tamale in 1929-30.

In these areas the water-supply is of extremely poor quality and very scarce in the dry season.

In certain localities in Ashanti, villages which have to depend on swampy pools for their water suffer heavily.

These localities are very circumscribed and local.

Here the people will put in any amount of work to better their supplies and frequently ask for advice and supervision.

They are quite intelligent enough to recognise guinea-worm as a water infection. The means of prevention consist entirely in improving and protecting water-supplies.

(c) ASCARIASIS.

Infection with ascaris is common. It is sometimes thought that, perhaps, not sufficient importance is attached to this infection. The Medical Officer, Zuarungu, remarks on the fact that he sees "very few cases."

The Medical Officer of Health, Kumasi, reports 106 cases as compared with 77 in 1928-29.

In 1929, three deaths were registered as due to ascariasis.

Prevention resolves itself into obtaining as satisfactory a night-soil disposal system as possible.

(d) TAENIASIS.

The most common helminthic infection treated throughout the Gold Coast.

The chief factors in its spread are—

- (a) Indiscriminate fouling of the ground with night-soil.
- (b) Insufficient cooking of meat.

The Medical Officer, Zuarungu, reports, "It is the next in order to yaws in point of frequency. Its great incidence is due to (1) the total lack of latrines, (2) owing to the scarcity of firewood their meat is probably undercooked."

The chief preventive measures are directed towards the education of the people to use a satisfactory system of night-soil disposal, which is difficult in some parts of the country where no real towns exist, the compounds being scattered over miles of country, and the provision of slaughter-houses or slaughter slabs with proper supervision of the meat before consumption.

(e) SCHISTOSOMIASIS.

Schistosomiasis is much less commonly treated than the other helminthic diseases.

The condition also is very local in its distribution.

The stations reporting the greatest number of cases are as follows :—Akuse 16 ; Winneba 8 ; Tarkwa 8 ; Accra 18.

The methods of prevention adopted are attention to excreta disposal, drainage of areas inhabited or likely to be inhabited by the particular mollusc hosts, and treatment of cases.

Cure in the case of schistosomiasis again is an important side of prevention.

The Medical Officer of Health, Akuse, reports excellent results from treatment with antimony.

Some interesting work was completed in Kumasi in 1929-30 when two overgrown ponds fed by the headsprings of the West Subin Stream were converted into pipe-delivery water supplies. (See appendix N.)

The ponds were drained and the surrounding swampy areas converted into firm ground.

These improvements took place in the cantonments area : the ponds formerly have been blamed for a small incidence of schistosomiasis among the troops.

One of these two pipe-delivery supplies is illustrated in this report.

4.—ANIMAL DISEASES.

During the year 1929-30, 47,919 head of cattle and 78,980 sheep and goats were imported into Ashanti and the Gold Coast Colony from the Northern Territories.

Cattle to the number of 2,905 head were imported into Accra from Lagos.

Small outbreaks of rinderpest were reported from Lawra and Zuarungu districts of the Northern Territories and from Ashanti. 1929-30, however, is reported as having been a good year.

From Tamale, anthrax was reported involving nine head of cattle and one suspected pig, and contagious pleuro-pneumonia involving 17 head of cattle.

A small outbreak of anthrax was reported from Achimota stock farm.

The principal pathological and parasitic conditions found during meat inspection at the Tamale abattoir were as follows :—

TABLE IX.

CATTLE.

Disease.	Number slaughtered.	Number infected.	Percentage.
Cysticercus bovis	559	52	9.6 per cent.
Contagious pleuro-pneumonia	559	48	8.5 per cent.
Trematodes in liver	559	169	30.2 per cent.
Onchocercosis	559	72	12.9 per cent.
Echinococci	559	6	1.1 per cent.

SHEEP AND GOATS.

Disease.	Number slaughtered.	Number infected.	Percentage.
Caseous lymphadenitis	2,956	87	2.9 per cent.
Trematodes in liver	2,956	171	5.8 per cent.
Hepatitis (various)	2,956	722	24.4 per cent.
Intestinal nodules (<i>Oesophagostomum columbianum</i>)	2,956	1,618	54.7 per cent.
Echinococci	2,956	1	0.03 per cent.
Nephritis	2,956	98	3.3 per cent.

All meat inspection at Tamale is carried out by the Veterinary department under the direct supervision of the Principal Veterinary Officer.

The above tables, therefore, will give a good idea of the commoner conditions met with.

Reports from Kumasi and Accra regarding cysticercal infection are as below :—

TABLE X.

	Cattle infected with <i>Cysticercus bovis</i> .		Percentage infected.		Swine infected with <i>C. cellulosa</i> .		Percentage infected.	
	1928-29.	1929-30.	1928-29.	1929-30.	1928-29.	1929-30.	1928-29.	1929-30.
Accra ..	20	15	0.7	0.72	890	795	19.8	17.4
Kumasi ..	57	39	2.5	1.9	6	1	3.2	0.69

Research with regard to cattle trypanosomiasis is at present in progress.

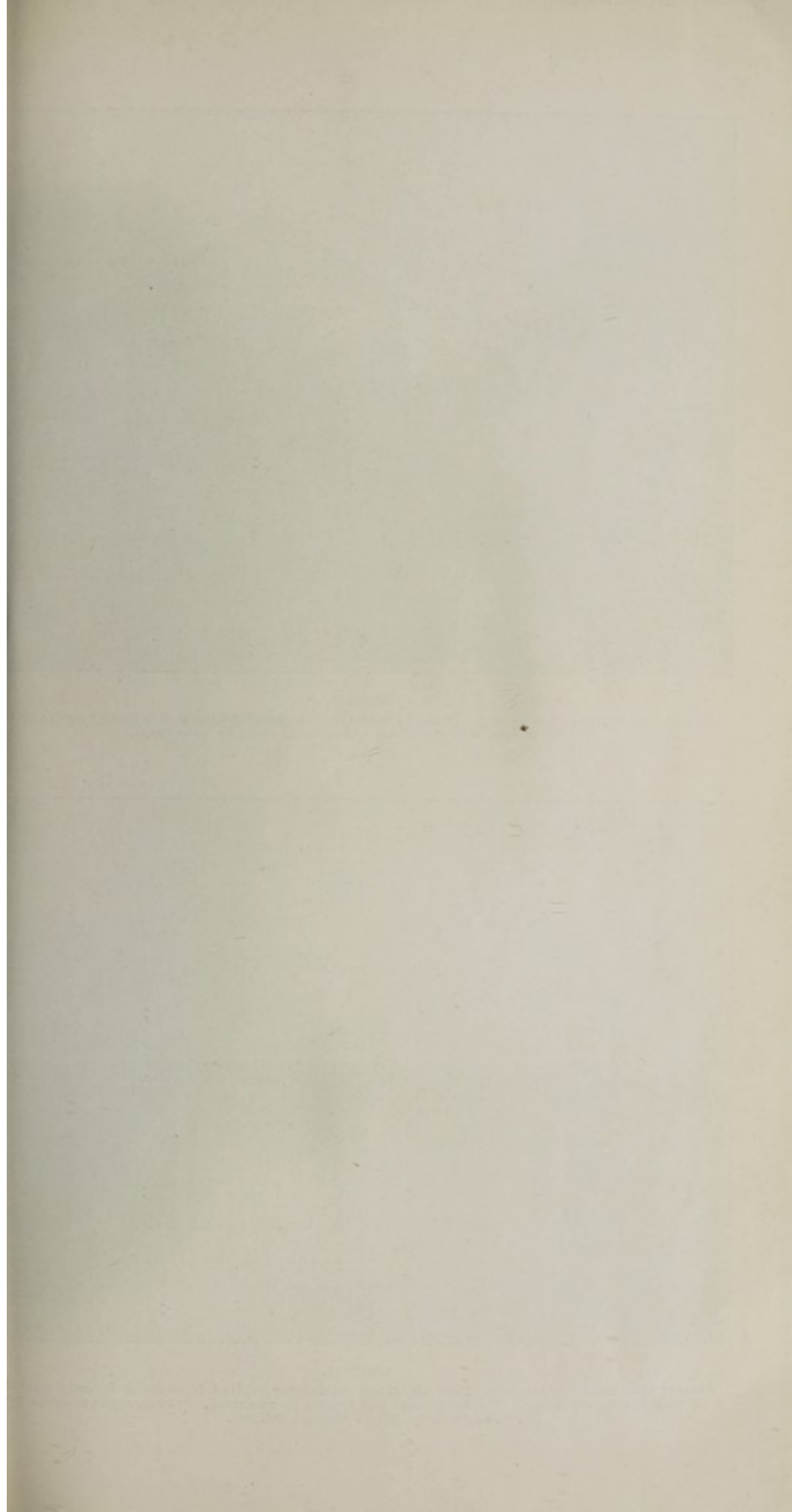
The result of this inquiry should prove useful in its bearing on human trypanosomiasis.

The following extract from an interesting report by Mr. R. G. Connolly, Superintending Sanitary Inspector, shows an unusually high percentage of sheep and goats infected with pseudo-tuberculosis (*Priesz-Nocard*) in a series of 611 animals killed over a short period, at the abattoir, Kumasi.

Sheep killed	...	395	Sheep infected	...	32
Goats killed	...	216	Goats infected	...	15
Total	...	611	Total	...	47

Total percentage infected—7.69.

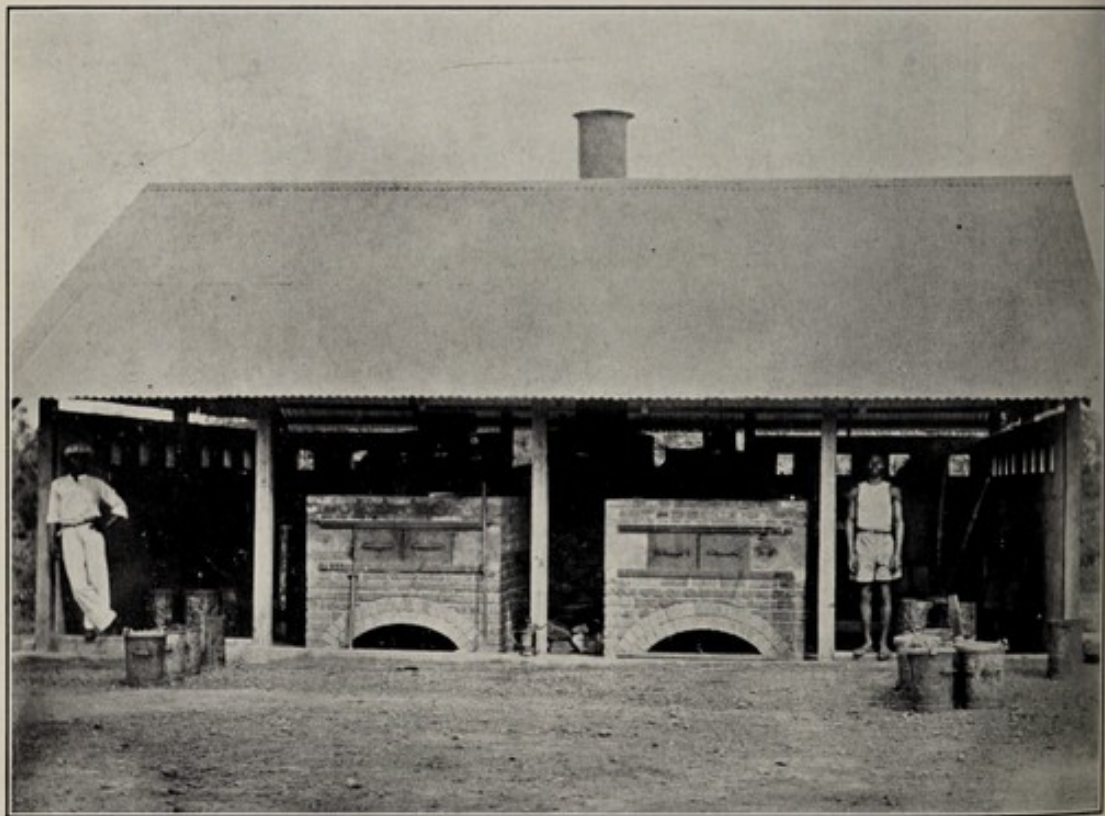
Mr. Connolly lays stress on the high percentage of infected prescapular over all other lymphatic glands.





OBUASI.

Ashanti Goldfields Corporation night-soil incinerator. (A plentiful supply of sawdust enables all night-soil from Mines, surface and underground, to be burned).



OBUASI.

Ashanti Goldfields Corporation. New night-soil incinerator evolved from above recently erected for Obuasi Sanitary Board. The foreground will shortly be cemented. (Photographs supplied by Dr. A. L. Anthony, Mines Medical Officer).

One fatal case of human rabies was reported from Accra. The infected dog was destroyed.

In the routine rounds-up of stray dogs 1,798 were caught and destroyed in the lethal chamber during the year in Accra alone.

5.—SEASONAL PREVALENCE OF DISEASES.

In the Gold Coast the seasonal prevalence of diseases is not marked.

The only definite seasonal increase takes place with relation to the increase in the number of respiratory diseases during the months of December and January, as a result of the cold, dusty harmattan wind.

Malaria shows no very definite relationship to season. In Kumasi, where exact figures are forthcoming, the greatest number of cases occurs in November and March.

The conditions pertaining during these two months are detailed as follows :—

Morth.	Larval index.	Malaria cases.	Rainfall.	Maximum shade temperature.
November	2.18	72	6.89	91.0
March	0.67	72	6.44	94.8

The particulars with regard to the months showing the fewest cases are :—

Month.	Larval index.	Malaria cases.	Rainfall.	Maximum shade temperature.
April	1.76	31	4.07	94.5
August	1.53	29	0.93	89.0

II.—GENERAL MEASURES OF SANITATION.

(a) SEWAGE DISPOSAL.

Water-carriage systems of sewage disposal are only to be found in Accra, at the Gold Coast Hospital, Korle Bu, at the Prince of Wales' College, Achimota, and two public-latrines in Accra town.

Experience has shown that the general mass of the population have still much to learn before such water-carriage systems can be adapted for general use.

Generally the type of public-latrine in use is the pan-type necessitating the removal of night-soil by motor-lorry or head-loading by prisoners to the disposal area.

Nightsoil is generally disposed of in the following ways (a) Sea-disposal (b) trenching (c) disposal into "fly-proofed" and "fly-trapped" pits (d) at one important centre, Obuasi, it is mixed with sawdust and burnt in specially constructed incinerators. This process is available only at Obuasi where large accumulations of sawdust are available for mixing with the night-soil to aid its combustion.

In Kumasi and Accra, experiments are progressing with a view to the elaboration of a simple, cheap septic-latrine.

It is felt there is a big future before such latrines. This system eliminates latrine-drums and, to a great extent, disinfectants and cartage of night-soil to the disposal area, thereby doing away with the necessity of the very expensive motor conservancy arrangements now in vogue at all the larger centres. In the smaller towns and villages salga-pit latrines are in use. The most satisfactory type is the "smoke-pit" salga latrine; this type is commonly in use in Ashanti, in towns where where proper supervision is possible.

In others the simple type is in use provided with a fly-trap and covers to the drop-holes.

(b) REFUSE DISPOSAL.

Destructible refuse is disposed of usually in brick-built incinerators of various types, or in swish-built, field-type incinerators.

In other places again the destructible refuse is packed into lowlying areas covered with $1\frac{1}{2}$ ' of earth and rammed down hard.

In Accra, a high temperature refuse-destructor costing approximately £7,000 will be in use in the near future.

In every large centre the destructible rubbish has to be carted from scattered public dust-bins to the incinerating or other disposal area.

This process may involve an expensive motor-lorry service or the very dirty hand-cart or head-loading method.

In Kumasi, owing to the existence of more open spaces and more easily acquired land, incinerators are very numerous, being about 50 in number.

No public dust-bins exist and the people have been trained in the past to carry their own household rubbish to these incinerators for disposal.

As a general rule this rubbish is put at once into the incinerator and disposed of.

A dust-bin is placed next to the incinerator in the more populous areas of the town in event of more rubbish arriving at the incinerator than can be disposed of at once.

Indestructible refuse is deposited in low-lying swampy areas, packed together, covered with $1\frac{1}{2}$ ' of earth and rammed down hard.

In Accra, at an early date a tin-baler and bottle-crusher will be in use for the more efficient treatment of these varieties of indestructible refuse.

A good deal of trouble is being experienced, particularly in Kumasi, with the disposal of useless, abandoned, derelict lorries. There is also a great tendency for transport firms to run their useless "junk" just outside the town boundaries and dump it by the road side.

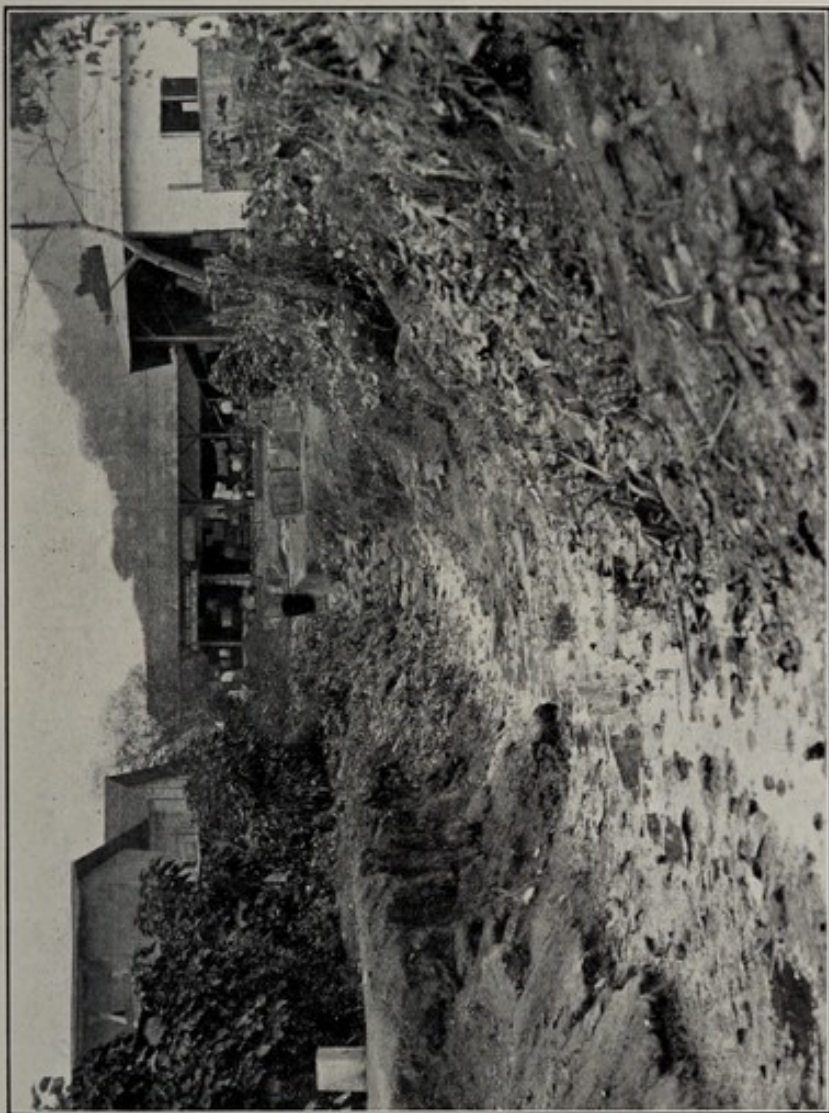
Water collected in many of these old motor parts and was responsible for a good deal of mosquito breeding.

(c) DRAINAGE.

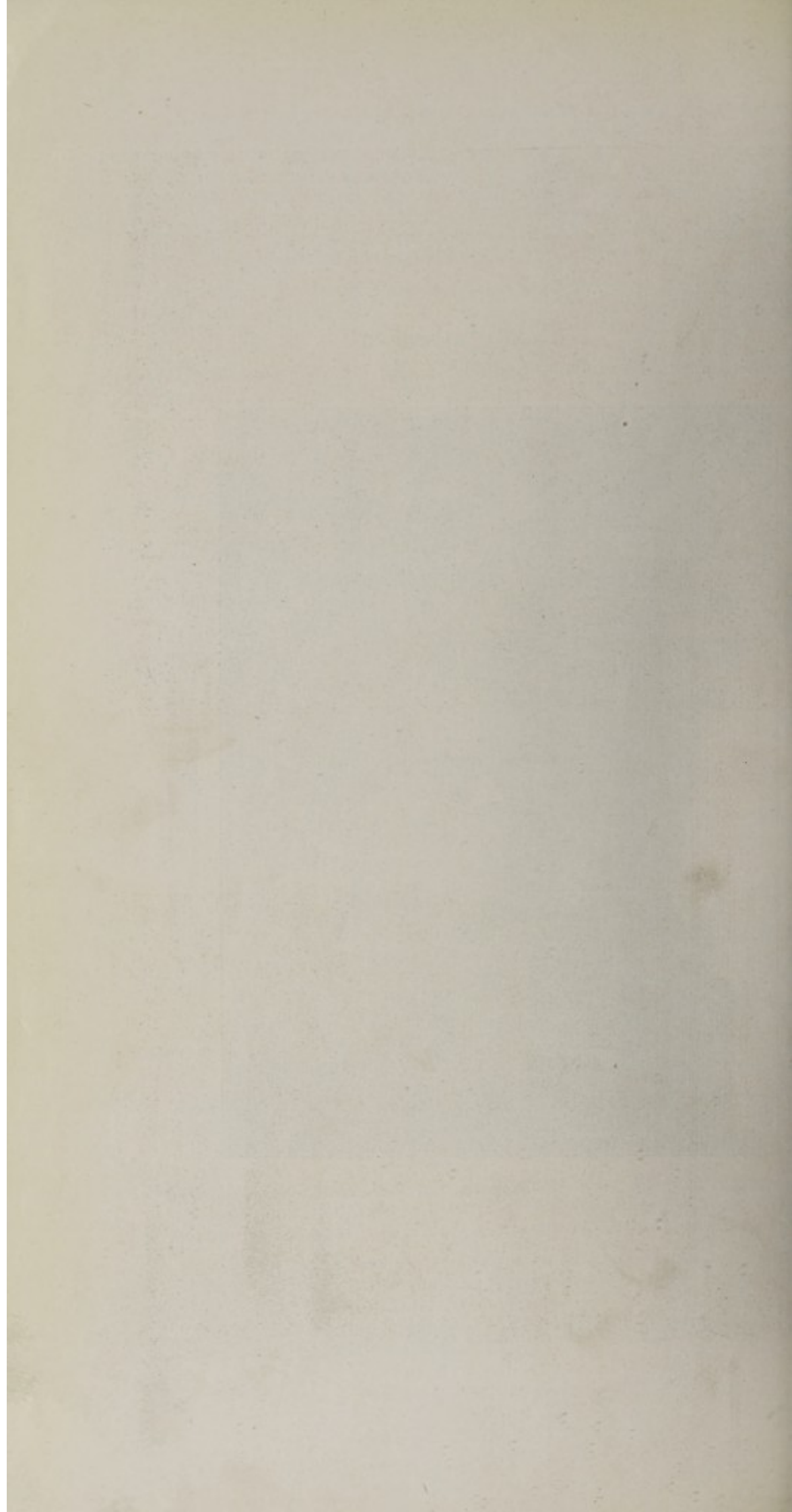
The Medical Officers of Health and the Medical Officers of the smaller centres pay continual attention to the low-lying swampy areas which abound in the surroundings of many of the towns of the Gold Coast.

Earth carry-off channels are provided and kept free of vegetation. These are fed by "herring-bone" collaterals which may be open or sub-soil.

The Medical Officer, Kintampo, has carried out very good work in this line during the past twelve months.



KOFORIDUA.
A typical outfall drain before improvement.

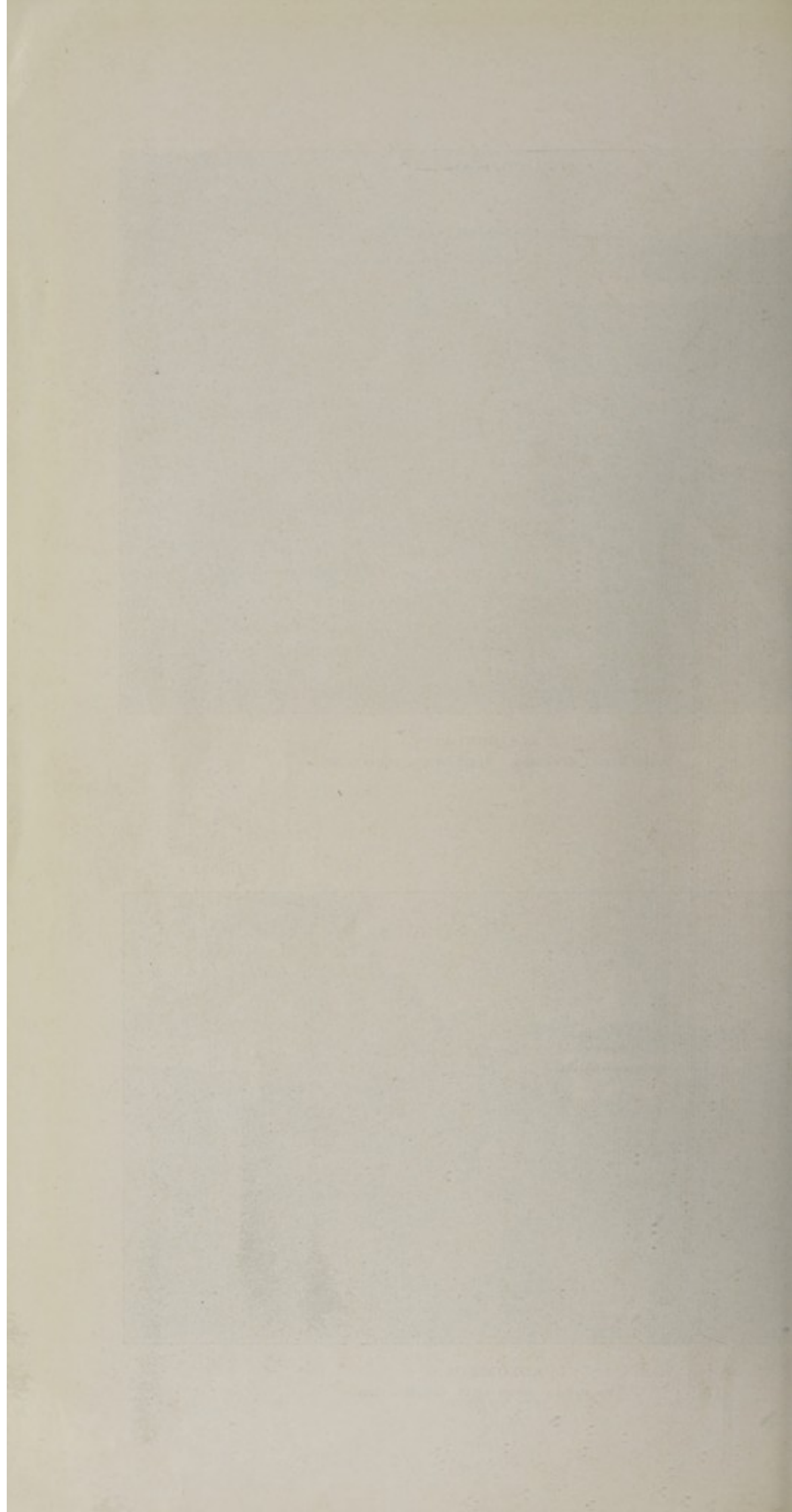




KOFORIDUA.
Kano Street drainage. Road before construction.

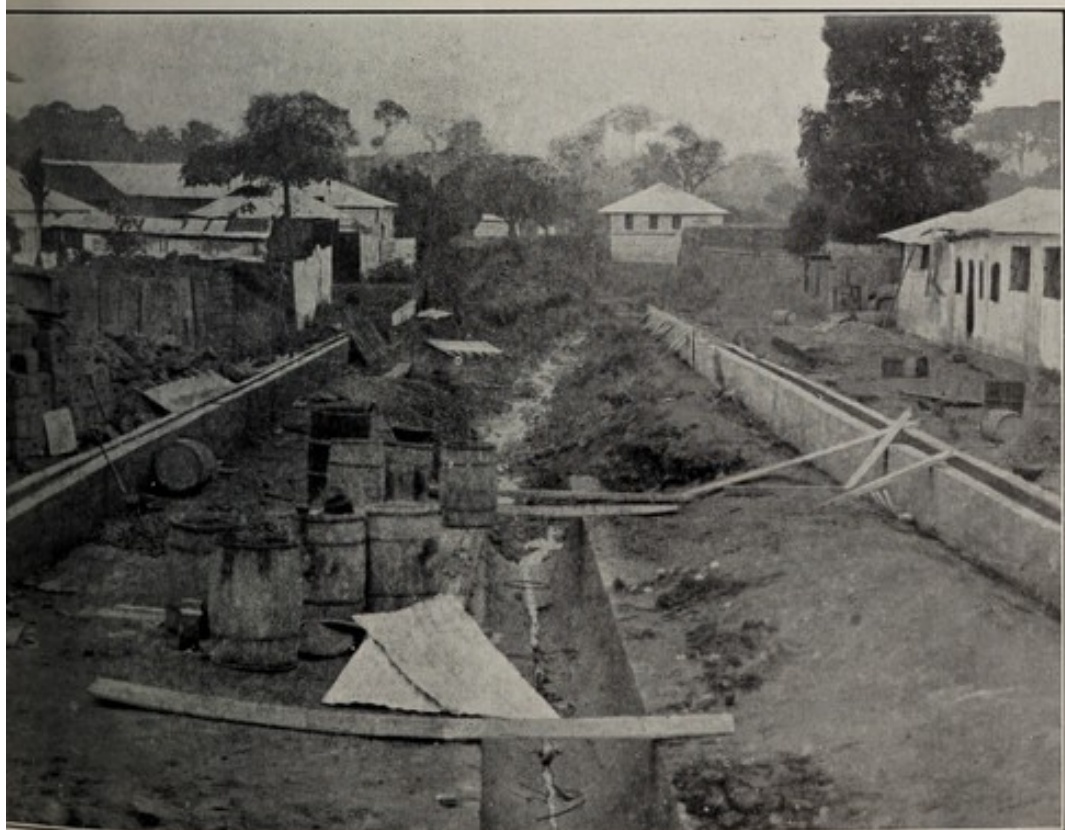


KOFORIDUA.
The same. Road after construction.

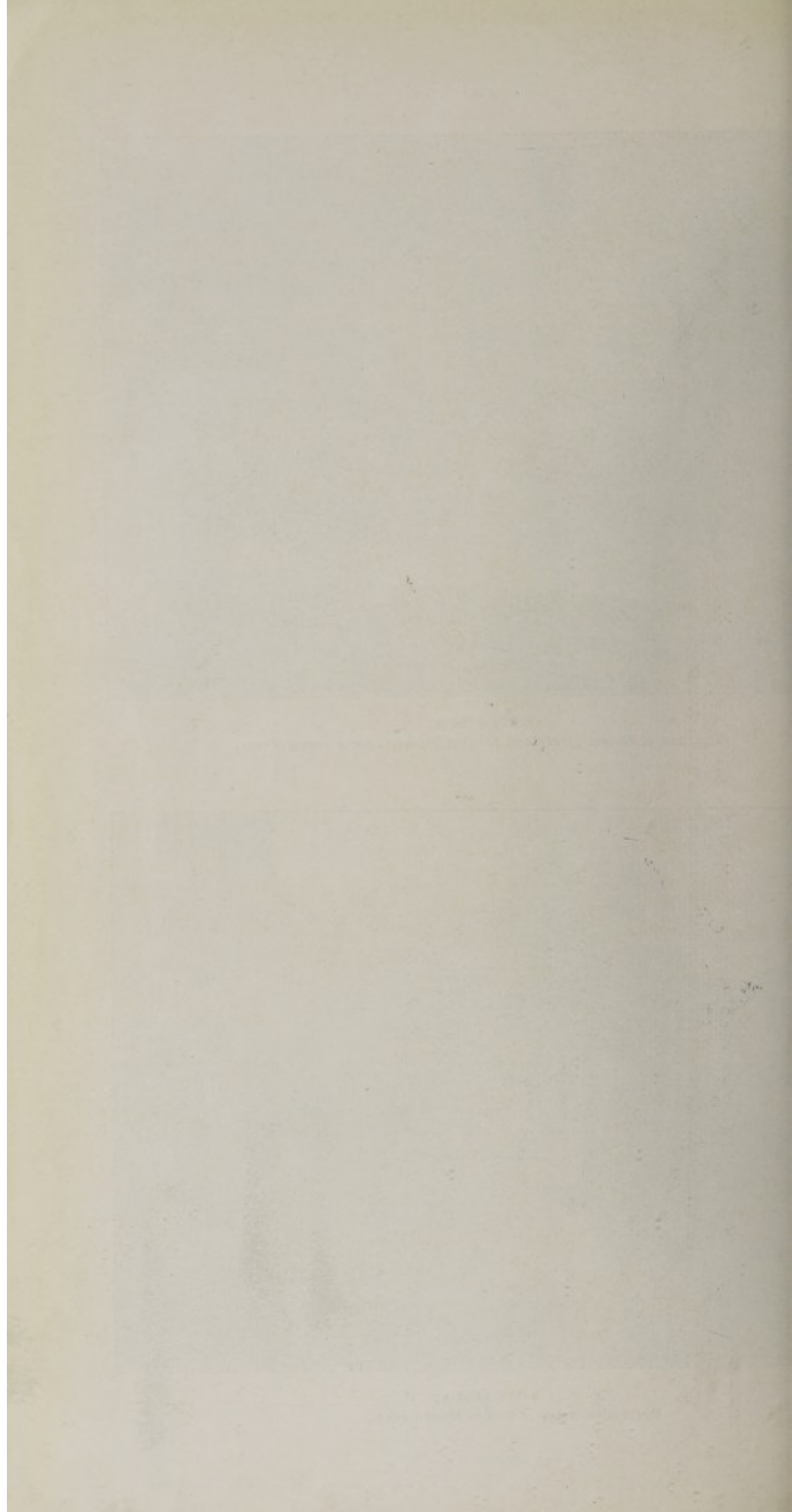




KOFORIDUA.
Junction of Queen Street and Market Street. After construction.



KOFORIDUA.
Recreation Street. Before construction.



All the large centres progressed with their main drainage schemes, especially Kumasi and Koforidua.

In Accra, most of the surface-drains carry their semi-sewage contents straight into the Korle lagoon.

A scheme has been elaborated to connect up their outfalls by means of a concrete drain and run the sewage contents into a collecting-tank, from which the sewage will be pumped through a rising main into the sea.

The tank is progressing rapidly and it is hoped this scheme will be working at an early date.

(d) WATER SUPPLIES.

It is pleasant to be able to report much good progress during the year.

A draft scheme has been prepared by the Senior Hydraulic Engineer for a supply of pipe-borne water to Tamale town. The scheme entails the impounding of water in the head of the Jonduli valley. It will necessitate moving two villages, and the cattle market. The trenching-ground will have to be moved about a quarter of a mile.

An excellent bed of white clay exists which will make the keying-in of the proposed dam an easy matter.

It is proposed to subject the water to a process of rapid filtration and chlorination, after which it will be pumped up to gravity distributing tanks.

The need for a pure water-supply in Tamale is an urgent one.

The Kumasi scheme has been sanctioned and the work is about to proceed.

The commencement of this work will mark a tremendous sanitary step forward and its completion is eagerly looked forward to.

The Koforidua supply is at present undergoing investigation by the Senior Hydraulic Engineer.

A supply for Koforidua is a matter of urgency.

At Accra, a million-gallon distributing tank has been completed on the high ground to the west of the Dodowa road three miles from Accra.

Samples are taken of the Accra, Sekondi and Takoradi water weekly, which are subjected to bacteriological examination.

Takoradi and Sekondi, while not producing quite the same uniform results as Accra, on the whole have been good.

During April and May, 1929, results were irregular, particularly with regard to Takoradi residential area and the harbour area; for the remainder of the year, however, the results were uniformly satisfactory.

Very creditable progress was made in Ashanti during the year in such towns as Tekiman, Kintampo town and cantonments, Attabubu Zongo, Intonsu, Juaben, Kumawu, Akrokerri, Fomena, Berekum, Chirrah, Odumasi, Yamfu, Kumasi cantonments, Chibe, Danso, Boanim, Wiemoasi, Damang and Insuta-Mampong (second supply).

Most of these water supplies are in the nature of concrete tanks provided with a sand-filter chamber, the water being delivered through pipes.

Many quite small Ashanti villages have vastly improved their own drinking water supplies.

The majority of these villages suffered from guinea-worm and applied for aid.

In many cases in Ashanti it is found that by digging down 12 feet or so a thick bed of white china-clay is struck. If this is gone through, water of a high chemical purity is usually obtained. The well is then lined with 4' lengths of reinforced concrete pipes of one metre internal diameter.

These pipes are made by a local Italian contractor and are supplied to the Health Department at the cost of £1 10s. per pipe.

The people themselves supply the stone, sand, labour and often half the amount of the cement required.

The Ashanti is keenly alive to the advantage of having a good water supply. He will work hard himself and often will meet a large proportion of the cost of material.

The inhabitants of the rural areas in the Colony, as a rule, are somewhat apathetic in such matters.

(e) OFFENSIVE TRADES.

As a general rule offensive trades are of no very great importance. Hides are cured to a small extent in various centres.

In Kumasi, one European firm does a fair amount of curing.

No great difficulty has arisen with regard to control.

Fish-curing in some of the coast towns is a nuisance and in most large centres special areas are marked out for this trade.

If done generally in the compounds a grave nuisance results.

In some inland places recuring of fish is carried-out, i.e., imperfectly cured fish, when putrefaction commences, is subjected to a second process. This industry can be very noisome, and requires careful control.

(f) CLEARING OF BUSH AND UNDERGROWTH.

This is a necessity of the first importance as rank grass and low bush are far too tempting a cover for the deposit of all kinds of filth.

The clearing is carried out as often as funds permit, and to be effective in the rain-belt must be done at least once a month.

In the larger centres in the dry season the hoe is substituted for the cutlass and the "elephant" and "spear" grass hoed-out.

In the long run this improves matters, producing a finer, more easily controlled grass.

In most large centres areas are planted annually with dhub grass.

An area over which dhub has once taken root presents little further difficulty. The process is slow, but is well worth the time, especially in and around residential areas.

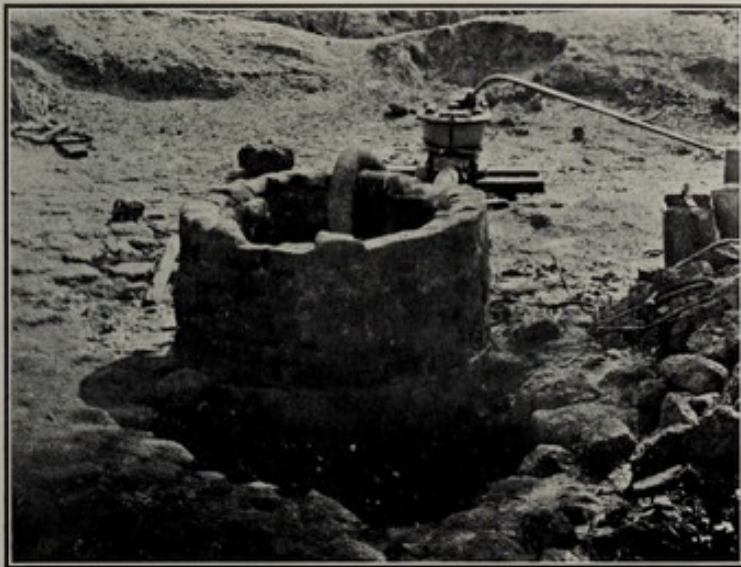
(g) SANITARY INSPECTION AND PROSECUTIONS.

During the year 840,725 house-to-house inspections were carried out as compared with 714,616 during the previous twelve-monthly period.

Table XI show the results of these inspections in five large centres.

TABLE XI.

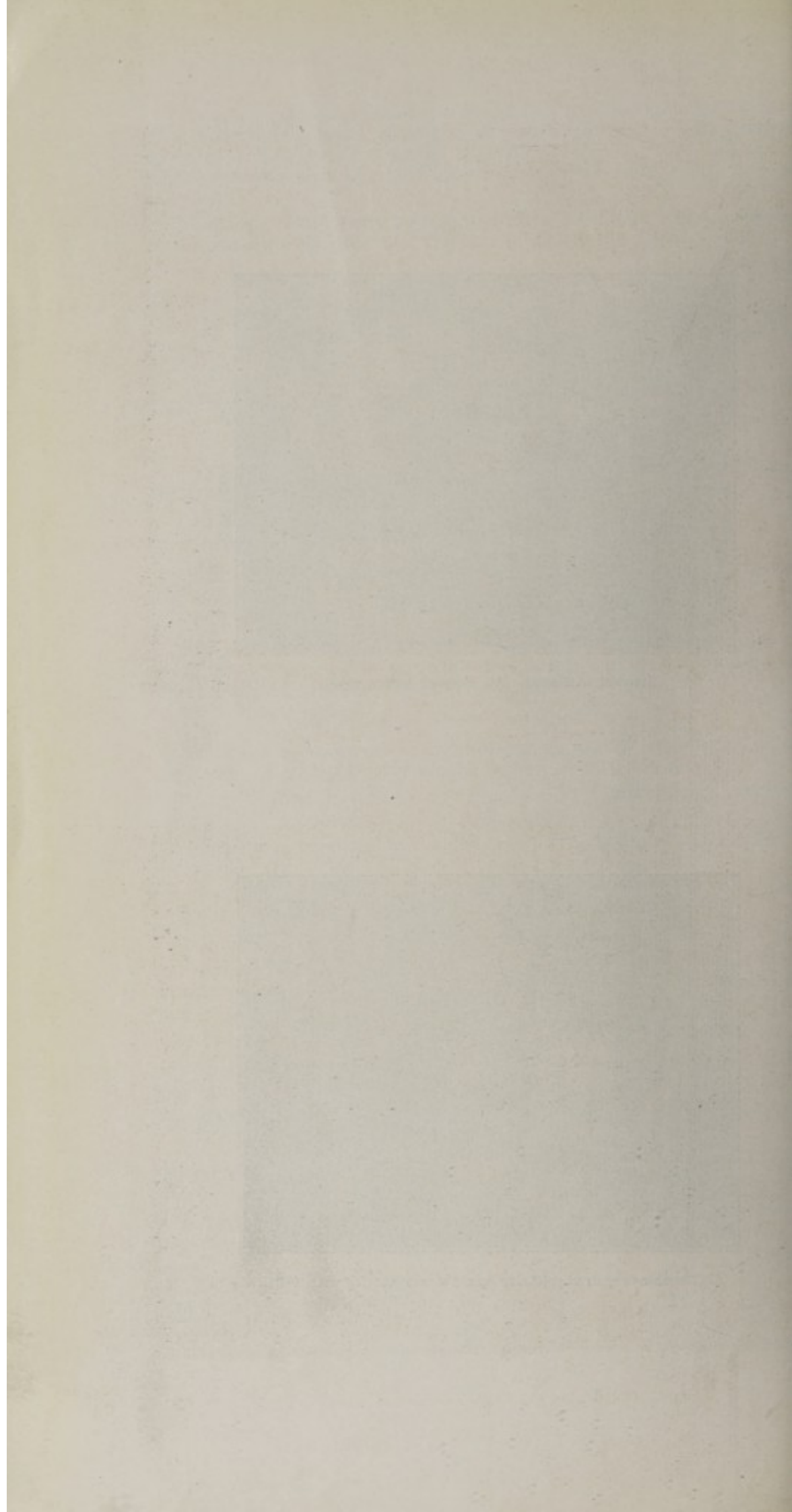
	Premises inspected.	Convictions for larvæ.	Fines for larvæ.	Insanitary conditions. Convictions.	Fines for insanitary conditions.
			£ s. d.		£ s. d.
Accra	158,741	613	449 0 0	3,103	837 4 0
Kumasi	56,140	544	280 0 0	2,605	934 4 0
Cape Coast	53,635	333	163 10 0	317	77 5 0
Sekondi	50,871	163	128 12 6	786	233 10 6
Koforidua	32,393	283	115 13 0	423	167 17 0



Sunyani (Ashanti). An old well before repair.

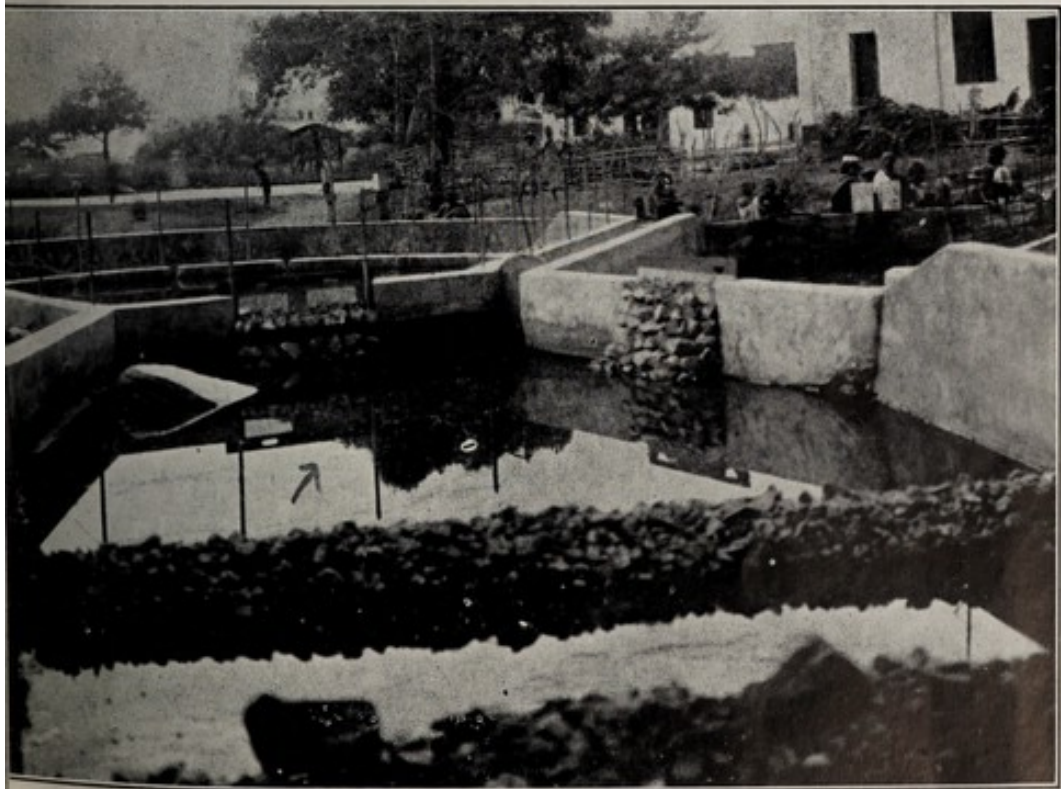


The same repaired. (Pump on right unconnected with well).

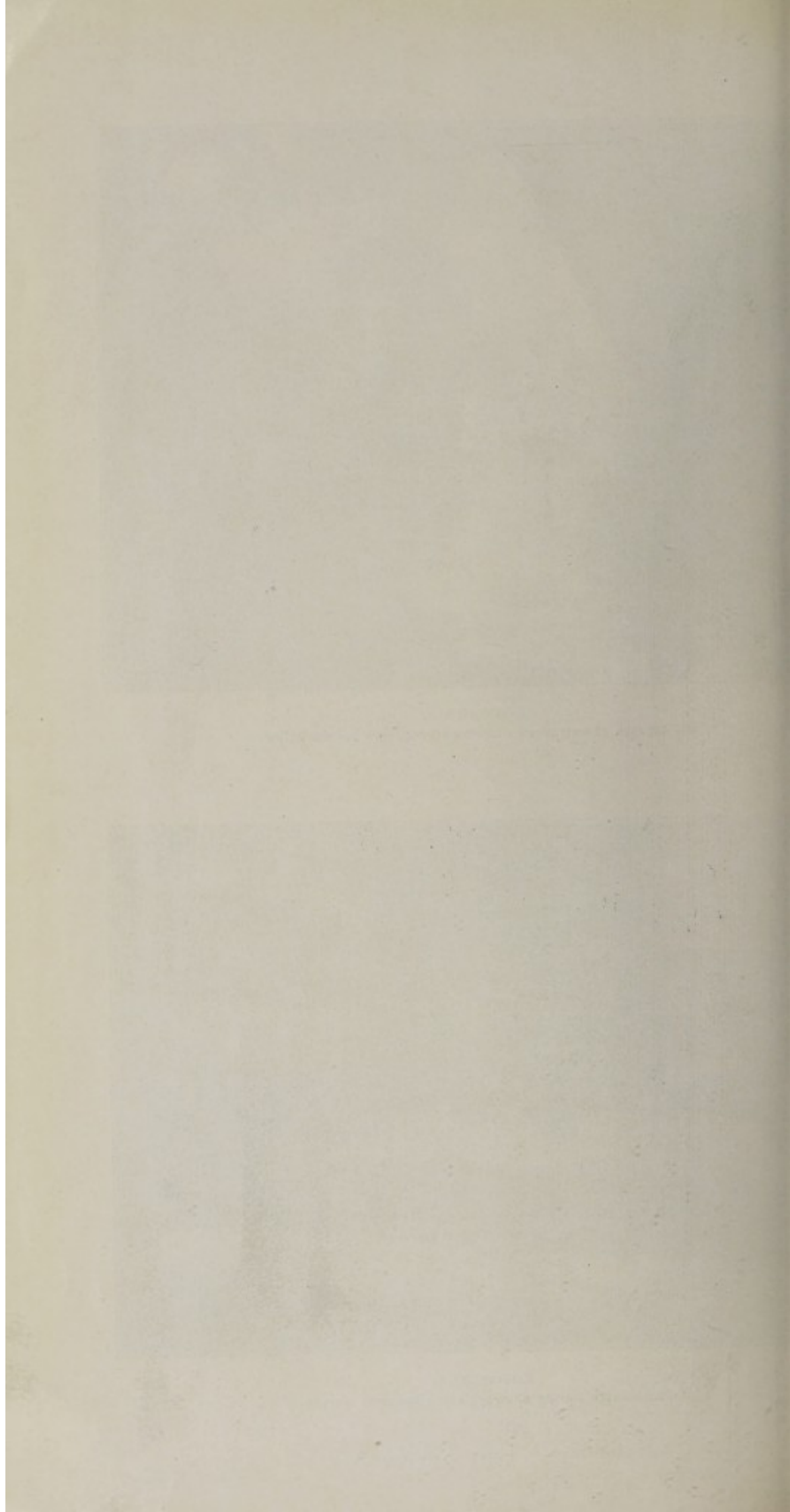




KOFORIDUA.
Su Stream at entrance to Catchwater Basins shown below.



KOFORIDUA.
Catchwater Basins showing stone barriers across.



Taking the Gold Coast as a whole 25,738 convictions were obtained for larval and insanitary nuisances, the fines resulting totalling £9,351 9s. 9d.

In 840,725 premises inspected, larvæ were found in 8,829 giving a larval index of 1.5. The fines for larval cases totalled £2,958 12s. 6d.

There is not the least doubt but that continual house-to-house inspection is one of the greatest factors in safeguarding the public health.

III.—SCHOOL HYGIENE.

The Medical Officer of Health, Accra, must be credited with an effort which has brought to light a very bad state of affairs in many non-assisted schools.

The Health branch of the Medical Department has lately applied for legal power to control these institutions which at present cannot be touched by either the Health Department or the Education Department.

The following extracts are given from the annual sanitary reports from various centres :—

The Medical Officer of Health, Accra, reports:—"Gross overcrowding is the general rule."

Keta :—"Accommodation is slightly cramped."

Tarkwa :—"Schools large and well ventilated."

Cape Coast :—"Some rather overcrowded latrine accommodation very inadequate."

Nsawam :—"Lack of latrine accommodation."

Sunyani :—"A school in charge of a European had no latrine a very bad example for African teachers."

Medical Officers in charge of welfare centres examine all children on commencing school life, and the children are brought up from time to time in batches throughout the year.

TABLE XII.—SUMMARIES OF THE DEFECTS FOUND.

	Total Scholars.	Defective.	Percentage defective.	Spleen.	Heart.	Lungs.	Debility.	Skin.	Mouth and teeth.	Throat and tonsils.	Ears.	Eyes.	Glands.	Nervous System.	Deformities.	Unvaccinated.	Yaws.
Accra (N'borg)	1,078	836	77.5	40.2	4.3	4.8	15.8	25.5	18.9	26.7	1.1	3.0	77.0	0.5	26.2	34.3	16.2
Kumasi	588	455	77.3	35.3	5.2	1.0	—	16.1	22.9	25	0.1	8.8	73.4	—	1.5	39.7	5.1
Sekondi	843	624	74.0	31.3	2.1	1.1	0.1	8.1	12.0	20.1	0.3	19.8	17.0	—	5.6	33.2	1.0
Cape Coast	596	314	52.6	12.0	2.3	—	—	4.1	22.4	8.0	—	4.5	29.6	0.1	—	7.8	2.1

It has been found impossible during the period under review to subject all school children to periodic medical inspection and the examinations have to a great extent been confined to children commencing their school career.

This has been chiefly due to the large amount of work thrown on the Medical Officers of the welfare centres in the nature of routine infant and ante and post-natal welfare work which has grown to such a great extent during 1929-30.

These records must, therefore, be considered as representing the physical condition of school children on beginning school life, rather than the average standard met with. Many of these children come from country districts outside the town areas supplying these records, and such children always reveal a lower standard of physical fitness.

Again, the children starting school for the first time do so between the ages of five and ten years, and all the reporting Medical Officers lay stress on the decreased percentage of enlarged spleens from 12 years of age and upwards.

Deformity also calls for brief consideration.

What constitutes "deformity" largely depends on the personal factor of the examining officer.

Probably the commonest deformity reported is umbilical hernia.

This condition being commonly seen in infancy has in the majority of cases disappeared by 14 years of age. It has been found not possible, with the present staff, for the Health branch to undertake the routine inspection of all school children and submit careful records of defects under age-groups, which this important section of preventive work demands if the records are to be of full value. This will be still more difficult next year with a diminished staff.

The attendance at school clinics in four centres for minor treatment is as follows :—

TABLE XIII.

	1927-28.	1928-29.	1929-30.
Christiansborg	888	2,152	3,176
Sekondi	7,542	3,274	2,152
Chama	—	1,426	479
Cape Coast	—	281	1,879

IV.—LABOUR CONDITIONS.

5,100 deck passengers and 362 Kru immigrants were examined at Accra during the year, and at Takoradi a total of 2,994 deck passengers, including Kru immigrants.

It is impossible to estimate the number of immigrants arriving in the Gold Coast *via* the land frontiers, but it must be very considerable.

These immigrants swell the ranks of the Northern Territory labourers which pour down the roads centring on Kumasi prior to and during the first quarter of the cacao season.

During the year, in spite of the fall in cacao prices, the number of these would-be labourers did not appear to fall off to any great extent.

In Kumasi, so many of these men arrived in a condition unfit to work, and so many were picked up in the town and along the North Road in the last stages of exhaustion that something had to be done for them.

A poor home, or "Refuge" as it is called, was therefore, instituted in the Kumasi Zongo.

This institute is controlled by the Health department of the Kumasi Public Health Board, assisted by Malam Sallow Katsina, the Serikin Zongo.

This institute is now well known and the debilitated and exhausted, on arrival at Kumasi, are taken in and deloused, cleaned, fed and housed until they are in a condition fit to fend for themselves. Without the aid of a humane and public-spirited Seriki this institute, which is a great success, would inevitably be a failure.

Even in the quiet period of the year between the cacao crops, the average number housed in the institute rarely falls below twenty per night.

The Medical Officer of Health, Accra, in his report, stresses the need for some such provision in Accra and adds—"Houses are not available for labourers and rents are exorbitant."

V.—HOUSING AND TOWN PLANNING.

Considerable progress has been made in Accra during the twelve months.

Labadi layout is complete and the extension to Adabraka finished.

Good progress has been made to the north and east of Christiansborg where the building of good houses is going on rapidly.

The Medical Officer of Health strikes a note of warning when he writes as follows :—

"In the meantime the congested areas of Accra are a serious menace to health and unless Government is prepared to spend an enormous sum of money in paying compensation for the insanitary huts these areas must remain a serious and constant danger to the health of the community."

This statement might well apply to the great majority of the larger centres in the Gold Coast.

In Kumasi, although the building of mercantile premises has slackened off, the building of a good type of dwelling-house in the residential areas of the town has gone ahead rapidly in Ashanti New Town and New Asafu.

Layouts have been made of the Amakom, Dechem, the old Zongo area and the new Zongo area to the east of the Accra railway.

Throughout Ashanti generally good progress has been made in the larger centres such as Mampon and Sunyani. Work at Juaso and Konongo has been somewhat delayed owing to the necessity arising for the re-survey of the town areas.

The most marked progress has been made in the smaller centres and the villages.

These layouts are made by a staff of Village overseers working under the Senior Health Officer, Kumasi.

The layouts are based on a type plan and houses of standard types are erected.

The Ashanti chiefs and people have taken to the new villages with alacrity, and it is to be regretted that lack of staff alone necessitates many of these villages being put on a waiting-list for their layout.

Approximately 150 Ashanti villages are working on their layout, some of these are of large size containing sometimes as many as 280-300 plots of a standard size of 60 feet by 80 feet.



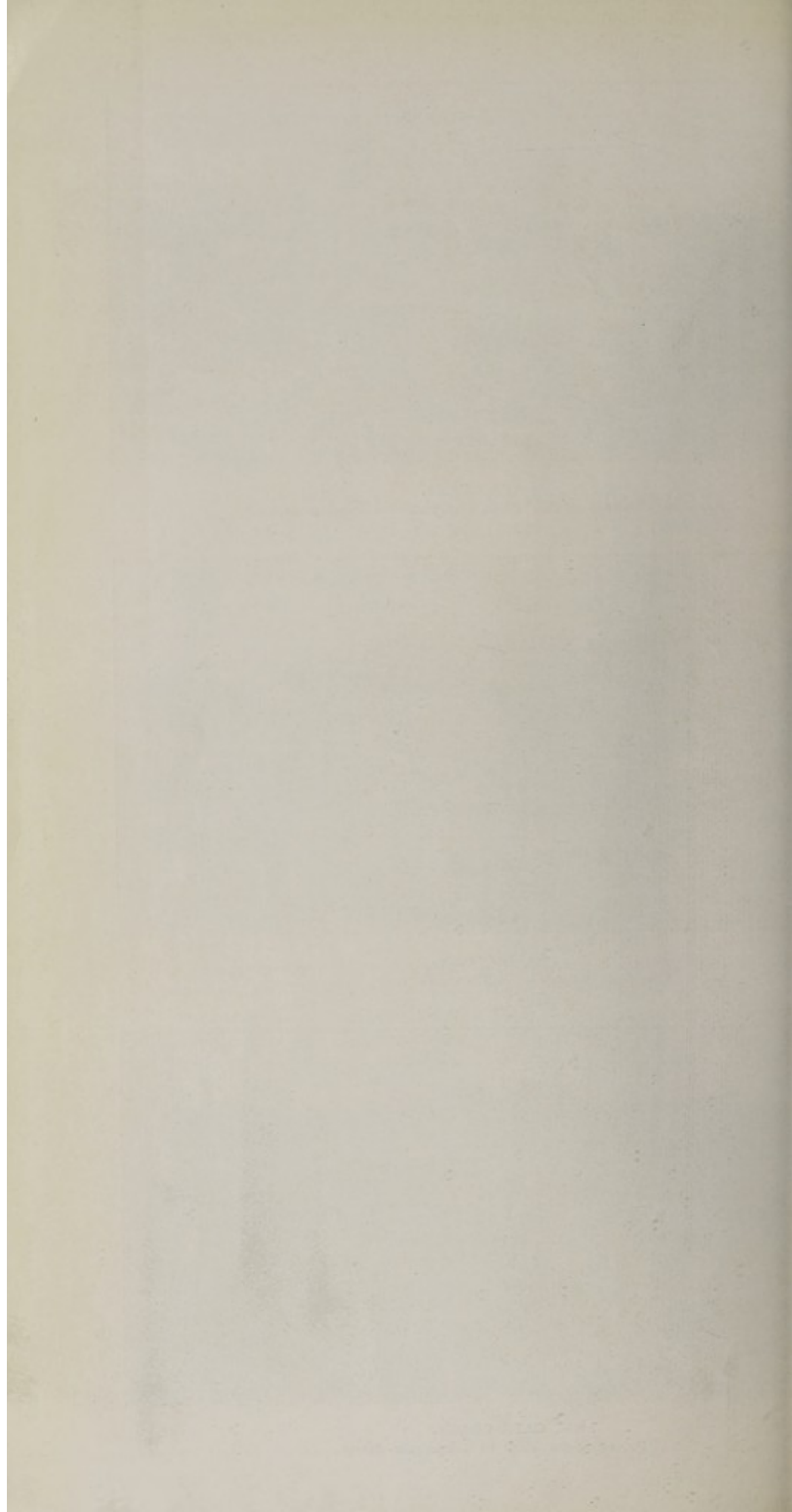
CAPE COAST.
Insanitary houses on Castle Hill seen from Commercial Street.



CAPE COAST.
Insanitary houses looking towards Rocky Lane.



CAPE COAST.
Primitive dwellings in Kotokoraba Zongo.



The progress in Ashanti during the last four years has been very great, but in view of the general trade depression the future is viewed with no little misgiving.

There is not much trouble in getting the "swish" walls built, but the roofing of the rooms is now a matter of some difficulty. Galvanized iron is still the cheapest permanent material in use. Formerly 'shingles' were commonly used, but now the 'shingle' makers cannot compete with the cheaper brands of galvanized iron. 'Shingle' making, once commonly seen, is now a rarity.

The people themselves do not wish to return to the "shingles" for the life of such a roof is only about six years.

In the Northern Territories, a layout is in progress in Tamale, and considerable advance has been made in the Moshi Zongo and Tishugu areas.

The standard types of houses devised for erection in the Ashanti villages have been adopted by the Tamale Sanitary Committee for local use.

This will insure uniformity and enable the work to proceed apace.

The housing conditions in the Kumasi cantonments, both as regards British non-commissioned officers and the African rank and file, are going to receive consideration during the coming year as they are not at present satisfactory.

At Takoradi, more bungalows are urgently required for European officials, more especially for the Harbour staff.

VI.—FOOD IN RELATION TO HEALTH AND DISEASE.

It is well known that in many centres in the Gold Coast large sections of the community have made very radical changes in their dietary, of late years tinned meat and fish being partaken of in increasingly large quantities.

The present is referred to by one influential chief as "the day of the tin and the bottle."

So far, little deterioration can be noted as a result of this change and it must be left to the future to be made clear.

During the registration (calendar year) 1929, the number of deaths certified as due to deficiency diseases totalled eight, comprising four cases due to beri-beri and four to rickets.

Mr. R. G. Connolly, Superintending Sanitary Inspector, has made some interesting experiments with regard to "blowing" of apparently sound tins containing pilchards when exposed to sunlight for short periods.

This series of experiments is not yet complete, but would show the need for care on the part of shippers of such foodstuffs.

The Medical Officer of Health, Cape Coast, has drawn attention to the importation of pork (barrelled in brine) which has been deprived of all lymphatic glands.

He states "this dissection has been done for a purpose."

It would appear that tuberculous meat is being imported into the country.

A test case is being brought at an early date before the Courts to decide as to whether the Health branch is in possession of sufficient legal power to deal with such meat.

It has yet to be seen to what extent the visitations of locust swarms to various areas last year will influence available vegetable foodstuffs this year.

No very exact information is to hand, but in some areas considerable anxiety is felt.

INSPECTION AND CONTROL OF MARKETS, ETC.

Markets.

Daily inspections of markets were undertaken by officers of the Health branch of the Medical Department throughout the year.

Forty-two prosecutions were instituted in respect of the sale of unwholesome food during 1929-30.

The sum of £19 was collected in fines.

The question of the hawking of food is one which causes the Health authorities of the large centres much uneasiness.

Food is hawked in crowded, dusty thoroughfares. The women sit about in crowds unless moved on and are often responsible for traffic obstruction.

Their trays of food are carried with them into public latrines or left outside, often attracting visitors in the form of inquisitive dogs.

The whole system of food-hawking is most unhygienic and the sale of food should be confined to well-regulated stores which are fairly easily controlled, or public markets.

The health authorities receive little or no support from the general public with regard to the control of food-hawking.

SLAUGHTER HOUSES.

In the larger centres slaughter-houses are under constant supervision and on the whole are satisfactory.

Many of the smaller centres require the provision of slaughter houses or slaughter-slabs.

Tamale slaughter-house is under the direct supervision of the Veterinary department where the veterinary learners undergo an excellent course in meat inspection.

Aerated Water Factories.

These in the larger centres are controlled and regulated by bye-laws.

They are regularly inspected and samples of the water produced are sent up regularly for bacteriological examination.

Bakeries.

These are regularly inspected and in the large centres require to be licensed.

Fly-proofing, dust-proof ceilings, concrete floors, proper ventilation and a sufficiency of storage shelves are required.

Fish Stores.

In Kumasi these must be licensed. The fish has to be stored in rat-proof, wire-gauze safes raised from the floor and standing clear of the walls.

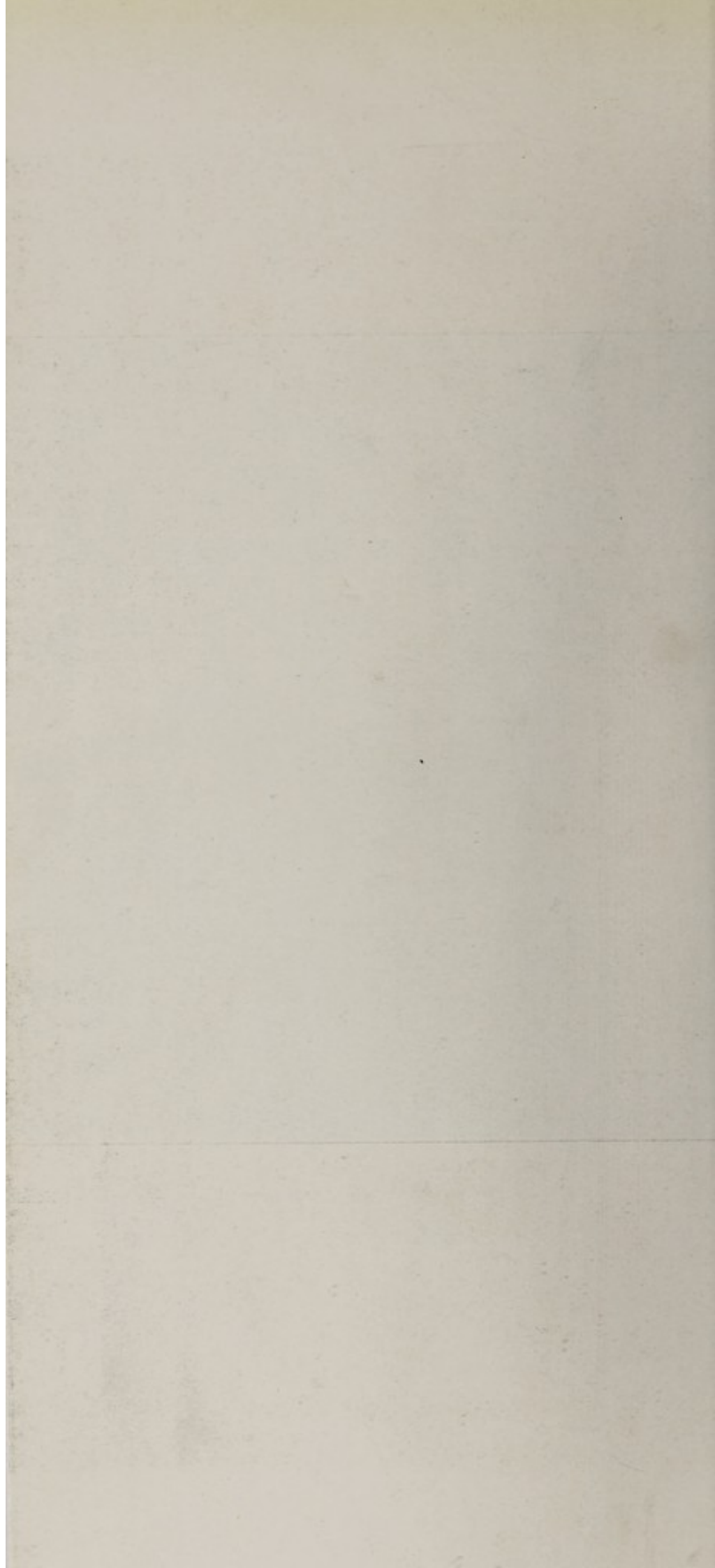
B.—MEASURES TAKEN TO SPREAD THE KNOWLEDGE OF HYGIENE.

(a) Hygiene is taught in the schools and practical interest is fostered by the holding of "Health Weeks."

"Health-Weeks" are held in the larger and many of the smaller centres annually.



ACCRA.
London Market under construction, showing old and new sheds.

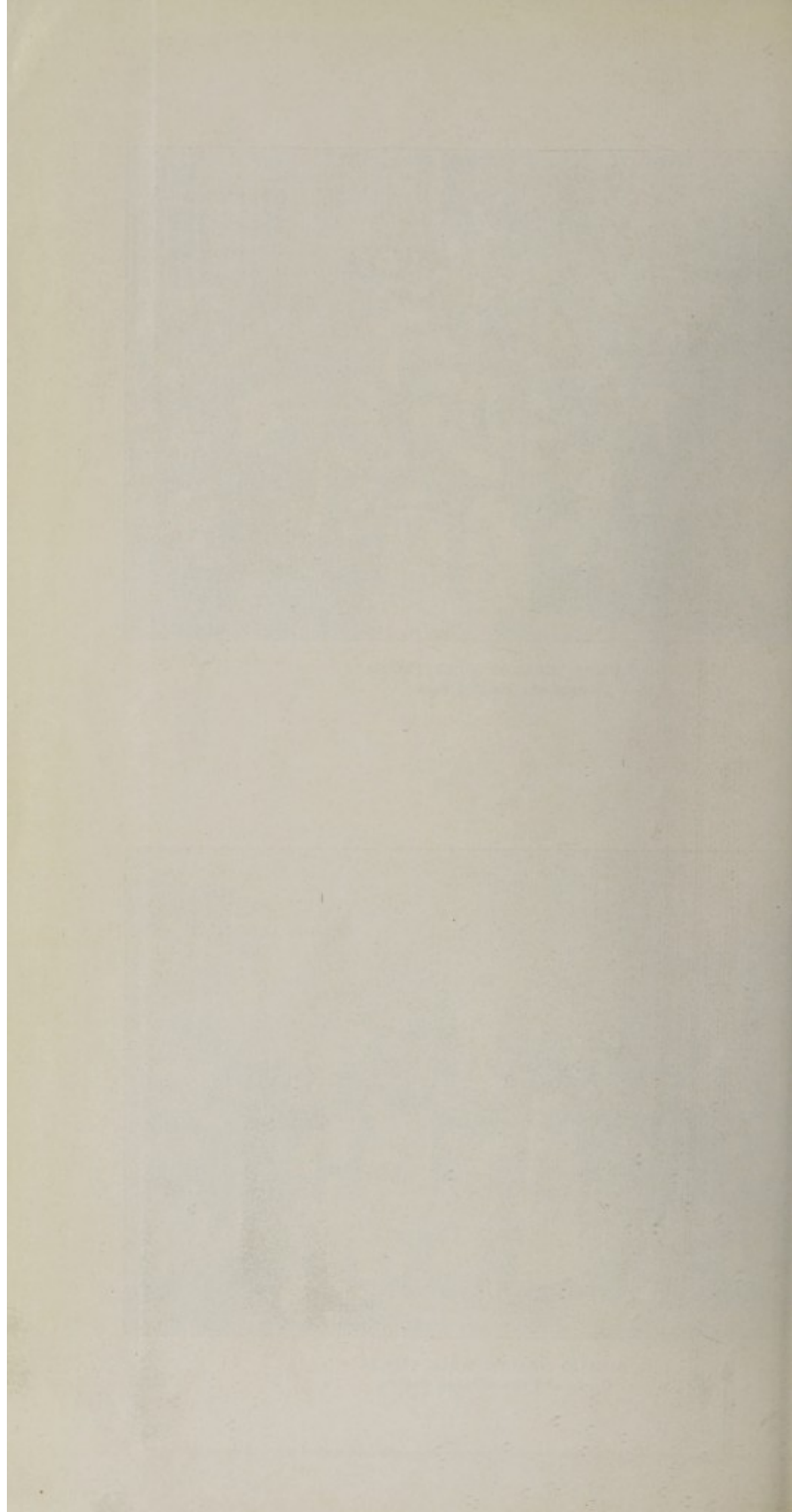




KUMASI HEALTH WEEK, 1929-30.
Babies in Judging Pens.



KUMASI HEALTH WEEK, 1929-30.
Group of Prize-winning Babies.



A challenge cup has been presented by the Health Week committee in Kumasi for annual competition in an inter-school "cleanliness" contest.

This is given to the school which is decided to be the most satisfactory in every way with regard to the cleanliness of buildings, the scholars themselves, and the grounds and annexes of the school.

Challenge cups are also available in Kumasi for competition in garden-produce and physical drill displays.

These events take place during "Health Week."

In most centres lectures are given to the scholars of the various schools by officers of the Health and Medical branches of the Department.

The Medical Officer of Health, Cape Coast, gave periodic addresses to the Tribunal Registrars which were a great success.

The Medical Officer of Health, Winneba, held friendly discussions on health matters with the Omanhene, elders and citizens of Winneba.

One of the most important educative factors in spreading a knowledge of hygiene is the house-to-house visiting by ladies of the Gold Coast League for Maternity and Child Welfare.

These ladies do a lot of good work by getting into close touch with the mothers in their own homes and discussing with them problems with regard to house cleanliness and the rearing of babies and children.

The ladies of the League meet once a month and are addressed by Medical and Health Officers on subjects bearing on their activities.

In Ashanti, the Senior Health Officer loses no opportunity in bringing home to the chiefs and people the various requirements of hygiene, during his extensive travelling. The trained Village Overseers are continually engaged in propaganda as they tour round their districts superintending layouts or on inspections.

(b) TRAINING OF SANITARY PERSONNEL.

A special training officer is employed in Accra for the purpose of training sanitary inspectors in practical and theoretical knowledge.

The course extends over a period of three years, when the young Sanitary Inspectors-in-Training are drafted to the various outlying stations.

The Senior Health Officer, Kumasi, runs a school for the training of Village Overseers in which he is assisted by Village Overseers of some experience.

These Village Overseers in Training are drawn on to fill vacancies in the permanent staff of Village Overseers as vacancies occur in Ashanti or the Colony.

The Medical Officers of Health of Kumasi, Sekondi, and Cape Coast undertake the training of their own Municipal Inspectors.

(c) RECOMMENDATIONS FOR FUTURE WORK.

1. (a) That satisfactory pipe-borne water supplies be provided for Tamale and Koforidua with the least delay possible.

The conditions in these two populous centres with regard to water-supply are urgent in the extreme.

(b) That the investigation of the possibilities for supplying good water to populous, rural communities be persisted in, and such places after investigation be placed on a waiting-list, in order of urgency, and be dealt with as opportunity arises.

(d) That a sum of money be set aside yearly for the improvement of water supplies in the Northern Territories.

These will usually take the form of wells.

Much good work has been, and is being done, on these lines and it is considered that extra financial aid should be afforded.

2. That a maternity block be provided at the Kumasi Welfare Centre. The growth of the ante-natal work at this centre makes the provision of such accommodation a matter of great importance and desirability.

3. Last year it was recommended that a water-carriage system of night-soil disposal be instituted in Accra and Sekondi and that motor-conservancy systems be introduced at Dunkwa, Tarkwa and Winneba. Takoradi should now be added to this list.

It is considered that the feasibility of simple, non-costly septic latrines has been proved over this year's experimental work.

This method is undoubtedly the least costly of all and it is urged that these experiments may be continued.

The problem would then be reduced in Accra and Sekondi to a central water-carriage system, with septic latrines for all areas except those on main thoroughfares in the very centre of the towns.

True, the people must be educated in their use, but it is thought that such education will not be more difficult with the septic latrines in view than with a water-carriage system.

4. That the reclamation scheme for Korle lagoon, Accra, be pushed on as fast as possible, and if practicable, further financial aid afforded for the acceleration of the work.

5. That the question of the Kumasi cantonments be considered, and that the housing of the British non-commissioned officers be taken in hand without delay.

6. That village sanitation work be commenced in the Northern Territories, and that a yearly grant be made in order to commence the training of Village Overseers at Tamale. Plenty of intelligent, local candidates can be obtained and every facility for their training exists at that important centre.

W. M. HOWELLS,

for Deputy Director of Health Service.

IV.—PORT HEALTH WORK AND ADMINISTRATION.

The following extracts are taken from the Port Medical Officer of Health report :—

" The number of vessels boarded during the year has been 665. One vessel, the s.s. *Jebba*, called at Takoradi on 6th December, 1929. This vessel had had a case of small-pox on board which was put ashore at Lagos, where the ship was disinfected.

" The quarantine period of the disease had not expired by the 6th December, and the vessel was dealt with under regulation No. 17 of 1928 made under section 3 of the Quarantine Ordinance.

" All cases of sickness are reported to and referred by the Port Medical Officer for treatment.

" One case of chicken-pox was discovered on M. V. *Appam*.

2,992 deck passengers were landed and passed through the disinfecting station, those from infected ports being subjected to disinfection and surveillance for the required period.

" Of the 2,994 passengers landed 2,055 were subjected to re-vaccination.

" All vessels arriving must fly the " Q " flag until *pratique* is given.

" Under regulation No. 12 of 1924 the Visiting officer has power to grant *pratique* in certain circumstances.

The Medical Officer boards all vessels in the port and in cases where the Visiting Officer decides not to grant *pratique* he awaits the arrival of the Medical Officer who can then grant or withhold *pratique* in accordance with the regulations of the Quarantine Ordinance.

" Regulation No. 24 of 1928, section 117-120, gives the Medical Officer power to insist on ships taking certain precautions with the view to preventing the migration of rodents.

" Most vessels provide their own rat-guards, but during the year seven rat-guards have been hired by vessels from this Department.

" 1,301 rats have been caught in the harbour area this year. A bacteriological examination of all rats caught is made every two weeks by the Pathologist at Sekondi.

" No dead rats have been found in the district.

" The motor-launch continues to prove satisfactory; the average monthly cost for maintenance and repairs for last year was £4 12s. 0d.

" The average monthly cost for this year is £3 5s. 4d. and the total cost is £39 4s. 0d. The crew consists of a driver at 4s., a coxswain at 2s. 8d., and a deck-hand at 2s. per day.

" The Harbour Authority's water-boat, which has a capacity of 180 tons of water, is subject to periodic inspections and is kept in a cleanly condition."

" The bacteriological report on the water has been satisfactory.

" 3,274,693 gallons of water have been supplied to main-line steamers during the year.

V.—MATERNITY AND CHILD WELFARE.

The Maternity Hospital continues to enjoy a rapidly increasing popularity.

The following table gives comparative figures for 1929-30 :—

Number of deliveries.		Number of live births.		Attendance expectant mothers.		Total Number of in-patients.		Total Number of out-patients.	
1928-29.	1929-30.	1928-29.	1929-30.	1928-29.	1929-30.	1928-29.	1929-30.	1928-29.	1929-30.
104	252	82	208	2,811	4,181	183	418	3,599	6,224

From the health standpoint the training of midwives and health visitors is of the first importance.

At the end of 1929-30 two health visitors were passed out, and passed out extremely well, obtaining a high percentage of marks after a stiff examination.

At the end of the year three midwives-in-training were approaching the end of their course of training and will be passed out early in 1930-31 after examination.

This reinforcement will enable the work to be commenced in stations heretofore not supplied with skilled aid.

Preliminary discussions with respect to the bringing in of a Midwives Ordinance have already commenced.

The ante-natal clinics continue to enjoy steadily increasing popularity.

The figures indicating the increasing in ante-natal work at Kumasi are worthy of note.

The propaganda work carried out by members of the Gold Coast League for Maternity and Child Welfare is of the greatest utility and has gone a long way towards the popularising of both ante-natal and infant welfare work.

The best thanks of the Colony are due to these ladies for their arduous and self-sacrificing work and in particular to their President, Lady Slater.

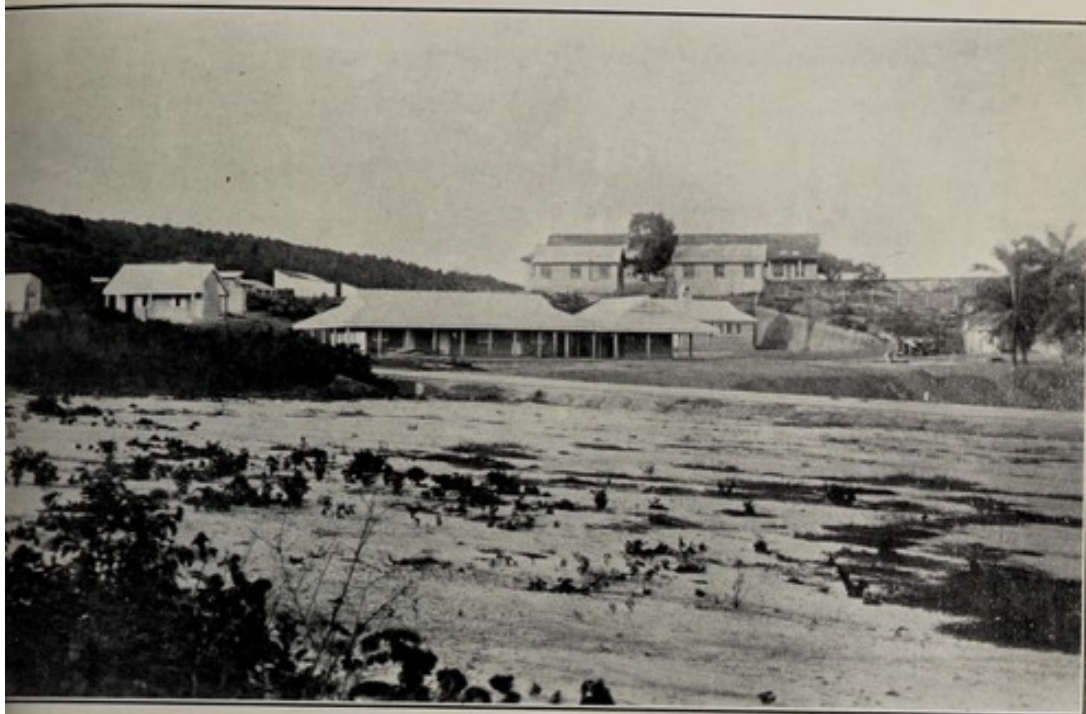
Table XV indicates the rapid growth of the work carried out at the welfare centres during 1929-30 ; special notice is invited to the growth of the work at Cape Coast.

TABLE XV.

Centre.	Attendances of children.		Attendances of expectant mothers.	
	1928-1929.	1929-1930.	1928-1929.	1929-1930.
Accra	18,938	28,902	946	1,600
Christiansborg	13,982	18,153	1,040	1,191
Sekondi	9,623	10,507	1,638	3,050
Chama	1,426	1,562	4	—
Kumasi	24,019	28,186	1,787	6,152
Cape Coast	3,838	21,878	21	1,257
Koforidua	Nil	3,487	Nil	120

During the year a new Infant Clinic and Welfare Centre was built at Cape Coast. It is considered that the number of attendances at the present temporary quarters has well justified this provision.

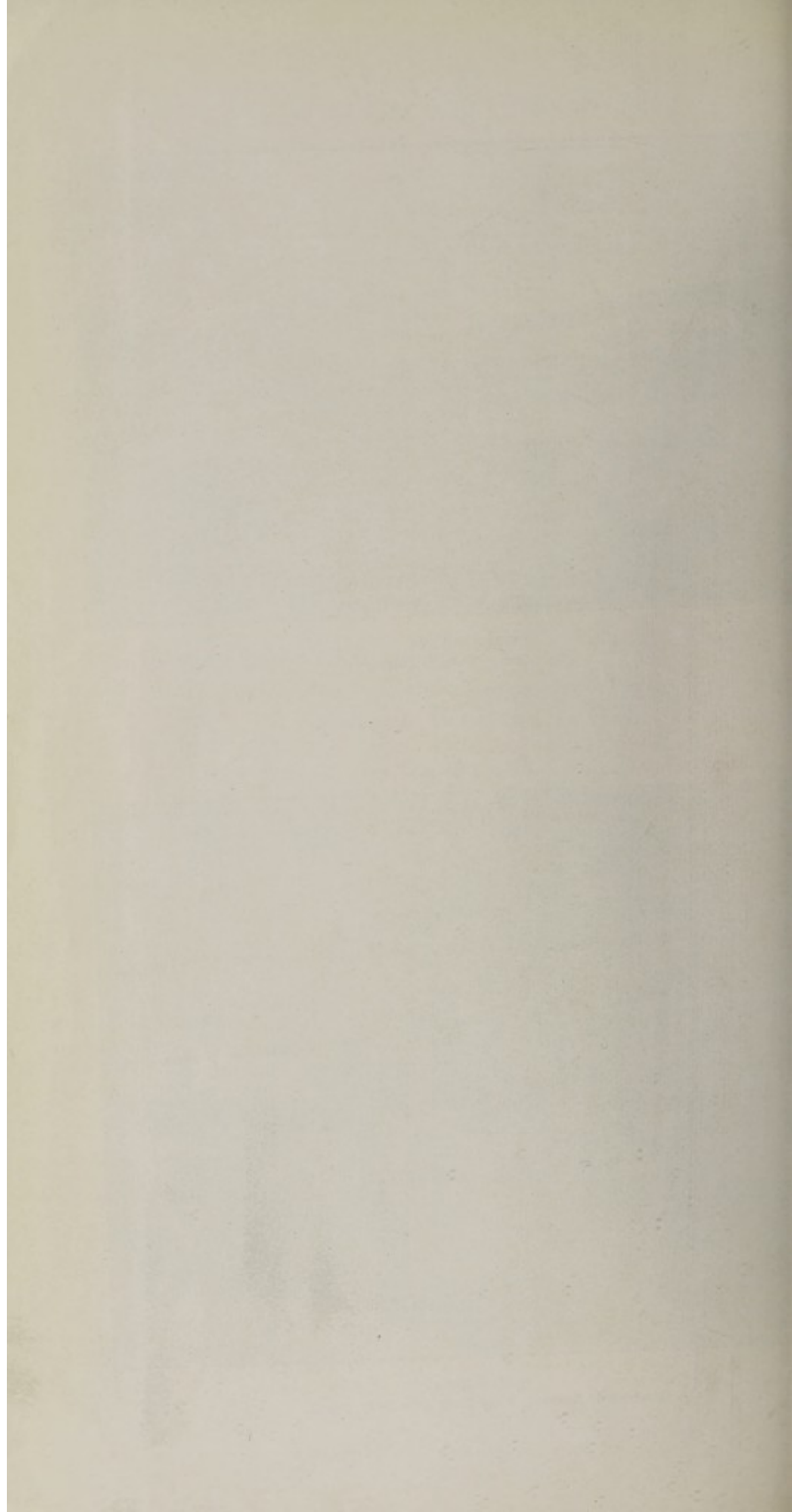
The building, however, was not quite ready for opening at the end of the year.



