Abridged annual report of the Medical Department / Nyasaland Protectorate.

NYASALAND PROTECTORATE.

ABRIDGED ANNUAL REPORT OF THE MEDICAL DEPARTMENT

For the Year ending 31st December, 1943.

PRICE 4/-

I. PUBLIC HEALTH.

A. GENERAL REMARKS.

Dr. T. A. Austin was appointed Director of Medical Services. On his arrival in the Protectorate on the 18th March, 1943, Dr. R. Calleja, O.B.E., Senior Medical Officer, who had acted as Director of Medical Services from the 29th June, 1942, reverted to his substantive appointment.

2. One senior medical officer, five medical officers and two nursing sisters remained seconded to the Army at the end of the year.

3. Dr. J. O. Creighton was granted permission to relinquish his commission in the East African Army Medical Corps and to resign from the Colonial Medical Service. Dr. D. A. Baird was appointed locally to fillt he vacancy.

4. Dr. W. A. Lamborn, O.B.E., relinquished his appointment as temporary medical officer. Dr. H. D. Cronyn, F.R.C.S., resumed duty in the Protectorate on the 11th May, 1943, his period of secondment to Cyprus having terminated. One retired officer, Dr. J. O. Shircore, C.M.G., and two refugee doctors employed in 1942 continued to serve as temporary medical officers.

5. Three nursing sisters resigned from the service; one was seconded to the Army. Four nursing sisters arrived from England on first appointment.

6. Four newly appointed sub assistant surgeons arrived from India to fill vacancies in the establishment.

7. The staff position improved steadily and before the end of the year postings were rapidly approaching normality. The leave conditions in force contributed towards this state as under existing regulations fewer officers are required for relief duty.

8. With a view to improving the standard of training of student hospital assistants and probationer dressers an additional medical officer was posted to the African Hospital, Zomba.

9. Owing to difficulties which arose in connexion with the provision of qualified medical staff and staff quarters, it was convenient to both parties to defer, until the 1st January, 1944, the arrangement whereby Government had agreed to undertake responsibility for the maintenance of the Church of Scotland Mission Hospital at Blantyre for African males and Asiatics.

10. Close liaison with military medical personnel continued to be maintained. The staff of the Medical Department examined several thousand recruits for Military Service and co-operated with the Military on health measures and the hospitalization of personnel. The D.A.D.M.S., Southern Sub-Area, paid two visits to Nyasaland during the year.

11. His Excellency the Governor appointed a committee under the Chairmanship of Mr. I. C. Ramsay, Labour Commissioner, to enquire into the social and medical aspects of the problem of venereal disease and to advise on the preventative and curative measures to be taken to control the spread of this group of diseases. The committee's investigations were not completed before the end of the year.

12. The bulk indenting system of medical stores was brought into operation during the year under review and the Medical Department is the sole importer of the Protectorate's requirements of drugs and hospital equipment. The full effect of this arrangement will not be apparent until 1944 but the extent to which assistance was rendered to medical missions and the public during 1943 is reflected in the increased revenue of £643 under sale of stores.

13. Owing to the need to conserve stocks of quinine for the treatment of malaria, restrictions on the use of this drug for prophylaxis were introduced on the 1st October, 1943. Permits to purchase quinine for prophylaxis are now limited to applications made on behalf of children under the age of ten years; persons over this age may be granted a permit if certified by a registered medical practitioner to be unable to take mepacrine. Adequate supplies of mepacrine were available to meet all demands and this drug is now in general use for prophylaxis and treatment. Totaquina tablets are available for sale to employers of African labour.

14. New buildings for the Medical Department have been completed at Ncheu, Kota Kota and Lilongwe, increasing the accommodation for African patients by ninety beds; a labour room at the Zomba African Hospital, an hostel and class room for compound inspectors in training for private estates, and a labour room for the European Hospital, Blantyre, were in course of construction at the end of the year.

15. Legislation—The following legislation affecting the Medical Department was enacted in 1943 under the Public Health Ordinance :—

(1) Proclamation No. 7 of 1943. Prevention of entry of yellow fever into the Protectorate.

(2) Proclamation No. 8 of 1943. Amendment to Proclamation No. 1 of 1938 : Prevention of entry of disease by air.

(3) Government Notice No. 120. Rabies (human) added to the First Schedule as a notifiable disease.

