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Editorial

WHAT IS LEPROSY?

The question is neither facetious nor superfluous. It is directed, as a very serious and practical interrogation, to all workers in leprosy—from epidemiologists, clinicians and administrators to reconstructive surgeons and microbiologists. It is prompted by a reacquaintance with leprosy programmes in the Far East and South-East Asia and by conversations with patients and non-specialist doctors, with dedicated laymen and public health officials. The varying answers given to the question, dependent, as they largely are, upon the field of activity, professional experience, and personal bias of the individual, not only account for the present trends of leprosy treatment/control programmes, but will determine the future prospects of success in the world-wide attack on the disease

The most abiding impression gained from recent contacts is one of disillusionment, amounting in some situations almost to resignation and despair. In some quarters the prevailing attitude is an apparent unawareness of the dimensions and intractability of the leprosy endemic, coupled with failure to keep abreast of new knowledge. There is enthusiasm, granted, and excellent work is being done—many more leprosy patients are being treated, and the disease is being arrested in the individual. But patients still come forward for diagnosis and treatment in an undiminishing, unending stream. The total patient load increases, since programmes are reluctant to release patients from control. And drug-resistance, presumed on clinical grounds, is appearing with increasing frequency, as is the number of patients with acid-fast degenerate mycobacteria persisting in the tissues. It is not surprising to note, therefore, that a pall of gloom seems to have enveloped not only many percipient leprosy workers, but also those concerned—at government level or in voluntary agencies—with providing money and staff for leprosy work.

It is here suggested quite seriously that the question "What is leprosy?" should be asked, and answered, in the light of experience gained during the past decade. The answers given will provide clues to the disappointing conclusions that are inevitable in any objective appraisal of the general situation.

In far too many countries, among far too many doctors and educated laymen, leprosy is equated with deformity, with claw-hand, plantar ulceration, lagophthalmos and the rest. The signs of "early leprosy" are thought to be epistaxis, or ulnar paresis, or drop-foot. A widespread nodular rash, pathologically and clinically "late", is often considered to be "early leproma". If medical men think along these lines, the general public can scarcely be blamed for regarding leprosy in terms of the distal secondary results of a fibrotic neuropathy.

The sad consequences of this failure to recognize early leprosy are seen in the typical cross-section of patients presenting themselves voluntarily at a diagnostic clinic. The great majority come because of some obvious or stigmatizing

deformity. In lepromatous disease it may be facial or helical nodules, madarosis, collapsed columellae, symmetrical ulceration of the extremities, or hoarseness. In tuberculoid disease it is often an extensive skin lesion that can no longer be concealed by clothing, or it may be plantar ulceration, or an infected, painless wound.

Interrogation of the patients themselves, and sometimes regrettably also of the doctors or paramedical workers in charge, reveals the glaring disparity between the answer they give to the question "What is leprosy?" and that given by those who appreciate the time differential between an initial delimited or generalized specific mycobacterial infection and the consequential fibrosis within the peripheral nerves that follows the established histopathological patterns.

Part of the present predicament is attributable to the new knowledge about nerve damage in leprosy gained by neurohistopathologists on the one hand and by reconstructive surgeons on the other. With new knowledge has come a far better understanding of the pathological processes involved—though some of these require further clarification—and the possibility of surgical interventions of various kinds that have brought some measure of mechanical and cosmetic hope. Some of the welcome newer emphases, however, are being over-emphasized in some medical teaching and public propaganda, so that the popular belief that leprosy is to be equated with deformity is being intensified and reinforced by misapplied knowledge.

Furthermore, some leprosy treatment/control schemes appear to be less effective than they were because doctors are devoting more time to rehabilitation (in the larger sense) than to case-finding and treatment of early leprosy. This subtle shifting of emphasis appeals to the surgically-oriented professional and to the supporter of leprosy work who is impressed by photogenic "before-and-after" pictures. It is not only that patients, because of their ignorance of the real "early lesion" of leprosy, present themselves (or are diagnosed) after advanced and irreversible damage to peripheral nerves has occurred, but that the expenditure of time and effort to discover and treat (medically and surgically) the great mass of patients makes the whole exercise prohibitively expensive for a developing country.

Rehabilitation, whether surgical or social, is costly in man-hours and in money. Ideally, it should not be necessary. An equivalent expenditure of effort on education and integrated treatment would undoubtedly be more productive of results in the individual leprosy sufferer and in the community. Some patients, especially among the lighter-skinned Mongolians or Caucasians, are going to suffer nerve damage despite our best efforts, but in many others—perhaps in most—judicious treatment of leprosy in its early stages will forestall and prevent clinically evident impairment of motor and sensory modalities.

The patient suffering from what is frequently miscalled "leprosy" may no longer require treatment for *leprosy,* yet he may be advised to trudge weary miles every week (on insensitive feet) to obtain a supply of an anti-leprosy drug that will have no effect whatever on his neuropathic ulcers. Moreover, from the epidemiological standpoint, such a patient may no longer constitute a source of infection to the community.

Perhaps one of the most important aspects of the presentation of patients with evidence of advanced peripheral nerve damage is the indication it affords of the existence of untreated leprosy. It is, in fact, an index of neglect, or at least of the non-availability of leprosy treatment in the past. A progressive reduction in the

proportion of newly-diagnosed patients already exhibiting some deformity indicates the success of treatment campaigns and health education.

A scarcely less important aspect of the problem relates to the false impression created concerning the real prevalence of leprosy in the community. The numbers of patients with lesions that are recognized as such and openly admitted to be leprous in nature by the doctor and the layman, may represent a small proportion of those actually suffering from leprosy, and moreover, may provide misleading data of the numbers and location of index cases disseminating viable bacilli, and of the success of a treatment programme.

Another point: if the question "What is leprosy?" is answered in terms of incurable established deformity and peripheral ulceration, then efforts will be directed towards custodial care of patients thought to be contagious. On the other hand, where leprosy is still regarded as a mysterious visitation or as a uniquely "unclean" condition, money may be expended in ways having little relevance to the reduction of contagious foci or the control of the disease.

The time is more than ripe to initiate a world-wide campaign of education and re-education among medical students and doctors (especially in countries where leprosy constitutes a major health problem), and also among community health leaders, auxiliaries and teachers, politicians, and ordinary people. If a greater and more lasting impression is to be made on the leprosy problem in these countries, current misconceptions must be exposed and replaced, whether they derive from pre-scientific traditional lore or from the recent admirable emphases on the surgical aspects of "leprosy".

Economic considerations correspond to and supplement humanitarian urges: it is cheaper, as well as better, to prevent peripheral nerve damage than to attempt to restore function (but not, unfortunately, sensation) to denervated muscles, to prevent cartilaginous and bony collapse of the nose than to restore lost contours and channels.

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News and Notes

HANSEN'S CENTENARY–COMMEMORATIVE POSTAGE STAMPS

Several countries will be issuing, during 1973, special commemorative postage stamps to mark the centenary of Armauer Hansen's discovery of *Mycobacterium leprae* and his associating the rod-shaped organisms with the human disease.

Norway and Argentina were the first to announce the issue of such stamps. Among other countries which have now decided to do so are France, Burundi, Cameroun, Chad, India, The Ivory Coast, Niger, Laos, and Peru. The Order of Malta will also be issuing a special stamp.

DAMIEN-DUTTON AWARD 1972

Leprosy Review extends its congratulations to Dr Patricia Smith of Seattle, Washington, U.S.A., on receiving the Damien-Dutton Award for the year 1972. The presentation was made to Dr Smith by the Rev. John G. Furniss, the President of the Damien-Dutton Society. Dr Smith has been working among leprosy sufferers in the primitive tribes living in the highlands of South Vietnam.

BELGIAN KING AND QUEEN VISIT A L E R T

The well-known interest of Their Majesties King Baudouin and Queen Fabiola of Belgium in social questions, including leprosy, was demonstrated in November 1972, when they made an extensive tour of the installations at the Princess Zenebe Work Hospital, Addis Ababa, now available for the All-Africa Leprosy and Rehabilitation Training Centre (A L E R T).

Two nursing sisters, Andrée de Jongh and Thérèse de Wael, who are together responsible for the "Gate Clinic", and Dr J. Cap–all Belgian nationals–play a prominent part in the service and teaching commitments of the Centre. King Baudouin announced a generous grant from the Belgian Government, and *Les Amis du Père Damien* also presented a much-appreciated gift.

A L E R T–POSTGRADUATE COURSE

Twenty-one doctors, 2 directors of national leprosy control programmes, and a volunteer educational training assistant registered for the postgraduate course organized by A L E R T and held from 3 to 27 October, 1972.

Countries of origin and basic training (one representative from each country unless otherwise indicated) were Austria, Denmark, Ghana, Holland, India (2), Ireland, Italy, Libya, Norway, Pakistan, Philippines, Poland, Spain, Sudan,

Fig. 1. King Baudouin of the Belgians and Queen Fabiola during their visit to A L E R T. Photograph by courtesy of Tegegn Gebre.

Tanzania, United States of America (3), and West Germany (4). Following their study at A L E R T, these participants are assuming, or returning to, their leprosy service assignments in Ethiopia (6, including 4 on temporary assignment at A L E R T), Ghana, India, Libya, Nepal, Nigeria, Pakistan, Sierra Leone (2), Sudan, Tanzania (2), Trinidad, Uganda (2), United States of America, Upper Volta, and Zaire. One participant returned to Austria for further study.

Course Treatment

The course content included lectures, profusely augmented by lantern slides and other visual aids, extensive out-patient clinic demonstrations, hospital ward rounds as well as demonstration sessions in the physical therapy department, orthopaedic workshop, and occupational and health education departments; there were also field trips to rural school clinics and rural leprosy control stations.

SEMINAR ON TROPICAL MEDICINE-- SEOUL, KOREA

The 12th South-east Asian Regional Seminar on Tropical Medicine and Public Health and the 4th Seminar on Tropical Medicine, Seoul, will be held in Seoul, Korea, from 29 May to 2 June, 1973. The seminar will be divided into five main groups as follows: Biology, Immunology and Epidemiology, Treatment, Immunodiagnosis of helminth diseases in the laboratory and in the field, and a Laboratory Demonstration.

In the section on "Treatment", opportunity will be afforded for contributions on the treatment of bacterial infections, including leprosy. The time allotted for individual presentations is 15 minutes, to be followed by 5 to 10 minutes of

discussion. Abstracts should be in the hands of the Chairman of the Organizing Committee, Professor Chin-Thack Soh, before 31 March, 1973. His address is:

Institute of Tropical Medicine,
Yonsei University,
International P.O. Box 1010,
Seoul, Korea.

CELLULAR IMMUNITY–SEMINAR IN ETHIOPIA

A seminar on "Cellular Immunity and resistance to leishmaniasis, leprosy and tuberculosis" was held in Addis Ababa, Ethiopia, from 25 to 30 September, 1972. It was financed by the World Health Organization, the Wellcome Trust of Britain, the Norwegian Agency for International Development, and the Norwegian and Swedish Save the Children Organizations, and the arrangements were made by the Armauer Hansen Research Institute (AHRI), which is affiliated to A L E R T (All-Africa Leprosy and Rehabilitation Training Centre).

A total of 42 delegates from 7 African countries and 3 from Europe took part; all were medical doctors or students, or research experts.

The guest consultants were: Dr D. C. Dumonde from the Mathilda and Terrance Kennedy Institute of Rheumatology, London; Prof. Morten Harboe from the Institute for Experimental Medical Research, Oslo; Dr G. B. Mackaness from the Trudeau Institute, Saranae Lake, U.S.A.; Dr R. J. W. Rees from the National Institute for Medical Research, London; and Prof. J. L. Turk from the Royal College of Surgeons, London. Prof. R. S. Bray, of the Wellcome Parasitology Unit in Addis Ababa and the staff of AHRI–Dr T. Godal its Director, Dr B. Myrvang, and Dr Dorothy Samuel–also presented papers. The seminar studied recent findings in immunological research, especially those emanating from projects in Africa itself.

In the words of Professor Morten Harboe, "this seminar is another step forward in bringing African research centres closer to their advanced counterparts in other countries".

