

LEPROSY REVIEW

The Quarterly Publication of
THE BRITISH EMPIRE LEPROSY RELIEF ASSOCIATION.

VOL. XI. No. 3.

JULY, 1940.

Principal Contents:

First Report on Leprosy
Control Work in the Owerri
Province, S. Nigeria.

Inoculation of Monkeys with
Leprosy.

The use of Diphtheria Antitoxin
and Toxoid in Leprosy.

Reviews Reports

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Published by the Indian Council of the British Empire Leprosy Association. (see Review in Oct. 1938 issue of "Leprosy Review")

This book has been re-written and now contains 192 pages and 86 illustrations. The book is issued primarily for the use of doctors in India who wish to be put in touch with practical means of dealing with leprosy from both the therapeutic and public health points of view. It is hoped that it will also prove useful in the British Colonies and in other countries where leprosy is endemic. Much of the teaching found in standard text books has been omitted in order to make it possible to condense within a few pages knowledge that is absolutely essential for understanding the nature of the disease, and the lines along which it may be dealt with successfully.

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EDITORIALS

For many years we have emphasised the importance in endemic countries of carrying the campaign against leprosy into the villages. Leprosy is a disease of unhygienic villages just as tuberculosis is a disease of unhygienic industrial centres. Leprosy settlements and other residential institutions for lepers may be able gradually to control the disease in countries like South Africa where the problem is a limited one, and where under a compulsory system lavish expenditure is possible; though even there it is realised that final success must await the efforts of district surgeons specially trained in the recognition and nature of leprosy. But in highly endemic areas of vast dimensions, such as are found in parts of India and West Africa, an active campaign must be carried into the villages themselves. Many of the institutions in these areas are able to segregate a number of the more dangerous lepromatous cases, but the great majority of these are left at large and the concentration of potential disease spreaders is scarcely appreciably diminished.

To deal with this problem, Dr. Davey in his *Report on Leprosy Control in the Owerri Province, S. Nigeria*, demonstrates a carefully planned and efficiently carried out experiment. The Uzuakoli Settlement with its 1100 patients is used not just as an end in itself to segregate and treat a few lepers, but also as a centre of training and a demonstration model of village conditions as they should be. Thus its influence is gradually radiating out to the whole province not only as a means of controlling leprosy, but at the same time as an agent for reconstructing villages, making new roads, giving practical demonstration of improved methods in agriculture, improving the diet of the people and in every way spreading enlightenment and hope. In this work the various government departments, administrative, medical, educational and agricultural are willingly giving their help.

On page 154 we give abstracts from a report of the *Saidapet Health Project* in South India. Here likewise we have a partially organised rural area where leprosy has been used as the key to general hygienic improvement.

These two examples give the best answer to the *laissez faire* attitude of those who advocate leaving leprosy to "die out of itself in the natural course of things when the standard of living and sanitation have improved."

.

Leprosy has long awaited a form of treatment to which

the term "specific" may be applied. Many claims to this title have been put forward in the past but further experience has not confirmed these assertions. The new form of treatment with diphtheria Formol-Toxoid recounted in the paper by Collier and McKean is described modestly and without making any ambitious claims. Fallacies are common in estimating the value of any treatment in leprosy. Signs of clinical improvement are particularly unreliable, and even clearing up of positive bacteriological findings may be dependent on seasonal and other temporary causes. Time must therefore be given to assess these various factors before judgment is passed. Already arrangements are being made in several different centres throughout the world to test out this treatment. We trust that the experience of others will confirm the results of the workers in Siam.

Of almost equal interest are the animal inoculation experiments described in another paper. The fact that leprosy, unlike tuberculosis, is confined to the human race has limited our knowledge and handicapped our attempts at treatment and control. If these therapeutic and experimental results are substantiated they may have far-reaching results not only in leprosy but also possibly in other diseases.

* * * * *

Reference is made on page 158 to the foundation of the Belgian counterpart of B.E.L.R.A., the *Father Damien Foundation for the Campaign against Leprosy*. Leprosy is an important disease in the Belgian Congo and we wish our sister society all success in carrying out the objects for which it is founded.

FIRST REPORT ON LEPROSY CONTROL WORK IN THE OWERRI PROVINCE, S. NIGERIA.

T. F. DAVEY

THE PROBLEM TO BE FACED

The Owerri Province of S. Nigeria covers an area roughly 150 miles in length by 60 miles wide. At its southern extremity, in the Niger Delta, there is an area of mangrove swamp traversed by some of the mouths of the Niger. This gives place to a low-lying plain covered by forest rich in oil palms, which occupies the greater part of the Province. In the North the forest belt gives place to savannah, and a range of hills brings one to the northern boundary. The soil is naturally rich, but deforestation and

careless farming have caused deterioration in some areas. The population is dense, in some places extremely so, (500 to the square mile) and is scattered in numerous villages throughout the area. There are no large cities, and there is no unpopulated area of any size. Apart from the palm oil industry, the people are engaged exclusively in agricultural pursuits.

Most of the inhabitants belong to the Ibo tribe, possibly the most intelligent group, yet strangely enough possessing among themselves no appreciable government outside the village. There are innumerable petty chiefs, each holding sway in his own little domain, the people of the next village often being regarded as aliens to be feared and avoided. The coming of European Government is rapidly changing the whole situation. Clan Councils have arisen, governing considerable groups of villages, education is spreading rapidly and travel facilities are removing the parochial outlook.

It is amid such a primitive rural population that leprosy seems to find the least resistance to its ravages, and the disease is endemic in the area. When superimposed on these conditions there comes contact with European civilisation and the sudden changes in native life which it evokes, conditions are produced which are, par excellence, those in which leprosy thrives. The incidence of leprosy in the Province is probably the highest in the world.

In 1938 the only forces actively combating leprosy were :—

(1) The Provincial Leper Colony at Uzuakoli, housing a maximum of 1100 lepers.

(2) Leprosy treatment given by a few Medical Officers and N.A. Dressers at isolated places in the Province.

Excellent though these forces may be in themselves, their value from the point of view of leprosy control in the Province is negligible. While one leper in 50 lives in happiness under model conditions at Uzuakoli, the remaining 49 remain at large, many of them foci of infection.

No large tract of land is available for the mass segregation of infectious cases. The multiplication of colonies such as Uzuakoli, ideal in theory, is quite impracticable as, apart from land shortage, the cost would be prohibitive. In Nigeria there are no financial resources capable of dealing with the problem in a heroic way, and it was therefore necessary to propound a scheme whereby some form of control could be combined with a minimum of expenditure.

THE EXPERIMENTAL SCHEME PROPOSED

In the Annual Report of the Uzuakoli Colony for 1938 an

experimental scheme was proposed for dealing with these very difficult circumstances. This was later published.* The following were the main points in the scheme.

(1) *Investigation.* The size of the problem must be assessed by means of accurate study in different areas. This can only be achieved by intensive leprosy surveys undertaken by trained workers.

(2) *Segregation.* The focus of the scheme is the segregation of infectious cases discovered in surveys. Experiments in different methods are to be made; the accepted unit of segregation being the leper hamlet, built by the lepers themselves under supervision and erected one or two miles from the parent village. The families of lepers are to be made responsible for their upkeep.

(3) *Treatment.* Clinics are to be erected in areas where survey and segregation work is in progress, treatment given by a leper nurse, and the clinic visited regularly by a responsible person from the Uzuakoli Colony.

(4) *Control.* With an intensive survey and the segregation of infectious cases accomplished, the vital step in the control of leprosy will have been taken. By the application of the Leprosy Ordinance and the repeated observation of the surveyed villages, a continuous control will be achieved.

A small grant given by B.E.L.R.A. Nigerian Branch in the Autumn of 1938 made possible the commencement of the scheme, and during 1939 it has been elaborated. Work has been carried out in a number of areas and valuable experience gained. It will be considered under various heads.

(I) SURVEYS

In October 1938 letters were written to the Councils of 10 Clans in the Bende and Okigwi Divisions explaining the scheme. There was an immediate response, 17 Councils replied requesting the early commencement of leprosy work in their area. Letters were made to most of these and the scheme explained more fully. It was discovered that there is a widespread desire for leprosy survey work. If surveys were confined to these areas where Clan Councils have already requested them, the survey staff would be fully occupied for the next five years.

A series of surveys has been carried out during 1939. These have all been of an intensive character, designed to obtain accurate information regarding the incidence of leprosy and also to provide data preparatory to the segregation of infectious cases. In all instances the surveys were carried out by a trained staff, a full

* *Leprosy Review*, Vol. X, No. 3, July, 1939.

census was taken by house to house visitation, the whole body surface of the entire population, both male and female was examined, and full bacteriological control was exercised. The results are therefore authoritative as shown in table 1.

Table 1

Town	Clan	Division	People Examined	Lepers found	Incidence per mille
Akelu Lodu	Umu Imenyi	Bende	527	24	46
Mbiokpon and Obunta	Oboro	Bende	283	4	14
Ogbuegbule	Oboro	Bende	767	4	5
Ekebedi	Oboro	Bende	441	5	11
Etiti Ama					
Nkporo	Abiriba	Bende	1893	123	60
Umu Akam	Igbo	Bende	252	9	35
Umu Osu	Igbo	Bende	413	5	12
Umunneze ...	Igbo	Bende	88	1	11
Mgboko	Igbo	Bende	305	4	13
Nkata Alocha	Igbo	Bende	170	1	6
Nkata Alike	Igbo	Bende	175	nil	nil
Elugu Mba	Ozuitem	Bende	246	8	32
Ebem	Ozuitem	Bende	93	6	64
Ndi Agho	Ozuitem	Bende	856	26	30
Amagbo	Ozuitem	Bende	349	13	37
Amankwu	Ozuitem	Bende	152	5	33
Mba	Ozuitem	Bende	388	17	44
Mbele	Ozuitem	Bende	186	8	43
Ndi Obu	Ozuitem	Bende	97	1	10
Ameke	Ozuitem	Bende	464	37	80
Umueze Ozuitem		Bende	375	36	98
Oboko	Ozuitem	Bende	1756	26	14
Amaeke	Item	Bende	1402	38	27
Totals			11,689	401	33

These figures do not include 240 people exhibiting doubtful signs suggestive of early leprosy who are being kept on observation. Some of them will certainly develop definite signs later.