16. During his visit to the Protectorate in September, Sir Cosmo Parkinson, G.C.M.G., K.C.B., O.B.E., the Secretary of State's personal representative, was able to meet members of the staff and to see some of the activities of the Medical Department.

17. Finance—The total expenditure by the Medical Department in 1943 was £71,136 13s. 5d. an increase of £2,543 1s. 4d. on the expenditure for 1942. The total revenue was £6,177 2s. 11d., the amount being made up as follows :—

		£	s.	d.
Hospital Fees	...	2,807	15	9
Sale of Stores	...	3,267	10	2
Pathological Fees	...	38	17	0
Radiological Fees	...	63	0	0

Sales of quinine and mepacrine at post offices amounted to £1,689 17s. 1d. and £218 11s. 11d. respectively.

18. Yellow Fever—Legislation dealing with this disease has been amended in accordance with the recommendations of the Inter-Departmental Committee on Yellow Fever Control.

Aircraft arriving in this country are now required to make their first landing at Chileka aerodrome.

Nutrition Unit.

19. Dr. W. T. C. Berry, the Medical Officer attached to the Nutrition Unit, was transferred to other duties in July, 1943. A preliminary review of his investigations on tropical ulcer is published as an Appendix to this Report.

20. Rabies continued to be prevalent in some districts and persons who had been exposed to the risk of infection took advantage of anti-rabic treatment ; 62 courses of vaccine were issued.

21. There were no serious outbreaks of epidemic disease but the occurrence of a small epidemic of diphtheria at Kasungu, and sporadic cases in other districts, gave rise to some anxiety.

B. GENERAL DISEASES.

22. During the year 2,573 European and 181,030 African patients attended at Government hospitals (See Table A); of these, 531 Europeans and 22,376 Africans were treated as in-patients (See Table B), compared with 468 and 20,624 respectively in the previous year. Military personnel treated in civil hospitals totalled 91 Europeans and 391 Africans. Attendances at rural dispensaries decreased from 460,193 in 1942 to 445,348.

23. The relative proportion of the different groups of diseases to the total cases treated at Government hospitals (excluding rural dispensaries) remained similar to that of previous years. Infectious and parasitic diseases provided the greatest number of cases, 36,933, (20.12 per cent. of the total) and accounted for 36 per cent. of the deaths in Government institutions; diseases of the skin and cellular tissue (17.05 per cent.) followed. Affections produced by external causes (16.39 per cent.) and diseases of the respiratory system (15.55 per cent.) were responsible for approximately 13 per cent. and 10 per cent. respectively of the total in-patient deaths.

C. COMMUNICABLE DISEASES—BLOOD INOCULATION GROUP I.

Trypanosomiasis.

24. Ten new cases of sleeping sickness were reported with two deaths; one case recorded in 1942 relapsed and died in 1943. Seven of the new cases occurred in the endemic area of Kota Kota District; one case was reported from each of the following districts:—Mzimba, Blantyre, and Dedza. The patient admitted to Dedza hospital was a resident of South Nyasa District where he is believed to have acquired the disease. Surveys carried out in the areas where the cases occurred failed to disclose further infections.

Malaria.

25. The incidence of malaria in the group of infectious and parasitic diseases amounted to 36.7% in the year under review, and accounted for 16.2% of the deaths in the same group. 13,255 African and 316 European cases of malaria were reported; 143 of the latter were treated as in-patients at European hospitals.

111 cases of malaria were reported by the Medical Officer, European Hospital, Zomba, compared with 172 in 1942. The distribution of these cases was as follows:—

Township		District		Army Camps	
Officials	Non-officials	Officials	Non-officials	Military personnel	Families
20	13	1	17	55	5

Many members of the European community do not pay sufficient attention to personal prophylaxis as a means of preventing infection.

Four European cases of blackwater fever were reported with one death.

INTESTINAL AND EXCREMENTAL GROUP II.

Helminthic Diseases.

26. There was a marked decrease in the total number of cases of ankylostomiasis and schistosomiasis treated at hospitals but this cannot be ascribed to improved sanitation or better water supplies. 8,035 cases of ankylostomiasis were reported, compared with 11,078 in 1942 but admissions to hospitals for this disease increased from 2,274 to 2,302.

Out of a total of 4,879 cases of schistosomiasis reported, 999 were treated as in-patients, compared with 971 the previous year.