MEXICAN SOCIETY OF LEPROSY

The 8th Annual Meetings of the Mexican Society of Leprosy were held from 13 to 15 September, 1972, at Mazatlán, Sinaloa, Mexico. A happy variety of papers presented laboratory findings, reports on control measures, and a review of the leprosy endemic in Mexico over the past 12 years.

The President of the Society is Dr M. M. Ramírez (Julián de los Reyes No. 315, San Louis Potosi, S.L.P., Mexico). The next annual meetings will take place in Leon, Guanajuato, from 29 to 31 August, 1973.

EDUCATING THE EDUCATORS

Leprosy is often the poor "country cousin" in medical curricula, even in schools set in the midst of highly endemic areas. Five serious obstacles to any innovation in teaching programmes were listed by Dr John Bryant at the recent World Conference on Medical Education held in Copenhagen in September, 1972. (His book, *Health and the Developing World,* was the subject of a review in a previous issue of *Leprosy Review* (1971) **42**, 224-5).

Among these obstacles Dr Bryant mentioned the following: innate conservatism; bureaucracy; the complexity of present curricula; lack of available resources; and the paucity of models on which suggested changes could be based. Perhaps the time is propitious to medical students and graduates for attempting to introduce leprosy as a clinical and pathological entity of great importance and increasing interest.

LEPROSY IN THE SOUTH PACIFIC

As in most areas of the world, the exact prevalence and distribution of leprosy in the islands of the South Pacific are unknown. Little indication is provided by either the numbers of self-reported cases or the numbers of crippled ex-patients. The total number of patients registered in all the Islands would be about 9000, of whom about 4300 are at present receiving treatment. The real total of leprosy sufferers, however, might well be as high as 33,000, to judge from limited population surveys, the advanced clinical state of self-reporting patients, and the lack of complete medical coverage of areas where leprosy constitutes a real public health problem.

The largest island, Fiji, with its total population of about half-a-million people, has under treatment about half the estimated total of 1400 sufferers, but systematic case-finding and determined contact examinations would almost certainly bring to light many patients whose leprosy is unsuspected by both themselves and their families. While the suggested over-all prevalence rate of 10 per 1000 is certainly too low, in some island groups (for example, Western Samoa, Tonga, and New Caledonia), a regrettably low proportion of the estimated total number of sufferers is receiving treatment. That the situation has international repercussions is to be deduced from the fact that Island immigrants into New Zealand—particularly from the Cook Islands, Samoa, and the Gilbert and Ellice Islands—account for an average of about 4 new cases of leprosy per year in Auckland, which now has the greatest Polynesian concentration in the world.

In Fiji, the Tuomey Memorial Hospital undertakes the care of in-patients from the island itself, and beyond. The hospital was erected with funds supplied equally by the Leper Trust Board, the Government of Fiji and the British Government. It replaced the historic Mopagai/Mokonai Leprosy Institution. The difficulties of diagnosis, treatment, and control in the islands indicate that some modification in modern concepts of domiciliary care should be evolved to cope with the need of a few leprosy patients in small villages separated by long distances of sea.

LEPROSY IN THAILAND

On the advice of the WHO Consultant based in Bangkok, the Thailand Government has completed a programme of leprosy case-finding and treatment in 43 of the 71 Provinces. In a total of nearly 25 million people examined (representing a 68 % coverage of the population), over 88,000 cases of leprosy were detected. During the past 17 years over 49,000 of these patients have received sufficient treatment to be released from control.

The Thai Department of Health now wishes to rapidly extend the leprosy programme to the remaining Provinces, but cannot do so because of the shortage of trained medical and paramedical staff. Partly for this reason, and partly

because it is theoretically desirable, a policy of integration of the leprosy programme into the general health services has been adopted. To this end, short "orientation courses" have in 1971 been given to 2300 auxiliary health workers in 21 Provinces, and a seminar was organized to bring together leprosy workers in both voluntary agencies and government. The omens appear propitious for continued collaboration in the leprosy campaign.

Government plans at present look forward to the extension of the integrated leprosy programme into a further 28 Provinces in the next 4 years, enlisting the co-operation of existing voluntary-agency hospitals. At the same time, the leprosy service already in operation in 43 Provinces will be intensified. The methodology of both operations is that approved by WHO. It is expected officially that the number of leprosy patients under treatment might reach 120,000 by 1976, occurring in a population of over 33 million, and that the number of patients released from control might well, by that time, reach over 65,000.

The bottleneck in this ambitious plan is trained staff, and no special budgetary provision has been made for training staff beyond the ordinary rhythm. It would appear that valuable and strategic help could be afforded by voluntary agencies providing financial help for training staff for the leprosy programme. Doctors are needed, and also senior auxiliary staff.

A further report on possible government budgetary provision for this purpose, and the precise size of the help requested of voluntary agencies, has been requested.

LEPROSY IN AUSTRALIA, 1971-72

The Annual Report of the Director-General of Health of the Commonwealth of Australia shows that 32 cases of leprosy were notified during the year 1971-72, as against an average of 67 for each of the 4 preceding years. Western Australia and the Northern Territory each accounted for 13 cases; there were 4 cases in Queensland, one in Victoria, and one in South Australia.

The Report discloses that rehabilitation and training of Aborigines in paramedical work were the main emphases during the year. The Leprosy Service now has a full-time physiotherapist.

The great majority of patients under medical care are not suffering from active, contagious disease. Instances of suspected relapse are fully investigated.

The School of Public Health and Tropical Medicine in Sydney continues its study of the efficacy of BCG vaccination in the Karimui Valley, Papua, and New Guinea. A further study on the use of Acedapsone (DADDS) confirms the earlier good reports, but 2 cases of suspected drug resistance have been detected.

LEPROSY IN KOREA

The Korean Leprosy Association held its 16th Annual Meeting on 26 and 27 October, 1972, in the commodious premises of the World Mission Centre in Seoul. Several guests from outside Korea attended: namely, Dr J. Rodriguez (Vice-President of the International Leprosy Association, from the Philippines), Dr F. Noussitou (World Health Organization Consultant to the Government of Korea), Prof. Masahiro Nakamura (Chairman of the Department of Microbiology,

Kanuma University School of Medicine, Japan), and Dr S. G. Browne (Secretary-Treasurer of the International Leprosy Association).

Under the vigorous Chairmanship of Prof. Lew Joon, Professor of Microbiology in the University of Seoul and for many years a leader in the struggle against leprosy in Korea, the Conference took the novel form of a short introductory talk on various chosen aspects of leprosy, followed by commentary and discussion. Dr Browne led a discussion on treatment, Dr Rodriguez spoke of non-lepromatous forms of leprosy in epidemiology, while Prof. Nakamura shared with the participants his recent work on the cultivation of *Myco. lepraemurium* in artificial media.

In the light of the leprosy situation in Korea and the low prevalence rates found in the few pilot surveys done, it was considered that far more emphasis should be given to education. Most people equate leprosy with advanced deformity, and hence early leprosy is unrecognized. The accepted estimate of 70,000 leprosy patients in a population of 25 million must be viewed in the light of these findings. The Korean Leprosy Association works closely with the various voluntary organizations, both indigenous and expatriate.

THE KOREAN RESETTLEMENT VILLAGES

During the meetings reported above, Dr Youn K. Cha, President of the Korean Leprosy Association and Director of the Korean Institute for Family Planning, gave a most interesting and informative paper on the Resettlement Villages which have recently become a feature of the leprosy programme in Korea. On the suggestion of Prof. Lew Joon, these villages were created in an attempt to tackle the social problems of a considerable population that had lived for years in the government-sponsored and Government-financed settlements. Many of these patients were no longer suffering from active disease, but repeated attempts to get them accepted by their families and villages had proved unsuccessful.

With grants from the central Government over 12,000 of these ex-patients, most of them with some physical deformity—often obvious and stigmatizing—had been transferred to areas of unoccupied but fertile land and had there constituted "Resettlement Villages". There are at present some 78 of these villages, and their population has increased to 24,420 souls in the past 10 years.

Dr Cha considered that the experiment had proved very successful. The people had a strong motivation to work, and self-support had in most cases been already achieved. In fact, many of these villages are now regarded as "rich" by the neighbouring communities. They are able to sell farm produce through the usual channels. He emphasized that medical rehabilitation should continue while the patients lived in the villages, and medical supervision and facilities should be provided.

A recent development is that patients who are still under treatment for multibacillary forms of leprosy have, on their own volition and at their own request, been admitted directly to such villages, without causing any disruption or antagonism.

Dr Cha thought that patients in these villages should qualify for social allocations and other financial benefits as if they lived in ordinary communities. Family planning advice should be made available to them on the same grounds, in the light of the fact that 60 % of the total village population is now in the

category of dependants, mostly children. (Vasectomy, which was first offered to leprosy patients, is now generally accepted by the non-leprous population as a means of family limitation.) He recommended that Government loans should be made available for the inhabitants of these villages so that they may develop to the full their economic potential.

One indication of the power of the past is that the children of ex-leprosy patients are not yet accepted in ordinary schools. The speaker advocated persistent educational propaganda to remedy this state of affairs, and the award of Government grants to promising students in the Resettlement Village Schools.

While the programme of Resettlement Villages was really a temporary expedient to meet a specific social problem within the context of a deep fear of leprosy, the undoubted success of the scheme should go far to help rehabilitate present sufferers from the social stigma of leprosy.

INDIAN ASSOCIATION OF LEPROLOGISTS: SEMINAR ON LEPROSY

On 28 and 29 October, 1972, the Indian Association of Leprologists conducted a week-end seminar on leprosy at the Gandhi Memorial Leprosy Foundation, Wardha. The theme of the seminar, "The critical assessment of leprosy control, with special reference to early diagnosis, management, case-holding, and criteria for discharge of patients from control", involved many matters of practical importance, and attracted a large and representative attendance of leprosy workers.

The National Leprosy Control Programme in India, which has been in operation for the past 15 years, has faced the special difficulties inherent in a very severe prejudice against leprosy. The mood of the seminar was established in its first session by Dr Kapoor, Special Leprosy Officer, Maharashtra State, when, in reviewing progress during the past 17 years in this advanced State, he concluded that while the programme has helped large numbers of patients, protected an equally large number of people against leprosy, and helped to promote understanding of the leprosy problem and the study of its epidemiology, no evidence is forthcoming that the disease is being controlled. This statement put into words an anxiety that was shared by those present.

The seminar was concerned first with the need to evaluate objectively the National Leprosy Control Programme and examine its successes and its failures. The principles that should govern such an evaluation have been laid down by the Government of India, but they have not yet been applied. The seminar addressed a memorandum to the Government urging the speedy implementation of these principles and offering the services of the Indian Association of Leprologists to this end.

Other papers presented at the seminar were concerned with ways and means to improve the technical side of the leprosy control programme. Throughout the territories so far covered, the lynchpin of the programme is the paramedical worker. Large numbers of such workers, supervized by relatively few medical officers, provide the setting to which the technical aspects of leprosy control have to be related and their limits determined. Absenteeism from treatment—a widespread and difficult problem in the cultural and economic situation of rural India—was analyzed by Dr Ekambaram, who made some useful suggestions.

"Action is based on knowledge" was the theme of Dr Nilakanta Rao in stressing the importance of health education among all concerned.

A series of papers discussed the problems of early detection and diagnosis in field conditions, dealing with such subjects as: the better training of personnel; the problem of masked lepromatous leprosy; the need for more thorough clinical examinations and recording and follow-up of all doubtful cases and contacts; more widespread and careful bacteriological examinations; and lastly, the co-operation of dermatologists and neurologists.

Suggestions for the future planning and organization of a control unit to incorporate a base hospital, were made by Prof. Antia and Drs Noordeen and Macaden. Problems of discharge, relapse, and drug resistance were the subjects of papers by Drs Parikh, Ramu, and Job; surgical aspects were dealt with by Drs Selvapandian and Gangadhar Sharma.