CAPE COAST.
New Infant Welfare Clinic.



KOFORIDUA.
Catchwater Basins. View from Broadway South.



A welfare centre was opened at Koforidua towards the end of the year in temporary quarters and has already more than justified itself.

The new clinic and welfare centre at Koforidua is nearing completion.

Good work continues to be carried out by the Roman Catholic Sisters at Kpandu in the Mandated Territory of Togoland: during the year an average of 678 cases were seen monthly.

A lot of good work also was carried out by travelling, visiting and advising in the homes of the people.

The most potent predisposing factors in infant and child mortality and morbidity would appear to be as follows:—Faulty feeding, yaws, oral sepsis during the first dentition, intestinal helminthiasis and bad housing.

The chief actual factor is undoubtedly malaria in its various forms.

The means of combating the above causes resolve themselves into education first and foremost, and steady, unremitting progress in anti-malarial work in all its branches.

It is strongly advised that the purchase of quinine be brought within the reach of all.

This could be done in "out-of-the-way" areas through post offices, schools, missions, etc., the quinine being sold in packets in which appropriate doses are done up separately and the method of administration indicated in the prevailing vernaculars.

The quinine, of course, would be sold at cost price.

It is considered that prevention should first take the form of general anti-malarial work and be followed by the "welfare," for "welfare" itself can never influence the incidence of the almost universal malarial menace.

It is considered that welfare work preceding actual "groundwork" sanitation would be a mistake from the prevention standpoint.

Maternal welfare must be, it is feared, of rather slower growth and will be dependent largely on the rapidity with which the Gold Coast parallel of "Sairey Gamp" can be replaced by trained midwives.

These midwives need not be of very high intellectual or scientific attainments, but so long as they have acquired the principles of "cleanliness" and "non-interference" as related to childbirth much good must result from their activities.

The students of the Prince of Wales College, Achimota, continue to do excellent work in welfare visiting in the villages surrounding Achimota.

VI.—HOSPITALS, DISPENSARIES, AND VENEREAL CLINIC. TABLES AND RETURNS, ETC.

At appendix A will be found a list showing all the hospitals and dispensaries in the Colony and Mandated Territory of Togoland, including the Infant Welfare centres and Contagious Diseases hospitals administered by the Health branch.

Table V gives a combined summary of all cases (both in and out) treated by both branches (Medical and Health) in the hospitals, dispensaries, and prisons of the Colony.

This table includes cases treated in the permanent contagious diseases hospitals and therefore gives all the cases treated during the year in Government institutions except the lunatic asylum. The

Venereal clinic figures are included in the out-patients' table. On table V are based the diagrams showing the incidence of infective and other diseases (facing page 7).

Table VI is an analysis giving separately the figures for the Medical branch and the Health branch. The Health branch figures are further dissected to show the cases treated at the Infant clinics and the contagious diseases hospitals.

The following five-year table shows the numbers of in-patients treated at the hospitals of the three principal centres of the Colony:—

Station.	1925-26.		1926-27.		1927-28.		1928-29.		1929-30.	
	European.	African.	European.	African.	European.	African.	European.	African.	European.	African.
Accra	258	2,372	294	2,640	286	2,724	312	2,606	300	3,087
Sekondi	228	820	172	885	224	794	224	888	216*	1,050
Kumasi	140	2,400	140	1,953	151	2,412	203	2,508	213	2,137
Total	626	5,592	606	5,478	661	5,930	739	5,982	729	6,274

*Includes Takoradi owing to the transfer of the European Hospital from Sekondi to Takoradi during the year.

AVERAGE COST PER PATIENT PER DIEM.

The average daily cost per patient per diem for the principal hospitals of the Colony during the past three years is shown below.
(These costs have been based on the expenditure for diets and provisions, fuel and light, medical comforts and kitchen staff only).

	1927-28.		1928-29.		1929-30.	
	£.	d.	£.	d.	£.	d.
European Hospitals, (Accra, Kumasi, Tamale, Sekondi, Cape Coast, Axim) average cost	6	4½	5	4½	5	5
African Hospitals, (Gold Coast Hospital, Accra, Kumasi, Tamale, Sekondi, Cape Coast, Axim, Saltpond) average cost	0	10	1	1	1	2

EUROPEAN HOSPITALS.

Accra.—The improvements in the European Hospital described in the Annual Report for 1928-29 have been greatly appreciated both by patients and staff. A further great improvement was effected during the year 1929-30 by the installation in a special section of equipment for electro-therapeutics. The new section was opened in January, 1930, and is in charge, under the supervision of the medical officer, of a nursing sister who has been trained in this branch of work at St. Thomas' Hospital, London. The section is equipped with a mercury vapour lamp, a Tungsten arc lamp and an electric switch-table capable of giving galvanic or faradic treatment, vibratory massage, high frequency current, ionisation, radiant heat and diathermy. In the short period it has been open, the section has dealt successfully with a number of cases suitable for such treatment and its services are already highly valued by the European community.

Cape Coast.—A pipe-borne water supply has been installed in the European Hospital.

Sekondi and Takoradi.—The European Hospital at Sekondi was closed on 14th November, 1929, and converted into an African Hospital. The European patients remaining in hospital at Sekondi were transferred together with the whole staff to the European Hospital, Takoradi, on that date. From the month of May, 1928, when it was taken over by Government, this hospital (which had previously belonged to the contractors for the building of Takoradi Harbour) had been in the hands of the Public Works Department for repainting, general repairs, and the erection of some minor buildings.

A good deal of renovation had been required to restore the building to a really satisfactory state and many details of equipment and staff worked out in order to effect a smooth transfer.

At the moment of writing the erection of quarters for the medical officer and nursing sisters had not been completed and quarters in the hospital had to be temporarily occupied, thus reducing the bed accommodation available for patients. It is expected that a new bungalow for the medical officer will be completed at an early date and thus render more bed-space in the hospital at once available.

AFRICAN HOSPITALS.

Accra.—The Gold Coast Hospital, Accra, continues as before its valuable work amongst the African population of the Colony.

The following table will show what is being accomplished.

STATISTICS.

	1926-27.	1927-28.	1928-29.	1929-30.
Out-patients—total	11,283	11,040	13,786	14,638
In-patients—total	2,640	2,724	2,661	3,087
Surgical operations, major ..	740	644	602	671
Surgical operations, minor ..	192	364	295	436
Average daily number in hospital	200	207	208	233

The training of dispensers for Accra itself and for all outstations is carried out in the dispensing school attached to the hospital by a Dispensers' Instructor. The work has grown to such an extent that extra accommodation will soon be required for the classes. A scheme for training extra dispensers on lines which will render them suitable for posting to dispensaries in populous areas in the bush under the regular supervision of medical officers has been worked out, and it is hoped that it may be possible to bring it into operation during the ensuing year.

With regard to the training of nurses for outstations and for Infant and Maternity centres for the Colony, this is also carried on chiefly by the Gold Coast Hospital.

It was pointed out in the report for 1928-29 that a scheme for keeping a supernumerary reserve of nurses-in-training at the larger centres in order that trained staff could be at once despatched to outstations or clinics as required but so as not to impair the efficiency of the larger centres or dislocate their work was to be put in force in 1929-30.

This was done, but the work of the hospital itself has so increased and the demands from outstations and clinics have been so great that a full course of training can seldom be completed before the nurses have to leave the hospital.

During the latter part of the year one European woman Medical Officer replaced one European male Medical Officer. It is felt that this alteration will meet a definite need of the out-patient females and children whose requirements are not met fully at the Infant Maternity centres of the Health branch.

Coal and firewood have been replaced by electricity for cooking during the year, and a much more satisfactory service has resulted.

MATERNITY HOSPITAL, ACCRA.

The appreciation of the African public of the work of this institution is as high as ever and the accommodation is constantly taxed to its utmost.

Miss G. M. L. Summerhayes, Woman Medical Officer, still remains in charge and continues to do excellent work. Her report on the work of the hospital in 1929-30 is attached as appendix F.

The question of extending the Maternity Hospital at Accra both for the purpose of dealing in the Accra area with more in- and out-patients and of training more midwives and health visitors for the Colony has been under consideration for some time as part of the larger problem of extending maternity hospital services generally. Meanwhile, as funds become available, facilities for dealing with obstetric cases in centres such as Kumasi will be created.

A scheme for the opening of a maternity centre at an early date at Sekondi is already in existence and is steadily being proceeded with.

The training of midwives still continues. Probationer midwives first undergo a preliminary course of training in general nursing at the Gold Coast Hospital before undergoing training in midwifery at the Maternity Hospital and it is expected that the first girls to have received a full training in midwifery will be passed out during the coming year for absorption into the staff of the Health Branch or for private practice in midwifery, as the girls themselves elect.

A Midwives Ordinance for the control and regulation of the practice of midwifery by midwives is being drafted and will probably come into force during 1930-31.

TAKORADI AND SEKONDI.

In the Annual Report for 1928-29 it had been stated that a scheme for the conversion of the present European Hospital at Sekondi into an African Hospital had been drawn up.

A new African Hospital at Sekondi had been very much needed for a long time. The work was satisfactorily completed on the 23rd of January, 1930, and by the 25th of the same month all the patients from the old African Hospital were transferred into the newly altered building and the old African Hospital was converted into a medical store.

The principal changes effected were the complete re-arrangement of the ward downstairs to hold 14 beds and two cots, the division of the waiting-room into two to form an extra office and store-room and the addition of various conveniences for bathing, etc.

These buildings are now in excellent order.

AXIM.

In September, 1929, at Axim, where it was urgently needed, an excellent new hospital of 16 beds (12 male and four female) was opened. The buildings consist of :—

- a) An administration block, comprising a waiting room, office, clinical room, store and dispensary with a dressing-shed nearby.
- (b) A ward block comprising :
 - i) Two wards. Male, 12 beds ; female, four beds.
 - ii) A kitchen behind this part of the building.
 - (iii) An operating theatre with anæsthetic and sterilizing rooms.
 - (iv) Three large rainwater tanks.
- (c) Staff quarters, giving accommodation for three male and one female officer.
- (d) A fly-proof mortuary with a separate tank for water supply.

CAPE COAST.

A new block of three wards with verandah, bathroom, etc., was erected and put into use towards the end of the year.

A pipe-borne water supply has been installed.

NSAWAM.

At Nsawam, a new modern ward with space for ten beds was completed towards the end of the year and was in course of being furnished.

SUNYANI.

A new African Hospital containing 16 beds (12 male and four female) was opened in May, 1929. The hospital is of an up-to-date type and is very well situated with sufficient space for further expansion. The grounds have been tastefully laid out by the Medical Officer.

TRAVELLING DISPENSARIES NOS. 1, 2, AND 3.

The travelling dispensaries still continue at work but the efforts of Nos. 2 and 3 have been seriously handicapped during the year owing to shortage of available medical officers and recurring motor troubles in the bush.

No. 1, which had been active during the previous year in the north-western area of the Northern Territories, continued at work there and over 5,000 cases were dealt with during the year. Yaws as before was the predominating ailment dealt with, constituting no less than 80 per cent of the total cases seen. Medical officers in their reports continue to complain of the difficulty of persuading patients to return regularly and to persist in treatment.

Early in March, 1929, Dr. Dixey, Medical Secretary to the British Empire Leprosy Relief Association, was placed in charge of No. 2 travelling dispensary in order that he might tour the country fully prepared to treat all diseases and by attracting cases of every kind to investigate the pre-

valence, etc., of leprosy especially. He spent the first three months of the year under report in the Northern Territories and then proceeded on leave of absence. On his return he took charge of No 3 dispensary and continued his investigations in the southern area of Togoland. His report on leprosy appears at appendix D. During the months he was touring with the travelling dispensaries he saw 3,375 patients of whom 222 were lepers.

MISSION DISPENSARIES.

The useful work of the White Fathers at Bolgatanga, Navrongo, and Wiaga and of the Sisters at Navrongo was continued. Regular supplies of drugs and dressings are furnished to them by this department.

The valuable work of the Mother Superior and Sisters of the Roman Catholic Mission at Kpandu was also continued throughout the year and is expanding. The Medical Officer at Ho visits Kpandu regularly and supplies the Sisters with necessary drugs and dressings, etc., and gives them advice and encouragement. The Sisters do not spare themselves and visit the outlying villages, covering many miles a month. The work is considered so valuable that an annual grant is made by Government.

A return furnished by the Medical Officer, Ho, and summarized below shows the number of cases that have been seen and dealt with by the Sisters during the past three calendar years, viz. :—

In 1927—5,583 or an average per month of 465 cases.

In 1928—7,680 or an average per month of 640 cases.

In 1929—8,094 or an average per month of 675 cases.

The proposal to open a similar centre for infant welfare work at Dzodze under the supervision of the Medical Officer, Keta, and with similar supplies and an annual grant has not yet materialized, some delay having arisen about the question of the site, type of building, and the amount of assistance which the chief and people can themselves furnish.

KUMASI AFRICAN HOSPITAL.

The considerable amount of work which is yearly being accomplished at this hospital is shown in the following table :—

KUMASI AFRICAN HOSPITAL.

	1927-28.	1928-29.	1929-30.
Out-patients—total	18,358	18,546	19,539
In-patients—total	2,412	2,508	2,137
Surgical operations, major	182	202	194
Surgical operations, minor	265	248	170
Average daily number in hospital	100	124.6	157.5

The drop in the in-patients' total is due in the main to the opening of the new infant clinic, but probably to some extent also to the setting-up in private practice of a certain number of non-Government medical practitioners.

The hospital itself is out of date and accommodation is insufficient and the need for a large and more modern hospital at this important centre is fully recognised. When the financial condition of the Colony improves and funds become available the problem for a new African Hospital for Kumasi will require to be dealt with. In spite of many difficulties, however, the staff continues to do most valuable work.

KUMASI DENTAL CLINIC.

A new permanent building suitable to the needs of the Dental Surgeon was opened at Kumasi in September 1929.

The building is well constructed, well ventilated, situated near to the African Hospital and contains a surgery, a waiting-room, and a laboratory.

Since the opening of the clinic the number of patients attending for treatment has increased considerably. And there is every prospect that owing to the additional accommodation now provided, many more Africans will avail themselves of the benefits of modern dentistry.

TAMALE.

At Tamale, a new ward built solidly of concrete with accommodation for 22 patients (an 18 bedroom and a four bedroom) was completed early in 1930 and opened at the beginning of March. Two concrete water tanks of 10,000 gallons each have been erected behind the ward and will supply a much felt need.

Electric light was introduced into Tamale in February, 1930, and a powerful 1,500 candle power electric lamp was installed in the operating theatre. The light is a great boon.

YENDI (MANDATED TOGO.)

A new hospital, which was very much needed in this part of the Mandated Area, was erected during the year. It contains nine beds with capacity for 12. The building is of improved African construction with walls of "swish" or pisé, (four windows on each side), "swish"-concrete floor, and thatched roof. It measures 45 feet by 24 feet and is 24 feet high. It was adequately equipped with iron bedsteads, linen cupboards, etc., and has been in full use during the last five months of the year.

Another block was built nearby, consisting of three rooms, viz., a theatre, sterilizing room and Medical Officer's consulting room. This building is also of improved construction, with "swish" walls, concrete floor and a double roof of corrugated iron and asbestos sheeting. The theatre is well furnished and the sterilizing room contains an up-to-date sterilizer. The supply of instruments had not been fully completed at the end of the year. The whole building is a very satisfactory one and measures 45 feet by 18 feet and is 14 feet high.

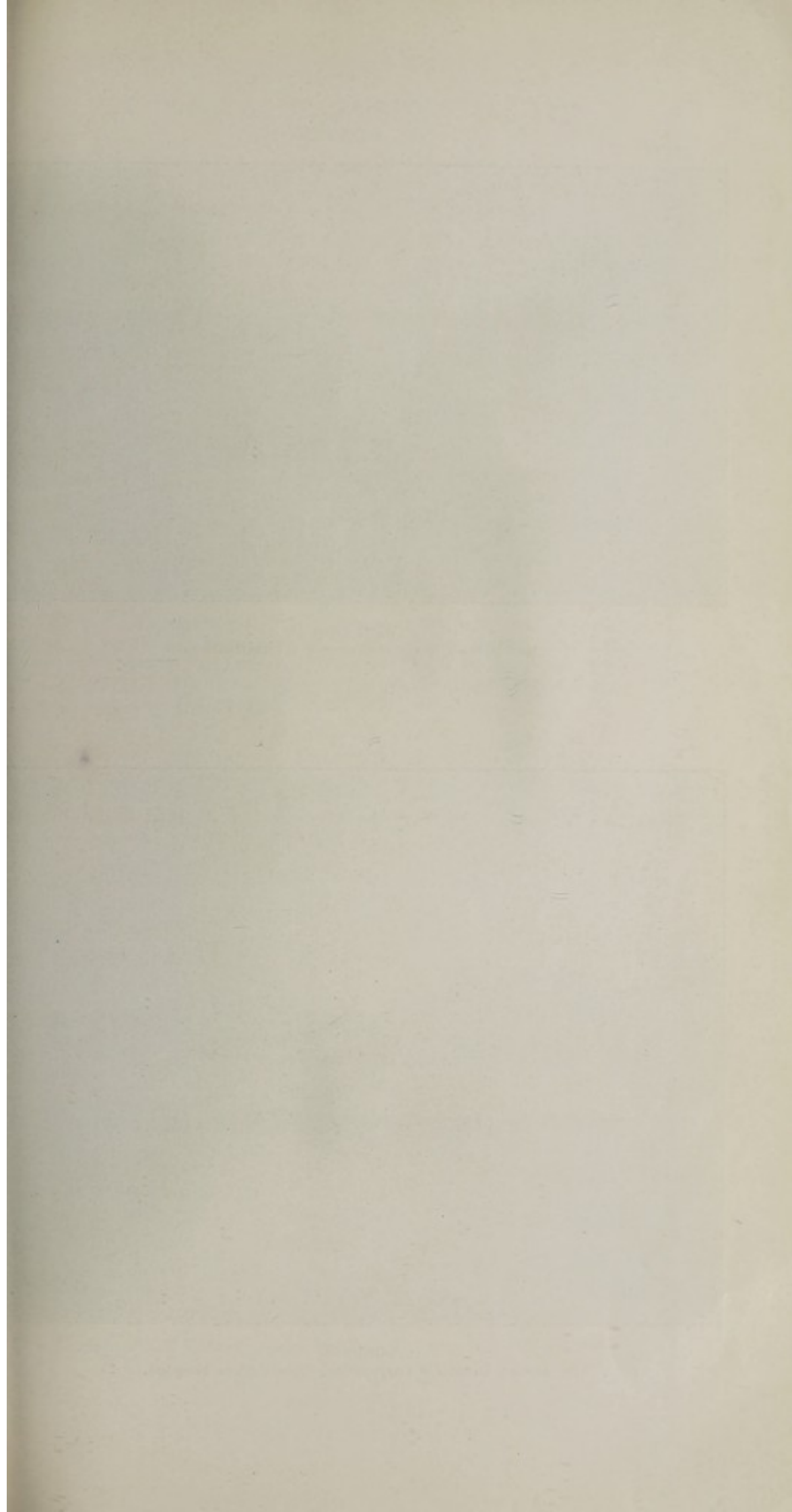
CENTRAL MEDICAL AND SANITARY STORE, ACCRA.

In the year 1926 the pressure on available store space for the stores of both branches became so great that it was obvious that at an early date it would become inadequate.

Accordingly it was decided that the existing medical store at the Gold Coast Hospital which served the whole Colony should be handed over to the Gold Coast Hospital and a large new central store for the Colony built. As extra store accommodation for the Health branch was more urgently needed than for the Medical branch, a new Sanitary store was built first in 1928-29 and a new Medical store the following year. Both buildings are on the same site but distinct and apart from one another owing to the nature of the materials stored. The buildings are well designed and roomy and should serve the Colony well for many years to come.

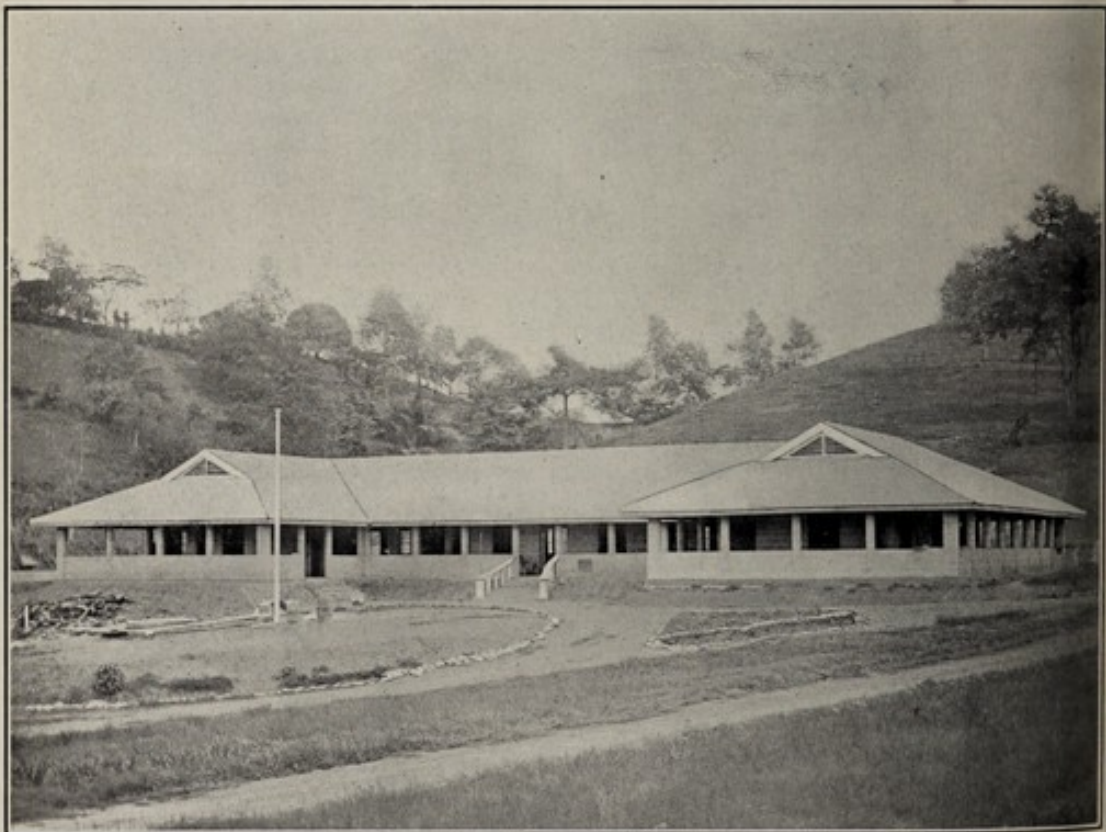
MINOR IMPROVEMENTS.

Various necessary minor works (wash-houses, latrines, alterations in existing buildings to improve lighting or ventilation, etc.), were undertaken at different hospitals throughout the year and constitute definite improvements.





WINNEBA.
New African Hospital in course of construction.



OBUASI.
Ashanti Goldfields Corporation. New African Hospital.

NEW HOSPITALS IN COURSE OF ERECTION.

WINNEBA.

The old African Hospital contained only 22 beds, was not well situated, was badly lighted, cramped, inconvenient and out of date and quite inadequate to cope with the needs of this important centre.

A new up-to-date hospital, with large airy wards and offices and containing 66 beds was commenced in the month of November, 1929. It is hoped to open it in the month of August, 1930. It is excellently situated with electric light and power and a good pipe-borne water supply has been laid on.

WA AND LAWRA (NORTHERN TERRITORIES).

New hospitals are being erected at these two centres and both are nearing completion. When completed and equipped they will fill a much needed want in their respective areas.

OBUASI.

A new 24-bed African Hospital with quarters for staff, stores, laboratory, etc., belonging to the Ashanti Goldfields Corporation, is rapidly nearing completion.

In the new building is a casualty theatre, operating theatre, sterilizing room, dispensary, two bathrooms, etc., etc.

As out-buildings, a venereal treatment room with dressing-room and washing-room is also being erected. All buildings will be fully equipped in the most modern manner and fitted with electric light and power and running water. It is hoped that the hospital will be opened and in full working order by July, 1930.

REPORT ON THE WORK OF THE X-RAY AND ELECTRO-THERAPEUTIC DEPARTMENT, GOLD COAST HOSPITAL, ACCRA, DURING THE YEAR 1st APRIL, 1929, TO 31st MARCH, 1930.

During the year under report this Department of the Gold Coast hospital remained in charge of Mr. G. MacLardie, Radiographer. His summary of the work done is as follows :—

“ The total number of X-ray cases was 1,189, classified as under :—

Examination of bones	...	...	...	739
Examination of skulls	...	...	...	26
Examination of sinuses	...	...	...	21
Examination of chest and lungs	...	...	...	111
Examination of heart	...	...	...	7
Examination by Barium meal	...	...	...	42
Examination by Barium enema	...	...	...	4
Examination of urinary tract	...	...	...	29
Examination of gall bladder and liver	...	...	...	4
Examination of pregnancy	...	...	...	10
Examination of dental cases	...	...	...	85
Examination by screen	...	...	...	13
Examination of spines	...	...	...	56
Examination for foreign bodies	...	...	...	25
Examination under lipiodol injection	...	...	...	4
Examination of gunshot wounds	...	...	...	9
Examination of tumours	...	...	...	4

The figures for 1928-29 was 1,367. A decrease of 178 is shown.

One hundred and fifty-seven treatments of X-ray therapy were given during the year, an increase of 87 over the previous 12 months.

The electric supply has been fully adequate for the work demanded. The X-ray plant complies with the National Physical Laboratory standards for the protection of operator and patients.

The steady increase in the number of patients attending the electro-therapeutic department is remarkable. In the year 1926-27 the total number of treatments given was 2,034. In 1927-28 it had risen to 3,177. In the year 1928-29 it reached the figure 5,702. In the year under review it had swelled to 9,001, an increase of 3,369 over the previous year. The usual procedures are massage, electrical stimulation, muscle-testing, diathermy, radiant heat and ultra-violet ray."

G. MACLARDIE,
Radiographer.

VENEREAL CLINIC—GOLD COAST HOSPITAL, ACCRA, 1ST APRIL, 1929, TO 31ST MARCH, 1930.

REVIEW OF THE WORK DONE DURING THE YEAR.

The annual increase in the number of attendances which had been taking place for some years past was maintained during the year. An important alteration in the hours of the clinic for general work (8.30 a.m. to 12 noon and 2 p.m. to 4 p.m.) to 8.30 a.m. to 1 p.m. was made, but this change has made no difference in the attendances of patients. The clinic still remains open for irrigations till 4 p.m. daily.

ATTENDANCES.

As compared with last year there has been an appreciable increase in the number of new cases of gonorrhoea in males from 501 in 1929 to 606 in 1930, and a slight increase in females from 300 in 1929 to 328 in 1930. The number of new cases of syphilis, however, has decreased from 595 in 1929 to 420 in 1930. On the other hand the number of new cases found on examination not to be suffering from venereal disease has increased from 315 in 1929 to 506 in 1930. The number of patients discharged after fully completing their course or courses of treatment was 386 as compared with 376 in 1929.

The number of cases of chancroid has also decreased from 80 in 1929 to 66 in 1930.

TREATMENT.

The routine treatment of gonorrhoea and syphilis has remained substantially the same. Towards the last quarter of the year, however, some obstinate cases of chronic prostatitis and arthritis of gonorrhoeal origin were treated by diathermy with most striking results.

Every patient presenting himself with an acute discharge is given three intramuscular injections of symmetrical urea (S. U. M. 36) each of 0.002 gramme at five day intervals and in the great majority of cases it stops discharge at once and relieves the patient of his subjective symptoms.

LABORATORY REPORT.

The usual weekly Wasserman test was carried on during the year. Three hundred and forty-six sera were examined, of which 121 were positive. The number of films examined was 309 of which 56 showed gonococci.

ATTENDANCES.

	1927-28.	1928-29.	1929-30.
Patients treated (old and new cases)	4,244	3,852	4,083
Gonorrhoea, male and female	562	1,599	1,772
Chancroid	22	80	66
Syphilis, male and female	337	1,161	1,318
Framboesia	882	—	—
Non-venereal	—	812	927
Injections N.A.B.	2,927	1,819	1,650
Injections B.S.T.	5,924	1,395	1,144
Injections colloidal iodine (vein)	—	—	1,460
Injections intramine (muscle)	—	—	1,137

RETURN SHOWING NUMBER OF CASES TREATED IN THE VENEREAL CLINIC FOR THE YEAR 1929-30, AND CONDITIONS OTHER THAN VENEREAL, ETC.

	Primary Syphilis.		Secondary Syphilis.		Tertiary Syphilis.		Congenital Syphilis.		Soft chancre.		Gonorrhoea.		Conditions other than Venereal.		Total.	
	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.
I. Remaining under treatment 1st April, 1929	134	2	100	122	212	328	—	—	—	—	71	767	284	137	801	1,356
II. New cases	111	12	75	56	69	97	—	—	66	—	606	328	249	257	1,176	750
(a) Complete I full course	43	7	25	28	33	54	—	—	—	—	—	—	121	164	222	253
(b) Complete II full course	24	—	18	15	24	33	—	—	—	—	201	—	42	42	—	—
(c) The full course	—	—	—	—	—	—	—	—	—	—	188	278	—	—	291	278
(d) The full course with final test	—	—	—	—	—	—	—	—	—	—	100	86	—	—	188	—
(e) Ceased to attend before completion of course	34	4	28	20	9	18	—	—	—	—	188	—	26	36	197	164
III. Discharged after completion of course	24	—	18	15	24	33	—	—	—	—	—	—	42	42	296	90
IV. Remaining under treatment 1st April, 1930	144	3	104	115	215	320	—	—	—	—	98	731	344	152	905	1,321

C. E. REINDORF,

Medical Officer-in-Charge,
Venereal Clinic.

REPORT ON THE WORK OF THE DENTAL CENTRES DURING THE YEAR.

Staff.—During the year dental work was carried out at Accra, Sekondi, Kumasi and Tamale.

Mr. Donald, Dental Surgeon, Accra, proceeded on leave of absence on 3rd April and returned on 18th September.

Mr. Campbell was on duty most of the year at Kumasi.

The following statements will show the number of patients of all classes treated, the number and nature of the treatment given and the chief pathological conditions that were dealt with during the period.

A.—Patients :—

Officials (European)	...	724
Officials (African)	...	1,548
		2,272
Non-Officials (European)	...	620
Non-Officials (African)	...	1,259
		1,879

B.—The following is a classification of the total patients treated giving the figures for 1927–28, and 1928–29 as well.

	1927–28.	1928–29.	1929–30.
Officials—Europeans	762	789	724
Officials—African	819	1,235	1,548
Total officials	1,581	2,024	2,272
Non-officials—European	708	805	620
Non-officials—African	1,506	1,605	1,259
	2,214	2,410	1,879
Total treated	3,795	4,434	4,151

C.—The following table shows the number of dental operations performed :—

	Officials.	Non-officials.	Total.
(a) Extractions :			
Local anaesthesia	787	1,103	1,890
General anaesthesia	80	156	236
(b) Fillings :			
Gold	6	15	21
Amalgam	310	214	524
Porcelain	122	127	249
Cement	58	44	102
Temporary	54	22	76
(c) Dressings, including root treatment	544	212	756
(d) Scalings	155	116	271
(e) Bridges, crowns and other restorations	8	14	22
(f) Dentures	92	74	166
(g) Repairs to bridges and dentures	64	50	114
(h) Minor treatments	691	376	1,067

D.—The chief pathological conditions met with during the period were as follows :—

(1) Dental caries	2,740
(2) Dental abscess	928
(3) Pulpitis, acute and chronic	257
(4) Periodonitis, acute and chronic	213
(5) Excessive calcific deposit	374
(6) Cases diagnosed as true pyrrhoea alveolaris	370
(7) Gingivitis	369
(8) Septic roots	433
(9) Stomatitis	97
(10) Sepsis arising in connection with eruption of permanent dentition	179
(11) Malposition of the teeth	69
(12) Fracture of teeth	39
(13) Necrosis of Alveolus	19
(14) Neuralgia of non-dental origin	8
(15) Polypus of pulp	29
(16) Pulp stones	12
(17) Excessive post-extraction haemorrhage ...	18
(18) Supernumerary teeth	27
(19) Dental cyst	8
(20) Epulis	3
(21) Fibrous sacoma of jaw	10
(22) Antral disease	2
(23) Cancrum oris	3
(24) Odontomes	4
(25) Perforation of the palate with supply of obturator	1

The prosthetic work of the department has been satisfactorily performed by L. Minto, Dental Mechanic.

W. H. DONALD,
Government Dental Surgeon.

VII.—PRISONS AND ASYLUMS.

PRISONS 1929-30.

The prisons of the Gold Coast administered by the Prisons Department are as follows :—

A.—Convict prisons 4

B.—Local prisons 24

The *convict prisons* are situated at Accra (Ussher Fort), Sekondi (Central), Kumasi and Tamale.

The local prisons are as follows and are constructed as shown below :—

Accra, James Fort	} Converted Forts of solid masonry.
Elmina	
Cape Coast	
Sekondi, Fort Orange	
Axim	
Keta	} Brick
Tarkwa	
Kintampo	
Akuse	} Stone.
Ho	
Salaga	

Bole	}	"Swish" or pise.
Obuasi		
Winneba		
Sunyani		
Kpando		
Gambaga		
Zuarungu		
Bawku		
Navrongo		
Lawra		
Wa		
Yendi		
Krachi		

No major alterations were made during the year to any of the buildings.

The general health was good throughout the year. In fact, it can very often be said that a prisoner leaves prison in better health than when he entered.

There is separate accommodation for females at the following prisons :—Accra, Elmina, Kumasi, Keta.

The daily average of female prisoners for the year was 26.16 as compared with 31.82 for the previous year.

In all prisons, prisoners sleep in association cells.

In the more modern prisons the cells are mostly smaller, accommodating three prisoners. This refers more particularly to the four convict prisons, whilst cells at all local prisons are for the most part large cells accommodating from ten to 30 prisoners.

There are no single cells, except for punishment segregation.

At Accra, Sekondi, Kumasi, and Tamale long-sentence prisoners are employed chiefly in the workshops or on re-construction work. Short-sentence prisoners are employed on farming or sanitary work. The hours of labour are from 6.00 a.m.—11 a.m. and from 12.30 p.m.—3.30 p.m.

Except in the case of particularly dangerous prisoners, of whom there are very few, no prisoners are required to work in their cells.

Satisfactory sanitary arrangements exist in all prisons.

Rations were adequate and of good quality and no illness due to food occurred. For the diet scale see appendix to this report.

The total number of deaths numbered 34 as compared with 39 in the previous year, equalling 19.38 per thousand.

The average number on the sick list was 32.89, i.e., 1.87 per cent as compared with 2.9 per cent for the previous year.

There was no serious outbreak of disease and no epidemic.

<i>Average daily lock-up.</i>			<i>Sick list (average).</i>		
1925-26	...	1,433.25	1925-26	...	3.10 per cent.
1926-27	...	1,620.25	1926-27	...	3.99 per cent.
1927-28	...	1,701.74	1927-28	...	3.22 per cent.
1928-29	...	1,806.85	1928-29	...	2.93 per cent.
1929-30	...	1,753.95	1929-30	...	1.87 per cent.

	Death-rate.	Total.	Per cent of average daily lock-up.
1925-26	—	35	1.29 per cent.
1926-27	—	30	1.85 per cent.
1927-28	—	53	3.11 per cent.
1928-29	—	39	2.16 per cent.
1929-30	—	34	1.93 per cent.

Of the deaths, 11 occurred at Accra, four at Tamale, four at Sekondi and three at Kumasi.

Recommendation.—For the future any new prison built should have individual cells and not association cells, in order to bring it into line with modern ideas of prison construction.

APPENDIX TO REPORT ON PRISONS. SCALE OF DIET.

No. I.	No. II.	No. III.		Punishment.	European.	West Indian.	Infirmary.	
		5 days a week.	2 days a week.				Full.	Low.
*Kenki .. Fish, fresh cooked 2 ozs. or Fish, salt cooked 3 ozs. or Beef, fresh cooked 1 oz. or Beef salt cooked 1½ ozs. Pepper .. ¼ oz. Salt .. ¼ oz.	Kenki .. 2½ lbs. Fish, fresh cooked 3 ozs. or Fish, salt cooked 4 ozs. or Beef, fresh cooked 1½ ozs. or Beef salt cooked 2 ozs. Pepper .. 1½ oz. Salt .. ¼ oz.	Kenki .. 2½ lbs. Fish, fresh cooked 4½ ozs. or Beef, fresh cooked 1½ ozs. or Beef salt cooked 2½ ozs. Pepper .. ¼ oz. Salt .. ¼ oz.	Boiled Cassada 2½ lbs. Fish, fresh cooked 3 ozs. or Fish, salt cooked .. 4½ ozs. or Beef, fresh cooked 1½ ozs. or Beef salt cooked .. 2½ ozs. Pepper .. ¼ oz. Salt .. ¼ oz. Palm Oil .. ¼ oz. Vegetables .. 4 oz. The above articles of diet, excepting the boiled cassada, are to be made into soup.	No. I. Kenki .. 1½ lbs. Salt .. ¼ oz. No. II. Kenki .. 1 lb. Salt' .. ¼ oz.	<i>Per diem.</i> Rice .. 1½ lb. Bread .. 1½ lb. Fresh Beef, cooked or Fowl cooked, 1 lb. or 3 days a week. Fresh fish, cooked .. ¼ lb. or Fresh Beef, cooked 1 lb. or Fowl, cooked 1 lb. <i>Per week.</i> Tea .. ¼ lb. Sugar ¼ lb. 4 days a week. Eggs 2	Same diet as First an Second Class except that the Kenki or Cassada shall be reduced by ½ lb. in respect of which reduction Rice ½ lb. or Agidi; ¼ lb. is to be substituted.	Kenki .. 2 lbs. or Rice cooked 1 lb. or Cassada cooked 3 lbs. or Fish fresh cooked 4 ozs. or Fish salt cooked 2 ozs. or Beef fresh cooked 2 ozs. or Beef salt cooked 1½ ozs. Pepper .. oz. Salt .. 0 oz. Vegetables, 3 ozs. Akassa 10 ozs.	Kenki .. 2 lbs. or Rice cooked ¼ lb. or Cassada cooked 2½ lbs. or Fish salt cooked 4 ozs. or Beef fresh cooked 1½ ozs. Pepper .. oz. Salt .. 0 oz. Vegetables, 3 ozs. Akassa 10 ozs.

All Native Prisoners are allowed 10 ozs. of boiled Akassa every morning, except when on No. 2 punishment diet, to be taken before the day's work is begun.

1. Prisoners sentenced to 7 days and under, No. 1 diet, without fish or meat.

2. Prisoners sentenced to more than 7 days and not more than one month, No. 1 diet.

3. Prisoners sentenced to more than 1 month and not more than six months, No. II diet.

4. Prisoners sentenced to more than 6 months, No. III diet.

5. In case of Kruo men Rice to be substituted for Kenki at the following rate:—No. I, ½ lb.; No. II, 1 lb.; No. III, 1 lb.; Punishment ¼ lb.; Infirmary, Full 1 lb.; Low, ¼ lb.

* Kenki consists of maize soaked in water, mashed and cooked by boiling. It is made into balls and wrapped in maize leaf.

† Akassa—a gruel made of maize. A thin pap.

‡ Agidi—A thick gruel is made from maize flour and boiled. When cold it solidifies and is made into balls; a corn flour blancmange.

CENTRAL LUNATIC ASYLUM, ACCRA.

The staff throughout the year consisted of the following :—

Medical Officer	1
Chief Attendant	1
Assistant Chief Attendant	1
Matron	1
Attendants	17
Gatekeeper	1
Female Attendants	3
The African Staff total	24

There is no other asylum.

On the 31st March, 1930, there was a total of 275 inmates as compared with a total of 246 on the 31st March, 1929.

Statistics for the year are shown below :—

Number of patients remaining 31st March, 1929	246
Admitted during 1929-30	104
Discharged during 1929-30	28
Escaped during 1929-30	2
Deaths during 1929-30	44

Number of inmates remaining 31st March, 1930 :—

Males	184	}	...	...	...	275
Females	51					
Criminal lunatics	40					

Deaths to the number of 44 were recorded as follows :—

Asthensia and exhaustion from mania	...	1
Acute epilepsy	...	1
Aortic endocarditis	...	1
Aortic incompetence	...	1
Bacillary dysentery	...	1
Cardiac failure	...	2
Cachexia and cardiac failure	...	1
Chronic dysentery and dropsy (beriberi)	...	1
Cerebral syphilis	...	4
Chronic nephritis	...	1
Cellulitis neck	...	1
Debility and wasting	...	2
Debility and cardiac failure	...	1
Debility and ankylostomiasis	...	1
Epilepsy	...	1
General debility	...	2
General debility and bacillary dysentery	...	1
General debility and exhaustion from mania	...	1
General debility and exhaustion	...	1
General debility and toxæmia	...	1
General paralysis of insane and cardiac failure	...	1
General paralysis of insane (beriberi)	...	1
General paralysis of insane	...	3
Hyperpyrexia	...	1
Lobar pneumonia (resolved) dropsy and beriberi	...	1
Pulmonary tuberculosis	...	1
Senility and general debility	...	1
Senility	...	1
Senility and myocardial degeneration	...	1
Tabo-paresis	...	1
Toxæmia and general debility	...	1
Undetected poison	...	1
Exhaustion from mania	...	2
Epilepsy and exhaustion	...	1
Natural cause (inquest finding)	...	1

The mental diseases from which the inmates suffered were as follows :—

	<i>Male.</i>	<i>Female.</i>
Imbecility	12	2
Mania	30	16
Homicidal	12	nil
Melancholia	7	3
Periodical insanity	2	nil
General paralysis	1	nil
Suicidal	5	nil
Epilepsy	6	1
Delusional insanity	20	8
Dementia	9	7
Secondary dementia	10	1
Dementia praecox	49	1
Recurrent mania	5	1
Confusional insanity	8	1
Acute mania	15	4
Mental deficiency	1	1
Chronic mania	3	nil
Non-systematised delusional insanity	8	1
Trypanosomiasis	1	nil
Under observation	20	4
	224	51

The general health of the inmates throughout the year was not entirely satisfactory but no outbreak or epidemic disease occurred. Overcrowding has taken place and is giving rise to anxiety. In spite, however, of the limited space available and the old type of building the sanitation of the Asylum is satisfactory. A temporary extension to relieve overcrowding will be erected early.

The construction of a new asylum for the Colony is still under consideration. The present asylum was built many years ago when the number of patients was much fewer and modern methods of treatment not known. Its accommodation is now insufficient for the extra work demanded and facilities for modern treatment are lacking.

Somewhere near Kumasi is favoured as a site for a new asylum for the Colony owing to its central position; the actual site there would depend in part on the ease with which the water supply could be obtained from the main supply for Kumasi, and in part on many other factors.

A Specialist Alienist Officer was appointed in August, 1929, and his recommendations are receiving careful consideration.

VIII.—METEOROLOGY.

AVERAGE FIGURE FOR THE YEAR 1929-30.

							Total rainfall.	Degree of.	Wind.	
	Solar max.	Terr. min.	Shade max.	Shade min.	Range.	Mean.	Amount in inches.	Rel. hum. per cent.	General direction	Average force.
Accra ..	141.3	73.0	86.3	75.2	17.0	80.7	34.41	75.4	S.W.	2.0
Kumasi ..	135.2	66.3	88.1	68.9	25.7	78.5	56.34	86.2	S.E.	1.0
Sekondi ..	138.1	69.4	86.0	72.8	18.3	78.5	37.89	80.3	W.	1.6
Tamale ..	148.3	66.5	93.3	71.1	29.5	82.1	52.62	62.5	S.W.	2.2

METEOROLOGICAL OBSERVATIONS, LABORATORY GROUNDS, KORLE BU, ACCRA.

Month.	Rainfall in inches.	Highest maximum temperature recorded.	Lowest minimum temperature recorded.	Daily average mean temperature.	Temperature of dew point.	
					Highest.	Lowest.
April, 1929	2.807	88	75	82.02	78	70
May, 1929	3.473	88	74	81.30	78	72
June, 1929	11.732	84	73	78.82	77	71
July, 1929	2.593	81	73	77.03	74	69
August, 1929	0.923	79	71	75.18	72	68
September, 1929 ..	0.197	81	73	76.97	73	69
October, 1929	0.373	85	72	78.91	74	69
November, 1929 ..	3.916	86	74	80.49	76	68
December, 1929 ..	2.921	86	70	79.02	76	64
January, 1930	0.345	86	74	80.23	76	71
February, 1930	1.620	87	75	81.35	77	71
March, 1930	0.690	87	74	81.80	77	71

Total rainfall 31.590 inches.

IX.—SCIENTIFIC.

(a) ANNUAL REPORT OF THE MEDICAL RESEARCH INSTITUTE AND ITS BRANCH LABORATORIES.

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ANNUAL REPORT OF THE LABORATORY SERVICES.

I.—GENERAL REMARKS.

This report covers the period 1st April, 1929 to 31st March, 1930.

2. **The European Staff** has been as follows :—A Director, Dr. G. G. Butler, who has been on duty for the period 18th September, 1929, to 31st March, 1930.

One Senior Pathologist, Dr. A. S. Burgess, who was on duty from the period 1st April, to 28th September, 1929, and acted as Director for the period 17th April to 17th September, 1929.

Six Pathologists, Drs. Robinson, Thomson, Russell, Saunders, Reid and Jackson. Dr. Robinson has been in charge of the Sekondi Laboratory from 29th August, 1929, to 31st March, 1930, and Dr. Thomson was in charge of that Laboratory from 1st April, 1929, to 28th August, 1929. Dr. Russell has been in the Colony from 26th June to the end of the year under review and has been engaged on investigation in Relapsing fever at the Research Institute.

Dr. Saunders was appointed a Pathologist as from 25th May, 1929, and has been stationed at the trypanosomiasis camp at Yeji throughout the remainder of the year. Dr. Reid was appointed a Pathologist on 17th August, 1929, and assisted as a part-time pathologist only until he went on leave on 23rd November, 1929, and did not return before the completion of the year under review. He is to be detailed for duty at Kumasi on his return. Dr. Jackson was appointed a Pathologist as from 28th January, 1930, and took over the duties of Clinical Pathologist to the Gold Coast Hospital from that date until 21st March, 1930, when he had to relieve Dr. Saunders at Yeji.

One Medical Entomologist, Mr. Pomeroy, has been in the Colony from 5th November, 1929, to the end of the year under review.

One Assistant Entomologist, Mr. Morris, has been on duty throughout the year in the Northern Territories completing the work of the tsetse investigation on the cattle route.

One Laboratory Superintendent, Mr. Leeson, has been on duty from 21st May, 1929, to 31st March, 1930, and has been stationed at the Medical Research Institute throughout.

Two Laboratory Assistants, Mr. Abbott and Mr. Woodward. The former has been on duty from 4th November, 1929, to 31st March, 1930, at Sekondi, while Mr. Woodward has been at the Medical Research Institute from 9th April, 1929, to the end of the year under review.

3. **The African Staff** has been as follows:—Twelve Laboratory Attendants and Attendants-in-Training, Messrs Paittoo, Bannerman, Nelson, Nettey, Gray, Williams and Venkumuni, and the balance as Laboratory Attendants-in-training. The first three are attached to the ordinary Laboratory staffs while the latter four have been engaged with the tsetse trypanosomiasis investigation. Mr. Bannerman resigned on 26th December, 1929. Six Laboratory Attendants-in-training are at present attached to the various branches and will be advanced to Attendants as vacancies and their abilities prove their worth. Lads, other than those from Accra, seem to be the more satisfactory for training and in ability.

One second division clerk, Mr. Marbell, has continued to hold this appointment.

One Laboratory Attendant was trained to carry out simple routine procedures and was then transferred to the European Hospital.

4. The African Laboratory servant staff consists of eight, of which six are employed at the Accra Laboratories and two at the Sekondi Laboratory.

5. **The Laboratories** under the Laboratory section of the Medical Department are the Medical Research Institute at Accra, the Clinical Laboratory in the Gold Coast Hospital, Accra, the Laboratory at Sekondi and the Field Laboratory at Yeji in the Northern Territories where Sleeping sickness is being investigated. The Kumasi Laboratory was not opened during the year as no staff was available, but Dr. Reid will be opening it very shortly on his return from leave and the majority of the equipment has been purchased already. The Mobile Laboratory is stationed at Accra and is available for duties wherever it is possible to send it, and it formed the commencement of the field laboratory at Yeji originally.

The senior staff of the Medical Research Institute consists of the Director of the Laboratory with two Pathologists, one of whom is almost always acting as a relief during the leave of one of the others.

The Gold Coast Hospital Clinical Laboratory was staffed as from the beginning of 1930 and has been open continuously since then, though there has been difficulty in keeping a whole-time Pathologist there because reliefs have had to be found for other stations; but I anticipate that this will not recur with the adjustments in our roster.

One Pathologist undertakes the work of the Sekondi Laboratory which has been open the whole year.

One Pathologist is responsible for the running of the Sleeping sickness camp at Yeji which has also been open throughout the year.

A board of survey was asked for in June, 1928, to investigate the system of store and ledger-keeping at the Research Institute. After two unsuccessful meetings a satisfactory report was received, I am glad to say, in November, 1929.

6. **Laboratory Animals.**—In past years it has been found necessary to purchase guinea pigs from England or locally; this appealed to me as so unsatisfactory that Mr. Woodward was placed in charge of the animals from the beginning of the year and great progress has to be reported. He has found no difficulty in keeping up the stocks of guinea pigs and he has also succeeded in breeding rabbits, an uncommon event in West African laboratories I believe. His report is given as follows as it may help others in West Africa.

“On the 1st April, 1929, there were 80 cavies in stock.

No cavies have been purchased throughout the year.

On 30th March, 1930, there were 126 covies in stock.

During the year there were 156 births and 110 deaths.

The deaths are accounted for as follows :—

Experimented	...	74
Killed by dog	...	14
Disease	...	22
		—
		110
		—

Of the 22 deaths due to disease, twenty occurred in covies under three weeks old and practically every case was due to bacterial fermentation (pot belly).

Two adult deaths were probably due to a poisonous weed being introduced amongst their food, ten were affected, the symptoms being paralysis of the limbs.

Food consists of grass cut daily, lettuce, green maize and cassava.

No water is given, but would be essential were dry cereals only in their diet.

Cages and runs are cleaned and fresh bedding of dried grass given daily.

It is also essential that cages and runs should be washed out thoroughly once a week.

The gestation period is about 70 days and all pregnant covies are segregated.

Litters vary from one to four.

It is not profitable to breed again from sows that desert their litters.

The care of rabbits is essentially the same as that of the covies, but water is given daily."

7. The Library is an excellent feature of the Medical Research Institute and it is desired to see that it never loses its status for it forms a reference library for most of the Gold Coast Hospital staff. A very large number of unbound periodicals of previous years has now been dealt with and missing numbers obtained so that incomplete volumes no longer lie about.

The sum of £150 is set aside annually to allow new additions and to continue the periodicals of former years for all branches of the laboratory division and we find the sum all too little.

8. The General Organization for the future is to concentrate research, as far as possible, at Accra at the Research Institute where better conditions prevail and to make the work of the Laboratories at Sekondi, Gold Coast Hospital and Kumasi deal with the regular routine duties of the large hospitals situated there as well as in their immediate neighbourhood. It can be foreseen that the work of the Kumasi Laboratory is likely to develop very largely indeed as owing to the geographical position of the town material is bound to reach it from very wide areas.

This leaves one Pathologist available for field duties who at the moment is studying Trypanosomiasis at Yeji in the Northern Territories.

One Entomologist has been employed partly in completing the tsetse investigation at Makongo, a sleeping sickness centre, and also along the route used by imported cattle while the senior Entomologist has been mainly employed in an investigation of the tsetse conditions of the Accra plains in order to decide the practicability of encouraging a stock-breeding area in the neighbourhood of Accra. During the coming year it is proposed to concentrate entomological attention on the malaria problem commencing at Takoradi, a rapidly-growing new town.

The clerical staff of the Medical Research Institute which deals with all the correspondence connected with the various branches has remained at one second division clerk for many years, but some idea of the growth of our activities may be gathered by the number of memoranda irrespective of routine reports sent from the Institute which have increased from an average of 213 per annum from 1920 to March, 1928, to 763 and 1,147 during the last two years.

9. The Cost of the Various Branches.—An attempt has been made to try and find out how the money voted for the Laboratory services is spent between the various branches with the hope that unnecessary expenditure can be best detected and curtailed if possible. The actual cost of running each branch of the Laboratory services has been aimed at exclusive of the cost of general administrative charges to which have been added items such as leave, salaries, passages, transport of stores, railway and other means of transport, costs of visits of inspection, cost of courses of instruction, uniforms, and possibly a few other small items.

The details given in the table under table IV (page 166) are of approximate accuracy for each section except in the case of Yeji where some of the cost has been incurred in the investigation of cattle trypanosomiasis and should more correctly appear as a charge against the tsetse trypanosomiasis investigation commenced under the Entomological section.

II.—REPORT OF THE ROUTINE DIVISIONS.

10. A general review gathered from the statistics of each branch will probably present in more readable form what type of work has been done, our general activities and the various results obtained: and I think this material presented under the headings of certain diseases will also considerably lessen the difficulties of extracting information than would the plain study of the statistical returns which are now given in the form of tables on page 163.

11. Malaria.—The laboratory statistics give a percentage of over 28 per cent positive bloods amongst a total of over 5,000 examinations: the positive infections in well over 90 per cent of the cases is due to *P. falciparum*, a figure that rather differs from the usual percentage appearing in annual reports of past years which probably must be largely acquired from the clinical picture of the disease. Amongst the 220 post-mortem examinations made during the year no death is recorded as due to malaria though it should be stated that autopsy was only made on 25 children among whom were several non-viable fetuses and recently born infants.

I think, however, I may be permitted to quote my experience that I have only seen two cases of proved cerebral malaria amongst West African children on the post-mortem table in many years experience in West Africa. This suggests to me that malaria is not a common cause of death *per se* and a distinction must be drawn between carriers of the disease and those who really suffer from it.

There is very little doubt that the carrier state of the disease outnumbers the afflicted and a compromise is obviously possible: in fact, the inhospitable host may actually suffer from parsimony in this respect when exposure to infection occurs sufficiently violently.

The Gold Coast is an hyper-endemic area and probably this is equally true of most of tropical Africa; a high immunity exists and as a constantly high immunity is inconsistent with epidemics amongst indigenous populations, there is probably little fear of the appalling epidemics and mortality such as have been recorded against malaria in India so long as the balance between infection and immunity is preserved or not violently disturbed on the Gold Coast. There are large native rural populations

quite unlikely to be able for decades to adopt any precautionary measures against malaria; and even the proportion in townships who can do so is comparatively small and what is commonly regarded as the enemy of man may possibly, under the conditions that prevail in West Africa, be the friend of the community by allowing frequent opportunities to acquire an immunity and thereby prevent epidemics and all the losses that accompany them.

Natural adaptation to environment must include the mutual adaptation of the human herd and its parasites and all evidence points to a negligible loss by the natives of West Africa in the process of acquiring this adaptation compared with what might occur if we may judge by the cost and loss in malaria epidemics such as have occurred in India.

These remarks, of course, refer purely to native populations and not to Europeans who have not had similar opportunities of acquiring immunity in infancy and are best protected by segregation.

12. Blackwater Fever.—Only one case has been under investigation at the Medical Research Institute and not a single blackwater urine has been received for examination either at Accra or Sekondi.

The single case referred to was not seen until the autopsy was performed and is described in detail here.

This case of blackwater occurred in a Swiss subject and is of value in that death took place less than 48 hours after the onset of blackwater and actually while hæmoglobinuria was occurring.

The autopsy was made within three hours of death. The body was that of a well-developed man aged 28 years and the whole body appeared to be slightly lemon-tinted, especially in the scleræ. The gums were healthy and there were no sign of hæmorrhages or post-mortem staining. The temperature within the abdomen seemed very high as if there had been hyperpyrexia. As a result of the exsanguination due to the post-mortem the pale lemon tint seemed much less apparent after the conclusion of the post-mortem.

Blood collected at the post-mortem clotted very feebly and showed hæmoglobin stained serum. The cartilages of the trachea and ribs did not appear lemon-tinted or at all suggestive of the presence of jaundice but unfortunately a van den Bergh test was forgotten.

The brain was not examined. The pleural cavities were dry and the lungs retracted; they were quite crepitant, showed no hæmorrhagic patches, but were mottled with darker areas as if from areas of collapse. A good deal of hæmorrhagic fluid could be squeezed out of the lungs.

The pericardial sac contained a little slightly hæmoglobin-stained fluid but showed no petechiæ, except a very few flecks over the right ventricle. The heart was normal in size and the cavities were empty except for some rather pale clot in the left auricle. The left ventricle was firmly contracted and the muscle of the whole heart was pallid and the endocardium was unusually pale. There was no apparent cardiac disease and no aortitis. The abdominal cavity was dry and the omentum was considerably fat-laden. The stomach was quite empty except for some slight greenish brown material which appeared to have regurgitated from the duodenum. The large and small bowels were healthy and contained much semi-liquid material stained a golden brown colour. No petechiæ were found anywhere about the stomach or intestines.

The spleen was large, about 20 ozs. (no scales were available) and its colour that of anchovy paste and not brown or slaty as from old malaria: the lymph nodes all stood out most prominently. There was no perisplenitis.

The liver was somewhat larger than normal, its surface quite smooth and paler than normal. On section it was a mottled yellow in colour and very friable but not greasy.

The gall-bladder was moderately distended with thick granular dark red material quite unlike ordinary bile, and the bile duct opening into the duodenum was quite patent.

The adrenals showed no golden orange colour, the cortex being much paler than normal though the cortex appeared normal in width.

The pancreas was normal in appearance.

The kidneys were tumid and enlarged, weighing about 7 ozs. each: they were of a deep brownish purple colour in *situ* and on section showed a mottled brownish purple colour and gave the appearance of dark red infarcts apparently due to the contents of the tubules.

There was no brown debris in the pelvis or ureters of either kidney. The bladder was full of a dark reddish-brown urine which was neutral in reaction and showed the spectrum of methæmoglobin. On standing overnight the urine deposited considerable brownish amorphous material some of which was in the form of tubule casts. No other type of cast or leucocytes were seen and no red copuscles.

Nothing else was noticeable in the gross and no malaria parasites were found in blood films taken at the autopsy.

Microscopically.—The heart muscle fibres show some slight separation but there is very slight fragmentation of the cells. Lipochrome is not much in evidence and there is no fatty degeneration observable. No malaria pigment is seen and free iron was not found.

Liver.—There is a good deal of separation of the columns of cells by congested capillaries especially in the neighbourhood of the central vein. Each lobule is very distinct in outline owing to slight oedema apparently of the perilobular connective tissue. The liver cells are slightly swollen and in the centre of the lobule they appear rather vacuolated. Fat staining shows that there is slight fatty degeneration near the central vein. No focal necrosis is observed. Polymorphonuclear leucocytes are noticeable in the blood sinuses but they do not amount to an invasion. By iron staining bluish material is present in the liver cells, especially at the periphery of the lobule and the Küpfer cells towards the centre of the lobule have a general lilac staining. At the periphery of the lobule there is also dark brown amorphous material in the liver cells often intermingled with the free iron staining granules. No malaria was seen.

The Kidneys are very seriously damaged. The vessels and capillaries are all engorged with red cells which show nothing unusual to attract attention. The glomerular tufts fill their capsules almost completely but there is some albuminous exudate between the tuft and Bowman's capsule. The convoluted tubules in general are distended and contain much granular coagulated material. The cells of the convoluted tubules are granular and vacuolated and separated in places. Some of the nuclei of these tubules still remain apparently intact but others are in the process of disorganization. The descending and ascending tubules are also seriously affected for there is much debris in their lumina and the cells are largely desquamated. The granular debris in this situation has the appearance of very small erythrocytes of very variable size and are not found in the tubules nearer the glomeruli. The collecting tubules are less affected but they usually contain plugs of granular or hyaline material. By fat staining no fatty degeneration is demonstrated.

There is a good deal of blackish brown pigment scattered about the tissue but it is so irregularly placed that it might be a formalin deposit.

The Spleen.—The malpighian bodies are very prominent to the naked eye but seem smaller and more compact under the low power: the germ centres frequently show active endothelial proliferation. The blood sinuses are all congested and show agglutination of red corpuscles in places. Some of the large endothelial pulp cells show erythrophagocytosis and many contain particles varying in size from minute specks of a brownish yellow colour to others of considerable size which are rounded and almost black in colour. By iron staining and counterstaining with neutral red many of the pulp cells are uniformly stained a bluish green colour and especially noticeable are those that have engulfed red corpuscles and acquired a lilac colouration.

The Adrenals show slight separation of the columns of cells. The cells of the cortex and medulla are granular but their nuclei stain well. Vacuolation of the cortical cells is well marked but by fatty staining there is almost a complete absence of fatty material in that situation though the medulla cells show fine fatty droplets. Chromaffin granules are not at all prominent. Free iron was not observed and there is no malaria pigment. No colloid like bodies were seen in the medulla.

The Pancreas shows no unusual features. There is no congestion. The acinar cells show no zymogen granules and the cells of the islets are distinctly vacuolated. Staining for fat shows a slight fine fatty stippling equally in the acinar and islet cells.

The Thyroid is apparently normal.

13. Yaws, Syphilis and Gonorrhœa.—The prevalence of high positive figures for Wassermann and Kahn reactions point to the prevalence of yaws or syphilis or both.

A total of over 3,000 Wassermann reactions were carried out at the Medical Research Institute, nearly all of which were performed on the sera of natives and the result obtained gave practically 45 per cent positive reactions.

At Sekondi, out of a total of 248 Kahn tests practically 50 per cent positive results were obtained. The high figure thus demonstrated militates very seriously against the diagnostic value of the test for at least 30 per cent of the population will give a positive result irrespective of any demonstrable disease: this may represent possibly the presence of a valuable immunity and suggests that in the absence of clinically demonstrable disease or history of recurring still-births that treatment should not be initiated automatically.

During a similar period in Accra and Sekondi a total of only nine examinations for chancres were asked for and the only positive finding amongst them occurred in Europeans. The comparative rarity of congenital syphilis and the infrequency of a demand for the examination of chancres in a supposedly heavily syphilised population requires some explanation, and arrangements are being made to definitely tackle the question of genital sores and their aetiology.

During the same period 206 urethral or vaginal smears have yielded 43 per cent gonococcal infections and one would expect in a population that does not practise any prophylaxis or much restraint that an equivalent prevalence of primary chancres should be met with and that syphilis should be rampant. It might be mentioned here that out of a total of 62 positive cases of genital gonorrhœa amongst natives 13 occurred in children of 15 years and younger, the average age of the ten female children showing the infection being under seven years of age.

An examination in parallel of maternal blood and cord blood obtained from the Maternity Hospital has been undertaken and will be recorded under Special Investigations.

Certain groups of cases can be classified together on the results of their Wassermann reaction and perhaps comparatively they are of interest.

	Maternity hospital cases.	V.D. clinic.	Lepers.
Positive ..	75 = 28 per cent approx.	109 = 35.5 per cent.	42 = 48 per cent.
Doubtful ..	1	1	—
Negative ..	193	197	45

14. Enteric Fevers.—While there appears not to be a great actual clinical increase in these infections recorded since 1921 there has been more actual corroboration of their presence during the last two years than at any time previously. Three cases of typhoid were seen on the post-mortem table and amongst the 144 Widal reactions carried out 41 gave a positive diagnostic test and seven others gave a group reaction. Seven of the positive cases occurred amongst Europeans. Bacteriological search for this group of diseases by discovery of their presence in urine or faeces has yielded two cases of typhoid and one case of Salmonella, Reading type infection from amongst the 47 urines examined and two cases of typhoid from faeces.

The main infection in this group is with *Bacillus typhosus* and the actual findings based on Widal reaction, post-mortem findings, cultivation from blood, urine or faeces are as follows:—

	By culture from			By P.M.	By Widal reaction.	Total.
	Faeces.	Urine.	Blood.			
Typhoid ...	2	2	5	3	32	44
Para A ...	—	—	1	—	5	6
Para B ...	—	—	—	—	4	4
Salmonella						
Reading ...	—	1	—	—	—	1

This gives a total of 55 cases proved at the Medical Research Institute, Accra, of this group of disease without taking into account the seven showing a group reaction with the agglutination test.

To these must be added the Sekondi figures which include one case considered to be a *B. paratyphosus* B. infection on the agglutination reaction and one case of typhoid proved on faeces cultivation.

The most satisfactory means of diagnosis for this group of diseases by blood culture in the early days of the illness is unfortunately rarely practised, for only 26 samples were received; it is hoped with the advent of a clinical pathologist attached to at least two of the larger hospitals that this procedure may be more commonly practised in the future.

The infection with Salmonella of Reading type is a very rare finding and occurred in an European at Accra.

The month of major incidence for the enteric group in Accra was October.

15. The Dysenteries.—Under this heading amoebic and the bacillary dysenteries are referred to chiefly, for only nine cases have revealed the presence of *Schistosoma mansoni* ova in faeces, five being seen at the Medical Research Institute, Accra, and two cases each at Sekondi and the Gold Coast hospital laboratories.

A very considerable number of examinations of faeces are made during the course of the year at the various laboratories though actual cultivation for the group of bacillary dysenteries has only been carried out on 120 samples.

Entamoeba histolytica has been demonstrated in 19 cases at the Medical Research Institute, Accra, and on 24 occasions at Sekondi, while the isolation of pathogenic bacteria has been successful on 42 occasions at Accra and nine occasions from Sekondi.

The tabulated positive findings in these dysentery cases may be seen below.

				Accra.	Sekondi.	Total.
<i>Schistosoma mansoni</i>	...	...	...	7	2	9
<i>Entamoeba histolytica</i>	...	...	...	19	24	43
<i>B. dysenteriae</i> Shiga	...	...	...	1	—	1
<i>B. dysenteriae</i> Flexner group	...	...	...	31	9	40
<i>B. dysenteriae</i> Sonne	...	...	...	1	—	1
<i>B. dysenteriae</i> Schmitz	...	...	...	4	—	4
<i>B. dysenteriae</i> Morgan	...	...	...	3	—	3

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The successful cultivation of the organisms of the bacillary dysentery group commenced in 1923-24 with four cases and have become more frequent recently gaining greater impetus when Dr. Thomson arrived in the Colony in August, 1926. Almost every known type of bacillary dysentery organism has been isolated now on the Gold Coast within the last two or three years.

There is very little doubt that bacillary dysentery is the more prevalent type generally and the positive laboratory findings in Accra have shown a tendency to show a peak during July.

16. Relapsing Fever.—This disease continues to supply a low number but regular series of cases: 25 cases have been diagnosed at the Accra laboratories while none were reported from Sekondi; this figures does not represent all the cases that have passed through the Gold Coast Hospital. The majority of the cases occur in Northern Territory natives seeking labour in Accra who occupy certain lodging-houses. Autopsy has been made on eight cases, but two other cases of toxæmic jaundice have been suspected as possibly being relapsing fever, and are referred to under yellow fever.

This disease is the subject of a special investigation by Dr. H. M. Russell and her report is given on page 90.

17. Typhus Fever.—I do not know of any record of this disease in West Africa and as a control observation approximately 100 routine Wassermann sera have been examined serologically against *Proteus* X 19: all the results were negative, but they are quoted as a matter of record.

18. Tuberculosis.—Little can be gathered from laboratory statistics as to the actual prevalence of this disease. A total of 26 cases of tubercular disease has occurred amongst the 220 post-mortems performed at Accra and Sekondi: this is nearly 12 per cent, a higher figure than given by pneumonia which usually heads the list of causes of death as found at autopsies.

The sputa examined at Accra and Sekondi total 512, yielding 232 showing the presence of tubercle bacilli which is a very high percentage; but it must be realised that the sputa are picked as likely cases in the first place.

From the post-mortem findings it is clear that there is very little, if any, evidence of the presence of healed tuberculosis and the disease must be fairly acute and frequently ends in a generalized infection.

Hæmorrhage from the lungs has not been recorded as a cause of death in the autopsies performed during the period under review.

I have seen at present many fewer cases of generalized glandular tuberculosis at autopsies on the Gold Coast that were met with in Lagos.

Education over a period of many decades is probably the only hope of reducing the prevalence of the disease, for spitting is the delight and the hand is both the handkerchief and the spoon in the communal feeding bowl.

19. Hookworm Disease.—Laboratory statistics from faeces examinations made at Accra and Sekondi yield approximately 12 per cent infected with hookworm ova, but no autopsy has been made at these stations in which the diagnosis of hookworm disease has been given as the cause of death and the disease, if not the infection, must be rare in these districts.

The few occasions in which the helminth has been examined from post-mortem material has proved that *Necator* is the common variety met with.

Haemoglobin estimations have been such an infrequent request that the few observations made give no indication as to the prevalence of anæmias due to hookworm infection.

20. Schistosomiasis.—This disease, whether the intestinal or vesical form is considered, probably is much more prevalent than is generally supposed.

The findings from the various laboratory statistics during the period under review are as follows:—

<i>S. mansoni</i>	...	...	...	9
<i>S. hæmatobium</i>	...	...	...	87

In order to obtain some sort of idea of what was the normal occurrence amongst the population I asked Dr. Jackson to undertake a series of routine examinations from in-patients of the Gold Coast Hospital irrespective of the cause of their admission.

Dr. Jackson reports as follows:—"The specimens of urine examined numbered 337; of these 33 or 10 per cent contained ova of *Schistosoma hæmatobium*. It was noted that of the infected urines very few contained sufficient amounts of blood to be detected by naked eye examination. In other words the specimens appeared to be quite normal. All were males."

At the same time I find the figure obtained from all post-mortem examinations in which the bladder has been examined gives a total of bilharzia infection in five cases in a total of 45 examined.

I think it may be safely said that in the neighbourhood of 10 per cent of the population of Accra that commonly attend the Gold Coast Native Hospital are infected with Schistosomiasis; apparently the disability caused is not a high one or it would have been recognized as a serious factor long ago.

The comparative commonness of cirrhosis of the liver and primary carcinoma of that organ may be associated with this high percentage of schistosome infection.

21. Trypanosomiasis.—Only one case is recorded in the laboratory statistics and that case occurred in an inmate of the Lunatic Asylum at Accra. It is anticipated that the opening of a laboratory at Kumasi will lead to the diagnosis more frequently.

One case suspected as sleeping sickness came to autopsy and though perivascular cuffs were distinctive in the brain sections no clinching actor could be made out.

This infection is the subject of a special report from the sleeping sickness camp at Yeji and is to be found on page 110.

Animal trypanosomiasis, except cattle examinations at Yeji and Kumasi, has not been a subject of investigation at all during the period under review except for occasional examinations of the Accra polo ponies.

22. Yellow Fever.—Fortunately this disease has not been encountered during the year. Two cases that have been labelled toxic jaundice are reported below by Dr. Russell and they are given as illustrating some of the difficulties in diagnosis which is not made easier by the usual absence of any history or one upon which any reliance can be given: particularly does this apply in a country where so many conditions are accompanied by jaundice and many strange illnesses are met with.

These two cases are placed here because one's attention is so closely rivetted on the diagnosis of yellow fever though neither of them are actually regarded as such.

Post-mortem finding in a case of 'Toxic Jaundice.'

Post-mortem 72. An unknown African male of about 35 years was admitted to hospital unconscious, jaundiced, with "black vomit."

He died the next day and the post-mortem examination was made two hours after death.

External examination: a well nourished and well developed man; rigor mortis present.

Internal examination: subcutaneous fat yellow, heart blood clotted.

Brain congested and a little oedematous, small vessels in substance of brain gaping.

Thorax œsophagus and trachea contain "black vomit"; petechiæ on the pleuræ, pericardium, and endocardium. Small hæmorrhages in substance the lungs.

Abdomen.—The liver was 34 ozs. only; small, tough, colour yellow with bright red specks.

Stomach dilated, contains typical "black vomit."

Duodenum and upper part jejunum contains a mixture of fresh and black blood.

Spleen 8½ oz. soft, surface crinkled, rather pale on section.

Kidneys: R. 5½ oz., L. 5½ oz. pale, jaundiced, vessels injected, cortex swollen, petechiæ in the pelvis of one kidney.

Bladder: a few white granules on mucous membrane and a little thickening—no active schistosomiasis.

Blood Films were negative.

Urine showed trace of albumen and a few stained casts.

Seven lice found on the body were dissected but no spirochaetes were found.

Histology.—The liver shows such extensive liver atrophy that the tissue is almost unrecognisable; islands of a few surviving liver cells appear to be mainly in the middle zone of the lobules.

Kidney early parenchymatous nephritis.

Note.—The Accra Laboratory staff did not think the changes in the liver were those of yellow fever. Other authorities to whom sections were sent were not unanimous.

A second case of 'Toxic Jaundice.'

A young African male.

Death 24–36 hours previously. Post-mortem examination made at request of Coroner.

External examination: decomposition considerable. Conjunctivæ jaundiced. No rigor mortis. Sabre tibiæ.

Internal examination: post-mortem change marked. Subcutaneous fat bright yellow, blood clotted and beginning to hæmolyse.

Brain congestion marked.

Thorax: excess of fluid in pericardium, petechiæ on heart surface.

Abdomen: quantity blood stained fluid in peritoneum.

Liver enlarged, plum coloured and rather friable.

Spleen soft, swollen, and dark red—old and new perisplenitis.

Stomach no "black vomit."

Left kidney large and swollen.

Right kidney very small but swollen, pelvis and ureter dilated because of stenosis of ureter where it enters the bladder.

Bladder: thickened—no active schistomiasis made out.

Films of heart blood, spleen, and brain were negative.

Urine: albumen present and bile. No casts or sugar.

Histology.—The post-mortem change was so marked that little was made out but it was possible to exclude the diagnosis of yellow fever.

Note.—Case returned as one of fever of unknown origin, possibly relapsing fever.

23. Having enumerated together the various routine laboratory examinations that are applied in the investigation of certain diseases, there remain several other routine investigations made at the laboratories at Sekondi and Accra which need to be mentioned among the activities of these laboratories.

Blood Chemistry.—A steady increase is noticeable each year in the demand for these procedures.

Blood ureas, blood sugars and van den Bergh reactions at present are all that have been asked for.

	<i>African.</i>	<i>European.</i>	<i>Total.</i>	
van den Bergh ...	14	2	16	} 110
Blood urea ...	22	1	23	
Blood sugar ...	68	3	71	

Colorimeter methods are employed and they are simple, quick in their application and very satisfactory for use in the tropics.

24. **Cell Counts and Cerebro-spinal Fluid Examinations.**—Nothing in the bloods examined has been of interest, but a series of 31 cerebro-spinal fluids have been examined very carefully: leucocyte counts, globulin test, chloride, glucose and urea tests have been included but not necessarily all the procedures were carried out on each case. Most of these examinations have been carried out by Dr. Burgess who reports as follows:—

"In counting the cells of cerebro-spinal fluid a Fuchs-Rosenthal counting chamber and an 8 mm. apochromatic objective were employed, sufficient working distance for the objective being obtained by the use of a thin reinforced cover glass.

"Owing to the depth of the cell the correct tube length was very short, viz. 135 mm., and this was obtained by fitting a specially constructed short eyepiece tube. With this arrangement good definition could be obtained with a magnification of 350 diameters. For counting white cells three parts of cerebro-spinal fluid were mixed with one part of

staining and laking solution, which contained one per cent cresyl blue and four per cent acetic acid. Turbid fluids were also examined in order to determine the number of red cells.

"As a rule leucocytes could be differentiated well enough in the counting chamber, but in some cases degeneration lymphocytes with broken up nuclei gave rise to confusion. Dried films of centrifuged deposit were found unsatisfactory. In drying many of the leucocytes appear to disintegrate into "basket cells" or mere amorphous stained patches, and in the case of fluids containing but few cells it frequently happened that no intact cells remained in the stained film. When high magnification was required it was found better to stain the deposit *intra vitam* by placing a little of it on a slide on which a drop of cresyl blue solution had been dried and to examine it wet.

"It may be noted that the disintegration of leucocytes could be prevented by fixing the cells before making the film. This was accomplished by mixing the blood with two per cent formol saline and making films of the deposit next day; the staining properties of the cells were, however, somewhat altered.

"The destruction of leucocytes during the preparation of dried films also occurs in the case of blood and in this connection some observations on a case of lymphatic leucæmia which came under observation during the year may be mentioned. In this case the large number of basket cells in a thin blood film was the feature which first called attention to the blood condition. A count showed 75,000 leucocytes per c.mm. and subsequent counts at intervals of six weeks showed 35,000 and 15,000 leucocytes per c.mm. "At the last count the leucocytes as seen in the counting chamber consisted of four per cent polymorphonuclears and 96 mononuclears. "A specimen fixed by mixing with formol saline gave a similar result there being 2.5 per cent polymorphs. The dried film, however, showed 12 per cent polymorphs. But in the film there were 440 basket cells and amorphous patches and if these were added to the total leucocyte count the proportion of polymorphs would drop to 2.2 per cent. This indicated that about four-fifths of the lymphocytes were disintegrated in the preparation of the film."

25. Histological examinations.—The majority of this material is obtained at autopsy, almost every post-mortem yielding material to be examined. Nearly every portion of the human body is included in the series, but of particular note are the malignant growths which have occurred as follows:—

Sarcomata of various kinds	...	17
Carcinomata of various kinds		14

Amongst the sarcomata have been placed four melanomata while among the carcinomata are three primary growths of liver, in each of which a marked cirrhosis was present.

No cases of carcinoma of stomach or uterus have been recorded during the period under review.

If one may judge by laboratory records malignant disease is by no means uncommon, but they have a tendency to differ in general character, origin and site of election from malignant disease in Britain.

Staining for fatty changes in liver, kidney and heart is almost a routine measure and many unusual and unexpected pictures are found.

A series of examinations have been made on the histology of ulcers, the leg and groin being the usual sites of origin of the material; no evidence of Leishmania has been obtained, nor of Blastomycosis. The numbers are too few to be able to classify the types met with.

26. Post-mortem examinations.—Though these have numbered 122 in Accra and 98 in Sekondi they are all too few. Seventy-two of the

former and 97 of the latter represent examinations under coroner's order, so that of the former only 50 post-mortem examinations have been obtained by the staffs of the various hospitals in Accra, and they have been distributed as follows. Korle Bu Native Hospital 37, Maternity Hospital 10, European Hospital two, and Princess Marie Louise Hospital one.

The average number of deaths annually at the Korle Bu hospital covering the last five annual reports number 195; 158 deaths in that hospital have escaped complete pathological investigation during the last year.

The abnormal can only be judged by knowledge of what the common findings are, and however straightforward a case may appear to be it is extraordinary what further details of interest and value can be found. It is in the post-mortem room that the foundations of modern medicine have been laid and it is there that the foundations of medical science in the tropics will also arise: it is there also that our vanities get the shocks that are good for them and our endeavours get their best encouragement. It is hoped, therefore, that less opportunities will be missed in the future now that clinical pathologists have been appointed to certain hospitals.

The detailed list of the actual findings is given in tabular form on page 163, much of the material is intensely interesting and it is scarcely possible to call attention to it all. Mention should be made of one case of blackwater (recorded on page 76), one case of anaemia of pregnancy, two cases of toxic jaundice (recorded on page 82), three cases of primary carcinoma of the liver, eight cases of relapsing fever (reported upon pages 90 to 92): two cases of eclampsia; one case of human rabies is recorded in detail by Dr. Russell and Dr. Hawe in the *West African Medical Journal* Vol. III, No. 4, page 77.

There remains a single case of heat stroke which, because of its rarity, is recorded here.

A case of heat stroke occurred in an European aged 28 years. Death took place within three hours of onset and was marked by convulsions and hyperpyrexia.

The Meteorological readings for the day showed a maximum shade temperature of 94° F., a minimum of 79° F. and a relative humidity of 85 per cent.

The average readings for the period 5th to 19th of February in 1930, 1929 and 1928 give a comparative indication of the usual conditions prevailing.

			1930.	1929.	1928.
Max.	...	...	92.6	86.4	88.6
Min.	...	...	78	75.4	70.9
Rel. Hum.	%	...	73.7	72.5	55.1

The body was that of a very spare, but not ill-nourished, European man. There was well-marked lividity at the dependant parts and some rather frothy blood stained material exuding from the nostrils.

The pupils were medium and equal. There was no jaundice, oedema and no injuries. The body within was still quite warm 12 hours after death.

The brain was about normal in weight and the veins over the cortex were all a little dilated giving the appearance in places of haemoglobin staining though that was not actually the case. The *cisterna interpeduncularis* was rather distended and on opening the cerebral ventricles there was a distinct excess of cerebrospinal fluid which was slightly blood-stained and the choroid plexus was seen to be very engorged. There were no gross haemorrhages or damage to the brain visible to the naked eye.

The lungs were voluminous and showed a few petechiae at their bases. They were a deep purple in colour and oedematous and showed no signs of consolidation. The bronchial glands were black in colour and there was no sign of tuberculosis healed or otherwise.

The pericardial sac held practically no fluid and a few petechiae were present at the base of the heart posteriorly. The heart was normal in size but flabby and collapsed on itself when removed. Apparently there was some slight dilatation as the mitral valve took three fingers easily and the tricuspid ring four fingers. There was no valvular disease or aortitis. The endocardium showed a few flecks of haemorrhage within the left ventricle.

The abdominal cavity showed nothing unusual and there was a fair amount of sub-peritoneal and omental fat.

The stomach was empty and showed marked ecchymosis at the cardiac end. The small and large bowel were healthy and only contained a little fluid material.

The spleen was about five ozs. in weight—a deep purple colour and showed no evidence of disease.

The liver was about normal in size, rather pale and friable.

Except for congestion nothing of note was made out in the kidneys.

The adrenals were thinned and the yellow cortex narrow.

The pancreas and thyroid were normal in appearance.

The bladder was empty so that no urine was available for examination.

Blood films showed no evidence of malaria nor did the brain smears. Blood collected at the post-mortem gave a negative Wassermann, a negative test for alcohol, 75 milligrams of dextrose per 100 c.cs and 66 milligrams of urea per 100 c.cs.

Microscopically the cerebral cortex, kidney, heart, spleen, lung, pancreas and thyroid showed nothing of note except passive congestion in some of the tissues.

The liver lobule cells were rather separated not only in columns but in groups by congested capillaries. The cells retained their polygonal shape but were very vacuolated; and by fat staining there was noticeable a considerable loading with fat in large globules particularly at the centres of the lobules.

The adrenal showed distinct changes for the staining of the cytoplasm of the cortex was quite unusually pale though the nuclei stood out markedly. All the cells of the cortex were very ragged, vacuolated and often completely separated from the supporting reticular structure. The medullary cells took up eosinophilic staining in contrast to the cortex and appeared more or less normal. Chromaffin granules were not obvious though they are present. By fat staining there is a most marked fatty deposit in the cortex but only a few of the medulla cells show any fat deposit at all.

27. Medicolegal Examinations.—Exclusive of post-mortem examinations there is not much demand, except a few examinations of various articles for stains: as all chemical investigations go to Analytical Chemist there is not a great deal to report upon.

Three weapons were received for investigation of stains; in two mammalian blood was detected. Four cloths of various types were received to be examined for spermatozoa, they were all negative. At Sekondi five cloths were examined for blood stains.

Thirteen articles making up the 'implements' of a native witch doctor were examined for human blood; though they were all well-smeared with old blood all proved to be avian in origin.

A very interesting sample of poison from a spear head was received from Zuarungu : this was a black pitch-like material and was proved to contain strophanthin. One-twelfth of a gram emulsified in saline killed a pouched rat (*Cricetomys gambianus*) in 45 minutes and a guinea pig was killed in 10 minutes.

28. Bacteriological examinations of Drinking Waters.—This is a regular routine at Accra and Sekondi though but few supplies outside the water supply of these two areas are received.

The samples examined and their origin is stated below.

<i>Examined at Accra.</i>			<i>Examined at Sekondi.</i>		
Accra supply	...	158	Sekondi supply	...	374
Kumasi	...	3	Insuta	...	14
Winneba	...	8	Dunkwa	...	2
Saltpond	...	2			

As regards the Accra Water supply, the results are almost invariably excellent only 12 samples yielding lactose fermenters in 100 c.cs or less and in the majority of the cases the smallest volume that yielded them was not less than 100 c.cs.

As regards the Sekondi supply there has been considerable improvement 317 samples out of 372 yielding no lactose fermenters in 100 c.cs and the tap supply for Sekondi or Takoradi and the pumping main only showed lactose fermenters in 100 c.cs on six occasions out of 203 samples.

Besides these waters, soda water has also been examined from the following areas.

Accra 29, Kumasi 18, Winneba 1, Sekondi 36.

Again the results may be considered satisfactory as on no occasion have the Accra or Kumasi samples contained lactose fermenters in less than 100 c.cs. and on only two occasions has this occurred in the Sekondi samples.

The tabulated results are given on page

29.—Animal Examinations and Inoculations.—Mention of course is only made of routine procedures and therefore includes none of the work recorded under special investigations.

Trypanosome inoculations have failed to infect the experimental animal (guinea pig, *Cricetomys gambianus* and white rat) on the three occasions attempted.

Inoculations have been made for suspected anthrax, plague and diphtheria, all with negative results.