Ankylostomiasis and schistosomiasis are important causes of morbidity in some districts.

SURFACE INOCULATION AND DROPLET INFECTION GROUP III.

Diphtheria.

27. Very few cases of this disease have been recorded in previous Annual Reports. In 1943 there were 60 cases with 26 deaths; one fatal case occurred in an elderly European.

During the year under review, diphtheria made its first appearance in Kasungu District. The hospital assistant in medical charge of the district reported the occurrence of deaths which he suspected were due to this disease and investigations carried out by qualified staff confirmed that the diagnosis was correct. Ample supplies of serum were available and the outbreak subsided after 42 cases with 16 deaths had occurred. Delay in bringing cases for treatment contributed towards the high case mortality. At a later date sporadic cases appeared in other districts.

Native Authorities were advised of the importance of notifying, with the least possible delay, the occurrence of cases of a disease of the throat with which the people were not familiar and steps were taken to give the rural dispensary staff instruction on the signs and symptoms of diphtheria. Private medical practitioners and the staffs of mission medical centres were informed that sporadic cases of the disease were occurring.

Smallpox.

28. 13 cases were notified; there were no deaths. Twelve of the cases occurred in one village in Mlanje District. The disease was mild and owing to the steps taken to isolate cases and contacts the outbreak was localised.

The number of vaccinations performed during the year was 120,005 of which 68,483 were recorded as successful.

Leprosy.

29. At the close of the year there were approximately 950 persons suffering from leprosy in the various settlements maintained by Missions. In addition, 266 cases of leprosy were treated at Government hospitals, including 55 cases admitted as in-patients.

According to a census carried out by Native Authorities during the year there were 1,378 persons suffering from leprosy in the Northern Province and 2.131 in the Southern Province, apart from cases undergoing voluntary segregation in leprosy settlements. In the circumstances in which the census was taken these figures should be treated with the greatest reserve. It is probable that they include a number of burnt-out non-infectious cases, and that many early cases not showing obvious signs of the disease were excluded. The question of providing better and increased accommodation for leprosy patients is under consideration.

Cerebro-Spinal Meningitis.

30. This disease continues to be endemic. The number of cases reported in 1943 was 54 with 26 deaths, compared with 118 cases with 39 deaths in 1942. A large proportion of the deaths occurred in cases which came under treatment too late to benefit by modern therapy.

Tuberculosis.

31. This disease is considered to be increasing but it is not known, even approximately, what the incidence really is.

The pulmonary form of the disease does not always follow an acute course and provided that the co-operation of the patient is forthcoming, and the disease is not too far advanced, response to prolonged rest and treatment is not unsatisfactory. 497 cases of tuberculosis were reported during the year, compared with 326 in 1942. Of the 244 cases admitted to hospitals, 146 were suffering from the pulmonary form of the disease. 334 cases of non-pulmonary infections were reported. The extent to which tuberculosis of bovine origin occurs is unknown as typing of bacilli from human cases has not been attempted.

Venereal Disease.

32. The number of persons treated in Government hospitals for venereal disease totalled 4,854 compared with 5,255 in 1942; facilities are now available at Army Camps for the treatment of military personnel.

3,857 persons (males: 1,874; females: 1,983) were treated for syphilis during the year under review, compared with 4,110 (males: 2,025; females: 2,085) in 1942. (Primary stage, 677: Secondary 2,502: Tertiary 291: Congenital 265: stage not defined, 122). Serious features with regard to this disease are that a large proportion of the cases delay obtaining treatment until the disease has reached the secondary stage, and that the majority of patients will not submit to a complete course of treatment. They cease attending after the visible manifestations of the disease disappear. Patients are encouraged to remain in hospital until rendered non-infectious.

Gonorrhoea accounted for 973 of the cases of venereal disease reported (males 674: females 299): 533 persons were treated as in-patients. Indifference to this disease or, in the case of female patients, failure to recognise infection may account for the fact that gonorrhoea appears to be less prevalent than syphilis.

Yaws.

33. The decline in the number of cases attending for treatment at hospitals, continues; attendances at Port Herald and Karonga account for the majority of the cases reported at hospitals during the year.

Other Infectious Diseases.

34. There was the usual annual incidence among children of whooping cough and measles.

D. VITAL STATISTICS.

35. Registration of births and deaths of Africans is not compulsory, and so far as this section of the community is concerned, the collection of vital statistics is restricted to the census enumeration only.