These figures give some idea of the immensity of the problem to be faced. Approximately one-sixteenth of the total population of the Bende Division has been examined. The areas examined may be considered as representative of the Division and a leprosy incidence of approximately 7,000 must be considered a conservative estimate for this Division alone.

The surveys reported represent an immense amount of laborious patient work. Literally thousands of microscope slides have been examined. Great praise is due to the African staff on whom the brunt of the work fell.

A number of lessons have been learned.

(a) *The need for propaganda.*

In spite of the unanimous support of the Clan Council, who understood fully what the aims of the survey were, we discovered on several occasions an almost complete lack of understanding among individual villages as to the reasons for the survey, and

a consequent failure of cooperation which led to its termination. Leper chiefs were invariably a source of trouble.

The Ibo people have a dread of leprosy and an almost uncanny ability to diagnose the disease. Most cases were already known as such to their fellows, though many early cases were discovered who were hiding their disease. These sometimes tried to conceal themselves on the occasion of the survey; but confining surveys to the neighbourhood of the clinics and the promise of free treatment reduced efforts at concealment to a minimum. It was only after repeated visits and exhaustive questioning that results were considered satisfactory.

(b) *The urgent need for anti-leprosy measures.*

In every area surveyed infectious lepromatous cases of leprosy were living among the general population without precautions of any sort being taken. Again and again it was possible to trace to these cases a group of early infections among the people in the neighbourhood. In all the areas examined conditions of housing and sanitation are most primitive, overcrowding was noticeable in many, and the danger of infectious cases of leprosy to a susceptible community in these conditions is considerable. In the minds of many, the obvious macules of uninfected neural leprosy were considered to represent a greater danger than the bacilli infested skin of the frank lepromatous case who presented no dramatic colour changes in his skin.

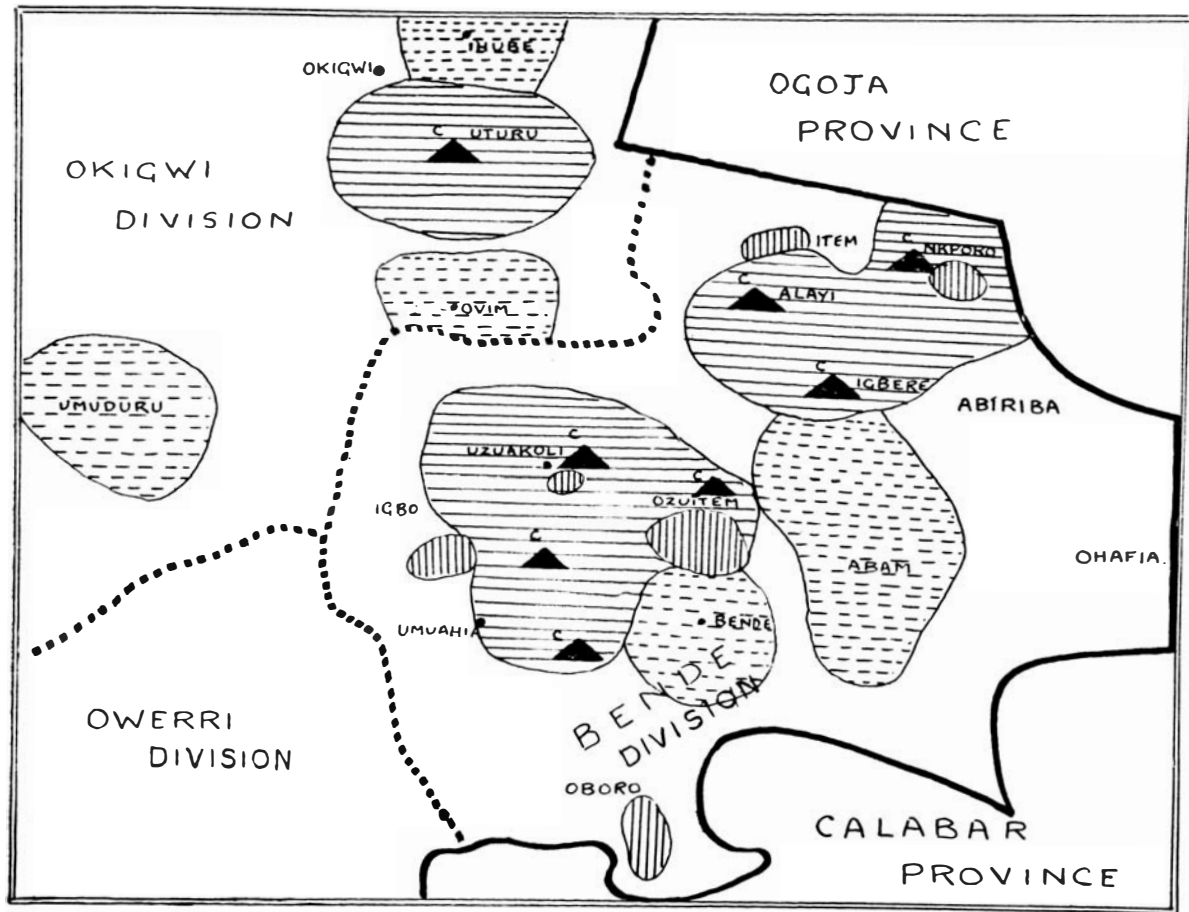
(c) *The lack of desire to assist lepers.*

The desire for a survey was universal but in some instances when that was accomplished cooperation ceased. A survey was sometimes welcomed so that lepers could be discovered and then driven out of the village without any regard whatever for their welfare. Wealthy lepers, able to bribe chiefs, were usually tolerated. Needless to say, no work was done in these areas.

Gradually, by a process of elimination, areas were discovered where there was a sincere desire to cooperate which included a willingness to provide land for the accommodation of lepers and the building of a clinic. It is in these areas alone that work will continue, and meanwhile active propaganda will be carried out elsewhere. Details of the means used are given later.

Experience has driven us to the following conclusion where survey work is concerned.

EVEN GRANTED THE PROMISE OF FULL COOPERATION BY THE CHIEFS, NO LEPROSY SURVEY SHOULD BE CARRIED OUT UNLESS TREATMENT IS MADE AVAILABLE FOR THE CASES OF LEPROSY DISCOVERED, AND ADEQUATE PROPAGANDA HAS FIRST BEEN UNDERTAKEN.



AREAS SURVEYED



LEPROSY TREATMENT NOW AVAILABLE



FACILITIES FOR TREATMENT PENDING



CLINICS



MAP OF PART OF THE OWERRI PROVINCE

During the year, surveys of specialised groups have been carried out. These include the Methodist College, Uzuakoli, the staff of the Agricultural Station, Umuahia, and several schools.

(2) LEPROSY CLINICS

The provision of treatment for lepers is an essential part of any humane scheme of leprosy control. The building of leprosy clinics has been continued through 1939, and at the year end eight are in operation. The most striking feature of them all is that they have not cost a single penny. Land in all cases has been given by the chiefs, the lepers have themselves built what simple buildings are necessary. The following table shows the location of these and the number of patients receiving treatment at the end of 1939.

Table 2 (see map)

Clinic	Division	Opened	Patients Attending			Total
			Male	Female	Children	
Alayi ...	Bende ...	Dec. 1938	50	38	7	... 95
Nkporo ...	Bende ...	Feb. 1939	115	162	42	... 319
Igbere ...	Bende ...	Feb. 1939	32	37	4	... 73
Uturu ...	Okigwi ...	Mar. 1939	194	121	13	... 328
Ozuitem ...	Bende ...	May 1939	50	64	11	... 125
Ibeku North	Bende ...	June 1939	31	9	—	... 40*
Ibeku South	Bende ...	Dec. 1939	46	28	3	... 77
Uzuakoli ...	Bende ...	Oct. 1938	102	82	2	... 186
Totals ...			620	541	82	... 1243

* These numbers are temporarily low as the Ibeku N. Clinic has been divided into two clinics.

1243 patients are thus receiving treatment and numbers are rising with great rapidity.

The method of managing these clinics may be of interest. All are built by the side of a motor road, and are visited from the Uzuakoli Colony once weekly. A special clinic lorry, provided by the Native Administration, is used for this purpose. It is equipped with a supply of medicines and all requisites for carrying out minor operations.

Patients on first attending a clinic are examined by the medical officer and bacteriological smears are taken. A record of treatment is kept.

A leper nurse is attached to each clinic. Later on, as lepers are segregated, it is intended that a nurse shall actually reside at the clinic. At present, this is arranged at the Uturu and Nkporo Clinics only, but nurses visit other clinics by bicycle from the Uzuakoli Colony. They take the temperature of patients prior to treatment, and carry out treatment by the intradermal and subcutaneous injection of hydnocarpus oil. Leper patients

give voluntary assistance at all clinics. Leprosy treatment is free, but patients may obtain medicine for inter-current ailments at the price of 1d., a special pharmacopoea of inexpensive prescriptions having been produced for this purpose.

Ulcers abound and special treatment, supervised by a European lady giving voluntary service, is applied to these. At clinics with a resident leper nurse, ulcer treatment is given daily.

The Uzuakoli Colony offers its facilities for special treatment to clinic patients. Many of these have been admitted to the hospital for special attention, and one infant, formerly starving, is now in the babies creche and is thriving.

The regular attendance of patients at clinics and the rapid increase in the numbers attending them indicate the value placed on them by the lepers themselves. We started clinic work very sceptical of its usefulness, but are now convinced of its value. Obvious improvement is being observed in many cases, and during 1940 it may actually be possible to discharge a few as symptom free. It must here again be emphasised that the establishment of clinics does not provide any measure of leprosy control, as infectious lepromatous cases exhibit little, if any, response to injections with hydnocarpus oil, and in spite of treatment remain as sources of infection. The focus of leprosy control must be on segregation.

(3) SEGREGATION

From the standpoint of segregation, 1939 has been a year of preparation. At one centre, viz. Nkporo, the scheme is working in its entirety, and its success has been established beyond all doubt. A brief description of measures taken there will illustrate the operation of the scheme.