Tuberculosis was under investigation in 23 inoculations, two only yielding positive results, one from sputum and one from ascitic fluid : the negative results were obtained in six pleural fluids, two cerebro-spinal fluids, five ascitic fluids, five urines and one sample each of joint fluid, gland emulsion, and testicular emulsion.

Eight animals were used in an investigation of an arrow poison as mentioned under para. 27.

Six rabbits were used in an investigation of human rabies and was proved thereby as referred to under para. 26.

The only dog suspected of rabies that came under investigation was negative by animal inoculation from its brain emulsion.

Rat examinations for exclusion of plague numbered 2,674 in Sekondi and 1,759 in Accra averaging over 222 and 146 respectively per month : fortunately no positive case was found.

The variety of rodents sent for examination in Accra were as follows:—

<i>Cricetomys gambianus</i>	...	1,375
<i>Mus rattus</i>		270
<i>Mus norvegicus</i>		114

As regards examinations of various animals sent to the laboratory because of unexpected deaths or illness not very much of note can be reported. Ninety-one animals of various kinds have been examined and the main results are four cases of trypanosomiasis in horses, and a case of anthrax in a sheep.

Four dogs have been examined for rabies and found negative.

III.—REPORTS ON VARIOUS SPECIAL INVESTIGATIONS.

A general survey of the activities of the various laboratories in routine matters is not a difficult though a tedious task, difficulties however arise when it comes to an annual survey of any special investigations that have been carried out.

The work is frequently incomplete, or quite ordinary control work which is interwoven into other investigations, but yet it has occupied during the year much Government time, money and equipment, and presumably therefore should be accounted for. It is difficult to choose a middle course between unsatisfactory brevity amounting to a head line and awaiting a report that may take several years to materialise.

As the annual reports to me from the various laboratories or divisions represent a report of the work done I think they should be included as received but that in future years it should be understood that these reports should be condensed as far as possible into the form of preliminary reports, interim reports and summaries.

Some of reports this year are somewhat more lengthy than was anticipated but it is difficult for me to cut them down without largely ruining them and wasting much time in sending them backwards and forwards for curtailment or amendment.

It should be realised also that absence of staff on leave may cause a large variation in the amount of work to be reported upon from year to year.

Dr. Burgess investigations on plague vaccine which have been reported in the last two Annual Reports is now completed with the final summary given in appendix B., page 100.

A commencement made in the form of a preliminary study of metazoan immunity mentioned in the last annual report unfortunately has had to wait a more favourable opportunity for further development and study.

Some further statistics on malaria in parturient women have been gathered during the year as have also the Wassermann reaction in the same patients in parallel with their infants in order to gather some information on the prevalence and relationship of yaws and syphilis.

Bilharziosis is extremely common and it appears that there could be much study of this disease, some observations on the local snail population however is as far as it has been possible to pursue this subject.

The nature of the high immunity of the adult population to malaria seems to indicate a line of research and a search for some serological evidence of this condition has been commenced with no results for the moment.

The presence of relapsing fever has given an opportunity of studying the disease in man and experimental animals and there is much to pursue still.

Human trypanosomiasis is under investigation at Yeji in continuation with the final observations on the effect of bush clearing on the incidence of trypanosome infection in cattle.

Many cases of human trypanosomiasis have been found in the neighbourhood of Yeji and the treatment of early cases by atoxye investigated, while the adhesion phenomenon is also being followed.

The infectivity of the fly in the neighbourhood of Yeji can be gathered by the statement that six out of 16 fly and pupa boys have become infected during their work in a period of three months.

I submit the reports of the various investigations *seriatim*.

APPENDIX A.

PRELIMINARY OBSERVATIONS ON RELAPSING FEVER.

BY H. M. RUSSELL.

Part I.—*Human Relapsing Fever.*

- A. *Diagnosis of Obscure Cases.*
- B. *Wassermann Reaction in Relapsing Fever.*
- C. *Examination of Lice from Cases.*
- D. *Types of Spirochætes.*

Part II.—*Experimental Relapsing Fever (with charts).*

- A. *Choice of Experimental Animal.*
- B. *Relapsing Fever in Cricetomys Gambianus.*
- C. *Survival of Spirochætes in intervals.*
- D. *Reinfection with Relapsing Fever.*
- E. *Alternation of Types of Spirochætes on Passage.*
- F. *Relapsing Fever in Splenectomised Animals.*
- G. *Spirolysins.*

PART I.—*Human Relapsing Fever.*A.—*DIAGNOSIS OF OBSCURE CASES.*

Cases of relapsing fever, in the Accra district, occur sporadically and the number of fatal cases examined by the staff of the Research Institute during the past three years has been one each year.

In August, 1929, there was a small outbreak of relapsing fever in the neighbourhood of Accra and since then cases have occurred steadily. The staff of the Research Institute made complete post-mortem examinations of eight fatal cases between August, 1929, and March, 1930. Five were hospital cases and three were made under coroner's order.

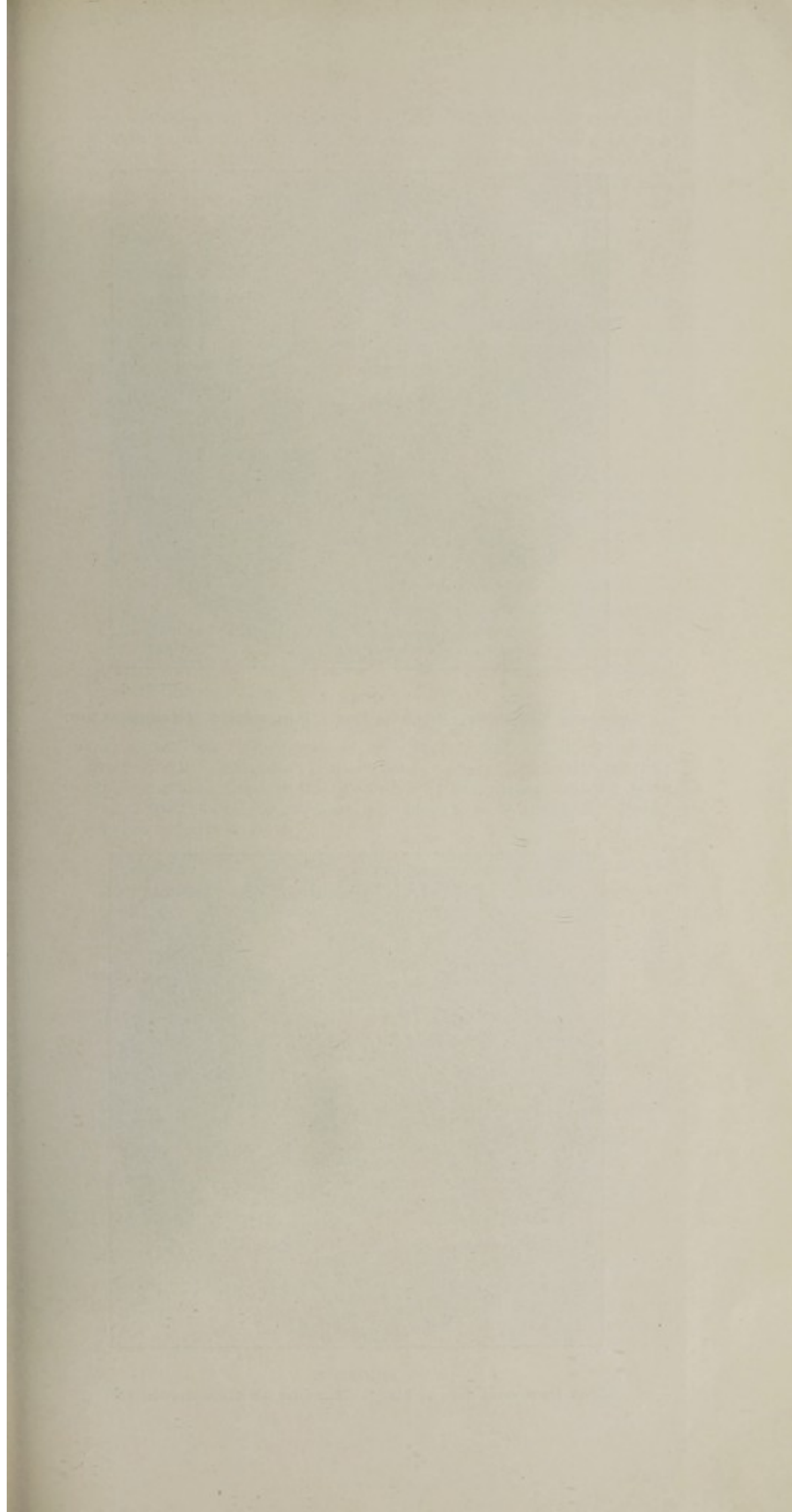
The differential clinical diagnosis of cases of toxic jaundice is not easy and gives rise to considerable anxiety in the Colony because of the possibility of an outbreak of yellow fever.

The details of several of the eight cases are recorded therefore because they illustrate the difficulty well.

Case I.—*Musah.*

Admitted to hospital unconscious with "black vomit," jaundiced, with a little albuminuria. (1/20th alb: and a few granular bile-stained casts). No spirochætes in blood. Died in six hours.

Post-mortem examination.—Three hours after death, small hæmorrhages lungs, heart, intestines. Liver small and cirrhotic. Bile black and sticky, ampulla blocked by swelling of duodenal mucous membrane. Spleen enlarged. Kidneys bile-stained and swollen. Bladder schistosomiasis. Stomach "black vomit" submucous petechiæ.



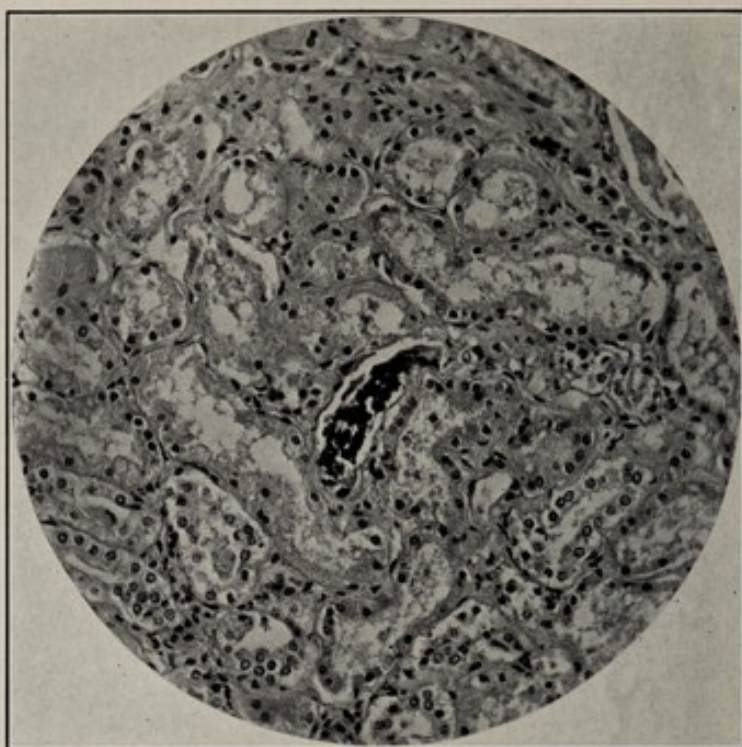


FIGURE 1.
"Lime casts" in kidney. Relapsing Fever. Haematoxylin Magnification 220.

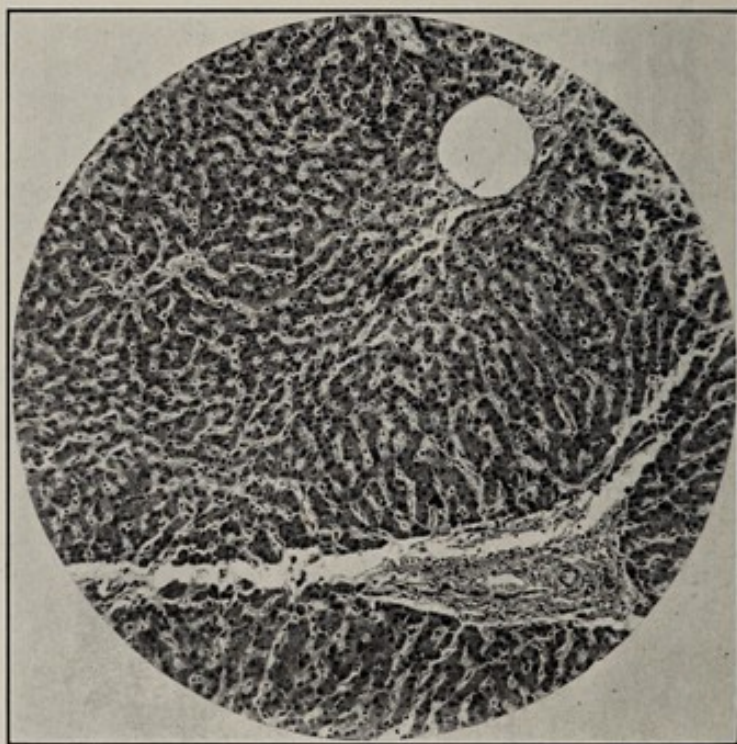


FIGURE 2.
Liver from same case as Fig. 1. Haematoxylin Magnification 220.

Histological examination.—Liver advanced cirrhosis, considerable fine fatty degeneration of the liver cells, but no loss of acinar arrangement. Kidney fine fatty degeneration of cells of convoluted and straight tubules. Spleen much congested, slide showing a small hæmorrhage. Blood smears microfilariæ.

Lice.—Contents of stomach examined in seven, no spirochætes.

Inoculation of C. gambianus with brain emulsion from the case showed spirochætes of relapsing fever nine days later.

Comment.—The clinical diagnosis was made because of the prevalence of relapsing fever in the town, and was only confirmed by animal inoculation. Yellow fever was excluded by the histological examination of the liver.

Case II.—*Karafia.*

Admitted to hospital semi-conscious, jaundiced, with high temperature, and in very poor condition. No spirochætes found in blood but were present in six of ten lice examined. Was given N.A.B. and temperature fell and he rallied but died a few days later. No albuminuria reported.

Post-mortem examination.—Sixteen hours after death. Lungs extensively mottled with dark areas and little patches of consolidation. Liver considerably cirrhotic. Bile dark, ducts healthy. Kidneys swollen and pale cortex rather narrow. Stomach nothing unusual seen. P.M. specimen urine albumen present but no casts.

Histological examination.—Liver fair degree of cirrhosis, no upset of arrangement of liver acini. Kidney slight interstitial changes, superadded early parenchymatous degeneration: lime casts present. Spleen inflammatory zone round periphery of malpighian bodies well marked. Blood smears negative.

Lice.—Ten examined, spirochætes in stomach contents of six.

Comment.—The diagnosis was made from the presence of spirochætes in six lice. The liver sections exclude the diagnosis of yellow fever. The presence of lime casts in the kidney is of unusual interest. see microphotographs Figs. 1 and 2.

Case III.—*An unknown Zabramah man* found by the police.

Post-mortem examination.—At least 24 hours after death, subcutaneous and other tissues extensively infected with a gas producing organism, many lice on clothes. Liver, cirrhosis present, organ full of gas bubbles. Spleen enlarged, gross P.M. infection. Kidneys decomposition considerable.

Histological examination.—Liver cirrhosis made out, but decomposition so advanced that liver cells not recognisable, no nuclear staining. Spleen tissue unrecognisable. Kidney decomposition not so advanced, lime casts present.

Spleen smears.—Spirochætes of relapsing fever.

Comment.—The case shows that if death occurs before the disappearance of spirochætes they may be detected in smears when the histological diagnosis is impossible because of decomposition.

The presence of lime casts in the kidney is of interest. see microphotographs Figs 3. and 4.

Case IV.—*Suly Wangara*.

Admitted to hospital, collapsed and died in 12 hours.

Post-mortem examination.—Six hours after death. Slight jaundice, petechiae heart and lungs. Liver large, yellow and cirrhotic. Bile dark and sticky, ampulla swollen. Stomach "black vomit." Small intestine, contents mixed with altered blood. Kidneys, pale and swollen. Bladder, schistosomiasis.

Spleen enlarged. Urine trace albumen no casts.

Histological examination.—Liver, considerable cirrhosis, some fine fatty degeneration of cells of whole lobule, but no loss of arrangement of liver cell columns. Kidney, early parenchymatous degeneration with fine fat deposit beside basement membrane of cells of cortical tubules. Spleen, circle of inflammatory reaction round malpighian bodies.

Smears.—Spleen and heart muscle few spirochaetes.

Comment.—This case probably died at the crisis of an attack when the spirochaetes were disappearing. The presence of "black vomit" in the stomach is of interest.

In the four remaining cases spirochaetes were easily found in the smears of blood or organs, and they are not reported in detail.

The diagnosis of relapsing fever may have to be made from a variety of details and by the exclusion of other diseases if spirochaetes are not found. There is no one lesion or group of lesions or symptoms which is invariably present. Albuminuria and "black vomit" may occur; jaundice is usually present in fatal cases. The spleen is usually enlarged but not always so.

The liver picture is often masked by cirrhosis. The zone of congestion and cell infiltration round the malpighian bodies of the spleen was noticed to be very marked in three of the eight cases, and as the same thing has been noticed in *C. gambianus* dying immediately after an attack of relapsing fever it is possible that it may aid in the diagnosis of obscure cases.

It is important to reiterate that the histological examination of the liver of fatal cases of obscure toxic jaundice is necessary in order to exclude yellow fever.

B.—THE WASSERMANN REACTION IN RELAPSING FEVER.

A note of the Wassermann reaction has been made in 35 cases of relapsing fever, and there is no evidence that a positive reaction is constantly present during, or after, an attack. The number of positive results tabulated in Table I coincides with the usual percentage of positive Wassermans in the population of the Colony. The records of the Accra laboratory show that percentage to be 30 to 40 per cent.

In Kumasi the figure is probably higher.

It appears therefore that the Wassermann reaction is of no value in the diagnosis of relapsing fever in the Colony.

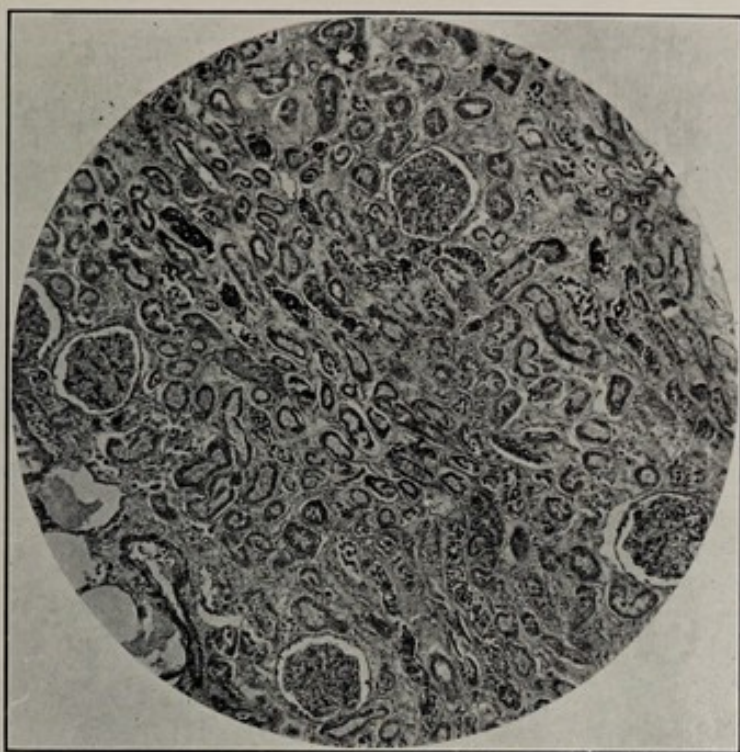


FIGURE 3.
"Lime casts" in kidney. Relapsing Fever. Haematoxylin Magnification 85.

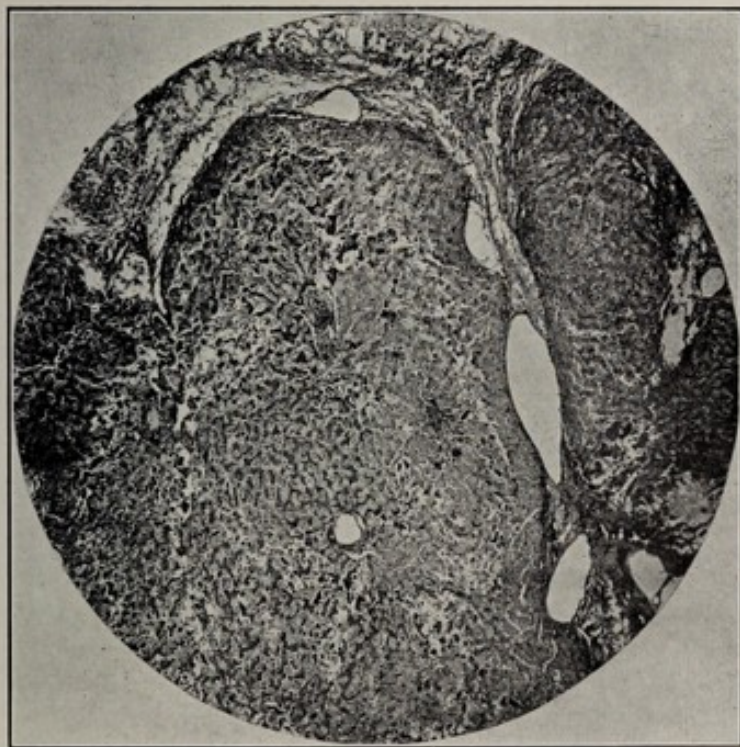


FIGURE 4.
Liver from same case—Fig. 3—showing advanced post-mortem changes in spite of which spirochaetes were found in spleen films. Magnification 85.



TABLE I.
THE WASSERMANN REACTION IN RELAPSING FEVER.

Case.	Stage of disease.	Wassermann reaction.
Angadumbo	Attack	Negative
Barazongo	Attack	
Yaya	Attack	Negative
Mamadu III	Attack	Negative
Seine	Attack	Negative
	Relapse	Negative
Musah III	Attack	Negative
	Interval	Weak+
Mamadu I	Attack	Negative
	Interval	Negative
Mamadu II	Attack	Negative
	Interval	Negative
Gariba	Second attack	
	Second interval	++
Peter	Attack	++
	Nine months later	++
Amadu Fulani	Crisis	++
	Interval	++
Osumani	Interval	++
Musawangara	Interval	++
Tsitin	Interval	Negative
Baryam	Interval	++
Sorh	Interval	Negative
Basikwei	Interval	Negative
Boateng	Interval	++
Kwamumi	Interval	++
Alidu	Second interval	Negative
Mamawangara	Second interval	Negative
Segu	Second interval	Negative
Chakara	Interval	++
Ali I	Interval	Negative
Bassaria	Interval	Negative
Arabigah	Interval	++
Buby	Interval	++
Sidey	Interval	++
Ali II	Interval	++
Talidu	Interval	++
Fulani	Interval	Negative
Heruna	Interval	Negative
Alidu Fulani	Interval	++
Heruna Briama	Interval	++
Jissy	Interval	Negative

C.—EXAMINATION OF LICE FROM HUMAN CASES OF RELAPSING FEVER.

It is generally accepted that relapsing fever is louse borne in the Colony. In 1923 Dr. Ingram succeeded in infecting himself and four native volunteers from lice collected from cases of relapsing fever. The exact mode of infection (whether by the bite of the insect, or the rubbing in of excretion) was not definitely proven.

During the recent outbreak of relapsing fever, when time permitted, lice were taken from the cases and the stomach contents examined. It was thought that possibly the presence of spirochaetes in the stomach contents of the lice might help in the clinical diagnosis of cases in which spirochaetes had disappeared from the circulation before the cases were seen by the clinician.

Lice from 18 cases were examined and in eleven cases spirochaetes were found. In three of the 11 cases (Karafia, Sikada and Musah II) the presence of spirochaetes in the lice was of value in the diagnosis. Karafia was diagnosed on that fact alone (other conditions were excluded at the post-mortem examination) Sikada was similarly diagnosed on admission and the diagnosis was confirmed when he relapsed. Musah II was also diagnosed from the examination of lice. He was admitted very ill with a falling temperature and spirochaetes were not found in his blood nor did he relapse.

TABLE II.

EXAMINATION OF LICE FROM HUMAN CASES OF RELAPSING FEVER.

Name.	Condition of lice.	No. lice examined.	No. lice in which spirochaetes found.	Condition of spirochaetes.	Method of diagnosis.
Musah I ..	Fresh ..	7	—		Animal inoculation of P.M. tissue.
Karafia ..	Fresh ..	5	2	One immobile	Presence of spirochaetes in lice.
	24 hours in Laboratory	5	4	All immobile	
Salifu Gruma ..	Fresh ..	4	—		Smears at post-mortem examination.
Unknown ..	24 hours in Laboratory	6	—		Smears at post-mortem examination.
Angadubo ..	Fresh ..	1	1	Immobile ..	Blood films during attack.
Sikada ..	Fresh ..	4	1	Mobile ..	Presence of spirochaetes in lice. Confirmed at relapse.
Seine ..	Fresh ..	4	1	Mobile ..	Blood films during attack.
Laminawongara ..	Fresh ..	8	—		Blood films during attack.
Busca Gruma ..	Fresh ..	5	—		Blood films during relapse.
Mahama ..	Fresh ..	7	1	Immobile ..	Blood films during attack.
Brahima ..	Fresh ..	3	—		Blood films during attack.
Awudji ..	Fresh ..	6	1	Mobile ..	Blood films during attack.
Alim ..	Fresh ..	6	1	Mobile ..	Blood films during attack.
Tsitsin ..	Fresh ..	4	1	Mobile ..	Blood films during attack.
Musah II ..	Fresh ..	5	2	Mobile ..	Presence of spirochaetes in lice.
Bonde ..	Fresh ..	4	2	Immobile ..	Blood films during attack.
Musah III ..	24 hours in Laboratory	5	1	Immobile ..	Blood films during attack.
Mamadu ..	Fresh ..	7	—		Blood films during attack.

D.—TYPES OF SPIROCHAETES IN CASES OF RELAPSING FEVER IN 1929 AND 1930.

In August, 1929, a human strain of relapsing fever was transferred to the bush rat *Cricetomys gambianus*, and that strain has been kept alive by passage (ten months) to the present time. With this strain three types of spirochaetes have been studied, an attack type, a first relapse type, and a second relapse type (the last occurring very seldom) similarly three immune sera have been obtained, each of which has a lytic action on the corresponding type of spirochaete. It was decided to call the attack type of spirochaete "A," the first relapse type "B" and the second relapse type "C." The corresponding sera were named "a," "b," "c."

During the first six months of 1930 cases were still occurring in the Colony and it became of interest to find out whether they were of the same types as the early cases. Table III gives the details of those from which either spirochaetes or interval serum was obtained for this classification.

From these observations it appears that the types of spirochaetes in the Colony did not change in ten months. Unfortunately the records of the early cases are very limited because the importance of the type of spirochaete was not appreciated at the time. The later records are more numerous and include cases from Suhum, and Kumasi, as well as Accra.

If the types of spirochaetes in outbreaks of relapsing fever are so constant as Table III suggests it becomes of interest to consider firstly whether vaccination of contacts might not be a practical proposition and secondly, whether the serological diagnosis of interval cases could be applied with advantage.

Further, the observation is of interest in the study of variation of type (or otherwise) in the insect vector. It also supports the belief in the alternation of types.

From experimental work in *C. gambianus* however, it does not appear that alternation of type can occur in the same individual, it appears to occur on passage.

TABLE III.—*continued.*

TYPES OF SPIROCHAETES IN CASES OF RELAPSING FEVER.

<i>Date.</i>	<i>Name.</i>	<i>Type of serum or spirochaete.</i>			<i>Method of arriving at result.</i>
1-8-29	Peter	..	c.	..	Serum tested nine months after attack with B. and C. spirochaetes.
22-9-29	Briama	..	Laboratory strain	..	source of types A.B. and C.
25-10-29	Mumuni	..	C.	..	Spirochaetes tested with a. and b. sera.
28-10-29	Alim	..	B.	..	Spirochaetes tested with a. and b. sera.
8-11-29	Seine	..	A.	..	Spirochaetes tested with a.b. and c. sera.
11-2-30	Tsitsin	..	b.	..	Interval serum with A. and B. spirochaetes.
18-2-30	Baryam	..	a.	..	Interval serum with A.B. and C. spirochaetes.
6-3-30	A. Zabremah	..	B.	..	Spirochaetes with a. and b. sera.
7-3-30	Sorh	..	a.	..	Interval serum with A.B. and C. spirochaetes.
8-3-30	Bonde	..	C.	..	Spirochaetes with a.b. and c. sera.
8-3-30	Musah	..	A.	..	Spirochaetes with a. and b. sera.
12-3-30		..	a.	..	Interval serum with A.B. and C. spirochaetes.
13-3-30	Mamadu II.	..	A.	..	Spirochaetes with a. and b. sera.
21-3-30		..	a.	..	Interval serum with A.B. and C. spirochaetes.
24-3-30	Basikwei	..	B.	..	Spirochaetes with a. and b. sera.
29-3-30		..	b.	..	Interval serum with A.B. and C. spirochaetes.
26-3-30	Ogodize	..	b.	..	Interval serum with A.B. and C. spirochaetes.
30-3-30		..	A.	..	Relapse spirochaetes with a. and b. sera.
31-3-30	Gariba	..	A.	..	Relapse spirochaetes with a. and b. sera.
9-4-30		..	abc	..	Second interval serum with A.B. and C. spirochaetes.
21-3-30	Boateng	..	abc	..	Interval serum with A.B. and C. spirochaetes.
	Suhum case	..		..	
21-3-30	Kuamumi	..	abc	..	Interval serum with A.B. and C. spirochaetes.
	Suhum case	..		..	
21-3-30	Amadu Fulani	..	c.	..	Serum at crisis with A.B. and C. spirochaetes.
28-3-30	Suhum case	..	bc	..	Interval serum with A.B. and C. spirochaetes.
26-4-30	Segu	..	abc	..	Second interval serum with A.B. and C. spirochaetes.
23-4-30	Mamadu III	..	A†	..	Spirochaetes with a. and b. sera.
26-4-30		..	c.	..	Interval serum with B. and A. spirochaetes.
6-6-30	Kumasi A.	..	a.	..	Interval serum with A. and B. spirochaetes.
2-6-30	Kumasi B.	..	B.	..	Spirochaetes with a.b. and c. sera.
6-6-30		..	b.	..	Interval serum with A.B. spirochaetes.
30-5-30	Kumasi D.	..	ab	..	Interval serum with A.B. spirochaetes.
2-6-30	Kumasi E.	..	b.	..	Interval serum with A.B. spirochaetes.
2-6-30	Kumasi F.	..	b.	..	Interval serum with A.B. spirochaetes.
2-6-30	Kumasi G.	..	b.	..	Interval serum with A.B. spirochaetes.
2-6-30	Kumasi H.	..	b.	..	Interval serum with A.B. spirochaetes.
2-6-30	Kumasi I.	..	b.	..	Interval serum with A.B. spirochaetes.
2-6-30	Kumasi J.	..	ab	..	Interval serum with A.B. spirochaetes.
3-6-30	Kumasi M.	..	b.	..	Interval serum with A.B. spirochaetes.
3-6-30	Kumasi N.	..	ab	..	Interval serum with A.B. spirochaetes.
3-6-30	Kumasi O.	..	b.	..	Interval serum with A.B. spirochaetes.
3-6-30	Kumasi P.	..	ab	..	Interval serum with A.B. spirochaetes.
3-6-30	Kumasi Q.	..	b.	..	Interval serum with A.B. spirochaetes.
3-6-30	Kumasi R.	..	b.	..	Interval serum with A.B. spirochaetes.
6-6-30	Kumasi S.	..	A.	..	Spirochaetes with a.b. and c. sera.
6-6-30	Kumasi T.	..	A.	..	Spirochaetes with a.b. and c. sera.
6-6-30	Kumasi U.	..	B.	..	Spirochaetes with a.b. and c. sera.
8-6-30	Kumasi V.	..	B.	..	Spirochaetes with a.b. and c. sera.
14-6-30	Ani Kweye	..	B.	..	Spirochaetes with a.b. and c. sera.
30-6-30	Amidu	..	C.	..	Spirochaetes with a.b. and c. sera.

Note.—Clinical histories are so unreliable that it is impossible to tell whether any case admitted with spirochaetes in the blood is having a first attack or a relapse. The serological reactions of several of the cases suggest that they suffered from an attack, or even an attack and relapse, before they came to hospital.

Acknowledgements.

I am indebted to the Medical Staff of the Gold Coast Hospital, Accra, for such clinical notes as have been used to make three of the four special cases more intelligible than they could have been otherwise; and am grateful for the opportunities they gave me of following the cases clinically.

I am also indebted to the Medical Officers of the Accra Prison and of the Kumasi hospitals who gave every facility to study the cases of relapsing fever which were under their care.

Part II.—Experimental Relapsing Fever.

A.—CHOICE OF EXPERIMENTAL ANIMAL.

During the 1923 outbreak of relapsing fever in the Colony Dr. Ingram made observations on the susceptibility of several experimental animals to the human spirochæte. He found the guinea pig and rabbit refractory; the white rat, *R. rattus*, and several monkeys relatively so; the bush rat *Cricetomys gambianus* became infected and relapsed.

The outbreak of relapsing fever in Accra in 1929 gave the opportunity of repeating those experiments, and showed that, of the experimental animals which easily are obtained in Accra, *C. gambianus* is by far the most valuable for the study of relapsing fever.

A limited number of experiments with other animals, including one rabbit, guinea pigs, and various local rats, confirmed Dr. Ingram's findings. Of the local rats, *R. coucha* and *Lemniscomys striatus*, were susceptible to relapsing fever, but less so than *C. gambianus*, and they both were found too nervous and *L. striatus* too delicate to be handled frequently.

B.—RELAPSING FEVER IN CRICETOMYS GAMBIANUS.

Preliminary experiments were made with various hospital strains of spirochætes, and then it was decided that the course of relapsing fever in *C. gambianus* must be worked out with one strain only, because otherwise the serological work would become too complicated. Accordingly *C. gambianus* 100 was infected with "strain V" (from Braima, Ward G, 22nd September, 1929) and that strain has been kept going in the laboratory since.

The blood of each rat was examined by dark ground illumination and a stained film before it was used for an experiment. Sixty one per cent were found infected with *Grahamella*, and five per cent with *S. minus*. Rats infected with *S. minus* were not used.

Technique.

"Strain V" was passed from rat to rat by the subcutaneous injection of 0.5 c.c. blood (drawn by heart puncture under ether anæsthesia) on the second day (usually) on which the spirochætes of the first attack were found in the tail blood. Chart I shows the course of relapsing fever in 22 rats which were examined daily from the time of inoculation to 30 days after the last day on which spirochætes were found.

Course of the disease.

The usual course of "strain V" in *C. gambianus* was an attack and one relapse. Of the 22 rats recorded in Chart I, three showed a second relapse; one showed an attack only; and one showed a relapse only, the attack being apparently suppressed. Almost invariably relapses were less severe than original attacks and second relapses were less severe than first relapses.

It was decided to call the attack type of spirochæte "A", the first relapse type of spirochæte "B", and the second relapse type of spirochæte "C."

The serum of the first interval was lethal to the attack spirochæte "A" and was therefore called serum "a." The serum of the second interval was lethal to the attack and the first relapse spirochætes, therefore it was an "ab" serum, the serum of the third interval (rarely obtained) was lethal to the spirochætes "A", "B", and "C" and was therefore an "abc" serum.

C. gambianus 144 (Chart I) was injected with attack spirochætes but the attack was suppressed and a relapse developed. After one

CHART I (OF APPENDIX A)

DAYS → 5 10 15 20 25 30 35 40 45 50 55 60

1	C. gambianus. 100. 22-9-29 0.75 cc BLOOD FROM BRIAMA	A	B	a ⁺ b ⁺	b ⁺ c ⁻
2	C. gambianus. 102. 27-9-29 0.75 cc BLOOD FROM C.g. 101.			a ⁺ b ⁺	a ⁺ b ⁺ c ⁻
3	C. gambianus. 103. 30-9-29 0.5 cc BLOOD FROM C.g. 102			a ⁺ b ⁺	a ⁺ b ⁺ c ⁻
4	C. gambianus. 105. 5-10-29 0.5 cc BLOOD FROM C.g. 6 (FROM 103)		a ⁺ B	a ⁺ b ⁺	a ⁺ b ⁺ c ⁻
5	C. gambianus. 106. 9-10-29. 0.5 cc BLOOD FROM C.g. 105.				a ⁺ b ⁺ c ⁻
6	C. gambianus. 108. 14-10-29. 0.5 cc BLOOD FROM C.g. 107		a ⁺	a ⁺ b ⁺	a ⁺ b ⁺ c ⁻
7	C. gambianus. 109. 17-10-29 0.5 cc BLOOD FROM C.g. 108		B		a ⁺ b ⁺ c ⁻
8	C. gambianus. 110. 19-10-29 0.5 cc BLOOD FROM C.g. 109	A	a ⁺	a ⁺ b ⁺	a ⁺ b ⁺ c ⁻
9	C. gambianus. 114. 29-10-29 0.75 cc BLOOD FROM C.g. 113	A		1 spirochaete seen	a ⁺ b ⁺ c ⁻
10	C. gambianus. 115. 1-11-29 0.75 cc BLOOD FROM C.g. 114		a ⁺	a ⁺ b ⁺	a ⁺ b ⁺ c ⁻
11	C. gambianus. 118. 10-11-29 0.5 cc BLOOD FROM C.g. 117	A	a ⁺	a ⁺ b ⁺	a ⁺ b ⁺ c ⁻
12	C. gambianus. 121. 19-11-29 0.75 cc BLOOD FROM C.g. 120	A	a ⁺	a ⁺ b ⁺	a ⁺ b ⁺ c ⁻
13	C. gambianus. 123. 23-11-29 0.5 cc BLOOD FROM C.g. 122	A	a ⁺	a ⁺ b ⁺	a ⁺ b ⁺ c ⁺ 2. RELAPSES
14	C. gambianus. 124. 25-11-29 0.5 cc BLOOD FROM C.g. 123	A			a ⁺ b ⁺ c ⁻
15	C. gambianus. 125. 28-11-29 1.0 cc BLOOD FROM C.g. 124	A	+ B	a ⁺ b ⁺	b ⁺ c ⁻
16	C. gambianus. 36. 1-12-29 a few months old. 0.5 cc BLOOD FROM C.g. 125				a ⁺ b ⁺ c ⁺ 2. RELAPSES
17	C. gambianus. 37. 1-12-29 a few months old. 0.5 cc BLOOD FROM C.g. 125		a ⁺ b ⁻		a ⁺ b ⁺ c ⁻
18	C. gambianus. 127. 4-12-29 1.0 cc BLOOD FROM C.g. 36.				a ⁺ b ⁺ c ⁻
19	C. gambianus. 128. 6-12-29 0.5 cc BLOOD FROM C.g. 127			a ⁺ b ⁻ c ⁻	ATTACK ONLY
20	C. gambianus. 131. 11-12-29 2.0 cc BLOOD FROM C.g. 129				a ⁺ b ⁺ c ⁻
21	C. gambianus. 134. 19-12-29 0.5 cc BLOOD FROM C.g. 133				a ⁺ c ⁻
22	C. gambianus. 144. 14-1-30 0.5 cc BLOOD FROM C.g. 143				a ⁺ b ⁺ c ⁻ SUPPRESSION OF ATTACK

RELAPSING FEVER IN C. gambianus.

EACH SMALL SQUARE = 1 DAY

■ = SPIROCHAETES PRESENT

■ = SPIROCHAETES NUMEROUS

■ = SPIROCHAETES AS NUMEROUS AS RED BLOOD CORPUSCLES.

ROMAN TYPE = TYPE OF SPIROCHAETE

ITALIC TYPE = TYPE OF SERUM

↑ = DAY ON WHICH SERUM TESTED.

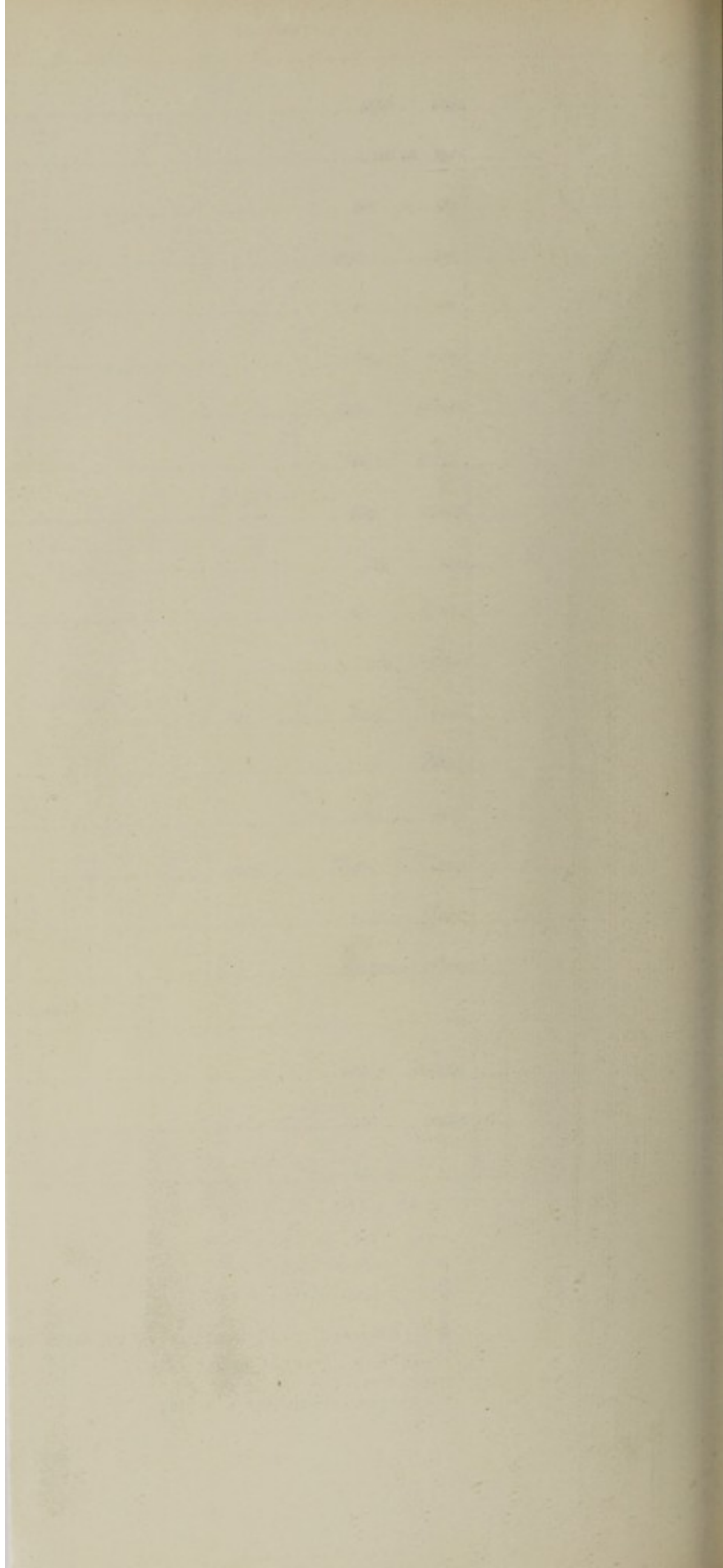


CHART II
(OF APPENDIX A)

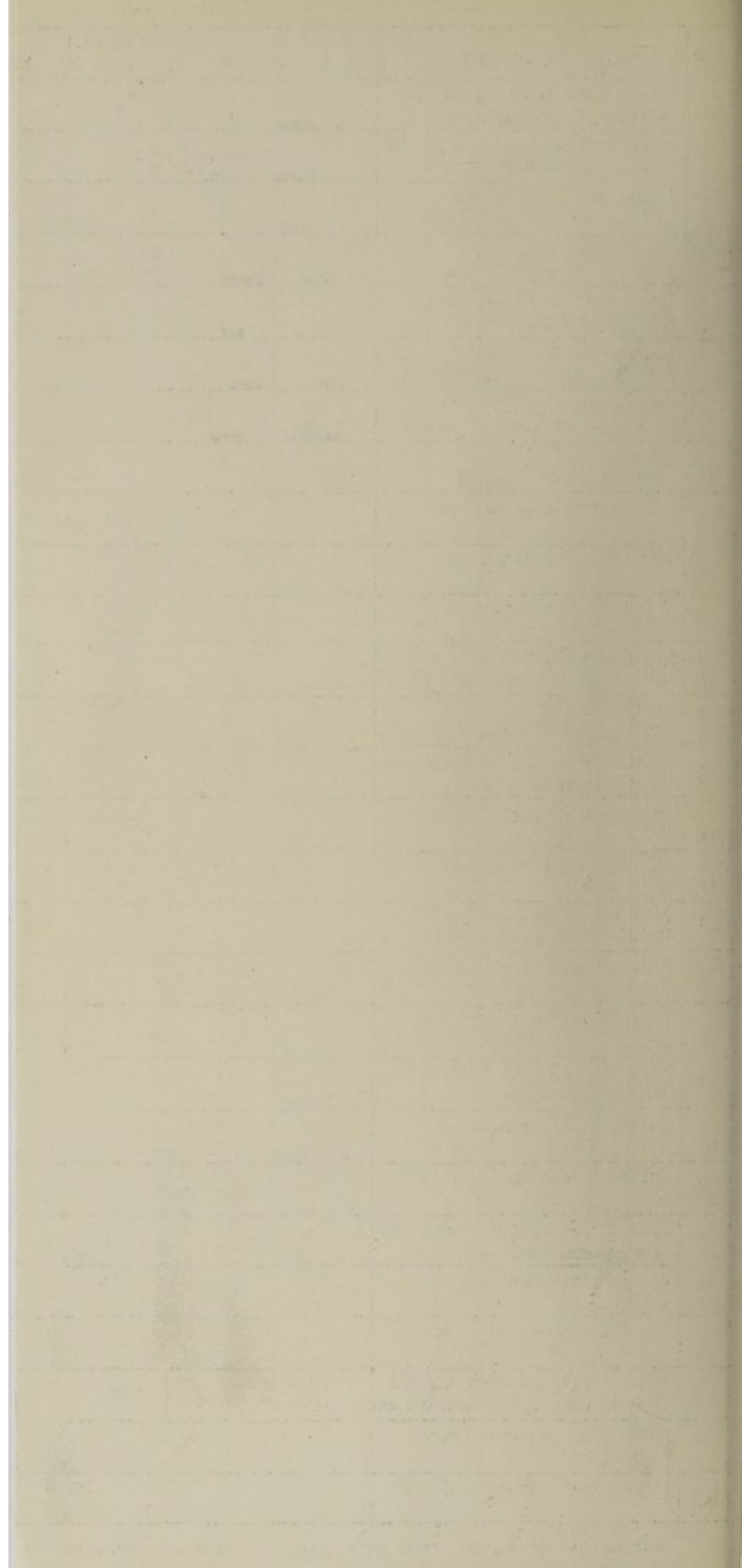
SUBSEQUENT INOCULATION

No	TISSUE INOCULATION	Days	5	10	15	20	25	30	35	40	Type	RESULT
1.	C.g. 10cc citrated blood C.g. 117 2 nd Day 1 st Interval type A			B			a- b+			a- b+	B	nil
2.	C.g. 2.0cc Spleen emulsion of C.g. 117 2 nd Day 1 st Interval type A				Ispirochaetes seen	a- b+				a- b+	B	nil
3.	C.g. 0.75cc blood C.g. 31 3 rd Day 1 st Interval type B				a- b+					a- b+		
4.	C.g. 0.5cc blood C.g. 120 3 rd Day 1 st Interval type A				C	a- b+				a- b+		
5.	C.g. 0.5cc well centrifuged serum C.g. 120. 3 rd Day. 1 st Interval									a- b+		
6.	C.g. 10cc blood C.g. 57. 3 rd Day. 1 st Interval type A				C	a- b+						
7.	C.g. 10cc blood C.g. 58 3 rd Day 1 st Interval type A					DIED						
8.	C.g. 1.0cc blood C.g. 63 3 rd Day 2 nd Interval					a- b-					A	
9.	C.g. 1.5cc spleen emulsion do					a- b-	DIED					
10.	C.g. 1.5cc Brain emulsion do					a- b-					A	
11.	C.g. 2.5cc Gland emulsion do				DIED							
12.	C.g. 1cc Blood C.g. 124 5 th Day 2 nd Interval						a- b-				A	
13.	C.g. 1cc Blood C.g. 31 6 th Day 2 nd Interval						a- b-					
14.	C.g. 2cc Blood C.g. 27. 34 th day after spirochaetes last seen						a- b-				A	
15.	C.g. 2cc Brain emulsion do						a- b-				A	
16.	C.g. 2cc Spleen emulsion do						a- b-				A	
17.	C.g. 1.5cc Lung emulsion C.g. 134 1 month after spirochaetes last seen						a- b-	DIED				
18.	C.g. 2.0cc Heart emulsion do						a- b-					
19.	C.g. 2.0cc Liver emulsion do						a- b-					
20.	C.g. 1.5cc. Blood C.g. 31. 5 weeks after spirochaetes last seen						a- b-					
21.	C.g. 2.0cc Brain emulsion do						a- b-					
22.	C.g. 2.0cc Spleen emulsion do.						a- b-					
23.	C.g. 1.5cc Blood C.g. 124. 6 weeks after spirochaetes last seen						a- b-					
24.	C.g. 1.5cc Spleen emulsion do						a- b-	DIED				
25.	C.g. 1.5cc Brain emulsion do						a- b-					
26.	C.g. 1.0cc Heart emulsion C.g. 32 7 week after spirochaetes last seen					DIED						
27.	C.g. 1.5cc Liver emulsion do						a- b-					
28.	C.g. 1.0cc Lung emulsion do						a- b-					

INOCULATION OF TISSUES FROM RATS TAKEN IN INTERVALS WHEN NO SPIROCHAETES FOUND IN TAIL BLOOD

1-7 Received 1st Interval Tissues.

8-28 Received 2nd Interval Tissues.



month its serum showed spirolysins for both the relapse and the attack spirochætes. The number of attack spirochætes in the 0.5 c.c. of infected blood which the animal received was sufficient to act as a vaccine and to produce spirolysins, although, for some reason, they were not able to multiply. It is hoped to work out later the strength of spirolysin which can be produced by the injection of dead spirochætes.

In two of all the rats examined (*C. gambianus* 135 and 200) the relapse type of spirochæte was found to belong to an unknown type, that is to say it was not destroyed by serum "a," "b" or "c."

The disease may be fatal, and death usually occurs soon after the crisis of the attack, this probably corresponds with the stage of collapse which is seen in man at the crisis.

Morbid Anatomy and Pathology.

The most constant pathological lesion in this rat is enlargement of the spleen. The glands draining the area of inoculation are enlarged and show minute red dots. Frequently there are small hæmorrhages in the lungs and petechiæ of the pleuræ, pericardium, and peritoneum. The zone of congestion and cell infiltration round the periphery of the malpighian bodies of the spleen is the only histological lesion which has been thought noteworthy.

C.—SURVIVAL OF SPIROCHÆTES IN INTERVALS.

It has been reported often that spirochætes survive in the body long after they can be demonstrated in the blood.

Chart II shows the results of inoculation of tissues of rats taken during the first interval, and also at different times after the relapse.

First interval tissues were infective in each case and the spirochæte which appeared was of the *relapse type*.

Second interval tissues (i.e. tissues taken after the first relapse) were not infective and produced no detectable spirolysins in the sera which were examined one month after inoculation. This suggests, that, an animal like *C. gambianus*, in which the usual course of relapsing fever is one attack and one relapse, is thereafter cured of the strain of relapsing fever with which it was infected.

From a further study of Chart II it may be assumed that a tissue vaccination from an animal cured of relapsing fever is of us practical therapeutic value. It produced no detectable spirolysins (rats 8—21) and did not protect any animal from a subsequent dose of living spirochætes.

However, the subsequent inoculations were made with the laboratory strain which at that time was giving severe and often fatal infections and yet not one of the series (rats 8—21) died of relapsing fever.

On the other hand it must be said that all the rats of the series were in fine condition having been well fed and in captivity for at least a month and that may have raised their resistance.

D.—REINFECTION WITH RELAPSING FEVER.

Chart III gives the results of efforts to reinfect rats with known types of spirochætes.

It shows that rats infected with any type of spirochæte are resistant to reinfection with that type, but can be infected with another type. This immunity lasts for months, and it occurs also in splenectomised rats.

C. gambianus 128 (chart III, reinoculation with "A" type) is an example of the suppression of first attack in an animal already immune to the attack type, described by Melleney. It cannot be said to be the same phenomenon as was seen in *C. gambianus* 144 (chart I).

There is some evidence from these experiments and others, that, apart from the development of spirolysins for individual types of spirochaetes, there is another more general resistance developed to all types. This is suggested because the reinoculations were made with virulent spirochaetes and yet produced short attacks in every rat except one, *C. gambianus* 16. It is noteworthy that *C. gambianus* 16 was a splenectomised animal.

E.—ALTERNATION OF TYPES OF SPIROCHAETES ON PASSAGE.

As seen in Chart IV the transfer of living spirochaetes of known type always reproduced the same type. That is to say that when type "A" was transferred, the new animals' first attack was type "A" and when types "B" or "C" were transferred the new animals' first attack was "B" or "C" as the case might be. The relapse of the new animals however, showed that the types *alternated on passage*. There has been no evidence at all that the types of spirochaetes can alternate in the same individual. Rather it has been found that they cannot.

After an attack of any type of relapsing fever spirochaete the serum develops spirolysins for that type which are demonstrable for months and the rat resists reinfection with the type.

F.—RELAPSING FEVER IN SPLENECTOMISED ANIMALS.

Fourteen rats were splenectomised. See Chart V.

The spleen was removed under ether anaesthesia. A left paramedian incision was used. The operation was occasionally a little difficult when the posterior part of the mesentery of the spleen is short, binding the organ down to the posterior abdominal wall. The rats recovered quickly.

Four rats (*C. gambianus* B, C, 2,* and 3) were splenectomised after they had had relapsing fever. This was an attempt to produce the reappearance of the spirochaetes in rats apparently cured. The attempt was not successful, there was no reappearance of spirochaetes in any one of the four.

Nine rats were infected after splenectomy and the results show that a splenectomised rat has usually a more severe infection with relapsing fever than a non-splenectomised one.

Splenectomy does not prevent the development of immunity. That is, the spleen is not a vital organ in the manufacture of spirolysins.

G.—SPIROLYSINS.

The serum of a rat which has recovered from an attack of relapsing fever with any type of spirochaete holds a substance which destroys that type of spirochaete. Its action *in vitro* is not characterised by agglutination. It immobilises the spirochaetes, makes them swell slightly so that their double contour can be seen, and finally disintegrates them so that their remains are almost unrecognisable. As soon as their mobility is affected the spirochaetes appear to have granules attached to them. It is impossible to say whether these are developed by the spirochaetes or are particles of blood dust which suddenly stick to them. The phenomenon is not the same thing as the "adhesion phenomenon" in which large particles and platelets adhere.

Chart VI give the titre of the spirolysin in several rats which were examined for many months after they were infected with relapsing fever.

CHART III.
(OF APPENDIX A.)

No	INOCULATION	RESULT	REINOCULATION WITH A		REINOCULATION WITH B		REINOCULATION WITH C	
			Time since first inoculation	RESULT	Time since first inoculation	RESULT	Time since first inoculation	RESULT
Cg. 24	1.0 cc blood 117 1st Interval Type A	B	3½ MONTHS	a- b+ ↑ c-	3 MONTHS	nil	6 MONTHS	
Cg. 26	2.0 cc spleen emulsion 117, 1st Interval type A	B 1 Spirochaete seen	3½ MONTHS	a- b+ ↑ c-	3 MONTHS	nil	6 MONTHS	
Cg. 36	0.5 cc blood 125 Spirochaetes + type A	A B	3 MONTHS	a+ b+ ↑ c+	3½ MONTHS	nil	2½ MONTHS	nil
Cg. 37	0.5 cc blood 125 Spirochaetes + type A		2½ MONTHS	a+ b+ ↑ c-	3½ MONTHS	nil	2½ MONTHS	
Cg. 128	0.5 cc blood 127 Spirochaetes + type A		2 MONTHS	a+ b- ↑ c-	6½ MONTHS	B	5½ MONTHS	
Cg. 132	0.5 cc blood 131 Spirochaetes + type A	A C	2 MONTHS	a+ b+ ↑ c+	2½ MONTHS	nil	5 MONTHS	nil
Cg. 100	0.75 cc blood Briama Spirochaetes + type A		5½ MONTHS	a+ b+ ↑ c-	5½ MONTHS	nil	4½ MONTHS	
Cg. 163	0.5 cc blood 162 Spirochaetes + type A		1 MONTH		1½ MONTHS	nil		
Cg. 10	0.5 cc blood L.W. Spirochaetes + type A	Splenectomised rat.	5 MONTHS	a+ b+ ↑ c-	5½ MONTHS	nil	1½ MONTHS	
Cg. 16	0.5 cc blood L.W. Spirochaetes + type A	Splenectomised rat	5 MONTHS	a+ b+ ↑ c-	5½ MONTHS	nil	8½ MONTHS	DIED

REINFECTION OF RECOVERED RATS.

Note. Unusual relapse type and serological change in 132.
Note. Suppression of injected spirochaetes in the first reinfection of 128.

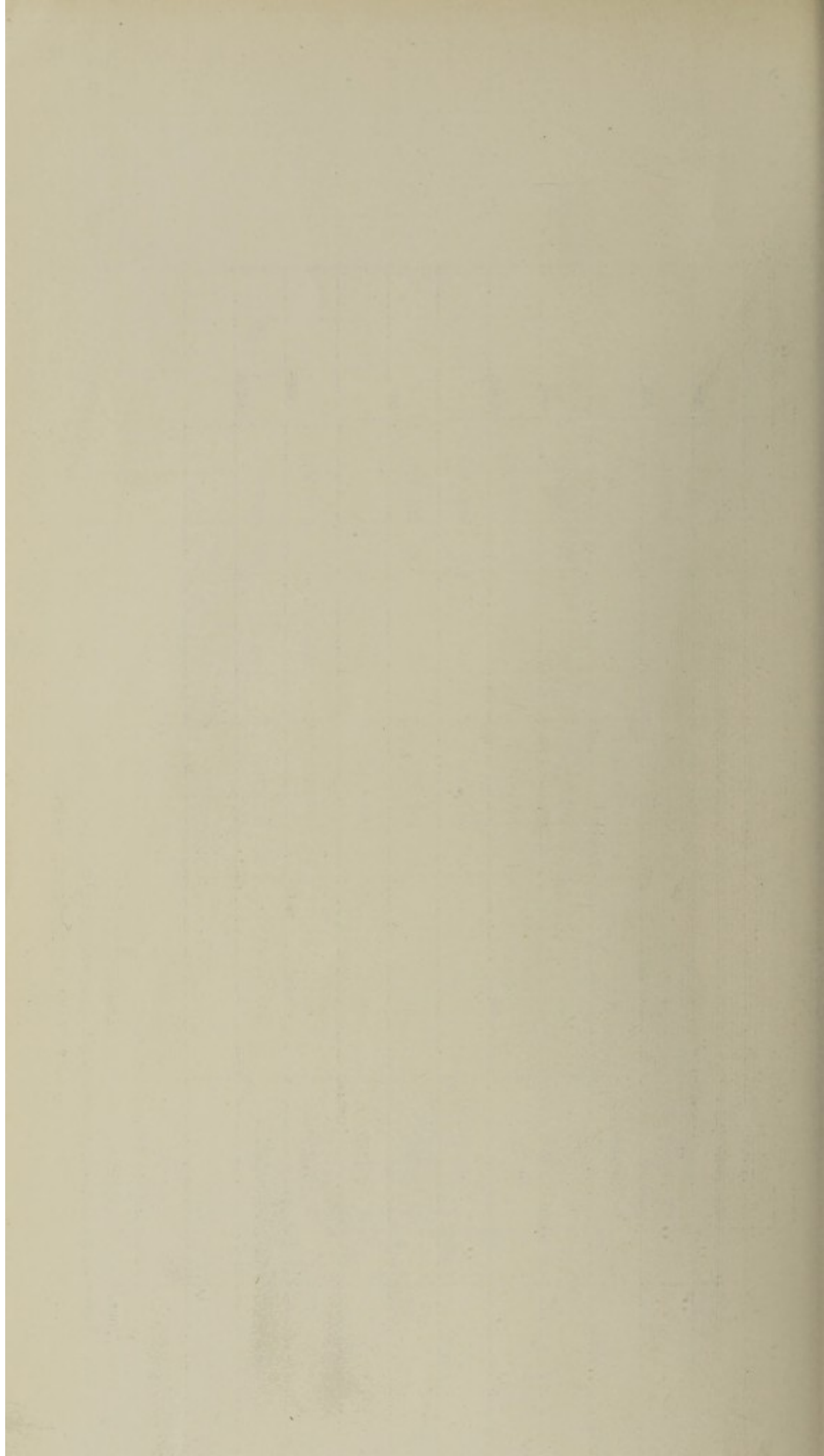
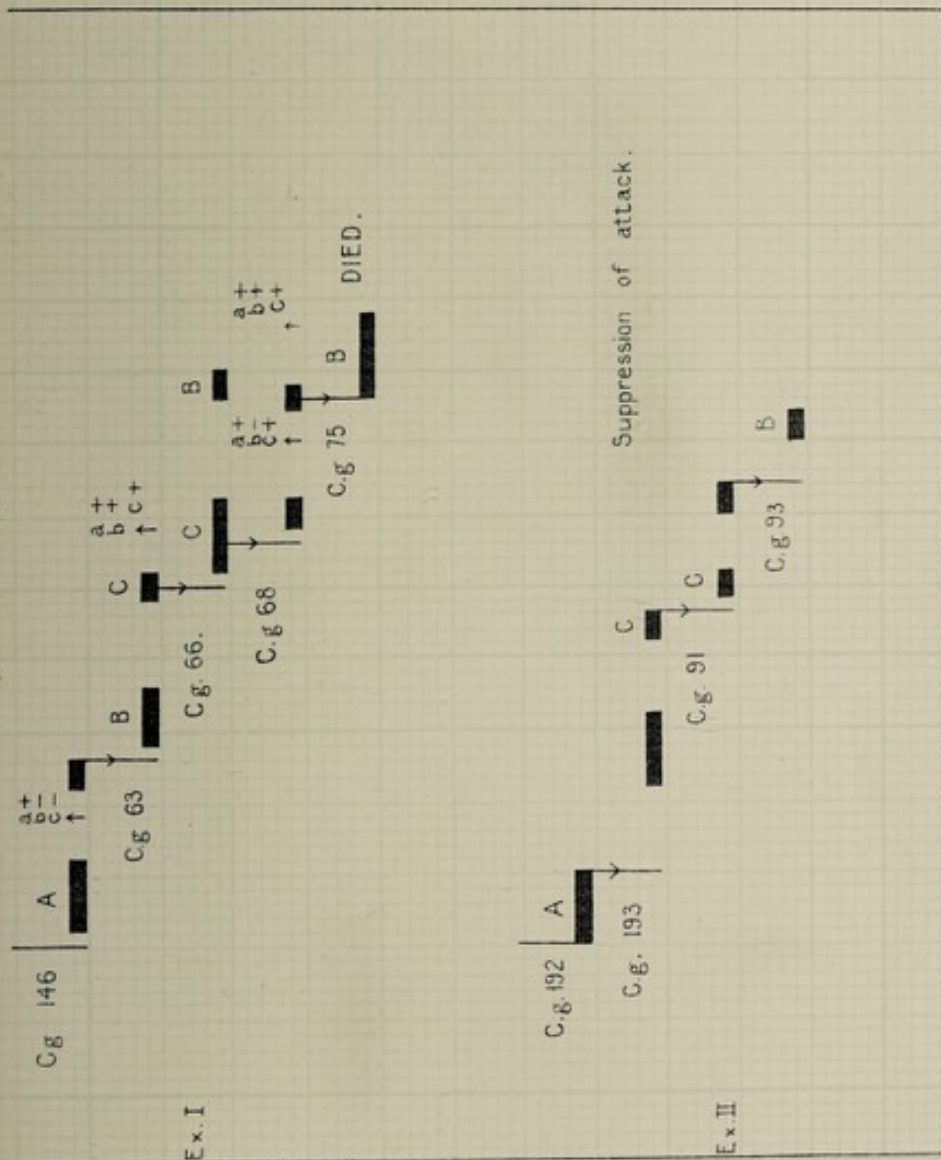


CHART IV (OF APPENDIX A)



ALTERNATION OF TYPES ON PASSAGE.

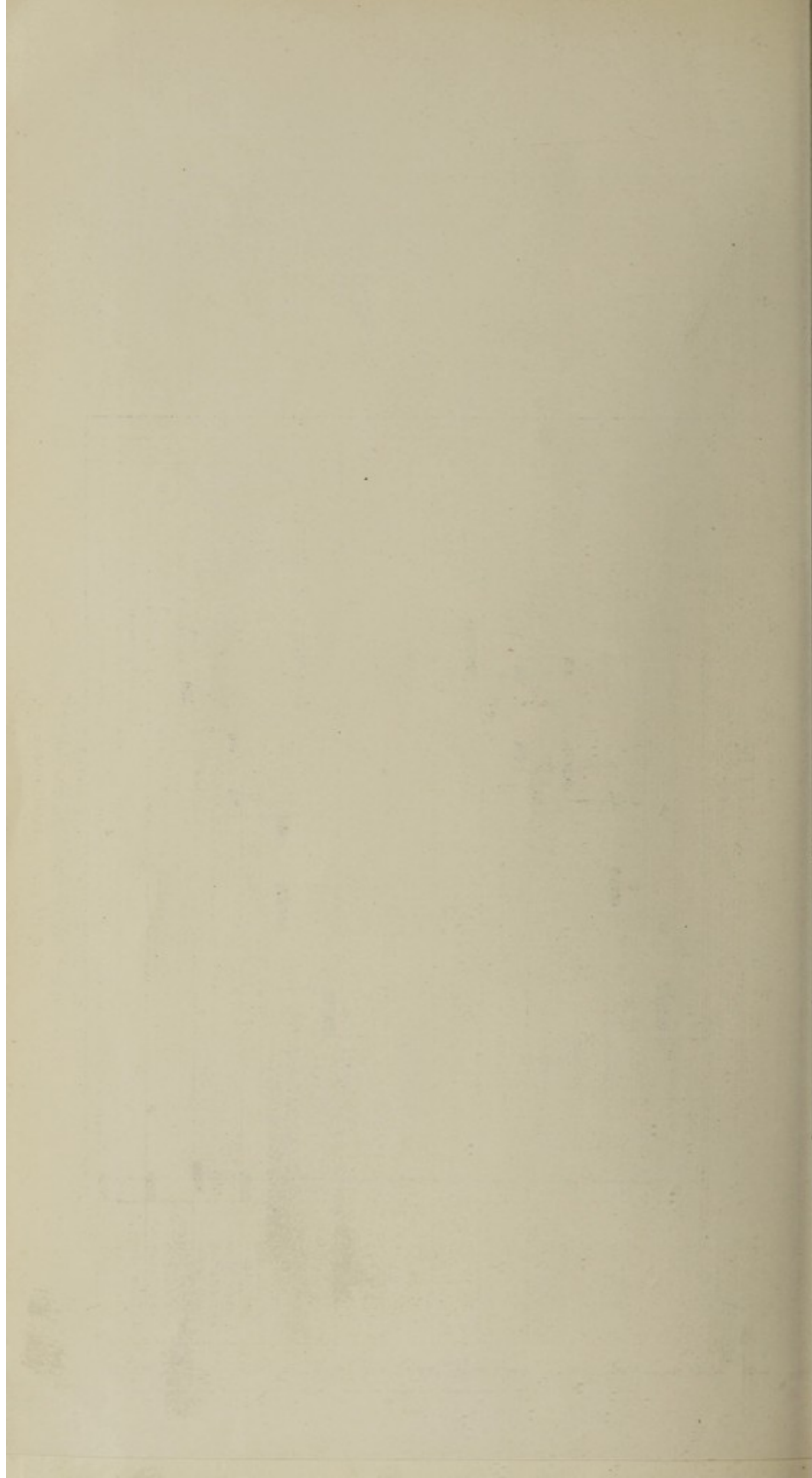


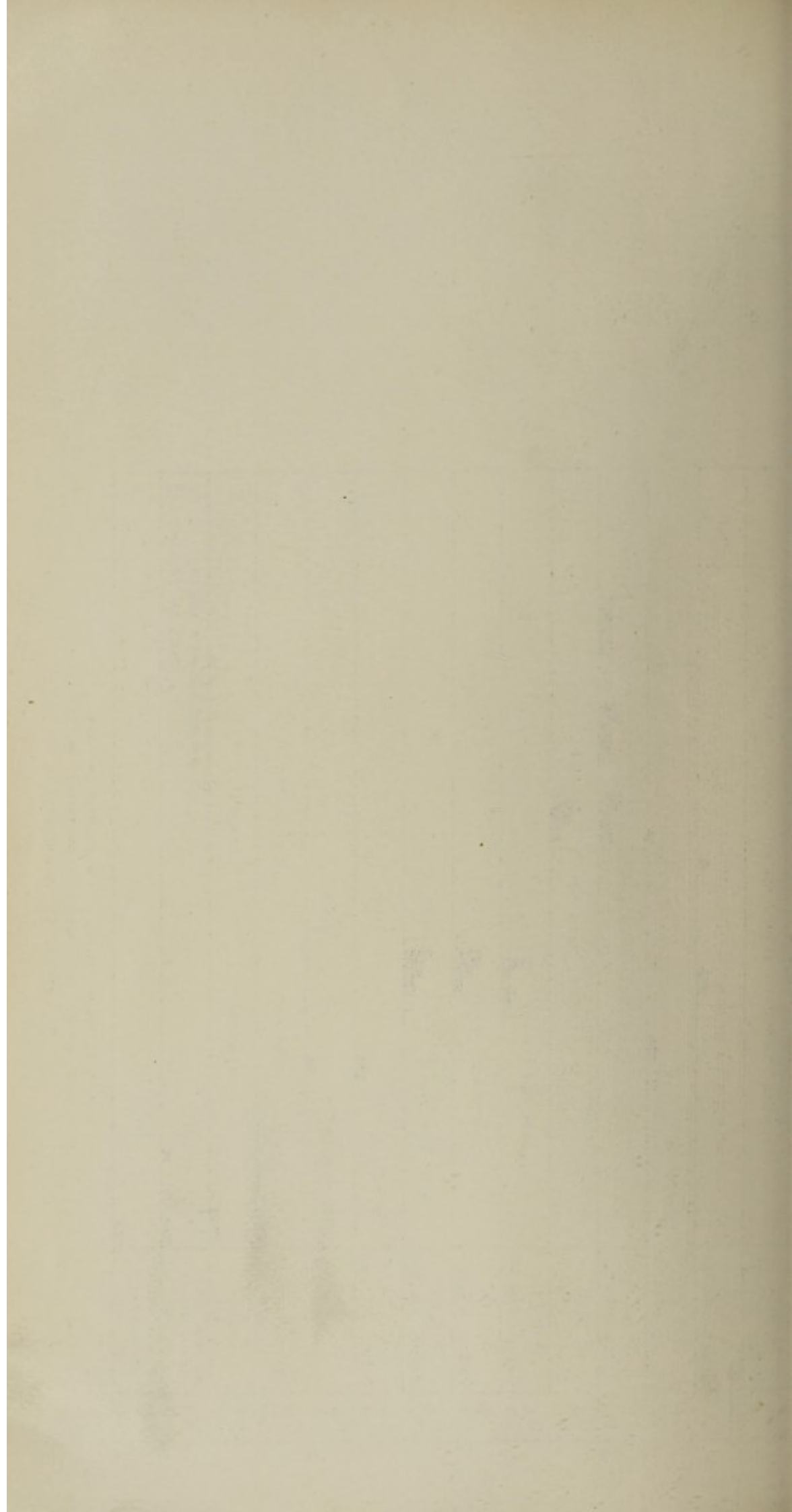
CHART V
(OF APPENDIX A)

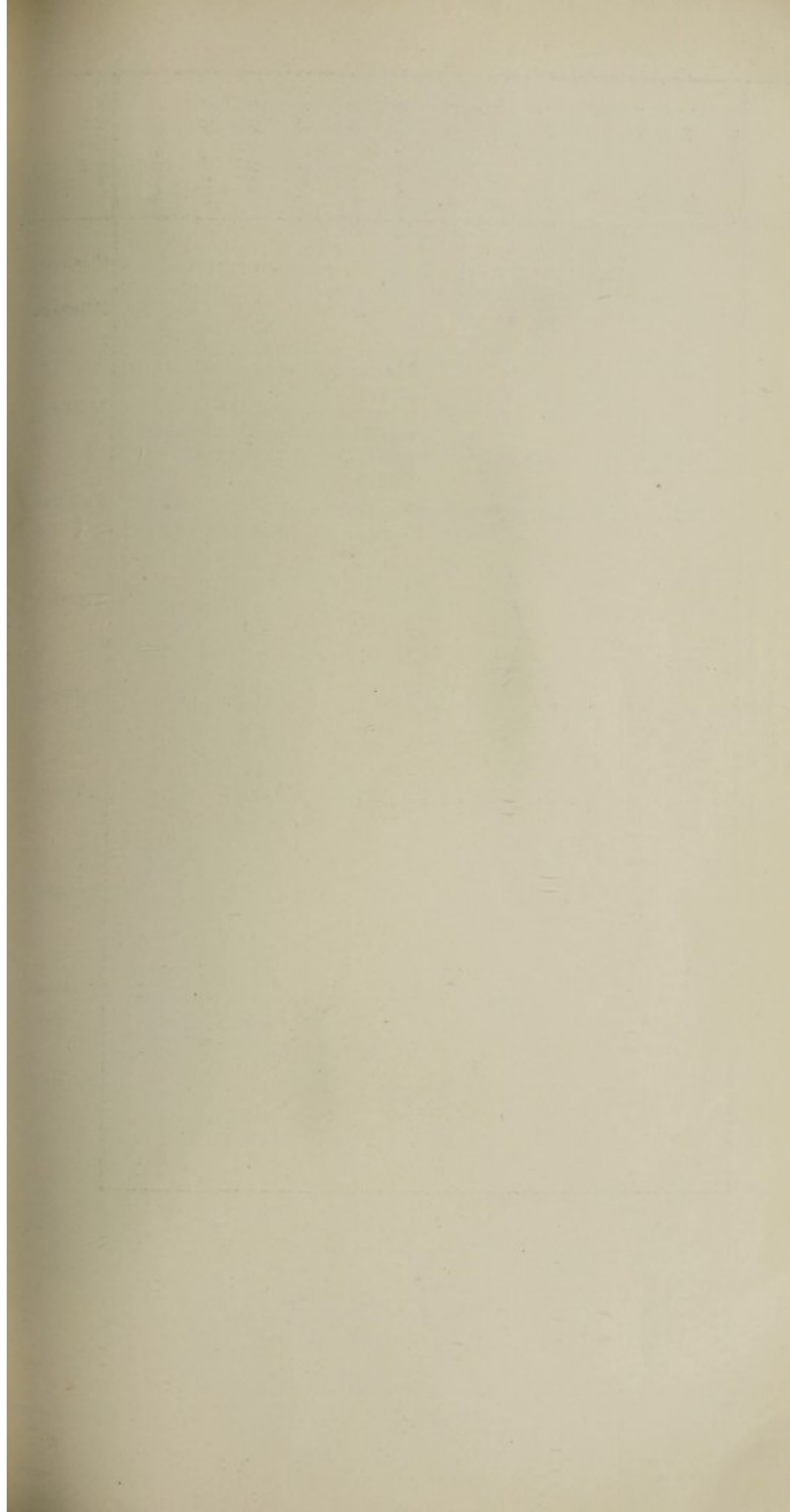
No	DATE OF SPLENECTOMY	Days 5	10	15	20	25	30	35	40	45	50	55	60	65	70	75 Days
C.g. 9	16-8-29 Before Infection			DIED	SUDDENLY.	WOUND HEALED.	CAUSE OBSCURE.									
C.g. 10	16-8-29 Before Infection		0.5 cc blood C.g. G. →													FINIS
C.g. 16	23-8-29 Before Infection		0.5 cc blood C.g. G. →													FINIS
C.g. 14	23-8-29 Before Infection					0.5 cc blood type A. →										DIED
C.g. 17	23-8-29 Before Infection					0.5 cc blood type A. →					DIED					
C.g. 28	18-11-29 Before Infection		0.5 cc blood type A. →				DIED									
C.g. 29	18-11-29 Before Infection		0.5 cc blood type B. →				DIED									
C.g. 30	18-11-29 Before Infection		0.5 cc blood type C. →				DIED									
C.g. 96	23-5-30 Before Infection		0.5 cc blood type B. →					FINIS								
C.g. 97	23-5-30 Before Infection		0.5 cc blood type B. →					FINIS								
C.g. B	20 Days after spirochaetes last seen				splenectomy					FINIS						
C.g. C	16 Days after spirochaetes last seen				splenectomy					FINIS						
C.g. 2	48 Days after spirochaetes last seen														splenectomy, piece size of lentil not removed	FINIS
C.g. 3	55 Days after spirochaetes last seen														splenectomy, piece size of lentil not removed	FINIS

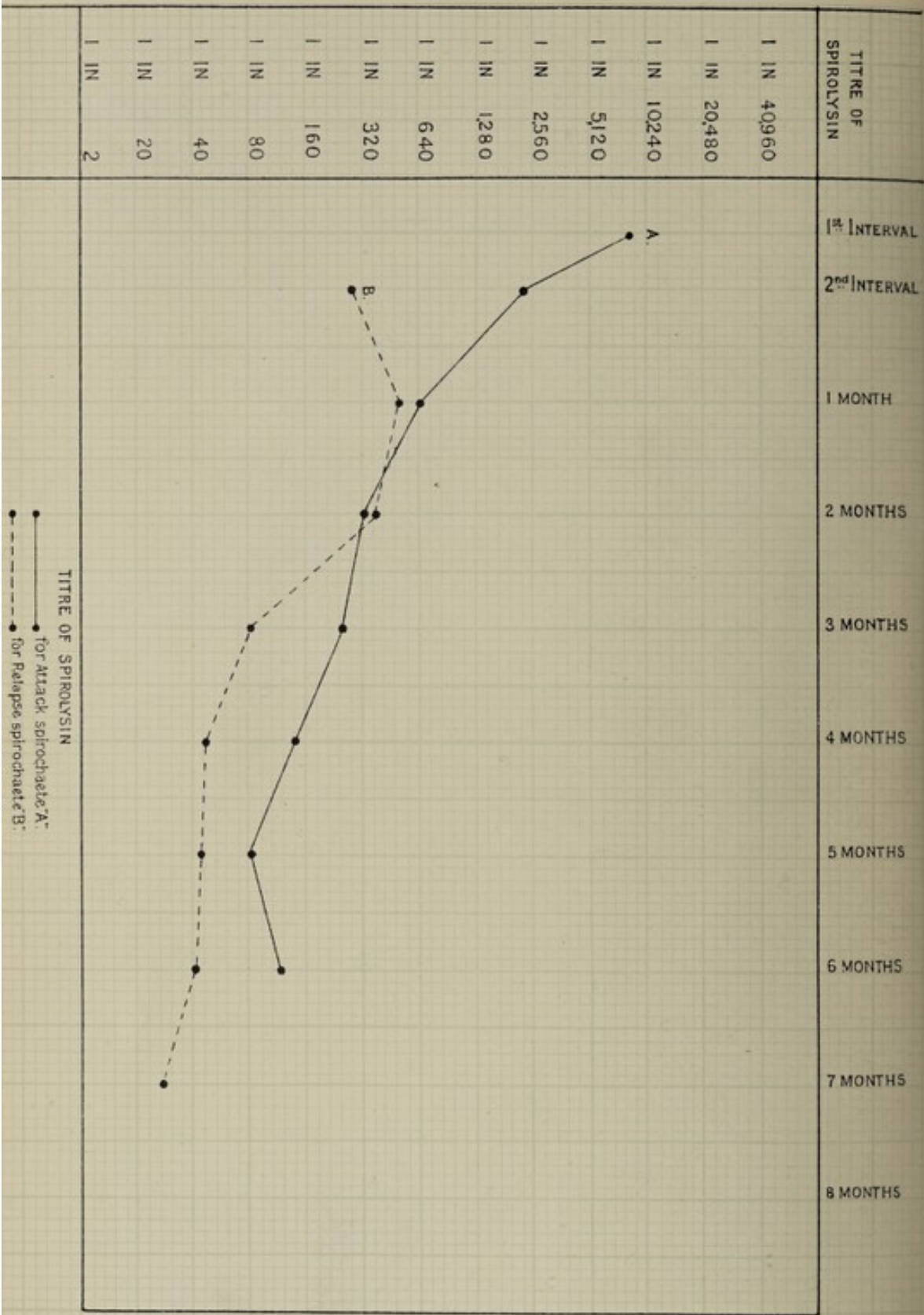
2-10 RELAPSING, FEVER, IN SPLENECTOMISED RATS.

11-14 ATTEMPT TO PRODUCE REAPPEARANCE OF

SPIROCHAETES BY SPLENECTOMY.







TITRE OF SPIROLYSIN
 —•— for Attack spirochaete "A"
 - - - • - - for Relapse spirochaete "B"

It will be seen that the titre of the serum for the attack type of spirochaete is higher than that for the relapse type. Both titres fall slowly month by month. The 2nd relapse spirochaete "C" was insolated so seldom that regular observations could not be made with it.

The living spirochaetes for this work were obtained from the rats in which the laboratory strain was being passed. They were used suspended in the serum of the rat from which they were taken. The examinations were made by dark ground illumination of coverslip slide preparations 45 minutes after they had been mixed and left at room temperature.

Most of the observations were not made twice; and some of them are not quite correct because some immune sera had to be kept in the ice chest for a few days before a suitable supply of spirochaetes was available and storage of immune serum even for a few days lowers the titre of the spirolysin. The results however, are sufficiently numerous to show that the specific spirolysins survive for many months in gradually waning strength.

The thermostability of the spirolysin has not been worked out. It is not destroyed by heating to 56°C. for half an hour.

APPENDIX B.

Final Summary on some Plague Experiment.

A paper on plague by Dr. Burgess will appear in the *Journal of Hygiene*. This gives an account of the plague work done since the publication of the last paper in the same Journal.

The course of the work has been outlined in previous annual reports 1926-27 *et. seq.* The summary of the present paper is reprinted below.

"VIRULENCE IMMUNITY AND BACTERIOLOGICAL
VARIATION IN RELATION TO PLAGUE."

BY A. S. BURGESS, M.D.

Summary and Conclusions.

1. African pouched rats (*Cricetomys gambianus*) are very suitable animals for plague experiments on account of their tolerance of captivity and their extreme susceptibility. After inoculation with small doses of plague culture of ordinary virulence they always die.

2. Broth grown vaccine was much more efficient as a prophylactic than agar grown vaccine. When two doses were given a survival rate of 56 per cent was obtained with the former and 25 per cent with the latter.

3. A vaccine composed of carbolised spleen pulp from animals which had died of acute plague, was rather more efficient than broth vaccine, giving a survival rate of 75 per cent. But it is not likely to be of practical value, as preparation is difficult, there are undesirable local effects and its superiority over broth vaccine is not very great. Its efficiency is attributed to the fact that the organisms which it contains are a true "body strain." The method of preparation is similar to that of Hindle's yellow fever prophylactic.

4. A number of experiments are described in which virulence was abolished or reduced by passage through immune or partially immune rats. This occurred only when the passage animals showed a considerable degree of immunity, as indicated by the length of the survival period after the test infection.

Cultures made from the abscess at the site of infection were less often attenuated than those from the liver of an immunised animal, but this was observed only in the case of large well-defined abscesses. It is suggested that a firm abscess wall protects organisms inside it against the action of antibodies appearing in the general circulation.

A culture attenuated by passage through an immunised rat was restored to normal virulence by successive passages through normal rats, but the process was slower than in the case of cultures attenuated by long cultivation, five passages being required in the former case and only one in the latter.

5. Cultures used in the later work, unlike those used in the earlier work, lost virulence rapidly when kept at room temperature. Experiments and observations are described which suggest that old strains, even when subjected to rat passage, are less stable as regards virulence than those recently isolated from human epidemic cases, and that the high temperature of the Gold Coast has an adverse effect upon virulence.

6. Attempts to isolate stable variants of *B. pestis* were not successful. Colonies vary much in form. Three types of colony are mentioned but all intermediate grades were observed.

Certain old avirulent strains had a greater tendency to produce large irregular colonies than recent strains, but the relation was so loose that the form of colony gave little indication of the degree of virulence. In old avirulent strains the bacilli tend to become longer and filaments of great length may be present. Salt stability tends to become less as a strain grows old and avirulent, but the change is not very marked and is apt to be masked by individual fluctuations.

APPENDIX C.
Malaria in Parturient Women.
 BY G. G. BUTLER.

In the last annual report a brief statement was given on this subject.

Observations have been continued throughout the year and the results recorded are now brought together though there is little further to add.

A total of 328 placenta have been received from the Maternity Hospital accompanied by a sample of maternal finger blood so that the results are in parallel. Blood smears taken from a cut surface of all the placenta have been examined as well as sections of the placental tissue in the first 200 cases after which it was dropped as at the time no further important information appeared to be derived therefrom.

I am extremely grateful to Dr. Summerhayes of the Maternity Hospital for all the details accompanying the specimens and to Dr. Russell who carried on much of the work particularly while I was on leave.

The results from this total of films from placenta and maternal finger blood are as follows :—

Parasites present in both placenta and peripheral blood	...	...	...	...	...	53	} 23.1 per cent.
Parasites present only in the placental smears	...					23	
Parasites present only in the peripheral blood	...					6	
Malaria pigment present alone in placental sections						34	
No parasites or pigment found	...	...	...			212	

The parasites encountered were only the subtertian variety but old engulfed pigment has been found on 20 other occasions in placenta accompanied by parasites but are not mentioned in the above table as the presence of parasites is better evidence of the infection present.

The occasions when parasites have been found in the peripheral circulation where the placental smears were negative have been infrequent, that is on only six occasions, and among these two showed scanty crescents and very scanty ring forms were present in three others.

It will be noticed how frequently peripheral infections are found in combination with placental infections, figures which are opposed to those recorded by Blacklock and Gordon from Sierra Leone and I fancy the explanation may be the constant use and practice with thick films in this laboratory. In the records of the 53 cases wherein both placenta and peripheral blood showed parasites the findings can be classed in the peripheral blood as a heavy infection in three, ordinary easily found in 29 and scanty in 21.