36. Estimates of the population for 1943 are not yet available. The estimated populations in 1942 were Europeans: 1,851; Asiatics: 2,039; Africans: 2,114,654.

37. 244 European officials on the permanent staff were resident in the country during the year; 100 were placed on the sick list. The main causes of morbidity were malaria and influenza. There were three deaths among temporary officials. The causes of death were: Diphtheria 1; Cancer 1; Myocarditis 1. One officer on the permanent staff died from a gunshot wound. One officer was invalided from the service.

II. HYGIENE AND SANITATION.

Township Sanitation.

38. The two European Health Inspectors maintained control of the routine sanitary services operating in Limbe-Blantyre and Zomba. A sanitary survey of Lilongwe Township carried out during the year disclosed that conditions were unsatisfactory. Steps have been taken to prevent further deterioration.

The vote for anti-malarial measures having been increased appreciably in 1943 the reconstruction in permanent materials of certain sections of the Zomba anti-malarial drainage system was commenced. The banks of the stream which passes through the Botanical Gardens were canalized and 200 feet of brick drain and 1,200 feet of pre-cast concrete inverts were laid. Of some 12,000 trees planted in the 'Market Swamp' approximately 8,500 survived; the drainage of this area has been improved following the laying of 700 feet of brick drain and 1,400 feet of pre-cast concrete inverts.

The usual routine anti-malarial measures were continued at all stations.

Rural Sanitation.

39. Slow but steady progress has been maintained. Little or no compulsion is exercised on the African population, even where the law provides for it, for it is considered that more can be accomplished by obtaining the willing co-operation of the native than by coercing him to do things for which he can see no reason.

Labour Conditions.

40. The improvements in housing which have been effected in recent years by employers of labour in the Southern Province are a credit to them, and an increasing percentage of labour employed on tea estates can now be considered to be satisfactorily housed.

41. Recruiting by the Witwatersrand Native Labour Association was continued on a reduced scale during the year. The standard of fitness required is high and the medical practitioner employed by the Association in Nyasaland reports that of 5,144 natives examined, 828 were rejected. The main causes of rejection were poor physique and defective lungs.

42. Repatriated labour continued to arrive back from Southern Rhodesia. During the year 246 repatriates were medically examined on arrival at Blantyre. The main diseases which were stated to have caused repatriation are as follows :—

Leprosy	13
Tuberculosis, pulmonary	12
Epilepsy, dementia and other forms of mental disease	34
Fractures	14
Amputations	11
Arthritis	12

Cases requiring further treatment before proceeding to their homes were admitted to the Church of Scotland Mission Hospital, Blantyre.

Prisons and Lunatic Asylum.

43. The Central and district prisons are inspected once weekly as a routine by the Medical Officer or Sub Assistant Surgeon in charge of the district.

During the year a 4-bedded hospital ward was built within the precincts of the Lunatic Asylum to accommodate male patients, and a new block was completed for convalescent cases.

Records are maintained of the weights of inmates of the Central Prison and Lunatic Asylum. The percentage of inmates in both institutions who lost weight during 1943 was much below the figure for the previous year.

III. SPECIAL SERVICES.

Maternity and Child Welfare.

44. There has been no increase in the number of Government medical centres engaged in maternity and child welfare work.

Returns are not received from all Mission Centres undertaking this work but records available reveal that attendances continued to expand. During the year more than 1,900 maternity cases were admitted to Government and Mission institutions and some 1,600 African women had skilled attention during labour in their own homes, or in district centres in charge of African midwives.

The posting of African midwives to Government Hospitals has resulted in a steady increase in the number of normal labours reported. Abnormal labours still constitute a high proportion of the total cases admitted.

Hospitals, Dispensaries and Medical Laboratory.

45. Government maintains three hospitals for Europeans ; for Africans, 18 hospitals and 92 dispensaries ; and a hospital for Asiatics at Lilongwe designed to accommodate eight patients. The daily average number of African patients in hospital throughout the year was 1,067.

Special clinics for venereal disease are held at Blantyre and Limbe. Attendances at these clinics are increasing steadily.

X-ray Department.

46. 342 investigations were carried out during the year at the X-ray Department of the Zomba African Hospital. The thanks of the Medical Department are due to the Electrical Engineer, Public Works Department for his assistance in maintaining the apparatus, and advice on technical matters.