Prior to starting work at Nkporo, the chiefs were already conscious of the danger of leprosy, and had more or less forcibly segregated the most advanced cases in a village about $\frac{1}{2}$ -mile away from the parent village. These lepers were visited and discovered to be possessed of an utterly despairing mental outlook and living in conditions of the utmost squalor. It is hard to find words to describe their wretchedness. In the spring of 1939 a clinic was opened, with a resident leper nurse. This rapidly became popular and improvement in the condition of several patients was noticed unusually quickly. In June, a most thorough survey of the parent village was made. Numerous lepers, some of them highly infectious, were discovered. The chiefs then offered land for the building of a village where all infectious lepers could be segregated, and also voluntarily gave all building materials. A Toc H man then went from Uzuakoli and marked

out the houses for this village which was planned on model lines in complete contrast to the villages in the neighbourhood. The lepers were then asked to build the village. They refused, saying they were too sick to work and incapable of doing anything for themselves. At this time they were discovering the value of the clinic, and they were informed that unless they cooperated, the clinic would be removed. They then agreed to work provided a suitable leader could be found, and it was decided to send out from Uzuakoli, a leper, accustomed to leadership and skilled in building. The wisdom of this measure was soon evident, for building started immediately and the Nkporo lepers soon discovered not only that they were able to work, but that they enjoyed doing it. The leper foreman from Uzuakoli living normally among them had a most tonic effect upon them. The outcome has been a sanitary village, completely different from the primitive village in the neighbourhood, and the pride of the lepers who live there. Now not content with building their village, they have built a good motor road to it, have cleared land and are literally a transformed community. Every infectious case is now segregated there. Some mild neural cases are permitted to remain in the parent village under strict observation, their parole being dependent upon their having treatment. The chiefs are on the alert and bring for examination at frequent intervals those cases which, being then doubtful, were put under observation at the time of the survey. The families of the segregated lepers are responsible for their maintenance.

In this way leprosy control has been achieved, and it is intended to take similar measures in other areas as the people become ready for them. At Ozuitem, a start is being made on a leper village in the near future, and work is pending at Igbere, Abam, Uturu, and Ihube, at all of which areas land for the segregation of lepers has been offered.

(4) PROPAGANDA

As the year has advanced, the need for antileprosy propaganda has been increasingly realised and is being met by the following means.

(a) *Posters.* Simple posters in the vernacular for use in native courts and public places have been printed and are being distributed. These present facts regarding leprosy and indicate prophylactic measures. A new set of posters in English for use in schools is now being prepared.

(b) *Propaganda through schools.* Visits to schools and surveys of school children have been undertaken. Vacation

courses in leprosy work for school teachers are proposed for 1940.

(c) *Instruction to health workers.* Special instruction has been given to sanitary inspector students, and is proposed for Native Administration Dressers.

(d) *Dr. Muir's booklet (the Control of Leprosy)* has had a wide distribution in the area, but requests for a simpler booklet, specially suited for S. Nigeria have been received from Educational Supervisors.

(5) PRESENT AND FUTURE DEVELOPMENT

The progress of the scheme up to the end of 1939 is best illustrated by reference to the accompanying map which shows the Bende Division and adjacent areas of the Okigwi Division.

Clinics are opening shortly at Ihube, Umuduru, and Ovim in the Okigwi Division, and their opening will bring the area which can be served directly from the Uzuakoli Colony to its maximum limit. Five full days in the week will then be devoted to Clinics, and with the present staff nothing further can be attempted.

It may be considered that within a radius of 30 miles from the Uzuakoli Colony direct supervision can be given, but beyond this distance other measures are necessary. The need for leprosy work outside this area is pressing, and the following two considerations deserve special mention.

Cooperation of Government Medical Officers and Mission Hospitals.

The extension of the scheme will depend on the cooperation of Government Medical Officers and Mission Hospitals. Where these are willing to give the necessary oversight, there seems no reason why leprosy clinics should not be opened in any part of the Province. Intelligent patients from all parts of the province are being trained as nurses at Uzuakoli, and it will be possible to supply a clinic in almost any locality, with a nurse whose home is in that neighbourhood. A start is being made in this direction in the Owerri Division.

Leprosy Inspectors.

There remain however large areas in the Province where weekly visits by European medical men are impossible. It is proposed to cope with these areas by the creation of a service of Leprosy Inspectors. These men will be ex-patients discharged from the Uzuakoli Colony as symptom free. They must have had an excellent record while in the Colony, and will have a minimum of 15 months' training made up as follows :—

(a) 6 months' training and experience as a nurse at Uzuakoli with a satisfactory examination result.

- (b) 3 months' experience as nurse attendant at a clinic.
- (c) 3 months' special course in hygiene and leprosy.
- (d) 3 months' practical experience in sanitary work.

Special English Language teaching will be given throughout the course.

Each man will fulfil the following functions:—

(a) Supervise leprosy clinics in a restricted area, holding one month's supply of essential drugs.

(b) Keep a record of lepers attending the clinic, trace these to their homes, and advise relatives regarding segregation.

(c) Plan a model leper village.

(d) Commence house to house visitation within his area and undertake sanitary work according to the scheme for sanitary inspectors, emphasis being laid on antileprosy propaganda. The area will thus be prepared for a leprosy survey.

Leprosy inspectors should be sent only to areas where chiefs have already offered land for clinics and for segregation purposes. These having been approved by the Administrative Authorities a clinic should be opened with a leper nurse in attendance. A leprosy Inspector should then be appointed. At least once monthly he must be visited either by a Medical Officer from Uzuakoli, or by another Medical Officer, according to the locality.

When point (3) in this scheme of the work has been reached, a Toc H man from Uzuakoli should visit the area and approve the layout of the leper village before the work on it proceeds. A record of the work done must be kept.

By combining leprosy work with the duties of sanitary Inspector, the need for appointing two men to the area is eliminated, economy is achieved, and at the same time an important correlation between sanitary and leprosy work is attained.

A small batch of men is already being trained with this work in view. It is suggested that they be paid at the rate of £1 to £2 per month.

In working out this proposal, valuable advice has been given by the Senior Health Officer, Enugu.

(6) RELATION OF THE UZUAKOLI COLONY TO THE SCHEME

The Uzuakoli Colony is the centre from which the scheme is operated, and the whole policy of the Colony is being so adapted that it best serves the interests of the scheme. The following types of case only are admitted:—

- (a) Infectious cases;

- (b) Educated lepers suited for training;
- (c) Children;
- (d) Pauper lepers;
- (e) Cases needing hospital attention;
- (f) Enough able-bodied lepers to manage essential services and farming.

This embraces those types of case which most need the special care and attention available at Uzuakoli. It must be pointed out however that many patients belonging to these types are attending clinics, and there is no accommodation for them at Uzuakoli. In future the Uzuakoli Colony will concentrate more and more on diagnosis, training, and research; and with standardised courses for leper nurses and leprosy inspectors, an important start has been made. The Colony will take its share in the proposed scheme of training for Medical Officers.

CONCLUSION

The means now available for combating leprosy in the Owerri Province may be summarised as follows:—

- (a) A trained and experienced survey team.
- (b) Leprosy clinics in a number of areas. The number of these can be increased indefinitely.
- (c) Segregation of infectious lepers in model villages under supervision.
- (d) Leper nurses, trained as clinic attendants.
- (e) Leprosy Inspectors in training.
- (f) Propaganda through posters, schools and native courts.
- (g) Vacation courses for school teachers.
- (h) Courses for people engaged in health services, Sanitary Inspectors, and Native Administration Dressers.
- (i) Special training for Medical Officers.

The machinery is thus available for extensive antileprosy work. The rate of advance now depends on the staff engaged in the work, and this is governed solely by financial considerations.

*INOCULATION OF MONKEYS WITH LEPROSY, FOLLOWING A DIET OF PUAKE (COLOCASIA)

A Preliminary Report

D. R. COLLIER

INTRODUCTION

A recent report by Cochrane⁽¹⁾ tells of his efforts in transmitting human leprosy to splenectomized monkeys. Adler⁽²⁾ has reported the transmission of leprosy to Syrian hamsters, and Balfour-Jones⁽³⁾ the transmission of rat leprosy to the hamster. It is quite evident that, if there were a laboratory animal available for the study of leprosy, its mode of infection and various methods of treatment, we might expect much more rapid progress in the study of this disease, which has been so baffling for many hundreds of years. It is also self-evident that a method of infection, which follows actual conditions found in humans, is highly desirable. In the following experiments the animals were fed with a diet, which is common to a great many people throughout the world, as suggested by Oberdoerffer.⁽⁴⁾

Following Oberdoerffer's ideas on the role of adrenal insufficiency in the production of predisposition to leprosy, presumably caused by sapotoxins in certain food plants, Oberdoerffer and I thought it worth while to attempt to infect animals with leprosy, after a preliminary diet of puak. (Puak is the common Thai name for colocasia.) The following is a preliminary report on such an experiment :—

EXPERIMENTAL PROCEDURE

Beginning September 1st, 1938, two monkeys were put on a diet of colocasia. Since the animals refused to eat it raw it was prepared by boiling for a few minutes. Occasionally other articles of food such as bananas have been given, but on the whole the diet has been the one article of food—colocasia.

Since that time other monkeys have been added to our collection, so that we have now 30 animals under treatment. Guinea pigs, rabbits, and ordinary pigs have been used as well. I might add that we have obtained interesting results with the pigs. We are all aware of the very long incubation period of human leprosy. If leprosy in monkeys runs a parallel course, then it is probable that the incubation period will also be lengthy. Only a few of our monkeys have been under observation long enough to enable us

*Reprinted with the permission of the author from the *Thai Science Bulletin*, II, 2, April 1940.

to draw definite conclusions. It is probable that a prolonged period, possibly one or more years, will be necessary before final conclusions can be reached. However, in order that others interested in leper research may also attempt similar experiments, this preliminary report is being published.