The parasites as found in the placenta as a rule are quite numerous and in some instances quite amazing in quantity : the commonest variety being sporulating forms and forms that we describe as 'stumpy or solid forms,' rings have however not been commonly found. The stumpy forms so frequently seen appear to be trophozoites showing pigment concentrated into a dense mass and very little chromatin staining material is present. Crescents have not been noted in any placental smears but many of the stumpy forms frequently look like precrescent forms though probably they cannot be owing to the constant non-observance of definite crescents.

Pigmented leucocytes may be extremely numerous and in these cases the diagnosis of a malaria laden placenta can almost be made on the reddish chocolate colour of the placenta compared with the usual dull red.

In many cases most beautiful preparations have been obtained in placental smears stained as in the thick film method with diluted Giemsa's solution. The sections prepared from placental tissue though confirming observation on the smears are as a rule not so beautiful and for the diagnosis of malaria have no advantage over the examination of smears alone: the one advantage they may have is in the detection of old engulfed pigment as evidence of old malaria.

Blood from the umbilical cord has been examined on 50 occasions and in no case except one were any parasites discovered: the one case in which they occurred was under suspicion of faulty technique in its preparation.

It has already been noted that over 23 per cent of the placenta examined in a routine manner show the presence of malarial parasites: an additional 17 per cent in the first 200 cases however also show evidence of old engulfed malaria pigment when the sections are examined so that probably at least a third of the patients have evidence of malaria recent or old in their placenta at the time of parturition.

The majority of these patients are probably living ordinarily under fair conditions so that one must assume that the corresponding figures for their sisters living under ordinary bush conditions must be infinitely higher and in fact the infection must be so universal that it can scarcely be affecting the people or the race would be dying out or have died out long ago.

With the information so kindly supplied by Dr. Summerhayes it has been found possible to classify 60 of the active malaria cases and 212 of the non-malaria cases according to the state of the infant at birth and shortly afterwards.

The termination of these 272 pregnancies can be tabulated as follows:—

	<i>Full term.</i>	<i>Premature.</i>	<i>Still births.</i>
Malarial placenta ...	34	20	6
Non-malarial placenta	155	30	27

Among these malaria placenta cases the six still births and six of the premature deliveries can be excluded as caused by obstetrical causes, interference or maternal illness. This leaves a total of 48 malaria laden placenta cases to examine and it will thus be seen that 70 per cent of them reach full term in spite of the malaria infected placenta as discovered at the time of the birth; the balance were premature.

In the non-malaria group, after exclusion of the premature and still births that can be explained on similar grounds, the corresponding figures are 90 per cent reaching full term and 5.3 per cent only premature. The main difference in these two groups appears to be due to the malaria infection and the surmise that malaria infection of the placenta is the commonest cause of the prematurity is also suggested by these further figures in that particular group, namely, of the 30 premature infants in whose placenta no malaria was found 30 per cent were premature without apparent adequate cause and this figure rises to 70 per cent in the group of 20 premature infants in whom the placenta was definitely malaria infected.

Active malaria infection of the placenta thus appears to be an important cause of premature delivery but that it does not affect the health of the child appears to be indicated for among the 14 cases of infants born in this premature manner, in whom the records are complete, eleven are described as healthy infants, that is nearly 80 per cent; it is further the considered opinion of the European staff of the Maternity Hospital that the premature infants born with a malaria infected placenta are healthy at birth and remain so while they are under observation at the Maternity Hospital which usually extends over more than seven days.

Whether at various stages in a pregnancy there is any difference in the effect of a malaria infection of the placenta remains to be discovered, but as 17 per cent of placentæ delivered at full term showed evidence of old malaria only in the form of engulfed pigment it would seem possible that placentæ infected earlier in the pregnancy may not lead to such trouble as an infection in the latest stages of pregnancy when possibly the uterus is in a less stable state: our present information is that there is little or no effect on the infant but whether there is any advantage to the infant to be born with a malaria infected placenta so that in its early free existence it may possess some passive immunity which slowly falls while it acquires an active one is a subject in which I am greatly interested and is important to elucidate by further researches. I believe the study of man and his parasites should be a combined biological study for they are both living organisms, both doing their best to live and reproduce and not to commit race suicide and that real perspective can only be obtained by search for fresh knowledge of the various reactions of the host and his parasite to their environment and not by any one sided study of a disease in man.

APPENDIX D.

Some Observations bearing on Yaws and Syphilis.

BY G. G. BUTLER.

The relationship of these two diseases is not only a subject of great technical interest but it is of great importance. I think it will be conceded that hospital returns and opinions in British West African colonies indicate the comparative infrequency of recorded cases of primary sores and congenital syphilis and that this is occurring where, owing to lack in the practise of prophylaxis or restraint, syphilis should be rampant. The low records of primary sore must either mean the disease is rare or unreported and if the latter the future is indeed serious for the stamping out of the disease in a community can only be done at the chancre stage and its immediate sequelae.

There is also, however, the question of cross immunity which might explain the paradox and if there is such a factor it may very definitely affect our procedure in anti-yaws and antenatal campaigns if syphilis is regarded as more serious in its results than yaws.

The control of syphilis is dependant on a whole population with at least a twentieth century appreciation of the disease, its dangers and consequences to the race: this is scarcely likely to be acquired, except by a negligible proportion of the general population of British West Africa, for many decades if not centuries, for it means not only the acquisition of a high standard of general medical knowledge, but a complete alteration in their standard of life and living. Syphilis, under these conditions of lack of control, probably means the slow disappearance of a race owing to still birth and other ante-natal effects, and it is to be hoped that there is at least some cross immunity from yaws, and that the difference between the two diseases is the survival in the tropics of a dermatropic strain by natural selection as against a strain altered by constant attack of drugs though still giving a type of immunity common to the two diseases.

In case any light could be thrown on this relationship a close co-operation with the Maternity Hospital has been maintained and a study of the results obtained from Wassermann reactions in both mother and infant has been made as well as an examination of placentae from a majority of the cases during the last year. Dr. Summerhayes who is in charge of the Maternity hospital has provided all the details of history, maternal and infants condition and without this aid no results could be obtained except bare statistical details: it is therefore to her that all the credit of any results, if any, must go.

There are so many variable factors that may influence results that it is difficult to sort out the various observations and gather those together that appear to throw light on the subject: it has been a time-consuming occupation with as yet apparently little indication of valuable results.

In the first place a few bare details perhaps should be given.

The bloods of 191 parturient women were examined by Wassermann reaction and 69 or 36 per cent of these gave a well-marked positive result and the probability is that 30 per cent positive may be considered to be about the normal finding amongst the usual population attending the Maternity hospital for confinement or ante-natal treatment. In a yaws-infected country these figures convey unfortunately no useful information as to the necessity of initiating ante-natal treatment against suspected syphilis.

The cord blood from newly born infants has been examined similarly on 169 occasions with nine positive results, that is 5.3 per cent.

Among these two series 157 maternal and cord bloods have been examined in parallel, the results show that among 55 mothers with a positive Wassermann one in six, approximately (16.6 per cent), yielded Wassermann positive infants at birth which did not occur at all amongst the 102 Wassermann negative mothers.

I can only find brief references as to results of a similar examination amongst Europeans or in any yaws-free community and they give figures varying between 20 per cent and 45 per cent positive results at birth in syphilitic infants. The figure (16.6 per cent) obtained at Accra in infants from Wassermann-positive mothers therefore suggests that syphilis cannot be very prevalent though the conditions are such that it ought to be very widespread: it also suggests that yaws does not commonly cause a positive Wassermann in the infants at birth for while the general population is approximately 30 per cent Wassermann positive the 169 infants examined have only proved to be 5.3 per cent positive.

Boas states that untreated syphilitic mothers yield 96.5 per cent syphilitic children but the diagnosis, I think, has not been based only on Wassermann reactions at birth and herein may lie the explanation of the low figures obtained in Accra. The opportunity for re-examination of the blood of infants after an interval of a few weeks is unfortunately not easy to arrange and unless there is a definite guide to its necessity it would appear that only a routine procedure with the large amount of work it entails will give the information required.

The nine cases, already quoted above, of infants with positive Wassermann reactions at birth are of interest for in the three that have been re-examined after a few weeks interval the reaction has become negative without any treatment to account for it: to what extent this is usual I am unaware but it may be an indication that Wassermann positive reacting bodies can filter through into the foetal circulation but die out after birth in the absence of the stimulation of the actual causative antigen in the foetal tissues.

Only one infant who had a Wassermann negative blood at birth has been re-examined after an interval of a few weeks, presumably because there was some clinical indication, and a positive reaction was obtained: this is very suggestive particularly as the child had not to me the appearance of a congenital syphilitic: the mother of this case had a strongly positive Wassermann.

Caution is undoubtedly very necessary in pronouncing upon the health of the newly born and the results—obtained by Wassermann tests on pregnant mothers and their infants at birth—do not at present appear to me as likely to yield such useful information as careful attention to the history of previous pregnancies and the Wassermann reaction on infants 12 weeks or so after birth.

The statistics quoted above appear not to throw any light on the relationship between yaws and syphilis or the prevalence of one rather than the other and the statistics of the Wassermann reaction in relation to the condition of the infant at birth will now be examined for they may yield some better information.

Dr. Summerhayes has kindly supplied me with information concerning the termination of 158 pregnancies of whom I had the Wassermann reactions.

Fifty-five Wassermann positive and 98 Wassermann negative women terminated their pregnancies as follows :—

	<i>Premature.</i>	<i>Still birth.</i>	<i>Full term.</i>
55 Wassermann positive mothers ...	9	5	41
98 Wassermann negative mothers ...	16	13	69

After the exclusion of premature deliveries and still births that can be satisfactorily explained on obstetrical and maternal conditions the table reads as follows :—

	<i>Premature.</i>	<i>Still birth.</i>	<i>Full term.</i>
55 Wassermann positive mothers ...	6	3	40
98 Wassermann negative mothers ...	5	—	69

This shows that 55 Wassermann positive mothers had an unexplained unsatisfactory termination to their pregnancies in 9 or 16.3 per cent of cases while in the Wassermann negative group only five, that is only 5.1 per cent, terminated in an unexplained unsatisfactory manner.

It has already been indicated that malaria is probably a cause of premature delivery and if these cases are also deducted namely, three from the Wassermann positive and five from the Wassermann negative group the percentage of unsatisfactory termination to pregnancies becomes 10.9 per cent in the Wassermann positive mothers and none at all in the Wassermann negative group of mothers.

The only comparable figures in a yaws-free country that I can find mentioned were obtained from St. Thomas Hospital where a group of untreated syphilitic mothers gave over 50 per cent unhealthy results in more than 700 pregnancies: still births and miscarriages each accounting for more than 17 per cent in this figure. As a result of antenatal treatment the occurrence of these two mishaps dropped to 1.3 per cent and 0.6 per cent respectively.

The figure (50 per cent) above quoted for a yaws-free country and the 10.9 per cent obtained locally for untreated mothers are probably not quite comparable in detail for there is doubtless much that is not known of the frequency of miscarriages in the local population, but the difference is so great that I think the local figure must be regarded as inexplicably low if the population is heavily syphilised: I am inclined therefore rather to regard the figure 10.9 per cent an evidence that syphilis is present but not rampant and that the reason of its comparative infrequency requires careful enquiry for fear it may be altered for the worse by unwitting meddlesomeness.

There remains to be culled any evidence available from the examination of placenta and umbilical cords.

Two hundred placenta have been received whole and a portion removed for sectioning and of these 155 have sufficiently clear histories attached to them to be divided into certain groups: Eighteen from Wassermann positive mothers, 27 from Wassermann negative mothers and 110 in which the Wassermann reaction was unknown.

Having excluded all cases in which still births and prematurity could be explained by obstetric or maternal illness reasons, there remained eight placenta in which it seemed definite evidence of syphilitic changes should be encountered. As a matter of fact in not one of the 155 placenta were changes considered to be present that suggested syphilis such as cellular hyperplasia of the villi, perivascular cellular infiltrations, or unusually extensive endarteritis: I admit, however, my general inexperience of the histology of placenta.

Staining for treponema has not been attempted at present.

Calcification in the placental sections was a fairly common observation; 45 per cent of the full term still birth placenta showed its presence as against only 19 per cent in the premature and as it was equally prevalent in the Wassermann positive and negative mothers it probably has no significance except as evidence of a mature placenta.

Sections were made of 50 umbilical cords and in eight of these there was definite indication of cellular infiltration of the vessel walls and occasionally of the stroma though in the corresponding placental sections there was nothing unusual noted.

Five of these cases gave birth to healthy full term infants, in two others a still born infant was accounted for on obstetrical grounds and the one in which there was a bad previous history of still births the lesions found in the cord were the least marked of any of the cases.

Williams states that the placenta offers twice as great a probability of giving correct information about the child's condition as a positive Wassermann reaction in the mother. If we may rely on this as applicable locally there are very few placenta that appear to be syphilitic amongst the Maternity Hospital patients under investigation, and if we interpret all the Wassermann positive cases as due to yaws the suggestion is given that yaws does not cause gross changes in the placenta.

The cord gave a pathological picture occasionally but it could not be correlated with the condition in the infant or the mother's previous history.

If I may make any deductions from these very incomplete lines of enquiry they are that about 30 per cent of the Maternity Hospital cases examined show positive Wassermann reactions but that only about one-tenth of this (i.e. 3 per cent) is likely to be caused by syphilis and this deduction is also supported by observation showing lack of syphilitic changes in placenta. The few cases of Wassermann positive infants who have been re-examined subsequently and found to be Wassermann negative suggest that these infants cannot still be syphilis-infected and that the Wassermann reaction in infants at birth in a yaws-infected country is not as useful a procedure as the same test at a later date.

There appears to be no evidence that yaws causes any gross histological changes in the placenta.

APPENDIX E.

Preliminary Report on a Search for a Precipitin test for Malaria.

BY G. G. BUTLER.

In spite of the unsatisfactory results obtained by other investigators in this line it is felt that a serological test for malaria would fill an important gap in our methods of diagnosis and would open up a new line of study of malaria and any immunity that it may convey and possibly some further information on blackwater fever.

The opportunity of obtaining placenta from the Maternity hospital has given the impetus to this line of investigation as placenta seem to accumulate malaria parasites in numbers unlikely to be met so easily in other tissues.

The results of Taliaferro in Honduras based on several years search have not been sufficiently encouraging to give the hope that his technique is the best or that the problem is easy of solution. Similarly in Malaya the disappointing results obtained by Kingsbury scarcely give encouragement to proceed further but yet I believe the issue is important and worth further expenditure of time.

This search for a suitable antigen has only recently been begun and at the moment there is very little to report except the methods that have been tried.

Placental extracts only at present have been employed in this search for the main ingredient in a precipitin reaction and should failure be the end an attempt will have to be made with an antigen prepared from cultures of *Plasmodium falciparum*.

Thirteen placenta laden with *P. falciparum*, one blackwater kidney and seven malaria-free placenta to act as controls have all been used. The general method of preparation has been to take a weighed portion of tissue, mince up in a mincer and subsequently pounding thoroughly with sterile sand and applying to this product various methods of extraction. The primary extractives used have been usually, buffered saline solution, alcohol, and glycerine though treatment subsequently by various secondary extractives has been the rule using one or more of the same solutions as mentioned above. Primary treatment with acetone or ether has occasionally been practised and it is useful in allowing easy drying of the minced placental tissue before applying other extractives.

Subsequently it was thought that rupture of cells might be better produced by grinding the original tissue with dry sodium chloride or magnesium sulphate prior to extracting with alcohol and finally great dilution with distilled water has been tried and then a salting out process applied.

The majority of the early extractions have been tested against various sera expected to contain precipitins but the experiments have not gone far enough to give any indication of success: in fact with only one antigen has there been any sign of any precipitin reaction and that particular antigen was a heavily malaria infected placental tissue extracted with alcohol after several weeks extraction with buffered saline solution. A very definite zone phenomenon indicating the necessity of optimal proportions was observed with this antigen and it was hoped that some indication had been given of how best to prepare a suitable antigen: unfortunately a similar technique applied to other placenta has not been successful. The investigation is being continued.

APPENDICES F., G. AND H.

To those readers who are unacquainted with the Gold Coast perhaps I should give a few details as a preliminary to the following three appendices F., G. and H.

Most of the work of these three sections has developed around the anti-tsetse measures on the cattle route through the Northern Territories of the Gold Coast.

Zebu humped cattle are brought on foot from various centres in French territory north of the Gold Coast to the cattle markets even as far south as Accra on the coast. In this passage south many tsetse fly belts are passed and the cattle become infected chiefly with *Trypanosoma vivax* and a vicious circle produced; the loss from this infection would be very great if the beasts were not slaughtered almost as fast as they arrived at their destinations.

The infection rate at the northern border has not been recorded above 24 per cent at the time of maximum distribution of the fly during the rainy season and the average for the whole of 1928 is about ten per cent while at Accra and Kumasi the figure is very high indeed and approximates 95 per cent for a single examination of a blood film at the former destination.

Experimental bush clearings have been made in the northern section of the route in the Gold Coast and the results, entomological and pathological, are described in sections F., G. and H.

The results have proved satisfactory and the experiment is ending but while the full effects are being observed and studied an opportunity has arisen to investigate human trypanosomiasis at one centre (Yeji) and this Dr. Saunders includes in his report, appendix F.

From Dr. Saunders report it will be noted that considerable shyness on the part of patients in coming forward is apparently observed and numerically the cases are not large at the time of this report, though on July 30th, 67 cases had come under investigation including six among the 16 fly boys.

The entomological side of these investigations is reported upon by Messrs. Pomeroy and Morris in appendices G and H.

APPENDIX F.

Annual Report on Trypanosomiasis by the Pathologist, at Yeji.

By. G. SAUNDERS

1. Staff.

1. On 1st April 1929, the staff consisted of :—

Dr. Matthews, Acting Pathologist.

Mr. Nettey, Laboratory Attendant.

Mr. Williams, Laboratory Attendant.

At the end of May Dr. Saunders took over from Dr. Matthews. Dr. M. Jackson took over from Dr. Saunders on 28th March, 1930. On 3rd January, 1930, Mr. Williams was transferred to hospital and did not return to Yeji.

2. Routine Work.

2. In the beginning of the year, the routine work being done was (a) the examination of about one-third of each herd of cows passing and (b) the dissection of flies caught in the neighbourhood of Yeji. Mr. Nettey did the routine cow work, Mr. Williams the routine fly work. Both had attained a high degree of efficiency at their work. In addition, treatment had begun of two human cases at Tunga, just north of the Volta from Yeji; strains of *T. brucei* and *T. vivax* were being maintained in laboratory animals; and a series of experiments on immunity were begun. As a preliminary to carrying out a series of adhesion tests, attempts had been made to establish a human strain in laboratory animals. After some failures a strain was established in a monkey on 21st May.

On 15th August, a human case came up for treatment, and since then they have come in steadily. Great care was taken to demonstrate trypanosomes in each case, and a considerable amount of time was spent in carrying out various techniques for diagnosis. From time to time villages were examined to find early cases.

Mr. Williams was on leave from 1st October to 4th December, and during this time the routine fly work was discontinued. It was not resumed on his return as it chanced that at that time several suspect cases were under examination and his time was fully occupied.

3. *Cattle Trypanosomiasis*.—The method of examination has been continued unchanged since the work began. Mr. Nettey has been here all the time, and each pathologist has carefully handed on the method to his successor. The results from time to time are therefore fairly comparable.

The general results are summarised in attached chart I.

The most marked feature in this chart is the reduction of the wet-season peak, which could hardly be due to anything but the bush clearing that had been done on the cattle route.

The 1928 wet season was unusually heavy in the north, as indicated by the Yeji flood level; this may account for the fact that the frontier rate in January, 1928, was lower than in January, 1929. There may, however, be some elimination by preferential slaughter of weak beasts between the frontier and Yeji.

The occurrence of the annual maximum at Yeji in October, 1928, and in September, 1929, can be co-related with entomological observations.

The Kumasi peak in July is presumably caused by the early rains which are much more marked in the observations made at Yeji than in those taken further north (chart 2); while the Kumasi October peak is due to the same factors as produce the frontier and Yeji peaks; but in 1929 this later rise may have been so small that it was swamped in the previous rise. It will be seen that there is a fairly close co-relation between rainfall and infection rate.

In chart three the infection rate is plotted against the length of journey from the frontier. The very short periods shown in one of the curves are due to a few herds crossing the eastern frontier in Yendi district. There was a fairly definite co-ordination between infection and duration of journey in June, 1928, as shown on the chart. A similar regular relation was shown in July and August; September and October were erratic; November was regular and December erratic.

The next six months showed no regular relationship, nor has any been observed since. There are many complicating factors which would tend to obscure any simple relationship, such as the previous route in French country, the length and place of halts; and it would be almost impossible to disentangle the various effects of these. In spite of this it may well have some significance that some co-relation was visible in four months of the wet season before clearing was done, while none has been visible since.

In conjunction with the Principle Veterinary Officer a few experiments were done to determine whether dipping in arsenical solution would prevent sheep becoming infected, would protect clean flies from infection, or would kill tsetse feeding on dipped sheep. The experiments were negative, and were abandoned when the account of Duke's elaborate observations on this in East Africa came to hand. (*Bulletin of Entomological Research*, Vol. XIX, No. 1, p. 7).

4. *Human Trypanosomiasis*.—Thirty-four cases of human Trypanosomiasis were diagnosed during the year. Of these 26 came for treatment; the remainder were more or less unwilling victims caught during surveys of villages. Trypanosomes were found in all except one advanced case who had previously had Bayer, and two advanced cases who had increased cell counts in cerebro-spinal fluid.

The methods of diagnosis were as follows :—

Tryps in fresh blood	...	...	...	13
Tryps in gland juice	...	...	...	8
Tryps in centrifuged blood	...	...	...	2
Inoculation of blood into animal	...	...	...	7
Inoculation of C.S.F. into animal	...	...	...	1
Cell count C.S.F.	...	...	...	2
Clinical (had had Bayer)	...	...	...	1
				34

The routine followed for the examination of cases who came up for treatment was as follows :—

- Direct examination of fresh blood.
- Gland puncture.
- Adhesion test.
- Animal Inoculation of blood.
- Triple centrifugalization.
- Lumbar puncture :—
 - Cell count.
 - Centrifugalization of C.S.F.
 - Inoculation of C.S.F. into an animal.

The fresh blood examination was repeated at each attendance.

The other procedures were repeated in rotation, except that lumbar puncture was avoided as much as possible.

Great difficulty was found in demonstrating trypanosomes in some of the cases. Centrifugal methods consume much time, and have given very small results. In doing the triple centrifugalization, the leukocyte layer from the first spin was always examined. The centrifuge used was a hand centrifuge with which it was not possible to maintain the speed of 2,000 per minute, so it was not a fair test of the triple method.

But the curious phenomenon was observed twice, that the trypanosomes came down with the red blood cells in the first sediment. The third sediment revealed trypanosomes only once (during a test for cure and therefore not included in list above). "Prates' Centrifugalization of much diluted blood" has never revealed trypanosomes. Here, again the speed available may have differed from that used by the original

author; it has not been found possible here to throw down all the red cells in 2-3 minutes (*League of Nations Final Report on Human Trypanosomiasis*. Page 151).

If the fresh blood drop was found negative once, subsequent examination has never revealed trypanosomes, unless during a febrile relapse. In general, the same applies to gland puncture; but on two occasions puncture of a different gland was positive on a subsequent occasion.

In two advanced somnolent cases diagnosis depended on the cell count in the cerebro-spinal fluid. One of the cases was moribund when first seen; the other diagnosis was confirmed by the adhesion test. Trypanosomes have not been found by centrifuging cerebro-spinal fluid, but have been recovered once by inoculating it into an animal.

Efforts to establish strains in rats by inoculation of blood with abundant trypanosomes failed, so it did not at first seem likely that animal inoculation would be useful as a diagnostic method. It was found, however, that monkeys would take a human strain, and that dogs would take it if they were afterwards given an intra-peritoneal injection of olive oil. On one occasion a rat was successfully inoculated, by this olive oil method, from a case with abundant trypanosomes in the blood; on another occasion from a case in which trypanosomes had been found only by gland puncture; but the successful inoculation direct from man to rat is so rare as to have no diagnostic value. Comparative direct inoculations showed that kittens or monkeys were better than dogs, and dogs better than rats for this purpose. Eight cases were diagnosed by animal inoculation, whereas only two were diagnosed by all centrifugal methods. The use of olive oil was suggested by Kligler and Weitzman (*Annals of Tropical Medicine and Parasitology*, XVIII, 4, p. 453.)

The intra-muscular injection of olive oil, and the intra-venous injection of glucose, have been tried in a few cases in the hope of bringing latent trypanosomes to the surface. No result followed, and the methods were abandoned.

In one advanced clinical case it was impossible to demonstrate trypanosomes by any method, though the clinical features, the increased cell count in cerebro-spinal fluid, and the adhesion test (+ - - - -), in conjunction with the reaction to specific drugs, left no doubt as to the diagnosis. In this case 19 blood examinations, four gland punctures, three triple centrifugalizations, three centrifugalizations by Prates method, one centrifugalization of cerebro-spinal fluid, three blood inoculations, one inoculation of cerebro-spinal fluid, failed to demonstrate trypanosomes.

Atoxyl, Bayer 205, and tryparsamide were used in treatment. The atoxyl was used in cases without nervous symptoms, to test the method used in the French Congo:—"Six strong subcutaneous injections of atoxyl with an interval of ten days between the injections. Two centigrams per kilo body weight with maximum of one gram per injection."

The results are summarised below.

Case No.	Method of diagnosis.	Stage of illness.	Result.
VI	Blood.	Early.	Tryps in triple centrifuged blood.
VIII	Gland puncture.	Early.	Negative to all tests.
IX	Gland puncture.	Early.	Headache and fever with tryps in blood after full course.
XIX	Blood.	Early.	Tryps in blood.
XXII	Blood.	Early.	Negative to all tests.
XXIII	Blood.	Early.	Negative to all tests.
XXV	Animal Inoculation.	Very early.	Negative to all tests.
XXXI	Animal Inoculation.	Early.	Tryps found by animal inoculation.

Four cases out of eight apparently cured. Six cases out of eight became negative to methods which would be used in an ordinary survey. Results are expressed graphically in chart 4.

It will be seen that the intensive course of atoxyl brings about a considerable diminution of infection. The disadvantage of atoxyl, apart from the immediate risk of optic atrophy, is that it makes it very dangerous to give either Bayer or tryparsamide after it. Of the two cases who applied for treatment for symptoms arising after their course was finished, one was given N.A.B. and the other tryparsamide with relief of symptoms. But one may doubt whether such a sacrifice of the individual to the cause of public health is justifiable except in the case of a serious and urgent epidemic.

In addition to these cases, two other atoxyl cases did not complete their courses and one case died of pneumonia before the tests for cure were done.

None of these cases showed any eye trouble. Case XXXI had on two occasions a fairly severe local and general reaction; fever, and a swelling which subsided without supuration. On one of these occasions the solution used for the case was used immediately afterwards for three other cases who showed no reaction. The same sort of reaction occurred once in case XXV.

As the other drugs used have been abundantly proved elsewhere to be efficient sterilisers of the blood, the cases treated with these have not been examined for cure with the same thoroughness as the atoxyl cases. A few of the usual dramatic symptomatic cures of advanced cases have been effected with Bayer. One maniacal case who got worse after injection of Bayer was restored to complete sanity during a course of tryparsamide. Although the drugs have been combined in some cases no case of eye trouble has so far arisen.

5. *Maintenance of Strains.*—By the use of intraperitoneal injections of olive oil as an adjuvant, it has been found that there is a greater likelihood that the inoculation of infected human blood into an experimental animal would be attended with success.

The olive oil may be injected into the animal either previous to, or subsequent on the blood inoculation, the former method being preferable, two days elapsing in either case between the injection and the inoculation or *vice versa*. In all, 15 strains of trypanosomes (*gambiense*) were successfully transferred to and subsequently maintained in experimental animals. Four such strains are still alive (at the date of the report). In the case of the first transfer from the human case to the animal the inoculation period is very variable, as is also the virulence of the infection.

The first and second passages are more likely to be successful (1) if accompanied by olive oil injection as above and (2) if some other animal than a rat is used, preferably a kitten, a monkey or a dog. Subsequently rats are used to maintain the strain. In the case of the first rat to be used for each individual strain, both the inoculation period and the virulence of the infection are variable. Thereafter the infection develops in rats with a short incubation period and rapidly proves fatal.

The following observation illustrates the effect of olive oil. On 28th October, six rats were inoculated with a small quantity of citrated blood from a dog with *T. gambiense*. On 30th October, three of these were given olive oil.

Rat No.	81.	82.	83.	84.	85.	86.
28/X	Inoculated with <i>T. gambiense</i>					
30/X	3cc Olive oil.	3cc Olive oil.	3cc Olive oil.			
1/XI	Tryps numerous.	Tryps 4 to a field.	Died of unknown cause.	Negative.	Negative.	Negative.
5/XI	Killed.			3cc Olive oil.	3cc Olive oil.	3cc Olive oil.
6/XI		Numerous.		Numerous.	Tryps 4 to a field.	Numerous.
		Numerous.			Numerous.	

The injection of olive oil immediately after the infective blood does not prevent the development of trypanosomes.

Injection of olive oil two days previously to injection of infected blood is slightly preferably to injection of oil two days after.

Rat No.	159	160	161	162
13/2	1cc Olive oil.	1cc Olive oil.		
15/2	Each given 1 cc dilute citrated blood with <i>T. gambiense</i> .			
17/2			1cc Olive oil.	1cc Olive oil.
18/2	Numerous.	Numerous.	3 tryp- per field.	3 tryps per field.

In practice, subsequent injection of oil has been used, as one seldom knows for certain when cases are coming up.

In general, if rats of about the same size are given the same infective dose at the same time, they will show about the same degree of infection after about the same incubation period, but the subsequent course of the disease may differ in each.

Occasionally exceptions to this uniformity of the early course are observed. In some cases no explanation for this suggests itself; in a few cases it has been observed that a rat with sepsis is more resistant to trypanosomiasis.

	Rat 161 <i>septic tail.</i>	Rat 162 <i>normal tail.</i>
15/2	1cc citrated blood from at 8 (<i>T. gambiense</i>).	
19/2	Negative.	Swarming.
3/3	Swarming.	

Another case has been observed in which a rat infected with tumbu maggots proved resistant to inoculation. In this case however there was no direct control.

Rat 120.	Cat 7.	Rat 121.
Dose 2cc citrated blood. Incubation seven days. Swarming in ten days. Killed.		Dose 2cc citrated blood. Incubation seven days. Swarming in ten days. Died in 13 days.
Rat 126.	Rat 130.	Rat 131.
Dose 2cc citrated blood. Infected with tumbu maggots did not take.	Dose 2cc citrated blood swarming in 4 days.	Dose 2cc citrated blood swarming in 4 days.

On the other hand no cause can be assigned to the contrast between Rats 203 and 204.

	Rat 203, bigger.	Rat 204, smaller.
3/3	1cc dilute citrated blood from infected rat.	
12/3	Positive	Negative.
22/3	Died	Still negative.

The apparent protective effect of sepsis may therefore have been co-incidence: but it has already been noted elsewhere that the leukocyte formula has some relation to resistance to trypanosomiasis (*Annals of Trop. Med. and Paras. Vol. XVIII, No. 4, p. 451*): but these conclusions were somewhat modified by a later article by the same authors in a later number of the same periodical.

If a very heavy dose of a strain which has been accustomed to rats be injected, say 4cc citrated blood, the rat may die of dyspnoea next day with his blood swarming. Using about $\frac{1}{2}$ cc. of blood the incubation period becomes three to five days and the rat dies in seven to ten days. For economy of time and rats, smaller doses are used; one or two drops from the tail are taken into citrated saline and divided among two clean rats. If, however the dose be very small, even a virulent strain may not take.

No case has yet been observed in which an untreated rat, once positive has become negative, or in which a considerable reduction of trypanosomes has taken place. In spite of the large variations of incubation period, of multiplication rate, and of life of the rat, the disease seems to be always steadily progressive. Symptoms are shown only in the last 12-24 hours of the rats life; sometimes definite dyspnoea is seen, but more often only loss of activity and refusal of food. Dyspnoea is more frequent when the course is rapid; that is to say, a rat whose blood is swarming four days after inoculation will usually have dyspnoea; a rat who has about the same number of trypanosomes in his blood after 14 days will not have dyspnoea.

In cats, dogs, and monkeys, relapses and variations in the numbers of trypanosomes occur. Monkey I, who had a chronic and irregular course, showed some of the symptoms of the human disease, tremors of the lip, somnolence, and anæmia; some of the other monkeys showed somnolence towards the end; in general the symptoms were only weakness and refusal of food. Trypanosomes were sometimes rare or absent when symptoms were present or death was imminent. Dogs became emaciated, and every infected dog has suffered severely from mange, which occasionally has attacked uninfected laboratory dogs, but less frequently and less severely.

Cats also show the variability of the number of trypanosome present. With them the disease is severe and often rapid. One developed convulsions and dyspnoea 14 days after inoculation; three others developed pan-ophthalmitis.

No definite control observations have been made on animals other than rats as to the effect of olive oil; but it seems both to make infection easier and to produce relapses.

Trypanosomes have not been found in pericardial fluid. Myocardial smears have never been obtained free from blood.

6. *Distribution of human trypanosomiasis.*—There are two possible means of working out the incidence of human trypanosomiasis; by noting the districts from which cases come for treatment, and by doing compulsory surveys of selected samples of population in various areas. Both methods are open to various fallacies. The number of cases coming from a given area is influenced greatly by matters of pure chance; the amount of personal contact between the doctor and the inhabitants of that area, the open mindedness of the people, and the result of the first case. If, on the other hand, compulsory surveys are done, it becomes a matter of honour for all natives to conceal any who are sick or whose glands are enlarged in order to avoid their being subjected to the manipulations of unsympathetic foreigners. These difficulties can be overcome only in very limited areas in which public opinion is sufficiently enlightened and the officer conducting the survey sufficiently well known to secure some degree of native co-operation. As it cannot be said that these conditions have been fulfilled here, the figures given have only a very limited value.

The operation of gland puncture is greatly disliked by the inhabitants of this area. The surveys were done by first examining finger blood and doing gland puncture if this were negative.

Village.	Examined.	Positive.	Percentage.	Remarks.
Makongo	48	2	4 per cent	Excluding cases found in a previous survey which gave 6 per cent.
Tunga	46	1	2 per cent	Excluding two cases found in a previous survey.
Kuli	12	0	0 per cent	} Bush farming villages near the river.
Kapoose	22	0	0 per cent	
Cherepon	26	0	0 per cent	
Kotokunji-Batau ..	20	0	0 per cent	A temporary fishing village.
Yeji, ferry labourers	7	4	57 per cent	

The cases coming for treatment may be classified thus :—

River workers infected on the river :—

Yapei	...	...	2
Dogonkade-Tunga	...	...	3
Village unknown	...	...	2
			7

Villages on main road :—

Makongo ...	...	...	5
Tunga ...	...	...	3
Yeji ...	...	...	6
Prang ...	...	...	1
Attabubu or Yeji	...	...	1
Yamuasi (near Prang)	...	...	1
			17

Miscellaneous :—

Near Kpando ...	...	...	1
Near Kumasi ...	...	...	1
Mpaha ...	...	...	1
Ashanti forest ...	...	...	2
Unknown ...	...	...	6
			11
			35

This list includes one case from the previous survey of Makongo.

There are probably other cases at Dogonkade-Tunga. It is stated that this village was formerly occupied by natives who left it on account of illness and has since been re-occupied by Hausa.

These two sets of information may be summarised thus.

(a) The bulk of infection in Yeji area occurs in two groups of cases :—

(a) River workers.

(b) Villages on the main road.

Where (a) and (b) intersect is the highest infection (i.e. Yeji ferry).

(b) A temporary fishing village (a "Batau", inhabited mainly by Ada people), has shown no infection.

(c) Permanent fishing villages ("Tungas"), (inhabited mainly by Hausas), are highly infected.

(d) Farming villages off the main road are not highly infected, though they are near the river, and although fly may occur. This is different from the conditions in Kintampo district, where the bush farming villages seem to be infected at least equally with the rest of the area.

7. *Adhesion phenomenon*.—An artificial reaction system was first constructed by injecting a number of rats with blood from a dog with *T. brucei*, and then giving the dog Bayer 205. The trypanosomes, which had been numerous, disappeared from the dog's blood. Eight days afterwards the test was done with the dog's citrated plasma against the

trypanosomes from one of the rats. Most of the trypanosomes had platelets adherent; the result was classed as + + + +—(5th October, 1930). On 12th October, the test was repeated, both at room temperature on a slide and incubated in a tube. The result was the same. On 16th October, the dog relapsed; on 22nd October, without any further treatment her blood was again negative. On 23rd October, the adhesion test showed all the trypanosomes adherent (+ + + + +). On 28th October, trypanosomes were again numerous in the blood. The dog became mangy and emaciated and was chloroformed on 27th November.

The behaviour of the reaction in this case seems to indicate that the reaction is not a very direct measure of an animal's resistance.

The test was then applied to *T. gambiense*, chiefly for confirmatory diagnosis in difficult cases.

Before treatment.

Cases not proved microscopally

XII ...	...	—	—	—	—	—
Attawa ...	...	—	—	—	—	—
Nineba ...	...	+	—	—	—	—
XXVII ...	...	—	—	—	—	—
Average ...	...	—	—	—	—	—

Before treatment,

Cases proved microscopally.

III ...	...	—	—	—	—	—
V ...	...	—	—	—	—	—
XIV ...	...	+	+	—	—	—
XXXII ...	...	+	—	—	—	—
XXVIII ...	...	+	—	—	—	—
XXXII ...	...	+	—	—	—	—
XXXV ...	...	+	+	—	—	—
XXXI ...	...	+	+	+	—	—
XIII ...	...	—	—	—	—	—
Average ...	...	+	—	—	—	—

During treatment.

III ...	...	+	+	+	—	—
XXXV ...	...	+	+	+	—	—
Average ...	...	+	+	+	—	—

After treatment.

With Atoxyl.

IV ...	...	—	—	—	—	—	Relapsed soon after.
VIII ...	...	+	+	+	+	+	Negative to all tests.
XXII ...	...	+	—	—	—	—	Negative to all tests.
XXIII ...	...	+	—	—	—	—	Negative to all tests.
XXV ...	...	+	—	—	—	—	Negative to all tests.
XXXI ...	...	+	+	+	—	—	Tryps found by animal inoculation.
Average ...	...	+	+	—	—	—	

With other drugs.						
XI ...	...	+	+	—	—	—
V ...	...	+	—	—	—	—
XXII ...	...	+	—	—	—	—
Average ...	...	+	—	—	—	—

Effect of treatment on the reaction.

Case.	Before.	Drug.	After.	Remarks.
XXV	— — — — —	Atoxyl	+ — — — —	A very early case.
iii	— — — — —	Bayer	+ + + — —	
XXXI	+ + + — —	Atoxyl	+ + + — —	Tryps found by animal inoculation before and after treatment.

There is one fallacy the possibility of which has been suggested by Davis and Brown. The test may be vitiated either by the animal supplying the trypanosomes having in its own blood the substance causing the reaction; or, owing to this condition having occurred in the past, it may have trypanosomes resistant to the phenomenon. The first fallacy has been guarded against by having, on each occasion, a control tube or slide with the trypanosome suspension alone. A slight degree of spontaneous adhesion has been seen once when trypanosomes from a cat were used. The second condition could not occur when rapidly developing infections in rats are used. Thirteen out of the 26 tests were done against rats; it is possible, for example, that the negative tests given by the chronic cases III and V may have been vitiated by this. The tryps for this purpose were from a guinea-pig in which the infection had developed very slowly.

The number of unimpeachable tests has therefore been too small to draw any definite conclusion. The first experiment on the dog in which it is hardly possible that any fallacy has crept in, suggested that the method is not a direct measure of the animal's power to destroy trypanosomes; and this is rather borne out by the + + + — — reaction given by case XXXI both before and after atoxyl treatment, in spite of the fact that tryps were found by animal inoculation both before and after.

As the centrifugalisation of plasma takes so much time as to prevent a large series of cases being done, six double tests in serum and plasma simultaneously were done. In five cases the reactions were identical; in one the serum gave a slightly stronger reaction (plasma + — — — — serum + + — — —). The serum was not diluted; the plasma was diluted half and half with citrated saline.

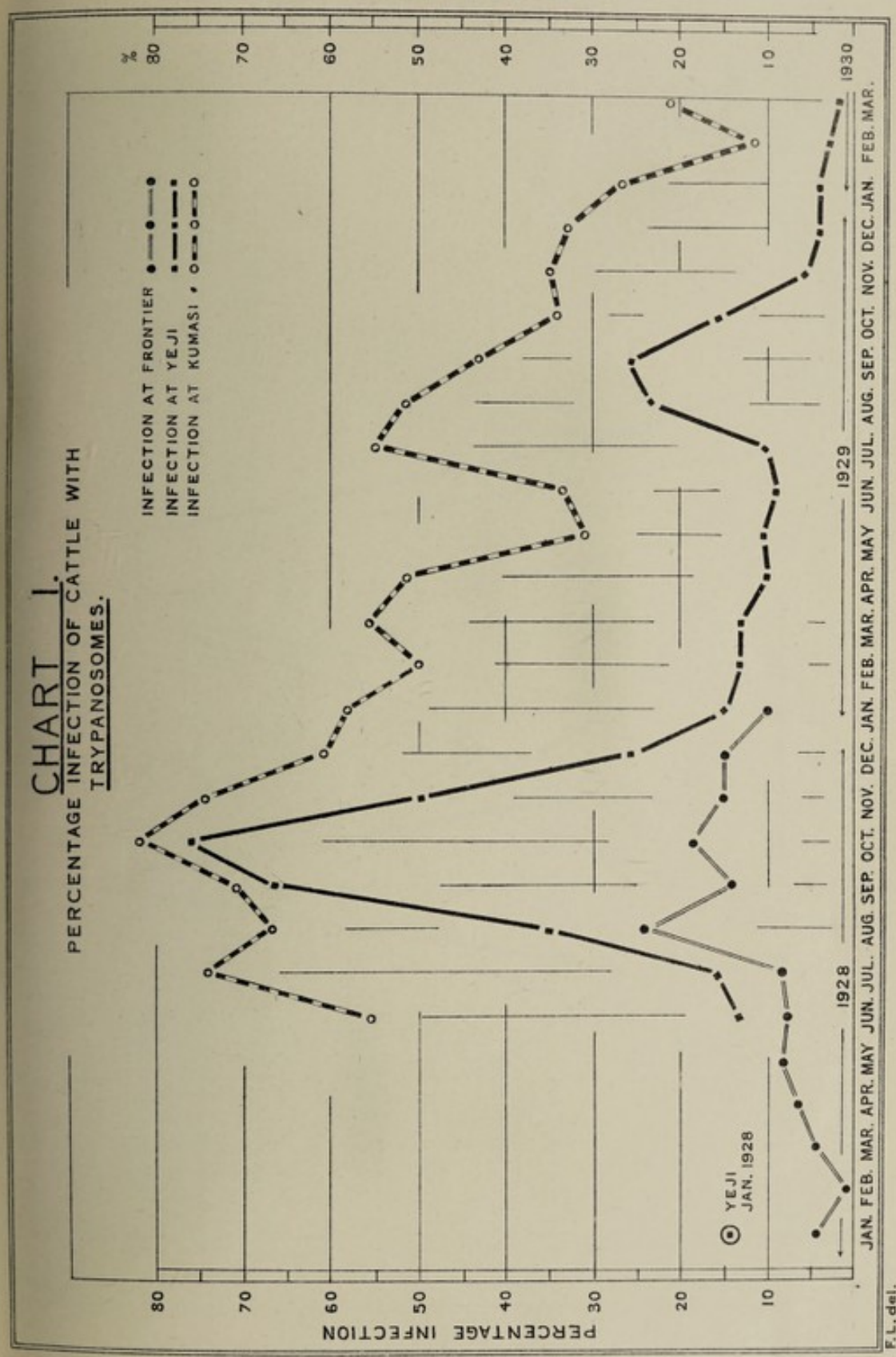
8. *Minor pathological work.*—The only other pathological work undertaken by this department was the investigation of a case of hydrophobia at Salaga. Sections were cut and examined at Accra. Negri bodies were not found in the brain of the case, but were found in the brain of a guinea-pig inoculated from it.

9. *Other Minor work.*—A few minor medical cases of an urgent nature have been treated:—poisoning, snake-bite, hæmorrhage. Minor conditions among the department's employees or in trypanosome cases have been treated. The Medical department were assisted in one case in which they were unable to give continuous attention to an official sick in Yeji. Cases which do not fall under these categories have been advised to seek treatment elsewhere, and the prestige of this department has been increased by its confining itself to cases which it can treat efficiently.

An exception has been made to this policy in the case of individuals requesting injection. Injections have been given in exchange for experimental animals. It has proved almost impossible to buy a sufficient supply, but by this method they can be obtained.

The pathologist acted as medical officer in charge troops during manoeuvres.

CHART I. PERCENTAGE INFECTION OF CATTLE WITH TRYPANOSOMES.



F.L.del.

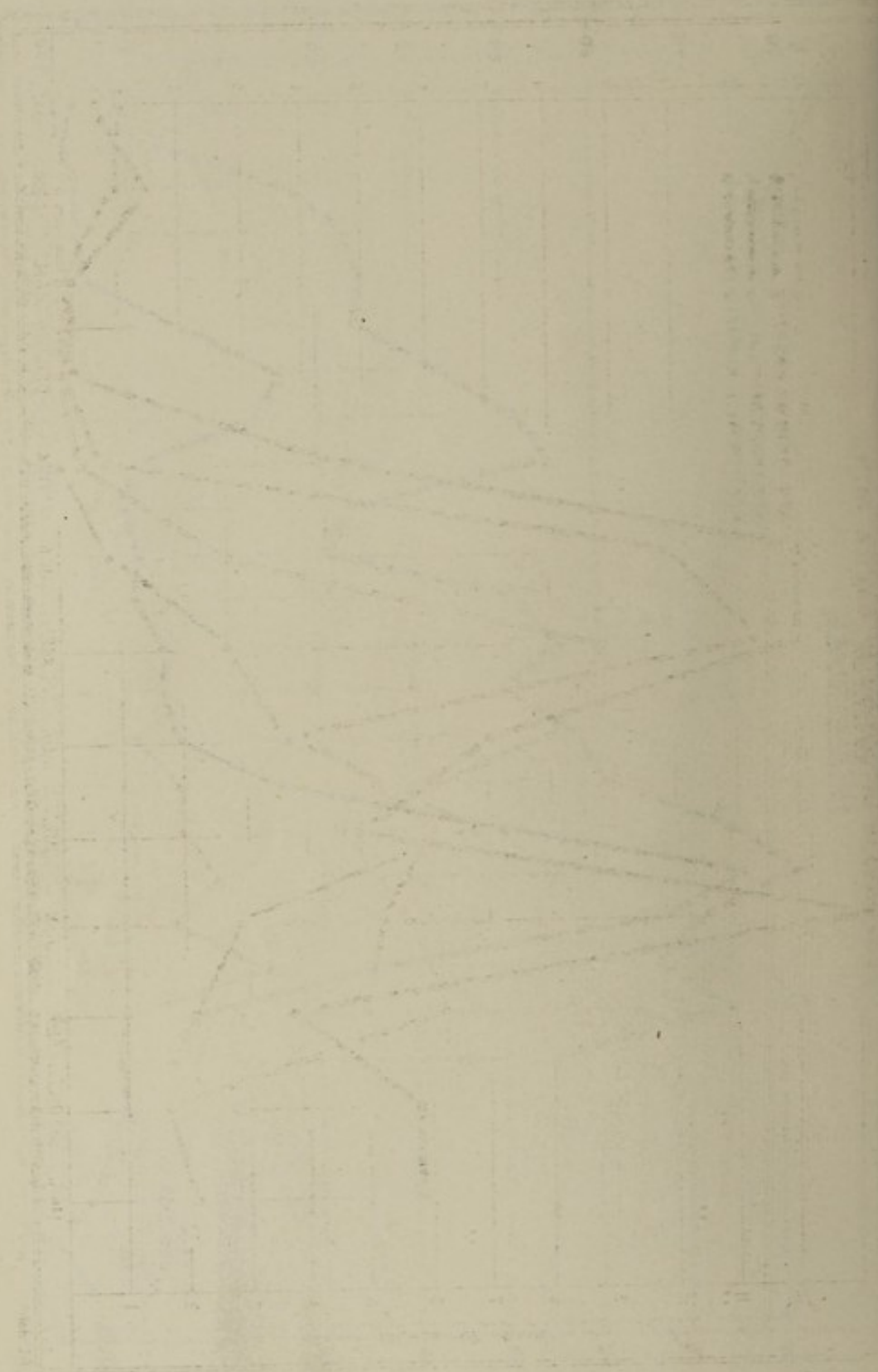
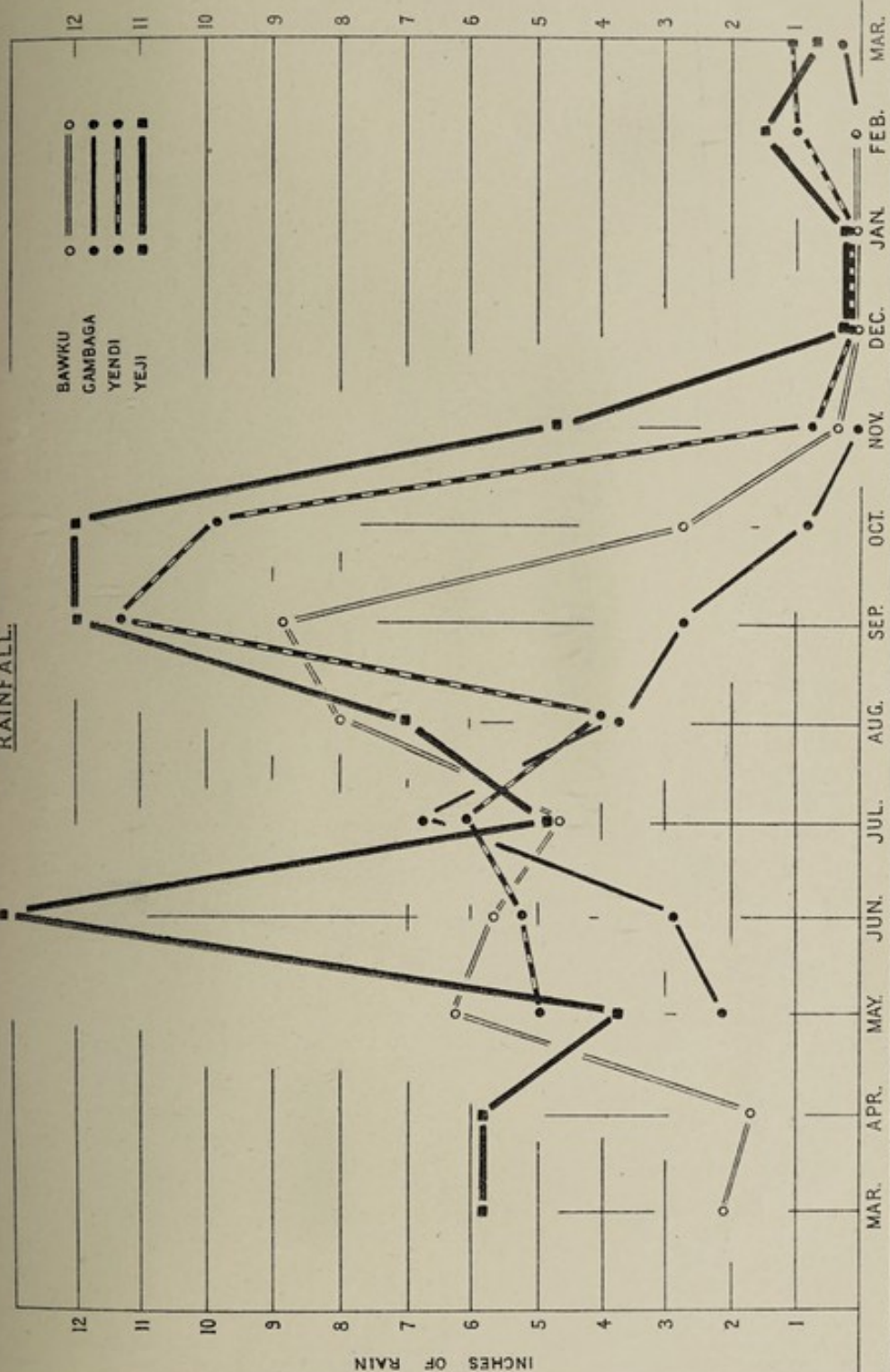


CHART 2. RAINFALL.



F.L. del.

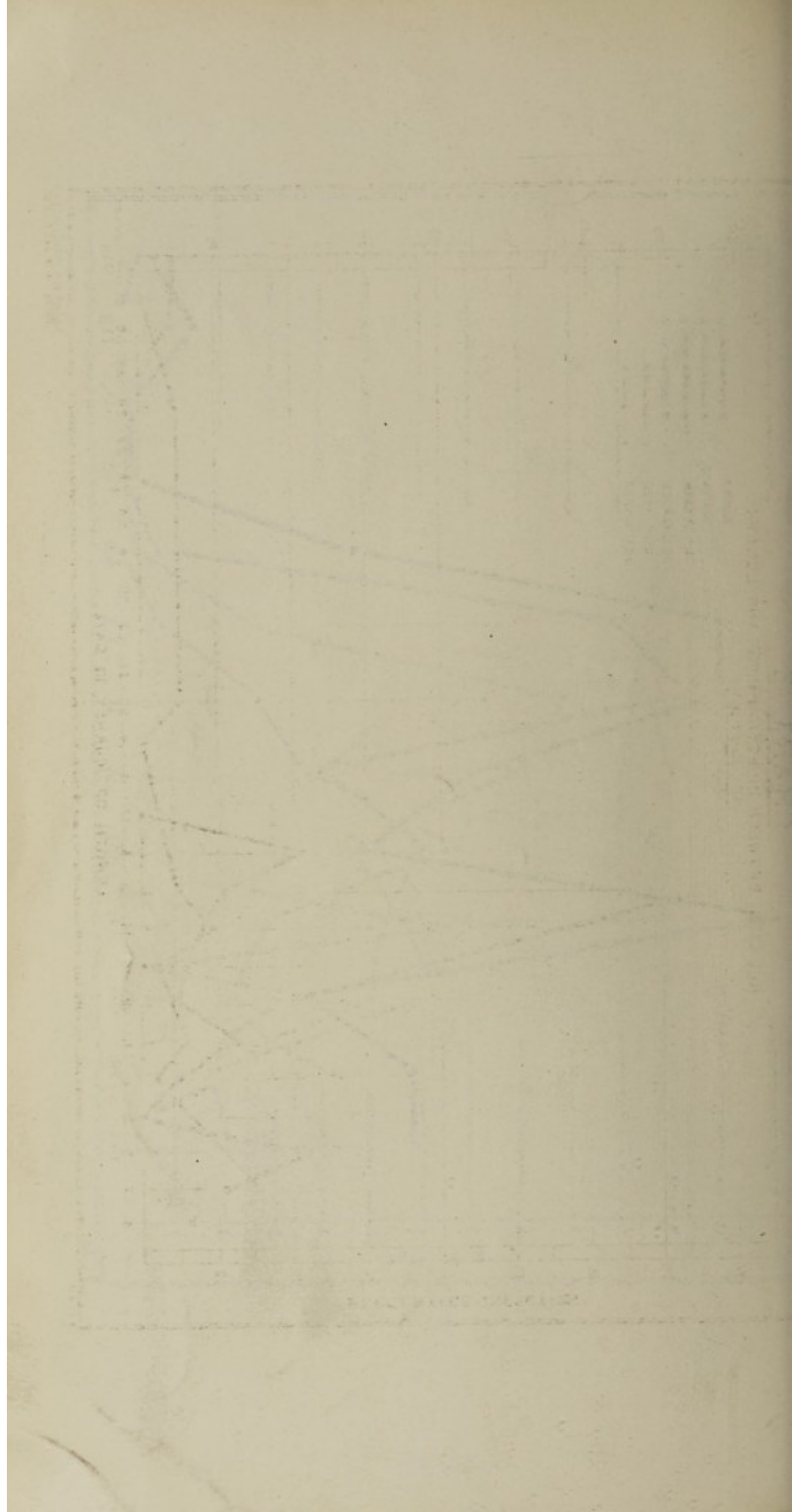
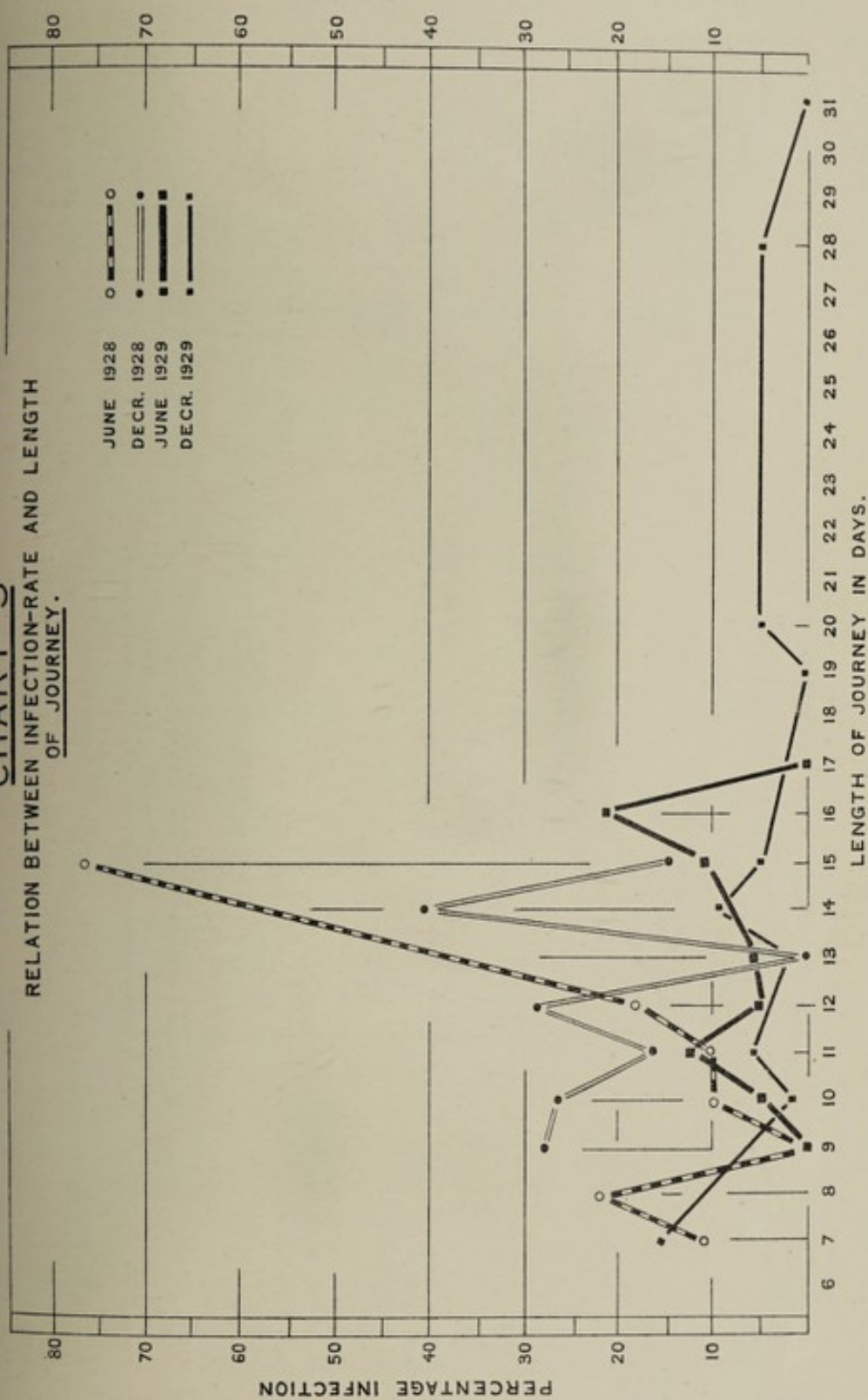


CHART 3
RELATION BETWEEN INFECTION-RATE AND LENGTH
OF JOURNEY.



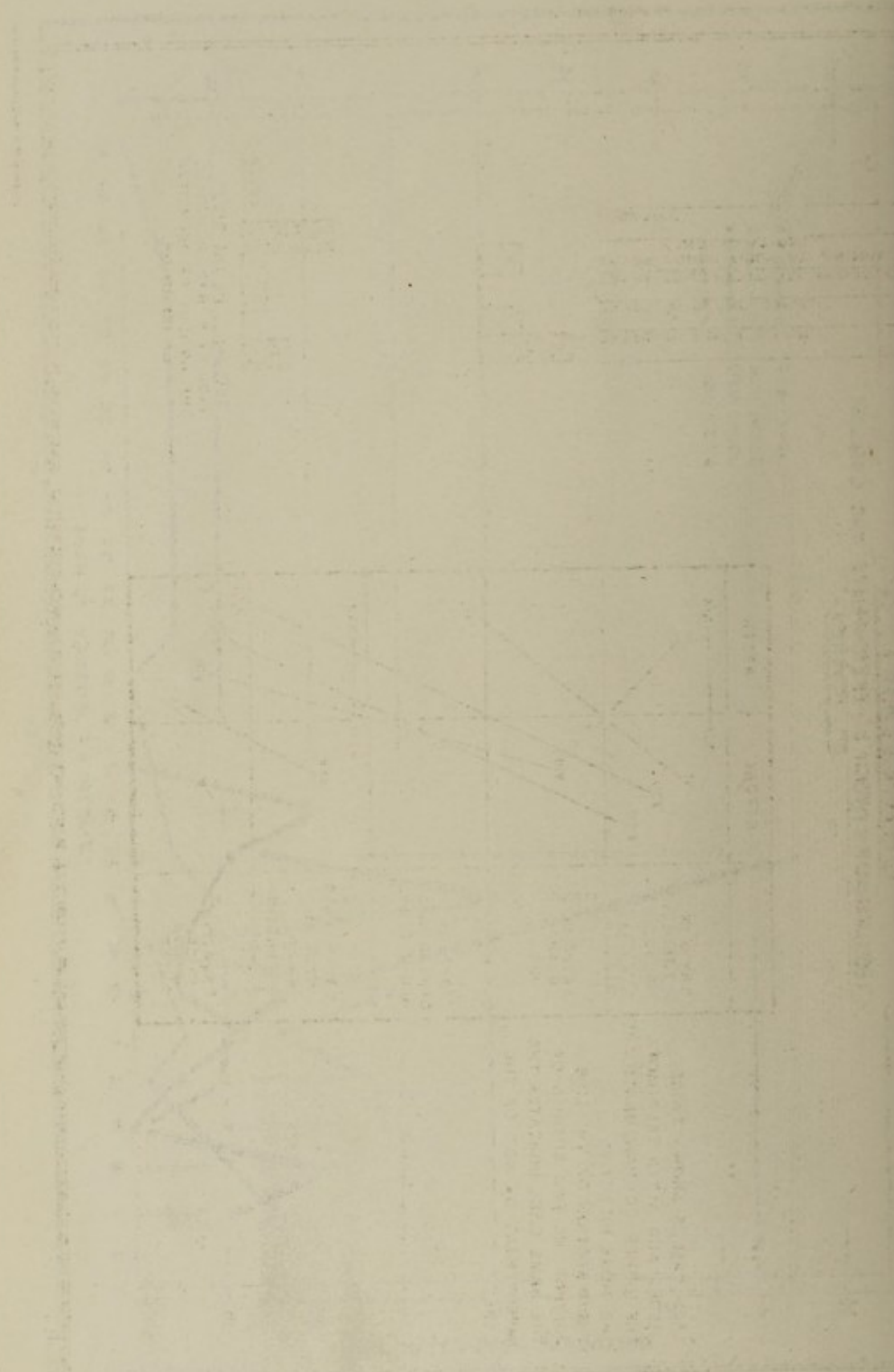
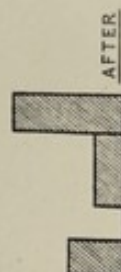
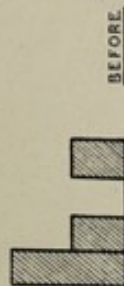


CHART 4 RESULTS OF ATOXYL TREATMENT.

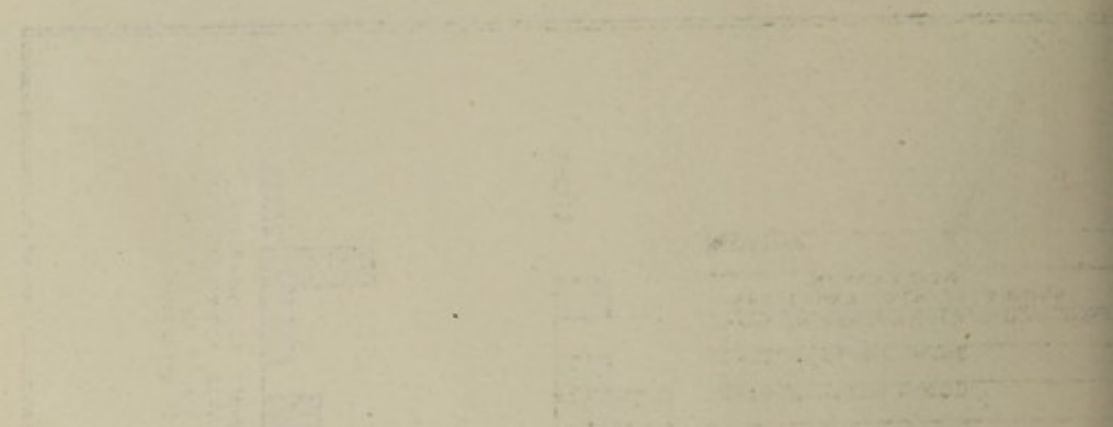
EACH CASE IS SHOWN TWICE,
BEFORE AND AFTER TREATMENT.
THE HIGHER COMPARTMENTS ARE
THE MORE INFECTIVE.
THE DIRECTION OF THE LINE
JOINING THE TWO ENTRIES OF
THE SAME CASE INDICATES THE
IMPROVEMENT OR NOT OF THE
CASE.

	BEFORE	AFTER
TRYPS. IN FRESH BLOOD.	VI XXII XXIII	XIX IX
TRYPS. IN GLAND JUICE.	IX	
TRYPS. IN CENTRIFUGED BLOOD ONLY.	VI VIII	VI
TRYPS. FOUND ONLY BY ANIMAL INOCULATION.	XXV XXXI	XXXI
NEGATIVE TO ALL TESTS.	XXV VIII XXIII XXII	XXV VIII XXIII XXII



THE SHIFT TO THE RIGHT
INDICATES APPROXIMATELY
THE AMOUNT OF DIMINUTION
OF INFECTION.

100



100

APPENDIX G.

REPORT OF THE MEDICAL ENTOMOLOGIST.

By A. W. J. POMEROY.

It is customary, when submitting an annual report, to record only the progress of work done in that financial year. On this occasion however, as the work of the main tsetse organisation, commenced in 1925, has come to an end, it is advisable to include a resumé of the last four years operations and to record the general conclusions reached; this is submitted as report No. II.

2. The work carried out this year by myself will be dealt with separately as report No. I, and as I was on leave from 5th April, 1929, to 5th November, 1929, Mr. K. R. S. Morris the Assistant Entomologist is writing his own report on the tsetse work, which he carried on during my absence.

REPORT No. I.

Tsetse Investigation of the coastal area of the Eastern Province of the Gold Coast Colony, from 22nd November, 1929 to 15th December, 1929 and from 26th February, 1930 to 18th March 1930.

1. The Acting Principal Veterinary Officer, Captain J. L. Stewart, had submitted a report on the Livestock of the Coastal area of the Eastern Province of the Colony, No. XX/1928-29, and proposed to develop cattle breeding in this area. A tsetse survey of the area therefore has been made, but no investigation has been carried out on the pathological side, or on the relative importance of trypanosomiasis in cattle within this area.

2. The area comprises the low-lying plain country from the east of the Accra-Dodowa road to the frontier of French Togoland. West of the Volta its northern boundary is the 6° line of latitude and east of the Volta—the Keta-Ho boundary.

3. The area between Accra and the Volta river to the east, consists of open grass country with salt water lagoons and along the coast three large fresh water lagoons drain into the Volta at the northern portion. The Shai hills are situated in the north western part.

4. There are two distinct drainage systems, one debouching into the Volta and the other into the Coastal salt lagoons.

5. The drainage consists of small streams which dry up in the dry season, with the exception of very occasional pools in the deepest portion of the stream bed. During the wet season when the ground becomes saturated, a large part of the area is inundated and the small streams become torrents.

6. These streams are fringed with a thick vegetation of scrub and a few tall trees near the permanent pools. The vegetation is very sparse at the source and disappears at the mouth, when the streams enter the salt lagoons. On the other hand, the streams draining the fresh water lagoons are clothed with an increasingly dense vegetation as they reach the Volta. The species of tsetse found was *G. palpalis*.

7. During the dry season *G. palpalis* is found only along the banks of the Volta river itself and where there are permanent pools in the smaller streams.

8. The fly can barely subsist during the dry season and the incidence is reduced to the absolute minimum. The incidence is so small that only two or three individuals could be taken during one day by 12 natives employed in catching. The majority of these flies were females.

9. During the rainy season however, there is a consistent history of a very considerable incidence, which is obviously due to migration from up the Volta.

10. Wild game is practically non-existent, and the food supply consists of cattle, and numerous herds of pigs which roam about in a semi-wild condition. The local natives, odd reptiles, varanus and crocodiles, also afford a further food supply.

11. There is every possibility, that with the clearing of the vegetation from the smaller streams belonging to the coastal drainage area, that the remaining *G. palpalis* would disappear. But by so doing the country would be rendered even more arid and the streams would even more rapidly dry up in the dry season.

12. The cost of conserving the water supply might be very considerable as these streams overflow their main channels, which makes damming difficult and it is probable that wells would have to be sunk in many parts of the area. The stream beds are very porous and do not hold water for any length of time.

13. When the water rises and floods the terrain, *G. palpalis* is dispersed over a very wide area and the fly migrates to secondary breeding places such as the thickets surrounding depressions, which support water for two or three months. As these temporary pools dry up, *G. palpalis* retreats on the permanent pools in the main channels.

14. Control of *G. palpalis* in the area should be quite easy, but the lack of population, the necessity for conserving the water, and the high price of labour are factors which must be weighed against the economic advantage of getting rid of the fly.

15. In addition proof is required that the indigenous small non-humped type of cattle, or even half-bred cattle, suffer any serious loss from trypanosomiasis.

16. I suggest that the clearing of the upper drainage system with its increasing vegetation toward the bank of the Volta is not an economic proposition at this time, when the present financial condition of the country is taken into consideration.

REPORT No. II.

A General Summary of the Tsetse Problem on the Gold Coast.

1. The organisation of definite research on tsetse and trypanosomiasis in the Gold Coast was commenced in December, 1925.

2. From previous reports and correspondence it appeared that the veterinary side of the problem was held to be of more importance than the human side, and in consequence research was undertaken on the main cattle route leading from the French territory of the Haute Volta to Kumasi in Ashanti.

3. A locality was therefore selected for investigation (Yeji on the Volta river), midway between the French border and Kumasi, and the cattle passing through were examined for trypanosomiasis. Over a

thousand animals were examined at Yeji from November, 1926, to March, 1927. Statistics showed a lower percentage of infection than those obtained at the border by the Principal Veterinary Officer, but as it was considered by him that the greater part of the infection in cattle probably took place prior to entry in the Gold Coast, the investigation was nearly brought to an end. As a result of the statistics obtained from blood films of cattle reported upon by Dr. Young and Mr. Abbott the Government of the Gold Coast decided to continue the investigation. The result of the continued work substantiated the opinion of the Medical Entomologist that the infection rate at the border was very much lower than half way down the cattle route, while at Kumasi, the distributing market for cattle, a very considerable increase in trypanosomiasis was found.

4. It was evident, as previously surmised by the Medical Entomologist, that a vicious circle of infection was taking place from the fly to the cattle and from *vice versa* all the way down, and on this evidence Government provided funds to clear a considerable portion of the cattle route as an experiment. The result has been to demonstrate reduction of the rate of trypanosomiasis infection in cattle passing down the route and also a definite control of tsetse in the areas cleared.

5. The object having been obtained, it was the opinion of the Medical Department, that as human sleeping sickness appeared to be of minor medical importance that the investigation should end about October, 1929.

6. The original object of clearing the cattle route was to provide a fly-free artery from the Haute Volta to a suitable cattle-breeding area in the Northern Territories to demonstrate that this was possible, and to clear a suitable area for cattle breeding.

7. Finally owing to the change of veterinary policy in concentrating on a different locality, the "Accra plains" area, for the purpose of establishing a cattle breeding centre, it became necessary to ascertain the prevalence of tsetse in conjunction with cattle breeding experiments and the control of rinderpest. It has been shown however, that the cost of clearing in the Colony as compared to the Northern Territories may be the deciding factor against applying remedial measures. The result of the investigations in this area have already been mentioned in report No. I.

8. During the course of investigation on cattle, statistics were obtained with regard to the trypanosome causing human sleeping sickness, both with regard to its incidence in man and the tsetse. This research is being carried out on the pathological side and it appears that human sleeping sickness may be of more importance than previously realised.

9. The Entomological point of view has remained the same throughout, as the principal species involved were *G. palpalis* and *G. tachinoides* and the control of these species in the localities dealt with was a matter of applying proved methods, and adapting them to local conditions, which were such, that generally speaking, the economic gain was greater than the cost of the measures taken.

10. The following outstanding features may be mentioned:—

With regard to tsetse, ecological conditions in a great part of the Gold Coast Colony and the Northern Territories, where *G. palpalis* and *G. tachinoides* are the principal vectors, show that it is economically possible to control tsetse. It must be borne in mind however, that this only applies to such areas where there is an adequate population and where it is intended to definitely establish a cattle breeding industry, clear a small endemic centre, or control a trade route.

The Bionomics of Tsetse in the Gold Coast.

11. As elsewhere in Africa, the distribution of the species of tsetse is definitely controlled by the environmental factors. Density of shade, geological formation and food supply determine, within very well defined limits, each specific habitat. Seasonal climatic conditions may cause a wide dispersal over a considerable area, but the primary foci of the breeding centres continue the same unless there occurs a definite change in the ecological conditions. The type of food appears to be the important factor with regard to the *G. morsitans* group, while the character of the floral conditions determines the existence of the other species. On the other hand while *G. tachinoides* and *G. palpalis* may be found in a certain locality in equal numbers, a preponderance or the absence of either species appears to be due to the geological formation. *G. tachinoides* prefers as a habitat, sandy and stony terrain with a flow of water and *G. palpalis* obtains its optimum environment where there is the presence of water combined with moist loam soil or clay. Thus *G. tachinoides* is found where the vegetation is slight, and where suitable breeding places are provided in the shelter of large rocks, while *G. palpalis* is dependant on a much denser shade and consequent humidity. The *G. fusca* group are essentially a forest species and occur in localities away from the dense forest belt only along the banks of large rivers, where a fringe of forest flora is established. Artificial disturbance of the shade appears to have much less effect on *G. tachinoides* than on *G. palpalis*, but nevertheless the elimination of shade had a marked effect on its range of flight from the primary breeding centre.

12. The following species, their habitat and distribution in the Gold Coast are as follows :—

In the areas investigated (a) the main cattle route from the French border to Kumasi, (b) the coastal plains of the Eastern Province, and (c) certain portions of the forest belt of Ashanti, the following species are of chief economic importance :—

(a) *G. palpalis*, *G. tachinoides*, *G. submorsitans*.

(b) *G. palpalis*.

(c) *G. palpalis*, and possibly *G. fusca*.

G. palpalis.—This species is distributed in the Gold Coast from the borders of the coastal area to the northern border of the Haute Volta, and is essentially a riverine species, though it can establish itself in the shade surrounding permanent pools of water. The partial drying up of the smaller streams covered with matted vegetation produce a series of cave-like shelters which form the ideal habitat for the breeding of this species. *G. palpalis* appears to exert a definite choice of position in which to drop the larvæ, and in many instances I have found a few large fallen logs alone to be selected in quite a considerable area, as many as 60 pupal cases have been found under one log. It is usual to find a small proportion of live pupæ, the empty cases being the result of continued deposition of larvæ over the breeding season. This is an important factor which may prove to be of value in artificial control and it was noticed that after clearing, considerable pupation took place under the piles of unburnt logs and brushwood which remained. Early clearing and later burning would appear to be the ideal method by which numbers of pupæ would be destroyed. These pupæ had originated from females forced to deposit larvæ in the only situations available after their natural haunt had been removed.

13. In the forest belt *G. palpalis* is found along the edges of streams where the heavy growth of timber has been cut down. *G. palpalis* is an omnivorous feeder. Its choice of waterholes as a habitat insures a food supply provided by the local native, and in the proximity of villages, man is undoubtedly its principal source of food. It is not dependant on wild

game for its existence, and in unpopulated areas it feeds largely on reptiles such as varanus and crocodiles. I have noticed however, this species to be very prevalent in the vicinity of the schools of Hippopotami, and on shooting one of this animals noticed numbers of tsetse attacking the softer portions of the carcase, such as nostrils, ears and the genital organs. In the thinly populated coastal area of the Eastern Province of the Colony its food supply consists of the numerous droves of semi-wild pigs, which frequent the streams, cattle and man at the water holes and odd reptiles.

14. The seasonal incidence is very well defined. During the dry season from January to the end of March breeding appears to be restricted to the primary foci. At the beginning of the tornado season in March, the early rains in April, May and June, and also November and December at the end of the rains, there is a very definite rise in the incidence, as however, a great portion of the Savannah country becomes inundated during the rains, the fly is driven to the remaining dry areas, a very wide dispersal takes place, and with the fall of the water numerous pools are left which form considerable secondary breeding foci for a period from a month to two months. The ebb and flow of the migration along the small tributaries leading from the primary centres of the dense shade of the large rivers such as the Volta, extends for considerable distances, as far as 30 miles. The elimination of the primary foci, while admirable in theory does not seem a practical solution. Not only is the expense very great, but also the denuding of the vegetation in the Northern Territories cannot be justified in an area, where, already, the destruction of trees is producing a dangerous aridity.

15. The partial clearing of forest country results in a definite increase in the incidence of *G. palpalis*, and in the dense forest of Ashanti *G. palpalis* has not been found except on the fringes of clearings. Around the environs of Kumasi, *G. palpalis* is found in considerable numbers, where the main factors are present; requisite shade, food supply, humidity and ideal situations such as fallen logs and tree stumps.

16. A typical instance of the difference between a *G. palpalis* and a *G. tachinoides* habitat is afforded by the Gambaga escarpment. Across the plateau, as the ground rises, meander two small sluggish streams fringed with short thick palm trees and occasional clumps of shade. The northern face of the escarpment is formed by a sudden fall of some hundred feet, the lower end being intersected with rocky stream beds with sandy bottoms. *G. palpalis* is found on the top of the scarp while *G. tachinoides* takes its place on the reverse slope. It was found that *G. palpalis* was the predominant species at Suguri on the headwaters of the Nasia river, but after clearing all the tall vegetation *G. tachinoides* replaced *G. palpalis* during the rains, as the lower vegetation reappeared. *G. palpalis* is very loath to come out into the sunlight, and it has been shown that 500 yards of clearing is sufficient to afford practical immunity from attack.

17. *G. pallicera*.—This appears to be a forest species and distinctly rare, recorded by Dr. C. M. Ingoldby, near the Birrim river in the Western Province of the Colony.

18. *G. tachinoides*.—*G. tachinoides* is essentially a species inhabiting a savannah type of country and is found breeding on the banks of rivers and small streams. The pupæ are found scattered over a wider area than those of *G. palpalis* and the fly does not appear to restrict itself as *G. palpalis*, in the choice of the situation in which to deposit larvæ. I have found pupæ in the debris in the fork of trees four feet up from the ground. It has not been found in the forest belt and appears absent from the coastal area of the Eastern Province. It may be designated as an "up country" species. Artificial disturbance does not appear to affect its incidence to the same degree as *G. palpalis*. It will survive in more open

country with comparatively little shade, and will penetrate clearings around villages and remain in the shade of the native houses.

19. Clearing and direct sunlight however, have a marked inhibiting effect on its flight and readiness to attack. It would appear that it is a much hardier species than *G. palpalis* and there also seems to be a definite connection in its choice of habitat with running water and the type of soil, which is usually sandy and stony. This phenomenon is illustrated in the coastal plains of the Eastern Province of the Colony, which lack the features referred to and where it is absent, though the other apparently necessary factors are present. *G. tachinoides* is usually very abundant where it occurs.

20. *C. caliginea*.—This species is very rare, and has been taken once at Nsuta near Kumasi, in the thick forest of Ashanti, it was found near a small stream.

21. *G. fusca*.—This is essentially a forest species, and is fairly abundant along the forest paths and the edges of clearings.

22. *G. nigrofusca*.—This species has the same habitat as *G. fusca*, and has been recorded from Sunyani, and does not appear to be very common.

23. *G. medicorum*.—This large species was found in the dense shade of the thickets and tall trees fringing the river Volta. It cannot be said that it is really abundant, but 30 to 40 specimens were taken from time to time in six months. It was observed following the cattle for three quarters of a mile, but is very local in its distribution. It is probably crepuscular in its habits, and it has never been found leading the dense shade to attack, and all specimens were taken in the darkest part of the thickets with the two exceptions found following the cattle, which had been resting there. It attacks readily if the host is stationary, and the bite is very severe. The pupæ are found under large logs together with *G. palpalis* in the tall and heavy vegetation by the river bank.

24. *G. longipalpis*.—*G. longipalpis*, common in many parts of the Northern Territories, has been found within ten miles of Accra itself, where vegetation commences toward the rising hills and also around Sekondi and Takoradi. This species however, was not found in any numbers on the cattle route in the Northern Territories. Its habitat appears to be dense thick secondary bush, an intermediate vegetation between the thick forest and the savannah country. I have observed that it is always associated with a considerable incidence of the smaller antelopes, and its biology approaches that of *G. submorsitans*.

25. *G. submorsitans*.—This species is essentially dependant upon the presence of the large antelopes for its food supply.

26. There is no doubt that in the areas investigated that the fly disappears when the larger antelopes are driven away. This has been shown in a remarkable way along the main north road from Tamale to Kumasi, where ample evidence has been obtained that formerly *G. submorsitans* infestation was very heavy and game abundant close to the road in many parts. Heavy motor traffic has dispersed the game and has driven it away from the main road. After continuously travelling by motor up and down this road for over three years I have never seen a single specimen of *G. submorsitans*, though it has been taken following cattle half a mile from the road on rare occasions, and more frequently following game three miles or more from the road. Along less frequented roads in a game area, a moving car is certain to attract this species. There is no doubt that the belts infested with this species are very well defined, and its distribution in some cases is restricted to waterholes around which game congregates. Pupæ have been found but rarely at the mouths of the large ant-bear holes, and porcupine holes. This

species does not appear to be dependent on water or shade. All game has practically disappeared from the coastal plains of the Eastern Province of the Colony, due to the ruthless hunting by the natives and in consequence *G. submorsitans* is absent. In the western part of the Northern Territories the true *G. morsitans* is found (Bole, Dr. Ingoldby), and I have found a belt in the Haute Volta close to the northern border, where game was very abundant between Navarongo and Po.

At present *G. morsitans* is not an important factor as a vector from a veterinary point of view, nor from a medical point of view, with the possible exception of the Bole and the Kintampo districts.

Natural Control.

27. A few empty pupal cases were found, some with an irregular hole which appears to be similar to that made by a Mutillid. Others had a small round pin hole, which appeared to be due to a Chalcid. No parasites were bred from live pupæ and further data are required.

28. Certain species of birds exercise a definite control on tsetse. When the bush is burning, the little egret or "Cowbird" readily devours the fly as it is driven out and various species of bee-eaters, *Merops*, will dart through the flames to secure their prey. Examination of the crops of *Merops* showed in one instance as many as ten tsetse in one crop. Dragon flies, *Odonata*, have been observed attacking tsetse by the river and also species of *Asilidæ*.

29. *Period of gestation of larvæ in females of G. palpalis.* Some experiments were carried out in the laboratory to ascertain the period between the deposition of larvæ. The females were fed every two days. Experiments were carried on during August, September, October, 1928. The minimum period was six days, the maximum was 17 days, and the average was ten days.

30. The following two tables show the percentage of gravid females during the rainy season. It appears that the male rate of *G. palpalis* and *G. tachinoides* is higher than that of the females during the rainy season, but that a considerable rise in the male rate takes place towards the end of the rains. The rate of gravid females of *G. palpalis* diminishes towards the middle of the rains in August, and that of *G. tachinoides* appears to reach its lowest in September and October. The maximum gravidity is reached in December, for both species just at the end of the rainy season.

31. The rise and fall of the Volta river plays a very important part in the bionomics of tsetse in this area, chart I. From the 23rd of August, there is a certain sharp rise in the height of the Volta, reaching its maximum, on the 3rd of October, and an equally sudden drop on the 14th of November, so that on the 20th of November, low level is again reached. During the period of the flooding the fly is dispersed over a very wide area and breeding cannot take place in the primary centres.

Summary.

1. From the results obtained by the pathologists, it appears that clearing measures have had a definite effect in reducing trypanosomiasis in cattle on the cattle route.

2. Clearing has undoubtedly succeeded in controlling the species of tsetse on the eastern cattle route.

3. In the areas under consideration, *G. palpalis* and *G. tachinoides* are the principal species of economic importance.

4. The clearing of the streams in the lower portion of the coastal plains of the Eastern Province of the Colony should result in a fly-free area where cattle-breeding could be increased. In the northern portion

however, the vegetation appears to be too extensive to warrant the expenditure at present.

5. Owing to the distribution and the bionomics of tsetse in the Gold Coast it is possible from an economic point of view to control tsetse by clearing and burning, provided that the efforts are confined to definite objectives, main cattle routes, isolated villages bounded by definite limits of tsetse infestation, and cattle breeding areas where *G. palpalis* and to a certain extent *G. tachinoides* are the species involved.