A fascinating analysis of leprosy among school-children in Greater Bombay by Dr Ganapathy repeated the principal preoccupation of the seminar with those factors in the transmission of leprosy that are not yet fully appreciated or covered by existing leprosy control measures. The presence of Dr Sushila Nayar as an honoured guest, the benign Presidency of Dr Job, and the perfect hospitality of Dr Nilakanta Rao and his staff made the seminar a memorable occasion.

LEPROSY SEMINAR IN FIJI

For some years the Leper Trust Board of New Zealand (Christchurch) has been actively concerned with the leprosy problem in the islands of the South Pacific, and has annually raised considerable funds for the support of Mission- or Government-sponsored activities related directly or indirectly to the treatment of leprosy. The Board broke new ground recently by generously financing the expenses for travel (by air, necessarily) and hotel accommodation of about a score of medical officers from 9 of the Islands to enable them to attend a 2-day seminar on leprosy conducted by Dr Stanley Browne. In addition, final-year medical students from the Fijian School of Medicine, local doctors and doctors from New Zealand and Australia brought the total number of participants to about 50. The Secretary for Health, Dr E. M. Salato, opened the Seminar at the invitation of the Dean of the Medical School, Dr T. G. Hawley.

For some of the participants, this seminar was their first systematic acquaintance with leprosy as a diagnosable and treatable disease. A clinical demonstration at the nearby Tuomey Memorial Hospital was arranged by Dr E. Karuru, its Medical Superintendent, and gave the opportunity to demonstrate the varied presentations of the disease and the problems of differential diagnosis.

In view of the lack of knowledge of the precise prevalence of leprosy in the Islands, the probable wide range of prevalence rates, the back-log of serious deformity, and the ignorance and prejudice concerning the disease, a more determined effort should be made both to ascertain the dimensions of the problem and to take steps to integrate leprosy as far as possible into the rather rudimentary health services at present available in the widely scattered island communities.

LEPROSY PROJECT FOR INDONESIA

The Danish Save the Children Organization has just concluded an Agreement with the Indonesian Government for a leprosy programme for the Maluku Islands,

Soluwesi, based on Macassar. The Agreement will run for 4 years (i.e. till the end of 1976).

With the technical guidance of the World Health Organization which will make available to the Project the services of a full-time leprologist, a leprosy control programme will be established in the area, consonant with the Government "Master Plan of Operation for strengthening the National Health Services". It will not only provide facilities for the diagnosis and treatment of leprosy, but will organize in-service training courses for Indonesian doctors and paramedical staff.

The actual plan of operation will be drawn up after full study and consultations between the Government, the WHO, and the Danish Organization. The total cost to be borne by the last named—excluding salaries, etc. for the expatriate staff—is limited to $500,000 spread over the 4-years' term of the Agreement. Salaries will probably amount to about $300,000.

The hope was expressed that German, Italian, and Dutch Member-Associations of ELEP might wish to share in the financial implications of the Project. For administrative reasons, the Danish Save the Children Organization has assumed prime responsibility for initiating and organizing the Project, but the other Scandinavian countries have signified their readiness to participate in the cost. Member-Associations of ELEP that have taken a much-appreciated share in the Pogiri and Aska Projects in India (now administered by the Indian Government) may wish to have a similar interest in the present Project in Indonesia. By mid-1973 a Dutch leprologist, at present engaged as WHO consultant in Burma, will be available for Indonesia.

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The Differential Tuberculin Test in Leprosy

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The differential tuberculin test has been carried out on a group of leprosy patients using 5 different PPD antigens (S, Y, G, B and F) obtained from *Mycobacterium tuberculosis* and other mycobacterial species. The patterns of sensitization seen in the leprosy patients were found to be different from those of the general population and of tuberculous patients, but no marked differences in the patterns were seen between the patients with lepromatous and those with tuberculoid leprosy.

In both groups of patients, there was with all the antigens except PPD-F, a clear-cut group of non-reactors and a group of reactors. Both tuberculoid and lepromatous leprosy patients had, in contrast to tuberculous patients, a significant proportion of non-reactors. It was also found that the patterns of sensitization to antigens obtained from mycobacteria other than *Myco. leprae* were not different in the two immunological extremes of leprous disease.

Introduction

Leprosy patients show two extremes of cell-mediated immunity (CMI). In the tuberculoid type of disease, CMI is said to be well developed, whereas in lepromatous leprosy the response is depressed (Almeida *et al.*, 1970). Attempts at experimental sensitization of lepromatous patients with dinitrochlorobenzene revealed that the majority of them could not be sensitized by this method (Waldorf *et al.*, 1966). On the other hand it has been shown that with the use of "stronger antigenic stimuli", such as keyhole limpet haemocyanin, it is possible to produce sensitization of these patients (Turk and Waters, 1969).

The immune deficiency in lepromatous leprosy has been shown to be specific to *Myco. leprae*. Thus, reviewing the work on the delayed-type response elicited by tuberculin-type sensitins, Hart and Rees (1967) concluded that species of mycobacteria other than *Myco. leprae* were capable of eliciting "positive" skin responses, irrespective of the clinical type of leprosy. They also deduced that "in spite of the common antigens shared by all species of mycobacteria, the characteristic anergy to lepromin in patients with lepromatous disease applies to no species of *Mycobacterium* other than to *Myco. leprae*." It has been shown that in a given area the prevalence of tuberculin positivity in leprosy patients is similar to that in healthy persons, but tuberculin reactivity is said to be significantly weaker in lepromatous patients than in tuberculoid patients in the same age group and from the same area.

The Ceylonese have been shown to possess a high level of sensitization to mycobacterial PPDs (Pinto *et al.*, 1972). At least in some rural areas in the lowlands of Sri Lanka, up to 98 % of the general population show reactions of

2 mm or more on tuberculin testing with PPD sensitins from various mycobacteria, indicating some degree of sensitization to mycobacterial antigens.

The present investigation is an attempt to study the reaction of leprosy patients in Sri Lanka to various mycobacterial PPD sensitins.

Materials and Methods

The patients studied in this survey (total 153) were those being treated for leprosy, either as out-patients at peripheral clinics or as in-patients at Institutions of the Anti-Leprosy Campaign of Sri Lanka. The diagnosis of the clinical type of leprosy was as made by the Campaign. Only patients considered to have active disease requiring treatment were tested.

The characteristics of the populations tested are summarized in Tables 1, 2, and 3. The majority of subjects investigated were patients who had been receiving treatment for longer periods of time. Also the majority of patients tested in this study had lepromatous disease, but the proportions of patients investigated do

TABLE 1

Percentage distribution of patients (total 153) according to source

	Type of disease		Total
	Tuberculoid	Lepromatous	
Hendala Hospital (in-patients)	24	24	48
Mantivu Hospital (in-patients)	7	31	38
Gampola Clinic (out-patients)	5	5	10
Katugastota Clinic (out-patients)	4	0	4
Total	40	60	100

TABLE 2

Percentage distribution of leprosy patients according to type of leprosy and duration of disease

Type of disease	Duration of disease (years)			
	<2	2-5	5-10	>10
Tuberculoid	10	6	12	12
Lepromatous	5	15	18	22
Total	15	21	30	34

TABLE 3

Percentage distribution of tuberculoid and lepromatous leprosy patients according to age and sex

Age (years)	Tuberculoid			Lepromatous		
	Male	Female	Total	Male	Female	Total
<24	3	2	5	1	1	2
25-34	3	1	4	8	1	9
35-44	5	2	7	12	1	13
>45	19	5	24	32	4	36
Total	30	10	40	53	7	60

not reflect the real distribution of the types of leprosy in the country as a whole, where in newly diagnosed cases tuberculoid disease is four times commoner than lepromatous leprosy (Department of Health Services, 1972). The antigens used in this survey (kindly supplied by Dr Lydia B. Edwards of the U.S. Public Health Service) were as follows:

PPD-S from *Myco. tuberculosis*; PPD-Y from *Myco. kansasii* (Runyon's Group I); PPD-G from Gause strain Scotochromogen (Runyon's Group II); PPD-B from *Myco. batteyi* (Runyon's Group III); PPD-F from *Myco. fortuitum* (Runyon's Group IV).

The test protocol followed was essentially the same as that described in a study of differential tuberculin sensitivity in rural populations in Sri Lanka reported earlier (Pinto *et al.*, 1972). Every subject was given 2 antigens on the volar aspect of either forearm, each antigen being administered in a dose of 0.1 ml (equivalent to 5 TU) intradermally, using the technique recommended by the World Health Organization (1963). Every subject was given PPD-S, and 3 other antigens when permitted. The reactions were read as the maximum palpable transverse induration, 48 to 72 hours after injection. All antigens were administered and results read throughout the study by the same person.

Results

The frequency distributions of the reactions to the different antigens in the entire group of leprosy patients tested is shown in Figs 1a to 1e. The majority of the patients tested (more than 80 %) came from the lowland coastal areas of Sri Lanka and hence the frequency distributions of the reactions to the same antigen from lowland Sri Lanka (Pinto *et al.*, 1972) are also presented in the same figure, together with the distribution of reactions seen in tuberculosis patients in the country (Pinto *et al.*, 1973). The distributions of reactions to the different antigens in the two clinical types of disease are shown in Figs 2a to 2e.

DISTRIBUTION OF REACTIONS TO INDIVIDUAL ANTIGENS

PPD-S. The distribution of reactions to this antigen in the entire group as well as in the separate tuberculoid and lepromatous groups is clearly bimodal. The right-hand component of the curve consists of a well-marked reactor group with a mode at 14 to 15 mm and closely resembles the frequency distribution seen in tuberculosis patients for whom this antigen is the homologous one. There appears to be no difference in the distribution of reactions between patients with the tuberculoid and lepromatous forms of leprosy.

PPD-Y. With this antigen, the distribution obtained from the entire group of leprosy patients (Fig. 1b) does not present as distinct a bimodal appearance as does the distribution of PPD-S, but a demarcation can still be made out. Here too the right-hand reactor component appears to resemble the distribution of the reactor component for this antigen, seen in tuberculous patients with similar modes. As with PPD-S a much greater proportion of non-reactors are seen in leprosy patients than in tuberculous patients. The distribution shown by the patients with tuberculoid leprosy seems to have a reactor component with a mode of 12 to 13 mm, larger than that of lepromatous patients (6 to 9 mm. Fig. 2b).