Monkeys No. 1 and No. 2 were put on a diet of colocasia September 1st, 1938. The ordinary long tailed brown Rhesus monkey, native to North Thailand, was used throughout. On October 1st, a bit of tissue from an advanced leptomatous leper was inserted under the skin of the back and the opening closed with a skin-clip. On November 15th, some 6 weeks after inoculation, the female (No. 1) developed an inflammation of the skin of the face, the palms of the hands, and the soles of the feet. The face was a deep red colour and somewhat swollen and infiltrated. The original lump at the site of inoculation on the back had more than doubled in size, but there was no sign of abscess formation. This "reaction" lasted about a month, and then subsided, though the thickening of the face below the eyes and across the eyebrows remained, and the face retained a reddish colour. A spot of depigmentation appeared on one side of the nose, which has remained ever since.

On March 1st, a skin scraping from the nodule of the back was found to contain acid-fast bacilli of the characteristic morphology of the mycobacterium leprae. On April 17th, 1939, the animal was reinoculated in the same way as before. On May 20th, and May 30th, an ear clip was made and found to be negative. A nasal smear, made on the latter date, May 30th, was positive for acid-fast bacillae. Periodic examinations were made, and in every case the nasal smears were positive. Occasionally clumps of bacilli were found. On July 24th, the ear clip was found to be positive, and has remained so ever since. In October, a year after the first inoculation, a deep red colouration appeared across the buttocks, down the tail and across the back to the level of the lumbar vertebrae. There was a diffuse swelling of this area. Skin scrapings have been negative from this region. The face has at times been highly inflamed, but not at any time has it returned to normal or lost its thickened reddish infiltration. The nipples have been red in colour and definitely hypertrophied. There has been no noticeable enlargement of the breast tissue. The ears have been enlarged and were red in colour.

The Male Monkey No. 2, inoculated at the same time as No. 1 and reinoculated similarly, has shown no signs of infection. His nasal smears and ear clips have been negative.

Monkey No. 3 (female) was inoculated December 15th, and reinoculated April 17th, 1939. On June 23rd, there was a positive

nasal smear. On September 27th, the nasal smear was positive, ear clip negative. From the first of September onward, the animal has had an intensely red induration of the face around the eyes, which has been persistent. This has not been noted in any of the control monkeys, nor in any monkeys which have not been treated at all. This has been accompanied with a swelling of the red area which shows in the illustration accompanying the article.

Monkey No. 4 Male. Inoculated with a culture made from leprous tissue. Leprous tissue was smeared on blood agar and after 24 hours the diphtheroid bacilli grown on this medium were injected in the form of a suspension. The only change following this injection was that the animal became very thin, though it remained as active as previously. On July 24th, a bit of leprous issue was rubbed inside of each nostril. There have been no symptoms of infection. Nasal smears since then have been negative.

Monkey No. 5 Female. Inoculated with a culture as described for monkey No. 4 on April 17th, 1939. Since there was no sign of infection, the animal was exposed by the rubbing of a nasal smear from monkey No. 1 in its nose. This was done July 24th, and on August 26th, she had a positive nasal smear. There have been no skin changes. A nasal smear made October 15th, was negative.

Monkey No. 6 Male. Injected with a culture as described above. There have been no further evidences of infection. Nasal smear negative on November 1st.

Monkey No. 7 Female. Inoculated with leprous tissue December 15th, and reinoculated April 17th. There were no skin changes, and on August 4th, she was again inoculated with leprous tissue. An abscess formed at the site of inoculation, and the micro-organisms found seemed to be entirely acid-fast bacilli. These were extremely numerous. No other micro-organisms were seen. This abscess healed spontaneously by the 13th (9 days later). On the 27th of September a large mass was found on the opposite side of the back from the original inoculation. It was one inch long by three-fourths of an inch wide. It was soft and there was fluctuation. On aspirating the centre with a hypodermic needle, a purulent fluid was obtained which contained acid-fast bacilli. The edges of the mass remained indurated, and the mass has persisted to date. There were similar masses, though smaller in size on both wrists. There has been loss of hair on the back, and in the region of the tail. This monkey did not develop the facial changes of monkeys No. 1 and 3. The nasal smear has been positive. On November 1st, the ulnar nerves were found to be enlarged.

Monkey No. 11 was inoculated on August 5th, with leprous

tissue. Beginning September 14th, he was given a number of injections of sapotoxin prepared from colocasia. This preparation was tested against rabbits, and 3 cc. of our solution killed a rabbit in 12 hours. The monkey was given 2 cc. of this preparation as an initial dose and the subsequent doses increased in amount. This was given in addition to the diet of colocasia, fed to the other experimental animals. By the first of October a mass was seen which grew slowly. On the first of November it had reached the size of a pigeon's egg—approximately one inch by three-fourths of an inch. This was situated some distance from the original inoculation, and on the opposite side of the back. The material aspirated from the centre contained acid-fast bacilli. Since then there has been a second mass located inferiorly to the first, and likewise it contained acid-fast bacilli. The eye-brows show thickening and are somewhat reddish in colour. The monkey has recently been seen to wipe his eyebrows repeatedly, sometimes continuing for as much as five minutes. We are inclined to believe that this may be due to paresthesia of the nerves around the eye. There has been loss of hair over the back and tail.

Monkeys 13, 14, 18, 19, were all inoculated with leprosy material on August 4th. They have not been given colocasia. On December 1st, 1939 none of them have shown any changes suggesting infection. The original lumps have disappeared. The nasal smears have been negative.

One baby monkey has been put into the cage with female No. 3 without being inoculated, but fed on colocasia, to see if contact of a baby with a positive foster mother monkey will result in infection. Observation will be continued in this case.

DISCUSSION OF RESULTS

Our observations show that all four of the female monkeys inoculated six months or more ago have shown positive nasal smears and positive ear and skin clips. Only one male monkey has shown signs of infection. In that animal there have been abscesses, skin changes, and possibly paresthesia. That monkey has had injections of sapotoxins in addition to the diet of colocasia. The rate of progress has been much faster than with the other animals, and we are adopting this same technique with other monkeys in an attempt to speed up the period of incubation and the certainty of infection.

So far as we have been able to determine from the literature of the previous attempts to infect animals with leprosy there has been no mention of clinical tests such as ear clips, nasal smears, enlarged nerves etc. applied as a criterion of infection. We feel

that such criteria are important since it is the clinical form of leprosy that is of value in such investigations. We believe that we have demonstrated such clinical signs in the experimental work covered in this preliminary report. The fact that several months elapse before symptoms appear is in accordance with our understanding of human leprosy. The clinical symptoms are very similar to those found in humans. The first positive symptom seems to be a positive nasal smear, though abscesses may occur previous to this. We have used this abscess material for inoculating other monkeys. The work has been done only recently and we must wait for a longer time before coming to conclusions. So far no control monkey has shown any of the symptoms noted for the inoculated animals who have been fed on colocasia.

The effect of colocasia on the infectivity of monkeys needs further study. It is suggested that a larger group be injected with sapotoxin from colocasia, in an effort to determine the exact role played by this food, and if possible to speed up the course of the disease and increase the certainty of infection. The juice from boiling colocasia appears to be very toxic to rabbits, and it may be that this will be effective in bringing about infection, following inoculation.

So far we have not attempted to treat any of our animals with anti-leprosy measures. This will be done later, as will pathological examination of internal organs. It is intended to report further progress with these experiments at a later date.

SUMMARY

A number of monkeys have been fed on a diet of colocasia, and then inoculated with material from lepers. All four female monkeys, so treated six or more months ago, have developed symptoms similar to those seen in leprosy in humans. There have been positive bacteriological findings in nodules and changes in pigmentation of the skin. One animal developed thickening of the ulnar nerves. One male monkey has developed abscesses containing acid-fast bacilli as well as other symptoms after being injected with a solution of sapotoxin in addition to the diet of colocasia.

References.

- (1) Cochrane, R. G. et. al. A preliminary note on inoculation of monkeys with human leprosy after splenectomy. *Internat. Jl. Lep.* VII, 3, p.377, July 1939.
- (2) Adler. Inoculation of human leprosy in the Syrian hamster. Abstract in *Internat. Jl. Lep.* VI, 3, p.467, July 1938.
- (3) Balfour Jones S. E. B. The experimental transmission of rat leprosy to the golden hamster. *Jl. Path. and Bact.* 45, 1937. 45 (1937).
- (4) Oberdoerffer, M. J. Regional variation of clinical types in leprosy, seasonal variation of bacteriological findings in tuber-

culoid leprosy, and their possible causation by sapotoxins in certain food plants. Congress of Far East Ass., Trop. Med. Nov. 1938.

[In a later personal communication Dr. Collier says " I have taken a nasal smear from one monkey and rubbed it in the nose of a second, which second has become positive. Also I have taken material from a nodule on one monkey and inoculated it into a second with positive results."

He also describes the method of extracting sapotoxin from colocasia:—" Peel the tubers, mince finely, mix with distilled water and leave for four hours. Add equal volume of 95% alcohol. Filter to remove precipitated starch; evaporate filtrate on water bath to remove alcohol. Add 30% normal lead acetate. Filter—precipitate contains sapotoxin. Wash precipitate with distilled water. Add hydrogen sulphide, after having suspended precipitate in water; filter and evaporate filtrate to syrup. Add cold alcohol until white precipitate appears. Filter. White precipitate is very hygroscopic and contains inorganic impurities, but contains a large amount of sapotoxin. Dissolve in saline for injection. Determine minimum lethal dose for guinea pigs or rabbits by injection." Readers will find previous reference to colocasia in *Lep. Review*, X, 2, p.112, July 1939.—Editor.]

*THE USE OF DIPHTHERIA ANTITOXIN AND TOXOID IN LEPROSY

A Preliminary Report

D. R. COLLIER and J. HUGH MCKEAN.

INTRODUCTION

Following the encouraging results of experimental work on infecting monkeys with leprosy following a diet of colocasia, and the use of diathermy in stimulating adrenal glands in lepers, reports of which are being published at the same time as this article, Oberdoerffer and Collier decided to try the use of diphtheria antitoxin. The reasons are as follows: Oberdoerffer has advanced the theory that adrenal insufficiency predisposes an individual to leprosy. This may be caused by the sapotoxins in certain food plants, as well as result from other causes of glandular hypofunction. We thought, that there might be something more than an analogy between the well proven attempt of the body to form antibodies against a toxin such as diphtheria toxin, which essentially damages the adrenals, and the lack of such an attempt in leprosy.