6. Motor transport and the gradual elimination of wild game is undoubtedly diminishing and restricting the distribution of the *G. morsitans* group.

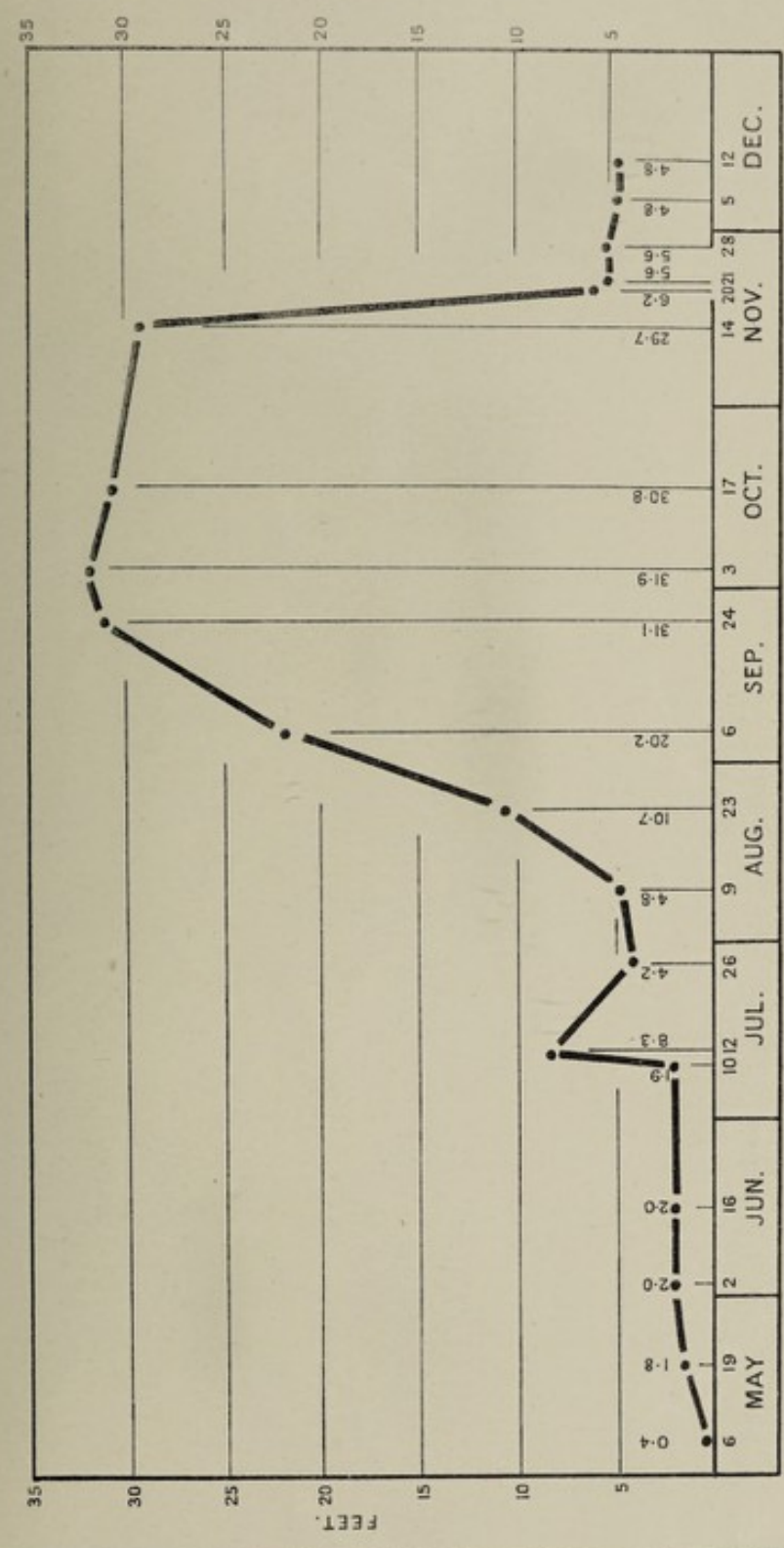
TABLE I SHOWING MONTHLY PERCENTAGE OF GRAVID FEMALES AND PROPORTION OF SEXES OF WILD FLIES CAUGHT AT YEJI, 1928.

Month.									Proportion of males to females caught.	Percentage gravid females.
<i>G. palpalis.</i>										
June ..	..	..	..	..	..	..	..	..	.88	12.4
July ..	..	..	..	..	..	..	..	..	1.1	9.8
August ..	..	..	..	..	..	..	..	..	1.1	.86
September ..	..	..	..	..	..	..	..	..	1.5	2.20
October ..	..	..	..	..	..	..	..	..	1.5	4.2
November ..	..	..	..	..	..	..	..	..	5.0	5.9
December ..	..	..	..	..	..	..	..	..	3.0	16.6
<i>G. tachinoides.</i>										
June ..	..	..	..	..	..	..	..	..	1.9	18.1
July ..	..	..	..	..	..	..	..	..	1.5	11.2
August ..	..	..	..	..	..	..	..	..	2.5	18.0
September ..	..	..	..	..	..	..	..	..	2.6	1.5
October ..	..	..	..	..	..	..	..	..	8.0	2.6
November ..	..	..	..	..	..	..	..	..	6.0	6.6
December ..	..	..	..	..	..	..	..	..	8.9	33.3

TABLE II.
FROM 1ST JUNE, TO 24TH DECEMBER, 1928,

Month.	Period.	Loc.	Total No. males caught.	Total No. females caught.	No. females with ova in abdomen.	No. females with larva in abdomen.	No. females flies dissected.
<i>G. palpalis.</i>							
June.	1st-7th.	Yeji	24	32	3	2	24
June.	8th-14th.	Yeji	39	42	4	—	18
June.	15th-21st.	Yeji	41	35	5	—	15
June.	22nd-30th.	Yeji	50	61	5	2	9
<i>G. tachinoides.</i>							
June.	1st-7th.	Yeji	108	64	7	2	31
June.	8th-14th.	Yeji	140	89	14	—	52
June.	15th-21st.	Yeji	109	83	9	1	65
June.	22nd-30th.	Yeji	110	60	6	3	24
<i>G. palpalis.</i>							
July.	1st-7th.	Yeji	150	160	13	2	60
July.	8th-14th.	Yeji	37	36	7	1	17
July.	15th-21st.	Yeji	36	46	3	—	15
July.	22nd-30th.	Yeji	34	22	—	—	2
<i>G. tachinoides.</i>							
July.	1st-7th.	Yeji	473	290	30	4	160
July.	8th-14th.	Yeji	104	76	12	—	29
July.	15th-21st.	Yeji	94	65	7	—	33
July.	22nd-30th.	Yeji	50	39	—	—	2
<i>G. palpalis.</i>							
August.	1st-7th.	Yeji	53	50	1	1.	5
August.	8th-14th.	Yeji	134	109	8	1.	18
August.	15th-21st.	Yeji	47	49	6	2.	11
August.	22nd-30th.	Yeji	78	61	4	—	20
<i>G. tachinoides.</i>							
August.	1st-7th.	Yeji	54	40	—	—	4
August.	8th-14th.	Yeji	234	112	21	3	44
August.	15th-21st.	Yeji	90	40	12	—	17
August.	22nd-30th.	Yeji	203	69	11	—	26
<i>G. palpalis.</i>							
September.	1st-7th.	Yeji	60	40	—	—	4
September.	8th-14th.	Yeji	63	37	1	—	8
September.	22nd-30th.	Yeji	17	14	1	—	4
<i>G. tachinoides.</i>							
September.	1st-7th.	Yeji	112	62	6	—	28
September.	8th-14th.	Yeji	92	26	3	—	12
September.	22nd-30th.	Yeji	40	7	1	—	4

CHART I RISE AND FALL OF THE RIVER VOLTA AT YEJI. MAY TO DECEMBER 1928.



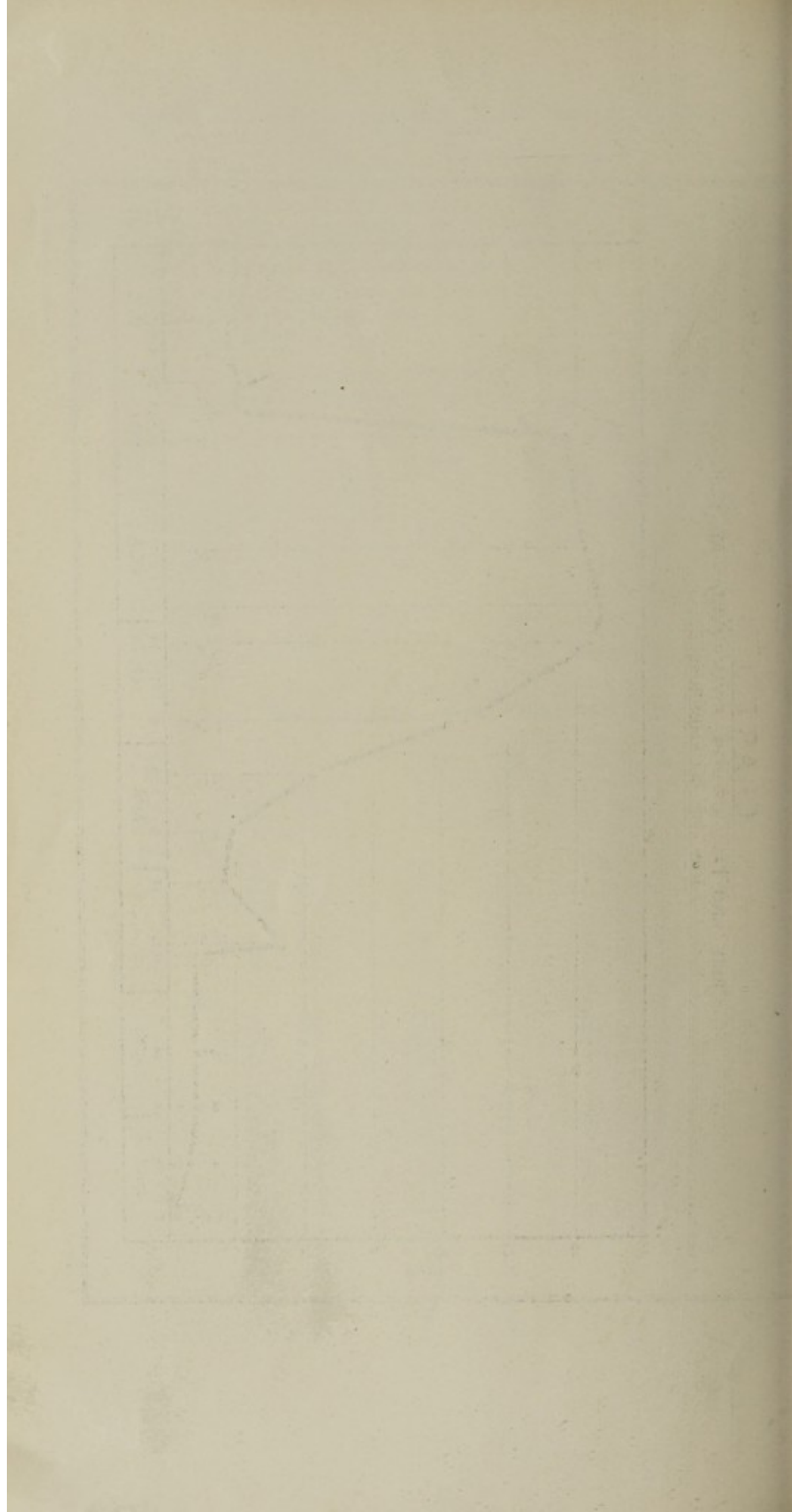


TABLE II.—*continued.*

Month.	Period.	Loc.	Total No. males caught.	Total No. females caught.	No. females with ova in abdomen.	No. females with larva in abdomen.	No. females flies dissected.
<i>G. palpalis.</i>							
October.	1st-7th.	Yeji	26	16	1	—	11
October.	8th-15th.	Yeji	30	22	1	—	5
October.	16th-22nd.	Yeji	50	32	1	—	11
<i>G. tachinoides.</i>							
October.	1st-7th.	Yeji	57	7	1	—	4
October.	9th-15th.	Yeji	144	13	—	—	4
October.	16th-22nd.	Yeji	102	18	—	—	8
<i>G. palpalis.</i>							
November.	15th-21st.	Yeji	15	3	—	—	—
<i>G. tachinoides.</i>							
November.	15th-21st.	Yeji	31	—	—	—	—
<i>G. palpalis.</i>							
December.	16th-17th.	Yeji	7	5	—	—	5
December.	18th-24th.	Yeji	11	1	1	—	1
<i>G. tachinoides.</i>							
December.	10th-17th.	Yeji	69	8	3	1	8
December.	18th-24th.	Yeji	41	4	—	—	4

APPENDIX H.

This is the first report submitted by Mr. Morris and forms an illustration of the amount that can be encompassed with the minimum of staff and a few pounds worth of equipment. He is well aware that he may have been over dogmatic and that his deductions are based on observations carried out over a comparatively short space of time (18 months) and may therefore require some modification by observations taken at similar areas at different times of the year and also that much may only be a repetition. These observations are of value however in confirming or indicating where further information is required. Mr. Morris has laid a good deal of stress on the reptilian source of the food of *G. tachinoides* as explaining some of his observations on the bionomics of that fly: he realises that these require confirmation or modification by further data though they are none the less observations that have struck him forcibly.

Report on Certain Tsetse Fly Areas of the Northern Territories.

By K. R. S. MORRIS.

A.—Staff.

On 1st of April, 1929, the staff consisted of:—

Mr. K. R. Stacey Morris, Assistant Entomologist.

Mr. L. P. Gray, Laboratory Attendant.

Mr. D. B. Venkumuni, Laboratory Attendant.

Mr. Gray proceeded on leave on 1st August, and did not rejoin the work in the N.Ts.

B.—Work Undertaken.

2. In January, 1929, the clearing of certain fly-belts crossing the eastern cattle route had been commenced, under the direction of the Medical Entomologist.

3. In March, 1929, the Medical Entomologist proceeded on leave and the Assistant Entomologist took over the work of studying this part of the cattle route with special reference to the effect of the clearings.

The area in question lies between Namburugu, in the north-east corner of Western Dagomba district, to the border quarantine stations at Mogonori and Pusiga in Kusassi district.

This work continued until 10th January, 1930, when the Assistant Entomologist and staff moved to Yeji to observe conditions at Makongo and advise as to the clearing of tsetse areas in the vicinity of the town.

C.—Species of Tsetse.

4. Only four species of *Glossina* have been met with in the areas under observation.

Glossina palpalis, Reb.-Desv.—Common and widespread; and a variety of this species noted by Simpson as occurring at Yeji in the N.Ts., Gold Coast in 1914 and named by him *G. palpalis* *ver pallida* (1). One has been found at Nagpanduri and Makongo.

Glossina tachinoides, Westw.—Common and widespread.

Glossina submorsitans, Newst.—Local and apparently decreasing in numbers.

Glossina medicorum, Austin.—At one place on the Volta river near Yeji.

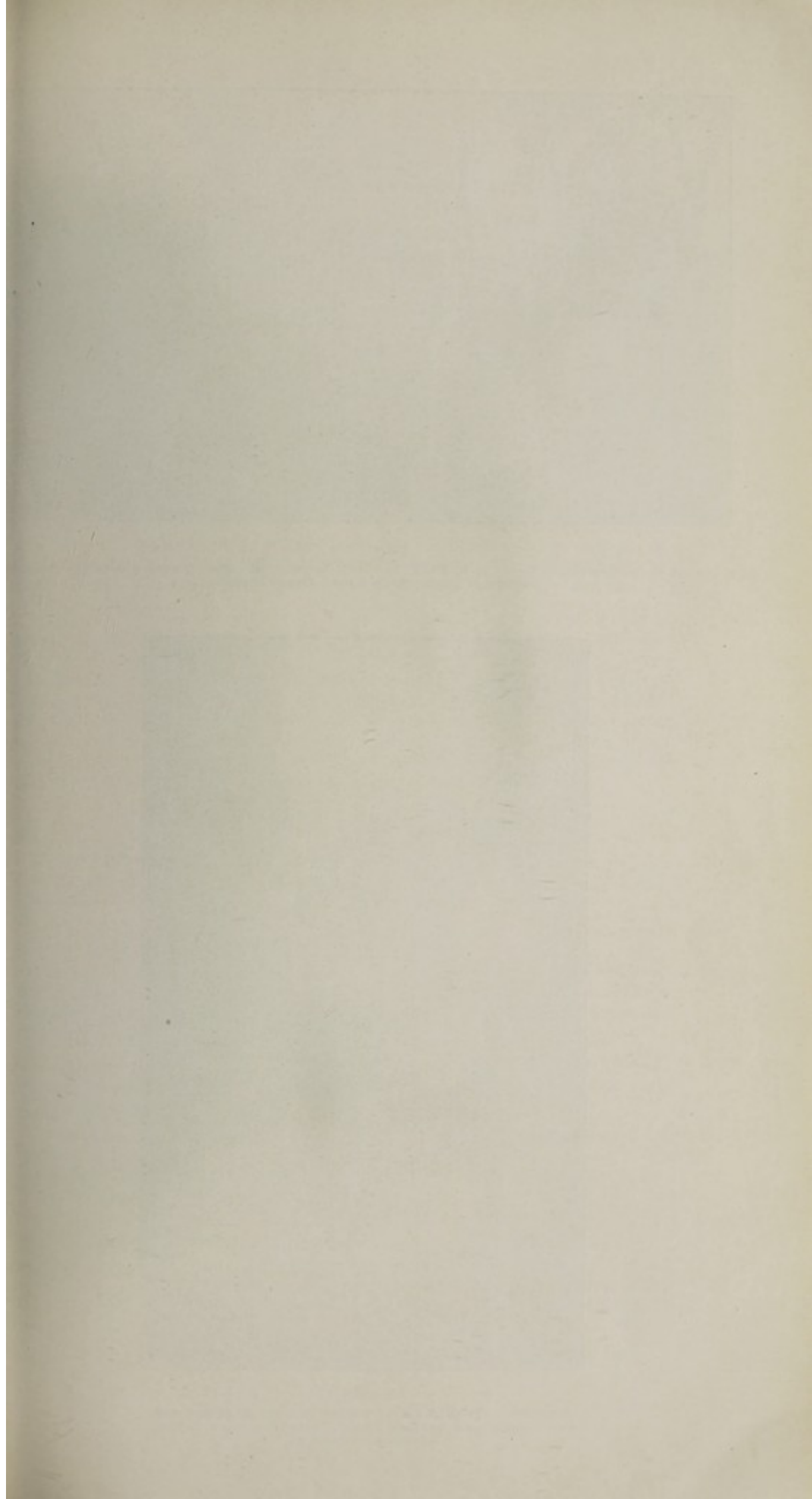




FIGURE 1.

A typical *G. submorsitans* haunt at Baghale, Northern Territories. Open grassy glades with scattered clumps of dense shade trees. Game abundant.



FIGURE 2.

A typical *G. palpalis* primary focus on a small stream with dense palm and bamboo shade. Bombilla, near Sakko, Northern Territories.

D.—Fly-belts and Distribution.

5. *Glossina submorsitans*.—This fly appears to be essentially a big game tsetse, and its distribution here has been found to coincide invariably with the presence of the larger species of antelope.

6. Its typical habitat is a type of country consisting of small open grassy plains interspersed and fringed with thick clumps of trees, where game is abundant and able to find ample food. (Fig. 1).

7. It is not by any means dependent upon surface water, but in the dry season is confined to fixed belts of evergreen trees and so is found in the neighbourhood of rivers or low lying savannahs where sub-soil water is present and the trees do not lose their leaves.

8. In the wet season, however, it is far more widely scattered, and, in consequence of its small numbers here, the dry season foci were found free from any fly late in the wet season after the flies had wandered or been scattered in following game animals. In June, one *G. submorsitans* was caught while following a herd of hartebeeste in open grass country at least three miles from the nearest known fly belt.

9. The most defined fly-belt, along the valley of a small stream close to Jowani, where regular numbers of *G. submorsitans* were caught in early June, was found quite deserted by the fly in early November, at the end of the rains.

10. This fly-belt impinges upon the cattle road at a point where a small stream crosses the road one mile south of Jowani, and continues down the valley of this stream to the point where it joins a larger river, the Kulda river. This stream is nowhere densely shaded, and in parts quite open, flowing over bare rocky ground. Along the more shaded parts of the stream a few *G. palpalis* were found, and *G. palpalis* and *G. tachinoides* were common along the bigger river. Game was very plentiful here. Buffalo, hartebeeste, waterbuck, bushbuck and duiker all present in the bush.

11. Further down the course of the Kulda river, between Tundi and Nagpallaga (on the cattle road) although *G. palpalis* and *G. tachinoides* were still present in fair numbers no *G. submorsitans* were found despite much searching, and despite the fact that the country was apparently ideal and in every way similar to other parts of the fly-belt.

12. At Baghale *G. submorsitans* was found again, in the savannah forest along the course of the same river. This discontinuity was explained by the presence of a pair of lions that hunted the country in the neighbourhood of Nagpallaga and had absolutely cleared the bush of all larger game. The only animal seen in this district was a very young and very innocent reedbuck which had obviously not yet met the lions.

13. The country round Baghale was very full of game, a big herd of waterbuck was always present close to the river and cob, reedbuck and duiker common.

14. The only other place where *G. submorsitans* has been found is in the thick orchard bush country bordering on savannah close to a water-hole about two miles west of Suguri. This was at least two miles from the Nasia river. Game was plentiful here.

15. Newstead mentions Makongo as one of the localities in the Gold Coast for *G. submorsitans*. (2) Mr. Pomeroy also found it there in 1929, at Yeji ferry in 1926, and on the river banks at Yeji in February, 1929. In January, 1929, none were found there in a fortnight's survey, and from January to March, 1930, extensive catching round Makongo has not revealed any flies of this species.

16. Although game is very common round Makongo it is mostly the smaller species, cob, bushbuck and duiker, that are found close to the town, the larger hartebeests and roan occur much further afield where not much catching was done.

17. Every year the larger species of game here gets driven further and further back, not so much by the motor traffic on the main road as by the native hunters, whose name is legion.

18. *G. palpalis* and *G. tachinoides*.—Both these species are confined in the dry season strictly to the presence of water and to the dense shade and undergrowth found around streams and swamps which never dry up.

19. These strictly defined fly-belts or primary foci, are often not more than ten to twenty yards in width where the stream is narrow and swift, but may extend to some hundreds of yards where the river is large and with wet and swampy banks, and are many miles in length as long as the vegetation along the course of a river is suitable.

20. *G. tachinoides* seems to be a far more riverine species than *G. palpalis* having been found in greater quantities along the banks of the larger rivers in the country inspected, while *G. palpalis*, though frequently found in the same fly belts as the former also occupies the smaller streams where cover is often considerably thinner (Fig. 2), and marshes where there is very little surface water but vegetation is sufficiently dense.

21. As soon as the first rains have fallen and the air becomes more humid and vegetation starts to grow up both species will wander from primary foci and *palpalis* especially will colonise secondary foci, usually thickets or streams that had dried up and become isolated from the primary foci.

22. The first tornado occurred here (Yeji) on 22nd February (1.5 ins. rain) and another on the 26th February (.9 ins.). During the first week in March it was noticed that tsetse were following along paths or in open country away from the river at Makongo, whereas hitherto Tsetse had been most strictly confined to the river banks. On the 15th of March it was very noticeable the way both species were leaving cover and coming out into the open to attack the passer by. This was at a spot down the Makongo river where a well-worn game-path skirted along the river within from ten to twenty yards of it, and here undoubtedly the tsetse were used to procuring their meals by dashing out on passing animals. However the fly followed us for at least half-a-mile into the bush on several occasions.

23. On the 17th some outlying thickets of trees and palms where no fly had been found previously were found to harbour one or two *palpalis*. By the end of the month they were quite numerous here. At this spot palms were being cut for palm-wine, and visited every day by a man who had to pass through a heavily infested fly belt on the way, and thus he would be introducing tsetse into this secondary focus.

24. As the rainy season advances, breeding and considerable increase in tsetse occurs in these secondary foci, and, in places where the primary focus is along the banks of rivers given to extensive flooding in the rains, these primary foci may be deserted altogether by the end of the wet season, the fly being driven back to secondary foci bush or up the course of small side streams.

25. Other factors also help in the dispersal of the fly, such as the movements of food hosts. These will be dealt with later.

26. *Seasonal Distribution.* In places where this wet weather dispersal occurs, notably along the Nasia River and further north at the Tamne River, (Tables 1 and 2) repopulation of the riverside primary focus may be very gradual. At both of these rivers fly were plentiful up to May and June, but when revisited in October the tsetse had practically disappeared.

27. At Suguri in the uncleared parts of the Nasia river the average catches were (only *G. tachinoides* present).

March 1929	...	...	42 per day.
April 1929	...	...	66 per day.
May 1929	...	...	59.3 per day.

On visiting this place in November and December, 1929, not a single specimen could be found, though a length of four or five miles of the river was searched thoroughly.

28. At the same time at Jowani, 16 miles up a side stream, the Kulda river, the catch in eight days in June was *G. tachinoides* 9; *G. palpalis* 20; two days in November, *G. tachinoides* 33; *G. palpalis* 28. This increase was not altogether due to increased breeding activity, no pupæ were found, but mainly to a migration up the stream throughout the wet season.

29. It has not been possible to visit Suguri since December, 1929, but the district will be visited again in May, 1930. At the beginning of February, 1929, tsetse were extremely difficult to find there.

30. Chart I shows the variation in proportion of *G. palpalis* and *G. tachinoides* on the Volta at Yeji over a period of six months. A graph of rainfall at Yeji is attached. It will be noted that this variation in the dominance of a species is brought about by an increase in one species accompanied by a fall in the other. Obviously several factors are responsible for this variation.

31. The greater rainfalls on 14th April and 21st June, appear to have brought about a temporary increase in *G. tachinoides*, but this has been modified and finally eliminated later by the steady reduction in numbers as the rainy season progressed.

32. It is possible that this temporary increase is due to the increased catching of pupæ under the influence of rains and decrease in length of pupal period (*see* breeding) but why this has not operated in the case of *G. palpalis* is not clear, if this hypothesis is correct.

33. The steady decrease of *G. tachinoides* in its normal habitat is most probably due to the flooding of the Volta and the inundation of its breeding grounds.

34. It has been noticed that this species in these localities is not so ready as *G. palpalis* to colonise secondary foci away from the river. The latter species however, as the wet season progresses and vegetation away from the river becomes denser, finds fresh breeding grounds and increases steadily in numbers.

35. The above hypothesis is compatible with the findings at Suguri (Nasia R.) and on the Tamne river, where tsetse had been practically exterminated by the end of the wet season.

36. *Annual Distribution.* When, however, it comes to considering the annual variation, as shown in the figures for the Volta at Yeji for



FIGURE 3.

A secondary flybelt of *G. tachinoides* at Mogonori. The very long grass and the shade of the few scattered trees were sufficient to harbour numbers of this Tsetse.



FIGURE 4.

The river at Pusiga, nine miles from Mogonori. There were dense shade-giving trees but the banks bare of low cover, and no Tsetse could live here.

three of the larger tributaries, the Moragho river immediately below the scarp, the Tamne river at Garu, and the Mobiri river at Mogonori on the French border.

48. The first two of these are permanent *G. tachinoides* belts, although the vegetation on either of these rivers in no way approaches in density that found along the rivers and streams further south. The essential points for the existence of *G. tachinoides* however are fulfilled, there is sufficient overhead shade formed by high trees and a low dense shade of grass or thorny bush along the river banks. Large crocodiles and varanids are common in these rivers.

49. Along the Volta and Moragho rivers to the south game is common, buffalo, roan, antelope, waterbuck, cob and duiker; but along the Tanine river game appears to be scarce, except for the red-fronted gazelle which animal does not seem to extend its range further south, and apparently does not avoid the company of man, but is found frequently among the farms here.

50. In the two border quarantine stations at Mogonori and Pusiga can be found an ideal example of the effect of clearing and farming in driving out tsetse (Figs. 3 and 4). At Mogonori on the Mobiri river *G. tachinoides* was found in quite large and regular number in July and August, 1929, average daily catch for July being 17.5, for August 20 only, three unskilled fly-boys being employed. This place however was obviously a secondary fly belt. Mr. Pomeroy in January and February, 1928, had found no tsetse there though present at the junction of this river with the Volta 12 miles away as Mogonori was cleared at the time. Trees here were not dense, only scattered here and there along the river banks, but a dense wet weather vegetation of long grass and a short creeping thorny scrub clothed the river banks, and this coupled with the just adequate overhead shade formed sufficient shelter for this tsetse.

51. About a mile down the river, where a side stream joined it, trees were more numerous and tsetse were common and breeding, and it is possible that this is a permanent tsetse focus.

52. At Pusiga, some nine miles distant and on a branch of the same river not a single tsetse could be found at this time. (July and August). Here the town was close to the river and population large, so the ground had been farmed right to the river's edge and trees away from the river all cut for fire-wood, although the river-side trees had been left and gave ample shade, greater than was found at Mogonori. However the absence of undergrowth was obviously the limiting factor, as has been found elsewhere.

53. At this time the herds of cows were coming in by the Pusiga quarantine station, and as each herd remained here for nine days their grazing was instrumental in keeping down the grass and shrubs for a large area. It is quite possible that if the cows were coming through Mogonori, instead of attracting and encouraging tsetse by their presence as food hosts, they would have banished them by keeping down the low vegetation in the neighbourhood of the river.

54. The food of *G. tachinoides* here appeared to be largely reptilian; few wild mammals exist there and the mammalian blood found in flies examined was probably human from the boys who caught them. *G. palpalis* is the species whose distribution is more influenced by mammalian hosts (see under "Food").

55. The flora of the primary foci of *G. palpalis* and *G. tachinoides* has been studied in some detail around Makongo. Elsewhere the study has been rather more general, but it is hoped the opportunity will occur for making a more scientific study of other fly belts.

56. *Influence of Geology.*—More fundamental than a study of flora is of course a study of the geology of the district. In this respect Makongo is so situated that the flora is rather richer than in the surrounding terrain.

57. The flat country around Makongo, and up to the Volta river in this part, is on a clay-shale rock, with the subsoil a hard, impervious clay which becomes baked dry in the dry season and is subject to considerable flooding in the rains.

58. The town of Makongo however is situated at a spot where the sandy soil of the higher country to the north extends down as an outlying pocket of sand on the underlying clay strata, producing a fertile patch of country where there is a good subsoil with a supply of subsoil water that does not dry up. Hence for four hundred yards of river-bank close to Makongo there is dense ficus bush, not found elsewhere on the river and full of tsetse, and to the east, north and west of Makongo and within a few hundred yards is permanent swampy ground with dense forest flora harbouring abundant *G. palpalis* (see Map 3).

59. *Flora of Makongo.*—In an area 100 yards along the river by about ten yards wide the following trees were counted.

<i>Ficus congensis</i>	...	...	12	The dominant tree, more prevalent than the numbers indicate as each root is spreading and with numerous upright trunks and long hanging roots forming beautiful breeding place for both species of tsetse. The range of this species is limited to a sandy soil.
<i>Pterocarpus santalinoides</i>	...	...	16	In the dense shade of the ficus this tree was small and straggling. Elsewhere it grows to a large size.
<i>Cynometra Vogelii</i>	...	...	6	This is the dominant tree of other parts of the river where, in the hard clay soil ficus does not occur.
<i>Syzygium guineense</i>	...	...	3	This also is more numerous in other parts of the river.

A low evergreen bush, unidentified, very numerous.

A low growing shrub not more than a foot high, with large leaves, forming dense low shade.

Creepers and lianas exceedingly numerous forming an impenetrable mat over all the bushes and trees. Two species were dominant.

Paullinia pinnata ... Thickly spreading evergreen creeper, exceedingly tough stems.

Unidentified.—(Chali, Hausa) ... Very common strong growing creeper with thorns. Delicate pink and white flowers in March.

60. In this bush both species of tsetse occurred, but *G. palpalis* out-numbered *G. tachinoides* by about 2:1. This belt of bush was extremely narrow, nowhere more than ten yards from the actual water. The *Ficus* grows most profusely right in the water, as also did *Pterocarpus*.

61. The other fly-belts around Makongo were more extensive, three in all, each two to 300 yards in length and up to 300 yards in depth at the widest part. Apart from one tree *Pterocarpus santalinoides*, and a few creepers, the flora was entirely different.

62. An attempt was made to count a typical strip of this bush, 100 yards long by ten yards wide.

<i>Isoberlinia doka</i>	...	...	20	Dominant. A large strong growing forest tree.
<i>Pterocarpus santalinoides</i>	...	...	16	Large strong growing tree in this bush.
<i>Sarcocephalus Russegeri</i> or possibly <i>Diospyros mespiliformis</i> (Ebony).	6 or 7	...	...	An important tree in this area, much covered with creepers. Grows always on the mounds of old termite hills.
<i>Terminalia sp.</i>	...	...	8	Fairly large tree, quite plentiful.
<i>Ficus capensis.</i>	...	...	...	Fairly common. Small tree.
<i>Vitex Cienkowski</i>	...	...	5 or 6	Small tree, fairly common.
<i>Pterocarpus erinaceus.</i>	...	...	...	Here and there mostly at edge of bush.
<i>Ouratea flava</i>	...	...	18	Low growing laural-like shrub, very numerous.
Palm. (Tukurua, Hausa)	20 to	...	...	Very numerous, growing close to
<i>Raphia vinifera</i>	30	...	...	the water.
Palm. (Quaqua, Hausa)	16 to	...	...	Not so common as above and grow-
<i>Elæis guineensis.</i>	20	...	...	ing in the drier parts of the bush, usually clumps of many together.

Both these palms are of great importance as the ground around their roots forms a favourite breeding place of *G. palpalis*.

A number of other trees were not identified, but were not of great importance. Creepers and lianas exceedingly numerous. A strong razor grass grew everywhere by the water.

63. Thus it will be seen that this fly-belt consists of a tall overhead shade combined with a dense growth of low shrubs. The ground was damp and marshy, and in many parts standing or running water.

This was in the height of the dry season.

64. The vegetation of the river banks away from the sandy soil of Makongo consisted mainly of *Cynometra Vogelii* which was dominant everywhere. Also *Syzygium guineense* in small numbers. The two creepers mentioned cover the lower parts of these trees to form dense impenetrable masses.

65. *Dominant trees in Primary Foci.*—Secondary foci around Makongo lacked the dominant species of the primary foci, and these three species, *Ficus congensis* by the river banks, *Isoberlinia doka* in the dense forest-like bush behind Makongo, and *Syzygium guineensis* along the river in the open clay country, may be taken as typical indicators of primary tsetse foci in this part of the country. (For photographs of Makongo bush see Figs. 7, 8 and 9).

66. There has been noticed a decided difference in the tsetse population of the *Isoberlinia* bush and the *ficus* bush around Makongo. In the former only *G. palpalis* was found, in the latter both *G. palpalis* and *G. tachinoides* were found, in a proportion of 2 : 1.

67. In the bush east of the town where two types of bush adjoin and merge slightly with one another both species of tsetse were found but in the proportion of *G. palpalis* : *G. tachinoides* = 4 : 1.

68. The average daily catch in January, 1930, of *G. palpalis* in *Isoberlinia* bush was 29, in *ficus* bush, 20.8 *G. palpalis* to ten *G. tachinoides*, but the female percentage of the catch (42 per cent and 37 per cent respectively) indicated hunger and a less permanent population in the former type of bush. When these areas around Makongo were cleared in February the fly left this part (*Isoberlinia* bush) almost at once and was practically completely eradicated. (See chart 2). The river banks, however, even when cleared and burnt, continued to harbour tsetse in small varying numbers. (See chart 3b). This will be discussed under "Control."

69. The flora of the Volta is far richer and more varied than that of the smaller rivers, and it has not been studied in detail as yet. *Ficus congensis* is certainly very common but not dominant everywhere. *Uapaca Heudelotii* is common and dominant in some parts. *Cynometra Vogelii* is dominant in the open parts of this river.

70. At Suguri the vegetation of the Nasia was almost exclusively *Ficus congensis*, which extended for some distance up the courses of the side streams.

71. On the higher parts around Gambaga however, where the streams were small and swift on a pure sandstone, the thick vegetation was replaced by bamboo and palm with abundant low growth of grass. (Fig. 2).

72. Secondary foci around Makongo have been found :—

(a) On the sandy soil, where thickets consist of *Pterocarpus santalinoides*, dominant, with several lesser trees and abundant palm of both species. Cover is not dense enough for tsetse in dry season, but with a few rains the grass and leaves soon afford the thick low shade necessary.

(b) In the orchard bush the tall ebony trees (*Diospyros mespili-formis*) will form little islands of thicker cover. This species has been always found growing on the mound of old termites nests, and collects around it a number of smaller thorny trees, and is always densely creeper covered.

73. *G. palpalis* has been found in these places quite far away from the main river, and it may breed here and from secondary wet weather centres, though this point has not yet been made certain.

74. A secondary belt of *G. tachinoides* have already been noted as occurring at Mogonori.

75. One point in common to both primary and secondary foci is the necessity of a tall overhead shade and a thick low undergrowth. The distinction may be in the presence of water all the year round in the primary focus, or may lie in the effect of this in maintaining an evergreen vegetation and low growth of herbage. The latter seems the most likely. In any case the vegetation is only influential in providing a suitable environment for the fly, the presence of tsetse in this environment will be determined by a number of other factors.

E.—Influence of Shade, Temperature and Humidity.

76. In January, February and March, 1930, experiments were carried out at Makongo with a wet and dry bulb hygrometer, to determine the temperature and relative humidity of the fly and its variation. All readings were at a height of two feet from the ground (the height at which tsetse usually fly) and observations at six places round Makongo were taken every four or five days.

77. Figures for the latter half of January (harmattan still blowing) for the open and two types of fly belt at Makongo are given as follows:—

January.	Open.		Isoberlinia Bush.		Ficus bush.	
	Shade temp.	Humidity.	Shade temp.	Humidity.	Shade temp.	Humid.
18th	91	30	80	56	84	51
21st	94	50	88.7	66.2	85.5	59
25th	95	15	83.7	37.2	87.5	29
29th	94	16	85.2	23.5	89.5	16.5
31st	90	22	83.6	50	86	30.3
Average ..	92.8	20.6	83.2	46.6	86.4	37.2

78. These figures are represented graphically in chart 2. The constantly higher temperature and lower humidity of *ficus* bush is accounted for by its being far narrower and rather less dense than the *Isoberlinia* bush.

79. The day-to-day variation in temperature is not great, and the range of variation is the same for the three sets of figures. Humidity however showed a much greater variation; the variation in the bush is through a greater range than in the open.

80. In February and March, after the first few rains had fallen, there was even less difference between humidity of open and fly-belt, and the over lapping of the range of each becomes greater. The fact that the humidity of fly-belt varies within the range of open air humidity even at the driest time of the year, seems to indicate that humidity is not an influential factor on the presence of tsetse. There is indication however that a general rise in atmospheric humidity determines the movements of tsetse outside the fly-belt.

81. *Effect of drought on breeding.*—In the matter of breeding however humidity undoubtedly plays a very important part, not only influencing the length of pupal period, but a certain degree of humidity is essential for the emergence of the adult fly.

82. During some breeding experiments in the laboratory in January and February, 1930, with an average humidity in the laboratory of 42 there was a 40 per cent mortality due to drought among the pupæ, and a 20 per cent mortality due to other causes. These laboratory figures of course cannot be taken as indicating the death rate for such a degree of humidity in the field.

83. The ground of the breeding places is always kept damp by sub-surface water and only prolonged exposure to a low air humidity would cause such death rate among pupæ. It will be seen however that a certain average humidity in the fly-belt must be maintained throughout the dry season in order to render this fly-belt suitable for breeding.

84. Chorley (4) in Southern Rhodesia working on *G. morsitans*, found that in the dry season (November), only 41 per cent pupæ produced flies, while in the wet season (February and March), 77 per cent emerged. He attributed this mortality to exposure to the rays of the hot sun. Half-and-hour's exposure to the rays of the sun was sufficient to produce 100 per cent mortality in pupæ covered with a layer of sand half to one inch thick. He also found that the pupal period was between three and four times as long in the winter months as in the summer months.

85. *Exposure to sun.* It is probable that the direct rays of the sun have little harmful effect on adult tsetse, in their normal haunts they appear to tolerate direct exposure quite well. This applies to *G. tachinoides* more than to *G. palpalis*.

86. On the Moragho river in February, 1929, when the water was very low, *G. tachinoides* was exceedingly abundant and attacked man

with avidity at the water's edge, or along the sandy or rocky parts of the stream several yards away from the nearest cover, and this cover was not very thick and by no means impenetrable to the sun's rays. This was at midday in the hottest part of the year and on a perfectly cloudless day. The flies however were invariably close to the water's edge.

87. At Makongo it was found that the best place to catch tsetse was in the small glades and open spaces not more than a few yards across in the dense bush. These places were exposed to the rays of midday sun. At certain water-holes which were very open and exposed to the full glare of the sun people were being constantly bitten by both *G. tachinoides* and *G. palpalis*: the nearest shade being ten to 15 yards in any direction.

88. Female flies when not actively searching for food, spend most of their time resting in deep shade. Observations in the fly belts have shown this, and it is amply proved by the enormous increase in female percentage in catches made during and after clearing operations.

89. Temperature has a directly proportional effect upon the activity of tsetse. On dull days in the early morning, or when there is a cold wind, for example when the harmattan is blowing, they are extremely hard to find, evidently remaining quiescent in the bush.

90. Catches show that activity is greatest during the hottest hour's of the afternoon, but will continue biting up to dusk. The writer has been bitten by a male *G. tachinoides* at midnight while trekking in October. Shade temperature in a fly belt is apparently a factor of no consequence except in its influence on the activity of the fly. The effect of clearing on humidity and temperature is given in chart III. and will be discussed later.

F.—Breeding.

91. No pupæ of *G. submorsitans* have been found during this year's work. The first adults taken at Baghale were caught at the mouth of an old ant-bear hole, and it is probable that such places are used as breeding grounds by this species and this has been noted previously by Mr. Pomeroy. Nowhere has the fly been found in sufficient numbers to make it worth spending much time in searching for pupæ.

92. *Glossina tachinoides* has its major breeding season throughout the dry weather, and in the beginning of the rains, from December up to May or June. Little or no breeding goes on in the primary foci during the middle and end of the rains, but in secondary foci breeding has been observed through July and August so it seems probable that breeding continues all the year round, with the possible exception of September and October when rainfall in the Northern Territories is heaviest and floods are most extensive.

93. *Influence of Food on Breeding.*—Table IV. shows the breeding of *G. tachinoides* as estimated by females found containing larvæ, and the correlation of this with the abundance and nature of food. Of course the correlation is not very close, so many other factors take effect, and some of these will have direct influence on both breeding and change of food.

94. There is a general tendency to increase in breeding from March onwards until the very heavy rains set in (August). The clearing operations on the Nasia river in March drove away the normal mammalian and reptilian food, but the fly obtained a certain amount of sustenance from the men engaged in the work of clearing, so there was not a very great drop in breeding.

95. In April the clearing on the Nasia river had not yet been repopulated by food hosts and the human hosts had gone. The

percentage of blood in gut dropped and there was a considerable falling off in breeding.

96. At Magonori, the secondary focus of *tachinoides* described above, the breeding rate was high in July. The river here was still low, and crocodiles and monitors common and easy to get at, in consequence there was a high percentage of reptilian blood.

97. In August there was a considerable rise in the river and frequent flooding. Reptiles became scattered and difficult to find. Other animals are very scarce here, and the fall in percentage of reptilian blood indicates hunger, which was confirmed by the poor condition of the flies. There was a consequent fall in the breeding rate. Thus it seems fairly certain that abundance of food, and to *G. tachinoides*, possibly an abundance of reptilian food, brings about an increase in the breeding rate, if the conditions are suitable for breeding. Further observations on the food of *G. tachinoides* are still required however to confirm this hypothesis.

98. Pupa collection on the Volta at Yeji in January, February and March, 1930, shows an earlier breeding season for *G. tachinoides* than further north. This is born out by the relative abundance of the fly. In the early months of this year *G. tachinoides* was comparatively scarce at Yeji, and pupæ were very hard to find. The following figures show the numbers of pupæ and empty cases obtained on the Volta banks, close to Yeji.

		Total.	Live pupæ.	Empty cases.	Percentage cases in catch.
January	...	86	15	71	82.6
February	...	90	24	66	74.4
March	...	104	—	104	100

99. The proportion of empty cases in a catch may be taken as indicating roughly the relative length of pupal period. There was an increase in breeding in February, but a decrease in length of pupal period in March when the rains had started. There seems to be another increase in breeding activity in May. Probably there are two periods of maximum breeding in the southern parts of the country, corresponding with the double rainy season.

100. The influence of humidity and temperature upon breeding has been dealt with under section D. *G. palpalis* was so scarce in the places where most of these observations were made that sufficient data have not been obtained to base any conclusions as to its breeding.

G.—Proportion of the sexes.

101. Fiske (3) working on Lake Victoria paid great attention to the phenomenon often noted of the great disparity between the sexes in catches of *G. palpalis* and formulated the hypothesis that sex proportion figures, taken over any district or region, are a fair index of the abundance of food supply and thereby the relative immunity of man, while taken locally they are an index of the attractiveness or repulsiveness of the environment.

102. The first part of the hypothesis is based on two lines of evidence. (a) When the favourite hosts of the fly are abundant the female ratio is low and flies are not persistent in their attacks on man, but where favourite hosts are scarce the female percentage is high and the fly attacks man very persistently. (b) By driving away the normal hosts of the fly and rendering it hungry the female percentage is raised to over 50 per cent, often higher.

103. The second part of the hypothesis is based on the habits of the fly in the natural fly belt. Female flies are usually engaged either in active hunting for food, moving quickly from place to place in the fly belt, or else, when full fed or when with larvæ, resting in deep shade and well out of the way. The males on the other hand are not so intent in feeding, but are moving about slowly and loitering in likely places in search of females. Especially will the males be found congregating around any likely hosts in the search for females that may be feeding thereon.

104. Thus normally the majority of flies in a catch will be the slow moving loitering males, as the majority of females are resting or hiding in shelter. If shelter is not adequate, or conditions have been upset or rendered unfavourable, a large proportion of females will be caught.

105. This hypothesis has been universally accepted and confirmed by workers in many parts of Africa and holds good for all species of *Glossina* whose bionomics have been investigated. During the work on the cattle route and at Yeji this theory has again and again been borne out by observation, especially in watching the effects of clearing experiments where considerable upset in environment has resulted.

106. In the parts of the country visited however, the apparently normal female percentage in a catch has been much higher than the normal figure for other parts of the country. Examples will not be quoted here, but this hypothesis of female proportion will be used elsewhere to illuminate problems of bionomics.

H.—Food.

107. Many stomach examinations of tsetse during the work here revealed the presence of a greenish yellow stain, and frequently small round green bodies of high refractive index resembling chloroplasts in the gut of wild flies. This and the invariable presence of bacteria in the gut (a possible symbiont aiding in digestion) led to the belief that plant juices were being taken as a food. Since then it has been noticed that similar green bodies result as products of decomposition of avian (and possibly mammalian) blood in the stomach of tsetse. Further work on this is being done in the laboratory.

108. Food of *G. submorsitans*.—*Glossina submorsitans* is the only species of tsetse here which has been found to feed almost exclusively upon one class of host, the larger antelopes, as has been previously reported. It has been noted how its distribution is influenced and limited by the presence of these animals, and how the gradual driving back of game around Yeji and Makongo is resulting in increasing scarcity of this fly, which however is still to be found in the remoter bush eight to ten miles back from the main road and where game is relatively abundant.

109. Food of *G. tachinoides*.—From observation on the distribution of *G. tachinoides* it seems to me probable that reptiles are its favourite and most usual hosts, and in many places it may be almost exclusively a reptilian feeder.

110. Its presence along the main rivers where crocodiles and monitors are very abundant; the fact of its being found frequently close to the water's edge where cover is scanty and inadequate may be explained by the fact that it is seeking reptilian food; and I have not found it along small streams where reptiles are rare or absent. All these points seem to indicate its preference for a reptilian diet. At the same time game animals undoubtedly form a large part of the food of *G. tachinoides*, and in the absence or scarcity of reptiles can form the major part of its diet. (Table IV.)

111. *Tsetse and Man*.—Man is never a preferred host of this fly. Although it frequently attacks man, follows him, and will live in the proximity of village water-holes and washing places, it has always been found that under such conditions there is a high female percentage indicating hunger, and that other hosts are rare or absent.

112. Catches at Makongo show the relationship of distribution of *G. tachinoides* and *palpalis* to man or other food hosts.

Makongo river.	Hosts.	<i>G. palp.</i>	<i>G. tach.</i>
Cattle-crossing	Cattle and Human	26 (70 per cent)	8 (75 per cent)
Waterhole close to town	Mostly human	15 (51 per cent)	3 (41 per cent)
Half mile south of town, fairly open	Reptiles and small animals ..	57 (50 per cent)	34 (56 per cent)
One mile north of town. Thick bush	Game common, reptiles rare	61 (49 per cent)	17 (29 per cent)
Two miles south of town. Orchard bush.	Game and reptiles common	48 (50 per cent)	32 (60 per cent)

The high female percentage shown by both species of tsetse close to the town was due to clearing operations which had started at the time these catches were made.

113. Maps 1 and 2 of Makongo shows the influence on the distribution of tsetse of changing the cattle route, from skirting closely a considerable frontage of thick bush in January, 1929, to only passing the end of this fly belt in January, 1930. The effect of this change is most marked on *G. palpalis*, and evidently cattle here outweigh in importance all other possible food hosts, whose distribution was fairly constant for the two years.

114. Food of *G. palpalis*.—From the above figures it appears that *G. palpalis* is far more catholic in its tastes than *G. tachinoides*, and will adapt its feeding habits to the exigencies of the moment.

115. It does not exhibit any preference for man, in fact is less numerous close to town and villages where man's presence has driven away more favoured hosts. Its preference seems to be for the smaller game animals, such as duiker, bushbuck, redbuck, etc., which frequent the thick bush of riversides. It probably feeds to a considerable extent on the smaller mammals, rodents, otters, palm-civets, etc., which are also common in the fly belts. It will feed readily on reptiles, but shows no marked preference. Birds may act as hosts when others are scarce or absent.

I.—Trypanosome Infection in Tsetse.

116. Table IV shows the infection found in *G. tachinoides* at the crossing of the cattle road over the Nasia river, and at the border quarantine station at Mogonori, where however no cattle were passing through at this time, only sheep and goats, and large numbers of traders and labourers from French country. The lack of infection in the fly at this latter place, is noteworthy. The absence of cattle and of game in this part at once explains the very small *T. vivax* and the absence of *T. congolense* infection, but the entire absence of *T. grayi* infection at a place where dissection showed that ingested blood in 75 per cent was reptilian is quite inexplicable, and not in accordance with the figures for Nasia river and Baghale.

117. The lower infection in *vivax* and *congolense* in the uncleared parts of the Nasia in March is because catching here took place in parts remote from the cattle road, whereas the "partly cleared" area was adjoining the cattle road.

118. Cattle were not visiting the Baghale lake, hence the lowness of infection. The mammalian blood in the flies here was mostly from

game animals. The lower infection in April and May was due to the larger number of young flies that were being caught at this time. During the first half of April the majority of flies caught were young soft-bodied flies, emerging from pupæ deposited in March. In later April and in May the proportion of young flies was smaller, with consequent slight rise in infection rate. In April a small number of flies (25) were examined from the uncleared bush remote from the cattle road, but no infection found. One infection belonging to the *T. brucei-gambiense* group was found in a *G. submorsitans* caught at Baghale.

119. At Nagpanduri, on the top of the Gambaga Scarp and one mile off the actual cattle road, a herd of local cattle is kept and these water at a stream harbouring *G. palpalis* in fair numbers all the year round, and at a point two miles below where the cattle road crosses the same stream.

120. A small number of flies were examined here, but showed no infection. The cattle, of the short non-humped variety were very healthy, and no trypanosome infection was found among them.

121. At Zongoiri, a small village just north of the Gambaga Scarp in the Kusassi district and where large herds of cows are kept, inspection of 76 cows (from three herds) showed an infection of:—

<i>T. brucei</i>	3 (4 per cent.)
<i>T. congolense</i>	1 (1.3 per cent.)

This part of the country is enclosed on three sides by large rivers, by the White Volta river 11 miles to the south and six miles east from Zongoiri, and the Red Volta ten miles west.

These herds are mainly fed and watered in beautifully open grass land with a small clear unwooded stream over granite bed, to the north-east of Zongoiri, but in the very dry weather when pasture here fails are taken down close to the White Volta to the east. All along the Volta river there are abundant *G. tachinoides*, and in December, when this part was visited they were very persistent in their attack upon humans when in the bush close to the river. Game is present along the course of the river. *Tachinoides* then must play a large part in spreading all three species of trypanosome, *brucei*, *congolense* and *vivax*, among cattle. A large number of dissections have been done previously at Yeji and elsewhere showing that *G. palpalis* also carries these trypanosomes.

J.—Infection in Cattle.

122. That the cattle themselves form the main reservoir for infection seems most likely at places where the cattle road passes a heavily infested fly-belt, where there is a continual supply of food (and incidentally of infection), so that the flies do not wander far away and get lost before they have the opportunity of re-infecting more hosts. Added to this of course is the greater number of flies, which makes the probability of infection and re-infection greater.

123. At a fly-belt where tsetse are few in numbers, not only is this probability of infection much less, but the tsetse population will be a moving one and infected flies will in all probability get lost or wander far away before they have infected more beasts. At the same time a heavily infested fly-belt seldom visited by infected animals (e.g. Mogonori) shows extremely low infection, or a heavy fly belt visited only by the same animals whether cattle or game, shows low infection. (Baghale, Nagpanduri.)

K.—Human Trypanosomiasis.

124. The same line of argument applies to human trypanosomiasis. The pathologist's findings on the sleeping sickness rate in villages is exactly in accordance with the findings on the cattle road.

125. Villages on trade routes, where there is constant supply of food and the possibility of new infected persons coming in to infect the

fly as well as local population among whom sleeping sickness may be endemic, and permanent fishing villages whose inhabitants are subject to constant and prolonged exposure to tsetse attack, and whose population is added to from time to time by fishermen from other villages, are the places where infection might be expected.

126. In temporary fishing villages on the other hand the sequence of the flies supply of food and infection is cut off by the vacation of the village during the rains and any infective flies would die or be dispersed without the chance of re-infecting other humans or carrying on the infection until the village is used again the next season.

L.—Wild Animals as Reservoirs.

127. As natural hosts of trypanosomes pathogenic to cattle and horses wild animals undoubtedly play an important part. Examination of the blood of a number of wild animals has been carried out in the country close to the cattle road in the Gambaga district, where game is plentiful, and at Makongo. The results are set out in table 3.

128. Of 18 animals examined in the former country, six, or 33 per cent, were found to harbour trypanosomes. All these were smaller game animals frequenting the thick bush close to rivers and streams, where *G. palpalis*, and *G. tachinoides* were abundant. Of the animals from the more open country where no tsetse or only *G. submorsitans* in very small numbers occur, no infection was found. Sufficient examinations have not been done at Makongo.

129. The connection between infection and habitat, and specially the degree of tsetse infestation of habitat, is most marked, and again supports strongly the statements made above on cattle infection. This has a very direct bearing on clearing operations directed against tsetse. This will be discussed under "Control."

M.—Enemies of Tsetse.

130. Enemies of tsetse may be direct or indirect. To take the latter first a notable example has been already quoted under the distribution of *G. submorsitans*, where it was shown how the presence of a pair of lions, by clearing a certain district of game, had also eliminated *G. submorsitans* and probably reduced in numbers *G. tachinoides* and *G. palpalis*. It is not suggested however that this line should be followed up in the control of tsetse.

131. Man is the most important indirect enemy of tsetse, and it has been pointed out above that in the vicinity of towns and villages, for example Makongo and Yeji, the number of tsetse is smaller and the population less stable than in the remoter bush where natural food hosts are undisturbed by man. Also it has been shown that a whole district when heavily populated (the Kusassi district around Bawku), will be free of tsetse through the cutting of bush and the driving out of food hosts.

132. Direct enemies may be sub-divided into predators and parasites. As *Predators* of adult flies may be mentioned birds such as certain bee-eaters and rollers, noticed in numbers along rivers where tsetse are common, and which most probably prey upon this fly to quite a considerable extent. Bats are usually present in the dense cover of riverside fly-belts, but the majority are fruit-bats and in any case the nocturnal habits of bats would render their chances of encountering tsetse very small.

Dragon flies are always present along rivers, but it is doubtful if they ever specialise in tsetse. Spiders' webs have been seen containing the remains of tsetse. Guinea fowl have been suspected of scratching up and feeding upon tsetse pupæ, but an examination of the stomachs of several wild guinea fowl shot in the fly-belts at Suguri revealed a mainly vegetarian diet with the elytra of a few beetles.

133. A search for *parasites* of pupæ has been carried on at Yeji, but no adult parasites have been bred out. The collection of 230 empty pupa cases showed only 11 that had not hatched normally, of which eight showed signs of parasitisation, the others being broken in from outside.

1930.	No. collected.	Parasitised.	Broken.
January	71	3 (4.2 per cent)	—
February	66	4 (6.0 per cent)	3 (4.5 per cent)
March	93	1 (1.0 per cent)	—
Total	230	8 (3.5 per cent)	3 (1.3 per cent)

The parasitised cases mostly showed a small circular hole in the mid dorsal surface, probably due to a small chalcid parasite.

134. While digging for pupæ in the sandy river bed at Jowani in December, 1929, an apterous female mutillid was caught resembling very closely *mutilla bonefactri*, a parasite of tsetse pupæ. This specimen and the parasitised pupa cases have been sent to England for identification.

N.—Experiments on control of Tsetse.

135. In the first 90 miles of the eastern cattle route, from the border quarantine stations at Mogonori and Pusiga to the Nasia river at Suguri, six clearings have been made at places where the road passes tsetse belts. In each case half-a-mile of river on each side of the road crossing has been cleared of bush, all trees and undergrowth along the banks of the river being removed.

The distribution of tsetse along the cattle route has been dealt with already so it will be sufficient here to describe the sequence of events at each clearing.

136. *The Tamne River Clearing.*—Four miles north of Garu, where the Bawku—Garu road crosses the Tamne river.

This is a slow-flowing river, practically dry in the height of the dry season and subject to much flooding in the rains.

When visited in February, 1929, it was almost dry. No fly were observed then during a very short halt. It was cleared in March.

In July the river was getting full and grass growing profusely throughout the clearing. No tsetse could be found. In September the river was very full and practically all the clearing flooded. Grass had grown rank and high. In ten days spent at Garu constant searching in both clearing and in uncleared bush resulted in the finding of only six *tachinoides* (four male and two female) in the bush outside the clearing. During this year the cattle have not been following this road, all were coming in by the Pusiga quarantine station.

137. *The Jelakologo.*—A small stream crossing the Bawku—Garu road two and-a-half miles north of Garu. This is a tributary of the Tamne river, is swift and flowing over clear sandy bed. Not subject to flooding, very light bush. All bush and grass removed for a good half mile each side of the road crossing. No tsetse have been found in the clearing or vicinity. When last visited in October farms were being made in the clearing, sweet-potatoes, tobacco and rice were growing very well.

138. *At Kagbiri.*—On another branch of the Tamne river, the Pusiga—Garu road crosses a small stream. There is fairly thick bush here.

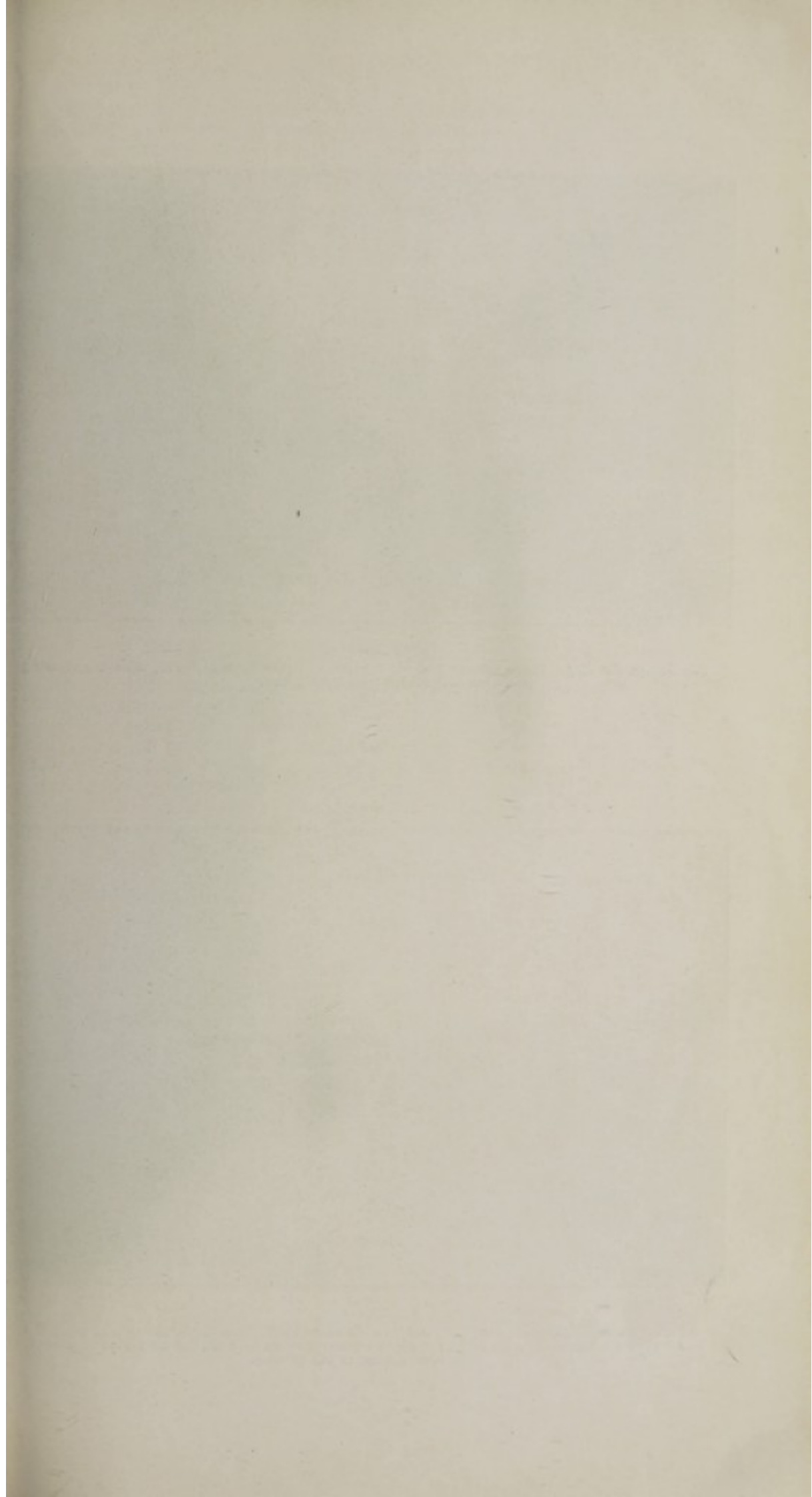




FIGURE 5.

The Jowani clearing. Cattle watering at the crossing. Taken in June, 1929, when the clearing had been maintained free from grass.



FIGURE 6.

An ideal watering-place for cattle at Tundi, on the cattle road. The open lake is a quarter of a mile from a Tsetse-infested river, but no fly were ever found far from the river-side because of the open nature of the ground.

In June the grass was growing up in the clearing but no trees had been left. No tsetse were found. In September most of the clearing was under water and the grass had not grown very high. No tree stumps were sprouting. No tsetse could be found in the clearing but in the uncleared bush east and west five miles, *tachinoides* were caught. These three clearings are in the Kusassi country described above, where tsetse are not numerous except on the large rivers. The District Commissioner, Mr. J. K. Syme, was encouraging the local natives to farm the clearings, and the Jelakologo river clearing has been farmed as described and the other clearings were going to be farmed as soon as the water subsided. The farming of these clearings will be adequate and very effective.

139. *At Nagbo*.—The cattle road crosses a swift river over a very rocky bed. Visited in February half the clearing was finished. Tsetse were still numerous in the uncleared bush. The clearing was finished in March, and a gang of men was kept working in the clearing cutting grass and bushes as they grew up, thus maintaining the clearing entirely free from vegetation. When next visited in June no tsetse could be found in the clearing though three *G. palpalis* were caught under some trees 50 yards from the river, at a place where women sell grain at the roadside.

The work of the clearing had been excellently carried out by Captain Ardron, then D. C., Gambaga, only the very largest stumps of trees remained, and these had been killed by burning. As this was so, and the uncleared parts of the river did not show a heavy incidence of tsetse at this time, the work of maintaining the clearing was stopped and the grass allowed to grow, as the expense of constant reclearing seemed out of all proportion to the danger from tsetse straying on to the cattle road. At the same time the chief of the village was persuaded to start farming in the cleared area. When the clearing was next visited in November the grass was very high and thick, growing right to the edge of the river banks, but no other vegetation had grown up. Quite a large area, about one-quarter of the total cleared area, had been farmed and planted with cotton, forming an excellent break in the continuity of cover formed by the grass. No tsetse were found in the clearing despite careful search for two days. When visited again in December no tsetse could be found in the clearing, although they were plentiful, mainly *G. palpalis*, in the uncleared part of the river.

140. *At Jowani*.—Eight miles south, the road crosses a stream similar in every way to that at Nagbo. The clearing has been equally well carried out, and in June no tsetse were found there. (Fig. 5).

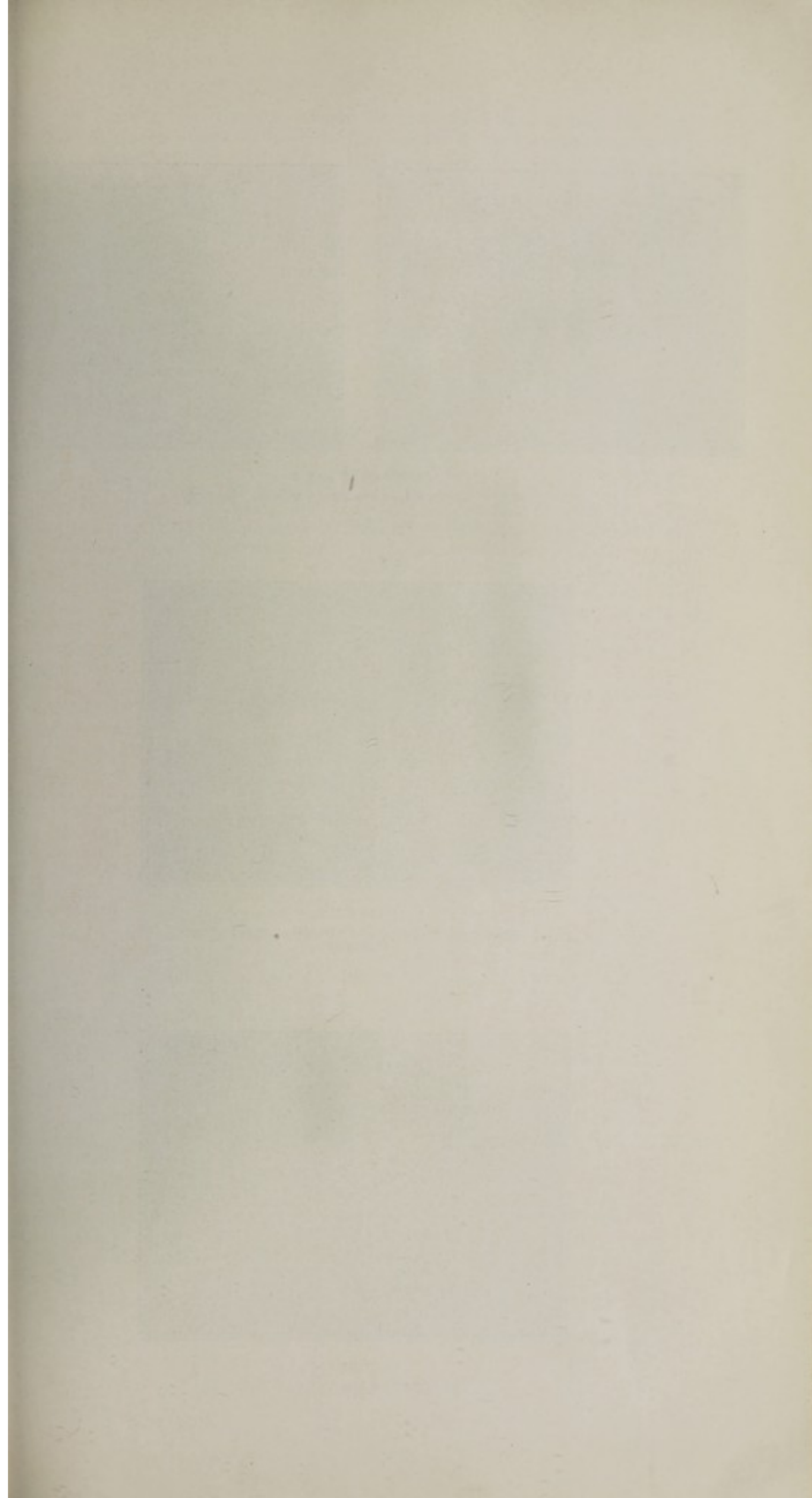
The remarks on the Nagbo clearing anent the necessity of reclearing farming, etc., apply equally well here, as the two streams and clearings, are precisely similar in character.

On revisiting in November conditions were similar to Nagbo. Long grass had grown up everywhere, but farms had been made in several parts of the clearing, sweet potatoes, yams, pepper and a dye plant all being cultivated, and are excellent crops in that they afford no cover for tsetse. Along the banks of the stream a few tsetse were found. During the whole of one day four were caught, on another afternoon one only was obtained. All were *G. tachinoides*, which was found to be most plentiful species along the uncleared river banks. These few stragglers however may be considered quite negligible. On visiting in December no tsetse were caught in the clearing. In both the above clearings, grass burning was held up until later in the season in order to get all growth as dry as possible so that the fire should have the maximum effect in destroying any growth of bushes or tree-stumps. Both clearings are now almost entirely under cultivation and form ideal examples of the way in which clearings can be maintained at no cost by persuading the chiefs and people to farm the cleared areas. The country here

(South Mamprusi district) is only thinly populated and it is entirely due to the energy and influence of the District Commissioner, Mr. G. F. Mackay that the idea has been carried out to such effect.

141. *At Suguri*.—Where the Nasia river crosses the cattle road, is the last clearing that has been done on this road. The Nasia river forms by far the most important fly belt in this part of the route. A large, slow flowing river with extensive drainage area to the east, it is subject to much flooding in the rains. Dense *figus* bush clothes the banks, and the surrounding terrain is mainly open grass land or orchard bush savannah. Game is very abundant in this district. Hippopotami are found on the river, crocodiles and monitors are very common. The distribution of tsetse has already been described. From March until end of May, 1929, continuous observations were kept on this clearing. Mr. J. K. Syme, Cadet, was in charge of clearing operations up to 7th March when Mr. H. A. Blair, Cadet, took over the work. Clearing was finished by 21st March. The clearing extended, as in the others, to half-a-mile along the river banks on each side of the road crossing, and was mainly confined to the actual river banks, but in the neighbourhood of the crossing extended to about 50 yards on either side. A few large trees were left standing in the clearing, especially at the road crossing where a small market was held, and at a place where a fish trap was thrown across the river. The cut wood and bushes from clearing were piled along the river banks and over stumps that had not been dug up. In April, a week after clearing operations had stopped, tsetse were being caught in the clearing. By the 10th of April an average catch of 20 per day was being made. During 12 days in the middle and end of April 413 tsetse were caught in the clearing, an average of 34.6 per day. At the same time the average catch along uncleared river was 66 per day. All the flies caught in the clearing were *G. tachinoides*, and the female percentage was 65 per cent, as against 50 per cent for uncleared bush. A very large proportion of flies caught on the clearing at this time were young soft-bodied flies, which were hatching from pupæ that had evidently been left in the ground undisturbed by clearing. As well as this, breeding was going on in the piles of bush wood, and it was here that the flies were finding sufficient shelter for existence. Infection of flies in the cleared area in April was much lower than the rate for the previous month (table IV), because of the number of young uninfected flies in the catch. On 26th and 27th April, the cut wood of the clearing was burned. For three days it appeared as if the tsetse had been all driven out or killed by the burning, but on the 1st of May 14 flies were caught in the clearing, showing a female percentage of 86 per cent. Very rapidly the number of flies caught in the clearing rose, and in May 24½ days catching produced 877 *G. tachinoides*, an average of 35.7 flies per day. The incidence of tsetse in uncleared fly belt was very high by now, 89 being caught in a day. Practically the same female percentage was observed in the clearing, 64.5 per cent. There were far fewer young flies in the catches. Infection rate was higher. The breeding places had now been destroyed, and although the rate of females with larvæ was higher this month (table IV) it is doubtful if many of these larvæ would find suitable places for pupation when dropped by females. Any likely breeding places round trees or under stumps were searched but no pupæ could be found.

The reason for the continued presence of tsetse in the clearing after the burning was in the delay in burning until after the first few rains had fallen and so grass and small shrubs had started growing and forming cover, especially under the few remaining trees, where tsetse could shelter. Every day most of the flies were caught under the trees and places where unburned stumps were sprouting again. Many of the big *figus* roots had been left and had not been completely burned, and these had sprouted and formed small bushes giving good shade and





FIGURES 7 and 8.
Village water holes and washing places, Makongo.



FIGURE 9.
Cattle-road crossing and village washing place,
Makongo.



FIGURE 10.
Fishermen on the Volta at Yeji.

shelter. Game was by now coming back to the neighbourhood of the clearing, duiker and cob used to drink there every day, and reptiles were again common. Hence the tsetse had adequate food. From the 31st of May Suguri was not visited again until the 23rd of November when great changes had taken place. The river had been subject to flooding over a considerable area, and was still very full. Grass had grown profusely all round but the actual banks of the river had been kept quite free of grass by flooding. All the stumps and trees which were living and flourishing in May were now apparently dead, and the clearing was remarkably free of vegetation. In one place by the road a small farm had been made, but there was no organised attempt at farming.

Game had been visiting the clearing in numbers both for drinking and for feeding on the small grass that was growing. Tracks of cob, duiker, bushbuck, baboons and hyena were seen. Crocodiles and monitors were common. Not a single tsetse was found, either in the clearing or in the remoter uncleared banks of the river. Two days were spent in November and two days at the end of December in a most careful search but no fly could be seen. It has not been possible to visit Suguri since, but it will be visited again in the beginning of the rainy season this year. It is difficult to explain the entire disappearance of *G. tachinoides* from this part of the Nasia river by the end of 1929, as it was impossible to explain the disappearance of *G. palpalis* the previous year. The question of migration up side streams has already been described, and the factors in the dispersal of *tachinoides*, i.e. flooding driving out the reptilian hosts and rendering inaccessible the breeding grounds, and the dispersal by following game into long grass, where the fly gets lost. Chart 4 represents graphically the effect of clearing on Tsetse at both Suguri and Makongo. When the Suguri clearing was finished (21st March), as some money was still available a small stream at Boo, where herds water before reaching Baghale, was cleared to an extent of 300 yards on each side of the road. Removal of stumps was not attempted and the work was finished by the 28th of March at a cost of £6. This clearing has proved to be adequate, the stream is only a wet weather fly belt.

142. *Makongo Clearing*—The village of Makongo (Maps 1, 2 and 3) on the main Kumasi-Tamale Road six miles North of Yeji ferry, has been found to be an endemic sleeping sickness centre, and in 1930 the experiment of clearing a belt around Makongo was started. The vegetation and fly belts of Makongo have been fully described elsewhere, and it will be seen that this village is exceptionally situated so as to be an ideal centre for the maintenance and dissemination of such an insect-born disease. On three sides were heavily infested primary foci of tsetse within a quarter of a mile radius of the town, and every approach to the village except by the Salaga road to the north east had of necessity to pass through one of these fly belts. All the waterholes of the village were situated in the middle of dense fly infested bush (Figures 7, 8 and 9), and to add to this the village is on the Eastern Cattle Road and is one of the main halting places for cattle (one day's walk from Salaga and just before the Yeji River crossing) the herds passing a heavily infested fly belt about two miles north of Makongo and another just before entering the town, so not only do the cows bring tsetse right into Makongo but they form a continuous food supply for the fly (Maps 1 and 2). Thus the residents of Makongo are continually exposed to attack from tsetse, and as the town is mainly a market for food for hundreds of strangers always passing along the main road, and these strangers usually rest in the town or wash in the river during the hottest hours of the day when tsetse are most active, there are enormous chances of trypanosomiasis being spread to an extent that it is difficult to estimate. Also in the wet weather the road from Makongo to the Yeji ferry is closed and so all the southward traffic from Tamale is held up at Makongo. Unfortunately clearing operations were held up until very late, and work was not

started until the beginning of February, Mr. Cooper, Cadet, being in charge of the work. The aim of the experiment was to arrive at the minimum of clearing necessary for the exclusion of tsetse from the village and watering places, and to do this at minimum expense, putting into effect conclusions drawn from observations on the cattle road clearings. Even then a very large amount of clearing had to be done owing to the presence of the exceptionally dense *Isobertia* bush to the north, west and south of Makongo. In all about 20 acres were cleared, of which 16 acres were *Isobertia* bush and only four acres of riverside *Ficus* bush. It is probable that very few villages could be found so badly situated as Makongo with regard to the close proximity of primary tsetse foci. The total cost of clearing, including the purchase of tools which are now retained at Yeji, was £120. There was no practical difference in the cost per acre of clearing the two types of bush, but the effect of clearing, as has been pointed out under "Flora of Makongo," was to drive out almost at once the tsetse from the *Isobertia* bush, whereas, as was found at Suguri, the cleared riverside has continued to harbour tsetse in varying numbers, even after burning. The reason for this difference does not lie in the fact that *G. palpalis* alone was represented in *Isobertia* bush, as by the riverside there was found to be no marked difference in the effect of clearing on the two species.

Chart 3 shows graphically the effect of clearing the area of *Isobertia* bush to the north of Makongo. Correlated with the graph of *G. palpalis* catches is a graph of humidity and temperature of the bush and rainfall. These show well how the effect of clearing in reducing humidity is nullified by the onset of the rains. Temperature on the other hand goes up considerably. This would chiefly have effect in preventing breeding, and would not exclude the fly. The rise in female percentage of the catch immediately on the commencement of clearing is very noticeable, bearing out the hypothesis quoted under section G. By the same time the wood was burned the fly had been practically eliminated, only two or three caught in a whole day.

Chart 4b shows the effect of clearing the *Ficus* bush of the Makongo river. Again the marked rise in female percentage of both species. Even during burning tsetse were present in fluctuating numbers. This leads to the belief that there was invasion of the cleared area from other parts of the river. Most certainly there was invasion from other parts where clearing was still going on. Marking experiments, in which 565 tsetse were marked and liberated at three places around Makongo just before clearing, showed this invasion of flies into cleared areas from other parts where clearing or burning was still being done. The experiments, also showed the extraordinary conservative nature of tsetse, three flies were caught in the riverside clearing close to Makongo 50 days after they had been liberated in the same spot, two more 42 days after. At the same time there was considerable migration of flies up and down the river, chiefly down. At a point one mile down stream marked flies were caught 17 and 23 days after liberation. At a point two miles down stream flies were caught 21 to 43 days after. Table V summarises the results of marking experiments up to the end of March. Clearing and burning was only finished by the end of March, so none of these experiments are by any means complete and conclusions cannot safely be based upon them. In general however the observations confirm closely those made on the Suguri clearing, and it is probable that, although tsetse will be present during the rains, by next year the clearing will effectively keep out all fly.

O.—Conclusions based on Clearing Experiments.

143. Effect of clearings on the rate of cattle infection at Yeji. The trypanosome infection rates of cattle passing down the eastern route have been estimated at the frontier station for one year, at Yeji and

at Kumasi for 21 months, and the results are summarised in the Pathologist's report for 1929-30.

There are one or two points that can be correlated with entomological observations on the cattle route. In the first place there is the apparent shifting forward of the peak of infection at Yeji from October in 1928 to September in 1929. This is explained by the Suguri clearing observations, showing the presence of tsetse in the clearing up to and during the rains but its entire absence afterwards, which was attributable to the extensive flooding of the Nasia. This did not occur until after the heavy northern rains in August and September, thus the rising infection rate was cut short in September and followed by an abrupt fall to a figure not much higher than the dry season infection for 1930.

The difference in infection rate at the frontier in January, 1928, and January, 1929, and the fact that Yeji figures for late 1929 are sometimes lower than frontier figures for the same months in the previous year, may be accounted for by the facts noted showing the annual variation in prevalence of *G. tachinoides* and *G. palpalis* in this part of the country. It may reasonably be assumed that similar annual fluctuations in the numbers of tsetse will occur in French territory, giving a variable frontier infection rate from year to year. The ideal clearing of course should aim at the total exclusion of tsetse, but, except in extreme cases, such as an incidence of 100 per cent infection with pathogenic trypanosomes this would involve such a vast amount of labour and expense as to be economically unjustifiable. There must be a degree of infection of tsetse below which the fly, as a spreader of disease is unimportant, and effects at reduction in its numbers below this point will be wasteful. To be able to estimate this degree even approximately will require more widespread observation and experiment. In any case before clearings are contemplated a careful survey of the conditions of the fly belt seems amply justifiable.

144. *Amount of clearing necessary.*—Again in estimating this the density of tsetse is of great importance. In lightly infested fly belts there will be practically no reasons such as overcrowding or competition for food to induce tsetse to wander far away from cover, which take effect in denser fly belts. Also where there is a small standing population the number of wanderers will also be small, and below the number at which exclusion of the fly becomes necessary for elimination of infection. Again further experiment and observation are required. At Makongo the standards were the removal of all primary foci within a quarter of a mile of the town and the removal of all bush within 100 yards of watering places. This is regarded as the absolute minimum of clearing for a town situated as is Makongo. Whether this will be sufficient for the effective exclusion of tsetse remains to be seen. More work might yet be done at this place by the clearing of paths outside the quarter-mile radius and removal of certain secondary foci, but for the sake of simplicity in the experiment the above standards were enunciated. Unless the removal of primary foci is undertaken for a very considerable area many miles in length thereby excluding tsetse beyond their possible range of flight, clearing must be regarded as a palliative measure only, and therefore, secondary foci should receive attention also, as it has been shown how a secondary wet weather fly belt may occur, as at Mogonori, showing quite a heavy incidence of tsetse. Had cows been coming in by this quarantine station, each herd stopping there for nine days, this fly would very certainly have been a distributive centre for trypanosomiasis.

145. *Maintenance of Clearings.*—Again the temporary nature of clearings as control measures is emphasised by the necessity of maintenance of the clearings. In a case where the work has been done thoroughly and efficiently the clearing will be self-maintaining for a certain period, as it will be some years before the bush has sufficiently

recovered and re-grown to form a fly belt. Then, however, re-clearing would be very nearly equal in cost to the original work. Against this however could be put the method of annual reclearing by removal of any sprouting stumps or bushes and the control of grass fires, to take place as late as possible to get the maximum effect. This is the better way of paid maintenance.

146. *The Farming of Clearings.*—The ideal way, as was suggested by Mr. Pomeroy, is to induce natives to farm the cleared areas. The very nature of fly belt vegetation, luscious and evergreen, is because it is growing in particularly well watered and fertile soil which makes the best possible farming ground. As has been mentioned all save one of the clearings of the cattle route are being maintained in this manner, and with the co-operation of sympathetic political officers this method should always be feasible. This of course is leading up to the question of the eradication of trypanosomiasis by the development and increase in population of the country. This is no longer a question of opinion but a recognised fact, but it may be noted here that the greatest advances on these lines have been made in countries where *G. submorsitans* is the scourge. In the part of this country under review *G. submorsitans* is already practically negligible and it is the more exclusively riverine species which are the menace, and consequently eradication by human invasion will be slower and less complete. The organised clearing of fly belts around important towns and in places where trypanosomiasis is proved to be a menace would however undoubtedly give considerable impetus to this advance against tsetse.

147. *Necessity of removal of trees.*—For several reasons it is recommended that in making the small clearing necessary for the control of *G. tachinoides* and *palpalis* ruthless removal of all trees be adopted. In the Suguri clearing in May tsetse were mostly caught under the few standing trees. Temporary fly belts may easily be formed where there is an overhead shade, even though scanty, with abundant low cover. (e.g. Magonori). This would necessitate the constant re-clearing of areas where the larger trees had been left. Without this high overhead shade temporary or permanent fly belt will be impossible, and the work of clearing can be dispensed with, as was found at Nagbo and Jowani. Far from long grass encouraging the encroachment of tsetse into a clearing it acts in the opposite way. Tsetse have been observed to leave cover and follow more readily over open ground than among long grass, where they soon get lost. It should not be surmised from this that a clearing should be allowed to lie fallow rather than being farmed. The period of long grass is only for a few months of the year, and the whole object of farming is to keep back the encroachment of bush into the cleared area. Another reason for the complete clearance of all trees is that perfectly open bare ground, being exposed to the maximum action of wind and sun, dries far more quickly than shaded by even scattered tall trees. As primary tsetse foci always occur on fairly moist ground this process of drying is of the utmost value in the reclamation and maintenance of such fly belts.

148. *Importance of early clearing.*—For the above reason the importance of starting clearing operations as early in the dry season as possible cannot be too strongly emphasised. By starting work as soon as the subsidence of floods and rivers will allow, about November or December, the cut wood can be thoroughly dried and burnt by at least a month before the onset of the rains, so that tree stumps and any vegetation not destroyed by burning will be subject to the full dessicating effect of the dry weather before the first rainfalls have again given them a chance of recovery.

For this reason the delay in starting work at Makongo was very much felt, the work of burning was not only hampered by the onset of the rains

but the effectiveness of the burning was halved because of the re-growth of stumps and the growth of grass that had taken place before burning could be started. If burning can be completed early in all probability tsetse would be completely eradicated in the first season, as happened at Jowani, Nagbo and the Tamne river clearings, but as long as the removal of all brush-wood and cover from the clearing area does not take place before the first few rains have fallen the presence of tsetse in the clearings up to and during the rainy season will be inevitable, as has been found at both Suguri and Makongo.