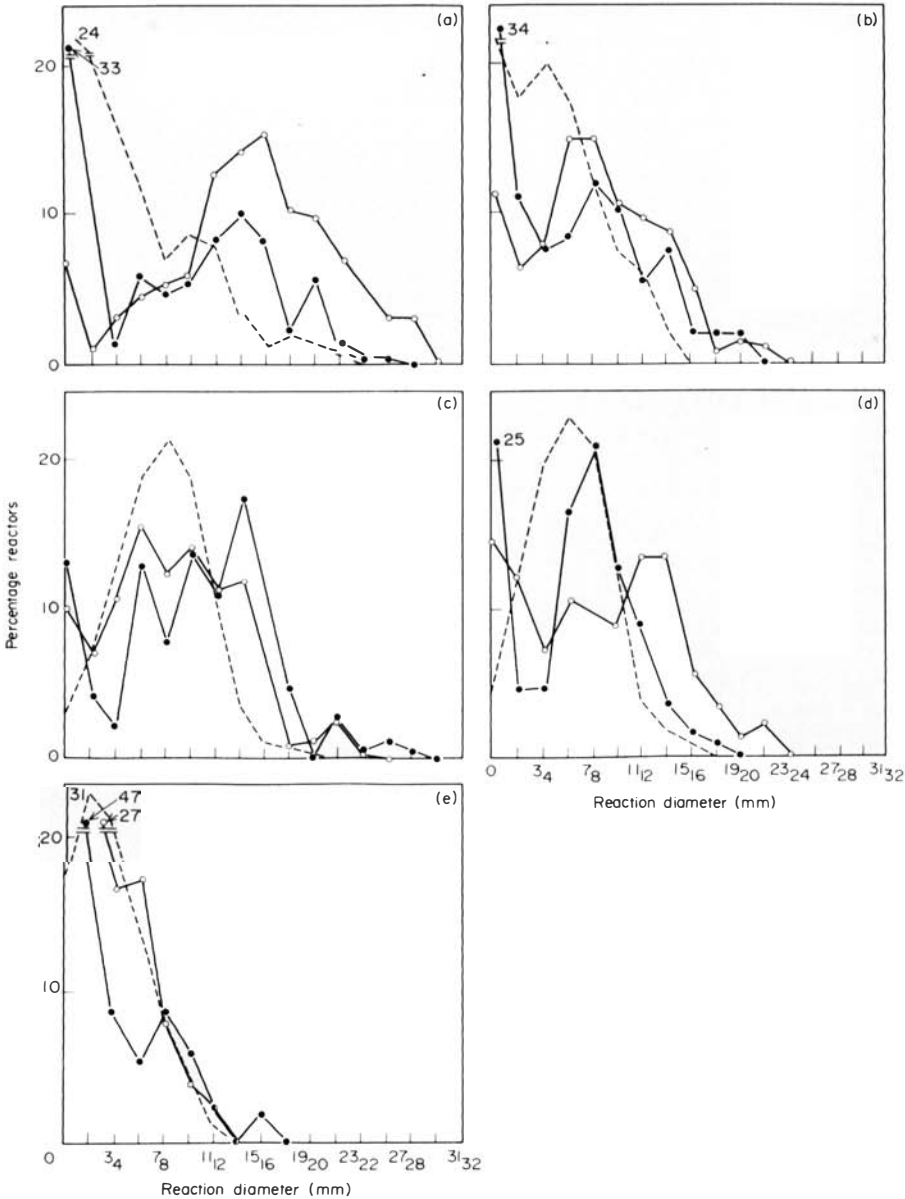

Fig. 1. Frequency distribution of reaction diameters in leprosy patients (—●—), tuberculous patients (—○—) and normal persons (– – –); a = PPD-S, b = PPD-Y, c = PPD-G, d = PPD-B and e = PPD-F.

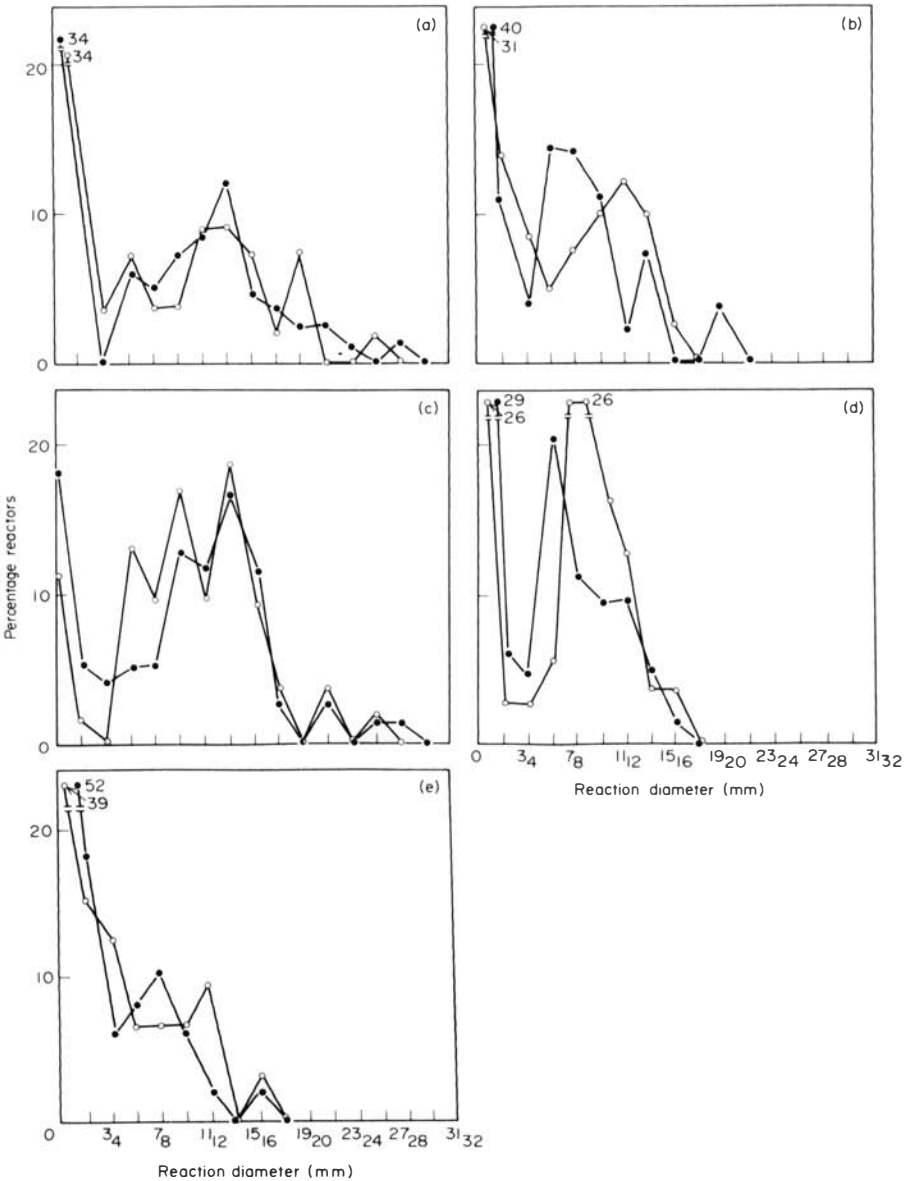

Fig. 2. Frequency distribution of reaction diameters in lepromatous patients (—●—) and tuberculoid patients (—○—); a = PPD-S, b = PPD-Y, c = PPD-G, d = PPD-B and e = PPD-F.

PPD-G. The frequency distribution to this antigen also appears to show a bimodal pattern. The identification of a clear cut mode of reactors is more difficult, but the latter mode seems to be larger than that of either tuberculous patients or of the general population presented for comparison (Fig. 1c). The distribution of tuberculoid and lepromatous patients also appear to be similar (Fig. 2c).

PPD-B. The separation of reactions into a reactor component and non-reactors is marked. The tuberculoid patients appear to show a larger mode (10 to 11 mm) than lepromatous patients (6 to 7 mm, Fig. 2d).

PPD-F. The separation of reactions into non-reactors and reactors is not clear. The distribution of reactions in the two types of disease appears similar (Fig. 2e).

The mean reaction sizes to the different antigens in leprosy patients, tuberculous patients, and the general population are presented as sensitivity profiles (Edwards, Hopwood and Palmer, 1965) in Fig. 3a. The profiles of the two types of leprosy patients are shown in Fig. 3b. There appears to be no difference between the profiles of the tuberculoid and those of lepromatous patients.

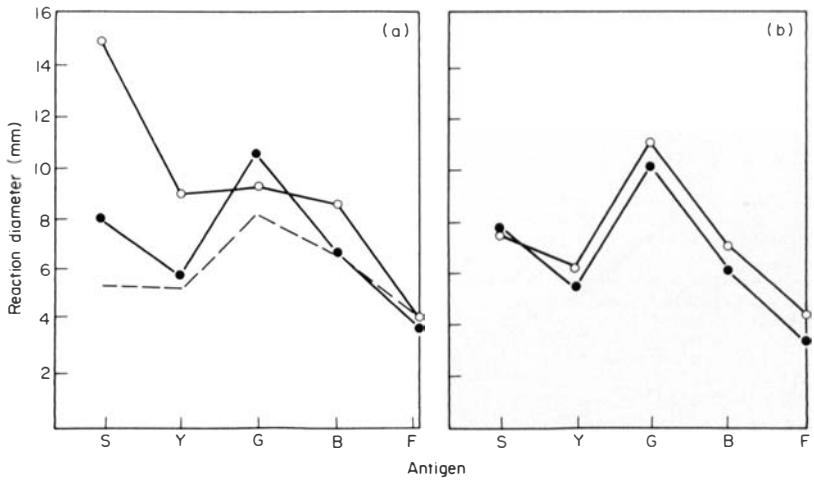

Fig. 3. a, Sensitivity profile of leprous (—●—), tuberculous (—○—), and normal persons (– – –) to 5 mycobacterial PPDs. b, Sensitivity profile of lepromatous leprosy (—●—) and tuberculoid leprosy patients (—○—) to 5 mycobacterial PPDs.

Clinically, it is a common practice to classify tuberculin reactions as "positive" or "negative"–positive being considered to indicate infection by the homologous organism. At different times varying criteria of "positive" have been proposed. In Table 6 is presented the percentage of positive reactors among the two clinical groups of leprosy patients as compared with tuberculosis patients and the general population from rural, lowland Sri Lanka.

Discussion

It has been said that the "evaluation of delayed hypersensitivity in leprosy has been hampered in the past by the use of antigens to which the incidence of

TABLE 4

Percentage distribution of non-reactors (0-1 mm) in leprosy and tuberculous patients

Disease	All 4 antigens	3 out of 4 antigens	2 out of 4 antigens	1 out of 4 antigens
Lepromatous leprosy	6	4	10	15
Tuberculoid leprosy	2	2	10	10
Tuberculosis patients	2	3	7	19
General population, lowland Sri Lanka	<1	4	10	23

TABLE 5

Percentage distribution of reaction size according to antigen and type of leprosy

Reaction size	Antigen S		Y		G		B		F	
	T[a]	L[b]	T	L	T	L	T	L	T	L
0-1 mm	34	34	31	40	11	18	26	29	39	52
>2 mm	66	66	69	60	89	82	74	71	61	48
>6 mm	50	54	46	46	89	73	69	60	30	24
>10 mm	40	44	34	22	67	61	38	25	18	10

[a] T, tuberculoid leprosy.
[b] L, lepromatous leprosy.

TABLE 6

Percentage distribution of leprosy patients according to type of leprosy and duration of disease

Type of disease	Duration of disease (years)			
	<2	2-5	5-10	>10
Tuberculoid	10	6	12	12
Lepromatous	5	15	18	22
Total	15	21	30	34

sensitization is not clearly defined in healthy or comparable controls" (Waldorf *et al.*, 1966). Thus the literature on the tuberculin test in leprosy appears to be conflicting. Wade (1950) found tuberculin reactivity to be diminished in lepromatous leprosy. In contrast, Lowe and McNulty (1953) and Lowe (1955) concluded that the clinical characteristics of leprosy did not influence the response to tuberculin. On the other hand, Bullock (1966) found a decreased incidence of skin reactions in certain patients with either the tuberculoid or lepromatous form of the disease. The evidence from this study seems to be more in agreement with the findings of Bullock. From the frequency distributions it is apparent that no single antigen used in this study could discriminate between the two types of leprous disease, since a high incidence of non-reactors is seen to each antigen in both groups of patients. With all antigens except PPD-F, it is seen that the frequency distributions in the leprosy patients are more or less different from those of tuberculosis patients and the general population. This suggests that the immunological status of leprosy patients with reference to cell-mediated

immunity is one that is different from that of the latter two groups. However, this pattern appears to be different in regard to the humoral antibody response, which is marked in lepromatous leprosy (Almeida *et al.*, 1970) whereas in tuberculoid leprosy the high levels of antibody seen in the former are not found. It has been shown that lepromatous leprosy patients show antibody titres of almost the same order as tuberculous patients, as detected by Takahashi's antitubercle phosphatide kaolin agglutination test (Takahashi, 1962) while patients with tuberculoid leprosy show a distribution of titres similar to that seen in "normal" blood donors (Pinto *et al.*, unpublished data, 1972). This finding, and the similarity of the reactor components of reactions to PPD-S in leprosy patients, suggests a close antigenic (phosphatide and protein) relationship of *Myco. leprae* to *Myco. tuberculosis.*

It is now generally accepted that some form of immunological deficit exists in lepromatous leprosy as far as cellular responses are concerned. But some workers believe that this immune depression is specific for the antigens of *Myco. leprae,* while others conclude that the depression is non-specific. Evidence has been produced that showed that following BCG vaccination, tuberculin conversion rates were much lower in children of leprosy patients as compared with those of parents without leprosy (Jamison and Vollum, 1968). This suggests that genetic factors may possibly be involved in the ability of subjects to respond to antigens which evoke delayed hypersensitivity responses.