*Reprinted with the permission of the authors from the "Thai Science" Bulletin II, 2, April, 1940. The plates appearing in the original paper are absent, but two photographs sent by the authors show the effects of toxoid treatment on a patient not specially mentioned in the text.

We did not expect that diphtheria antitoxin would cure leprosy, but it might be that diphtheria antitoxin would neutralize leprosy toxin in the toxaemic syndrome in leprosy, namely leprosy reaction. As far as we have been able to determine the literature contains only one reference to the use of antitoxin in leprosy. Babes treated lepromatous lepers (2 cases) with diphtheria antitoxin and reported initial flattening out of nodules, but he never wrote on the subject again. It is too early to state definitely the kind of chemical relation or biological relation between leprosy and diphtheria, but the use of antitoxin and toxoid, as shown in the following report, does show results which do not seem to be that of a nonspecific serum protein.

EXPERIMENTS WITH DIPHTHERIA ANTITOXIN

On December 6th, 1938, we chose a number of patients who were having repeated leper reactions. As controls a number of similar cases were given injections of tetanus antitoxin, and several others were given antivenom. Approximately forty injections of these two substances were given. Case histories of a number of patients treated with diphtheria antitoxin are given below. In general the effects have been as follows: after the initial injection of 6,000 units of diphtheria antitoxin in a case of acute reaction, the patient may return the next day complaining that his fever has increased and that he is worse than before. After three or four days he begins to improve. In many cases the leprosy nodules and elevated red areas scale over, that is a fine, whitish, rather transparent membrane forms over the area. This is followed by a gradual shrinking of the area, and a change in colour from bright red to a dark brown. In the cases of more acute reaction the centre of the nodule may soften with the accumulation of a purulent fluid in the centre. If this fluid is examined it will be found to contain acid-fast bacilli of the morphology of the *Microbacterium leprae*.

A definite change in the form and shape of the bacteria occurs. as far as our records show, in every case where they are to be found at all. At first the bacilli seem to form granules at the poles suggesting polar bodies. In a few days the slide, either from the purulent fluid in the nodule, or from a skin scraping at the edge of the lesion, or from an ear clip, shows masses of acid-fast granules and cellular debris, with often an almost complete absence of the usual form of bacilli. These masses of granules tend to gather in clumps, which at times have a clear zone surrounding them.

The intensity of response to the antitoxin varies with the individual, being more severe in the more acute reaction. In approximately fifty cases treated this way, we have not found one who did not respond in the manner described. In the cases treated

with either tetanus antitoxin or antivenom no appreciable change in the condition of the patient resulted.

Some months after the initial injection of a number of patients, as noted, we went over the records of the institution and found that most of the cases had been free from further reactions for a considerable period, also that certain individuals showed marked improvement in local skin manifestations and general condition. We therefore began treating these and other cases of reaction with smaller doses of antitoxin, repeating the injection as often as once a month if the reaction recurred. Later on we found that repeated doses gave encouraging results in several cases who were not having reactions. 2,000 units of antitoxin were given at ten day intervals. The following brief summaries of case histories are typical of the group.

CASE HISTORIES

No. 1205. Male, age 25. Duration of disease four years. Admitted to asylum June 6th, 1939. Skin lesions over the body and anesthesia are shown in the photographs and charts. Laboratory findings as follows:

Urine—albumen plus 1, with granular casts.

Stool—negative for parasitic ova.

Blood—W. B. C. 10,400. R. B. C. 4,690,000 Hgb. 70%.

Bacteriology—skin positive. Nasal secretions negative.

Kahn—negative.

Formol-gel—negative.

There was marked edema of the hands and legs, the hands being so stiff that the patient could use them only with difficulty. On June 19th, he was given 4,000 units of diphtheria antitoxin. Routine treatment with injections of chaulmoogra oil was given twice weekly, throughout the course of the treatment up to date. Diphtheria antitoxin was repeated at 10 day intervals, 2,000 units being the usual dose. In all 34,000 units have been given in 14 doses. On August 5th, there is the following notation on his chart: "Raised areas are now all flat. Many have disappeared, and some remain only as a discoloration. No raised areas remaining on face." At no time during the treatment of nearly six months has he had a leper reaction, or fever, though he states that he had many reactions before coming to the asylum.

No. 1200. Male age 48. Duration of disease 4 years. Patient was brought to the asylum by friends who believed him to be in a dying condition and wished to be rid of him before that event could take place. His body was covered with a most severe leper reaction, with many ulcers. There was a diffuse infiltration of the entire skin with edema of hands and feet. Laboratory findings were:

Urine—heavy cloud of albumen.

Feces—negative for parasitic ova.

Blood—W. B. C. 6,450, R. B. C. 3,630,000. Hgb. 60%.

Kahn—plus three.

Bact.—skin plus three. nose plus two.

Formol-gel—negative.

The reactions were severe and he was not given the usual injections of chaulmoogra oil. Instead he was given 2,000 units of diphtheria antitoxin. The beneficial results were immediate. The entire body showed scaling. The antitoxin injection was repeated at 10 day intervals. On August 7th, he came complaining of badly swollen feet and legs. The urine contained albumen three plus, which required considerable treatment. October 10th, he was given a small dose of

neosalvarsan. This brought on a severe reaction with fever. However after 4,000 units of antitoxin it subsided. His general condition is much improved. This is an instance where there has been marked improvement in spite of serious complications of syphilis and nephritis. Bacteriological examinations show the characteristic fragmentation and granulation, as noted elsewhere.

No. 994. Male, age 26. Patient admitted in 1937. Duration of disease one year before admission. Stage L-1. Prognosis on examination doubtful. On December 6th, 1938, patient reported with a leper reaction. 6,000 units of antitoxin were given. A second slight reaction occurred on the 14th of October. Up to December 1st, 1939, there have been no other reactions. In this case one injection effectively cleared up a reaction, and there was no recurrence for 10 months.

No. 868. Male, age 39. Admitted January 1936. Duration of disease 12 years. Stage L-1, N-1. During the first six months of 1939 patient had repeated reactions. July 1st, 2,000 units of antitoxin were given. Up to December 1st, there have been no further reactions.

No. 1047. Male, age 27. Admitted June 1937. Stage L-1. Patient was in reaction during all of May and first part of June. June 12th, 2,000 units of antitoxin were given. Reaction occurred a month later at which time a second 2,000 units were given. Since then, after four and a half months there has been no further reaction.

No. 1122. Male, age 32. Admitted October 1938. Stage N-2. Duration of disease one year. Patient was given antitoxin December 6th. There have been no further reactions during the year following.

EXPERIMENTS WITH DIPHTHERIA TOXOID

Since the effects of diphtheria antitoxin were so encouraging we decided to try diphtheria toxoid. On October 20th, 1939, we selected sixty cases from the patients of the Chiangmai Leper Asylum and injected one c.c of toxoid. Cases were chosen from the following groups: L-1, L-2, L-3, N-1, N-2, N-3. Most of these cases had been under our care for a year or more and had complete case records giving the following data:—urine and stool examination, W.B.C., R.B.C., Hgb. differential count, Kahn test, formol-gel test, sedimentation rate, weight and height, blood pressure, and a careful charting of the lesions of the skin together with notations as to enlarged nerves and deformities. Some twenty cases previously treated with antitoxin were added to this group, as were a number of cases of enlarged ulnar nerves.

The patients were examined the day following injection and notation made as to where local or general reaction occurred. Within two weeks we noted that in those L (lepromatous) cases with nodules or raised areas there was first a fine scaling-over, as described for the antitoxin, and then a change in the pigmentation from red to brown and a fine wrinkling or crepe-paper effect over the raised areas indicating a definite shrinking of the nodule or plaque. In the more severe skin cases the wrinkling was more marked and the vigour of the response in direct relation to the severity of the disease.

A month later the patients showed a continued improvement. The nodules and plaques were further reduced, many of them no

longer raised, but flat with the skin. This change was present in every individual showing such lesions. (See figs 1 and 2). Bacteriological findings were the same as those noted in connection with antitoxin, which changes were found in every instance, excepting those cases in which no bacilli were found.

A number of the patients volunteered the information that following the toxoid their faces had become less swollen, that they "felt lighter." This was quite apparent after 14 days. There was a general reduction of the induration wherever present. In a few cases of the more severe skin types with lepromata the thickness of the skin was reduced leaving hard nodules standing out as



Fig. 1. After treatment with toxoid. Beginning of resolution of face lesion.



Fig. 2. Same patient four weeks later.

islands. In some few cases there was abscess formation in the centre of such nodules, which, on examination, showed granulation and cell debris with an occasional acid-fast bacillus. The granules were also acid-fast.

The effect of the treatment was less apparent in the nerve cases, but after two weeks some of the patients stated that they had experienced paresthesia of certain areas, previously anesthetic. One or two remarked that they had a complete return of sensation in previously anesthetic spots, and one patient a return of function of a partly paralyzed hand.

A month after the first injection of toxoid the group was examined for nerve enlargement and anesthesia. More than 50% showed improvement in these respects. When examined blindfolded for anesthesia, a considerable number showed definite improvement, as indicated by comparison with their previously charted lesions. Enlarged ulnar nerves in a number had returned

to normal size and were no longer palpable. In some of these cases there was a return of sensation in part or all of the area supplied by the ulnar, together with improvement in muscular activity.

The general condition of the patients is good. A good many have gained weight. There have been only a very few leper reactions among this group, and in those cases it has been accompanied by or caused by an attack of malaria. Only three out of eighty cases have failed to maintain the improvement gained, and they were complicated in each case by some other debilitating disease or condition.

Among the children there are several early cases in which flat depigmented areas have slowly returned to normal colour, and have all but completely disappeared, so that without a previous history one would be quite unable to make a diagnosis of leprosy.