149. *Effect of burning and flooding on vegetation.*—The killing of trees and stumps by flooding, which occurred in the Suguri clearing, is a point worthy of notice. These riverside trees are physiologically very different to the trees of the orchard bush savannah country which are annually subjected to burning at the time of grass fires and have in consequence developed into a "pyrophytic" or fire resisting flora. The riverside trees are never subjected to this burning as the vegetation of these belts is always green and forms a barrier to the annual fires. Hence in the process of clearing these trees were subject, first to the shock of cutting and mutilation and then the shock of burning which, although it did not kill outright all of the stumps (many were sprouting green leaves in May), at least severely weakened them. They were then subjected to complete immersion for a period of about three months during the floods and were literally drowned. The aerial organs of the plant were gone and the roots were too weakened to be able to withstand so long a deprivation of oxygen. Thus it would seem that for economical clearing the arduous and lengthy task of removing all roots can be dispensed with, *provided that burning is controlled and efficiently carried out and that the river is subject to flooding in the rains.*

150. *Measures against the encouragement of tsetse.*—At Makongo and at Yeji has been demonstrated the effect of cattle in influencing the distribution of tsetse. Not only does the continual passage of cows through a fly-belt form a regular food supply of tsetse and so encourage their presence and breeding but tsetse will follow the herd for a long way and so be introduced into towns and villages beyond the fly-belt. For this reason it is strongly recommended that in such places where cattle cross a fly-infected river close to a town or village, or a village washing place either adequate clearing be made to banish tsetse from the neighbourhood of this cattle crossing, or in places where clearing is not considered justifiable the cattle road and crossing be not allowed within at least half-a-mile of the town and watering place, and that the road, after passing such a fly-belt should not approach within at least half-a-mile of any town within at least two miles of the fly-belt.

151. *Acknowledgements.*—The writer wishes to express his thanks to the political officers who have been in charge of the clearing operations and to the officers of the districts in which this work has been done for their interest and co-operation which has enormously facilitated the work and to which is due in great measure the success of the cattle route clearing experiments.

Thanks are also due to Mr. C. Vigne of the Forestry Department and Mr. L. Williams of the Agriculture Department for their assistance in naming botanical specimens and without whose help the study of the flora of the tsetse belts could not have been done.

The African staff have proved very capable especially in the field, and have carried out efficiently a great deal of work which the continual trekking has involved.

152. References :—

- (1) *Bionomics of Tsetse and other Parasitological Notes in the Gold Coast.* Dr. J. J. Simpson, Bull. Ento. Res. London, Vol. XI, Part 4, February, 1918.
- (2) *Guide to the Study of Tsetse Flies.* R. W. Newstead, 1924, page 207.
- (3) *ibid.*
page 123.
- (4) *Binomics of Glossina morsitans in Southern Rhodesia.* J. R. Chorley. Bull. Ent. Res. London, Vol. XX part 3, October, 1929.
- (5) Pomeroy, *Sessional Paper VII*, 1927-28, *Gold Coast*, pages 53-57, 58-66.
- (6) Pomeroy, *Annual Report of the Medical Department*, 1926-27, *Gold Coast*, page 123.
- (7) Pomeroy, *Annual Report of the Medical Department*, 1927-28, page 57.
- (8) Pomeroy, *Annual Report of the Medical Department*, 1928-29, pages 67-73.

TABLE I.
SEASONAL VARIATION IN DISTRIBUTION OF *G. PALPALIS* AND
G. TACHINOIDES.

Fly-belt.	Date.	Actual numbers collected.		Approximate proportion. <i>G. tach.</i> <i>G. palp.</i>
		<i>G. tachinoides.</i>	<i>G. palpalis.</i>	
Volta River at Yeji ..	April, 1929 ..	400	86	5 : 1
Volta River at Yeji ..	March, 25-30, 1930	52	85	1 : 2
Makongo River at Makongo	Nov. 1-14, 1928 ..	179	200	1 : 1
Makongo River at Makongo	Jan. 1-18, 1929 ..	33	205	1 : 7
Makongo River at Makongo	Jan. 1930	76	284	1 : 4
Nasia River at Suguri ..	May 1-7, 1928 ..	681	291	2 : 1
Nasia River at Suguri (half cleared)	March 1-16, 1929 ..	460	13	40 : 1
Nasia River at Suguri (cleared and uncleared)	April, 1929	946	—	
Nasia River at Suguri (cleared and uncleared)	May, 1929	966	—	
Nasia River at Suguri (cleared and uncleared)	Nov. and Dec., 1929	—	—	
		No tsetse found in cleared or uncleared river-banks.		
Kulda River at Jowani ..	June 15-23, 1929 ..	9	20	1 : 2
Kulda River at Jowani ..	Nov. 20-22, 1929 ..	33	28	1 : 1

TABLE 2.
DISTRIBUTION OF *G. PALPALIS* AND *G. TACHINOIDES* ALONG
CATTLE-ROUTE.

Suguri to Mogonori.

Fly-belt.	Date.	Actual numbers collected.		Approximate proportion. <i>G. tach.</i> <i>G. palp.</i>
		<i>G. tachinoides.</i>	<i>G. palpalis.</i>	
	1929			
Nasia River at Suguri. (Main river)	May	966	—	
Kulda River at *Baghale. (4 miles from Nasia river)	March 16-27 ..	56	8	7 : 1
	June 1-9	81	26	3 : 1
Kulda River at *Tundi. (10 miles from Nasia river)	June 10-14 ..	9	20	1 : 2
Kulda River at Jowani. (16 miles from Nasia river)	June 15-23 ..	3	37	1 : 12
Bombossa River at Nagbo. (Branch of Kulda, 23 miles from Nasia river)	June 25-30 ..	13	23	1 : 2
*Gambaga. (32 miles from Nasia River)	Dec. 18	—	13	<i>G. tach.</i> absent.
Gurugu River at Sakku. (30 miles from Nasia River)	Oct. 8	—	9	<i>G. tach.</i> absent.
Rivers at Bombilla, Levi- singa Nagpanduri. (30 miles from Nasia River)	Oct. 4-7	—	88	<i>G. tach.</i> absent.
Moragho River north of Gambaga Scarp	Feb. 22	17	—	<i>G. palp.</i> absent.
	Oct. 3 (20 mins. halt)	9	—	
	Dec. 25-26 ..	19	—	
*Volta River below Gam- baga Scarp	Oct. 17	Numerous ..	—	<i>G. palp.</i> absent.
Tamne River near Garu ..	Sept. 9-19 ..	11	—	<i>G. palp.</i> absent.
Mobiri River at Mogonori. (Temporary fly belt)	July 11 to Sept. 4	535	—	<i>G. palp.</i> absent.

*These fly belts do not affect the cattle route.

TABLE 3.
EXAMINATION OF BLOOD OF ANIMALS.

Species.	Date.	Infection.	Locality.	Presence of Tsetse.
<i>Mammalia.</i>				
Hartebeeste ‡	9-5-29	—	Orchard bush two miles N.W. of Suguri.	G. submorsitans found near here.
Hartebeeste † ..	25-5-29	—	Marsh close to Suguri.	None.
Hartebeeste † ..	1-6-29	—	Baghale. Marsh across river.	None.
Hartebeeste ‡ ..	12-6-29	—	Tundi. Marsh three miles east.	None.
Hartebeeste ‡ ..	12-6-29	—	Tundi. Marsh three miles east.	None.
Hartebeeste ‡ ..	18-6-29	—	Jowani. Orchard bush west of small stream.	G. submorsitans found in neighbourhood.
Waterbuck ‡ ..	16-6-29	—	Jowani. Thick bush east of river.	Close to G. submorsitans belt.
Waterbuck ‡ ..	16-6-29	—	Jowani. Thick bush east of river.	Close to G. submorsitans belt.
Cob † ..	16-5-29	Trypanosome unidentified.	Suguri. Close to Nasia river.	G. tachinoides and palpalis.
Bushbuck. Young	23-5-29	Trypanosome unidentified.	Thick bush along Nasia river at Suguri.	G. tachinoides and palpalis.
Reedbuck † ..	2-6-39	—	Baghale. Bush close river.	G. palpalis.
Reedbuck † ..	20-2-30	—	Makongo. Marsh three miles west.	None.
Reedbuck. Young	9-6-29	T. vivax.	Nagpalaga. Marsh by river.	G. palpalis and tachinoides.
Duiker † ..	6-6-29	T. vivax.	Baghale, by river.	G. palpalis and tachinoides.
Duiker † ..	10-6-29	Trypanosome (Brucei group)	Tundi, marsh by river.	G. tachinoides and palpalis.
Duiker ‡ ..	26-6-29	T. vivax.	Nagbo. One mile west close to river.	G. palpalis.
Duiker † ..	30-12-29	—	Suguri, orchard bush.	None.
Hyæna † ..	27-5-29	—	Suguri.	None.
Palm civet ‡ ..	25-2-30	—	Makongo. Thick bush.	G. palpalis.
Otter † ..	13-3-30	—	Makongo. Bush by river.	G. palpalis and tachinoides.
Otter. Young ..	13-3-30	—	Makongo. Bush by river.	G. palpalis and tachinoides.
Squirrel	7-6-29	—	Baghale, orchard bush.	G. palpalis.
Mouse † ..	25-3-30	—	Makongo rest house.	G. palpalis.
Mouse ‡ ..	27-3-30	—	Makongo rest house.	G. palpalis.

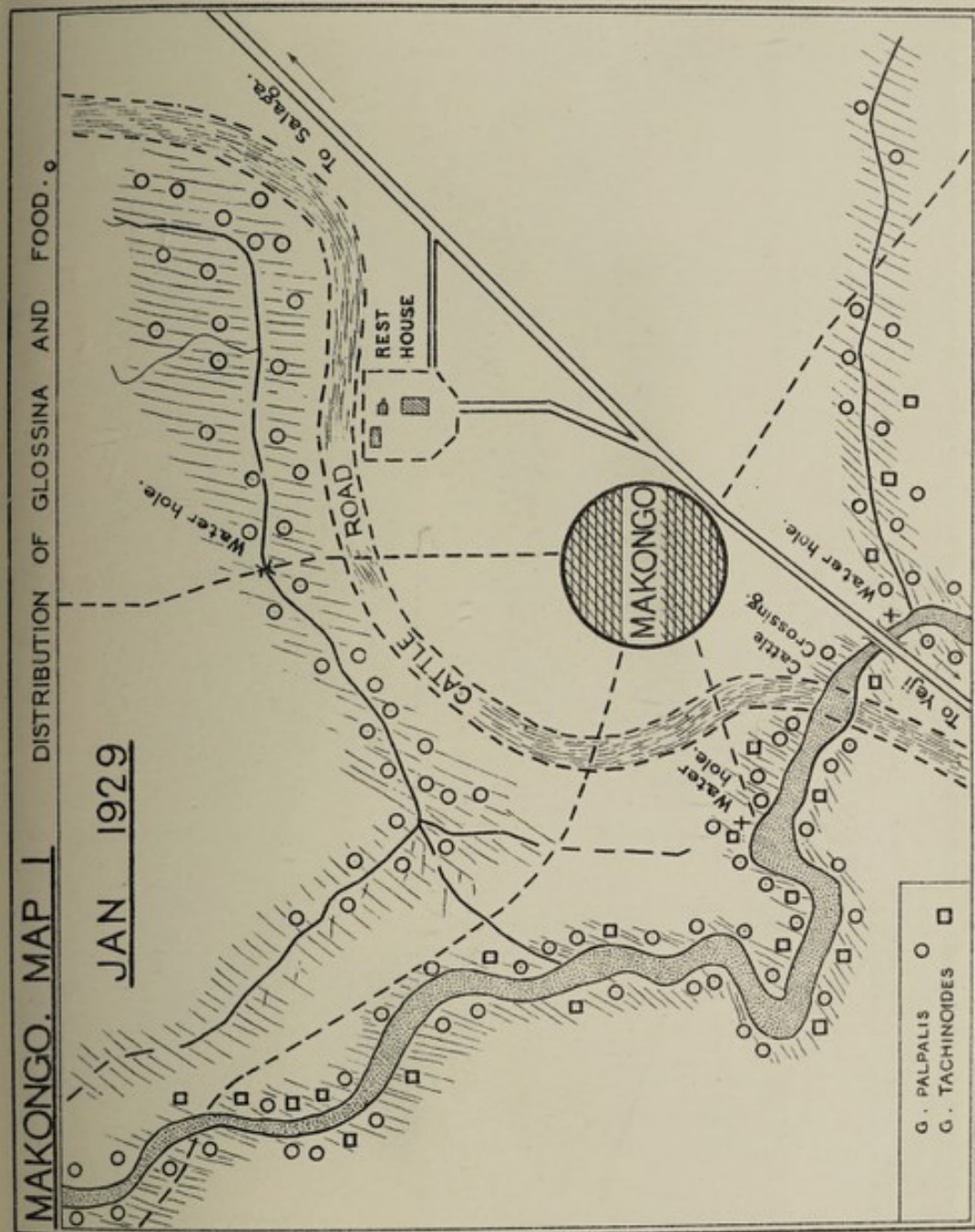
† Male. ‡ Female.

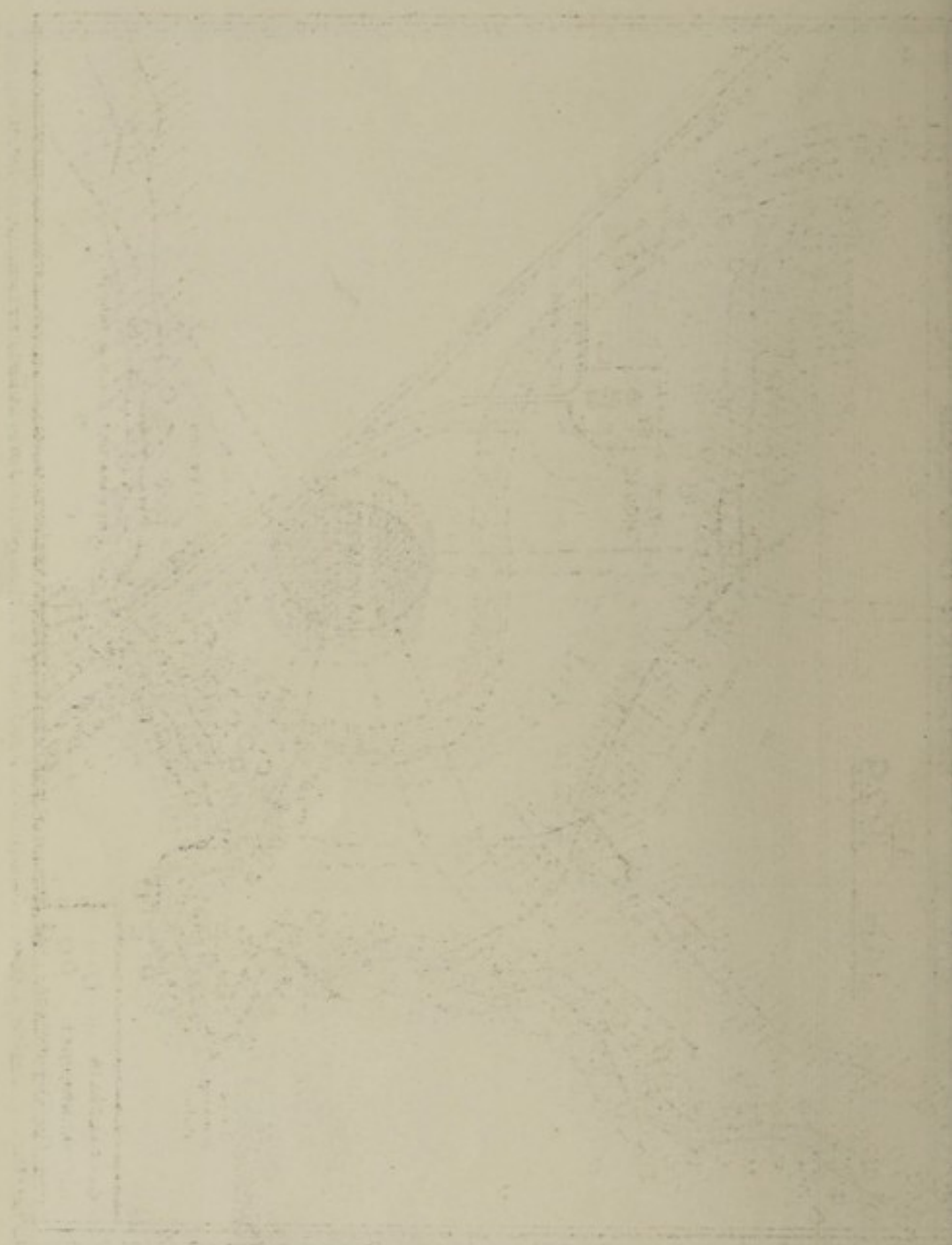
TABLE 4.
GLOSSINA TACHINOIDES.
Stomach contents, breeding and infection.

Date.	Locality.	Number examined.	Number with blood.	Percentage mammalian blood.	Percentage reptilian blood.	Percentage females with larvae.	Percentage infection.		
							T. vivax.	T. congolense.	T. grayi.
1929.									
March ..	Nasia River uncleaned ..	63	15 (24 per cent)	40 per cent	60 per cent	15 per cent	3.2 per cent	3.2 per cent	12.7 per cent
March ..	Nasia R. partly cleared ..	40	8 (20 per cent)	33 per cent	66 per cent	13 per cent	5 per cent	7.5 per cent	10 per cent
March ..	Lake by Baghale ..	64	17 (27 per cent)	63 per cent	37 per cent	7.5 per cent	1.5 per cent	3 per cent	4.7 per cent
April ..	Nasia River cleared ..	160	25 (16 per cent)	64 per cent	36 per cent	5 per cent	2.5 per cent	1.8 per cent	1.2 per cent
May ..	Nasia River cleared ..	158	24 (15 per cent)	75 per cent	25 per cent	12 per cent	2.5 per cent	3.1 per cent	8.2 per cent
July ..	Mohiri River Magonori (Secondary focus).	84	19 (22 per cent)	25 per cent	75 per cent	25 per cent	1.2 per cent	—	—
August ..	Mohiri River Magonori (Secondary focus).	202	59 (29 per cent)	79 per cent	21 per cent	12.5 per cent	—	—	—

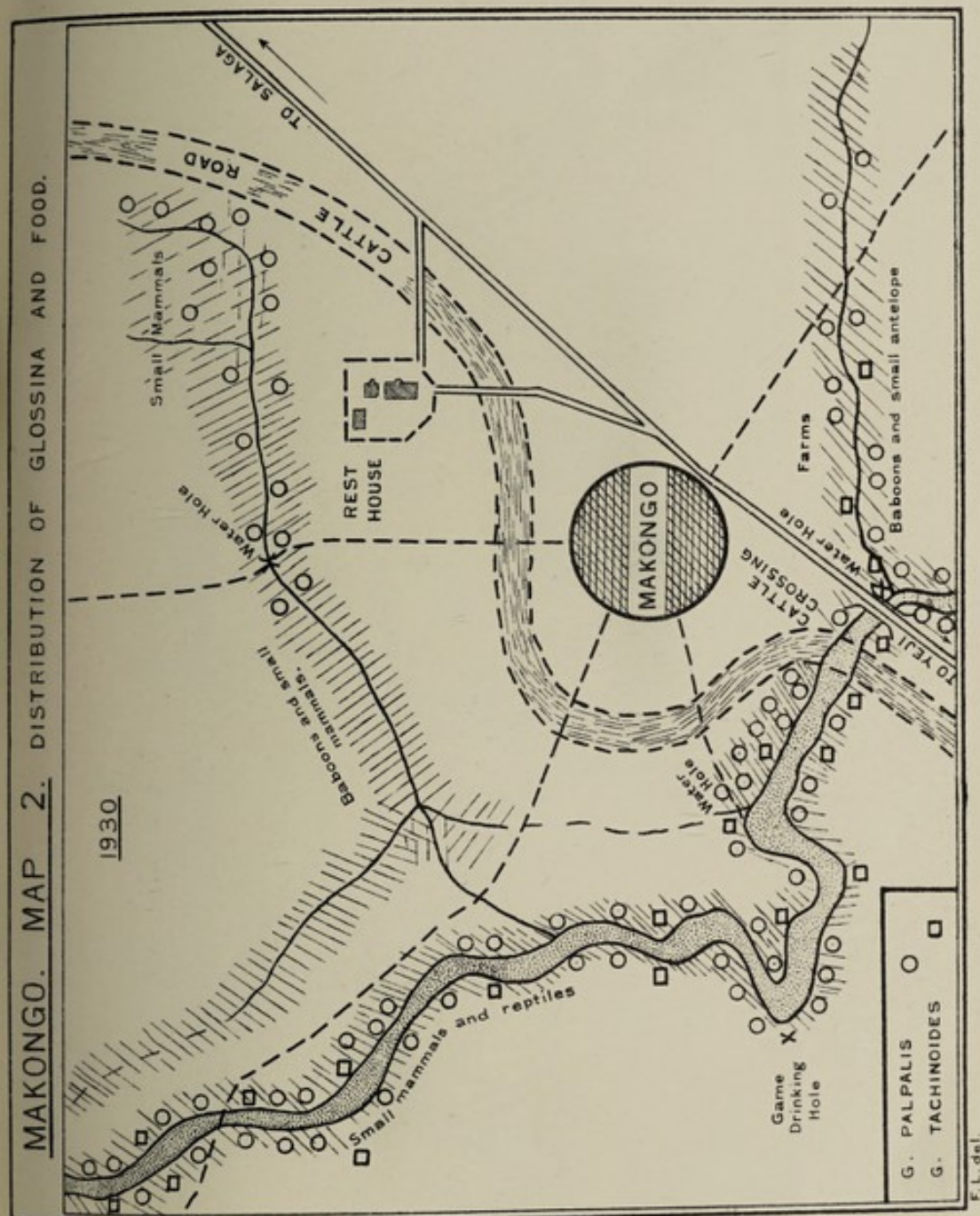
TABLE 5.
MAKONGO MARKING EXPERIMENT.
4TH FEBRUARY, TO 31ST MARCH, 1930.
Analysis of Recaptures.

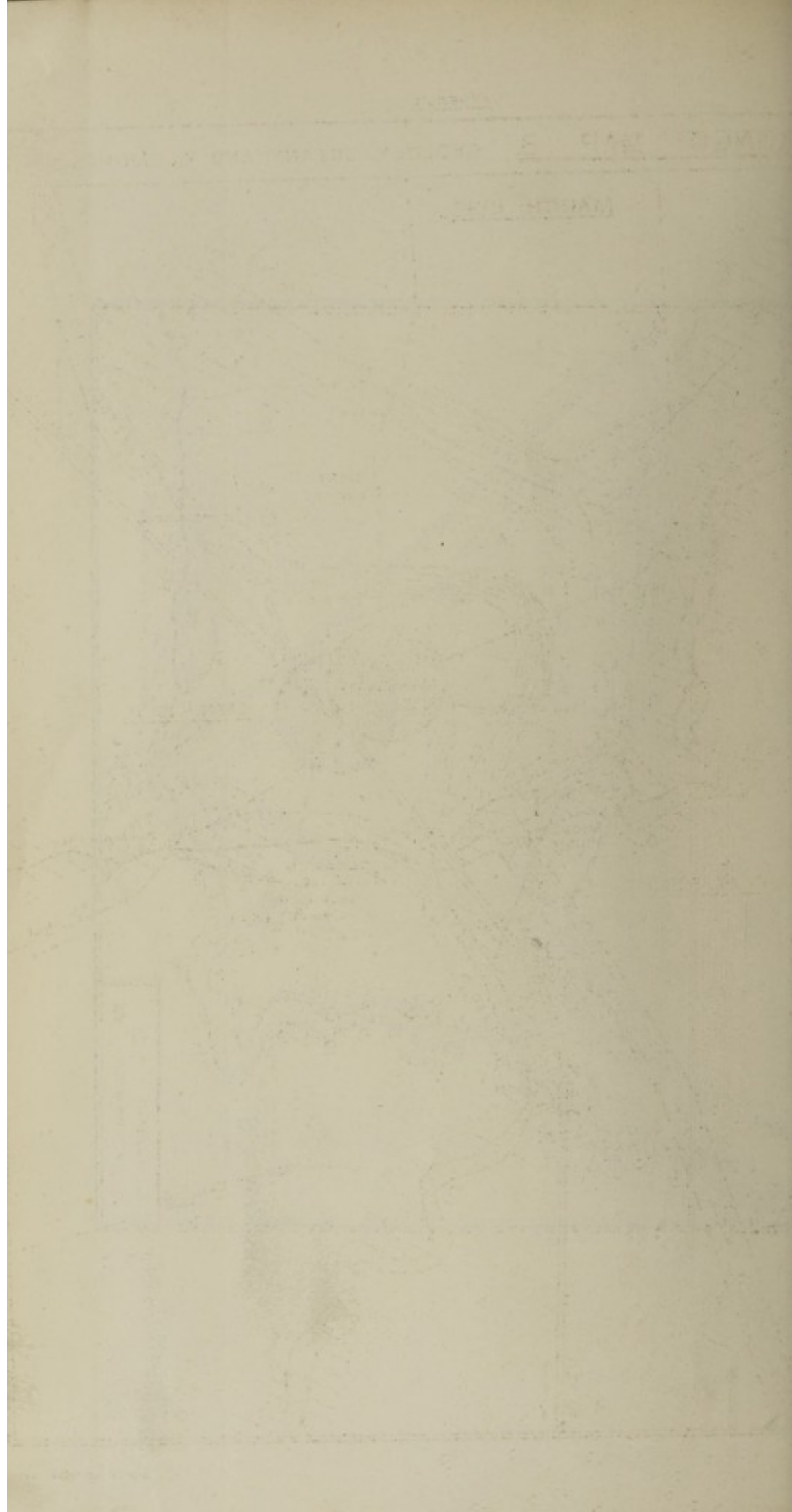
Species and Sex.	G. palpalis.		G. tachinoides.	
	Male.	Female.	Male.	Female.
Number marked and liberated.	148	254	84	79
<i>Table 1.</i>				
Weekly Recaptures .. 1st week	21 7	24 10	4 1	3 2
(Recaptured in same place marked in roman) .. 2nd week		1 7	2	
(Recaptured elsewhere in italics) .. 3rd week	1 2	3	1	1
4th week	1 1	8	1	1
5th week	1			1
6th week	2	1 2	1	
7th week		2	1	
8th week		2		1
Total Recaptures and percentage of numbers liberated.	23 15.5 per cent 13 8.8 per cent	27 10.6 per cent 32 12.6 per cent	4 4.8 per cent 7 8.3 per cent	5 6 per cent 4 5 per cent
<i>Table 2.</i>				
Distance from place of liberation 1 ml.	9	14	3	3
1 ml.	1	6	1	1
1 ml.		4	1	
1 ml.	1	2		
1 1/2 ml.		2		
2 mls.		2		
2 1/2 mls.	2		1	1





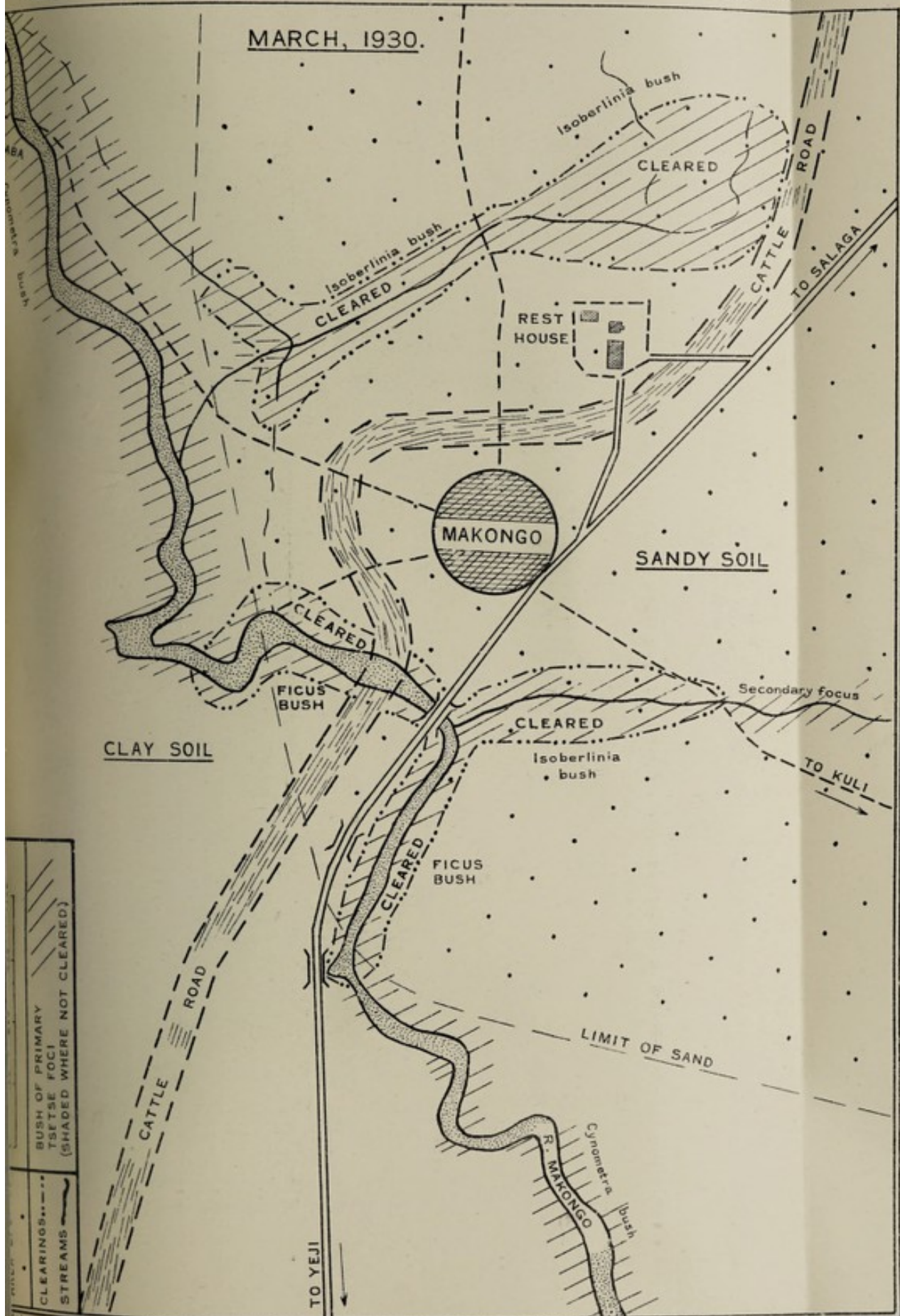
MAKONGO. MAP 2. DISTRIBUTION OF GLOSSINA AND FOOD.





MAKONGO MAP 3. GEOLOGY, BOTANY AND CLEARINGS.

MARCH, 1930.



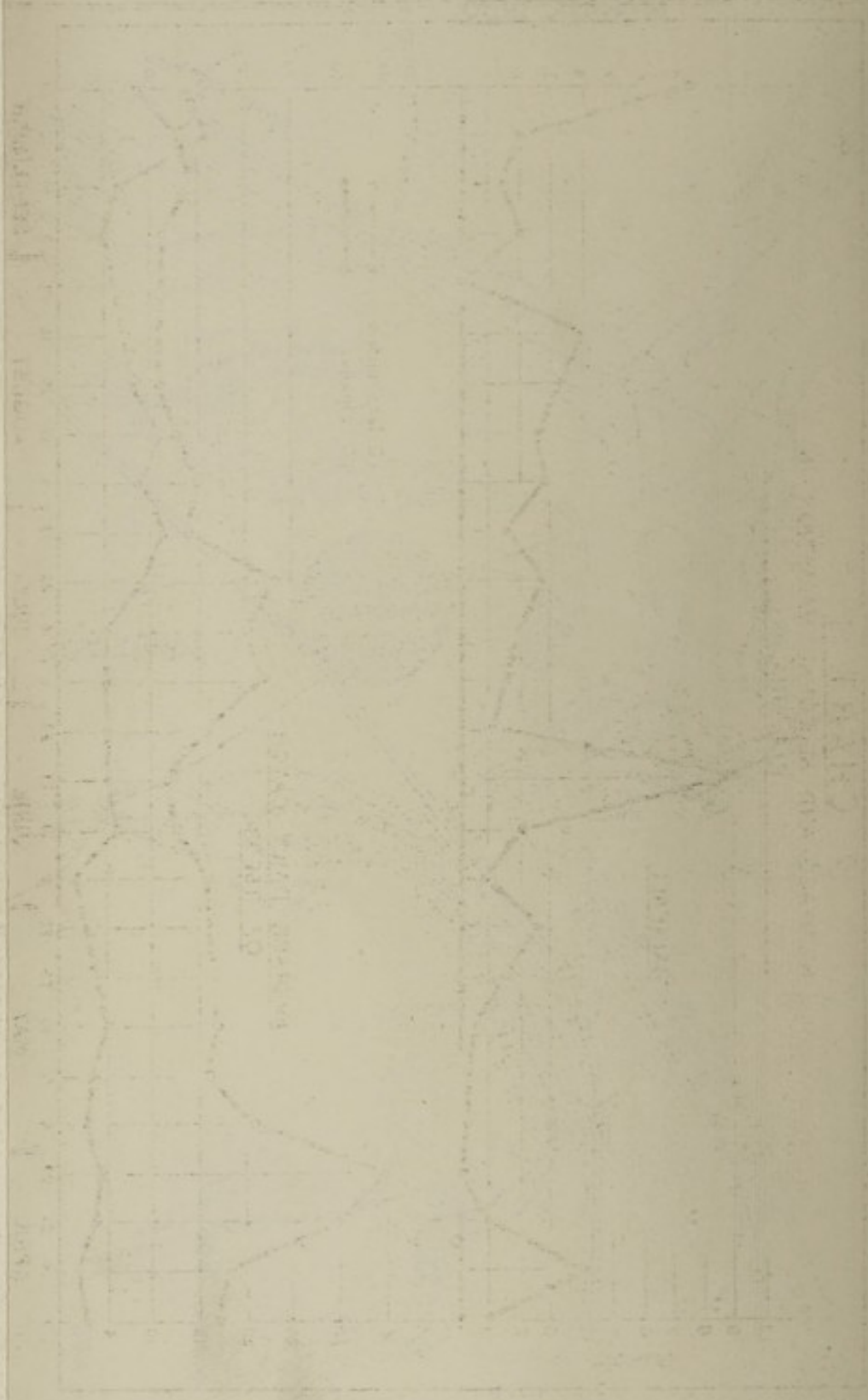
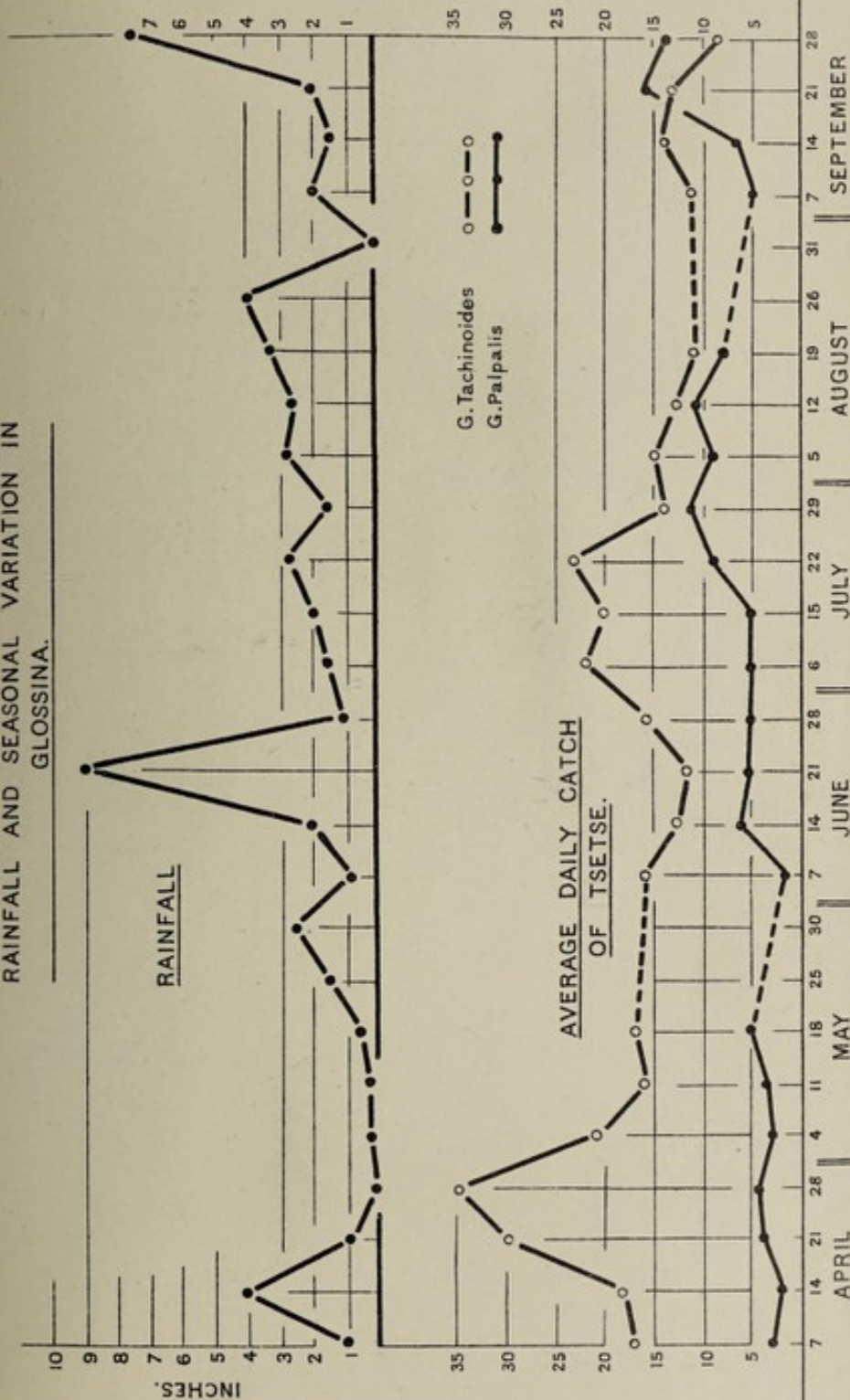


CHART I
RAINFALL AND SEASONAL VARIATION IN
GLOSSINA.



F.L.del.

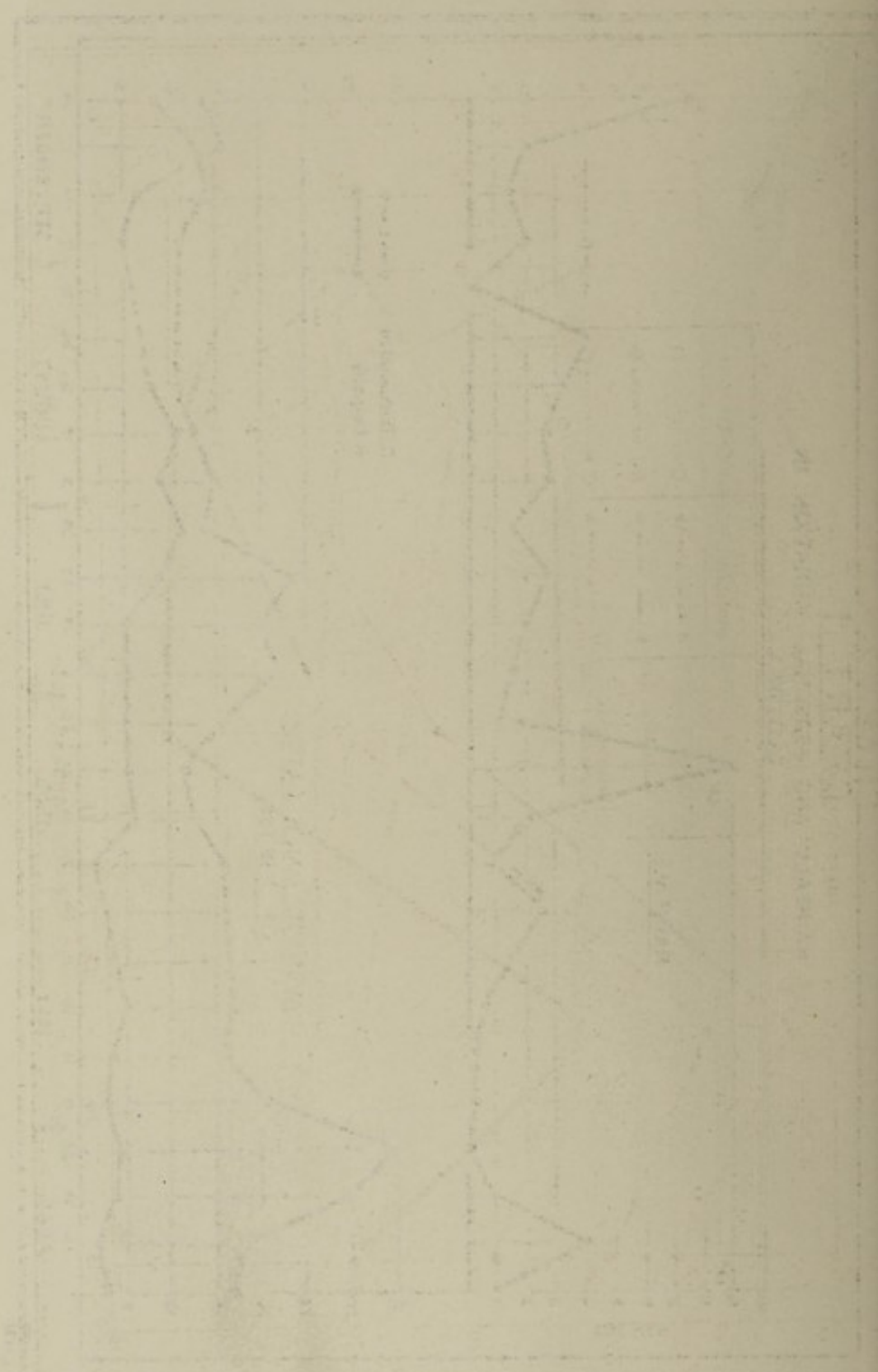
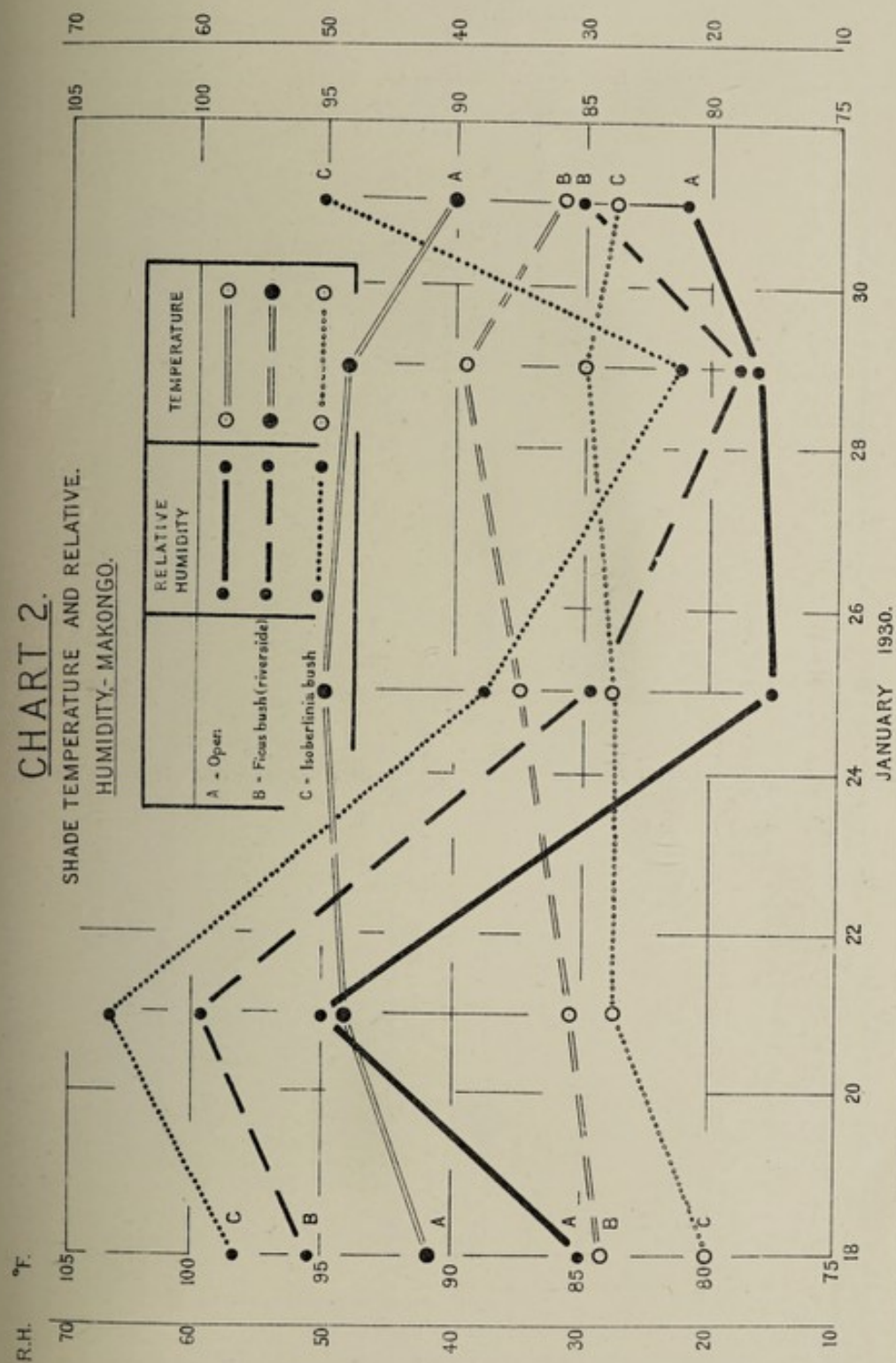


CHART 2.
SHADE TEMPERATURE AND RELATIVE
HUMIDITY.- MAKONGO.



F.L. del.

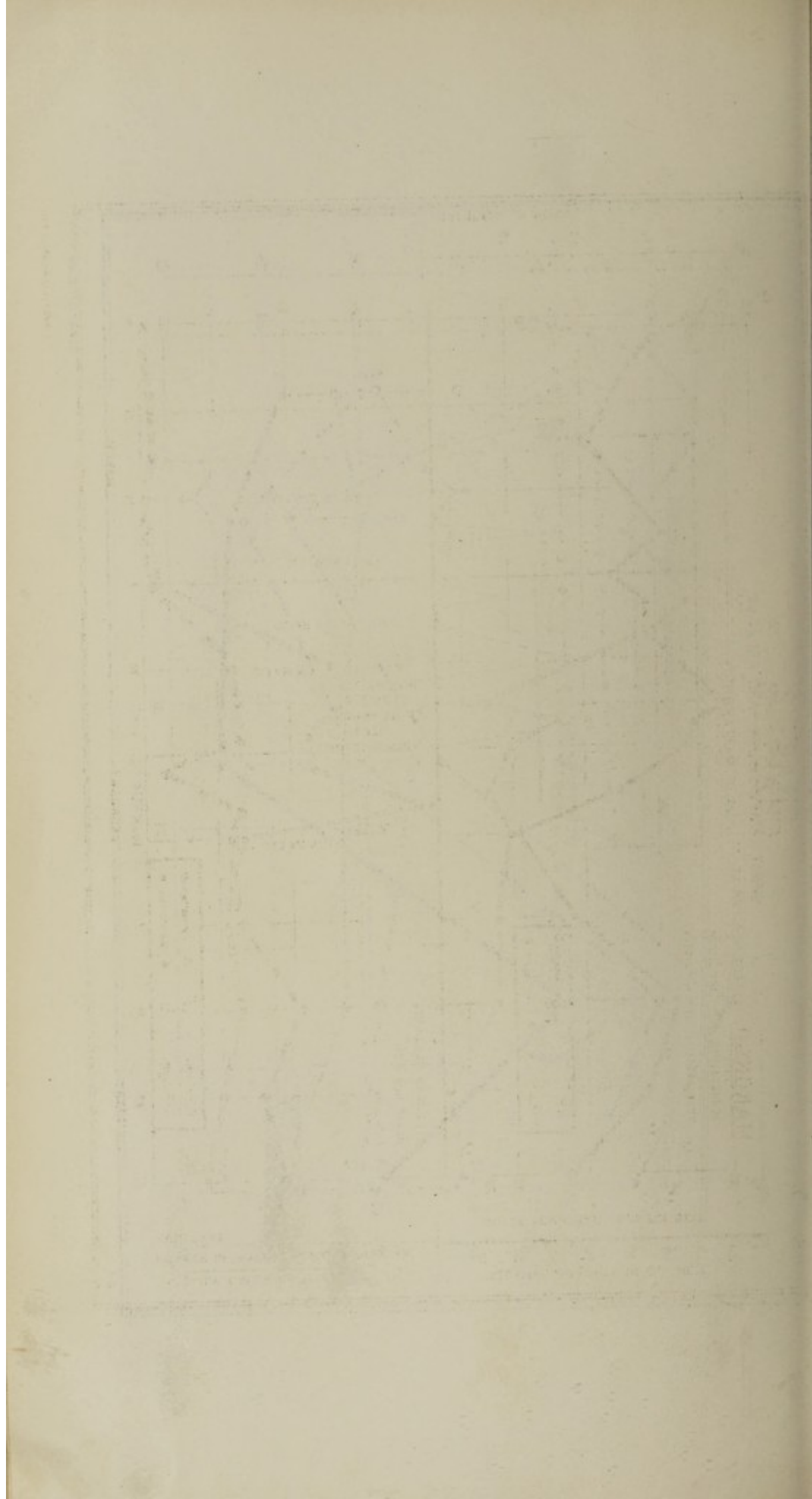
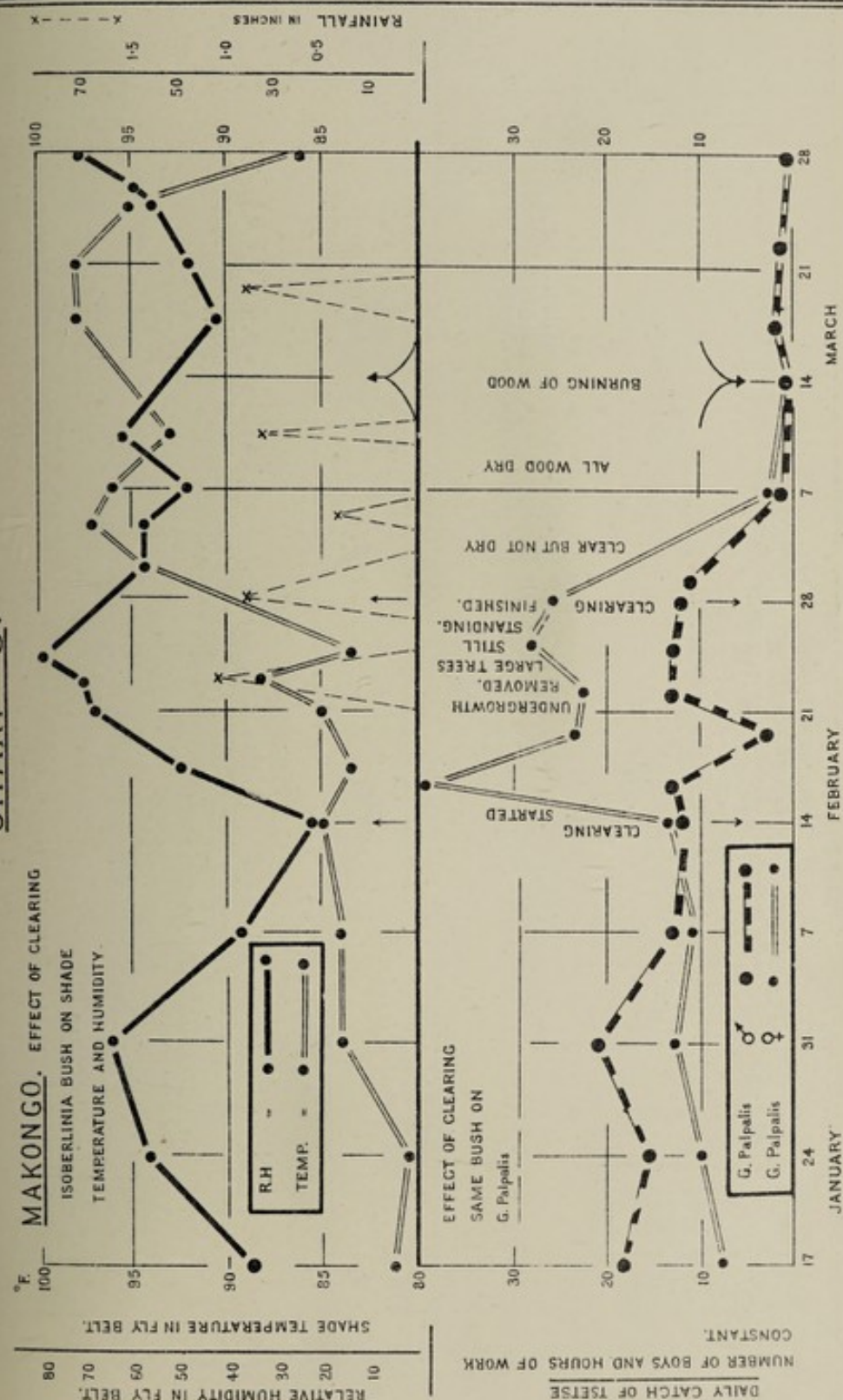


CHART 3.



f.l. del.

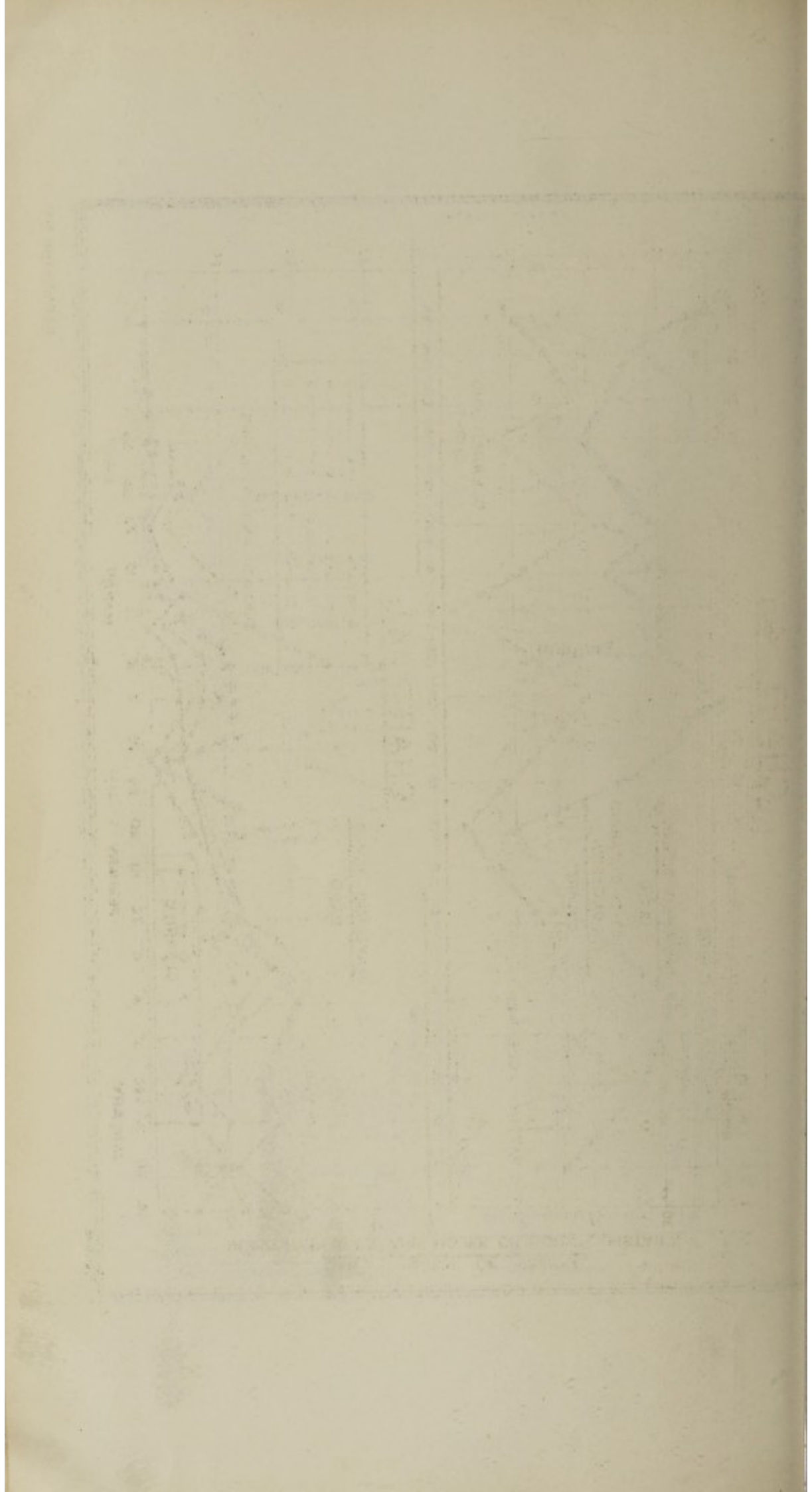


CHART 4a

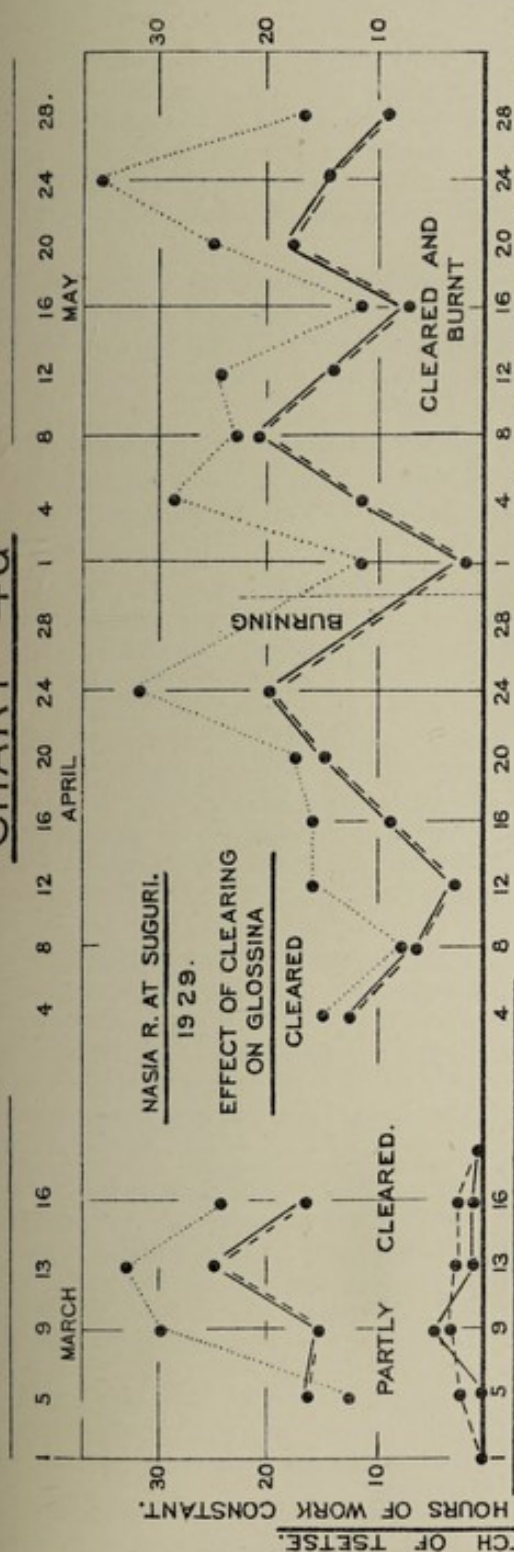
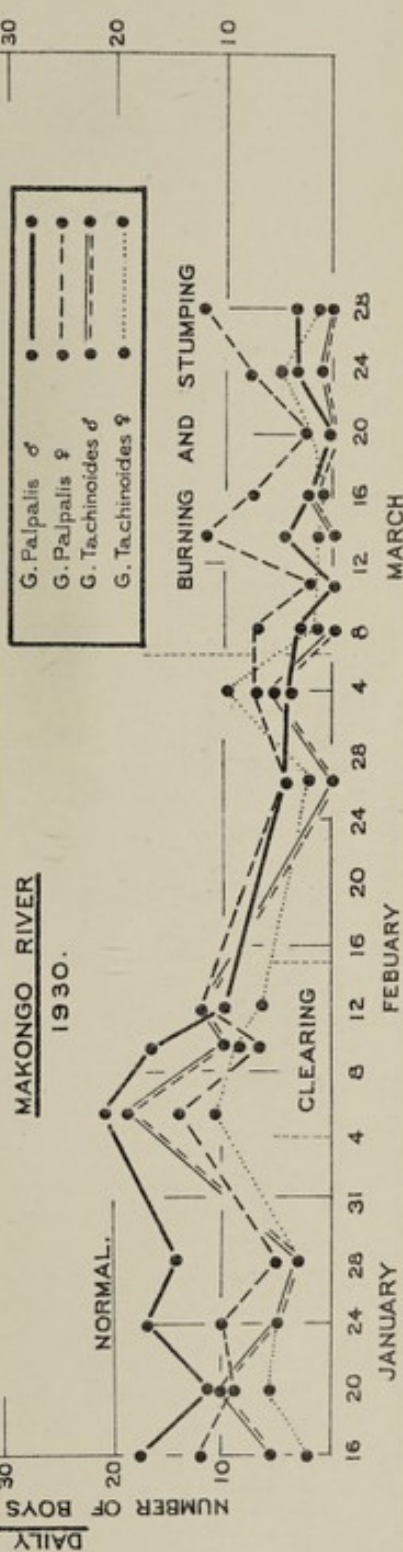
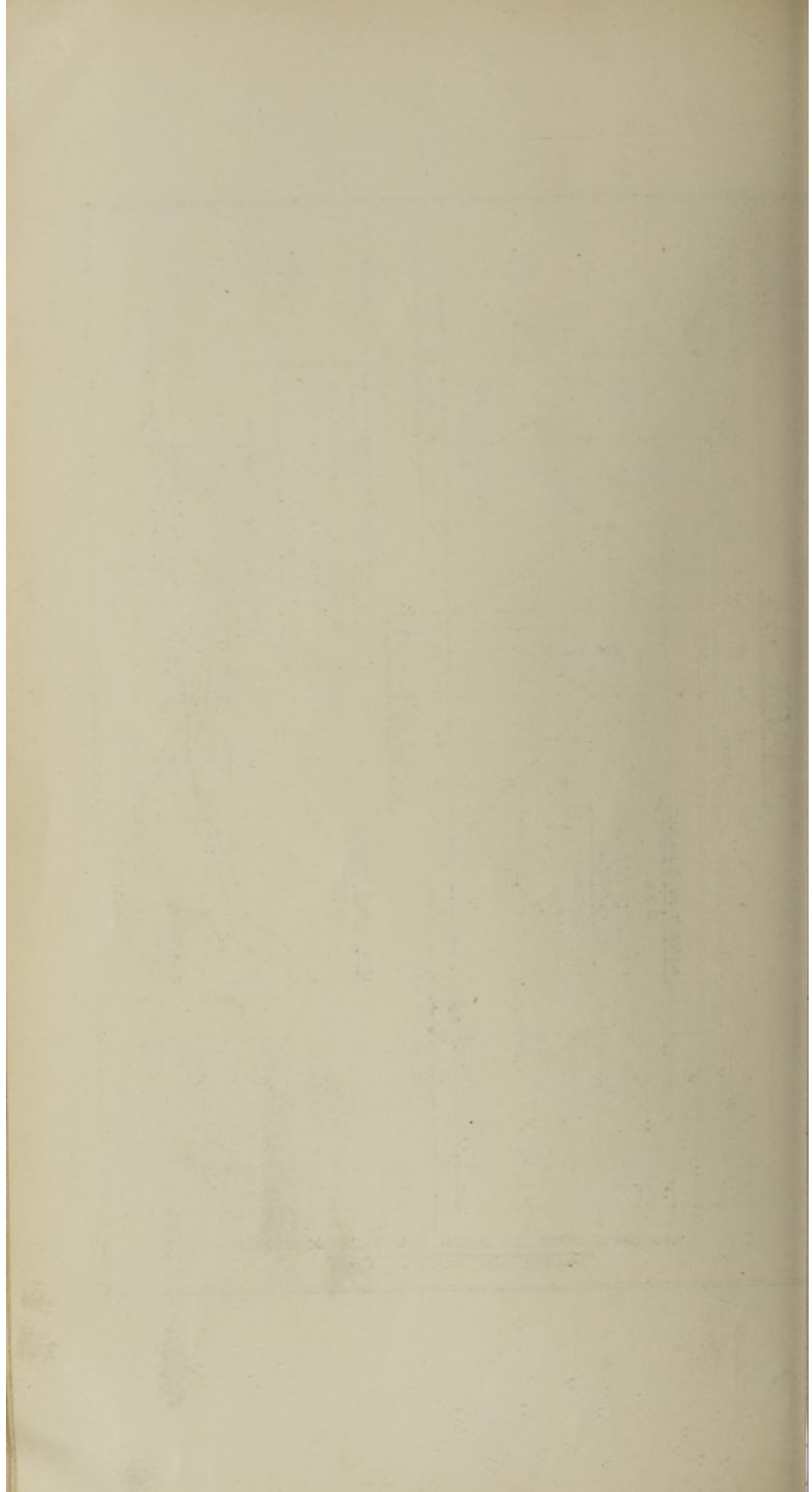


CHART 4b

MAKONGO RIVER
1930.

F.L. del.



APPENDIX I.

THE DICK TEST IN THE TROPICS.

BY G. G. BUTLER.

This investigation scarcely deserves reporting for it has only amounted to a few tests applied to Europeans and natives chiefly in order to test the keeping qualities of the toxin rather than to pursue its usefulness.

The Dick toxin was received on 28th August, 1929, and brought out to the Gold Coast at room temperature in the cabin of the steamer. On 2nd October, 1929, the toxin was tested on five Europeans and five natives. The five Europeans consisted of one who had had scarlet fever, one who had been a contact of that case but not known to actually have had scarlet and three that had no history of scarlet fever.

There was a completely negative result in two cases, one being the known recovered scarlet fever case: in one there was a poor reaction, the contact with the known case: in the remaining two the reaction was very marked the area of flush reaching a diameter of five centimeters.

The controls in each case were completely negative.

The positive cases showed a commencing flush in about seven hours and lasted between 48 and 72 hours, definite fading commencing after 48 hours.

The five Africans, all adults, who were injected at the same time were completely negative as far as could be determined and the fact that they could not detect anything themselves probably is indicative that they were actually negative.

The same batch of Dick toxin was retested on 12th December, 1929, on the two known positive reactors: the toxin in the meanwhile having been kept in the laboratory library where the mean temperature for the preceeding three months had been 79.5°F. Both cases reacted as they had done in the previous test so that the Dick toxin was quite satisfactory after three months storage at room temperature at Accra.

On 12th December, 1929, the same Dick toxin was placed in the ice safe and has remained there continuously. On 21st July, 1930, the toxin was retested on one of the original positive reactors and an unknown case, both Europeans. The unknown case gave no reaction to either toxin or control but the known positive reactor again responded in a similar manner as previously, a very good reaction, while the control was quite negative.

It would seem therefore that under ordinary room tropical conditions Dick toxin remains potent for three months and will remain active under ice safe conditions for at least eleven months if not for a considerable longer period which has not yet been found. It should be stated that the expiring date on the packet of Dick toxin was 6th September, 1929, but I understand there is a very safe margin always given to this product.

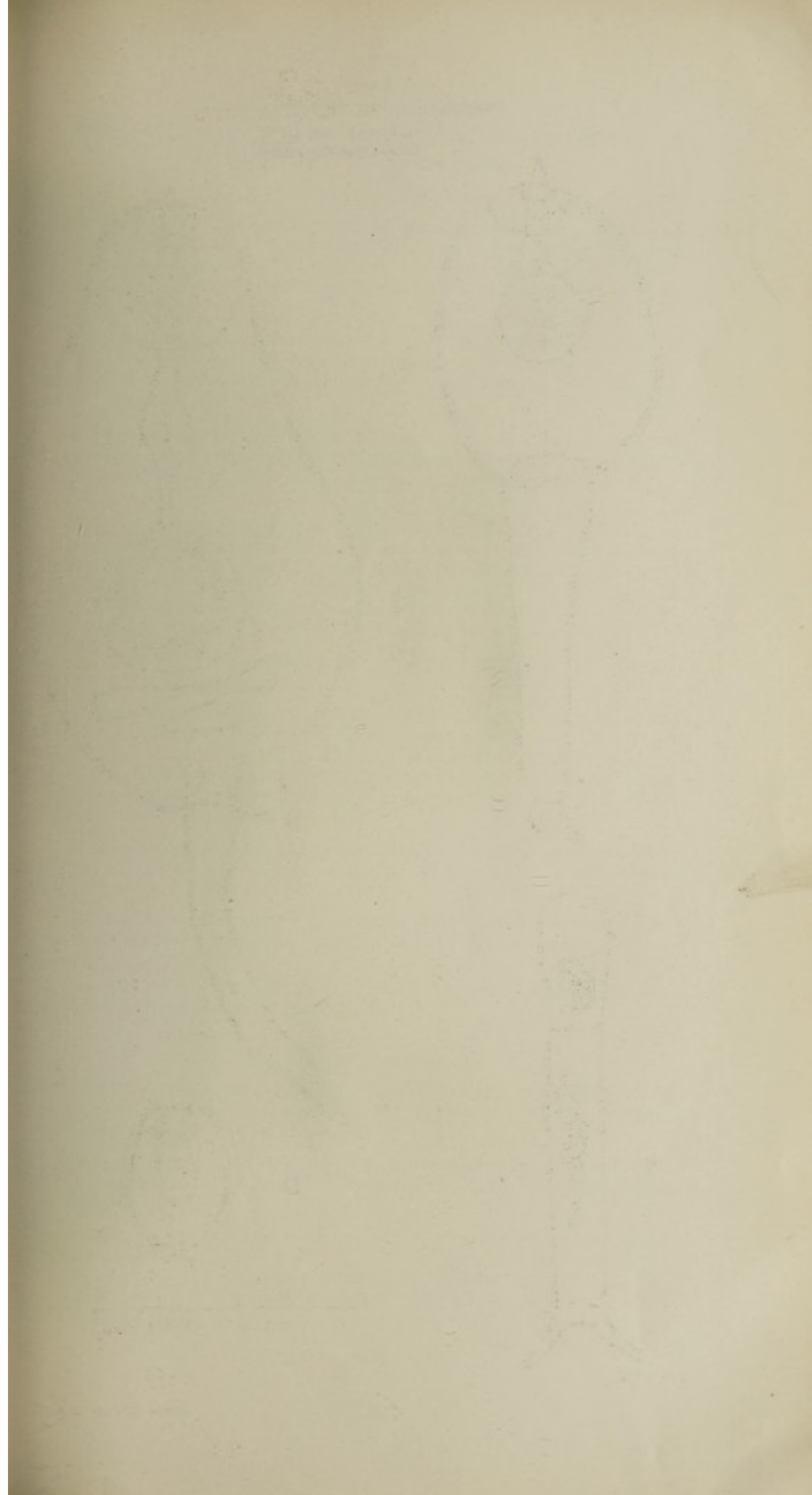
The Dick test in black-skinned races.—A few observations were made to test this point all within the period when the toxin was known to be potent by control on Europeans.

Seven adults in all were tested and 13 children, three of whom were infants under a month old.

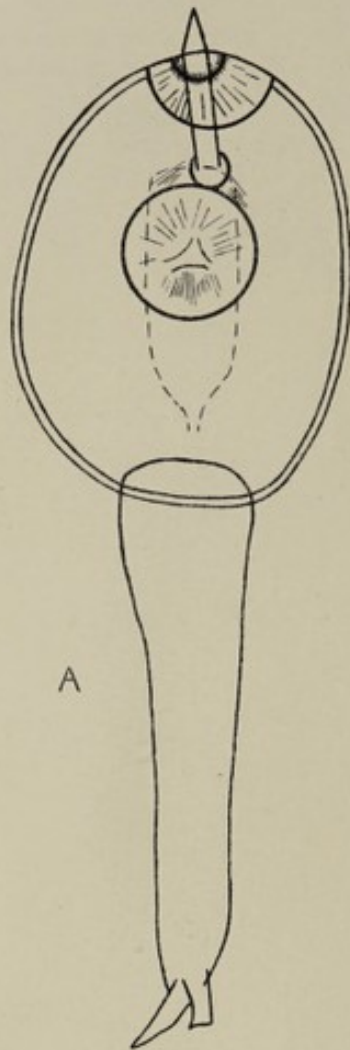
Among the adults all were negative but there was a suggestion of a partial reaction in one who was rather light skinned.

Among the children, ten were between the years two to eight, two of whom had a fairly light coloured skin: all but one of these were definitely negative but in one, a light skinned child with a mulatto father, gave a definite area of flush though the control gave an area of flush also but very much smaller in size.

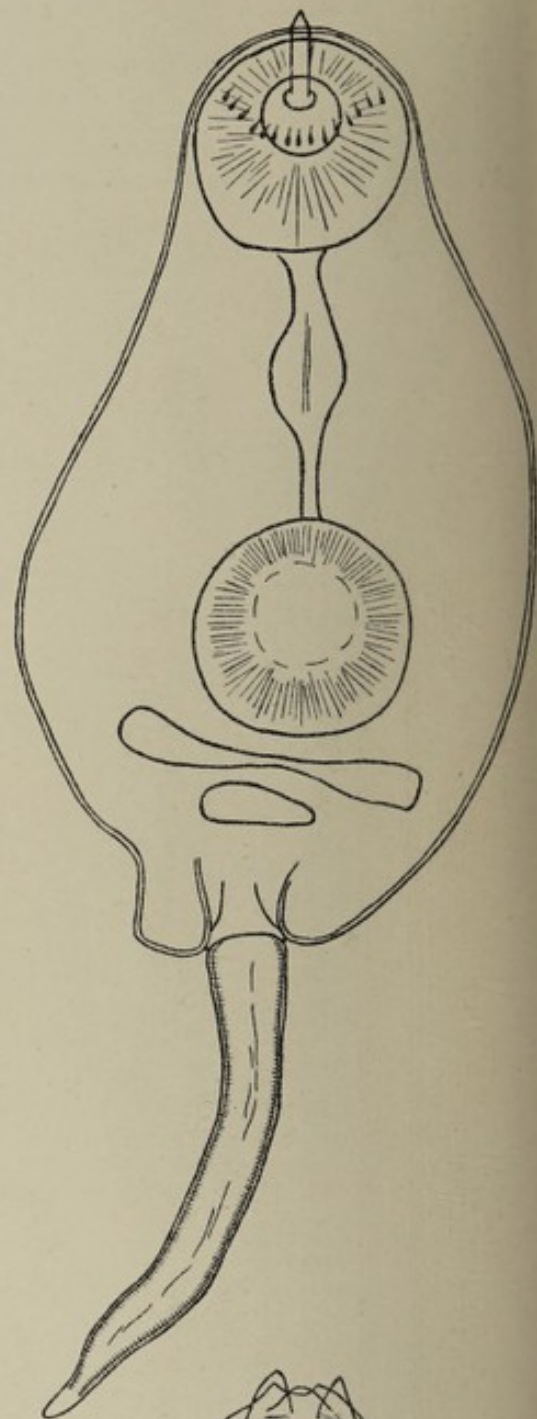
The three infants under one month old were all quite negative. It would seem that even if the local population were non-immunes the reaction will be of small value owing to the difficulty in reading the results but there does not seem much indication that the general population will react at all if we may judge from the few children and infants that have been scrutinized very careful.



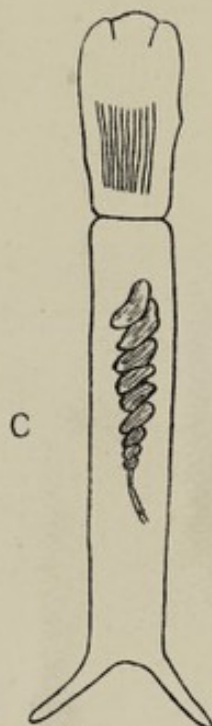
EXAMPLES OF
NATURAL INFECTIONS OF FRESH
WATER SNAILS.



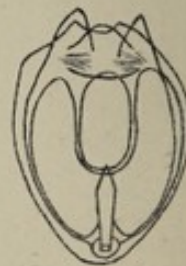
A



B



C



D

1. DIV. = 0.01 M.M.

F.L. DEL.

APPENDIX J.

SOME PRELIMINARY OBSERVATIONS BEFORE COMMENCING AN
INVESTIGATION ON SCHISTOSOMIASIS.

BY G. G. BUTLER AND F. LEESON.

So much bilharzial infection can be demonstrated in the natives of the Gold Coast that I think there is great opportunity for some experimental and preventive work: as a preliminary I asked Messrs. Leeson and Woodward to collect likely samples of snails and investigate their parasitization with cercaria.

Messrs. Leeson and Woodward have occupied several Saturday or Sunday afternoons and an occasional week-end in touring the neighbourhood of Accra to find likely spots for a supply of suitable snails and infected pools.

Mr. Leeson submits a report of this work and drawings of some of the cercaria that have been met with in their dissection. At present nothing suggestive of natural infections of the right type has been discovered.

Short excursions have been made during January to March to obtain possible intermediate hosts of schistosomes in the neighbourhood of Accra. Collections of snails were made from fresh-water pools at the villages of Kwantanang, Frafraha and Latiman on the Dodowa road. The pools on the Nsawam road as far as Ofado are few and most of the outlying villages have pools only during the wet season.

The people of this area depend upon water supplied by carriers from the Accra standpipes.

All the pools in and near the villages on the Dodowa road from which snails were collected are artificial pools, fairly well shaded, free from mosquito larvæ, some are used for drinking supplies and others for bathing and lie on ground which is between 250 and 300 feet above sea level. It was found that five types of fresh water snails exist and that where they exist they do so in abundance.

Attempts to infect snails by contaminating their containers with centrifuged deposits of urine containing the ova of *Schistosomum hæmatobium* have so far failed.

Examinations of the livers at irregular intervals after contamination have been made on nine series of experiments. These experiments are continuing.

The figures in the attached drawing illustrate what might be considered as natural cercarial infections.

Explanation of Plate.

- A.—Form of cercaria found in swarms in preparations of teased liver of *Isidora forskali*. Examined 9th February, 1930. Origin Kwantanang, 8th February, 1930.
- B.—Form of cercaria found in swarms in preparations of teased liver of *Isidora forskali*. Examined 14th March, 1930. Origin Latiman, 14th March, 1930.
- C.—Swimming body (three seen in same preparation) found in a preparation of teased liver of *Bullinus* sp. Examination made 13th March, 1930, 16 days after exposure to water medium contaminated with *S. hæmatobium* ova. Origin Kwantanang, 22nd February, 1930.

D.—Immature cercaria seen in teased liver preparation of *Bullinus* sp. Examination made 3rd March, 1930, six days after exposure to water medium contaminated with *S. hæmatobium* ova. Origin Kwantanang, 22nd February, 1930.

APPENDIX K.

ACKNOWLEDGEMENTS.

It is a pleasure before concluding this report to express my thanks to all those who have contributed specimens and their time to the making up of this report: without their aid nothing at all satisfactory could be produced except bare statistics.

Specimens have been received from most outstations and I am very grateful for them.

To Mr. Leeson I am particularly grateful for redrawing most of the charts to make them suitable for reproduction.

For the loyalty and hard work of the whole staff it is impossible for me to make adequate appreciation.

G. G. BUTLER,

Director, Medical Research Institute.

1st August, 1930.

TABLE I.—STATISTICAL RETURN FROM THE ROUTINE DIVISIONS.

	Medical Research Institute.	Sekondi.	Gold Coast Hospital three months only.	Total.
Examinations of blood:—				
(a) Parasites total	2,390	2,074	347	6,025
1. Malaria	769	602	50	1,421
2. Relapsing fever	12	—	13	25
3. Trypanosomes	1	—	—	1
4. Microfilaria	—	—	4	4
5. Negative	1,608	1,472	280	3,360
(e) Differential and other Counts	82	40	40	162
(c) Agglutinations	149	12	—	161
(d) Wassermann reactions or Kahn tests	3,068	248	—	3,316
(e) Blood cultures	26	1	—	27
(f) Chemical examinations totals	110	—	6	116
1. Van den Bergh Reactions	16	—	6	22
2. Urea estimations	23	—	—	23
3. Sugar estimations	71	—	—	71
Examination of Faeces Totals	839	268	390	1,497
(a) General examinations	696	258	390	1,344
(b) Bacteriological examinations	143	10	—	153
Examinations of Urines Totals	261	268	337	866
(a) General examinations	204	257	304	765
(b) Chemical examinations	14	—	—	14
(c) Bilharzial infections	43	11	33	87
Examinations of sputa	237	167	108	512
Miscellaneous examinations and pus examinations	351	112	46	509
Cerebro-spinal fluid examinations	31	13	—	44
Histological examinations	778	45	—	823
Post-mortem examinations	120	98	2	220
Medicolegal examinations	21	5	—	26
Bacteriological examinations of drinking waters	219	426	—	645
Animal examinations and inoculations	138	—	—	138
Rats examinations	1,759	2,674	—	4,433

TABLE II—POST-MORTEM EXAMINATIONS,

	Accra.	Sekondi.
Typhoid	2	—
Paratyphoid B.	1	—
Relapsing fever	8	—
Obscure fever with jaundice (Toxic Jaundice)	2	—
Blackwater fever	1	—
Dysentery chronic amœbic	—	2
Dysentery amœbic with perforation	—	2
Rabies	1	—
Tetanus	—	1
Tuberculosis pulmonary	5	14
Tuberculosis meninges	—	1
Tuberculosis lymphatic system	1	—
Tuberculosis spleen	—	1
Tuberculosis pericardium	1	—
Tuberculosis generalized	1	2
Septicæmia	3	3
Carcinoma of liver primary	3	—
Carcinoma of breast	—	1
Sarcoma of fauces	—	1
Sarcoma of spleen	1	—
Lymphosarcoma	1	—
Beriberi ?	1	—
Anæmia of pregnancy	1	—
Leukæmia lymphatic	1	—
Leukæmia myelogenous	1	—
Meningitis	5	1
Meningitis hæmorrhagic	1	1
Encephalitis	1	—
Cerebral abscess	—	1
Cerebral embolism	1	—

TABLE—continued.

						<i>Accra.</i>	<i>Sekondi.</i>
Mental alienation ...	...	...	...	...	...	3	1
Multiple neuritis ...	...	...	...	...	...	1	—
Pericarditis ...	...	...	...	...	...	1	—
Myocarditis ...	...	...	...	...	...	1	7
Endocarditis chronic	...	...	...	...	...	—	1
Aneurysm ...	...	...	...	...	...	2	1
Atheroma ...	...	...	...	...	...	1	—
Coronary disease ...	...	...	...	...	...	2	2
Aortic disease ...	...	...	...	...	...	3	—
Bronchitis ...	...	...	...	...	...	2	—
Bronchopneumonia	...	...	...	...	...	—	6
Pneumonia (lobar)	...	...	...	...	...	6	13
Congestion of the lungs	...	...	...	...	...	2	—
Enteritis ...	...	...	...	...	...	4	—
Appendicitis ...	...	...	...	...	...	1	—
Hernia—strangulated	...	...	...	...	...	—	1
Intestinal obstruction	...	...	...	...	...	—	1
Rectal stricture ...	...	...	...	...	...	1	—
Cirrhosis of liver ...	...	...	...	...	...	4	2
Liver abscess amœbic	...	...	...	...	...	1	2
Peritonitis ...	...	...	...	...	...	1	—
Acute nephritis ...	...	...	...	...	...	—	1
Chronic nephritis ...	...	...	...	...	...	5	1
Puerperal eclampsia	...	...	...	...	...	2	—
Ectopic gestation ruptured	...	...	...	...	...	1	—
Ovarian cyst with torsion and peritonitis	...	...	...	...	...	—	1
Sequela of labour ...	...	...	...	...	...	3	—
Prematurity ...	...	...	...	...	...	2	—
Still born ...	...	...	...	...	...	3	—
Icterus neonatorum	...	...	...	...	...	1	—
Suicide by poisoning	...	...	...	...	...	1	—
Suicide by hanging	...	...	...	...	...	1	3
Suicide by cut throat	...	...	...	...	...	1	—
Burns ...	...	...	...	...	...	—	1
Suffocation ...	...	...	...	...	...	—	4
Drowning ...	...	...	...	...	...	8	7
Wounds—gun shot	...	...	...	...	...	2	2
Fractured skull ...	...	...	...	...	...	5	4
Ruptured spleen ...	...	...	...	...	...	1	2
Laceration of lung	...	...	...	...	...	1	—
Fractured neck ...	...	...	...	...	...	1	—
Knife Wounds ...	...	...	...	...	...	—	2
General Injuries ...	...	...	...	...	...	—	3
Heat stroke ...	...	...	...	...	...	1	—

TABLE III.—ACCRA WATER SUPPLIES.

Source.	Negative.	Present in 100 c.c.s.	Present in 10 c.c.	Present in 1 c.c.	Present in 0.1 c.c.	Present in 0.01 c.c.	Totals.
Alumina out fall ..	—	—	—	—	1	—	1
No. 1 Storage reservoir ..	11	4	1	—	—	—	16
No. 2 Storage reservoir ..	9	—	—	1	—	—	10
No. 1 Final filter ..	12	1	—	—	—	—	13
No. 2 Final filter ..	13	—	—	—	—	—	13
No. 3 Final filter ..	12	—	—	—	—	—	12
No. 4 Final filter ..	13	—	—	—	—	—	13
No. 5 Final filter ..	13	—	—	—	—	—	13
No. 6 Final filter ..	12	1	—	—	—	—	13
Laboratory tap ..	51	2	1	—	—	—	54
Soda waters ..	23	6	—	—	—	—	29
Other Samples examined at Accra.							
Kumasi well ..	2	—	—	1	—	—	3
Kumasi soda waters ..	18	—	—	—	—	—	18
Winneba ..	8	—	—	—	—	—	8
Winneba soda waters ..	—	—	1	—	—	—	1
Saltpond well ..	—	—	—	—	—	2	2

SEKONDI WATER SUPPLIES.