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An Account of a Leprosy Village and its Place in the Treatment of Leprosy*

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The history and working of a leprosy village in the British Solomon Islands are described. Treatment carried out in the village is reviewed. The rôle of the leprosy village is discussed. The leprosy village described is a success in that it gives adequate treatment, saves money and, most important, the inhabitants are happy. A competent and respected person in charge of the village is essential. He should have a basic nursing training. The village must be adequately supervised.

Introduction

The Solomon Islands comprise an archipelago stretching in a south-easterly direction from New Guinea and spreading over 900 square miles (1450 square km) of the Pacific Ocean. One of the 6 larger islands in the group is Malaita; like its neighbours, it has a mountainous spine and is covered with dense tropical rain forest which, at intervals, drops down to the coastal reefs. The island is 140 miles (225 km) long and has a maximum width of 20 miles (32 km). The population of 52,000, which is all Melanesian, lives in scattered villages both in the interior and on the coast. The average annual rainfall in Malaita is 125 in (318 cm). In the only 2 leprosy surveys done on Malaita, the prevalence of leprosy was approximately 1 % (Ross Innes, 1937; Drake, 1963). A third survey is now being carried out.

The Government Administration centre for Malaita District is at Auki, which lies on the island's north-west coast. The leprosy village of Ombufau is 4 miles (6.4 km) from Auki town and 3½ miles (5.6 km) from the Government District Hospital. The hill-top setting of Ombufau is very picturesque, with a magnificent view across the sea to the neighbouring islands. However, the village is not easily accessible. It can be reached either by foot along a bush path from Auki or by Landrover up a very rough 2½-mile (4 km) track which becomes impassable in bad weather.

History

Ombufau village was started in 1941, just before World War II came to the islands. In this year a 22-year-old policeman, P.C. Mahlon Moite'e, of the British Solomon Islands Constabulary, on being found to have leprosy, was discharged from the Force. After initial treatment, he returned to his village in an area of Malaita where there has always been a high prevalence of leprosy. After a short

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period at home, he decided to become a dresser with the idea of helping others who had contracted leprosy. He discussed the matter with Dr Hugh Wheatley, one of the first Solomon Islanders to qualify in medicine. The latter readily agreed to have Mr Moite'e trained, and this was undertaken at the District Hospital. It was during this period that Dr Wheatley and Mr Moite'e conceived the idea of a leprosy village in the Auki area. At that time the only permanent settlement for leprosy patients was at the Hospital of the Epiphany at Fauambu, 15 miles (24 km) from Auki. This hospital, which is run by the Melanesian Mission, still has a small leprosy settlement.

On completion of his training as a dresser, Mr Moite'e returned to his village and gathered together the leprosy families in the area. After discussion most of them decided that they would like to form a community and live together at a place where medical help was at hand. A local landowner provided land at Ombufau for the village and its gardens. This land has now been inherited by Moite'e's son, John Quaeifiae, who unfortunately contracted leprosy himself and now lives at Ombufau with his family. Dr Wheatley gained Government approval for the scheme and the patients themselves cleared the land and built, in bush materials, houses for themselves, a sturdy clinic, and two dormitories. The village, which had a fluctuating population of about 40, soon became permanently established and entirely self-supporting.

Life at Ombufau was disrupted when World War II came to the Solomons. During this time Dr Wheatley died and, as a result, the village ran solely under Mr Moite'e's care for several years. Although no military action took place at Ombufau itself, Japanese forces were in the vicinity. After the war years responsibility for the maintenance of the village and for Mr Moite'e's salary was assumed by the Malaita Council, and medical supervision was re-established by the Government Medical Department.

As might be expected, the fortunes of the village have fluctuated over the years with the inevitable changes of staff and the waxing and waning of enthusiasm for leprosy work at both medical and council levels. Thanks to Mr Moite'e's personality and dedication, and despite some damage to his hands and feet, the village has kept going. In 1963 he was honoured with the Western Pacific High Commissioner's Badge.

In 1960 the Lepers' Trust Board Inc. of New Zealand, which has given generous financial support and shown much interest in the problems of leprosy in the Pacific, rebuilt the clinic and dormitory block in permanent materials and installed a water supply. Recently the Board financed repairs to the clinic and provided new water storage tanks. Since the beginning of 1969, medical supervision of Ombufau has been assured by regular monthly visits by government medical staff.

Description

Ombufau is situated on top of a 500 ft (152.4 m) hill with good surrounding agriculture land. The village is dominated by its Rural Health Clinic, a building in permanent materials, 40 ft long by 22 ft wide (12.2 by 6.7 m)—see Fig. 1.

The entrance to the clinic leads into a central reception or waiting area, and on either side are two large rooms, one of which is used as a dormitory by females, the other as a recreation centre. Behind the reception area are two smaller rooms, one of which is a store for basic medical equipment and provisions and the other a

Fig. 1. The Rural Health Clinic at Ombufau.

consulting and treatment room. Behind the clinic is a permanently constructed single-roomed dormitory 30 ft by 20 ft (9.2 by 6.1 m) with accommodation for 12 male patients (Fig. 3). Scattered around these two buildings are 11 typical Solomon Island leaf houses; these have been built by the villagers for their families.

The main water supply to the village has been installed by the Lepers' Trust Board Inc. of New Zealand, and consists of 4 large fibre-glass tanks which supply water to the clinic, the dormitory and a tap in front of the clinic where villagers collect water for domestic use (Fig. 3). The Lepers' Trust Board has also built an ablution block and pit latrines to encourage a high level of hygiene. Around the

Fig. 2. Three ex-policemen: right, Mr Moite'e in charge of Ombufau; left, Mr Satafana, his assistant; and centre, a patient with trophic ulcers in a plaster boot.

Fig. 3. The dormitory block, fibre-glass water tank, and village houses at Ombufau.

village are gardens which are worked communally. The garden produce and the rearing of livestock make the village practically self-supporting.

Aims of the Village

These are: (1) To offer a normal village life in a home-like environment to leprosy sufferers and their families. (2) To accommodate patients who are undergoing short-term treatment such as the healing of trophic ulcers. (3) To provide an opportunity to educate patients in their disease, and particularly in the care of their hands and feet. (4) To provide facilities for investigation and treatment at low cost. (5) To provide a refuge for patients who are rejected by their villages—fortunately an uncommon happening in the Solomon Islands.

The Work of the Village

The village is under the vigilant care of Mr Moite'e, who is officially the Council Dresser for the clinic; he also acts as the village Headman. He is held in great respect by the village and by all those in the area served by his clinic. His police training has helped to mould him as a leader. His assistant is Mr Satafana, also an ex-policeman, who contracted leprosy in his youth (see Fig. 2).

The clinic opens every morning for the administration of anti-leprosy drugs and for any other medical treatment required. Serious problems, including leprosy reactions, are referred to the District Hospital. The only leprosy drugs administered by Mr Moite'e are those ordered by medical officers. No maternity work is undertaken at the clinic.

On the first Thursday of every month the clinic is visited by a Government Medical Officer and the Government physiotherapist. Not only do the village patients attend, but also leprosy patients from the surrounding district. Treatments are reviewed and all hands and feet examined. Neuropathic ulcers of the feet are treated by plaster of Paris boots, and the patients are given crutches.

Owing to weather conditions, short leg walking plasters have proved impracticable. Footwear, which is supplied by the Lepers' Trust Board of New Zealand, is distributed to all patients who need it. This consists in most cases of durable plastic sandals or canvas basketball boots, some of which are modified to accommodate foot deformities.

During these visits, the physiotherapist holds an exercise session. Encouragement is given to continue the simple exercises in her absence. Every opportunity is taken to teach care of the hands and feet during these routine visits. Patients who are having their drug dosage increased stay in the village for a short time; this has proved satisfactory and popular. Some food is provided by the Government to help feed the short-time patients billeted in the village.

Apart from the medical work described, village life goes on as in any other Solomon Island community, with the men building the houses and preparing new gardens, while the women do the cooking, collect firewood, and tend the gardens.

Results

Visits have continued every month for 3 years. The statistics that follow deal with the period July, 1969 to June, 1972 inclusive.

TABLE 1

Leprosy patients seen at Ombufau

Leprosy patients living at Ombufau	16
Patients temporarily housed at Ombufau	22
Leprosy patients attending from the surrounding area	31
Total	69

The average number of patients seen each month was 31, the total number varying from 15 to 47. Low attendances were accounted for by heavy rain which made the journey to Ombufau difficult.

The patients who were admitted on a temporary basis came from all over Malaita. The commonest cause for admission was trophic ulcers. Other causes included patients awaiting the confirmation of the diagnosis of leprosy, the establishment of drug therapy, and the general care of the hands and feet. The average stay of these patients was 12 weeks.

TABLE 2

Treatment carried out for leprosy patients

Patients established or re-established on leprosy drugs	13
Patients accommodated for the investigation of leprosy	8
Trophic ulcers treated with plaster of Paris bandages	37
Burns treated	11

All adult leprosy patients were given a weekly dose of 200 mg of dapsone; "burnt out" cases were also given treatment since this simplified the administration of drugs. Patients newly diagnosed were given treatment initially in the District Hospital and they tolerated the drugs well. They were transferred to Ombufau, where the dosages were increased. When the dose had been increased to the maintenance level, patients coming from a distance returned home.

Eight patients were accommodated in the village for further investigation of possible leprosy. The delay in diagnosis was due to the fact that skin biopsy specimens have to be sent to New Guinea for a histo-pathological report, and this takes approximately 3 weeks. Of the 8 biopsies, 5 were positive and 3 negative. As all confirmed leprosy patients were being given anti-leprosy drugs, there would appear to be little risk to the 3 patients who were found not to have leprosy.

Of 43 feet with neuropathic ulcers, 37 were treated with plaster of Paris boots. Treatment of these ulcers in the village was satisfactory in that all the ulcers eventually healed, although a few later recurred and plasters had to be reapplied. Most of the ulcers that had to be treated in plaster were seen in the first year of the survey.

A few small ulcers were treated by dressings alone, a procedure found to be adequate.

Discussion

Although very little about leprosy villages appears in the literature they do in fact exist in varying forms in many parts of the world. Opinions differ as to their value.

After World War II four leprosy villages were started in various parts of the Solomon Islands. After running fairly well, one was washed away by a cyclone in 1967 and the inhabitants returned to their original villages. Two others have unfortunately fallen into disuse, owing to lack of support and a suitably trained person in charge. Ombufau alone continues to function.

In 1952, C. J. Austin visited Ombufau on Malaita and a leprosy village, now completely run down, at Sidu on the island of Santa Ysabel. He felt that there was certainly a place for leprosy villages of this kind.

J. N. Rodriguez visited the Solomon Islands in 1957 as a World Health Organization consultant and while there inspected Ombufau. He, like Austin, felt that Ombufau was playing an important rôle in the management of leprosy on Malaita. However, he emphasized that such villages must be properly supervised.

In 1964 R. V. Wardekar also visited the Solomon Islands as a World Health Organization consultant and saw some of the leprosy villages. He stated in his report that "it is doubtful if these (leprosy) villages are serving any useful purpose".

It is clear from personal experience in the Solomon Islands that while a leprosy village can serve a useful rôle, it must be in the charge of a responsible person with at least a basic nursing training. He must have an interest in leprosy, and his work should be supervized regularly by a doctor. One of the advantages of Ombufau is that it is easily accessible from the district headquarters, allowing medical staff to visit the village and return to base in one day; two of the other villages failed because of their remote location. Ombufau has been fortunate in that it includes a Health Clinic.

Adequate finance is always a problem in any leprosy programme. The Solomon Islands' Government finds it more economical to house patients in a leprosy village than in a busy district hospital, or to incur the expense of sending them (and perhaps their families) to the Government Leprosarium on another island. Ultimately the factor that determines the success of such a village is whether or not the inhabitants are content. The people of Ombufau always appear cheerful, and the fact that many of the neighbouring leprosy patients attend the monthly

visits shows that the village is an acceptable centre. The patients receive better individual attention in a village concerned mainly with leprosy problems than in an acute general hospital.