DISCUSSION

We believe that the granulation and fragmentation of the bacilli and the wrinkling or crepe paper appearance of the skin, seen in the advanced skin cases following treatment, is most significant. Hitherto we have always understood that such fragmentation and such wrinkling occurred only in those cases of leprosy that had acquired sufficient resistance to the disease, as to bring about a gradual diminution of all active symptoms, and that they were in all probability past the peak of their infection and were on the down grade as far as the disease was concerned. If such a stage can be induced by treatment at some early point in the disease, early recovery might be expected. The observation, that the effects of toxoid seem to be constant and that we can predict the progress with a fair certainty, is very encouraging. This is particularly true in respect to the early and as yet unmutilated cases.

In a disease of the chronicity of leprosy, observations of new methods of treatment must of necessity cover a considerable period of time. This is particularly so since this disease is noted for its long periods of exacerbation and quiescence. However this report is offered at this time in order that the results may be verified by others, and the benefits extended as widely as possible. It is hoped that further observations may confirm the impression so far obtained, that in diphtheria toxoid and antitoxin we have a new method of treatment which brings definitely beneficial results.

CONCLUSIONS

While we are not able, at present, to explain the relation between diphtheria and leprosy, or the mechanism responsible for the improvement following injections of diphtheria antitoxin and toxoid, we are convinced that such improvement does occur in a

large percentage of cases treated. We have noted the following beneficial results from among approximately 120 cases treated:

1. Immediate reduction of leper nodules, plaques, and tuberculoids.
2. Rapid improvement in leper reactions, with usually lasting effects.
3. Return of sensation in some previously anesthetic areas.
4. Reduction of enlarged nerves, particularly the ulnars.
5. General physical improvement.
6. Fragmentation and granulation of the bacilli.
7. As yet we have not seen any harmful or deleterious effects from this treatment.

[In a personal communication Dr. Collier mentions that the dose of formol-toxoid used is 0.5 c.c., rising by 0.5 c.c. to 2.0 c.c., injections being given intramuscularly once a fortnight. He states that out of twelve bacteriologically positive children, seven had become negative in six months, and four more showed fewer bacilli. In a summary of his results over the period October 1939 to April 1940, out of 170 cases treated with toxoid (of which 122 were of the lepromatous type) 35 became negative, 70 had fewer bacilli and 128 showed improved skin lesions. These results would appear excellent if it were not that in 147 controls treated with chaulmoogra alone (58 of which were of the lepromatous type) 46 became negative, 25 had fewer bacilli and 16 showed improved skin lesions. Unfortunately the subtype (L1, 2 or 3) of the lepromatous cases is not mentioned.—Editor.]

REVIEWS

Leprosy in India, Vol. XII, No. 1, Jan. 1940.

Leprosy and Dermal Leishmaniasis, by Dharmendra and S. N. Chatterji. The resemblance of the lesions in these two diseases is commented on and illustrated in a series of cases and excellent photographs. Cases of D.L. are often sent to the leprosy department of the Calcutta School of Tropical Medicine under the impression that they are suffering from leprosy. Differential diagnosis depends on the history, such as a previous record of suffering from Kala-azar; on clinical manifestations such as the site and number of lesions, absence of anaesthesia or nerve thickening; and laboratory findings, examination showing *Leishmania donovani* instead of *Mycobacterium leprae*. D.L. appears as hypochromic spots, thick erythematous lesions and nodules. It has a habit of concentrating round the nose and lips and leaving the ears alone. Many serious mistakes have been made in mistaking D.L. for leprosy. Occasionally the two diseases appear in a patient at the same time.

General Principles in Treatment of Trophic Ulcers in Leprosy, by R. G. Cochrane. After cleansing frequently changed eusol dressings or iodoform grs. 10 in eucalyptus oil oz. 1 with or without castor oil are among the remedies recommended. In foul ulcers saturated magnesium sulphate baths for ten minutes. Syringing out sinuses with dettol, 1 in 20 solution. The well-known method of small subcutaneous injections of hydnocarpus oil or other substances is mentioned, as is also strapping after inserting a paste consisting of sulphanilamide 75 grs., adeps lanae 18 drachms and liquid paraffin $6\frac{1}{4}$ drachms. Metatarsalectomy is used when this bone is diseased, the toe being left when it is healthy.

Leprosy in Ancient Hindu Medicine, by Dharmendra. The *Sushruta Samita* of 400 B.C. refers to leprosy under the name of Kushtha, which is divided into seven major and eleven minor forms. One of the former, Arunakushtha, is characterised by loss of sensibility to touch. The disease is supposed to be hereditary and also highly contagious, and it may come as a divine retribution for killing a Brahman, a woman or a relative.

Leprosy, by Sir Leonard Rogers and Ernest Muir, (2nd Edition), 15/-. Wright & Sons, Ltd., Bristol, February, 1940. The first edition of this excellent book on leprosy was published 15 years ago. The joint authors had both had great experience of leprosy work in India, Sir Leonard Rogers, indeed, having, during the long period of his service in India, been brought continually in touch with the problem of that disease, while Dr. Muir had similar experience and did similar work that continued into later years after his colleague had retired from the field. It was under such circumstances that the first edition was produced, with the two authors separated by the distance between England and India, making intimate collaboration between them difficult in the preparation of the work. There has been no such handicap in the case of this second edition, as the two authors both now live in England and have been able to work in closer association.

There have been several very important happenings intervening between the appearance of the two editions: the Leonard Wood Memorial Leprosy Conference at Manila in 1931 and the International Leprosy Congress at Cairo in 1938, the development of the British Empire Leprosy Relief Association and the extensive tours of inspection by Dr. Muir in the leprosy countries of a large part of Africa. The result has been that this second edition is enriched by all the fuller knowledge thus gained, and so embodies all the latest developments in leprology in such matters as early diagnosis, a wiser, more intelligent and humane system of prophylaxis and

prevention, and a very necessary recognition of the special susceptibility of young children to the disease; the formation of agricultural colonies, improved methods of the general treatment, as well as of the various types of special treatment of the disease.

The book is divided into six sections which deal with all phases of the subject: history and distribution, epidemiology and communicability, prophylaxis, prevention, isolation, the bacteriology of the disease; its clinical manifestations; and the classification of the various types. Special attention is given to the latest most approved methods of treatment as accepted by and recommended by the authors. Chaulmoogra oil and its derivatives and their methods of preparation and application are dealt with very thoroughly. The Cairo International Congress of Leprosy in 1938 reported that "hydnocarpus oil and its esters, administered intramuscularly, subcutaneously and intradermally, remain so far as our present knowledge goes, the most efficacious drugs for the special treatment of leprosy." Except for a few charts appearing in the text of the book, the eighty-one illustrations are placed at the end of the book.

As a scientific treatise on leprosy, the first edition held a very high place; this second edition will hold the highest place for authoritative teaching, as the work of two world-renowned leprologists. It ought to appeal also to general readers who are interested in work among lepers. The book is beautifully printed and is easy to read. The authors and the publishers are to be congratulated on the production of such a valuable work.

J. W. LINDSAY.

Revista Brasileira de Leprologia, Vol. VII, No. 3, Sept. 1939.

E. Mendes and G. de C. Cerqueira write on *Lepromin Experiments*. Their conclusions are as follows:—

"Lepromin consists of two portions: one solid, the other liquid, dissociable by filtration, the former being responsible for reactions. In the solid portion the bacillus plays a preponderant role in determining reactions. Since reactions depend on the bacillus, lepromin must be standardized. At present the only feasible method of standardizing lepromin is that of comparison. The extent and intensity of lepromin reactions vary in the same individual according to the dose and concentration. Reactions are no more produced by original lepromin in dilutions above 1/30. Variations in diameter of the nodule formed and in intensity of reaction are found in the same patient, according to the region of the skin where inoculation is made. Leprous individuals show great differences of reaction. Lepromin test is of the greatest value to ascertain local immunity."

A paper by M. Vespoli describes the *Treatment of Leprous Ulcers by Infiltration*. For that purpose he uses chaulmoogra oil and injects it round the edge into the subcutaneous tissue. Good results are obtained as is shown by a series of "before and after" photographs.

Leprosy in Colombia. The *Revista Colombiana de Leprologia*, Vol. I, No. 3, Oct. 1939, estimates the number of lepers in the Republic at 7,897 in institutions, 1,729 registered and other probable cases 7,170, making a total of 16,796. With the population of 8,801,816, this makes 1.92 per mile.

Analysis of Chaulmoogra Oils, by H. I. Cole and H. T. Cardoso. *Jl. Am. Chem. Soc.* 61, 2351, 2349, 2442, (1939).

The authors give the results of a qualitative and quantitative analysis of the three principal chaulmoogra oils, those from *Hydnocarpus anthelmintica*, *Taraktogenos kurzii* and *Hydnocarpus wightiana*. They also describe three new homologs of chaulmoogric acid: alepric, alepylic and aleprestic acids. These three are successively the next lowest homologs to hydnocarpic acid and to each other, each differing from the one above it by C_2H_4 . The percentage composition of the fatty acids of the three oils is as follows:—

Acids	<i>H. Anthelmintica</i>	<i>T. Kurzii</i>	<i>H. Wightiana</i>
Hydnocarpic	67.8	34.9	48.7
Chaulmoogric	8.7	22.5	27.0
Gorlic	1.4	22.6	12.2
Oleic	12.3	14.6	6.5
Palmitic	7.5	4.0	1.8
Lower homologs of hydnocarpic acid	0.1	0.4	3.4
Loss	2.2	1.0	0.4

Differential Diagnosis of Leprosy and Syringomyelia, by S. Schujman. *Revista Brasileira de Leprologia*, Vol. VII, No. 4, Dec. 1939.

Intradermal injection of one drop of a 1 in 1,000 solution of histamine produced a triple response in anaesthetic patches of skin in cases of syringomyelia; in cases of leprosy this triple response was not observed in the anaesthetic patches. The triple response consists of an immediate red halo of a half to one centimeter. A secondary erythema (in about 60 seconds) which extends from 3 to 8 cms. and has a diffuse margin; last to appear is a papule at the point of injection. In leprosy the peripheral neuritis

suppresses the pathway of the axon reflex; while in syringomyelia and other conditions with anaesthesia of central origin the cutaneous nerves are intact, so the histamine flare can be produced. The histamine test is a simple, rapid and accurate means of differentiating leprosy from syringomyelia and other diseases producing cutaneous anaesthesia of central origin.