Mission Hospitals.

47. These institutions are a valuable adjunct to the Medical Services of the Protectorate.

Laboratory Services.

48. The Medical Laboratory functioned throughout the year; 8,787 routine and special bacteriological and pathological examinations of material were made. The medico-legal work undertaken at the laboratory included the examination of 26 specimens submitted by the Police Department; 22 post mortems were performed. Reports were made on 8 specimens of water and 43 specimens of various foodstuffs.

The supply of anti-variola lymph produced at the Vaccine Lymph Laboratory under the supervision of the Pathologist was more than sufficient for the requirements of the Protectorate. The cost of production was low. Revenue from sales of lymph amounted to £86.

The Pathologist continued teaching at the Medical School; four students were trained in laboratory technique and microscopy at the Medical Laboratory.

TRAINING OF MEDICAL AND HEALTH PERSONNEL.

49. The staff of the Zomba African Hospital was augmented towards the end of the year by an additional medical officer with previous experience in training of African personnel. Reorganization of the existing courses is under consideration with a view to providing probationer dressers and student hospital assistants with more practical and clinical, and less theoretical instruction.

The following were successful in passing the examinations conducted by the Nyasaland Medical Council, and were registered:—

(*a*) Eight Junior Hospital Assistants.

(*b*) Six Midwives.

Four dressers who had completed their second year of training, and four dressers who had been given a 'refresher' course, were posted to districts to fill vacancies.

Considerable difficulty is experienced in recruiting women suitable for training as nurses; during the year 10 nurses in training and 3 midwives resigned.

The course of training for Sanitary Assistants conducted by the Health Inspector at Zomba now extends over a period of two years.

GENERAL.

In conclusion I wish to record my thanks to the European, Asian and African personnel of the Medical Department for their willing service and loyal co-operation throughout the year.

T. A. AUSTIN,
Director of Medical Services.

TABLE A.—INCIDENCE OF DISEASES ACCORDING TO GROUPS.

(European and African Cases treated at Government Hospitals only).

	Diseases	Cases	Percentage of group to total cases
I.	Infectious and Parasitic Diseases	36,933	20.12
II.	Cancer and Other Tumours	337	0.18
III.	Rheumatism, Diseases of Nutrition and of Endocrine Glands and other General Diseases	2,555	1.40
IV.	Diseases of the Blood and Blood-forming Organs ...	272	0.14
V.	Chronic Poisoning	1	—
VI.	Diseases of the Nervous System and Sense Organs	17,115	9.33
VII.	Diseases of the Circulatory System	536	0.29
VIII.	Diseases of the Respiratory System	28,540	15.55
IX.	Diseases of the Digestive System	22,049	12.00
X.	Non-Venereal Diseases of the Genito-Urinary System and Annexa	905	0.49
XI.	Diseases of Pregnancy, Childbirth and the Puerperal State	547	0.30
XII.	Diseases of the Skin and Cellular Tissue ...	31 272	17.05
XIII.	Diseases of the Bones and Organs of Locomotion ...	5,250	2.85
XIV.	Congenital Malformations	12	0.05
XV.	Diseases of Early Infancy	76	
XVI.	Old Age	25	0.01
XVII.	Affections produced by External Causes ...	30,024	16.39
XVIII.	Ill-defined Diseases	7,154	3.85
	TOTAL ...	183,603	100.00

TABLE B.—INCIDENCE OF DISEASES AND DEATHS ACCORDING TO GROUPS.

(European and African In-Patients at Government Hospitals only).