Health Education at Ombufau appears to have been successful in that the patients now want to have footwear and are quick to present their worn-out shoes for replacement. Patients who formerly neglected their hands and feet are now more careful, knowing that they will be inspected each month.

The patients appear to have lost much of the dread of leprosy in recent years. This is partly due to the fact that they realize they can live happily in a village setting rather than be incarcerated for many years in an institution—a most important factor in making leprosy villages successful.

Acknowledgements

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Lepr. Rev. (1973) **44**, 29-32

Necrotizing Reaction in Lepromatous Leprosy*

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Classification of the lepra reaction is reviewed. The cutaneous eruptions in the form of vesicles, pustules, or necrosis are indicative of a severe form of the reaction. A case is reported in a woman who presented, for the first time, a lepra reaction. She had systemic symptoms, and cutaneous and mucous membrane lesions leading to palatal perforation. The rarity of lesions of this type and the difficulty in their categorization into recognized types of lepra reaction are discussed.

Reactions in leprosy are the greatest obstacles to the cure of the patient, retarding recovery in the most favourable cases and in others often bringing about death prematurely. Opinions differ as regards the definition of this condition. The panel on reaction at the 8th International Congress of Leprologists held in Rio de Janeiro in September, 1963, defined it as "An acute or subacute clinico-pathological syndrome which appears during the chronic course of lepromatous leprosy with systemic symptoms and local lesions in the skin and other organs". To this, Ridley (1969) added "the histological disturbance which occurs during reactions is not associated with either the activity or the regression of the leprous granuloma".

There has so far been no generally acceptable classification of lepra reaction. Wolcott (1947) and Jopling (1959) defined the difference between "lepra reaction" and *erythema nodosum leprosum* in terms of mild and moderate forms of lepromatous reaction. The panel dealing with reaction at the Rio congress used the terms "leprosy-exacerbation" (which was the old lepra reaction) and "lepra reaction" (which was the old *erythema nodosum leprosum*). As Dharmendra subsequently remarked: "They made confusion worse confounded". Ridley (1969) proposed a classification of lepra reaction into down-grading reactions, reversal reactions, exacerbation nodules, and *erythema nodosum leprosum*.

Necrotic skin lesions appear rarely in lepra reaction. Such reactions when they occurred were variously attributed to Lucio's phenomenon (Fernandez *et al.*, 1962), cutaneous allergic vasculitis, bullous reaction (Job and Gault, 1960), a form of *erythema nodosum leprosum* (Canizares, Costello and Gigli, 1960) and lepra reaction modified by keratosis blenorrhagica (Henry, 1963).

In this paper a case is described which demonstrated unusual cutaneous, mucosal, and systemic expression of the lepra reaction. The patient, a 26-year-old married Moslem female, was admitted to the local University Hospital in August,

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1971. She had been having recurrent pustular eruptions and ulcerations all over her body for the previous 5 years. Weakness, weight loss, and intermittent high fever accompanied by pain and swelling of the joints had been present for the last 3 years. Perforation of the palate, leading to nasal regurgitation, had occurred 10 months before admission to hospital. She also complained of loss of sensation in the hands and feet.

In 1966, a few "boils", like eruptions, appeared on her face, but these subsequently healed with treatment. After 6 months, periodic crops of small painful nodules began to appear on her extremities, chest and back. In 1968 she consulted local physicians because of high fever which was accompanied by swelling of the knees, ankles, and elbow joints; treatment resulted in some alleviation of her symptoms. Two years later she experienced an episode characterized by high fever, chills, myalgia, recurrence of pain and swelling over the joints, and painful erythematous nodules and pustules. Finally, 10 months after the above episode, i.e. in August, 1971, she was admitted to our hospital with nasal regurgitation and necrotic ulcerative lesions of her extremities.

Physical examination showed a febrile, toxic and cachectic woman in moderate distress. There were many crusted lesions, the crusts being bloody and loosely attached. There were also superficial ulcers and scars on her extremities. Besides these, she had multiple necrotic lesions on her legs, arms, buttocks, shoulders and face (see Fig. 1). Fresh papulo-pustular lesions were present over the skin of the face and arms, her nose was slightly depressed, and there was a perforation in the anterior third of the palate. Her fingers were severely tapered and resembled

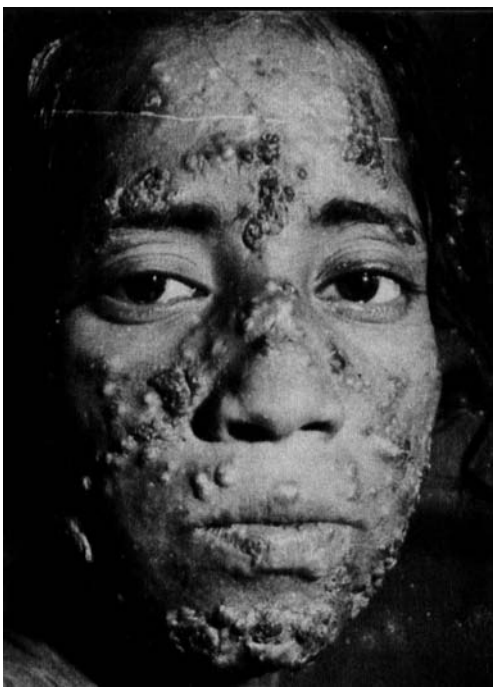

Fig. 1.

"sharpened pencils". Some flattening of the thenar and hypothenar eminences due to muscular wasting was noted. The ulnar nerves were tender and visibly enlarged. Areas of anaesthesia to heat and cold, pain, and light touch were present on her hands and feet. She had minimal pitting oedema on her ankles and there was generalized lymphadenopathy. The liver was palpable two fingers' breadth below the right costal margin.

Blood examination showed a mild leukocystosis and hypochromic microcytic anaemia. The results of urinalysis were normal. Slit examination of skin smears revealed numerous acid-fast bacilli; the smears were taken from both infiltrated and reactive lesions. The biopsy specimen of a reactive skin lesion of 72 hours' duration revealed histopathologically infiltrative lepromatous leprosy with subepidermal bulla and intense angiitis of blood vessels of all sizes. The latex-fixation test for rheumatoid factor and L.E.-cell tests were negative.

The patient was treated with small doses of dapsone and intramuscular injections of antimony in the form of Fantorin (stibophen, B.P.). The systemic symptoms subsided and the ulcerations began to heal.

Discussion

The cutaneous expression of the lepra reaction is determined by the sub-type of lepromatous leprosy, the location, the degree to which cutaneous vessels are involved, the duration of the reaction, and the degree to which the reaction has been modified by therapy (Jopling, 1959; Waters and Ridley, 1963; Moschella, 1967). Severe reactions characterized by vesicles, pustules and necrosis remain a source of considerable difficulty in categorization (Waters and Ridley, 1963). These do not fully conform to any accepted classification (Ridley, 1969; Moschella, 1967), which is further documented by the present case.

Necrotic skin lesions may be seen in patients manifesting Lucio's phenomenon (*erythema necrotisans*), severe *erythema nodosum leprosum* and a lepra reaction simulating the allergic vasculitis of Reuter (Moschella, 1967). The Lucio phenomenon is known to be a rarity outside South and Central America. Perusal of the literature, however, reveals that it has more world-wide distribution than hitherto believed (Moschella, 1967). The cutaneous lesions of the lepra reaction, resembling the cutaneous allergic vasculitis of Reuter, are numerous, superficial and more polymorphous than those of *erythema nodosum leprosum* There is little justification for classifying the present case on one or the other. Moschella (1967) described a patient who had severe *erythema nodosum leprosum* with necrosis of her reactive skin lesions. Earlier, such patients were reported as having "formes escarrotiques" and *erythema nodosum leprosum*. Furthermore, pustulation and ulceration are known to occur in severe lepra reaction and in "progressive reaction" as defined by Cochrane and Davey (1964). In severe *erythema nodosum leprosum*, suppuration, with or without ulceration, has been reported by many workers including Wolcott (1947), Jopling (1959) and Ridley (1969). To represent such dual manifestations, a new name, *Erythema nodosum necrotisans*—was introduced at the Rio Congress.

Fresh involvement of mucous membrane may produce eye and nose symptoms for the first time during the reaction (Dharmendra, 1967). In our case eye symptoms were absent, but the nasal tone in her voice and regurgitation, due to the perforation of the palate, made the patient visit the hospital. Swollen joints and nephritis are less common manifestations of *erythema nodosum leprosum*,

according to Ridley (1969). In our patient, in addition to the skin and mucosal lesions, constitutional symptoms and polyarthritis were the distressing problems.

That leprosy can appear for the first time in the form of the lepra reaction is well documented. In endemic areas, because of the healthy appearance of the patients with lepromatous leprosy, they are usually diagnosed late (Cochrane, 1964). This was also true in the present case.

The use of systemic corticosteroids in the lepra reaction of all types is inadvisable unless the reaction is very severe and uncontrollable (Jopling and Cochrane, 1957). Even though the reaction was very severe in our case, we resorted to antimony treatment in the form of Fantorin (stibophen) injections. This was effective in controlling the reactional state.

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The Nasal Mucus in Leprosy*

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An account is given of the examination of the nasal mucus discharge smears for the presence of *Myco. leprae* in 322 untreated cases of leprosy seen during a period of one year of which 111 were cases of lepromatous leprosy and the remaining 211 were borderline disease. The majority of the patients with lepromatous leprosy had leprosy bacilli in their nasal secretion, often in very great numbers, and showed a high Morphological Index. Of 41 of the most active cases among the 211 patients with borderline leprosy, only one had *Myco. leprae* in the nasal mucus. Morphologically normal bacilli are no longer found in nose-blows after 6 months' treatment with DDS. It is suggested that the nasal mucus provides a true index of infectivity, and that patients with borderline leprosy are in general not to be regarded as infectious.

During the past 4 years the nasal mucus discharged by patients suffering from leprosy has been examined after staining for acid-fast organisms. In the past 12 months, 322 new patients (111 with lepromatous and 211 with borderline diseases) who had received no previous treatment for their leprosy, were thus examined by the author personally, with the following results.

Lepromatous Leprosy

In 80 patients (out of the 111) bacilli were present in the nasal discharge, the concentration of organisms being: light to moderate in 47 patients, heavy in 13 patients and very heavy in 20 patients.

The proportion of solid-staining organisms was very high when the concentration of bacilli was great; such organisms were more numerous in the nasal mucus than in material obtained from the skin by the standard slit-smear technique. In most instances it was possible to examine only one specimen of nasal mucus, but in a few of those classified as showing "light" concentration in the above summary, no bacilli had been found on the first examination but a few bacilli—a small cluster, or a globus, or a single bacillus—were found subsequently. Thus, some of the 31 patients in whom no bacilli were found might indeed have been discharging a small number of organisms which would have been discovered had it been possible to examine several specimens of nasal mucus.

Borderline Group

Of the 211 patients diagnosed clinically as having Borderline disease, 41 were selected for bacterioscopic examination of the nasal mucus. The criterion for

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selection was clinical activity, as indicated by elevation and erythema of the well-demarcated lesions. In only 1 of these 41 patients were acid-fast organisms found in the nasal mucus, and this patient was suffering from ulceration of the septal mucosa.

The distribution of the cutaneous lesions in these 41 patients, classified according to their clinical presentation (and unconfirmed histologically) (Ridley and Jopling, 1966) is shown in Table 1.

TABLE 1

Group	Distribution of lesions	Number of cases	Clinical classification			
			BT	BB	BL	LI
1	Face	7	2	0	2	3
2	Face and body	27	2	6	10	9
3	Trunk and limbs	7	2	2	1	2
	Totals	41	6	8	13	14

It is noteworthy that 34 of these patients had lesions of the face, i.e. near the nares, of whom 27 had, in addition, numerous lesions of the trunk and limbs. Facial lesions may be viewed as being in proximity to the nasal mucosa, while lesions elsewhere on the skin indicate widespread bacillary dissemination.