Transmission of Human Leprosy to the Hamster by the Digestive Tract, by E. Burnet and H. Jadford. *Bul. de l'Acad. de Med.*, 122, 31, p.383, 7 Nov., 1939.

The authors fed a hamster (*Cricetus auratus*) for 12 days on material rich in bacilli taken from human liver. Nine months later it became ill and died. At the autopsy there were no outward signs of disease. Leprous foci were found in the lungs and liver and in the mesenteric lymph nodes, with characteristic lepra cells and bunches of bacilli. The conclusion is that in virtue of this experiment the digestive tract should be considered seriously as a route of infection.

Staining Acid-Fast Bacilli; the Effects of Fixatives and H-ION Concentration on Acid-Fastness, by J. W. Fielding. *Aust. J. Exp. Biol. and Med. Sc.* XII, 1934.

The author refers to the well-known fact that acid-fast bacilli vary in the degree of intensity with which they take up the stain, and that when present in tissue preserved by formalin or other fixatives they may fail completely to hold the stain. He then describes a series of experiments which tend to show that loss of acid-fastness is due to the low pH value of either the fixing solution or the stain. One of these was to subject smears with tubercle bacilli to boiling in 1 p.c. hydrochloric acid, after which, on staining with Ziehl-Neelsen, no organisms could be found. He claims that in tissue fixed in formalin or alcohol the factor responsible for the apparent destruction of acid-fastness is not the fixative, but changes brought about by autolytic action in the tissue which lower the pH value of the fixing solution. Destruction of staining power in sections is accentuated by treatment with fluids having an acid reaction, such as alcohol, xylol, balsam, etc., which are frequently used for lengthy periods, and by finally bringing them in contact with a carbolic acid stain which has a pH value of 2.0. Estimations were carried out with bulky tissue placed in 10 p.c. formalin supersaturated with sodium bicarbonate, showing an initial reaction of pH 8.0. Autolytic action in the tissue was responsible in one case for reducing the pH to 4.0 within a period of 49 days.

The author tested the well-known statement of Dreyer, that tubercle bacilli, heated 100°C in 40 p.c. formalin and then extracted in acetone at 65-70°C for twenty-four hours, lose their acid-fast characters; he found that, using alkaline formalin and alkaline acetone, there was no destruction of their acid-fast properties, and that the factor causing this apparent destruction is the same as that acting in tissues fixed in alcohol and formalin.

The author obtained excellent results by the following two methods of fixing and staining tuberculous or leprous material.

(1) Fixation of small pieces of tissue in 10 p.c. formalin containing 0.5 p.c. sodium bicarbonate and staining with Ziehl-Neelsen. Lung tissue containing numerous acid-fast organisms was placed in this solution for two weeks. Sections from this were stained with Ziehl-Neelsen, washed, and placed in 15 p.c. sulphuric acid. At intervals they were taken from the acid, counterstained, mounted and examined; after two weeks in the acid the bacilli showed fully 100 p.c. staining and acid-fastness. Whereas, with similar tubercle bacilli-laden tissue, fixed in ordinary 10 p.c. formalin for a month, sections stained similarly and immersed in 15 p.c. sulphuric acid for 66 hours, had lost 80 p.c. of their staining property.

(2) Staining tissue fixed in formalin or alcohol with an alkaline fuchsin mixture. The stain is made up in two solutions, (a) 0.25 p.c. sodium bicarbonate solution, and (b) basic fuchsin 1.5 gm. dissolved in 40 c.c. of absolute alcohol and made up to 400 c.c. with tap water, having a reaction of about pH 8.0. The two solutions are mixed immediately before use in the proportion of 1 to 3. Either steam for three minutes with the mixture, or heat the mixture to the boiling point and pour it on the slide and stain for at least ten minutes. Wash in running water, decolourize for two minutes in 15 p.c. sulphuric acid, wash and counterstain for two minutes with 1 p.c. methylene blue.

International Journal of Leprosy, Vol. VII, No. 4, Oct.-Dec., 1939.

Vitamin B₁ Excretion in Urine, by H. C. Hou. This is the first of a series of articles on the subject of vitamin B₁ in the treatment of leprosy. The author selected at random a number of patients from the leprosarium in Shanghai and found that in none of them was vitamin B₁ excreted in the urine, indicating that there was a vitamin B₁ deficiency in these patients. After the oral administration of vitamin B₁ this substance was found in urine in quantities similar to that in normal individuals, and the same results were obtained by parenteral injection. This excretion was not affected by the type of the disease or by the occurrence of fever.

The importance of adding vitamin B₁ to defective diet is emphasised in its bearing on the prevention and treatment of leprosy, the findings of J. A. K. Brown in S.E. Nigeria being quoted (see *Leprosy Review*, April, 1936, p. 54).

Conversion of Simple Macular Neural Leprosy to the Lepromatous Type, by J. N. Rodriguez, H. W. Wade and F. C. Plantilla. Three cases are traced as far as possible through this stage of evolution, the changing histological and clinical signs being described. The lepromatous form was first found in new lesions and not in the old simple macules.

The Course of Open Cases of Tuberculoid Leprosy at Cebu Leprosarium, by H. W. Wade, J. N. Rodriguez and J. G. Tolentino. This is the fourth article of a series on this subject. The authors emphasise the well-known fact that after lesions have existed for some time a secondary set of lesions may develop that can be ascribed only to metastatic dissemination by way of the blood stream. Lesions were found to pass from major to minor tuberculoids [or, in other words, a temporary phase of reaction appeared and passed off]. The article is well illustrated with photographs.

Inoculation of Human Leprosy into the Syrian Hamster, by J. A. Doull and E. Megrail. *Maintenance of the Golden Hamster*, by P. Laidlaw. These two articles deal chiefly with the technique of keeping and breeding hamsters for experimental work with human leprosy.

The Histopathology of Simple Leprids, by N. Ermakova. This form of lesion, which was placed by the Cairo Congress classification along with tuberculoid macules under the neural type, gives a histological picture different from both the tuberculoid and the lepromatous lesion. Neither the epithelioid cell and Langhan's cell of the former, nor the lepra cell of the latter are present. The histological picture is that of an ordinary chronic inflammation with small round cells arranged chiefly round the bloodvessels and generally accompanied by a similar small cell infiltration of the neighbouring nerves. "The following stages can be observed in the course of evolution of a simple flat leprid: (1) with diffuse erythema; (2) with marginal erythema and central regression; (3) with hypochromia and marginal erythema; and (4) the pale, depigmented condition."

The Fight against Leprosy in the French Overseas Territories, by H. Delinotte. The census of 1936 gave the total population of the French overseas territories as 1,212,436 French

citizens (Europeans and assimilated peoples) and 47,685,972 natives.

" In all the French territories overseas the numbers of lepers recorded, up to the beginning of 1938, reached 104,000. According to estimates that have been made there are in the neighbourhood of 170,000 cases in these territories. It is evident, however, that an exact index of the disease cannot be established until it has been possible to make a complete census of lepers among all the populations. That will be a work of long duration. This study shows how, under the inspiration of the things that have been accomplished, and the results that have been obtained in other countries, France has made an important contribution to the campaign undertaken against the world scourge of the disease of Hansen. The efforts of all those who are charged with conducting this great effort are guided, and justly appreciated, by the Consultative Commission on Leprosy of the Colonial Ministry, which ably assists the national government.

" The measures of prophylaxis employed have as a base the application of modern scientific principles and conceptions imbued with liberalism. These measures are supported by active propaganda which permits the natives of the colonies to understand better the end that is sought. As was recently written by Professor Marchoux, president of the Commission and also of the International Leprosy Association, in a communication presented to the Academy of Medicine: ' We no longer tolerate protection against the patient, but against the germ which he carries . . . We do not agree that the leper should be treated with less humanity than are persons with tuberculosis . . . For this horrible social evil which desolates the best among our possessions beyond the seas, we cannot expect to attain the result sought without the co-operation of the people, instructed with regard to the means of protecting themselves. It is to dissipate ignorance that we must today apply all our efforts.'

" The progress of public and personal hygiene, the resources of therapy made daily more effective, the understanding of the patients justified by aid given them unceasingly; these are the elements which permit us to anticipate the diminution if not the disappearance, in the French colonial empire, of one of the evils which oppresses them and contributes for a time to those things that impede their progress towards prosperity."

Vitamin A Treatment of Ulcers, by G. A. Ryrrie.

" In recent work with leprotic ulcers fairly definite indications have been seen that local applications of vitamin A have an almost specific healing effect. Any dressing with a substance rich in vitamin A—cod liver oil, red palm oil, minced goat liver, etc.—made up as an ointment will do. At present I am using shark liver oil which is cheap and has vitamin content of 22,000 international units per gram. Necrotic bone must of course be removed before benefit can be expected, and no alkaline substance should be used in the preliminary cleansing. In any place where sharks are to be had it is a simple matter to obtain a vitamin-rich oil; it is only necessary to wrap the liver in muslin and place it in boiling water, when the oil comes to the surface.

" Under this treatment it is amazing, and very pleasant, to see large intractable ulcers healing up. Vitamin A dressings are most valuable in very sluggish, anaemic or semigangrenous ulcers. The clinical maxim should be: the more intractable the ulcer the higher the concentration of vitamin A should be in the dressing. Conversely, the vitamin concentration should be lowered where there is already healthy granulation, otherwise over-stimulation will occur with tissue irritation. An agreeable preparation is:—

Red palm oil	...	...	4 parts
Cod liver oil	...	...	4 parts
Eucalyptus oil	...	...	1 part
Zinc oxide	...	...	1 part
Hydnocarpus oil	...	...	2 parts

For syringing sinuses the eucalyptus oil and zinc oxide may be omitted from the prescription. Applications of high vitamin A content should not be used on ulcerative tuberculoid leprosy. Shark liver oil or halibut liver oil will not heal ulcers that are due to concomitant syphilis, and if rapid healing of an ulcer does not take place the diagnosis should be reconsidered from this point of view."

REPORTS.