	Diseases	European In-patients at Government hospitals		African In-patients at Government hospitals	
		Cases	Deaths	Cases	Deaths
I.	Infectious and Parasitic Diseases ...	195	2	10,192	140
II.	Cancer and Other Tumours ...	10	2	212	17
III.	Rheumatism, Diseases of Nutrition and of Endocrine Glands and other General Diseases	12	1	170	3
IV.	Diseases of the Blood and Blood-forming Organs	3	—	52	2
V.	Chronic Poisoning	—	—	1	—
VI.	Diseases of the Nervous System and Sense Organs	16	1	1,098	9
VII.	Diseases of the Circulatory System ...	19	1	176	18
VIII.	Diseases of the Respiratory System ...	36	—	1,215	42
IX.	Diseases of the Digestive System ...	109	—	901	29
X.	Non-Venereal Diseases of the Genito-Urinary System and Annexa ...	25	2	446	10
XI.	Diseases of Pregnancy, Childbirth and the Puerperal State	36	1	466	20
XII.	Diseases of the Skin and Cellular Tissue	14	—	3,772	13
XIII.	Diseases of the Bones and Organs of Locomotion	8	—	479	5
XIV.	Congenital Malformations ...	—	—	11	—
XV.	Diseases of Early Infancy ...	—	—	40	4
XVI.	Old Age	—	—	17	—
XVII.	Affections produced by External Causes	28	1	2,236	49
XVIII.	Ill-defined Diseases	20	—	892	21
	TOTAL ...	531	11	22,376	382

TROPICAL ULCER.

Dr. W. T. C. Berry's preliminary review of his investigations.

Tropical ulcer causes much disability among natives, who, however, vary in their susceptibility to the disease. Evidence has been brought forward by many workers that this variation in susceptibility is due to differences in diet. Such evidence is based mainly upon the study of communities or classes of people, on different diets. The disadvantage of such evidence is that other conditions in the contrasted groups are rarely identical; the climate, or the vegetation, or the agricultural practices (upon which depend in many cases the number of wounds received on the leg) may be different, the diet usually differs not in one, but in many constituents, and parasitisation often complicates the picture. There is little agreement among workers as to what factor is missing in the diet, nor have the findings of any of them been supported by controlled experiments upon patients in hospital.

Apart from the demonstration of a missing dietetic factor, several subsidiary questions need to be cleared up. Are the common fusiform and spirochaetal organisms found in ulcers a specific part of the disease, or is ulcer, as alleged by some workers, purely a dietetic lesion in which the infecting organism is of little significance? If the former, what is the relationship of the two organisms? Is there a seasonal incidence and if so to what is it due? And do physical and climatic conditions greatly affect it? Why is tropical ulcer almost invariably on the lower leg, though rarely on the sole of the foot, and why, though lesions are often extensive, do they so seldom invade muscle? It seemed unlikely that any investigation into the aetiology of ulcer would be successful if it did not clear up some at least of these problems.

The following methods were employed:

(i) In two villages under very different conditions and diets the children were examined every week, and every abrasion incurred on their legs was recorded. The fate of these abrasions was observed; some healed quickly, others developed into tropical ulcers. The children habitually neglected their abrasions anyway, and since the ulcers were caught at an early stage, severe lesions were avoided, in contrast to the state of affairs in surrounding villages, where parents frequently brought up their children with horrible ulcers. This study was carried on for a period of three years during which 1,949 abrasions were observed from start to finish. During the second and third years selected groups were fed a supplement (*a*) of *meat*, supplying an average daily dose of 1.5 gm./k.b.w. of protein to each child and (*b*) of *yeast*, supplying an average daily dose of 165 I.U. thiamin, 1.02 mgm. riboflavin and 16.6 mgm. nicotinic acid.

For a period of one year, a smear of pus was taken from every abrasion which would yield pus, every week, and was examined by Gram's method.

(ii) Experiments were carried out on volunteers who were inoculated with ulcer pus, and as a result produced tropical ulcers.

A detailed report will be submitted later. A few of the more obvious findings of the whole work may here be cited.

(*a*) *The relationship of the two common infecting organisms in tropical ulcer.*

In a series of 9 ulcers in which pus smears were taken weekly, 7 showed fusiform bacilli but no spirochaetes and 2 showed fusiform bacilli only at first, but later scanty spirochaetes appeared. In none of these early ulcers did spirochaetes appear in the vast numbers that were seen in smears from patients from neighbouring villages with severe ulcers, and there appeared to be little if any increase in the rate of development of the ulcer coinciding with the appearance of spirochaetes.

Other workers have noted that bacilli may appear alone even in very severe ulcers, and also that the bacilli persist in healing ulcers long after the spirochaetes have disappeared. It would appear that the bacilli play the more important role in the infection. The very doubtful efficacy of arsenicals in the treatment of tropical ulcer is explicable in this light.