Discussion

The importance of the discharge from highly bacilliferous nasal mucosa has been stressed (Pedley, 1970*a*, *b*). Skin adjacent to the nose, or areas of skin that are repeatedly touched by fingers previously contaminated by contact with skin near the nose, may have on its surface numerous acid-fast organisms far in excess of the number reputedly discharged from sweat glands, hair follicles, or microscopic breaks in the skin. The presence of organisms in the nasal discharge should therefore be regarded as a better indication of the infectivity of the individual patient than their presence in the skin itself, from which they rarely penetrate to the surface.

The following criteria for absence of contagiousness, in order of decreasing importance, are therefore submitted:

(1) Absence of *Myco. leprae* from the nasal mucus on repeated examination; (2) intact skin, despite numerous lesions; (3) diagnosis of Borderline leprosy (rather than lepromatous); (4) absence of *Myco. leprae* from the smears obtained from the most active skin lesions.

Histological Demonstration of *Myco. leprae* in the Nasal Mucosa

When *Myco. leprae* are not found in the nasal mucus in patients suffering from lepromatous leprosy, prolonged search of sections of the nasal mucosa may reveal scanty organisms. Their presence, however, does not invalidate the suggestion that as an index of infectivity, i.e. contagiousness, the nasal mucus itself provides the true indication.

In spite of the observation that the actual surface of the nasal mucous membrane (removed and examined microscopically after being suitably stained) appears to be completely intact, bacilli have been found in the mucus from

adjacent mucosal surfaces. They apparently emerge to the surface in the absence of any observable interruption in the integrity of the surface, such as an erosion or a chronic ulceration.

It is furthermore to be noted that in sections of the nasal mucous membrane, bacilli are seen at various depths of the actual section, that is, they have not been pushed by the mechanical pressure of the microtome as it cuts through the embedded tissue.

Dr D. J. Harman (of The Leprosy Study Centre, London) comments on a typical section in the following terms: "It is only in active untreated lepromatous cases, where the bacilli are multiplying and disseminating, that the organisms are so numerous that they pass through the mucous membrane and come to the surface, and thus can be obtained in the nose-blow, or in nasal washings. Where any Borderline element is present, the bacilli are less numerous and tend to be held more in the phagocytes, and are therefore only obtained by nasal scrape."

Conclusions

(1) The majority of untreated patients with lepromatous leprosy in Nepal discharge solid-staining leprosy bacilli through their nasal mucosa; these bacilli are present in the nasal mucus.

(2) Such patients must therefore be considered as contagious, until they cease (as the result of treatment) to discharge viable bacilli in the nasal secretion.

(3) In Borderline leprosy, despite the presence of reactive lesions on the face and elsewhere, the nasal mucus very rarely contains leprosy bacilli.

(4) In none of the 14 cases in which the clinical diagnosis was LI (lepromatous indefinite) were leprosy bacilli found in the nasal mucus.

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External and Internal Neurolysis of Ulnar and Median Nerves in Leprous Neuritis*

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Out of 36 cases of leprous neuritis treated by external and internal neurolysis of the ulnar and/or median nerve (17 bilateral), 91.2 % of those followed-up cases were free from pain, 58.3 % showed complete or partial clinical improvement of motor function, and 46.2 % showed sensory improvement after the operation.

E.M.G. study of 8 cases of ulnar neuritis (6 bilateral) before and at varying intervals after the operation was performed. It showed marked or limited improvement of muscle action potentials in 64.3 % of decompressed nerves.

Best results were obtained when the nerve trunk at operation showed hyperaemia of its sheath, oedema, and swelling. The worst results were noted in cases in which the nerve was thin, ischaemic, and fibrosed. Nerve abscess was encountered 5 times, 3 times in the ulnar nerve and twice in the median nerve.

In spite of the modern treatment of leprosy, neuritis sometimes supervenes. The persistent and continuous nagging pain which it causes adds much to the misery of leprous patients. In addition to the pain and paraesthesia, motor paralysis, deformity and trophic ulceration are the ultimate results in neglected cases.

Many attempts have been made to relieve the pain of leprous neuritis. Among the conservative measures tried are: peri- or intra-neural injection of hydrocortisone, lignocaine and hyalase (Jennings, 1964; Tio, 1966), the application of heat in the form of hot compresses, diathermy or wax baths, and ethyl chloride spray (Henry, 1964).

Surgical decompression of affected nerves was advocated by Muir (1948), Vaidyanathan and Vaidyanathan (1968), and Parikh, Ganapati and Kothare (1968) among others. These workers limited their decompression to exposure of the nerve trunk, and in the case of ulnar nerve, slitting of the fibrous arch covering the nerve at the back of the elbow. They reported varying degrees of success following surgery. On the other hand, Brand (1964) holds the view that operation on nerves is an unwise procedure, because surgical interference may cause further damage and subsequent fibrosis. Cochrane (1964) limited operations on nerves to cases of nerve abscess, when the nerve should be explored; for if, under those conditions, surgical interference is not initiated, gross damage may result—a damage far more crippling than that caused by any surgical interference.

This report is an assessment of the results of external and internal neurolysis of

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the ulnar and median nerves in leprous neuritis, carried out in the Department of Orthopaedic Surgery, Assiut University Hospital.

Material and Methods

The 36 patients who constituted the material of this study (31 male and 5 female) were selected at random; 30 of them had tuberculoid leprosy and 6 had the lepromatous type of the disease (Table 1). All of them had been on sulphone treatment for less than 1 year.

TABLE 1

Details of material

		No. of patients
Total		36
Sex	Male	31
	Female	5
Type	Tuberculoid	30
	Lepromatous	6
Symptoms	Pain	36
	Sensory loss	28
	Motor paralysis	25
Ulnar n. neurolysis		30
	Bilateral	17
Median n. neurolysis		4
Combined ulnar and median n. neurolysis		2
E.M.G. study		8
	Bilateral	6

The main complaint, common to all of them, was pain in the forearm and hand in the distribution of the affected nerve. The pain was in some cases severe enough to interfere with sleep and was not alleviated by analgesics or antiphlogistic measures. In 28 cases there was superficial sensory loss and 25 showed manifestation of motor deficit, in the form of atrophy of the forearm and/or hand muscles and deformity of the fingers characteristic of the affected nerve. Records were kept of the duration of pain, sensory charting, motor power, degree of atrophy of muscles, and the patients' own statements concerning ability to work. All these were noted before and after treatment.

Ulnar nerve neurolysis was performed in 30 cases (in 17 bilateral), median nerve neurolysis in 4, and ulnar and median nerve neurolysis in 2 (Table 2).

TABLE 2

Details of 36 cases of ulnar and/or median nerve neurolysis by type of disease

Type	No. of patients	Ulnar n. neurolysis	Median n. neurolysis	Ulnar and median n. neurolysis	Abscess
Tuberculoid	30	26	3	1	5
Lepromatous	6	4	1	1	
Total	36	30	4	2	5

Electromyography was performed before and at varying intervals after the operation in 8 patients who had undergone ulnar nerve neurolysis (6 bilateral). Percutaneous stimulation of the ulnar nerve was made using two disc electrodes placed on the sides of the nerve in its superficial course in the upper arm. Muscle action potentials were recorded from the flexor carpi ulnaris by means of a bipolar needle electrode introduced into the muscle about 8 cm below the elbow. The electropotentials were recorded on a 6-channel "Physiograph". Electrical stimuli varying in frequency (25, 50, and 100 per sec) and in voltage (0.1 to 25 V) were used. The duration of the stimuli was constant in all the records (2 m sec). Calibration was also constant throughout all records, in which 1 mV was equal to 0.5 mm. Two speeds for recording were used, 2.5 cm per sec and 5 cm per sec.

Operative Technique

A pneumatic tourniquet was applied to the upper part of the arm, unless this was impossible because the thickening of the nerve extended high up. The ulnar nerve was exposed from the middle of the arm to about the upper quarter of the forearm. The superficial and deep fascia and the medial intermuscular septum were incised to expose the nerve. The nerve was followed proximally until normal-looking nerve trunk was reached. Distally, the fibrous arch between the two heads of the flexor carpi ulnaris was slit, freeing the nerve in its course behind the elbow into the forearm.

In most of the cases the nerve trunk was oedematous and thickened, sometimes being as thick as a finger. Coursing on its surface were tortuous vessels of good size. In some cases the nerve trunk was fixed to its bed by dense adhesions. In 6 cases the nerve was found to be fibrosed, thinned, and ischaemic. The part of the nerve trunk deep to the divided arch was always thinner and paler than the proximal part of the nerve.

The nerve sheath and epineurium were then cut longitudinally. Using a sharp knife, a longitudinal cut was made into the substance of the nerve trunk between nerve bundles, taking great care not to go across any of the latter. This inter-bundle cut was deepened to about 2/3 of the diameter of the nerve and extended along the whole affected segment. No attempt was made to dissect the nerve out of its bed, so as not to interfere with its blood supply, except in cases showing dense fibrous adhesions. The median nerve was exposed in the lower half of the forearm and into the hand, cutting the flexor retinaculum. It was treated in the same way.

Nerve abscess was encountered 5 times, 3 times in the ulnar and twice in the median nerve trunks. It was well encapsulated and fusiform in shape, reaching sometimes a length of up to 12 cm. It was incised, and its contents, which were caseous in consistency, were scooped out. The wound was closed, and drainage maintained for 24 hrs.

Results

All the patients had complete relief of pain immediately after the operation. Of the 34 who were followed up for an average period of 17 months (ranging from 3 months to 3½ years), 31 (91.2 %) were free of pain at the time of follow-up. Of the 26 followed-up patients who had sensory changes before operation, 4 (15.4 %) had complete and 8 (30.8 %) had partial recovery of sensation. Of the 24

who had shown impaired motor function before the operation 14 (58.3 %) showed complete or partial recovery of function. Details of the followed-up cases related to the duration of neuritis and nerve pathology encountered at operation are presented in Table 3.

TABLE 3

Average duration of neuritis and post-operative results in 34 followed-up cases by nerve pathology

Nerve pathology	Total	Average duration of neuritis	Type		Relief of pain	Sensory improvement	Motor improvement
			T	L			
Oedematous and swollen ± adhesions	23	11 months	17	6	23	9	12
Nerve abscess	5	13 months	5	–	5	2	2
Fibrosed and ischaemic	6	3 years	6	–	3	1	–
Total	34		28	6	31	12	14

Eight patients had electromyographic records before the operation and at varying intervals after it; 6 underwent bilateral decompression of ulnar nerves. Out of the 14 decompressed nerves, 5 (35.7 %) showed marked improvement in muscle action potentials in post-operative E.M.G.'s (Figs 1, 4 and 5), 4 (28.6 %) showed improvement (Fig. 2), in 2 (14.3 %) there was no change, and 3 (21.4 %) showed reduced action potentials (Fig. 3). There was almost no difference in the results for the two sides in the same patient. The results are presented in Table 4.

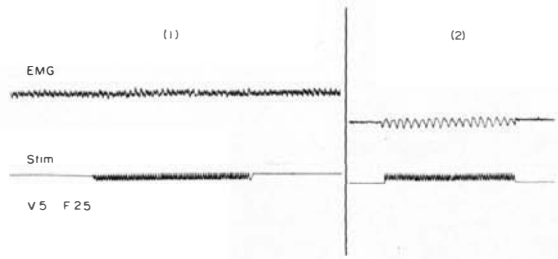

Fig. 1 Case 1, Table 4. E.M.G. before and after operation showing marked increase of amplitude.

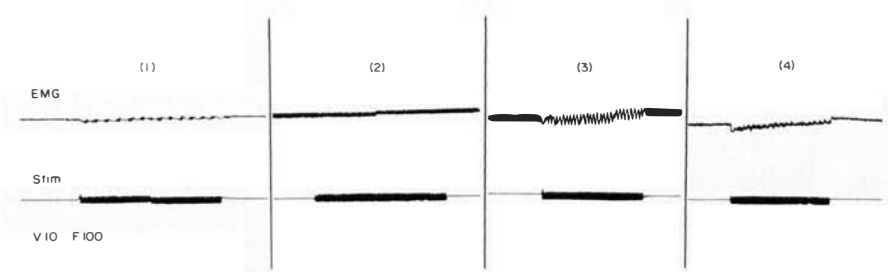

Fig. 2. Case 2, Table 4 comparing the post-operative records (2, 3 and 4) with pre-operative record shows limited increase of amplitude, and regular waves.