Saidapet Health Project. The Second Progress Report describes the work of the Saidapet Health Association from its beginning in 1933 up to 1939. Saidapet is a suburb of Madras and many of its 33,000 citizens work in the city. "When, in 1932, the Y.M.C.A. College of Physical Education moved to Saidapet, an opportunity was available to its staff and students for community service in the town. It was agreed that in no better way could such an effort be inaugurated than by assisting in the formation of a Health Association. In co-operation of this kind a useful avenue of experience and service is opened up for all teachers, and especially for those who organise courses of physical education activities in schools and municipalities." This suburb was found to be suffering from defective sanitation, epidemics of small-pox, cholera, filariasis and leprosy. There were private doctors, but medical relief was not well co-ordinated.

After considering how it should begin work, the Health Association decided to concentrate on leprosy, the disease in the eradication of which the people themselves were most interested. Enquiry at the Government dispensary elicited the reply that there were *only 9 cases* in the whole of Saidapet. It was therefore decided to carry out a leprosy survey and visits to 3,000 homes discovered no fewer than 456 cases. However, the startling fact appeared that $2\frac{1}{2}$ times more children than adults were suffering, a finding which is considered to point to active spread of the disease.

"The next problem to be faced was the fact that leprosy is a chronic disease. Efforts to discover cause and relief must, if effective, be continued with unabated enthusiasm for years. How then was this interest to be maintained? During the survey, requests for a maternity centre had been insistent. The opportunity was taken therefore to interest the citizens of Saidapet in the efforts of the Association to relieve and eradicate leprosy, by first winning their co-operation and interest through an efficient maternity and child welfare centre. It has been, and increasingly is, a valuable means

of maintaining public interest in all the work which has been co-ordinated as the Saidapet Health Project.

“ The injections for leprosy are painful, improvement slow, investigations tedious and troublesome. The leprosy clinic staff must constantly visit the homes explaining the necessity for persistent treatment and regular observation; enthusiasm is apt to wane and faith and patience must slowly be developed. For this the work of the Maternity Centre is invaluable. The women attending the Ante-Natal Clinic have after a few months a lovely baby, born under better care than they could otherwise hope to secure. The result of this is that the mothers, because of what has been done for them, have confidence in the rest of the work undertaken by the Association. Soon after the maternity centre was started it became apparent that it was to be the corner stone upon which research in leprosy would be built. Therefore, in judging the work of the maternity centre, its main object of acting as a propaganda centre for the research into leprosy must constantly be borne in mind. If this is done it is easy to appreciate the need for expenditure upon it over and above that usually spent upon a maternity centre.” In the last year as many as 1,575 mothers attended the ante-natal clinics.

As a later development the establishment of a tuberculosis unit is under way.

In the Silver Jubilee Children's Clinic, 576 children are now registered. Its object is to investigate the causes of the development of leprosy in children, the types found and their significance, and the factors influencing the development of the more serious types. While treatment is given, this clinic is primarily an investigation centre and it is hoped that the information obtained will be of benefit to those endeavouring to control leprosy throughout the Presidency of Madras, and elsewhere. . . . As with the rest of the world to-day, Saidapet is caught in an economic conflict. There is much confusion between tradition and modern social and educational ideas. Old loyalties have been lost and firm new ones not yet developed. In the midst of this uncertainty it is not enough merely to save life. We must also work for a better life. So in all of this work, the foundation of which is leprosy investigation, we keep in mind the motto of the Saidapet Health Association: ‘ Saidapet shall be the cleanest and the healthiest town in South India, by 1950.’ ’

Leprosy in French Guiana. *Rev. du Palud. et de Med.Trop.* 15th February, 1940. Professor Ch. Achard describes his visit to this territory. There are rules for the notification and detention

of lepers, but these are not carried out. At Cayenne there are about 200 leper children who are excluded from ordinary schools. It will be necessary to create a special school for them. It is difficult to say how many lepers there are in the colony, the total population of which is about 47,000. Floch in 1938 found 692 definite cases, 178 suspects and 464 under surveillance. There are several village settlements for the lepers, a leprosaria under the Cluny sisters with 30 patients, and on the island of St. Louis 136 patients, 62 of whom are from the penal settlement. In Cayenne, the chief town, a part of the hospice is inhabited by lepers of which the isolation is "*assez illusorie.*" It is realised that it is necessary to establish an institution which will be effective and which will be attractive to the patients, with gardens and room for agriculture. The cost of construction is estimated at about seven million francs.

Methylene Blue and Neutralised Oil. The Annual Report on Leprosy in French India recommends two forms of treatment in particular which may be used alternatively in the same patients:—

1. Intravenous methylene blue, made up in 5 c.c. ampoules according to the following prescription:—

Official methylene blue	...	1 g.
Magnesium chloride	...	1.20 g.
Distilled water	...	100 c.c.

It is injected once a week, 0.5 c.c. being given on the first week of the month and 1 c.c. on the following weeks. Four out of five positive cases treated in this way, who were positive at the beginning of the year, have now become negative, and fifteen cases have shown clinical improvement.

2. Intravenous injections of neutralised Hydnocarpus wightiana oil. Two injections of 2 c.c. per week are given, commencing with 1 c.c. Though effects are procured to begin with, further improvement ceases after 80 injections. When this occurs the treatment should be changed to that with methylene blue or with subcutaneous injections of neutralised oil for a period of six months.

Leprosy in Hawaii. Annual Report of Board of Hospitals and Settlement for year ending June 30th, 1938. The Hawaii Islands have an area of 6,406 square miles. The population was 191,909 in 1910, 255,912 in 1920 and is now 412,000. There were 649 lepers in segregation in June, 1938, making about 1.5 per mille. The Board was organised in 1931 to carry out the Leprosy Program

in the Territory. There is a " continued decrease to a new low record in the total number of active leprous patients at Kalihi Hospital and Kalampapa Settlement. . . . It can be stated safely that there is no place in the world where the problem is handled any better than in Hawaii, both from the standpoint of protecting the public and the welfare of the patient." The total per capita cost per day for all purposes was \$2.09 (about £150 a year per patient). The Board had available for expenses for the year no less than \$1,206,361. Forty-five patients were admitted during the year.

Leprosy in the Gold Coast. The following is an abstract from the Report of the Medical Department for 1938 :—

" Settlements accommodating 390 lepers are situated at Ho, Kumasi, Accra, Yendi and Sekondi. The most important settlement is that at Ho, which has 236 inmates. In Accra, Kumasi and Sekondi the lepers are housed in portions of the local Contagious Diseases Hospital; a not wholly satisfactory arrangement. In Accra, where 78 lepers are maintained, it is hoped in the near future that a new settlement will be built on a site much more favourable for farming and poultry raising. The question of the re-housing of the Accra lepers is now somewhat urgent as the huts occupied by them in the old Contagious Diseases Hospital are rapidly becoming dilapidated beyond repair. Owing to staff shortage our knowledge as to the incidence of leprosy in the various localities, and generally, has not been materially increased during recent years. The incidence progressively increases as one proceeds north. Calculations based on the generally held supposition that there are about two lepers per mille of population show the total number of lepers in the Gold Coast to be between 7,000 and 8,000. This estimate, it is considered, is on the low side. Of the lepers seeking admission to one or other of the settlements, most are those who have become a burden on their relations and friends. Others are removed as homeless wanderers from the streets. For those lepers, discovered during routine house-to-house inspections, who are unwilling to enter a settlement, nothing much can be done except to advise them to seek treatment as out-patients. Some follow this advice; the majority do not. In all cases where lepers are accommodated in ordinary living houses, the house owner is advised how best to avoid spread of the infection to others. Sometimes this advice is well carried out. As a general rule the people exhibit little fear of infection, and it is chiefly when the infected become helpless and a burden that an effort is made to obtain accommodation for them elsewhere."

In 1936 recommendations were made in his Report by the Medical Secretary of B.E.L.R.A. for controlling leprosy (*Leprosy Review*, January, 1937, p. 182). Apparently, unlike Nigeria which was visited at the same time, the Gold Coast has done little or nothing to implement these recommendations or to control the disease in recent years.

Father Damien Foundation for the Campaign against Leprosy.

In December, 1937, the Belgian Minister for the Colonies appointed a Royal Commission to study the means of co-ordinating, reinforcing and extending the campaign against leprosy in the Belgian Congo and in Ruanda-Urundi.

They found 60,000 lepers in the colony, but considered that the total number was probably far larger. Of these, 14,983 are isolated in agricultural colonies.

The following conclusions were come to by the Commission:—

“ The fight against leprosy in the Belgian Congo has reached a phase of great activity. The number of those affected by leprosy is more than 5 per mille, and the task undertaken is enormous. The fight against leprosy raised many problems and complications in the domains of medicine, sociology and finance.

“ The Commission considers that in order to accomplish its object the fight against leprosy in the Colony should be placed under the direction and control of a single stable organisation under the Director-General of Hygiene for the Colony.

“ It is, besides, persuaded that this authority should not cease from its efforts till it has rendered moral, scientific and material help. The Commission, in accordance with the spirit of the Minister of the Colonies who has appointed it, makes the following resolutions:—

1. That the action taken by the Government for isolating lepers in agricultural colonies be extended, and that isolation be improved by a more scientific selection of the lepers isolated, by studying the different types of leprosy and the separation of those particularly infective, by the creation of creches for the healthy children of lepers, by the establishment of treatment in each colony and the hospitalisation of the bed-ridden.

2. That the Government create the posts of leprologists who will be in particular charge of the application of social measures against leprosy, the supervision of the colonies and epidemiological study.

3. That scientific study of leprosy be concentrated in a well-equipped central laboratory.

4. That in seeking for more active means of treatment, the planting of Chaulmoogra oil-producing trees be extended in the Colony.

5. That this action be re-inforced by the creation of a National Belgian Organisation with a view to associating the active good will of Belgium in an effort to combat leprosy in the Colony.

“ In conformity with this last resolution, the Commission has the honour to submit to the Minister of the Colonies a project for the creation of a National Belgian Association for fighting leprosy in the Belgian Congo and Ruanda-Urundi, in memory of Father Damien, the apostle of lepers.

“ The Commission propose that the resources of the Association be assured by contributions from the budgets both of the Colony and of the metropolitan country, by generous private contributions, by subscriptions from Members of the Association, and from other sources.”

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