(*b*) *The significance of the fusiform bacillus in ulcer.*

Nearly all the septic abrasions which were observed showed cocci only in the smear for a preliminary period of 1—8 weeks. No ulcers developed in which cocci only were found, and the appearance of fusiform bacilli in the pus was usually accompanied by an increase in severity of the lesion. Nevertheless, in the series from which these 9 ulcers arose, altogether 120 abrasions were infected with fusiform bacilli, *i.e.* infection need not necessarily result in ulcer formation. Whilst the persistence of bacilli in the lesion may depend upon some defect in metabolism, it is probable that if the bacillus does find itself in a suitable environment, it is much more capable of exploiting it than are the common septic organisms.

(*c*) *The seasonal incidence of ulcer.*

An increased number of abrasions on the legs occurs in natives during the agricultural months, and this undoubtedly increases the liability to ulcer. It is, however, not the only factor. Because the subjects observed in this study were children, they did not show this seasonal increase in abrasions, yet the incidence of ulcer was much higher during the five months rainy season than in the seven months dry weather.

The number of abrasions, in relation to the ulcers arising, was as follows:

Dry season	May — Nov. inclusive	*Abrasions*	764	*Ulcers*	5
Wet season	Dec. — April „	„	672	„	10

(These figures refer to two years study in groups susceptible to ulcer only). One reason (perhaps the only reason) for this was found in the bacteriology of abrasions, as shown by Gram-stained smears over a period of 12 months. In the dry season in 414 abrasions, fusiform bacilli were found in smears from 33 (7.9 per cent.). In the wet season, in 381 abrasions, 87 (22.8 per cent.) were infected with fusiforms. This increased infection rate was thought to be due mainly to (1) the increase in numbers and activity of muscid flies (musca sorbens being the predominant species) and (2) the moist and cloudy, but not too cold, weather, which prevents exudates from drying out whilst favouring the viability of organisms.

The conclusion was reached that in the groups observed the seasonal incidence of ulcer is explicable entirely on non-dietetic grounds.

(*d*) *The effect of a protein supplement to the diet of the children.*

The addition of 1.5 gm./k.b.w. animal protein to protein contained in the children's diet raised the total intake to above the optimum. Nevertheless, the children were still susceptible to ulcer.

(*e*) *The effect of a yeast supplement to the diet.*

Again the supplement supplied (see above) must have raised the intake of all B. vitamins up to, or very close to, the optimum. Nevertheless, ulcers still occurred, though it may be noted that they arose only very slowly, and from severe lesions occurring below the ankle.

(*f*) *Individual experiments on volunteers.*

The first necessity was to determine whether ulcer could be produced in volunteers, since a very high proportion of failures has been reported. Three "healthy" African labourers were scarified on the external malleolus, ulcer pus was smeared on and a dressing applied so as to prevent the access of air without giving support to the tissues. In all three cases typical ulcers arose, and this technique was followed in subsequent experiments.

(*g*) *Relation between immunity of tissues and their position relative to the heart.*

(i) A labourer was inoculated on the external malleolus of the ankle, and the external condyles of both humeri. The lesions on the arms healed by first intention, whilst a typical ulcer formed on the leg. (ii) A labourer was inoculated on the external malleoli of both legs. As soon as it was obvious that the ulcers were forming, he was placed in bed with one leg raised on a Thomas' splint, and the other lowered through a space cut in the bed, onto the ground. After three days, though no discomfort was felt in the raised leg, the lowered leg was giving much pain, and had to be raised onto the bed. Hourly dressings of Eusol were applied to both and after 6 hours the slough from the raised leg separated leaving a shallow clean bed of granulation tissue. The slough on the lowered leg showed no sign of separating after a further two days, so the leg was raised on a splint, and recovery was rapid. No apparatus was available for measuring areas of the ulcers, but that on the lowered leg was obviously the bigger and deeper.

(*h*) *Individual immunity of ulcer.*

The author inoculated himself and a control with pus from an ulcer. The control developed a severe ulcer. The author developed a small, sluggishly progressing sore, in which fusiform bacilli were scant and palely staining, and the yield of pus and general reaction of the tissues very mild compared with the control. After a week during which ordinary activities were pursued, pressure of work made it necessary to end it. Under treatment it healed reluctantly after three weeks.

Conclusion and Discussion.

Obviously this work is not complete. Equally obviously, however, the inoculation of volunteers opens a line of investigation which ought to be followed up. The caprices of chance which affect the incidence of ulcer in communities, can be ruled out, and anyway all that can be got from community study in Nyasaland has, it is thought, now been extracted.