Raw water ..	11	4	8	22	8	—	53
Final filter No. 1 ..	25	—	—	—	—	—	25
Final filter No. 2 ..	22	—	1	—	—	—	23
Final filter No. 3 ..	21	2	1	—	—	—	24
Final filter No. 4 ..	18	1	2	—	—	—	21
Final filter No. 5 ..	23	—	—	—	—	—	23
Pumping main ..	49	—	—	—	—	—	49
Bungalow tap ..	—	1	—	—	—	—	1
Laboratory tap ..	50	1	—	—	—	—	51
Takoradi residential area ..	48	2	—	—	—	—	50
Takoradi Harbour ..	50	2	—	—	—	—	52
Soda waters ..	34	—	1	—	1	—	36
Other Samples examined at Sekondi.							
Insuta ..	14	1	1	—	—	—	16
Dunkwa ..	—	—	—	—	2	—	2
Totals ..	562	28	17	24	12	2	645

TABLE IV.—SCHEDULE OF EXPENDITURE OF THE MEDICAL RESEARCH INSTITUTE AND ITS BRANCHES, 1929-30.

(a) *Administrative.*

PERSONAL EMOLUMENTS			OTHER CHARGES.		
Director and Acting Director	1,497	} £2,305	Railway	36	} £250
Laboratory Superintendent and acting officer ..	678		Motor Transport	214	
Clerk and messenger ..	130				

(b) *Branches.*

	Accra.	Sekondi.	Cost of equipment 1929-30. Kumasi.	Yeji.	Mobile unit	Medical entomology.	Total.	Total Administrative .. £2,555
PERSONAL EMOLUMENTS.	£	£	£	£	£	£	£	
(a) European ..	2,013	1,319	—	1,079	—	1,143	5,554	
(c) African ..	697	155	—	89	29	194	1,164	
OTHER CHARGES.								
(a) Equipment ..	794	413	308	147	61	294	2,017	
(c) Transport and travelling ...	71	15	—	269	—	651	1,006	
(c) Temporary labour ..	—	—	—	329	—	190	519	
Total personal emoluments..	2,710	1,474	—	1,168	29	1,337	6,718	
Total other charges	865	428	308	745	61	1,135	3,542	
Total expenditure of branch ..	3,575	1,902	308	1,913	90	2,472	10,260	Total Branches £10,260

(c) *General Expenditure.*

PERSONAL EMOLUMENTS.			OTHER CHARGES.		
European officers on leave	£3,434		Passages	851	
African Officers on leave ..	45		Railway	91	
		£3,479	Motor transport ..	43	
			Telephones ..	61	
			Courses of instruction	110	
			Miscellaneous ..	23	
				1,179	
			Total	£4,658	Total General Expenditure .. 4,658
					Total, Medical Research Institute and its branches .. £17,473

IX.—SCIENTIFIC.

(b) ANNUAL REPORT OF THE ANALYTICAL CHEMIST.

The number of samples dealt with was 1,069, made up as follows:—

Examinations for poisons:—				
Viscera, stomach contents, etc.	...	...	29	
Drugs and native medicines	...	...	25	
				54
Medical and Health Services:—				
Waters	...	...	29	
Foods and beverages	...	...	13	
Miscellaneous	...	...	6	
				48
Customs Department:—				
Whisky	...	...	27	
Brandy	...	...	37	
Gin and geneva	...	...	53	
Rum	...	...	79	
Beer and stout	...	...	96	
Wine	...	...	74	
Medicated wine	...	...	43	
Liqueur	...	...	13	
Vermouth	...	...	35	
Methylated spirit	...	...	56	
Perfumery	...	...	169	
Paint, varnish, etc.	...	...	37	
Patent medicine	...	...	103	
Condensed milk	...	...	37	
Miscellaneous	...	...	98	
				957
Other Departments:—				
Miscellaneous	...	...	10	10
Total			...	1,069

Viscera, etc, were examined in connection with 16 cases of suspected poisoning.

Positive results included arsenic (two cases).

Lysol (1 case) and toad-poisoning (two cases).

Of the native medicines, one, suspected of being the cause of severe illness was found to contain an appreciable amount of saponin.

Of the drugs, four were sent in in connection with cases of suspected poisoning. In the other cases contravention either of the Druggists' Ordinance or of the Drugs Ordinance was suspected.

The work done for the Medical Department calls for little comment. It included several samples of Korli Lagoon water and two samples of mineral oil submitted by the Medical Officer of Health in connection with his mosquito campaign, and three samples of drugs tested for purity or strength.

As usual, the Customs Department furnished the greatest part of the work done. Both the total number of samples and the numbers of samples of the different classes have been very similar to those in the previous year.

The samples analysed for other departments, though few in number, have been of a very varied character, including material for road-spraying, petrol, sulphuric acid, cement and an incrustation on bags containing cacao.

Among the samples included in the work done for the Medical Department are five samples of native palm-wine analysed at the instance of the Commission of Enquiry regarding the consumption of spirits in the Gold Coast. The results are included in an appendix to its report and commented on therein.

Mr R. W. Clarke returned from leave on the 24th July, 1929 and Mr R. Simmons proceeded on leave on the 6th December, 1929.

April, 1930.

R. W. CLARKE,
Analytical Chemist.

G. HUNGERFORD,
Acting Director,
Medical and Sanitary Services.

RETURNS.

TABLE I.—MEDICAL, SANITARY AND MEDICAL RESEARCH
INSTITUTE STAFF ON THE 1ST APRIL, 1929.

Office.	Authorised Establishment.	Provision in Estimates.	Vacancy.
Director of Medical and Sanitary Service	1	1	—
Deputy Director of Medical and Sanitary Service.	1	1	—
Deputy Director of Sanitary Service	1	1	—
Director of Medical Research Institute	1	1	—
Assistant Directors of Medical Service	2	2	—
Assistant Director of Sanitary Service	1	1	—
Specialists (two Surgical and one Medical)	4	3	—
Senior Sanitary Officers	2	2	—
Senior Medical Officers	6	6	1
Pathologists	7	7	3
Medical Entomologist	1	1	—
Assistant Entomologist	1	1	—
Medical Officers	47	46	2
Medical Officers of Health	18	18	3
Alienist Officer	1	1	—
Medical Secretary, Gold Coast Branch, British Empire Leprosy Relief Association.. .. .	1	1	—
Women Medical Officers	2	1	—
Women Medical Officers (Infant Clinic)	8	8	2
African Medical Officers	6	4	1
Junior African Medical Officers	3	2	1
Temporary African Officer, Venereal Clinic—Accra	1	1	—
Secretary to Director of Medical and Sanitary Service	1	1	—
Radiographer	1	1	—
Assistant Radiographer	1	1	—
Dental Surgeons	2	2	—
African Government Dentist	1	—	—
Analytical Chemists	2	2	—
Dispensers' Instructor	1	1	—
Medical Storekeeper	1	1	—
Secretary, Gold Coast Hospital	1	1	—
Senior Superintending Sanitary Inspector	1	1	—
Superintending Sanitary Inspectors	25	25	1
Laboratory Superintendent	1	1	—
Laboratory Assistants	2	2	—
EUROPEAN NURSING STAFF.			
Matron	1	1	—
Senior Nursing Sisters	4	4	—
Nursing Sisters	30	30	3
MEMBERS OF THE SUBORDINATE STAFF.			
MEDICAL BRANCH.			
Chief Dispensers	3	3	—
First Division Dispensers	6	6	1
Second Division Dispensers and Dispensers-in-Training	69	69	17
Laboratory Attendants	3	3	1
Chief Nurses	3	—	—
First Division Nurses	14	8	1
Second Division Nurses and Nurses-in-Training	202	202	46
Midwife Probationers	6	3	3
Chief Clerk	1	1	—
First Division Clerk	1	1	—
Second Division Clerks	25	25	1
Lodgekeepers	2	2	—
Telephone Operators	2	2	—
LUNATIC ASYLUM.			
Chief Attendant	1	1	—
Assistant Chief Attendant	1	1	—
Attendants	20	20	4
Matron	1	1	—
Gatekeeper	1	1	—
SANITATION BRANCH.			
Chief Clerk	1	1	—
First Division Clerk	1	1	—
Second Division Clerks	18	18	6
Sanitary Inspector and Training Officer	1	1	—
Senior Division Sanitary Inspectors	2	2	—
First Division Sanitary Inspectors	6	6	—
Second Division Sanitary Inspectors	100	100	13
Female Sanitary Inspectors	2	2	—
Storekeepers	2	2	—

RETURNS.

TABLE I—MEDICAL, SANITARY AND MEDICAL RESEARCH
INSTITUTE STAFF ON THE 1ST APRIL, 1929.—(contd.)

Office.	Authorised Establishment.	Provision in Estimates.	Vacancy.
Disinfector Mechanic	1	1	—
Vaccinators	12	12	—
Senior Village Overseer	1	1	—
Village Overseers	18	18	—
Assistant Disinfector Mechanics	4	4	1
Nurse-Midwives	6	6	3
Second Division Dispensers and Dispensers-in-Training	6	6	2
Second Division Nurses and Nurses-in-Training	11	11	2
Health Visitors	4	4	—
Engineering Fitter	1	1	—
CONTAGIOUS DISEASES HOSPITALS.			
Caretaker	1	1	—
Attendants	3	3	1
MEDICAL RESEARCH INSTITUTE.			
Laboratory Attendants	8	7	1
Laboratory Learners	4	4	—
Second Division Clerk	1	1	—

Accurate return of statistics of population for the year cannot be given as the birth and death registration districts cover but a small portion of the Colony and its dependencies.

TABLE V.
RETURN OF DISEASES AND DEATHS (IN-PATIENTS) AND DISEASES
(OUT-PATIENTS) FOR THE YEAR 1929-30.

DISEASES.	IN-PATIENTS.					OUT-PATIENTS.	
	Remaining in hospital on 31st March, 1929.	Yearly Total.		Total cases treated.	Remaining in hospital on 31st March, 1930.	Male.	Female.
		Admis- sions.	Deaths.				
I.—Epidemic, endemic, and infectious diseases.							
1. Enteric Group—							
(a) Typhoid fever ..	2	36	11	38	—	1	—
(b) Paratyphoid A. ..	—	4	1	4	—	—	—
(c) Paratyphoid B. ..	—	3	1	3	1	—	—
(d) Type not defined ..	—	5	—	5	—	2	—
2. Typhus	—	—	—	—	—	—	—
3. Relapsing fever ..	—	78	8	78	4	39	F
4. Undulant fever	—	—	—	—	—	—	—
5. Malaria—							
(a) Tertian	6	93	1	99	—	814	359
(b) Quartan	1	15	—	16	1	42	14
(c) Aestivo-autumnal ..	5	607	26	612	20	4,485	2,293
(d) Cachexia	—	31	3	31	—	127	64
(e) Blackwater	1	18	7	19	—	6	—
(f) Unclassified	10	348	17	358	2	5,199	4,409
6. Smallpox	—	280	105	280	—	5	2
Altastrim	—	—	—	—	—	1	1
7. Measles	—	31	—	31	4	236	154
8. Scarlet fever	—	—	—	—	—	—	—
9. Whooping cough ..	—	1	—	1	—	570	580
10. Diphtheria	—	—	—	—	—	—	—
11. Influenza	2	114	—	116	—	410	169
12. Miliary fever	—	—	—	—	—	—	—
13. Mumps	1	6	—	7	1	70	36
14. Cholera	—	—	—	—	—	—	—
15. Epidemic diarrhoea ..	—	2	—	2	—	3	—
16. Dysentery—							
(a) Amoebic	6	185	17	191	8	538	289
(b) Bacillary	6	83	16	89	—	100	52
(c) Undefined or due to other causes ..	1	36	7	37	—	624	327
17. Plague—							
(a) Bubonic	—	—	—	—	—	—	—
(b) Pneumonic	—	—	—	—	—	—	—
(c) Septicaemic	—	—	—	—	—	—	—
(d) Undefined	—	—	—	—	—	—	—
18. Yellow fever	—	—	—	—	—	—	—
19. Spirochaetosis ictero- haemorrhagica ..	—	—	—	—	—	—	—
20. Leprosy	67	33	4	100	90	824	547
21. Erysipelas	—	7	1	7	—	9	7
22. Acute polymyelitis ..	—	—	—	—	—	2	4
23. Encephalitis lethargica	—	—	—	—	—	—	—
24. Epidemic cerebro-spinal fever	—	1	—	1	—	—	—
25. Other epidemic diseases—							
(a) Rubella (German measles)	—	—	—	—	—	6	4
(b) Varicella (chicken- pox)	11	448	—	459	—	131	58
(c) Kala-azar	—	—	—	—	—	—	—
(d) Phlebotomus fever ..	—	—	—	—	—	—	—
(e) Dengue	1	9	—	10	—	6	2
(f) Epidemic dropsy ..	—	—	—	—	—	—	—
(g) Yaws	21	326	3	347	27	30,862	21,757
(h) Trypanosomiasis ..	6	53	24	59	3	46	17
26. Glanders	—	—	—	—	—	—	—
27. Anthrax	—	1	1	1	—	1	—
28. Rabies	—	1	1	1	—	—	—
29. Tetanus	1	52	22	53	3	33	10
30. Mycosis	—	1	—	1	—	8	4
31. Tuberculosis, pulmonary and laryngeal ..	23	270	126	293	23	465	223

TABLE V—continued.

RETURN OF DISEASES AND DEATHS (IN-PATIENTS) AND DISEASES
(OUT-PATIENTS) FOR THE YEAR 1929—30.

DISEASES.	IN-PATIENTS.					OUT-PATIENTS.	
	Remaining in hospital on 31st March, 1929.	Yearly Total.		Total cases treated..	Remaining in hospital on 31st March, 1930.	Male.	Female.
		Admis- sions.	Deaths.				
I.—Epidemic, endemic, and infectious diseases (contd.)							
32. Tuberculosis of the meninges or central nervous system ..	—	7	5	7	—	1	1
33. Tuberculosis of the intestines or peritoneum ..	—	9	3	9	—	8	13
34. Tuberculosis of the vertebral column ..	6	33	4	39	8	16	7
35. Tuberculosis of bones and joints	4	22	1	26	2	33	27
36. Tuberculosis of other organs	1	6	4	7	1	—	—
(a) Skin or subcutaneous tissue (lupus)	—	2	1	2	—	2	3
(b) Bones	1	5	—	6	—	—	—
(c) Lymphatic system ..	2	21	4	23	1	10	5
(d) Genito-urinary ..	—	—	—	—	—	—	—
(e) Other organs ..	—	—	—	—	—	2	—
37. Tuberculosis disseminated—							
(a) Acute	—	—	—	—	—	2	—
(b) Chronic	1	—	—	1	—	—	1
38. Syphilis—							
(a) Primary	4	43	—	47	2	277	84
(e) Secondary	9	57	5	66	2	202	108
(c) Tertiary	1	69	11	70	1	325	243
(d) Hereditary	—	5	1	5	—	26	28
(e) Period not indicated ..	—	15	1	15	1	65	27
39. Soft chancre	2	74	—	76	3	339	16
40. A.—Gonorrhoea and its complications ..	15	243	5	258	11	2,582	612
B.—Gonorrhoea ophthalmia ..	1	50	—	51	3	64	25
C.—Gonorrhoeal arthritis	5	85	1	90	4	350	120
D.—Granuloma venereum ..	—	4	—	4	—	106	41
41. Septicæmia	1	48	42	49	—	23	6
42. Other infectious diseases trypanosomiasis ..		See Item	25 (h)				
II.—General Diseases not mentioned above.							
43. Cancer or other malignant tumours of the buccal cavity ..	—	—	—	—	—	7	2
44. Cancer or other malignant tumours of the stomach or liver ..	1	10	4	11	—	1	—
45. Cancer or other malignant tumours of the peritoneum, intestines, rectum ..	1	5	1	6	—	1	2
46. Cancer or other malignant tumours of the female genital organs	—	4	1	4	—	—	2
47. Cancer or other malignant tumours of the breast	—	4	1	4	—	—	3
48. Cancer or other malignant tumours of the skin	—	8	1	8	—	3	2
49. Cancer or other malignant tumours of organs not specified ..	1	29	15	30	1	12	5
50. Tumours non-malignant ..	5	86	3	91	11	198	110
51. Acute rheumatism ..	—	—	—	—	—	—	—
52. Chronic rheumatism ..	7	125	3	132	8	4,225	1,814

TABLE V—*continued*.
 RETURN OF DISEASES AND DEATHS (IN-PATIENTS) AND DISEASES
 (OUT-PATIENTS) FOR THE YEAR 1929—30.

DISEASES.	IN-PATIENTS.					OUT-PATIENTS.	
	Remaining in hospital on 31st March, 1929.	Yearly Total.		Total cases treated.	Remaining in hospital on 31st March, 1930.	Male.	Female.
		Admis- sions.	Deaths.				
II.—General diseases not mentioned above (contd.)							
53. Scurvy (including Barlow's disease) ..	—	2	—	2	—	8	4
54. Pellagra	—	—	—	—	—	—	—
55. Beri-Beri	1	15	6	16	—	14	2
56. Rickets	—	—	—	—	—	12	4
57. Diabetes (not including insipidus)	—	10	2	10	1	6	2
58. Anæmia—							
(a) Pernicious	1	6	—	7	—	—	—
(b) Other anæmias and chlorosis	2	49	3	51	5	695	419
59. Diseases of the pituitary body	—	—	—	—	—	—	1
60. Diseases of the thyroid gland—							
(a) Exophthalmic goitre	—	—	—	—	—	—	2
(b) Other diseases of the thyroid gland, myxœdema ..	1	4	—	5	—	38	32
61. Diseases of the parathyroid glands ..	—	—	—	—	—	1	—
62. Diseases of the thymus ..	—	—	—	—	—	—	—
63. Diseases of the suprarenal glands ..	—	—	—	—	—	—	—
64. Diseases of the spleen ..	—	4	—	4	1	129	65
65. Leukæmia—							
(a) Leukæmia	—	—	—	—	—	—	—
(b) Hodgkin's disease ..	—	1	—	1	—	4	—
66. Alcoholism	—	16	—	16	—	3	—
67. Chronic poisoning by mineral substances (lead, mercury, etc.) ..	—	1	—	1	—	—	—
68. Chronic poisoning by organic substances (morphia, cocaine, etc.)	—	1	—	1	—	—	—
69. Other general diseases ..	—	—	—	—	—	2	—
Auto-intoxication ..	—	—	—	—	—	23	20
Purpura hæmorrhagica	—	—	—	—	—	2	—
Hæmophilia	—	—	—	—	—	1	—
Diabetes insipidus ..	—	3	—	3	—	2	2
69a. P.U.O.	3	16	—	19	1	357	236
III.—Affections of the Nervous System and Organs of the Senses.							
70. Encephalitis (not including encephalitis lethargica)	—	7	1	7	—	69	31
71. Meningitis (not including tuberculous meningitis or cerebro-spinal meningitis) ..	1	28	11	29	—	3	2
72. Locomotor ataxia ..	1	8	1	9	—	1	—
73. Other affections of the spinal cord ..	3	10	2	13	—	4	—
74. Apoplexy—							
(a) Hæmorrhage ..	—	10	2	10	—	13	4
(b) Embolism ..	—	1	—	1	—	—	1
(c) Thrombosis ..	—	—	—	—	—	3	—
75. Paralysis—							
(a) Hemiplegia ..	2	37	7	39	8	99	26
(b) Other paralysees ..	4	29	2	33	6	205	78
76. General paralysis of the insane	—	8	5	8	1	4	—
77. Other forms of mental alienation	—	32	—	32	1	28	13

TABLE V—*continued*.
 RETURN OF DISEASES AND DEATHS (IN-PATIENTS) AND DISEASES
 (OUT-PATIENTS) FOR THE YEAR 1929—30.

DISEASES.	IN-PATIENTS.					OUT-PATIENTS.	
	Remaining in hospital on 31st March, 1929.	Yearly Total.		Total cases treated.	Remaining in hospital on 31st March, 1930.	Male.	Female.
		Admis- sions.	Deaths.				
<i>III.—Affections of the nervous system and organs of the senses (contd.)</i>							
78. Epilepsy	6	30	6	36	1	100	42
79. Eclampsia, convulsions (non-puerperal) five years or over ..	—	2	—	2	—	9	9
80. Infantile convulsions ..	—	10	3	10	—	55	47
81. Chorea	—	—	—	—	—	5	10
82. A.—Hysteria	—	6	—	6	—	9	14
B.—Neuritis	—	41	—	41	3	425	232
C.—Neurasthenia	—	26	—	26	1	133	55
83. Cerebral softening ..	—	14	4	14	—	5	4
84. Other affections of the nervous system, such as paralysis agitans ..	1	8	2	9	1	70	25
85. Affections of the organs of vision—							
(a) Diseases of the eye ..	5	93	—	98	5	393	194
(b) Conjunctivitis	7	182	—	189	8	2,783	1,901
(c) Trachoma	—	2	—	2	—	62	35
(d) Tumours of the eye ..	2	9	—	11	—	29	12
(e) Other affections of eye	5	82	—	87	7	909	339
86. Affection of the ear or mastoid sinus ..	—	65	2	65	8	1,940	1,131
<i>IV.—Affections of the circulatory system.</i>							
87. Pericarditis	1	10	6	11	1	6	1
88. Acute endocarditis or myocarditis	—	11	7	11	1	13	6
89. Angina pectoris	—	2	—	2	—	—	—
90. Other diseases of the heart—	—	15	4	15	3	12	7
(a) Valvular—							
Mitral	1	46	16	47	4	190	137
Aortic	1	15	4	16	1	43	17
Tricuspid	—	—	—	—	—	1	—
Pulmonary	—	—	—	—	—	13	2
(b) Myocarditis	1	26	9	27	—	64	31
91. Diseases of the arteries—							
(a) Aneurism	—	5	2	5	—	6	1
(b) Arterio-sclerosis ..	—	2	1	2	—	16	3
(c) Other diseases	—	6	2	6	—	40	16
92. Embolism or thrombosis (non-cerebral) ..	—	1	—	1	1	—	—
93. Diseases of the veins—							
Hæmorrhoids	2	105	—	107	3	342	89
Varicose veins	—	3	—	3	—	36	11
Phlebitis	1	4	—	5	—	6	4
94. Diseases of the lymph- atic system	—	2	—	2	—	—	1
Lymphangitis	—	4	—	4	—	64	23
Lymphadenitis, bubo (non-specific) ..	5	136	1	141	7	611	217
95. Hemorrhage of undeter- mined cause	—	3	—	3	—	16	11
96. Other affections of the circulatory system ..	—	5	—	5	—	22	13
<i>V.—Affections of the respiratory system.</i>							
97. Diseases of the nasal passages—							
Adenoids	—	1	—	1	—	28	20
Polypus	—	8	—	8	—	60	28
Rhinitis	—	4	—	4	—	127	70
Coryza	—	33	—	33	—	1,350	269
Ill defined	—	5	—	5	—	5	—
98. Affections of the larynx—							
Laryngitis	—	22	1	22	—	233	129

TABLE V.—*continued.*
 RETURN OF DISEASES AND DEATHS (IN-PATIENTS) AND DISEASES
 (OUT-PATIENTS) FOR THE YEAR 1929-30.

DISEASES.	IN-PATIENTS.					OUT-PATIENTS.	
	Remaining in hospital on 31st March, 1929.	Yearly Total.		Total cases treated.	Remaining in hospital on 31st March, 1930.	Male.	Female.
		Admis- sions.	Deaths.				
V.—Affections of the respiratory system (contd.)							
99. Bronchitis—							
(a) Acute	10	337	12	347	20	5,096	3,283
(b) Chronic	2	96	8	98	—	2,539	1,194
100. Broncho-pneumonia ..	3	165	49	168	3	1,250	150
101. Pneumonia—							
(a) Lobar	10	430	135	440	22	573	274
(b) Unclassified ..	3	41	15	44	3	43	16
102. Pleurisy, empyema ..	2	104	8	106	8	440	88
103. Congestion of the lungs	—	9	3	9	—	56	49
104. Gangrene of the lungs ..	—	—	—	—	—	—	—
105. Asthma	1	22	—	23	—	260	134
106. Pulmonary emphysema	—	3	1	3	—	3	2
107. Other affections of the lungs—	—	14	—	14	—	64	27
Pulmonary spirochaetosis	—	—	—	—	—	—	—
VI.—Diseases of the digestive system.							
108. A.—Diseases of teeth or gums—							
Caries, pyorrhœa, etc.	2	54	—	56	—	2,339	1,419
B.—Other affections of the mouth— ..	—	3	—	3	—	8	2
Stomatitis	1	30	1	31	3	619	519
Glossitis, etc. ..	1	15	—	16	—	140	246
109. Affections of the pharynx or tonsils—							
Tonsillitis	2	43	—	45	4	514	390
Pharyngitis	—	12	—	12	—	333	189
110. Affections of the œsophagus	—	—	—	—	—	30	1
111. A.—Ulcer of the stomach	2	18	1	20	1	13	4
B.—Ulcer of the duodenum	1	8	1	9	—	4	—
112. Other affections of the stomach	—	4	1	4	—	3	1
Gastritis	1	61	—	62	—	705	510
Dyspepsia, etc. ..	—	31	—	31	1	1,724	1,078
113. Diarrhœa and enteritis— Under two years ..	4	67	8	71	1	1,357	1,039
114. Diarrhœa and enteritis— Two years and over ..	4	252	12	256	12	1,795	887
Colitis	—	33	4	33	5	200	108
Ulceration	—	1	—	1	—	10	—
114a. Sprue	—	—	—	—	—	—	—
115. Ankylostomiasis ..	5	55	5	60	7	62	29
116. Diseases due to intestinal parasites—							
(a) Cestoda (taenia) ..	—	14	—	14	—	1,012	356
(b) Trematoda (flukes)	—	—	—	—	—	1	—
(c) Nematoda (other than ankylos- toma)— ..	—	4	—	4	2	—	—
Ascaris	1	30	—	31	1	648	459
Trichocephalus dispar	—	1	—	1	—	—	—
Trichina	—	—	—	—	—	1	1
Dracunculus	9	245	—	254	9	1,095	336
Strongylus	—	—	—	—	—	41	27
Oxyuris	—	1	—	1	—	84	87
(d) Coccidia	—	—	—	—	—	—	—
(e) Other parasites ..	—	1	—	1	—	4	2
(f) Unclassified ..	—	2	—	2	—	169	235
117. Appendicitis	2	34	3	36	3	40	11
118. Hernia	9	207	16	216	15	425	26

TABLE V.--*continued.*
 RETURN OF DISEASES AND DEATHS (IN-PATIENTS) AND DISEASES
 (OUT-PATIENTS) FOR THE YEAR 1929-30.

DISEASES.	IN-PATIENTS.				OUT-PATIENTS.	
	Remaining in hospital on 31st March, 1929.	Yearly Total.		Total cases treated.	Remaining in hospital on 31st March, 1930.	Male. Female.
		Admis- sions.	Deaths.			
<i>VI.—Diseases of the digestive system (contd.)</i>						
119. A.—Affections of the anus, fistula, etc. . .	4	76	5	80	1	192 82
B.—Other affections of the intestines—	—	20	9	20	—	6 1
Enteroptosis . . .	—	5	2	5	—	5 4
Constipation . . .	4	86	—	90	2	7,435 2,651
120. Acute yellow atrophy of the liver . . .	—	—	—	—	—	1 —
121. Hydatid of the liver . .	—	—	—	—	—	— —
122. Cirrhosis of the liver—	—	—	—	—	—	— —
(a) Alcoholic . . .	—	—	—	—	—	1 —
(b) Other forms . . .	2	29	16	31	—	17 6
123. Biliary calculus . . .	—	—	—	—	—	3 1
124. Other affections of the liver—	—	1	—	1	—	2 —
Abscess . . .	1	25	4	26	2	81 24
Hepatitis . . .	1	18	2	19	2	99 28
Cholecystitis . . .	—	6	—	6	—	14 —
Jaundice . . .	1	38	—	39	3	111 66
125. Diseases of the pancreas .	—	—	—	—	—	— —
126. Peritonitis (of unknown cause) . . .	1	13	9	14	—	2 3
127. Other affections of the digestive system . .	—	20	11	20	—	68 15
<i>VII.—Disease of the genito- urinary system (non-venereal).</i>						
128. Acute nephritis . . .	8	65	19	73	4	165 104
129. Chronic nephritis . . .	3	95	35	98	3	154 78
130. A.—Chyluria . . .	—	—	—	—	—	— 1
B.—Schistosomiasis . . .	3	68	—	71	8	306 74
131. Other affections of the kidneys—	—	9	1	9	—	3 1
Pyelitis, etc. . .	1	3	—	4	—	14 12
132. Urinary calculus . . .	2	15	—	17	1	5 —
133. Diseases of the bladder—	—	10	1	10	1	1 1
Cystitis . . .	2	37	2	39	6	246 178
134. Diseases of the urethra—	—	—	—	—	—	— —
(a) Stricture . . .	5	100	10	105	4	274 2
(b) Other . . .	3	44	2	47	16	230 25
135. Diseases of the prostate—	—	2	—	2	1	— —
Hypertrophy . . .	—	—	—	—	—	5 —
Prostatitis . . .	1	13	—	14	—	57 —
136. Diseases (non-venereal) of the genital organs of man—	1	26	—	27	1	20 —
Epididymitis . . .	2	30	—	32	—	113 —
Orchitis . . .	2	58	—	60	6	294 —
Hydrocele . . .	2	57	—	59	2	218 —
Ulcer of penis . . .	2	45	—	47	3	112 —
Phimosis and para- phimosis . . .	2	140	—	142	5	379 —
137. Cysts or other non-malig- nant tumours of the ovaries . . .	—	4	—	4	—	— 11
138. Salpingitis—	2	41	1	43	3	— 46
Abscess of the pelvis . .	—	5	2	5	—	— 33
139. Uterine tumours (non- malignant) . . .	1	24	1	25	—	— 27
140. Uterine hæmorrhage (non-puerperal) . . .	—	3	—	3	—	— 51
141. A.—Metritis . . .	1	33	1	34	3	— 176
B.—Other affections of the female genital organs . . .	1	41	1	42	3	— 151
Displacement of uterus . . .	1	11	—	12	1	— 49

TABLE V.—*continued.*
 RETURN OF DISEASES AND DEATHS (IN-PATIENTS) AND DISEASES
 (OUT-PATIENTS) FOR THE YEAR 1929-30.

DISEASES.	IN-PATIENTS.				OUT-PATIENTS.		
	Remaining in hospital on 31st March, 1929.	Yearly Total.		Total cases treated.	Remaining in hospital on 31st March, 1930.	Male.	Female.
		Admis- sions.	Deaths.				
VII.—Diseases of the genito-urinary system (non-venereal)— <i>contd.</i>							
141. B.—Other affections of the female genital organs:—							
Amenorrhœa ..	—	4	—	4	—	—	200
Dysmenorrhœa ..	—	1	—	1	—	—	536
Leucorrhœa ..	—	6	—	6	1	—	197
142. Diseases of the breast (non-puerperal)—	—	2	1	2	1	—	—
Mastitis	2	18	—	20	1	1	143
Abscess of breast ..	—	15	1	15	—	—	62
VIII.—Puerperal state.							
143. Normal labour ..	16	255	—	271	19	—	—
Maternal Welfare (anti-natal) ..	—	1	—	1	—	—	13,080
B.—Accidents of pregnancy—							
(a) Abortion	2	50	—	52	5	—	145
(c) Ectopic gestation ..	—	—	—	—	—	—	—
(c) Other accidents of pregnancy ..	2	122	10	124	2	—	115
144. Puerperal hæmorrhage ..	—	7	2	7	—	—	11
145. Other accidents of parturition ..	2	138	45	140	8	—	15
146. Puerperal septicæmia ..	—	21	11	21	—	—	8
147. Phlegmasia dolens ..	—	2	—	2	—	—	2
148. Puerperal eclampsia ..	—	7	4	7	—	—	2
149. Sequelæ of labour ..	1	47	3	48	3	—	24
149a Post-natal attendances on mothers and infants ..	—	—	—	—	—	—	2,043
150. Puerperal affections of the breast ..	—	4	—	4	—	—	8
IX.—Affections of the skin and cellular tissues.							
151. Gangrene	—	23	6	23	1	31	6
152. Boil—	1	54	—	55	2	1,090	294
Carbuncle	1	30	—	31	2	315	225
153. Abscess—	7	259	4	266	16	766	334
Whitlow	5	57	—	62	5	614	271
Cellulitis	19	414	7	433	21	1,515	588
154. A.—Tinea	—	25	—	25	—	1,462	896
B.—Scabies	—	40	—	40	—	933	553
155. Other diseases of the skin—	—	53	4	53	11	622	539
Erythema	—	—	—	—	—	106	82
Urticaria	—	4	—	4	—	385	272
Eczema	2	24	—	26	1	1,258	660
Herpes	—	8	—	8	1	220	194
Psoriasis	—	—	—	—	—	53	53
Elephantiasis ..	5	30	1	35	3	114	41
Myiasis	4	—	—	4	—	5	1
Chiggers	1	3	—	4	1	21	2
Cutaneous leishmaniasis ..	—	—	—	—	—	—	—
155a. Ulcers	71	900	—	971	139	8,139	4,237
X.—Diseases of bones and organs of locomotion (other than tuberculous).							
156. Diseases of bones ..	—	—	—	—	—	7	3
Osteitis	5	58	1	63	6	555	296
157. Diseases of joints—	—	—	—	—	—	2	—
Arthritis	2	121	3	123	13	1,042	372
Synovitis	7	77	—	84	5	436	121
158. Other diseases of bones or organs of locomotion ..	5	114	9	119	10	1,511	720

TABLE V.—*continued.*

RETURN OF DISEASES AND DEATHS (IN-PATIENTS) AND DISEASES
(OUT-PATIENTS) FOR THE YEAR 1929-30.

DISEASES.	IN-PATIENTS.					OUT-PATIENTS.	
	Remaining in hospital on 31st March, 1929.	Yearly Total.		Total cases treated.	Remaining in hospital on 31st March, 1930.	Male.	Female.
		Admis- sions.	Deaths.				
XI.—Malformations.							
159. Malformations—	—	—	—	—	—	9	5
Hydrocephalus ..	—	2	—	2	—	14	12
Hypospadias ..	—	1	—	1	—	1	—
Spina bifida, etc. ..	—	5	—	5	—	15	6
XII.—Diseases of infancy.							
160. Congenital debility ..	4	63	14	67	2	138	158
161. Premature birth ..	1	22	9	23	—	35	36
162. Other affections of infancy ..	4	99	31	103	4	489	560
163. Infant neglect (infants of three months or over)	—	36	2	36	—	76	63
163a. New born infants (attendances on) ..	—	208	16	208	13	—	—
XIII.—Affections of old age.							
164. Senility—	—	11	2	11	—	28	14
Senile dementia ..	1	4	3	5	—	4	2
XIV.—Affections produced by external causes.							
165. Suicide by poisoning ..	—	2	1	2	—	6	4
166. Corrosive poisoning (intentional) ..	—	5	1	5	—	1	—
167. Suicide by gas poisoning	—	—	—	—	—	—	—
168. Suicide by hanging or strangulation ..	—	—	—	—	—	6	1
169. Suicide by drowning ..	—	—	—	—	—	—	—
170. Suicide by firearms ..	—	3	2	3	1	1	—
171. Suicide by cutting or stabbing instruments	—	1	1	1	—	2	1
172. Suicide by jumping from a height ..	—	—	—	—	—	—	—
173. Suicide by crushing ..	—	—	—	—	—	—	—
174. Other suicides ..	—	—	—	—	—	1	—
175. Food poisoning—	—	2	—	2	—	3	2
Botulism ..	—	—	—	—	—	—	—
176. Attacks of poisonous animals—	—	—	—	—	—	—	—
Snake bite ..	—	37	2	37	—	67	12
Insect bite ..	—	8	—	8	—	166	106
177. Other accidental poison- ings ..	—	23	2	23	2	12	4
178. Burns (by fire) ..	3	102	26	105	1	386	190
179. Burns (other than by fire)	3	17	—	20	1	82	56
180. Suffocation (accidental)	—	—	—	—	—	—	—
181. Poisoning by gas (accidental) ..	—	5	—	5	—	—	—
182. Drowning (accidental) ..	—	5	2	5	—	2	1
183. Wounds (by firearms, war excepted) ..	9	142	20	151	16	60	2
184. Wounds (by cutting or stabbing instruments)	53	427	21	480	19	2,726	675
185. Wounds (by fall) ..	15	190	10	205	15	1,909	413
186. Wounds (in mines or quarries) ..	1	4	—	5	—	107	—
187. Wounds (by machinery)	1	8	1	9	—	231	18
188. Wounds (crushing, e.g. railway accidents, etc.)	28	223	14	251	10	832	192
189. Injuries inflicted by ani- mals, bites, kicks, etc.	2	34	5	36	9	189	50
190. Wounds inflicted on active service ..	—	—	—	—	—	—	—
191. Executions of civilians by belligerents ..	—	—	—	—	—	—	—
192. A.—Over fatigue ..	—	1	—	1	—	—	—
B.—Hunger or thirst ..	—	12	7	12	2	47	3

TABLE V.—*continued.*

RETURN OF DISEASES AND DEATHS (IN-PATIENTS) AND DISEASES (OUT-PATIENTS) FOR THE YEAR 1929-30.

DISEASES.	IN-PATIENTS.					OUT-PATIENTS.	
	Remaining in hospital on 31st March, 1929.	Yearly Total.		Total cases treated.	Remaining in hospital on 31st March, 1930.	Male.	Female.
		Admis- sions.	Deaths.				
XIV.—Affections produced by external causes—(contd.)							
193. Exposure to cold, frost bite, ect. . . .	—	24	—	24	—	2	—
194. Exposure to heat—							
Heatstroke . . .	—	4	1	4	—	5	—
Sunstroke . . .	—	1	—	1	—	—	—
195. Lightning stroke . . .	—	—	—	—	—	—	—
196. Electric shock . . .	—	—	—	—	—	—	—
197. Murder by firearms . . .	—	—	—	—	—	—	—
198. Murder by cutting or stabbing instruments . . .	—	—	—	—	—	3	2
199. Murder by other means . . .	—	—	—	—	—	—	—
200. Infanticide (murder of an infant under one year) . . .	—	—	—	—	—	—	—
201. A.—Dislocation . . .	2	61	—	63	2	201	81
B.—Sprain . . .	—	79	—	79	1	593	130
C.—Fracture . . .	29	400	29	429	26	444	302
202. Other external injuries . . .	26	225	7	251	14	1,759	543
203. Deaths by violence of unknown cause . . .	—	—	—	—	—	—	—
XV.—Ill-defined diseases.							
204. Sudden death (cause unknown) . . .	—	2	2	2	—	22	10
205. A.—Diseases not already specified or ill-defined—	—	—	—	—	—	46	23
Ascites . . .	3	21	8	24	2	60	35
Edema . . .	1	27	1	28	2	113	34
Asthenia . . .	3	114	26	117	13	516	243
Shock . . .	—	7	1	7	1	11	3
Hyperpyrexia . . .	—	23	1	23	1	30	22
Other diseases . . .	—	14	2	14	1	147	115
B.—Malingering . . .	—	15	—	15	1	87	12
XVI.—Diseases, the total of which have not caused ten deaths.							
Observation cases . . .	22	36	2	36	1	75	35
Total . . .	—	55	—	77	2	8,509	1,463
Total . . .	801	15,162	1,432	15,963	965	142,310	90,853

90,853
133163

TABLE VI.

Analysis of the totals given in Table V. (showing the figures for the Medical Branch and the Health Branch separately, also showing separately the Health Branch figures for Infant Clinics and Contagious Diseases Hospitals).

DISEASES.	In-patients.					Out-patients.	
	Remaining on 31st March, 1929	Admissions.	Deaths.	Total cases treated.	Remaining on 31st March, 1930.	Male.	Female.
Medical Branch	678	13,405	1,156	14,083	849	111,707	58,634
Health Branch { Infant Clinics ..	17	869	127	886	30	22,500	26,483*
{ Contagious Diseases Hospitals ..	106	888	149	994	86	8,103	5,736
Total	801	15,162	1,432	15,963	965	142,310	90,853

*This figure includes 4,223 "Maternal Welfare" cases.

APPENDIX A.

GOVERNMENT HOSPITAL BED ACCOMMODATION AND DISPENSARIES, GOLD COAST COLONY, ASHANTI, NORTHERN TERRITORIES AND
BRITISH MANDATED TOGO, MEDICAL BRANCH.

Colony.	Hospital.		European.				African.				Dispen- saries.	Medical staff (Medical officers and women Medical officers)	Remarks.
	Euro- pean.	Afri- can.	Total Beds at present.		Number of Beds possible.		Total Beds at present.		Number of Beds possible.				
			M.	F.	M.	F.	M.	F.	M.	F.			
Accra ..	1	1	17	3	17	3	156 6	53	181 6	53	2	5 (M.Os.)	A children's Hospital.
Accra Cantonments ..	—	1	—	—	—	—	—	—	—	—	1	1 (M.O.)	
Accra Maternity ..	—	1	—	—	—	—	—	22+15 cots	—	22+15 cots	—	1 (W.M.O.)	
Accra Princess Marie Louise ..	—	1	—	—	—	—	—	2+20 cots	—	2+20 cots	1	1 (W.M.O.)	
Accra Christiansborg • Accra Achimota ..	—	1	—	—	—	—	—	10	10	10	1	1 (W.M.O.)	Infant Welfare Clinic. Prince of Wales' College.
Sekondi ..	—	1	—	—	—	—	38+2 cots	8+4 cots	38+2 cots	8+4 cots	1	1 (M.O.)	
Sekondi ..	—	—	—	—	—	—	—	—	—	—	1	2 (M.Os.)	
Takoradi ..	—	—	—	—	—	—	—	—	—	—	1	1 (W.M.O.)	
Chama ..	1	1	8	2	16	4	18	8	18	8	1	1 (M.O.)	Infant Welfare Clinic opened during the year.
Cape Coast ..	1	1	3	1	4	2	20	20	24	22	1	1 (W.M.O.)	
Cape Coast ..	—	—	—	—	—	—	—	—	—	—	1	1 (M.O.)	
Saltpond ..	—	—	—	—	—	—	—	—	—	—	1	1 (M.O.)	
Winneba ..	1	1	6	2	6	2	8	2	8	2	1	1 (W.M.O.)	Infant Welfare Clinic. New African Hospital under construction.
Ada ..	—	—	—	—	—	—	13	7	13	7	1	1 (M.O.)	
Keta ..	—	—	—	—	—	—	4	4	8	4	1	1 (M.O.)	
Kibi ..	—	—	—	—	—	—	13	4	13	4	1	1 (M.O.)	
Mpraeso ..	—	—	—	—	—	—	16	4	16	4	1	1 (M.O.)	New African Hospital completed.
Dunkwa ..	—	—	—	—	—	—	6	2	8	6	1	1 (M.O.)	
Tarkwa ..	—	—	—	—	—	—	10	4	10	4	1	1 (M.O.)	
Axim ..	—	—	—	—	—	—	11	4	11	4	1	1 (M.O.)	
Wiso ..	1	1	4	2	4	2	12	4	12	4	1	1 (M.O.)	Infant Welfare Clinic. Visiting from Cape Coast. New 10 bed Ward added.
Akuse ..	—	—	—	—	—	—	6	2	6	2	1	1 (M.O.)	
Koforidua ..	—	—	—	—	—	—	14	4	14	4	1	1 (M.O.)	
Koforidua ..	—	—	—	—	—	—	14	5	14	6	1	1 (M.O.)	
Elmina ..	—	—	—	—	—	—	—	—	—	—	—	1 (W.M.O.)	Infant Welfare Clinic. Visiting from Cape Coast. New 10 bed Ward added.
Oda ..	—	—	—	—	—	—	—	—	—	—	1	1 (M.O.)	
..	—	—	—	—	—	—	12	4	12	4	1	1 (M.O.)	
Nsawam ..	—	—	—	—	—	—	10	4	10	4	1	1 (M.O.)	
Total ..	5	24	38	10	47	13	397+2 cots	173+ 39 cots	432+2 cots	180+39 cots	26	33	

*Not included in total figures, being no longer under Government.

APPENDIX A.—*contd.*GOVERNMENT HOSPITAL BED ACCOMMODATION AND DISPENSARIES, GOLD COAST COLONY, ASHANTI, NORTHERN TERRITORIES AND
BRITISH MANDATED TOGO, MEDICAL BRANCH.

Ashanti.	Hospital.		European.				African.				Dispensaries.	Medical staff.	Remarks.
	Euro- pean.	Afric- can.	Total Beds at present.		Number of Beds possible.		Total Beds at present.		Number of Beds possible.				
			M.	F.	M.	F.	M.	F.	M.	F.			
Kumasi	1	1	9	2	10	2	101	37+2 cots	104	37+2 cots	1	3 (M.Os.)	Infant Welfare Centre. New African Hospital. Mines Medical Officer.
Kumasi	—	1	—	—	—	—	—	20 cots	—	20 cots	1	1 (W.M.O.)	
Bekwai	—	1	—	—	—	—	4	4	4	6	1	1 (M.O.)	
Sunyani	—	1	—	—	—	—	6	2	6	4	1	1 (M.O.)	
(Obuasi)	—	(1)*	—	—	—	—	—	—	—	—	(1)	1	
Kintampo	—	1	—	—	—	—	18	11	18	12	1	1 (M.O.)	
Total	1	5	9	2	10	2	129	54+22 cots	132	59+22 cots	5	7	

*Mines Hospital—A new mines Hospital is under construction.

Nontherin Territories.	Hospital.		European.				African.				Dispensaries.	Medical staff.	Remarks.
	Euro- pean.	Afric- can.	Total Beds at present.		Number of Beds possible.		Total Beds at present.		Number of Beds possible.				
			M.	F.	M.	F.	M.	F.	M.	F.			
Tamale	1	1	4	2	6	2	20	4	20	4	1	2 (M.Os.)	New Hospital under construction. New Hospital under construction.
Wa	—	1	—	—	—	—	12	2	18	4	1	1 (M.O.)	
Lawa	—	1	—	—	—	—	—	—	—	—	1	1 (M.O.)	
Zuarungu	—	1	—	—	—	—	5	—	8	—	1	1 (M.O.)	
Salaga	—	1	—	—	—	—	6	2	6	2	1	1 (M.O.)	
No. 1. Travelling Dispensary	—	—	—	—	—	—	—	—	—	—	1	1 (M.O.)	{ Both have been used on Leprosy investiga- tion during the year and general work.
No. 2. Travelling Dispensary	—	—	—	—	—	—	—	—	—	—	1	1 (M.O.)	
No. 3. Travelling Dispensary	—	—	—	—	—	—	—	—	—	—	1	1 (M.O.)	
Total	1	5	4	2	6	2	43	8	52	10	8	9	

APPENDIX A.—*contd.*GOVERNMENT HOSPITAL BED ACCOMMODATION AND DISPENSARIES, GOLD COAST COLONY, ASHANTI, NORTHERN TERRITORIES AND
BRITISH MANDATED TOGO, MEDICAL BRANCH.

Mandated Togo.	Hospital.		European.				African.				Medical staff.	Remarks.
	Euro- pean.	Afric- can.	Total Beds at present.		Number of Beds possible.		Total Beds at present.		Number of Beds possible.			
			M.	F.	M.	F.	M.	F.				
Ho	—	1	—	—	—	—	8	3	8	3	1 (M.O.)	New Hospital.
Kete Krachi ..	—	—	—	—	—	—	—	—	—	—	1 (M.O.)	
Yendi	—	1	—	—	—	—	9	—	12	—	1 (M.O.)	
Total	—	2	—	—	—	—	17	3	20	3	3	
Grand total ..	7	36	51	14	63	17	586+2 cots	238+ 61 cots	636+2 cots	252+61 cots	42	52

CONTAGIOUS DISEASES HOSPITAL—HEALTH BRANCH.

	Hospital.		European.				African.				
	Euro- pean.	Afric- can.	M.	F.	M.	F.	M.	F.			
Labadi	1	1	—	—	—	—	19	19	(1 M.O.H.)	Visiting.	
Cape Coast	—	1	—	—	—	—	15	15	(1 M.O.H.)	Visiting.	
Sekondi	—	1	—	—	—	—	26	24	(1 M.O.H.)	Visiting.	
Tarkwa	—	1	—	—	—	—	4	2	(1 M.O.H.)	Visiting.	
Winneba	—	1	—	—	—	—	8	6	(1 M.O.H.)	Visiting.	
Ada	—	1	—	—	—	—	8	4	(1 M.O.H.)	Visiting.	
Saltpond	—	1	—	—	—	—	4	2	(1 M.O.H.)	Visiting.	
Kumasi	—	1	—	—	—	—	40	36	(1 M.O.H.)	Visiting.	
Total	1	8	—	—	4	—	—	124	108	—	

*The number of beds possible is a variable figure. It can in case of outbreak be largely increased.

APPENDIX B.

The following interesting case of blackwater fever in a boy of pure African descent was reported from Tamale by Dr. A. M. Gillispie, Medical Officer :—

NICHOLAS ASHONG—AGE TEN YEARS—REPORT ON BLACKWATER FEVER.

The patient, a school boy, had been under treatment months previously for schistosomiasis (*S. hæmatobium*).

He attended the out-patient clinic on 6th November, 1929, having been unwell for three days and complained of cough, pains in the chest, headache and fever.

On examination he was found to have a temperature of 98.8°F. pulse rate 80, respirations 22 per minute. The conjunctivæ were pale and the gums likewise so. There was no dullness over the lungs on percussion and the breath sounds were harsh, vesicular in character, and with a few rhonchi.

The heart was not enlarged, the rhythm was regular, and there were faint systolic murmurs in the mitral, pulmonary and aortic areas.

The spleen was enlarged 2½" below the costal margin and was tender to touch. He complained of pain in the left side over the lower ribs and in the left hypochondrium.

The liver was not enlarged or tender.

Urine.—There was no albumen or sugar.

Blood showed a slight infection with *P. falciparum*.

Mononuclear count was 18 per cent. Hb. 70 per cent.

Treatment.—Quinine sulphate in solution (grs. 2½) was given thrice daily and No. 2 stimulant expectorant mixture prescribed.

Next day he was much better, and he did not return again until 11th November, 1929, when he was seen at 7 a.m. He had had a rigor on the previous evening. He was very ill.

Temperature 104°F., pulse 120, respirations 28. The skin was hot and dry.

Conjunctivæ slightly jaundiced. He had vomited once during the night. Tongue dry and coated; breath offensive; bowels constipated.

He complained of pain in the epigastrium and over the lower ribs on both sides. The pain was increased when he took a deep breath or coughed. There was frontal headache, with pain in the orbits, increased on movement.

There was severe pain in the lumbar region.

Urine.—Dark amber. Acid. No albumen or sugar. Sp. Gr. 1.020.

Blood.—Moderate infection with *P. falciparum*; more parasites than on 6th November, 1929. Pigmented mononuclears present.

Mononuclear count 15 per cent showing poikilocytosis; other leucocytes staining poorly.

Blood Counts R.B.C.s 3,500,000, W.B.C.s 10,500, Hb. 60%, C.I. 8.

Spleen.—As already noted.

There was slight enlargement of the thyroid.

Respiratory System.—There was a slight cough. The physical signs noted on 6th November, 1929, had largely cleared up.

Circulatory System.—Pulse rapid; rate 120; tension low. Heart rhythm regular. Systolic murmurs in mitral, aortic and pulmonary areas.

Nervous System.—Pupils dilated; reacting briskly.

Superficial and deep reflexes were normal.

He was admitted to hospital.

Treatment :—

(3) Quin. sulph. in solution grs. iii t.i.d.

(4) R. Sod. bicarb. grs x

Pot citras

Pot acetas.

Calc. carb.

Mag. carb. pond aa grs iii.

Aqua menth pip ad $\frac{1}{2}$ oz. four hourly in water.

(5) A powder containing :—

Acid acetyl salicyl grs $2\frac{1}{2}$

Phenacetin.

Caffein citras aa grs i was given.

(2) Fluid diet—barley water, milk and water, Horlicks and Benger's Food alternately every four hours.

(1) Cold sponging.

(6) Antiphlogistine was applied over the spleen and hot fomentations to the loins.

(7) A saline purge was administered and the bowels opened freely.

The patient vomited bilious material once during the afternoon

He passed a fairly comfortable evening and the temperature was 101.4° F. at 7 p.m.

The skin acted freely and he took copious fluid by the mouth.

He slept fairly well during the night.

12th November, 1929, he did not look so well in the morning. Temperature was 104.2° F. Respirations 26; pulse 104, and of low tension.

He passed eight ozs. of port wine coloured urine at 8 a.m.

Sp. Gr. 1.022. Acid. Albumen-positive. Bands of Oxy—and Met—Hb; Casts-hyaline and granular.

There was considerable pain in the loins and hot packs were applied two hourly. Glucose ten per cent in normal saline was given per rectum every four hours and six ozs. to ten ozs. were well retained.

The patient slept for a short period during the afternoon and at 7 p.m. the temperature was 100°; pulse 102, a little stronger, respirations 32.

Urine passed at 6 p.m. ten ozs. sherry colour; neutral; Sp. Gr. 1.020. Albumen, a trace. Casts-hyaline and granular. At 8 p.m., eight ozs. of urine were passed of port wine colour; acid; Sp. Gr.

1.022. Albumen-positive Hb. and Oxy-Hb bands showing. Casts hyaline and granular.

The bowels moved three times during the day.

The skin acted well.

Total urine for 24 hours, 47 ozs.

Blood.—No parasites seen. R.B.C.s staining poorly in many cases. Hb. 40%.

Thirteenth November, 1929, the patient passed a fairly comfortable night sleeping at intervals. The temperature was 104.8° ; respirations 36; pulse 130 and weak and irregular.

Camphor in oil grs. $1\frac{1}{2}$ given. First mitral sound weak. Urine 4 ozs. Dark sherry colour. Sq. Gr. 1.020; neutral; albumen-positive; casts-granular and hyaline.

At 11.15 a.m. a small quantity ($2\frac{1}{2}$ ozs) of urine of dark port wine colour was passed.

At 12.45 p.m. $\frac{1}{2}$ oz of urine sherry colour neutral; albumen-positive; casts-positive.

The temperature kept up; coming down after sponging to 101° , but going up again in a short time.

He complained of severe epigastric pain and fomentations gave relief. There was no vomiting. He took fluids freely by the mouth.

The rectal salines with glucose were well retained. The skin acted fairly well.

Intravenously Sodii bicarb. $\frac{1}{2}$ pint (grs. 150 to a pint) was given.

At 2.40 p.m. 4 ozs urine were passed amber colour. Sp. Gr. 1.020. Alkaline; albumen, a trace. Casts, a few. The temperature remained elevated throughout the day; at 11 p.m. being 104° ; respirations 40; pulse 130. Total urine, 51 ozs.

Blood.—Hb. 30%. No parasites seen.

Fourteenth November, 1929, passed a restless night sleeping only for short periods at a time. Temperature 101° ; respirations 40; pulse 120.

The urine was clear and remained so throughout the day, alkaline in reaction.

Intravenously Sodii bicarb. $\frac{1}{2}$ pint (150 grs to pint) in Saline given.

Rectal saline continued four hourly and retained.

The epigastric pain was not so severe and there was not so much pain in the loins.

The temperature in the afternoon rose to 103.4° . The pulse was weak and the patient inclined to be restless. The conjunctivæ were blanched with a slight jaundiced tint. The respiration was rapid and shallow at times. Brandy in water was given every four hours.

Blood.—No parasites seen. Many of cells stained poorly. R.B.S.s 1,500,000 W.B.Cs. 9,000 Hb. 20% C.I. 6—Total urine 58 ozs.

Fifteenth November, 1929, the patient passed a restless night. He slept for several periods of one hour at a time. In the morning he had an anxious expression.

Respiration rapid and sighing.

Temperature 98.8° F, pulse 130, irregular and weak.

Camphor in oil ($1\frac{1}{2}$ grs.) given. Rectal saline not retained well. Attempt to give intravenous glucose ten per cent in normal saline had to be discontinued as patient became very restless and struggled.

Arrangements were made to give blood transfusion from the father but the patient struggled and it had to be given up.

He died suddenly at 1.15 p.m. while attempting to raise himself in bed.

Remarks.

1. There was a considerable degree of anæmia at the commencement of the attack.

2. There was an infection with *P. falciparum* from at least 6th November, 1929, and probably for some time before.

3. No parasites were seen after the onset of the attack.

4. The skin acted well throughout and plenty of fluid was taken by the mouth. The rectal salines were well retained and fluid nourishment taken freely.

5. The hæmolysis was very great, R.B.C.s falling from 3,500,000 on 11th November, 1929, to 1,500,000 on 14th November, 1929, and hæmoglobin from 60 per cent to 20 per cent in the same period.

6. The kidneys acted well through.

7. The condition of the heart gave rise to anxiety on 13th November, 1929, and finally succumbed to the strain.

URINE CHART.

NICHOLAS ASHONG

Day of disease.	Date and time passed.	Amount ozs.	Colour.	Reaction.	Sp. Gr.	Albumen.	Casts.	Spectroscopic bands.	Total urine for 24 hours.
Day before	11-11-29 7.15 a.m.	8	Dark amber ..	Acid ..	1.020	—	—	—	
1st	12-11-29 8 a.m.	8	Dark red ..	Acid ..	1.022	+	Hyaline granular	Oxy Hb. and met Hb.	
	10 a.m.	6	Dark red ..	Acid ..	1.018	+	Hyaline granular	Oxy Hb. and met Hb.	
	11.30 a.m.	4	Dark red ..	Acid ..	1.020	+	Hyaline granular	—	
	3.15 p.m.	8	Light red ..	Acid ..	1.022	+	Hyaline granular	Met Hb.	
	6 p.m.	10	Sherry ..	Acid ..	1.020	+	Hyaline granular		
	8 p.m.	8	Dark red ..	Acid ..	1.022	+	Hyaline granular	Oxy. Hb.	
	11.15 p.m.	5	Dark red ..	Acid ..	1.020	+	Hyaline granular	Oxy. Hb.	47 ozs.
	11.50 p.m.	3	Dark red ..	Acid ..	1.020	+	Hyaline granular	Oxy. Hb.	
2nd	13-11-29 2.30 a.m.	4	Sherry ..	Neutral ..	1.020	+	Hyaline granular	Nil	
	4 a.m.	6	Sherry ..	Neutral ..	1.018	+	Hyaline granular	Nil	
	6.10 a.m.	8	Sherry ..	Neutral ..	1.020	+	Hyaline granular	Nil	
	9.30 a.m.	3	Sherry ..	Alkaline ..	—	+	Hyaline granular	Nil	
	11.45 a.m.	2½	Port wine ..	Acid ..	—	+	Hyaline granular	Oxy Hb.	
	12.45 a.m.	4	Port wine ..	Acid ..	—	+	Hyaline granular	Oxy. Hb.	
	1.50 p.m.	5	Sherry ..	Neutral ..	1.016	—	—	Faint	
	2.40 p.m.	4	Amber ..	Alkaline ..	1.014	Trace	A few	Nil.	
	3.35 p.m.	½	Amber ..	Alkaline ..	—	—	—	—	

BLOOD CHART.

Date.	R.B. Cs.	W.B. Cs.	Hb.	Colour. Index.	Parasites.	Remarks.
6/11/29	—	—	70	—	Light P. falciparum	
11/11/29	3,500,00	10,500	60	.08	Moderate P. falciparum	
12/11/29	—	—	40	—	No parasites	Onset of Blackwater fever.
13/11/29	—	—	40	—	No parasites	
4/11/29	1,500,000	9,000	20	.06	No parasites	Day before death.

DIFFERENTIAL COUNT. 11/11/29.

Polymorphonuclears ... 70 per cent.

Small lymphocytes ... 10 per cent.

Large lymphocytes ... 4 per cent.

Large mononuclears ... 15 per cent.

Eosinophiles ... 1 per cent.

APPENDIX C.

SHORT NOTE ON THE LEPER SETTLEMENT, HO, 1929-30.

This note should be read in conjunction with appendix C of the Annual Report of the Medical Department for 1926-27, appendix D of the Annual Report for 1927-28, and appendix D of the Annual Report for 1928-29.

Buildings.—The history of the erection of the buildings of the permanent settlement up to the 31st March, 1929, has already been given in previous reports. During the year under review, building has rapidly progressed and all the compounds (11 in all) were occupied on the 31st March, 1930, by 436 lepers.

Compounds No. 6 to 9 are not in the compound shape previously described, but the six-roomed huts are placed in line—two huts facing two huts—thus improving the appearance of the general lay-out.

A permanent hospital constructed of stone and cement has been completed. It consists of two wards each 29 feet by 18 feet with a store-room, 18 feet by 18 feet, between.

Like the office building referred to in last year's report, it has a concrete floor and a well constructed good ceiling of beaver boards.

Market Sheds.—On the north side of the office is a market shed, 34 feet by 16 feet, and on the south side a smaller shed for the shoemakers and wood carvers. On the south-east is a fine carpenters' shop and above this is a shed 50 feet long for the weavers. All these sheds are permanent, being floored with concrete, (with the exception of the weaving shed which has an earthenware floor), and covered with corrugated iron sheets.

The superintendent's house is on the eastern boundary of the settlement and is also a permanent building.

South-east of the settlement and on the other side of the main road, two houses have been built, as rest houses, for the parents of those lepers who are unable to attend to themselves.

The inmates are, with a few exceptions, natives of British Togoland and the area of the Gold Coast which lies east of the Volta river, and accommodation is only available for these people. They are given a maintenance allowance of 6d. a day, but during the month of March this allowance was reduced to 3s. for every eight days, thereby allowing every inmate to receive a share. A large area of new land (about 70 acres) has been acquired and is being plotted out for farming purposes. Each compound is allocated a certain area depending on the fitness of

the inmates. The produce reaped is sold to the inmates of the settlement, and after deducting the cost of seeds and seedlings, the balance will be returned to general revenue against the vote for maintenance allowance. It is hoped therefore, that in the future, the settlement will be more or less self-supporting.

The trades of weaving, carpentry, shoemaking and wood carving are carried on and encouraged. Of the weavers there are nine in all: two weave excellent Keta cloth. The cloths are thoroughly sterilised before they are sold. All monies obtained from the sale of articles produced are, after deducting the cost of the material, put into a general fund for the benefit of the inmates.

Discipline.—The superintendent is directly responsible for the general behaviour of the inmates, but there is also a system of headmen. Each compound has a headman who is responsible for the cleanliness and order of his compound. So also with the women who have a headwoman or Djipola, and over all is the headman or Amega of the settlement who controls all labour. He is elected to the position by the inmates and with the compound headmen hears all complaints and adjusts all differences that may arise, reporting to the Medical Officer and Superintendent whatever decisions he arrives at. I have never interfered with any of his findings, as in every case both sides have abode by his decision.

SUMMARY FOR YEAR 1929-30.

Remaining on 31/3/29	...	...	...	418
Admitted during year 1929-30	...	...	...	169
Discharged cured	...	...	...	22
Discharged on parole	...	...	...	50
Died	...	...	...	5
Ran away	...	...	...	11
Remaining on 31/3/30	...	...	...	499
On maintenance allowance	...	...	...	436
Out-patients (not on maintenance but residing in temporary huts within the settlement).	...	...	...	63

F. H. COOKE,
Medical Officer.

APPENDIX D.

JASEKAN,
TOGOLAND,
31st March 1930.

SIR,

I have the honour to forward a Report of Leprosy work carried out for the year 1929-30.

The work has been proceeding along several lines as in the previous year:—

- (a) The continuation of the Leprosy survey.
- (b) The formation of Leper out-patient clinics at stations where Medical Officers are resident.
- (c) Leprosy work propaganda.
- (d) Visiting existing settlements.

During the year a commencement has been made in :

- (e) Laboratory investigations among cases in the settlements to determine the commoner concomitant infections prevalent.

During April and May survey work was carried out at Navrongo, Northern Territories, with the aid of a travelling dispensary, visits being made to Zuarungu, Bawku, Kanjaga, Tumu, Wagadugu in the French Haute Volta, and finally to Gambaga.

As a result 215 lepers were seen, 111 males and 104 females 83.8 per cent of the males and 77.9 per cent of the females were purely anæsthetic cases, the remainder, 16.2 per cent males and 22.1 per cent females being mixed or nodular cases.

The White Fathers of the Catholic Mission, Navrongo, have taken three censuses in and around Navrongo, the figures being—

1907	...	...	...	65 lepers.
1915	...	...	...	105 lepers.
1921	...	...	...	165 lepers.

They are naturally of the opinion that leprosy is on the increase.

The bulk of cases seen by me (169 out of the total of 215) were seen in and around Navrongo.

With regard to the total number of lepers seen in the Northern Territories, Dr. MacGregor found 207 lepers during his tour of service at Wa. Sixty-one were in the Wa district, 58 in the Lawra-Tumu district and 88 in the Bole district.

During his present tour at Zuarungu he has seen many new cases.

Dr. Saunders while working with the travelling dispensary in the Lawra-Tumu district saw 396 lepers.

Dr. Gillespie, Medical Officer, Tamale, had seen 213 cases by January of this year.

At Yendi there has been a fall in the number of patients, as at one period of the year it was not possible to station a Medical Officer there. Since the commencement of the settlement there have been nearly 60 admissions, all of whom appeared to have stayed for a few months and then left of their own free will. The people around Yendi are (I was informed during my visit) still very primitive and shy of European medicine.

From these observations there can not be the slightest doubt that leprosy is very prevalent in the Northern Territories, especially in the populous Northern Province.

Leprosy was found to be the commonest contagious disease (after yaws) in Dr. Saunders series of 11,198 patients seen, accounting for 396 cases, and also among the 4,370 patients seen by me, leprosy accounted 215 cases.

The French Medical authorities informed me that leprosy was very prevalent in the Haute Volta colony, but can give no definite statistics. Attempts appear to have been made to segregate lepers at some centres ; unfortunately, owing to the poverty of the Colony, and the fact that the Government was unable to contribute towards their maintenance, the lepers after a short stay returned to their homes.

It must be borne in mind, that the vast majority of the lepers seen in the Northern Territories, were seen in the course of treks, and have not received, and cannot receive thorough treatment, with the exception of the few cases near stations where medical officers are resident.

For the population of the Northern Province which is approximately 412,000, there are two stations where Medical Officers are resident, and

a travelling dispensary in charge of one Medical Officer. The Medical Officers at the stations have frequently to go on trek. In two of the places where the survey was most accurately done, the rate was in the neighbourhood of seven per mille.

I approached Monseignor Moran of the White Fathers' Catholic Mission at Navrongo with regard to the founding by the Mission of a leper out-patient clinic, which may later on become a leper settlement. Monseignor Moran had previously considered the matter, and was most enthusiastic, if funds could be raised. The British Empire Leprosy Relief Association was approached and generously made a grant of £150 towards the building and equipment of a dispensary and the Government has granted an annual sum of £50 for maintenance.

Another qualified Nursing Sister is joining the Mission shortly, and work will soon be commenced on the treatment of lepers as out-patients.

It is doubtful, however, if there can be a very marked decrease in leprosy incidence, as long as methods of refuse and nightsoil disposal are everywhere so primitive, and also where the water-supply consists of pools and ponds which are used indiscriminately for bathing, washing and drinking purposes.

The diseases acquired in consequence of these conditions, lower vitality and open up channels for infection by leprosy.

Steps are being taken to remedy as far as possible these deficiencies, but progress is necessarily slow amongst such a large primitive population.

Leper out-patient clinics are still being carried on for treatment as described in my last report. At Tamale and at Zuarungu the numbers attending have greatly increased.

At many stations, however, the incidence of leprosy has not been considered sufficiently high by the Medical Officer in charge to warrant the commencement of special clinics for the treatment of lepers only as out-patients.

Propaganda is being steadily carried on by Medical Officers and Medical Officers of Health.

"*The Review of Leprosy*" is circularised regularly, to all stations.

Dr. Cochrane's latest booklet, on "*Leprosy*" *Symptoms, Diagnosis, Treatment and Prevention*, 2nd edition, has also been circularised.

An endeavour is made to keep in touch with Medical Officers and others who are specially interested in leprosy.

At Achimota College, a certain amount of propaganda has been carried out among the children in the Senior School, with the aid of specially designed charts sent from England, which have been found of value.

Use has also been made of the locally published *Teacher's Journal*.

The leper settlements at Ho and Accra and Accra have continued their work throughout the year.

Dr. Cooke informed me that at Ho nearly 500 lepers were now resident, and weaving, carpentry, basket-making, and farming are in full swing.

During the present month while working with a travelling dispensary, I have met a few lepers in the Northern Ho district, most of whom are keen on getting into the Ho settlement as vacancies arise, whilst others been met, who had been discharged from the settlement as "burnt out" non-infectious cases. This demonstrates what a successful settlement can do in attracting patients from a considerable area.

In Accra in July, 1929, I had the opportunity of carrying out a routine bacteriological investigation with the help of the Medical Research Institute on the 40 inmates then in the Accra leper settlement.

These investigations included a Wassermann reaction test, thick and thin blood films, the examination of nasal smears and stools.

The object was to discover and treat concomitant infections and to investigate whether in the more acute cases of the disease (such as cases with well marked skin invasion) there are more marked protozoal and helminthic infections to account for this fact, than in the purely anaesthetic cases.

The results were as follows :—

TABLE 1.—CLASSIFICATION OF CASES ACCORDING TO THE STAGE OF THE DISEASE.

			<i>Males.</i>	<i>Females.</i>
Early anaesthetic	...	...	6	4
Late anaesthetic	...	...	9	3
Nodular or mixed	...	...	10	8
			25	15

THE NUMBER OF EACH TYPE WITH A POSITIVE WASSERMANN REACTION WAS AS FOLLOWS :—

TABLE 2.

			<i>Males.</i>	<i>Females.</i>
Early anaesthetic	...	...	4	1
Late anaesthetic	...	...	6	2
Nodular or mixed	...	...	4	4
			14	7

Or 64 per cent males and 46 per cent females.

These figures represent the yaws-syphilis rate.

It is difficult to give any figure by way of control as in hospitals the reaction is usually taken only in suspicious cases. At the Maternity hospital, Accra, however, where the Wassermann reaction is done as a routine on every case seen in the ante-natal department, in a series of 308 cases, 30.5 per cent had a positive Wassermann.

Moss considers that a number of the positive cases become negative after as little as 1.8 grams of N.A.B., if the Wassermann reaction is positive as the result of yaws. All positive cases had a course of two grams of N.A.B., and were re-examined six months later on my return from leave. The result was that five cases (four males and one female) with a double plus Wassermann became negative, and one case (a female) with a single plus Wassermann became negative.

The result of the examination of thick and thin blood films showed no cases with filaria, though the following had sub-tertian ring forms present.

TABLE 3.

			<i>Males.</i>	<i>Females.</i>
Early anæsthetic	...	...	—	—
Late anæsthetic	...	...	3	—
Nodular or mixed	...	...	3	1
			—	—
			6	1
			—	—

These figures represent adults in an unusually dry site on the sea shore, with a constant sea breeze.

The examination of nasal smears was carried by swabbing the nasal septum in order to learn how many cases had infective discharges.

The results were as might be expected; with three exceptions, all the nodular cases gave positive smears.

TABLE 4.

			<i>Positive nasal smears.</i>	
			<i>Males.</i>	<i>Females.</i>
Early anæsthetic	...	...	1	—
Late anæsthetic	...	...	1	—
Nodular or mixed	...	...	10	5
			—	—
			12	5
			—	—

The stool examinations showed a low degree of helminthic infection, six cases of hookworm, two of ascaris, one of mixed trichuris and entamoeba histolytica, one case of strongyloides, and one case of mixed ascaris and hookworm.

The infections were distributed as follows :—

TABLE 5.

			<i>Males.</i>	<i>Females.</i>
Early anæsthetic	...	...	2	—
Late anæsthetic	...	...	2	1
Nodular or mixed	...	...	3	3
			—	—
			7	4
			—	—

The results are very much lower than those of a similar investigation undertaken in Nigeria.

From this small series of cases there would appear to be no ground for thinking that cases which become nodular, have their resistance lowered by being more highly parasitised than early anæsthetic cases.

The whole matter requires, of course, very much fuller investigation and on a far large scale.

The results of the surveys have been interesting, and demonstrates to date that there is definitely a higher leprosy incidence in some areas, than in others, as was indicated in my previous report.

An impression is also gained that there is a greater relative prevalence of leprosy than was formerly believed.

The confidence of the people is undoubtedly gained by means of a travelling dispensary, and many cases come forward which otherwise might remain hidden.

The main difficulty in dealing with leprosy is, however, that owing to the shortage of Medical Officers and trained native assistants, the

majority of lepers seen in districts at a distance from a Medical Officer are seldom seen again or receive further treatment.

From August till February I was on leave. I had, on leave, the opportunity of meeting medical men from other parts of the world who were interested in leprosy. While the consensus of opinion of those I met was in favour of treatment with hydocarpus oil, or alepol, potassium iodide was believed to have a more limited application than was at first thought. It was considered that it should be confined more to early anæsthetic cases, or healthy nodular cases in an early stage, and not administered to all nodular cases, owing to their special susceptibility to reaction which might lower their vitality and cause a dissemination of the disease throughout the system.

Similar observations have been made to me by Medical Officers in the Colony.

M. B. DUNCAN DIXEY,
*Medical Secretary, British Empire
Leprosy Relief Association.*

APPENDIX E.

REPORT ON THE RESULTS OF TREATMENT OF TUBERCULOSIS IN THE GOLD COAST HOSPITAL, ACCRA, DURING 1929-30.

In all 98 cases diagnosed as tuberculosis were treated in the Gold Coast Hospital during 1929-30. In not all of the cases was the diagnosis completely confirmed (i.e. by the finding of the tubercle bacillus or by post-mortem examination), but clinically the diagnosis appeared certain.

The cases fell into the following categories:—Pulmonary tuberculosis 49, pleural effusion 4, dry pleurisy 10, adenitis 11, peritonitis 6, enteritis, bones and joints 17, (spine 13, iliac crest 1, sternum 1, and hip joint 2).

No case of tuberculosis of the skin was seen either in an in-patient or in an out-patient except for some occasional infections around tubercular sinuses.

Pulmonary Tuberculosis, 49 cases.—The results were almost uniformly bad. The average stay in hospital was 50 days ranging from one to 150 days. The ages could only be guessed at: but 45 of the patients were estimated as being between 20 and 40 years, equally divided between the two decades 20-30 and 30-40. In 35 cases both lungs were extensively affected.

In seven the right only. In seven the left only. Twenty-two cases died. Twenty-two were sent out unimproved while five were said to have been improved. None were cured. In 40 cases tubercle bacilli were found abundantly in the sputum on the first examination. In four cases the immediate cause of death was a profuse hæmoptysis.

Pleural Effusion, 4 cases.—Average stay in hospital 50 days.

The ages lay between 15 and 30. Three cases were right-sided and one left-sided. No cases were cured. None died. Two were said to be improved.

Dry Pleurisy, 10 cases.—Here the diagnosis of tuberculosis was in all cases doubtful. In seven cases the pleurisy was left-sided, in two cases right sided, in one both sides were affected. The ages lay between 15 and 30. The average stay in hospital was ten days. Five were said to be cured and five improved.

Adenitis, 11 cases.—Here again the diagnosis was at times very doubtful. Where however, a gland suppurated to form a clod abscess.

which was sterile, it was considered that the cause was the tubercle bacillus. In nine cases the cervical glands were affected. In three of these bilaterally. In one the axillary glands of both sides were affected, in one the epitrochlear gland of the right side. One case died from generalised tuberculosis. Seven were improved, three were cured.

The general treatment was to exercise the glands if possible, otherwise to scrape sinuses and treat with B.I.P.P. with subsequent X-ray treatment to sinuses and local or general ultra-violet ray treatment, and cod liver oil.

The ages varied between eight and 30 with a slight majority below 20. The average stay in hospital was 40 days.

Tubercular Peritonitis, six cases; three died.—One went out improved and two were cured. In both of the later cases a laparotomy was performed, with removal of the peritoneal fluid and in one of the cases the improvement was remarkably rapid. The ages varied between 12 and 40. The average stay in hospital was 15 days.

Bones and joints, 17 cases; *Spinal caries* 13 cases.—The ages ranged from four to 38, four being between four and ten, five between 20 and 30, and four between 30 and 38.

In seven cases the cervical spine was affected, in six the lumbar spine. Three cases died. Seven went out unimproved, two were said to be improved and one cured.

In four cases paraplegia developed and four cases were complicated by the formation of abscesses and sinuses.

The average stay in hospital was 100 days. Treatment was very unsatisfactory. An attempt was made to secure complete rest by using a Phelps' box and in one case a laminectomy was performed.

Two cases of tubercular hip were treated. Neither was improved. One case of tuberculosis of the sternum was cured and one case of tuberculosis of the iliac crest was improved.

Enteritis, one case.—One case of tubercular enteritis died.

Summary.—Of the 98 cases treated, 30 died, 34 were not improved, 22 were considered to be improved, and 12 considered to be cured. The results of the treatment of Africans of the Gold Coast for tuberculosis as shown by the above records are not satisfactory.

Whether, in view of the known poor resistance of the African to the bacillus of tuberculosis, once it has obtained a foothold in his system, the results of treatment, even under highly specialised conditions would be very considerably better, is a matter of some doubt.

STANLEY BATCHELOR,
Medical Officer.

APPENDIX F.

REPORT OF THE MATERNITY HOSPITAL, ACCRA, 1929-30.

This is the second year of the hospital's existence. As predicted it has in nearly every way doubled the work done last year:—

	1928-29.	1929-30.
Ante-natal and post-natal clinic attendances	... 3,599	6,224
Total In-patient admissions	... 183	418
Total number of babies born	... 100	260

It has only been possible during the year to increase the number of beds by three, making a total of 22 beds and 14 cots.

The work of the hospital falls under three headings :—

- I. Out-patient work.
- II. In-patient work.
- III. Training of nurse midwives and health visitors.

I.—Out-Patient Work.

The attendances at both ante-natal and post-natal clinics have increased, and it is gratifying to find that on the whole they are regular, ante-natal work losing half its value if it cannot be continuous. Pregnant women in this part of the country are in the habit of seeking advice and treatment from some native woman throughout pregnancy, and therefore the idea of ante-natal work does not come foreign to them.

The number has been as follows :—

Ante-natal new cases ...	...	...	1,011
Ante-natal old cases ...	...	...	3,170
Post-natal new cases ...	...	...	460
Post-natal old cases ...	...	...	1,583
Total			6,224

Ante-natal clinic.—As noted last year the accurate taking of histories from all mothers attending gives evidence of a tremendously high rate of miscarriages, stillbirths and neonatal deaths.

The bloods of 257 patients have been tested for the Wassermann reaction :—

Negative ...	...	...	174
Positive ...	...	...	83

Post-natal clinic.—As this clinic is intended to deal chiefly with healthy infants during the first year of their lives, there is the opportunity to observe the normal infant more easily than in a clinic dealing with sick children only.

The following points have been noticed :—

Birth weight.—The average birth weight of the African infants of this district is considerably below that of an English infant. It is about 6½ lbs. as compared with 7½ lbs.

This is fortunate as the native woman's pelvis is small and she nearly always has difficulty with a baby weighing over 8 lbs.

During the year only one infant of 10 lbs. has been born.

Increase in weight.—The normal African infant seen at the clinic doubles its birth-weight more rapidly than an English infant, in 3½–4 months, instead of 5½–6 months.

It also begins to crawl and to walk rather earlier.

Umbilical Hernia.—It has often been pointed out that the frequency of umbilical hernia amongst these infants is usually due to ignorant treatment by native midwives, such as leaving the cord too long (it is the custom to leave it long enough to reach the baby's knee) umbilical sepsis, etc.

On following up cases born in hospital, it is found at the postnatal clinic that a certain proportion of these have an umbilical hernia just the same as the babies delivered at home. This shows, what must have been observed before, that the great number of umbilical herniæ seen here are due to some racial congenital weakness. A great many of these herniæ disappear during the 1st and 2nd year.

Syphilis.—A syphilitic baby is rarely seen.

II.—In-Patients.

The numbers of cases admitted and of deliveries have been as follows:

Total In-patient admissions	...	...	...	418
Admitted for ante-natal treatment	...	...	...	94
Labour cases	...	...	...	247
Admitted for post-natal complications	...	...	...	37
Infants	...	...	...	37
Other cases	...	...	...	3
Total number of deliveries	...	...	...	252
Total number of infants born (including 12 pairs of twins)	...	...	...	260
Living infants	...	...	...	208
Stillbirths	...	...	...	52
Abortions	...	...	...	4

Admitted for Ante-natal treatment.

Of the 94 cases admitted for complicated pregnancy the following were the chief conditions found :—

Albuminuria
Cystitis
Anæmia of pregnancy
Anæmia due to other causes (schistosomiasis, etc.)
Malaria
Pre-eclampsia
Constipation
Antepartum hæmorrhage.

Cases of anæmia during pregnancy are all treated with a diet containing $\frac{1}{4}$ – $\frac{1}{2}$ lb. raw liver daily and show remarkable improvement.

Not many cases of the type which appears to be the true anæmia of pregnancy, have been noted this year.

The prognosis of this condition seems extremely bad when untreated but strikingly good if treated early.

One such case is as follows :—

Admitted.—30th December, 1929, in 34th week of pregnancy.

Condition on admission. Marked anæmia. Slight cough.
Rapid pulse. Soft blowing cardiac murmur.
R.B.C. 825,000.
W.B.C. 2,500.
Nucleated reds present.
Poikilocytosis, anisocytosis and chromatophilia.

Investigations to eliminate other causes of anæmia :—

Wassermann—Negative.
Fæces—No ova or protozoa seen.
Urine—No schistosome ova.
Blood film—Rings present.
Van den Berg reaction—very weak indirect.

Treatment.—Raw liver $\frac{1}{2}$ lb. daily.

Two intramuscular injections of fresh blood taken from placental end of umbilical cord of newly born infants.

Progress.—9th January, R.B.C.s had risen to 2,185,000 and pulse rate had dropped.

2nd February, R.B.C.s 3,700,000. No nucleated reds.
Poikilocytosis very slight. Now looking very well.

Labour—14th February. Delivered of a normal healthy infant.

This is the type of case which without treatment often collapses and dies immediately after delivery.

The point worthy of note is the simplicity of treatment and the assured and quick results—the improvement in the blood count being noticeable two or three days after liver diet is begun.

Though the etiology of this interesting condition is still debateable its treatment seems clear.

B.—Labour Cases.

Of the 252 deliveries 184 were normal and 68 abnormal. The presentations were as follows :—

Vertex	...	...	235
	V. LOA	...	132
	V. ROA	...	78
	V. LOP	...	6
	V. ROP	...	7
	Unclassified	...	8
Brow	...	...	1
Breech	...	...	17
Transverse	...	...	7

Abnormal Labours.—Of the abnormal labours the majority were cases of obstructed labour who had not previously attended the ante-natal clinic, but were brought in having been in labour already two or three days. Other complications were :—

Eclampsia	...	...	...	7
Antepartum hæmorrhage	...	...	...	5
Postpartum hæmorrhage	...	...	...	7
Ruptured uterus	...	...	...	2
Prolapsed cord	...	...	...	6

Multiple Births.—There were 12 sets of twins born during the year. One case of triplets occurred. Two of the infants were born before admission, and the mother was brought in suffering from severe post-partum hæmorrhage due to the separated placenta being obstructed by the third infant which was lying transversely.

Malformations :—

One microcephalic infant.

One anencephalic infant, diagnosed antenatally and X-rayed.

One exomphalic infant, its intestines presenting at the mother's vulva.

Maternal Mortality.—There were 25 maternal deaths :—

Eclampsia	...	...	...	3
Anæmia	...	...	...	4
Toxæmia of pregnancy	...	...	...	2
Ruptured uterus	...	...	...	2
Ante-partum hæmorrhage	...	...	...	2
Post partum hæmorrhage	...	...	...	2
Puerperal fever	...	...	...	2
Pelvic Peritonitis	...	...	...	2
Obstetric shock (following obstructed labour at home).	...	...	...	3
Cardiac Disease	...	...	...	1

Also two deaths unconnected with labour :—

Typhoid	...	...	...	1
Acute suppurative meningitis	...	...	...	1

Morbidity Rate.—According to the standard of morbidity of the British Medical Association, 64 patients have been classed as morbid. The cases are as follows :—

Eclampsia	5
Malaria	7
Breast conditions	5
Parametritis	5
Pelvic peritonitis	3
Septic perineum	3
Amoebic dysentery	2
Pyelitis	2
Ruptured uterus	1
Bacillary dysentery	1
Typhoid	1
Stitch abscess	1
Rectal Ulcer	1
Splenitis	1
Pleurisy	1
Cystitis	1
Pneumonia	1
Bronchitis	1

In a third of these cases the pyrexia was due to causes which were non-obstetrical.

The native women appears to have a good natural resistance to local infection ; cases are brought in after much septic interference but they generally respond well to treatment. Though the resistance to local infections is good, the response to a toxæmia such as eclampsia is markedly bad.

Infants.—Causes of infant deaths :—

Prematurity	18
Congenital debility	1
Peritonitis	1
Tetanus of umbilical origin (born at home).	1
Tetanus neonatorum	1
Intra-cranial hæmorrhage	1

Stillbirths.—Stillbirths, deadbirths, premature stillbirths, have been counted together.

The rate of stillbirth is exceedingly high. A certain number of the premature stillbirths are due to albuminuria in the mother. Others seem to be due to syphilis, despite the apparent non-existence of syphilitic infants. Investigations are being made into this matter, and as the Wassermann reaction of the infant's cord, the history of yaws in the mother having been first ascertained. Of 75 mothers 30 had a positive Wassermann reaction, this being 40 per cent as compared with 5-7 per cent for Scotland.

Of these 30 positive cases, seven shewed a positive reaction of the infant's cord. When a large enough series has been completed, the problem may be clearer as to how much the high stillbirth rate in this area is due to syphilis.

Every placenta has again this year been examined at the Research Institute for malarial parasites, malaria accounting for abortions or

prematurity rather than stillbirths. For the findings the reader is referred to the Annual Report of the Medical Research Institute.

OBSTETRICAL OPERATIONS.

Forceps delivery	...	...	42
Perforation and cranioclasm	...	...	5
Cæsarian section	...	...	3
Internal podalic version	...	...	7
Manual removal of placenta	...	...	5
Manual rotation	...	...	3
Surgical induction of labour	...	...	14
Laparotomy	...	...	3
Decapitation	...	...	1
Episiotomy	...	...	5
Dilatation and curettage	...	...	4
Repair of cervix	...	...	5
Circumcisions	...	...	20

In going through the case sheets of the in-patients during the year the following conclusions were reached :—

That a maternity hospital in the tropics is an admirable place for the investigation of many conditions apart from those which are purely obstetrical, both by clinical observation and by laboratory investigation.