A very tentative opinion as to the aetiology of ulcer is here given in order that the nature and prospects of future work may be seen.

In culture, the fusiform bacillus (and the spirochaete) is a compulsory anaerobe. When man is in the upright position, and especially when standing still, back pressure in the superficial system of veins in the leg leads to stagnation anoxia in the tissues, and conditions are more favourable to the bacillus than anywhere else in the body. Conscious and unconscious movements of the leg are sufficient to empty the veins of the sole of the foot and of the leg muscles within their fascial covering, which serves as an elastic stocking ; therefore these tissues are very much less susceptible to ulcer. Theoretically, the superficial tissues of the leg should be rendered less susceptible to ulcer by, say, applying an elastoplast bandage to serve the same role as does the fascial sheath to the muscles, and in practice this is borne out. The bacillus, when established in favourable surroundings, competes with the tissues for their food so that the tissues die of starvation rather than intoxication. The quiet necrosis which is a characteristic of ulcer can be thus explained.

From the single experiment described on the author, it seems unlikely that even when established in a favourable medium, the bacillus can compete successfully with healthy tissues. The fact that the African labourers suffered typical ulcers was an indication in them of bodily defects, and the problem of the aetiology of ulcer is the elucidation of these.

Presumably general debility is one (though the control used against the author was free from helminths and malaria). Anaemia would enhance tissue anoxia, which would encourage the growth of the bacillus, and it is possible that the anaemia in the experimental groups of children, average : 72.8 per cent. (Talquist), range : 60—80 per cent., was sufficient to permit ulceration even though the hypothetical dietary defect had been made good. Anaemia is in James' (1) opinion, a contributory, but not the main factor. A great deal of evidence has been brought forward by Clement (2) in favour of lack of vitamins of the B complex as being specifically associated with ulcer, and it is easy to see that if there were a lack of oxidation reduction enzymes, tissues already put to it to compete with the fusiform bacilli for food would be embarrassed through being unable to metabolise efficiently what little they did get.

If the theory suggested above is correct, then it is doubtful whether feeding experiments upon patients in hospital will yield any information. Most patients suffer from ulcers which do not invade muscle, *i.e.* their disease is associated largely with defects in the circulation which are put right when they are kept in bed, whilst whatever dressing is applied, it is kept in place by a bandage which goes right round the leg and assists the venous return with every movement. In many ulcers the body, unable to cast out the invaders by ordinary inflammatory mechanisms, has walled them off with fibrous tissue, which plays a more important role in preventing healing than does any dietetic deficiency.

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(1) JAMES, Clifford S. Tropical Phagedaenic Ulcer in the Pacific, T. Roy. Soc. Trop. Med. and Hyg. XXXI. 6th April, 1938. p. 647.

(2) CLEMENTS, F. W., Tropical ulcer with special reference to its aetiology. Med. Jrnl. of Australia, No. 7th, 1936. p. 615.

These objections apply whether the theory of stagnation anoxia proves correct, or whether ulcer is due to the effect of the erect position upon lymphatic return or upon volume changes in the leg, and it seems therefore that the experimental approach is the most promising for future work.

The immediate indications are:

(1) To determine, by means of experiments on Europeans (and possibly on really well fed and healthy Africans) what range of reaction can be expected of the tissues in complete health.

(2) A few further experiments upon the effect of gravity upon ulcer are needed, such as the inoculation of both legs followed by fixation in raised and lowered positions without waiting for the lesion to become established.

(3) Provided care is taken, there should be no risk in inoculating volunteers with (*a*) varicose veins, (*b*) elephantiasis, to contrast the effects of venous and lymphatic stasis.

(4) The same applies to mild cases of pellagra.

(5) Inoculation of the leg with Vincent's organisms of the gum, if successful in inducing ulcer, would make it possible to continue the experiments in England.

Following this, the next step is either to render proven immunes susceptible, by specific dietary restrictions (such as are occasionally carried out for other purposes) or to make proven susceptibles immune by specific dietary reinforcements.

The author had hoped to complete some of these experiments, if not all, before the end of 1943, but work has come to an end for lack of volunteers. Whilst the author hopes to obtain sufficient material to round off his work, and to compile a final paper in some six months' time, he suggests that workers in other colonies might like to take up the investigation.

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