In a maternity hospital it is often possible to follow up a patient for a year or more, first in the ante-natal clinic where the taking of an accurate history is attempted, later as an in-patient, and again at the post-natal clinic.

Thus it is possible to see her in health, and also under the strain of labour, whereas in most hospitals patients are only met with in disease.

It is also possible to trace the effects of disease in the offspring. The following examples suggest themselves as conditions which should repay such observation in a maternity hospital :—

Albuminuria.—Investigations as to the origin of kidney disease should be useful in a maternity hospital, pregnancy having been described as "the most delicate test of renal efficiency."

Albuminuria in many pregnant women here is frequent, and an exceedingly virulent type of eclampsia is met with.

Diet Deficiency and Avitaminosis.—Such conditions should be more marked during pregnancy. Vitamin deficiency has already been pointed out in Sierra Leone as being responsible for sore tongue which is also prevalent here during pregnancy, and indicating a diet deficiency always present but only appearing during the added strain of pregnancy.

Diet deficiency may also play a part in the cases of albuminuria and eclampsia, as it is in a certain class of people eating a certain diet that these cases most often occur.

Anæmia.—Another general condition more marked during pregnancy. The specific anæmia of pregnancy is still under debate, and its investigation may throw light on the other numerous forms of anæmia.

Malaria, Syphilis, Yaws.—Mention has already been made of the work on the yaws-syphilis question and on the estimation of latent malaria by an examination of placental smears possible in a maternity hospital.

TRAINING OF NURSE MIDWIVES AND HEALTH VISITORS.

Since the opening of the hospital this has been considered as of even greater importance than the actual obstetrical work, for eventually its value has a far wider scope. The aim before the hospital is not only to

deal with the abnormal midwifery of Accra and its neighbouring villages but to train nurses in midwifery, who shall eventually spread all over the Colony and raise the prevailing standard of midwifery, thereby lowering the maternal mortality and rate of stillbirth.

The first nurse to complete her training, passed the Midwifery Certificate examination during the year and is now employed as a Government midwife in Accra. Three more will complete their training in April, 1930.

Two Health Visitors have completed their training and passed an examination for Health Visitors in March, 1930.

Preliminary steps towards a Midwives' Ordinance for the Colony have been taken.

It is an important advance and the Ordinance should prove of immense value when it comes into force.

G. M. L. SUMMERHAYES,
Medical Officer,
Maternity Hospital,
Accra.

APPENDIX G.

MISCELLANEOUS CASE, REPORTS OF INTEREST, AND EXTRACTS FROM ANNUAL REPORTS BY MEDICAL OFFICERS.

1. The following interesting case of Encephalitis was reported by A. J. Hawe, Medical Officer, Gold Coast Hospital:—

Name, A. Kosasi, Occupation, Soldier, Age 42 years, admitted 1. p.m. 18th May, 1929 died 25th June, 1929.

History.—On admission to surgical ward there was a history of waist pain for about one month. There was also a history of gonorrhœa for three months. Buboës in both groins for two months. No history of penile sore.

On Examination.—Patient is drowsy and sleeps a good deal during the day and night time. He is dull and does not converse spontaneously. Has been running an irregular pyrexia up 100° F. Says he has been losing weight. Double inguinal adenitis. Right side incised and both sides seem to be very much improved. Had treatment in surgical ward. Has a urethral (purulent) discharge.

Adenitis.—Glands in both groins and over saphenous opening are enlarged. Glands in right groin are painful but small and matted. Saphenous glands are fairly large and discrete and softish, not painful. Epitrochlear glands are enlarged and also glands along posterior border of the sternomastoid. Glands in the axilla are also positive. Sub-mental glands positive. Puncture of cervical glands failed to show trypanosomes.

C.N.S.—Mental condition drowsy; stupid; sleeps a lot, eats fairly well.

A. J. HAWE.

SUPERFICIAL REFLEXES.

Plantars, both Flexor	...	Brisk contraction of ipsilateral Tensor fasciæ femoris.
Cremasteric	...	Present on left, not elicited on right.

Abdominals ...	...	...	Present and brisk all quadrants.
Pupillary ...	...	...	Equal in size; react to light briskly. Photophobia.
Cranial Nerves ...	...	...	3rd, 4th and 6th normal, 7th normal 8th normal, 12th normal, 9th and 10th appear normal. No evident wasting of Trapezius.
Deep Tendon Reflexes ...	...	...	Knee jerks brisk (exaggerated). Ankle jerks present. Triceps jerks present. Supinator jerks not elicited. No sphincter trouble, no Rombergism. Gait slow but normal.
Alimentary ...	...	...	Tongue a little furred. Teeth Pyorrhœa of the lower incisors. Throat relaxed; No snail track ulcers; No mucous patches. Abdomen; will not relax. Spleen not enlarged. No hepatic enlargement.
Stool Normal.			
Appetite Normal.			
Chest and heart ...	...	...	Slight brachycardia only; heart normal in size; no bruit, no irregularities; vessels nil, blood pressure is low chest nil abnormal detected.

POST-MORTEM REPORT BY DR. A. S. BURGESS.

Post-Mortem on 25th June, 1929, at 10 a.m.

In-Patient. Native, Male.

Patient had been semi-comatose for several days.

Trypanosomiasis or cerebral syphilis suspected.

Cerebro Spinal Fluid on 4th June, 1929, showed 720 lymyocytes
per c.mm. globulin in excess, no tryps, Wassermann negative.

Emaciated.

Lungs œdematous.

Heart normal except very slight atheromatous patches in aorta.

Abdominal organs normal, spleen 5 oz.

C.N.S. On opening the skull the membranes of the brain appear
to be definitely œdematous and the blood vessels somewhat dilated.

On section of the brain blood vessels rather dilated. C.S.F. somewhat
large in amount.

II. A similar very interesting case, which it is suggested might
have been due to trypanosomiasis (although trypanosomes were not
found after close search) or to cerebral syphilis, was reported by Dr.
L. D. Quigley, Medical Officer, Kumasi, and led him to suspect
encephalitis lethargica. A note of the examination of the cerebro
spinal fluid (pleocytosis and globulin content) and of the blood (counts,
Wassermann, etc.) would have been very valuable. Similar cases are
occasionally met with by Medical Officers and further research on this
subject is very desirable in order to be certain as to the existence in the
Colony of encephalitis lethargica. If found to be present it will in certain

cases increase the difficulties of medical officers in differential diagnosis. Dr. Quigley's note is as follows :—

A Kumasi boy aged 17 to 18 years was admitted to hospital in July, 1929. It was gleaned from the history that some months previously he began to complain of recurring headaches.

He later became abnormally drowsy during the day and his people thought that he was becoming mentally deranged. The drowsiness passed off, but the mental change seemed to have become permanent.

On admission to hospital he presented definite parkinsonian features. The face was expressionless and mask-like. The attitude was stooping and the arms were held partially flexed and forward of the body. He had definite squint and the mental condition was obviously abnormal. There was no tremor but there was a degree of weakness and rigidity of the limbs rendering him partially helpless.

Thorough examination for trypanosomiasis yielded negative results and the history of the case does not tally with poliomyelitis and the youth of the patient is against paralysis agitans.

After a stay of three weeks in hospital there was no improvement and the patient was removed by his relatives.

III. The following case of tumour of the larynx is reported by Dr. A. M. Gillespie, Medical Officer, Tamale :—

Name Wartei Grunshi Female, aged about 45 years.

History.—The deceased was brought to the African hospital, Tamale, about 1 p.m. on 11th October, 1929. She was in a collapsed and limp condition, was breathing stertorously and all the auxilliary muscles of respiration were in extreme action. It was obvious that there was some obstruction to the respiration. The pulse was weak and rapid. Immediate tracheotomy was of no avail and the patient died almost at once.

Previous History.—It was stated by the relatives that the patient had been troubled with a dry cough and huskiness of the voice for several years. She had attended the African hospital, Tamale, about two years previously but had not been for treatment for more than a year. She kept in fairly good health for a time, but lately had been losing weight and getting weaker. On 10th November, 1929, she was suddenly seized with a choking sensation in the throat and had great difficulty in breathing. The relatives met and discussed the matter and finally decided to bring her to hospital where she arrived in the condition stated.

A post-mortem examination was made. The body was emaciated. The abdomen was retracted and post mortem rigidity was present.

The Lungs were dark and engorged with blood and blood stained froth escaped from the cut surface.

The Thyroid Gland was enlarged and congested.

Larynx.—There was a red granular, infiltrating and fungating growth involving the epiglottis, aryepiglottic folds and ventricular bands and extending on to the adjacent parts of the pharynx which were extensively involved. There was considerable œdema of the tissues around and the surface was covered with blood stained mucopus. The neighbouring lymphatic glands were enlarged and hard.

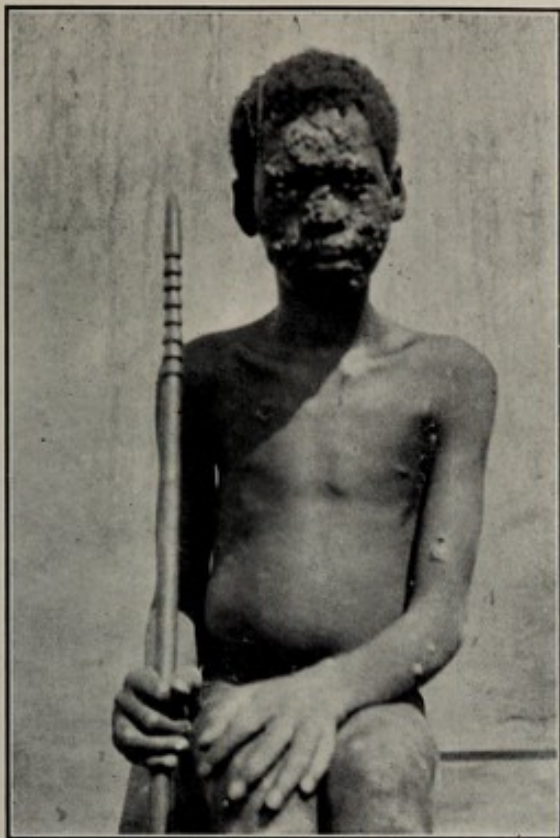
The Heart.—The right side of the heart was engorged with dark fluid blood. No gross pathological changes were noted in the organ.

The Liver was congested. No secondary growths were observed.

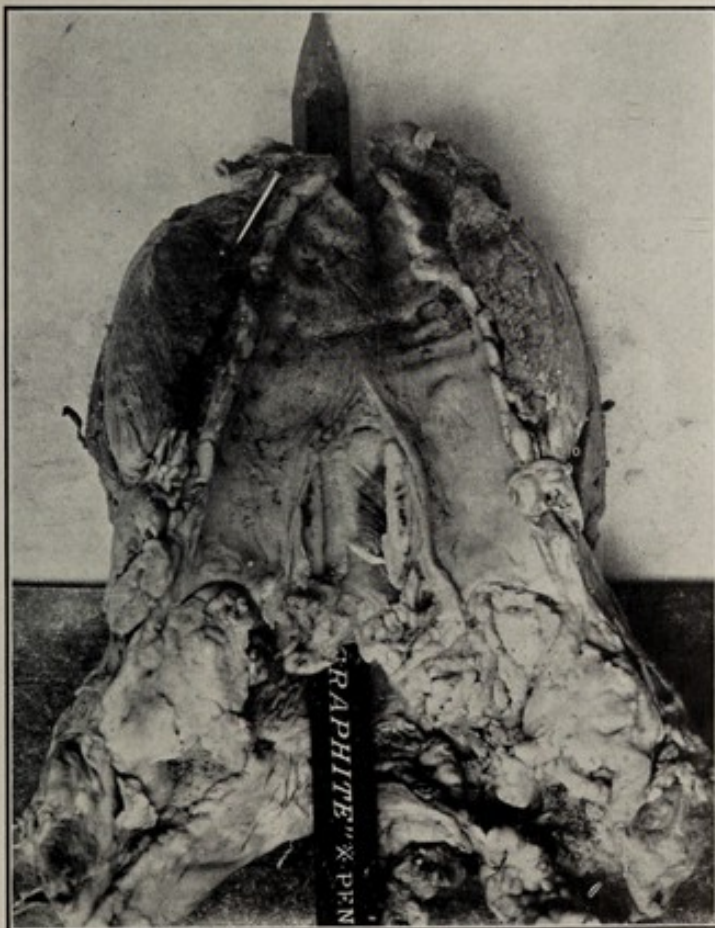
The Spleen was enlarged and firm.

The Digestive Tract.—The mucous membrane of the stomach and small intestine was pale and atrophied.

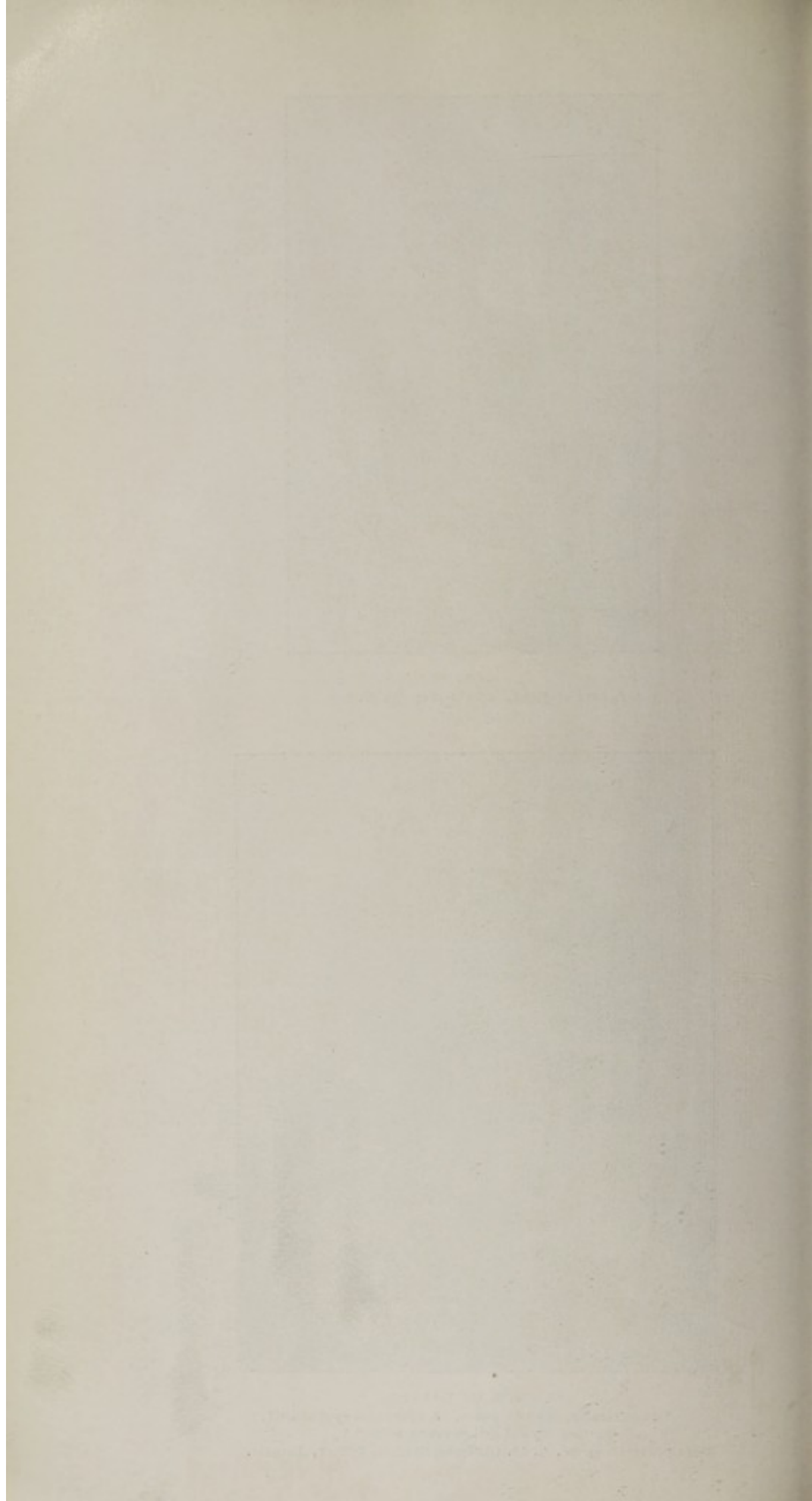
No other pathological changes were noted.



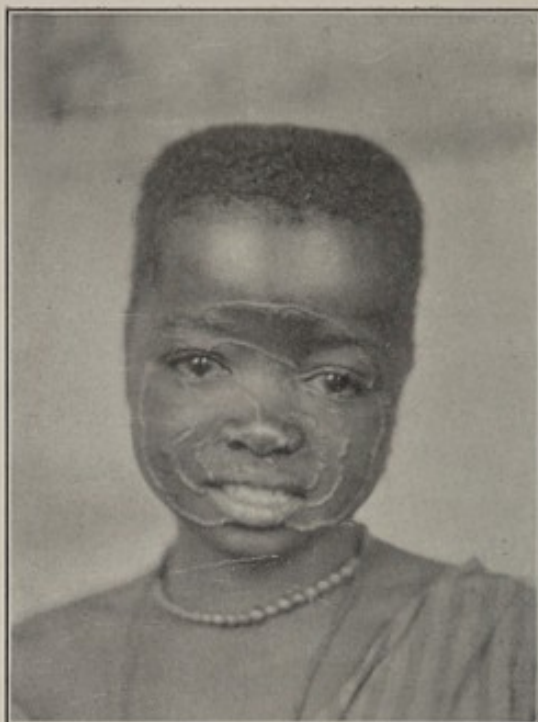
WA.
A case of Yaws. Florid eruption on face.



TUMOUR OF LARYNX.
(African female, aged 45 years. A squamous epithelioma
showing typical cell nests in section.)
Case reported by Dr. A. M. Gillespie, Medical Officer, Tamale.







A STRIKING SKIN MANIFESTATION (? YAWS).

A first glance suggested tribal markings.

It cleared up in a week after '3 N.A.B. and local treatment.

Case of Dr. H. S. Townsend, Medical Officer, Axim.

Pathology.—The tumour was a squamous epithelioma showing typical cell nests.

IV. A case of Status Thymico-lymphaticus reported by Dr. A. M. Gillespie, Tamale.

Name, Huhu Dagomba; age two years; Male. Dagomba.

The History.—The child had been in good health and while at play about 4 p.m. on 7th November, 1929, became suddenly ill. It was feverish, had several "fits," the breathing suddenly became embarrassed and he died at 6.30 a.m. on 8th November, 1929. The body was brought to the mortuary in the course of the late afternoon of 8th November, 1929.

The body was somewhat flabby and the child was well developed for his age. Post-mortem rigidity was present. There were no enlarged glands. There was a blister two inches in diameter on the right side of the abdomen said to be due to a recent burn. On opening the thorax it was at once observed that the thymus was abnormally large. It extended downwards behind the sternum in front of the pericardium almost to the level of the diaphragm.

The intra abdominal lymphatic glands were enlarged and discrete. The external glands were not enlarged.

Heart.—The left ventricle was dilated.

Lungs.—The lungs were congested. There was no sign of compression of trachea.

Spleen.—Enlarged and firm. Smear preparation.

Smears from spleen showed numerous *P. falciparum*.

Liver.—The surface had the appearance of fine morocco leather. The organ was congested.

Kidneys.—The kidneys were congested.

The child had evidently had an attack of subtertian malaria on the evening before death and the symptoms of respiratory embarrassment lead one to believe that the sudden fatal termination of the illness may possibly have been due to some compression either of the trachea or of the vessels or nerves due to acute hyperaemia of the thymus gland and resulting in cardiac failure.

V. A case of dissecting Aneurysm of the ascending portion of the aorta terminating in hæmopericardium, reported by Dr. Gillespie, Tamale.

Name, Allasan Dagomba, aged 45 years. Dagomba.

The man had been troubled with shortness of breath on exertion for some time but had not paid much attention to the symptom. On 18th January, 1930, about 8 a.m. he was engaged in sweeping his compound when he was observed to fall suddenly on his face. His friends noticed he did not attempt to rise, and on going to his assistance found he was dead.

He had not complained of illness and seemed to his friends to be quite well on the morning of his death.

The body was brought to the mortuary and a post-mortem examination made at 9 a.m.

The body was well nourished with a slight tendency to obesity. There were no marks in the skin. The body was warm and post-mortem rigidity had not set in.

The lungs were healthy.

The pericardial sac was greatly distended and tense. On making an incision it was found to be full of blood. The visceral and parietal pericardium appeared healthy to the naked eye.

The heart was enlarged and there was a slight increase in the fat.

The heart with the ascending aorta were removed and on laying bare the aorta and the left ventricle it was observed that there were several depressed linear scars just distal to the aortic valves. The intima was split transversely on the anterior aspect and there was a dissecting aneurysm. The tract was followed downwards between the coats of aorta and found to open into the pericardial sac through the intrapericardial portion of the Aorta.

The aortic valve cusps were slightly thickened.

The wall of the left ventricle was hypertrophied.

The orifice of the right coronary artery was somewhat narrowed.

The spleen was small and firm.

The liver was moderately enlarged and extended two inches below the costal margin. The surface of the right lobe showed numerous fibrinous adhesions. The kidneys showed the naked eye changes of chronic interstitial nephritis.

The digestive tract showed no naked eye pathological changes. Dissecting aneurysm is not common, rupture into the pericardial sac less so and this case seems worth placing on record.

VII. The following case reported by Dr. V. J. G. MacGregor, Medical Officer, Zuarungu, is of some medico-legal interest:—

A CASE OF SUICIDE BY MEANS OF DISLOCATION OF THE FIRST CERVICAL VERTEBRA.

A Nankani was brought in having just died. His head and neck were in a very congested state. His mucous membranes were deeply cyanosed. He had had a dispute about the payment of "head-money" for his daughter and as the "money" (actually some cattle) was not forthcoming he became enraged, lowered his head and charged into the compound wall. He immediately fell unconscious and died in a minute or two.

Post-Mortem.—He was found to have dislocated his first cervical vertebra.

The evidence at the inquest was clear. There was no possibility of his having been knocked off the compound roof to the ground.

There were no external signs of violence.

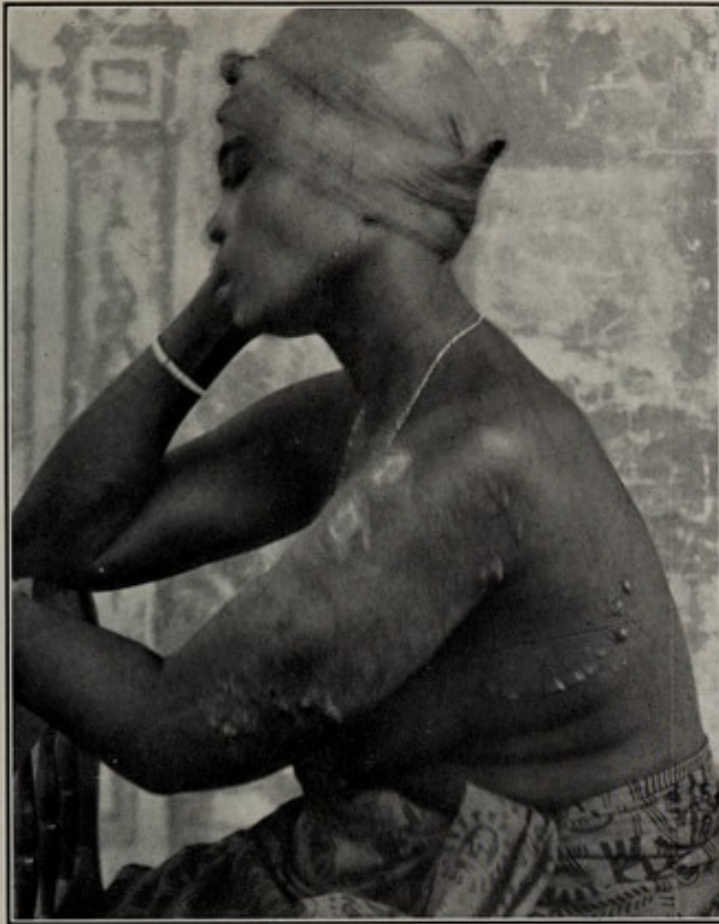
VIII. The following case, described by Dr. G. W. Vaughan, Medical Officer, Saltpond, was submitted to Miss G. M. L. Summerhayes, Woman Medical Officer, Maternity Hospital, Accra, for her views. Her comment follows the account of the case.

A CASE OF (?) ECLAMPSIA.

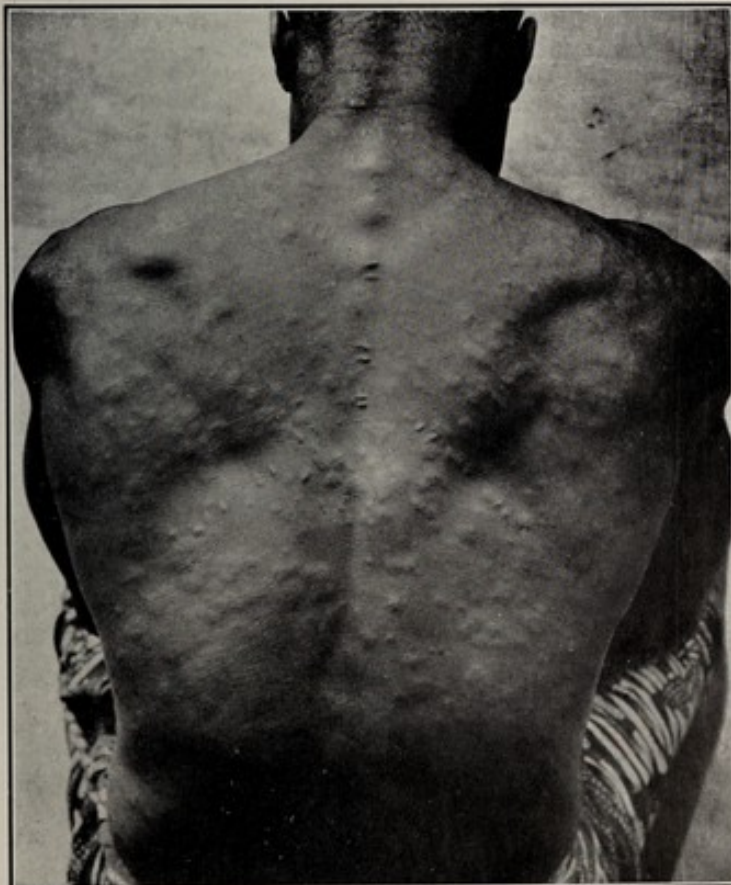
On 2nd November, 1929, I was called to see a patient in Saltpond. She was nine months pregnant, a primigravida and suffering from oedema of the legs and feet. A specimen of urine was taken and examined and found to be free from albumen. So far as I could ascertain there had been no diminution in the output of urine. Apart from oedema of the legs and feet, signs and symptoms were negative, and the patient looked and felt quite well.

The patient was put on a meat-free and salt-free diet and the relatives requested to inform me should she complain of nausea, abdominal pain or headache.

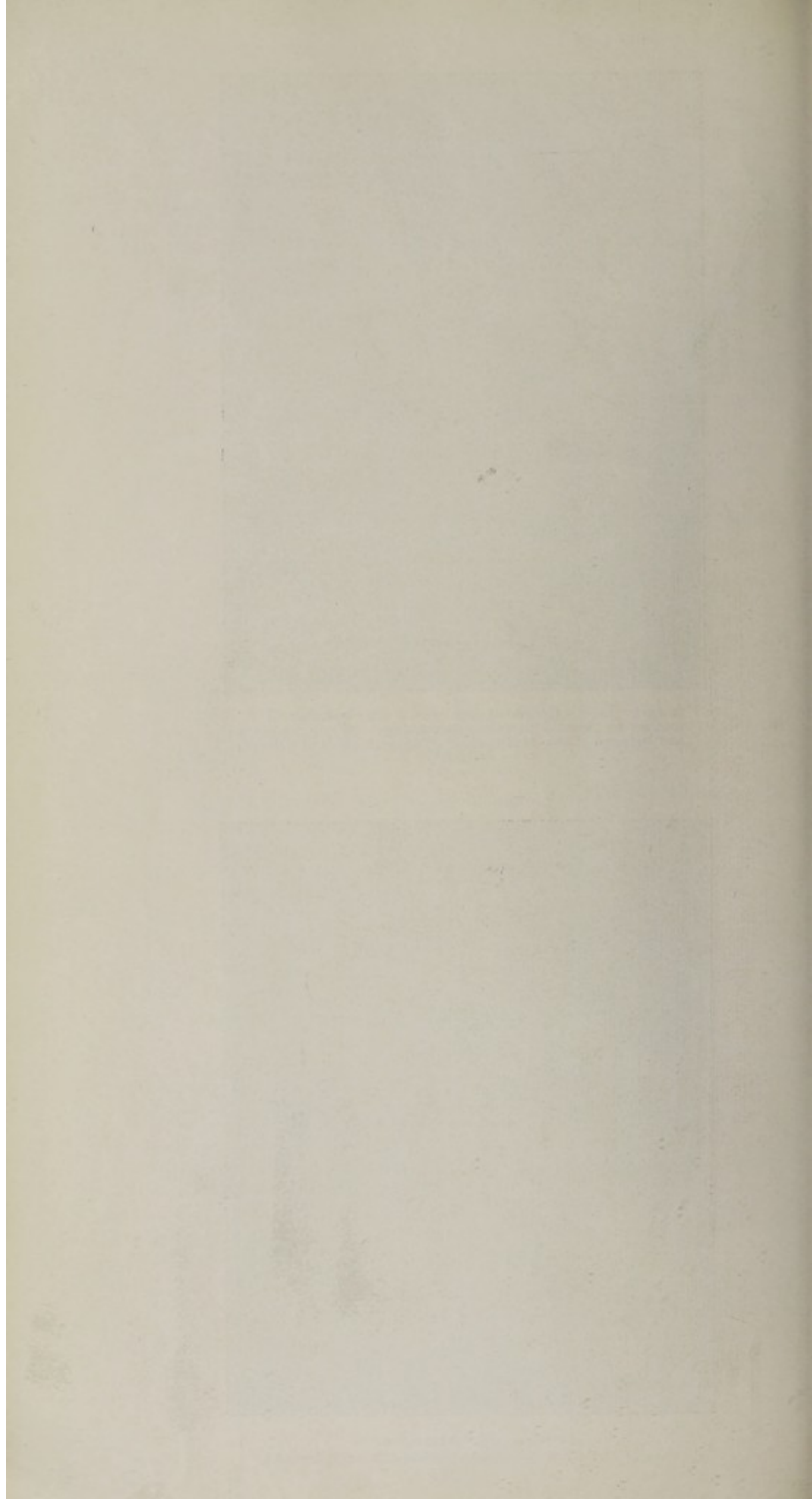
The patient was visited daily and mist. alba two ounces administered each morning. There was no fever; pulse was normal and urine normal. On Tuesday the 12th November, she complained of headache. Unfortunately I had to proceed to Winneba on the same day but returned



Herpes Zoster.—Occurring two weeks after vaccination (of interest in view of the connection between variola, varicella and herpes). Case of Dr. G. W. Vaughan, Medical Officer, Saltpond.



Urticaria after vaccination.
(Case of Dr. G. W. Vaughan, Medical Officer, Saltpond.)



on Wednesday morning the 13th and was informed by my dispenser that the patient had had nine or ten fits during the night the last fit being about 4 a.m. About 10 a.m. on 13th the child was born and during the birth the patient had a fit. The child was normal and was born normally, the whole labour only occupying about one hour from the onset of labour pains.

About a half-an-hour after the birth of the child the patient had another seizure and as the placenta had not come away I removed it manually. The uterus was douched out with hot pot. permang. 1-4,000. A soap and water enema was administered followed by 15 grs. Pot. Bromid., 15 grs.

Chloral hydrate, and 15 minims liquor morph. hydrochlor. per rectum in one pint normal saline.

A specimen of urine was taken and examined but was negative for albumen. The patient made an uneventful recovery.

The family history was negative for epilepsy.

Note on the above case by Miss G. M. L. Summerhayes, Woman Medical Officer, Maternity Hospital, Accra.

"The points of interest in this case are:—

1. *The occurrence of oedema, presumably of a pre-eclamptic nature with no albuminuria.*

Oedema is a symptom generally appearing earlier than albuminuria, the latter sometimes not being present till a short time before the first fit. But eclampsia with no concurrent albuminuria has only been very occasionally reported.

Cases of an albuminuric oedema were referred to in a recent medical publication (B.M.J., Apr. 26, 1930), as occurring amongst all classes of patients, men or women, but especially in debilitated, or pregnant women. This was said to be associated with an underlying acidosis. In such cases eclamptic fits might presumably occur before damage to the kidney made itself apparent by albuminuria.

2. *The number of fits with no bad result to mother or child.*

One of the points in determining the prognosis in eclampsia is the number of fits, any cases in which the fits number over seven being counted as severe.

In this case 11 fits occurred with no ill effects to mother or child.

I have seen other similar cases in this country, and women here seem peculiarly liable to fits during labour of a mild nature differing somewhat from the usual eclamptic convulsion. Some of these may possibly be due to native drugs, but another possible cause is the deficiency of calcium in the native diet.

The depletion of calcium salts in the maternal organism has been one of the many suggested causes of eclampsia. Although the theory is not accepted, a deficient calcium content of the blood leads to an increased nervous excitability, and therefore a diet poor in calcium may possibly be a factor predisposing to such fits."

APPENDIX H—(HEALTH BRANCH).

REPORT ON THE PRINCESS MARIE LOUISE HOSPITAL AND CHILD WELFARE CENTRE, ACCRA, FOR 1929-30.

Childrens' Clinic.

Table A shows a marked increase in the attendances throughout the year; the women have learnt to come to the clinic whenever they are in need of advice. It is satisfactory to note that all classes attend.

people from remote villages and wives of educated Africans. Every effort is made to give advice to the women on matters of hygiene and child welfare as well as treating the ailments of the children; unfortunately the large numbers attending make it impossible to give much time to each individual mother.

Each infant is weighed, and its temperature taken before seeing the Medical Officer. Voluntary assistance has been rendered by many European ladies in Accra, thus enabling accurate records to be kept of each infant's progress.

Malaria remains prevalent amongst the children both in Accra and out-lying villages. In addition to the 2,075 cases recorded many children suffering from other complaints had also definite clinical signs of malarial infection. A marked anæmia frequently accompanies the disease in young children. The question arises as to whether the routine exhibition of quinine in all cases with a palpable spleen, as is the practice at this clinic, is retarding the development of a natural immunity to malaria.

Yaws.—This disease is now rarely seen in children born and bred in Accra. Nearly all the cases come from out-lying villages for treatment—intramuscular injections of sodium bismuth tartrate are so effective that the children suffering from secondary lesions seldom return for a complete course. Consequently recurrent attacks are seen after an apparent cure.

It is noteworthy that out of 8,531 new cases examined no single case of rickets, rheumatic fever, scarlet fever or diphtheria were diagnosed, all diseases of common occurrence in England. Congenital deformities are rarely seen.

Vaccination for infants is becoming more popular, this is partly due to the work of voluntary visitors. Since the recent outbreak of smallpox in the Colony, children are frequently brought voluntarily by their parents for vaccination.

Number of vaccinations performed, 1,850.

IN-PATIENTS.

Number of cases admitted	...	...	368
Children of 1 year and under	...	...	183
Malarial parasites found in blood	...	...	165
Ascaris ova found in stools	...	...	34
Mother dead after parturition...	...	...	11
Premature twins	...	...	4
Premature triplets	...	...	3
Ophthalmia neonatorum	...	...	6
Icterus neonatorum	...	...	2
Pemphigus neonatorum	...	...	2
Tetanus neonatorum	...	...	4
Hydrocephalus	...	...	1
Congenital syphilis	...	...	4
Congenital heart disease	...	...	1
Teething	...	...	2
Marasmus	...	...	25
Malnutrition	...	...	15
Wrong feeding	...	...	1
Diarrhoea and vomiting	...	...	10
Enteritis	...	...	20
Dysentery	...	...	3 (1 Amoebic).
Helminthic infections	...	...	5
Debility	...	...	13
Constipation	...	...	1
Rectal prolapse	...	...	1
Acute conjunctivitis	...	...	12

Blepharitis	...	...	...	...	1
Stomatitis	...	...	...	...	7
Gingivitis	...	...	...	...	10
Cancrum oris	...	...	...	...	2
Thrush	...	...	...	...	2
Parotitis	...	...	...	...	1
Mastoiditis	...	...	...	...	1
Otorrhoea	...	...	...	...	1
Synovitis	...	...	...	...	1
Para-typhoid—B.	...	...	...	...	1
Jaundice	...	...	...	...	1
Typhoid	...	...	...	...	1
Pneumonia	...	...	...	...	13
Broncho-pneumonia	...	...	...	...	14
Croup	...	...	...	...	1
Bronchitis	...	...	...	...	22
Asthma	...	...	...	...	4
Pleurisy	...	...	...	...	1
Malaria	...	...	...	...	66
Schistosomiasis	...	...	...	...	2
Guinea-worm	...	...	...	...	2
Umbilical sepsis...	...	...	...	...	3
Ulcer	...	...	...	...	19
Abscess	...	...	...	...	7
Cellulitis	...	...	...	...	2
Ringworm	...	...	...	...	1
Impetigo	...	...	...	...	2
Septic foot	...	...	...	...	1
Septic toe	...	...	...	...	1
Septic finger	...	...	...	...	1
Cervical adenitis	...	...	...	...	2
Burn	...	...	...	...	6
Yaws	...	...	...	...	17
Meningitis	...	...	...	...	1
Nephritis	...	...	...	...	2
Convulsions	...	...	...	...	5
Fractured femur	...	...	...	...	1
Nocturnal enuresis	...	...	...	...	1
Tuberculosis of bone	...	...	...	...	3
Hæmorrhage from circumcision	...	...	...	...	1
Cases for observation	...	...	...	...	8

CAUSES OF DEATHS.

Bronchitis	...	...	...	...	1
Broncho-pneumonia	...	...	...	...	7
Pneumonia	...	...	...	...	6
Convulsions	...	...	...	...	1 (Triplet)
Tetanus neonatorum	...	...	...	...	4
Malaria	...	...	...	...	4
Para-typhoid—B and Br. pneumonia	...	...	...	...	1
Pertussis and malaria	...	...	...	...	1
Congenital syphilis	...	...	...	...	1
Nephritis	...	...	...	...	1
Meningitis	...	...	...	...	1
Malaria and enteritis	...	...	...	...	2
Gastro-enteritis	...	...	...	...	1
Dysentery	...	...	...	...	1
Prematurity	...	...	...	...	2 (1 twin)
Icterus neonatorum	...	...	...	...	1
Debility	...	...	...	...	1

Debility and anæmia	...	...	...	...	1
Cancrum oris	...	...	...	...	1
Pyæmia	...	...	...	...	1
Malnutrition	...	...	...	...	5
Marasmus	...	...	...	...	11 (1 twin 1 triplet)
Malnutrition and convulsions	...	...	...	...	1
Hæmorrhage from cord	...	...	...	...	1

57

Table B shows a marked increase in the number of children admitted to the wards. By the addition of "treasure-cots" for infants the number of beds has been increased from 16 to 20—it is still not possible to provide accommodation for all requiring treatment.

Frequently patients have to be discharged too soon to make room for more acute cases. As most of the infants are breast-fed the mothers are allowed in the wards at most times of the day; this adds considerably to the difficulties of the nursing staff but should be of value in teaching simple hygiene to the women. Efforts have been made to institute wet-nursing for motherless infants but the women are resistant to the idea even when good pay is offered.

MOTHER WELFARE.

Ante-Natal Clinics.

Number of women examined—

Primiparae	...	...	...	...	8
Not pregnant	...	...	...	...	46
Brought by native midwife	...	...	...	...	43
Deliveries reported	...	...	...	...	55
Advised to attend Maternity Hospital	...	...	...	...	12
History of miscarriages	...	...	...	...	125
History of yaws	...	...	...	...	147
History of yaws treated previously	...	...	...	...	29
History of yaws with W +	...	...	...	...	95
Albuminuria	...	...	...	...	5
Nausea and vomiting	...	...	...	...	12
Breech presentation	...	...	...	...	2
Ovarian cyst	...	...	...	...	1
Mastitis	...	...	...	...	2
Miscarriages	...	...	...	...	6
Twins	...	...	...	...	5
Stomatitis	...	...	...	...	5
Pyorrhœa	...	...	...	...	2
Dental caries	...	...	...	...	1
Constipation	...	...	...	...	60
Skin lesions	...	...	...	...	7
Cardiac disorders	...	...	...	...	12
Bronchitis	...	...	...	...	14
Piles	...	...	...	...	2
Varicose veins	...	...	...	...	1
Septic finger	...	...	...	...	1
Number of Wassermann reactions	...	...	...	...	415
Number of Wassermann reactions positive	...	...	...	...	150

The ante-natal clinics held twice a week have been fairly well attended. Until the last two months there has been no African midwife attached to the centre which has prevented the development of a midwifery practice.

The European sister has delivered five cases, and paid 646 visits to women during the puerperium. The car purchased for the hospital for the sister's transport and for midwifery visiting has been a great asset.

The general health of the women attending the clinic was good; the majority complaining of minor ailments such as vague abdominal pains and constipation. The small number complaining of vomiting and nausea is partly accounted for by the fact that the women do not as a rule attend until at least half way through pregnancy.

Septic mouth conditions, hæmorrhoids and varicose veins are rarely seen, conditions which account for so much ill-health during pregnancy at home. It is noteworthy that many women with strongly positive Wassermanns have produced apparently healthy children with often no history of even a miscarriage. It may be assumed in these cases that the blood reaction is due to yaws and not to syphilis. Intravenous injections of N.A.B. have been given to women with positive W. reactions, but unfortunately these attendances for treatment have been very irregular.

Owing to the lack of accommodation at the clinic, which was designed only for child welfare work, ante-natal cases requiring special treatment have to be referred to the Maternity Hospital.

Nursing Staff.

European Nursing Sister	...	...	1
Nurses-in-Training	...	...	6
New Nurses	...	...	2
Transferred to Welfare Centre at Kumasi			2
Transferred to Gold Coast Hospital for six months	...	...	1

Two lectures are given every week, one by the Medical Officer and one by the Nursing Sister. Some of the nurses have shown a keen interest in their work. With 20 small children to nurse the ward work is heavy.

Sister Audric, who has been at the hospital throughout the year has effectively dealt with a much increased number of patients both in the wards and in the out-patient treatment room.

Gold Coast League for Maternity and Child Welfare.

The League continues to do useful work in bringing together African and European ladies interested in welfare work. The voluntary visiting in the homes of the people continues, though frequent breaks occur owing to workers going on leave or to sickness.

Several meetings have been held during the year when lectures and demonstrations were given by Medical Officers.

One very successful baby show was organised.

M. C. CHAPPEL,
Woman Medical Officer.

APPENDIX.

TOTAL ATTENDANCES.

Out-Patients.

TABLE " A "

			1927-28.	1928-29.	1929-30.
April ...	...	...	1,178	1,320	1,963
May ...	...	...	998	1,397	2,130
June ...	...	...	960	1,711	2,098
July ...	...	...	1,110	1,694	2,518
August ...	...	...	996	1,543	2,403
September ...	...	...	1,233	1,556	2,398
October ...	...	...	1,270	1,360	3,308
November ...	...	...	1,465	1,301	2,568
December ...	...	...	1,897	1,340	2,173
January ...	...	...	1,683	1,876	2,402
February ...	...	...	1,423	1,778	2,227
March ...	...	...	1,549	2,062	2,714
Total	...	...	15,762	18,938	28,902

In-Patients.

TABLE " B ".

			1927-28.	1928-29.	1929-30.
April ...	...	...	15	15	29
May ...	...	...	38	22	18
June ...	...	...	22	25	32
July ...	...	...	26	13	34
August ...	...	...	21	17	36
September ...	...	...	22	16	34
October ...	...	...	18	20	34
November ...	...	...	27	25	31
December ...	...	...	17	26	24
January ...	...	...	21	32	29
February ...	...	...	18	24	32
March ...	...	...	21	26	35
Total	...	...	266	261	368

APPENDIX.

ANTE AND NEO-NATAL.

Table " C ".

NEW CASES.

			1927-28.	1928-29.	1929-30.
April ...	...	...	—	49	53
May ...	...	...	—	45	45
June ...	...	...	41	40	43
July ...	...	...	31	34	46
August ...	...	...	31	36	35
September ...	...	...	45	34	43
October ...	...	...	35	27	54
November ...	...	...	61	16	25
December ...	...	...	51	37	31
January ...	...	...	38	37	66
February ...	...	...	62	44	40
March ...	...	...	57	49	63
Total	...	...	421	448	544

OLD CASES.

			1927-28.	1928-29.	1929-30.
April ...	...	...	—	—	51
May ...	...	...	—	—	45
June ...	...	...	—	—	39
July ...	...	...	—	—	38
August ...	...	...	—	—	37
September ...	...	...	—	—	33
October ...	...	...	—	17	32
November ...	...	...	—	15	42
December ...	...	...	—	26	27
January ...	...	...	—	39	30
February ...	...	...	—	39	49
March ...	...	...	—	52	43
Total	...	...	—	188	466

APPENDIX.

TOTAL ATTENDANCES.

Ante and Neo-natal.

TABLE "D."

			1927-28.	1928-29.	1929-30.
April ...	...	...	—	83	157
May ...	...	...	—	87	152
June }	...	...	41	78	123
July }	...	...		50	128
August ...	...	...	31	63	106
September ...	...	...	45	72	115
October ...	...	...	38	44	157
November ...	...	...	72	44	110
December ...	...	...	62	76	94
January ...	...	...	57	112	160
February ...	...	...	122	107	148
March ...	...	...	102	130	150
Total	...	...	570	946	1,600

TABLE "E".

<i>Vaccinations.</i>	<i>Vaccination attendances.</i>
----------------------	---------------------------------

			1929-30.	1929-30.
August ...	...	...	151	—
September ...	...	...	253	—
October ...	...	...	260	1,095
November ...	...	...	270	417
December ...	...	...	184	10
January ...	...	...	81	90
February ...	...	...	107	79
March ...	...	...	142	159
Total	...	...	1,448	1,850

APPENDIX I. (HEALTH BRANCH).

ANALYSIS OF THE MORE IMPORTANT CONDITIONS TREATED IN THE
OUT-PATIENT DEPARTMENTS OF THE CHILD WELFARE CLINICS DURING
1929-30.

Disease.	Male.	Female.	Total.	Ratio to diseases due to all causes.
Yaws	5,850	4,957	10,807	24.1
Malaria	4,157	4,104	8,261	18.4
Diseases of respiratory system	1,827	2,164	3,991	8.9
Diarrhoea and enteritis	1,187	1,034	2,221	4.9
Diseases of teeth gums and mouth	774	1,029	1,803	4.0
Diseases of the eye	811	845	1,656	3.7
Ulcers	785	808	1,593	3.5
Diseases of infancy	661	755	1,416	3.1
Constipation	494	573	1,067	2.3
Whooping cough	420	481	901	2.0
Parasitic skin diseases	374	410	784	1.7
Intestinal parasites	350	418	768	1.7
Dysentery	427	263	690	1.5
Injuries (external causes)	390	260	650	1.4
Pyrexia of unknown origin	181	180	361	0.8
Diseases of lymphatic system	141	134	275	0.6
Measles	96	99	195	0.4
Other conditions	3,575	3,746	7,321	16.3
Total	22,500	22,260	44,760	—

APPENDIX J. (HEALTH BRANCH.)

Maternal Welfare.
Visits and Deliveries.

Child Welfare.
Health Visits.

1929-30.

Station	Visits.	Deliveries.		Number of domiciliary visits.	
		Woman Medical Officer.	Midwives.	Woman Medical Officer.	Health Visitors.
Accra	4,044	—	57	826	2,055
Kumasi	2,158	9	18	206	548
Sekondi.	6,553	9	23	464	2,442
Cape Coast	—	1	—	305	1247

APPENDIX K.
(HEALTH BRANCH).

MEDICAL EXAMINATION OF SCHOOL CHILDREN.

RETURN OF SCHOOL CHILDREN EXAMINED FOR THE YEAR 1929-30.

Number examined—Boys 742 } Total 1,078
Girls 336 }
Number found defective—Boys 565 } Total 836
Girls 271 }

SUMMARY OF ORGANS AFFECTED, ETC.

No.	Number.	Male.	Female.	School.	Spleen.	Heart.	Lungs.	Debility.	Skin.	Mouth and Teeth.	Throat and Tonsils.	Ears.	Eyes.	Glands.	Nervous System.	Parasites.	Yaws (a).	Yaws (p).	Deformities.	Unvaccinated.
149	82	67	15	St. Mary's School	59	4	5	28	43	33	42	1	6	150	—	29	—	9	20	73
110	98	12	86	Royal School	48	6	5	20	33	22	26	1	1	135	—	21	6	17	63	11
132	72	60	12	Wesleyan Mission School	60	9	7	31	15	44	42	2	1	136	2	25	1	6	44	64
74	50	24	26	Baptist Mission and Collegiate	25	1	6	9	26	13	26	3	4	56	—	13	12	14	—	21
73	—	73	—	Wesleyan Girls' High School	17	1	2	3	6	5	20	—	—	22	1	12	—	2	33	8
135	104	31	73	Labadi Presbyterian Mission—Junior	44	3	1	33	24	9	47	—	9	118	2	42	13	29	52	38
70	45	25	15	Labadi Presbyterian Mission—Infant	26	4	5	19	10	21	28	—	1	74	1	32	2	6	15	45
166	122	44	78	Teshi Presbyterian Mission—Junior	65	10	16	25	90	35	39	5	3	22	—	103	14	32	51	97
21	21	—	21	Teshi Presbyterian Mission—Senior	10	1	—	1	7	1	8	—	1	15	—	5	2	8	9	8
148	148	—	148	Adabraka Government Infant	80	8	5	2	21	21	10	—	7	47	—	57	1	1	6	5
Total ..	1,078	742	336		434	47	52	171	275	204	288	12	33	975	6	339	51	124	283	370

APPENDIX L.
(HEALTH BRANCH).
SCHOOL MEDICAL INSPECTIONS, ACCRA.

ANALYSIS OF CONDITIONS FOUND.

Total number examined 1,078, period April, 1929–March, 1930.

		Number.	Per centage	
VACCINAL CONDITION :—	G	495	—	Total 495 or 45.9 per cent.
	F	204	—	Total 204 or 18.9 per cent.
	N	370	—	Total 370 or 34.3 per cent.
DEVELOPMENT :—	1	1,050	—	Total 1,050 or 97.4 per cent.
	2	26	—	Total 26 or 2.4 per cent.
NUTRITION :—	1	893	—	Total 893 or 82.8 per cent.
	2	175	—	Total 175 or 16.2 per cent.
	3	11	—	Total 11 or 1.0 per cent.
SKIN :—	Ringworm ..	16	—	Total 275 or 25.5 per cent.
	Itch	31	—	
	Others	328	—	
GLANDS :—	Sub	474	—	Total 975 or 90.4 per cent.*
	Ax	90	—	
	Cer	41	—	
	Gr	365	—	Total 644 or 59.6 per cent.
	Parotids ..	5	—	
SPLEEN :—	N	644	644	
	+ 1	324	—	Total 434 or 40.2 per cent.
	+ 2	81	—	
	+ 3	3	—	
	+ 4	26	—	Total 339 or 31.4 per cent.
PARASITES :—	Q	—	—	
	BT	—	—	
	MT	339	—	
	R	—	—	
	Cr	—	—	
	Sch	—	—	Total 135 or 12.5 per cent.
	Gam	—	—	
MOUTH AND TEETH :—	1	135	—	
	2	59	—	Total 59 or 5.4 per cent.
	3	10	—	Total 10 or 0.9 per cent.
NOSE AND THROAT :—	T. Enl. ..	288	—	Total 288 or 26.7 per cent.
	A	—	—	
	Other Defects ..	—	—	
EAR :—	Otorrhoea ..	8	—	Total 12 or 1.1 per cent.
	Deafness ..	—	—	
	Other Diseases ..	4	—	
EYE :—	External disease	33	—	Total 33 or 3.0 per cent.
VISION :—	Good	598	—	Total 598 or 55.4 per cent.
	Fair	28	—	Total 28 or 2.5 per cent.
	Bad	17	—	Total 17 or 1.5 per cent.
	Cannot Read ..	435	—	Total 435 or 40.3 per cent.
HEART AND CIRCULATION :—	O	16	—	Total 47 or 4.3 per cent.
	F	30	—	
	Cong. M.C. ..	—	—	
	An	1	—	Total 51 or 4.7 per cent.
LUNGS :—	Br.	50	—	
	Emph	1	—	
	Asth	—	—	
	Pl	—	—	
	Ph	—	—	
TUBERCULOSIS :—	?Ph	4	—	Total 4 or 0.3 per cent.
	Ph	—	—	
	Tb. Gl	—	—	
	Tb. bones ..	—	—	
	Tb. spine ..	—	—	
	Tb. hip	—	—	
	Other forms ..	—	—	

*77 per cent constituting actual defect.

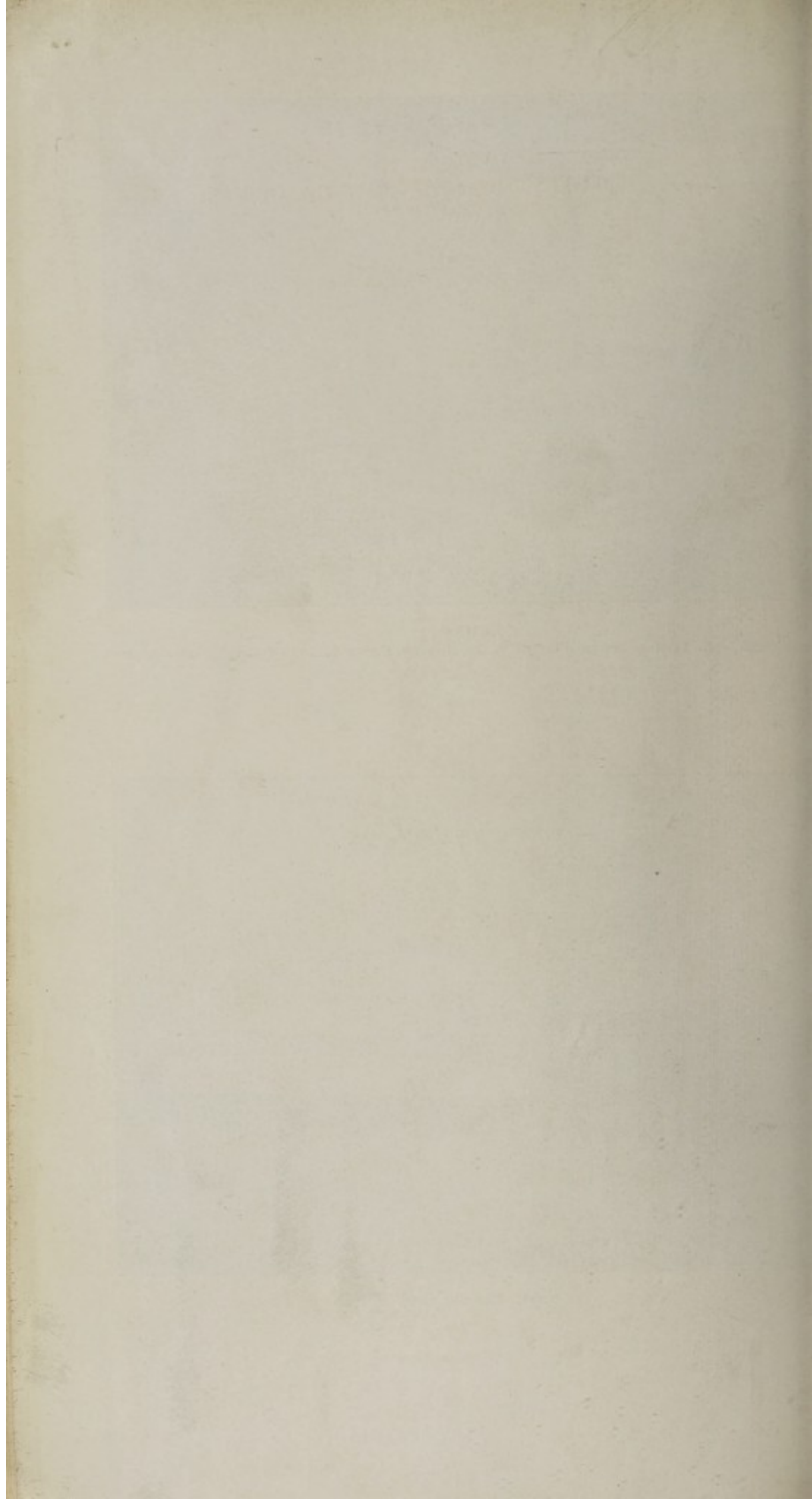
		Number.	Percentage.	
NERVOUS DISEASES :—	Pr	—	—	} Total 6 or 0.5 per cent.
	Ch	—	—	
	Ep	—	—	
	Polio	2	—	
	Others	4	—	
DEFORMITIES :—		283	—	
YAWS :—	1	27	—	Total 27 or 2.5 per cent.
	2	22	—	Total 22 or 2.0 per cent.
	3	78	—	Total 78 or 7.2 per cent.
	Having had	48	—	Total 48 or 4.4 per cent.

APPENDIX M.

(HEALTH BRANCH.)

RETURN OF DISEASES AND DEATHS (IN-PATIENTS) FOR THE YEAR
1929-30 IN CONTAGIOUS DISEASES HOSPITALS IN THE GOLD COAST.

Diseases.	Total new cases treated, 1929-30.	Total deaths, 1929-30.	Remarks.
1. <i>Epidemic, endemic and infectious diseases.</i>			
Smallpox	280*	105*	*Most of the <i>smallpox</i> cases were treated in scattered "bush hospitals" over a wide area, only three of the full total were treated in established Contagious Diseases Hospitals.
Chicken-pox	352	—	
Pulmonary tuberculosis	32	21	
Yaws	23	—	
Measles	6	—	
Dysentery	1	1	
Trypanosomiasis	1	1	
Syphilis	2	—	
Leprosy	91	4	
Mumps	1	—	
2. <i>General diseases.</i>			
Beri-Beri	2	—	
3. <i>Affections of the nervous system.</i>			
Mental alienation	2	1	
4. <i>Affections of the circulatory system.</i>			
Lymphadenitis	1	—	
Phlebitis	1	—	
5. <i>Affections of the respiratory system.</i>			
Bronchitis	3	—	
Pneumonia	4	2	
Pleurisy	1	—	
7. <i>Diseases of the urinary system.</i>			
Urethral stricture	1	1	
9. <i>Diseases of the skin and cellular tissue.</i>			
Cellulitis	3	1	
Scabies	14	—	
Chiggers	2	—	
Ulcers	1	—	
10. <i>Diseases of the bones and organs of locomotion.</i>			
Arthritis	1	—	
14. <i>Affections produced by external causes.</i>			
Insect bites	1	—	
Hunger and exposure	23	12	
Contacts	39	—	
Total	888	149	
Remaining from 1928-29	106	—	Remaining 31st March, 1930.
Grand Total	994	149	86

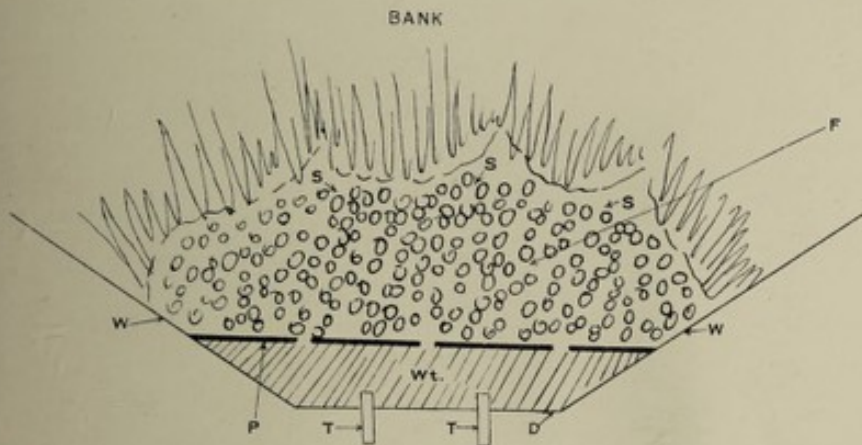


APPENDIX N.

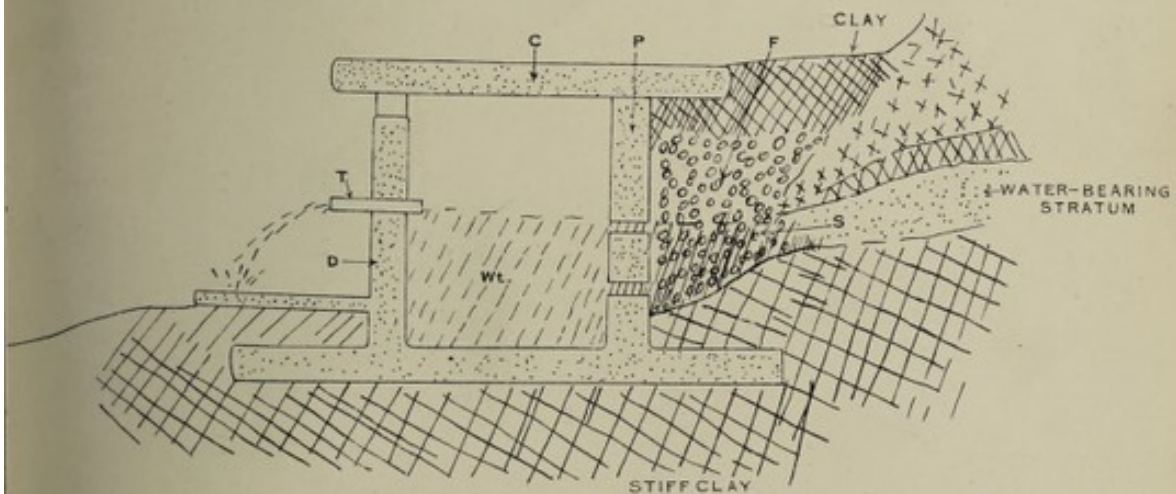
WEST SUBIN HEAD SPRINGS, KUMASI.

I.

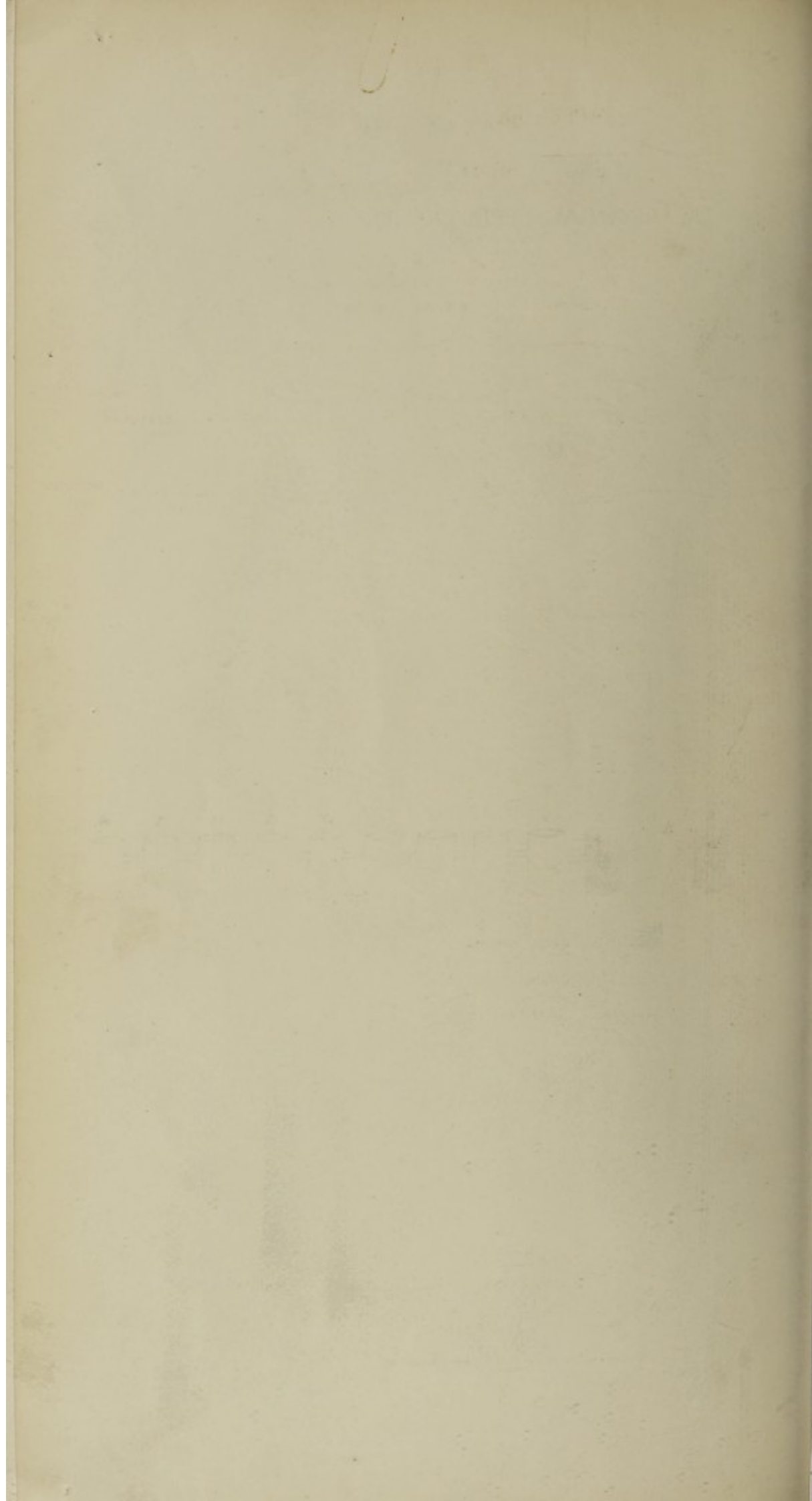
"BIRD'S-EYE" VIEW OF SPRINGS & CONCRETE
WORK WITH COVER REMOVED.



II. SECTION



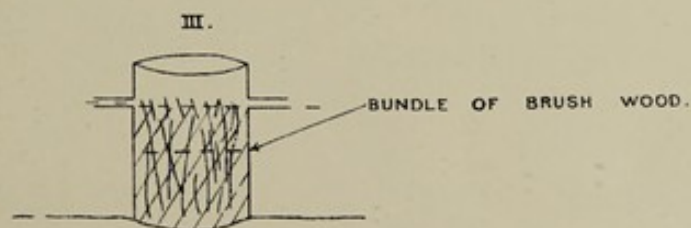
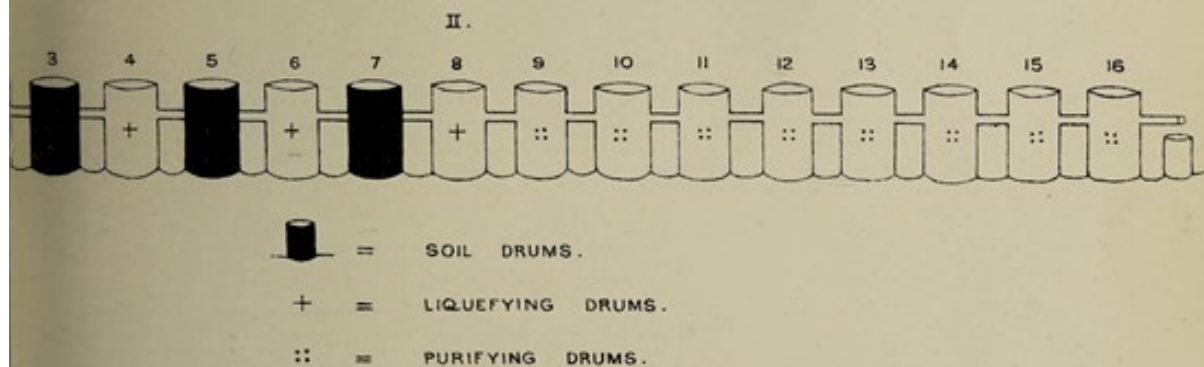
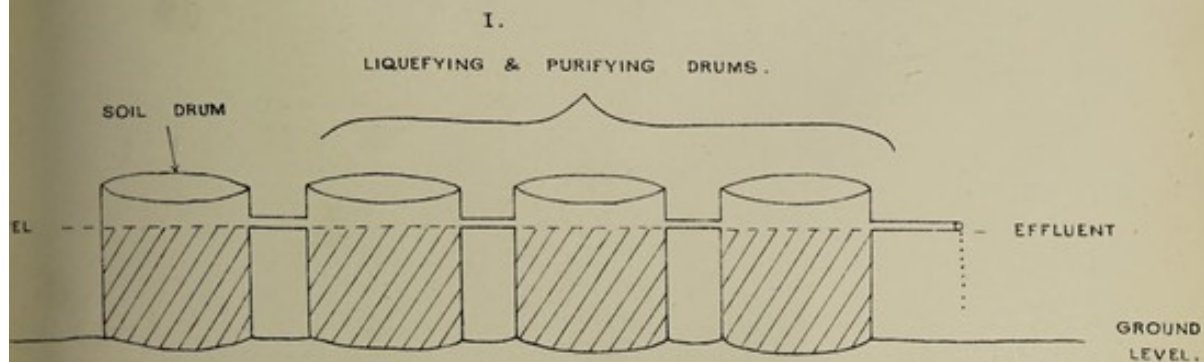
- S - SPRING
- F - FILTER
- W - WING-WALLS
- D - DAM
- Wt. - WATER RESERVOIR
- T - DELIVERY PIPE
- C - COVER
- P - PERFORATED WALL

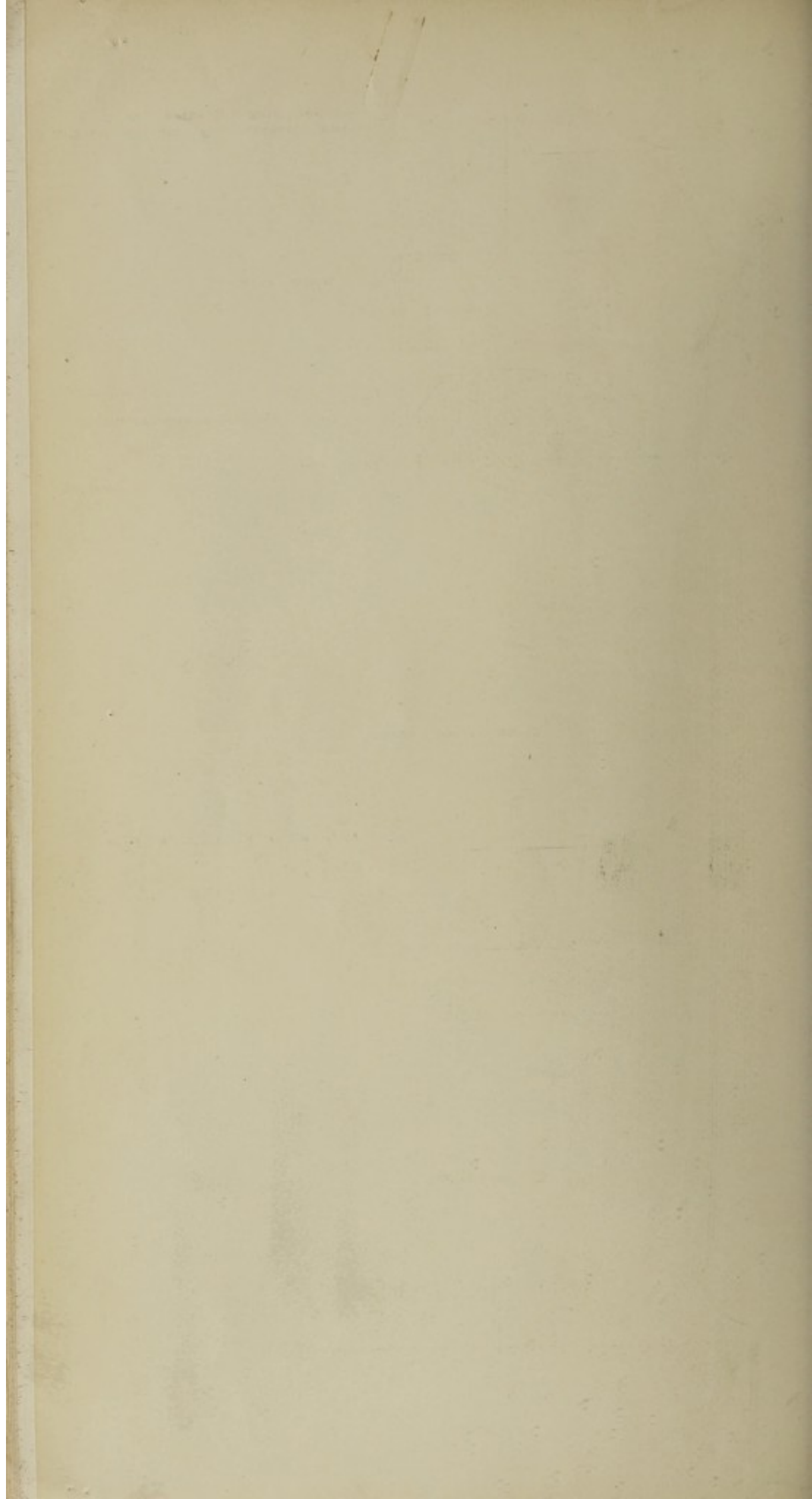


APPENDIX O

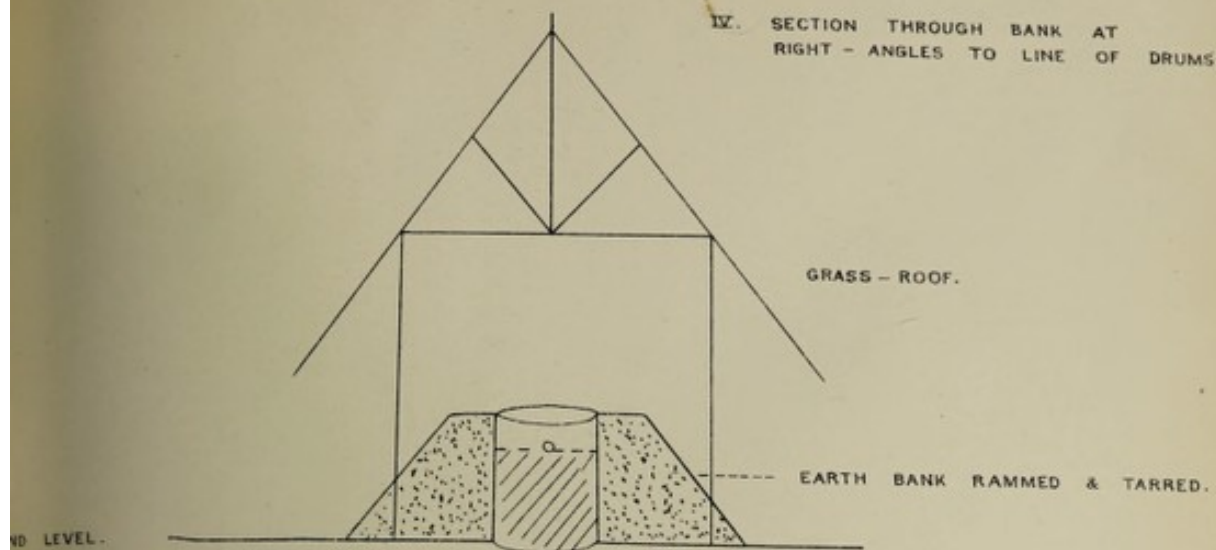
HEALTH BRANCH

EXPERIMENTAL SEPTIC LATRINE.

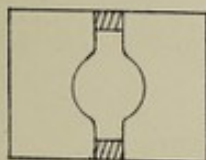




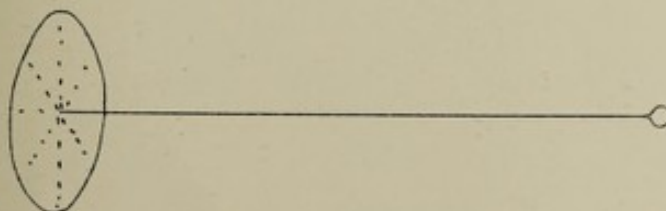
IV. SECTION THROUGH BANK AT
RIGHT - ANGLES TO LINE OF DRUMS.

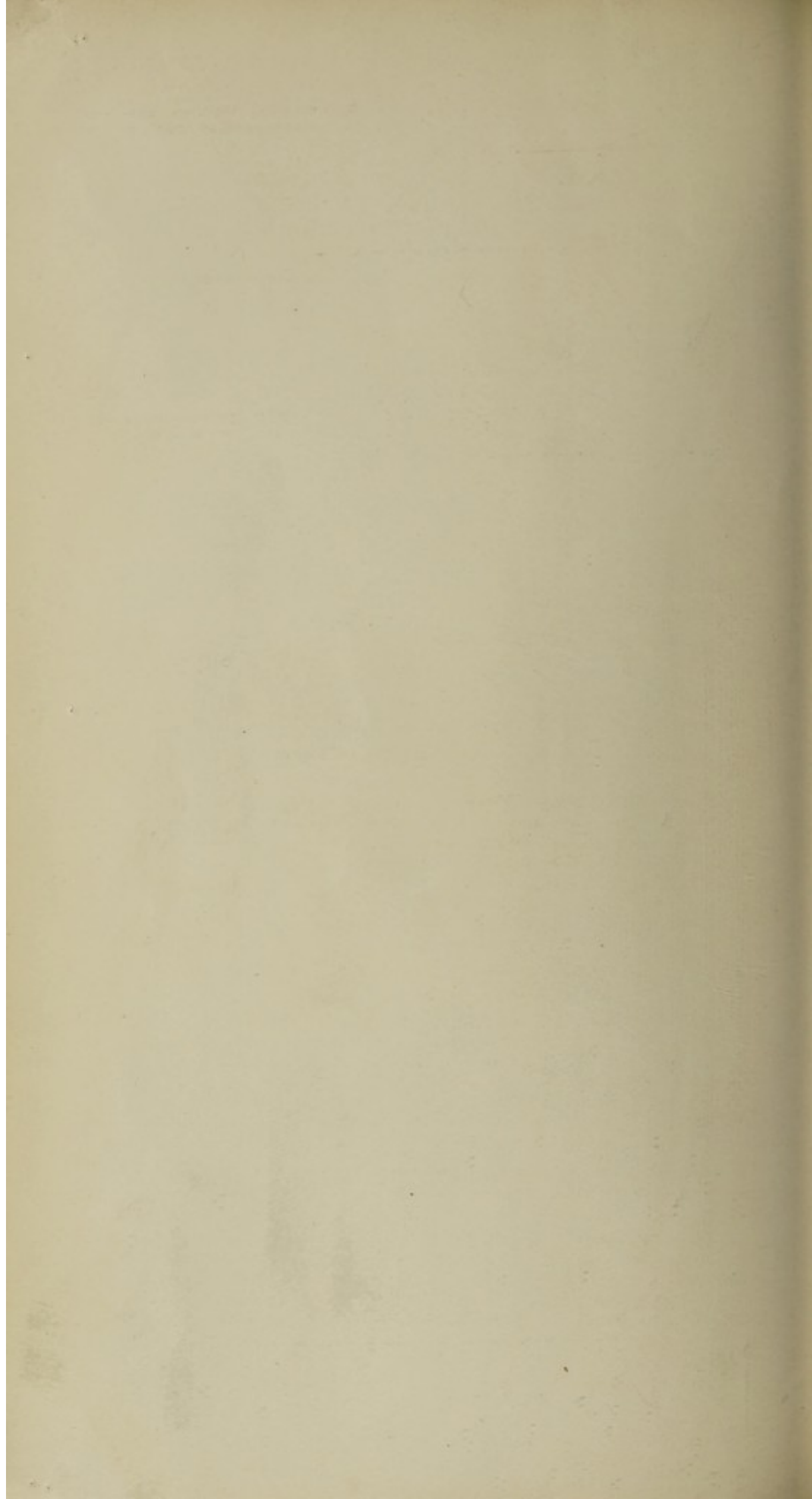


V. SQUATTING - BOARD.



VI. MACERATOR.





was slower and not so complete as if it occurred in a series of semi-separate cells, i.e. that the various processes would effect their purposes better if they had—as it were—a cell of their own.

This, it is thought, has been borne out. The various processes appear sharply defined in the series of drums.

There is a sharp definition when the scum disappears, when all faecal characteristics are lost and when the fluid becomes non-offensive.

3. The system is very simple. A number of ordinary coal-tar drums is linked-up in series by 1' lengths of 2" iron piping. The last drum in the series having an effluent pipe; Fig. I.

This work was done by a fitter of the Public Works Department at a cost of £3 10s., the piping being provided for the work. These linked-up drums are placed on level ground, the fluid "decanting" over from drum to drum. It was found from experiment that for every drum used as a "soil drum" three "purifying-drums" were required. In the latrine illustrated there are four drums used for the deposition of night soil and 12 purifying-drums; Fig. II.

The liquefying drums are placed next to each soil drum. Each purifying drum, with the exception of the last, is filled with a loose filter of cut "brush-wood" lashed together with "tie-tie" to form a loose sheaf thus; Fig. III.

All connections between the drums take-off at some 9" below the top of the drum.

4. The drums are "banked in" with earth as far as the 8th drum, i.e. to include the four soil and liquefying drums. The remainder of the drums stand in the open and are merely covered with a few sheets of corrugated-iron.

The users enter the latrine up an easy ramp.

The actual latrine house is simply constructed with rough bush-wood and galvanised iron roof.

The screen walls are simply "swish"; or a better method than this is to discard the screen-walls and to bring the roof well down to protect the slopes of the bank. The roof can quite well be made of grass. The platform and slopes of the earth bank are rammed hard, washed over to give a smooth surface and tarred; Fig. IV. Over the tops of the soil-drums "squatting-boards" are placed. These are quite loose and fixed in no way. They are rendered impervious by treatment with crude oil or tar; Fig. V.

The liquefying drums are simply covered with a piece of old galvansied iron kept in place by a large stone.

5. *The Latrine in use.*—When the construction of the latrine has been completed the whole series of drums is filled with water and a catch-drum placed under the effluent pipe. Near each of the "soil-drums" is placed a tin for the disposal of used cleansing material, e.g. sticks, stones, corn-cobs, and scraps of cloth, etc. In practice the latrine is practically fly-free. Flies are not attracted by the thick scum which forms on the surface of the fluid in the soil drums.

Care must be taken, however, to prevent mosquito-breeding in the purifying drums for as soon as the scum disappears mosquito-breeding will start.

In practice the surface of the fluid in the purifying drums is covered with a thick layer of crude oil. This appears in no way to interfere with the process. The effluent comes over at a very slow rate and daily it is poured back into the soil drums; in this way a kind of "reinforcement process" is brought into play. Water has to be added daily and is poured

into the first soil-drum. The amount of water added varies with the rate of evaporation and only the minimum required to keep the system full should be added.

In practice the effluent is odourless and is only slightly opalescent.

6. *Liquefaction*.—This takes place much quicker than was at first expected. At times, however, the scum becomes so tenacious that faeces lie on the top of it and do not fall through into the liquid. To obviate this a macerator was devised consisting of a heavy iron-plate mounted on a straight iron-rod Fig. VI. A few up and down strokes of this implement through the contents of the drum is sufficient to rectify this. This breaking-up process has only to be done at comparatively long intervals.

7. The greatest stumbling-block to this type of latrine is the indiscriminate addition to the contents of the soil-drums of indestructible cleaning material. This experimental latrine has only served Hausa people, who are very amenable to reason and easily got into touch with through their Sariki. Before it can be adapted to an Ashanti population some method must be devised to obviate this misuse.

If the users will deposit the material after use in the drums provided, these can be removed and dealt with periodically, but if thrown into the drums they speedily become filled and require emptying.

8. The latrine illustrated has been in use for over eight months without cleaning of any sort. It is used by approximately 35 to 40 people daily.

No effluent has had to be disposed-off as it is simply poured back into the soil-drums.

APPENDIX P. HEALTH BRANCH. MOSQUITO PROFING OF OFFICIALS QUARTERS 1929-30.

Province, etc.	Permanent quarters.	Temporary quarters.	Bush quarters.	No. partly protected.	No. completely protected.
Accra	240	4	—	18	—
Eastern province (other than Accra).	75	2	—	3	—
Central	51	19	4	—	1
Western	209	13	2	2	10
Ashanti	152	—	2	2	—
Northern Territories	39	22	—	17	—
Total	760	60	8	42	11

APPENDIX Q.
HEALTH BRANCH.

(1) SUMMARY OF BACTERIOLOGICAL EXAMINATION OF
WATER SAMPLES 1929-30, ACCRA.

Origin of sample.	Total number of samples.	Number without B. coli.	Number having B. coli in 100 cc but not in a less quantity.	Number having B. coli in 10 cc or less.	Percentage of samples having no B. coli in 100 cc.	Percentage for 1928-29 for comparison.
Storage Reservoirs ..	18	16	—	2	88.8	68.1
Filters.. ..	52	52	—	—	100	96.2
Taps in Accra ..	37	37	—	—	100	95.5

(2) SUMMARY OF BACTERIOLOGICAL EXAMINATION OF
WATER SAMPLES 1929-30, TAKORADI AND SEKONDI.

Origin of sample.	Total number of samples.	Number without B. coli.	Number having B. coli in 100 cc but not in a less quantity.	Number having B. coli in 10 cc or less.	Percentage of samples having no B. coli in 100 cc.	Percentage for 1928-29 for comparison.
Takoradi Harbour ..	39	34	4	1	87.1	12.5
Takoradi Residential Area	39	31	5	3	79.4	18.7
Laboratory Tap ..	38	36	2	—	94.7	30.7

- (1) With regard to the Accra Water Supply there is little to be said as there has been no modification with regard to plant or purification process during the year.

The uniformly excellent results, the best yet recorded, reflect the highest credit on the responsible officers.

- (2) The Sekondi and Takoradi supply although not showing the high standard of purity of that of Accra has manifested a remarkable improvement on the results of 1928-29.

Since the end of May, 1929, all samples taken have failed to reveal B. coli in 100 cc, i.e. for ten months out of the twelve.

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