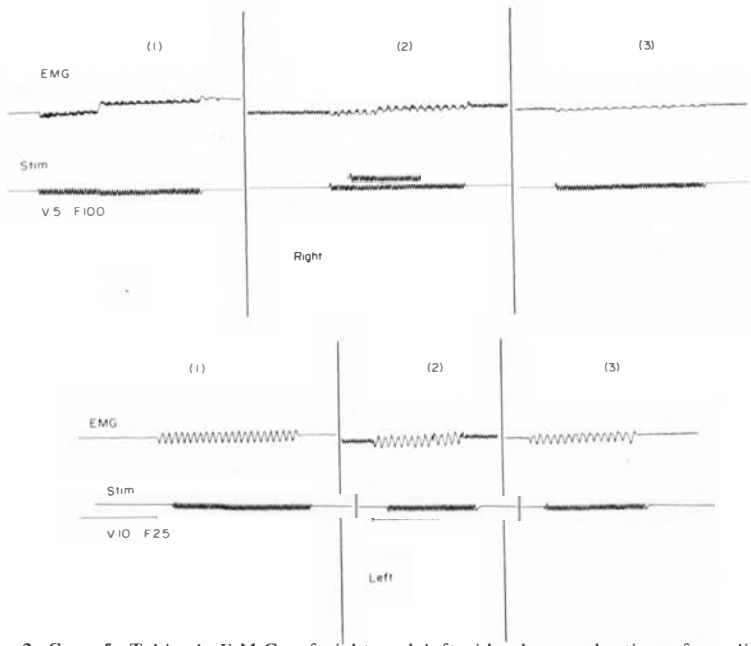

Fig. 3. Case 5, Table 4. E.M.G. of right and left side show reduction of amplitude. This result was graded "worse".

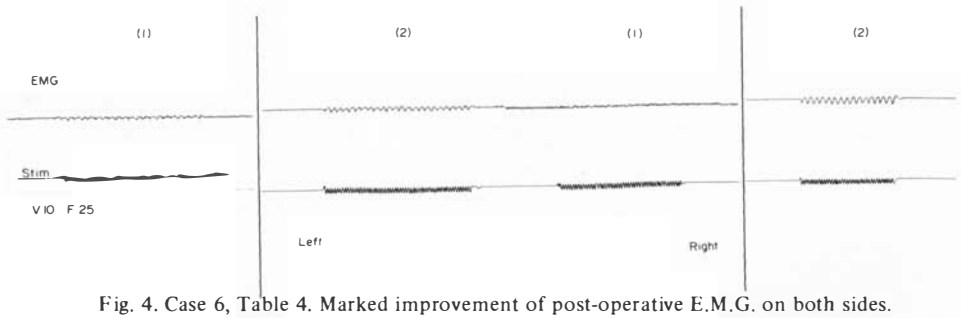

Fig. 4. Case 6, Table 4. Marked improvement of post-operative E.M.G. on both sides.

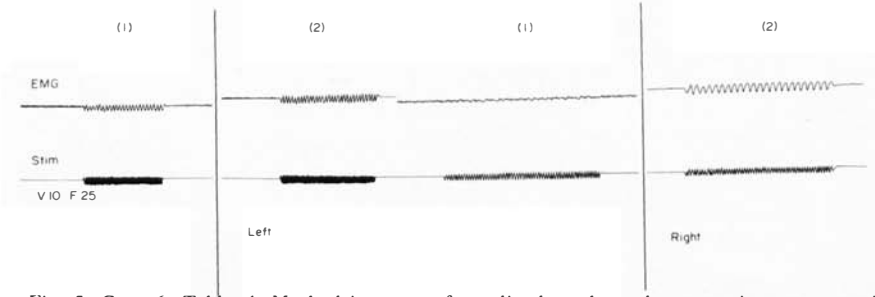

Fig. 5. Case 6, Table 4. Marked increase of amplitude and regular waves in post-operative tracing of right and left sides.

TABLE 4

Change of amplitude of E.M.G. before and after operation in 8 cases (6 bilateral) related to nerve pathology

Case no. and side	Type	Amplitude of E.M.G. in M.V. Record 1 (Before op.) B.S.	Record 1 (Before op.) A.S.	Record 2 (Within 1 month) B.S.	Record 2 (Within 1 month) A.S.	Record 3 (3 months) B.S.	Record 3 (3 months) A.S.	Record 4 (12 months) B.S.	Record 4 (12 months) A.S.	Comment	Nerve pathology
1 Rt	T	5	7	1	8	–	–	–	–	Much improved	Hyperaemic and swollen
2 Lt	T	1	2	3	3	5	10	2	5	Improved	Nerve abscess
3 Rt	T	3	3	3	4		–	2	2	Same	Oedematous swollen and adherent
3 Lt	T	3	4	4	4	–	–	2	4	Improved	
4 Rt	T	1	4	4	6	–	–	1	2	Worse	Fibrosed, thin and ischaemic
4 Lt	T	1	10	4	11	–	–	1	8	Worse	
5 Rt	L	1	6	4	10	–	–	–		Improved	Oedematous and swollen
5 Lt	L	1	10	3	13	–	–	–		Improved	
6 Rt	T	1	2	0.5	6	–	–	–		Much improved	Oedematous swollen and hyperaemic
6 Lt	T	1	3	0.5	4	–	–	–	–	Much improved	
7 Rt	T	4	12	–			–	3	6	Worse	Fibrosed and ischaemic
7 Lt	T	4	9	–	–	–	–	3	5	Same	
8 Rt	T	1	3	1	8				–	Much improved	Hyperaemic and swollen
8 Lt	T	1	5	1	6	–	–	–	–	Much improved	

T, tuberculoid; L, lepromatous; B.S., before stimulation; A.S., after stimulation.

Discussion

Leprosy is primarily a disease of nerves. The lepra bacillus lodges in the axoplasm of nerve fibres, which as a result of metabolic activity of the organism undergoes degenerative changes. The myelin sheath also undergoes disintegration. The collapsed Schwann tubes are converted into ribbon-like bands. The bacilli find shelter in these bands and in the cytoplasm of the Schwann cells. The bacilli which escape from the nerve fibres are taken up by the endoneural cells and histiocytes. The latter change gradually into lepra cells or epithelioid cells in the endo- and perineural spaces, depending on the difference in the immunological response of the host (Khanolkar, 1964).

Aggregation of this cellular infiltration in the endo- and peri-neural space, in addition to oedema, results in swelling of the nerve and compression of the nerve fibres, as well as relative ischaemia inside the nerve. There may be plenty of blood vessels in the nerve sheath and epineurium, but inside the nerve itself the blood vessels are very few.

Partial ischaemia causes a reversible paralysis without Wallerian degeneration. If, however, the ischaemia becomes absolute or lasts for a long time, the nerve will be destroyed and the paralysis is then irreversible.

Sometimes localized areas of autolysis occur in a peripheral nerve trunk, forming what is called a nerve abscess. In such cases the nerve is greatly thickened and tender and contains masses of necrotic debris and sloughs. Rapid deterioration of nerve function and destruction of its fibres depend upon the amount of the abscess contents as well as on its long-standing tension inside the nerve. It is presumably an allergic localized autolysis of the nerve trunk at certain well-defined sites (Browne, 1965). In certain places, for instance in Calcutta, nerve abscesses are more common than elsewhere in India (Cochrane, 1964). Wheate (1964) and Browne (1965) drew attention to the rarity of nerve abscesses in Africa. However, Priestman (1966) found 7 patients with nerve abscesses within 4 years in Nigeria. Among our patients in this study, 5 abscesses were encountered. So it would seem that nerve abscesses in certain places in Africa are not as rare as generally believed.

The commonly affected motor nerves in leprosy are the ulnar nerve just above the elbow and just above the wrist, the median nerve just above the wrist, the lateral popliteal nerve at the knee, the posterior tibial nerve about 10 cm above the ankle, and, rarely, the radial nerve just above the elbow (Brand, 1964; Said, 1971).

Brand (1964) maintains that there are three main factors which determine whether a nerve infected by lepra bacilli becomes paralysed or not: (1) Type of the disease: the tuberculoid type, with strong tissue reactivity, is the commonest type in which selected nerves are paralysed. In the lepromatous type the tissue reaction is weak and therefore the chance of nerve damage is small. (2) The number of nerve fibres which are enclosed in the epineurium of the nerve: the greater the number of nerve fibres within the bundle, the greater is the likelihood of paralysis. (3) The perpendicular distance from the surface of the body: the greater the distance from the surface, the smaller is the chance of paralysis.

External neurolysis can relieve the nerve from external pressure, but the interior of the nerve, which is the part actually suffering from compression and ischaemia, is left as it is. Parikh, Ganapati and Kothare (1968), adopting this technique, found the progressive paralysis unchecked by decompression in about 25 % of their cases because "only the external pressure on the individual nerve was relieved and the nerve fibres themselves were not subjected to any

interference during surgery". The only way to decompress the interior of the nerve is to slit it longitudinally between the nerve bundles, as performed in our patients in this study.

Our results of external and internal neurolysis were gratifying in that the intractable pain was relieved in 91.2 % of followed-up patients, a fact which could change the whole mental and spiritual state of the individuals; 58.3 % of the patients showed complete or partial clinical improvement of motor function postoperatively. Of the cases studied by electromyography 64.3 % showed improvement after the operation. Sensory improvement occurred in 46.2 % of cases. In none of the cases was there clinical deterioration of nerve function after operation. The best results were obtained in patients in whom the nerve trunk at operation was oedematous, swollen and surrounded by a hyperaemic sheath, especially so if not stuck by adhesions to its bed. On the other hand, fibrosed, thinned and ischaemic nerves showed the least improvement after surgery. Thus the results of external and internal neurolysis depend primarily on the nerve pathology at the time of surgery and not on whether damage to nerve fibres at operation occurred. Further evidence for this statement is the fact that cases operated upon bilaterally, and showing the same pathology, also showed almost equal results on the two sides.

The results presented in this report compare favourably with those of other workers performing external neurolysis only (Vaidyanathan and Vaidyanathan (1968) and Parikh, Ganapati and Kothare, 1968). However, comparison of different surgical techniques in different countries is not practical as the pathology of leprous neuritis varies from place to place, as mentioned above.

Acknowledgement

We wish to thank Dr Dia Abdel-Rehim, Assistant Professor of Dermatology, for allowing us access to leprosy patients attending the Skin Clinic, Assiut University Hospital, and for assistance in following-up the cases.

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Lepr. Rev. (1973) **44**, 44-46

Abstracts

1. **Surface peptid glycolipid filaments on *Mycobacterium leprae*,** by J. GORDON and R. E. WHITE. *Clin. exp. Immunol.* 1971, **8**, 539-547.

The reticulated network composed of waxy substances, and demonstrated by the special techniques of electron microscopy, is now shown to be composed of biologically active wax-D. Although the diameters of the filaments and their precise disposition may be different for the various mycobacteria examined, and different also for *Myco. leprae* from (human) lepromatous tissue and mycobacteria grown in culture media, there would appear to be some biochemical (and immunological) similarities between the waxes. [The significance of these findings will not be lost on those interested in adjuvant factors and in the immunological importance of cell-wall moities in lipid solvents.]

S. G. Browne

2. **Does entrapment neuropathy contribute to nerve damage in leprosy?** by H. SRINVASAN and P. R. NAMASIVAYAM. *Indian J. Med. Res.* 1971, **59**, 1385-1391.

The authors conclude from their examination of 192 male patients suffering from lepromatous leprosy that the occurrence of ulnar-nerve damage was not influenced by the degree of mobility of the nerve, as indicated by the ease with which the nerve above the elbow was displaced when the joint was flexed and extended. On the other hand, there was some evidence of entrapment when the interval between the medial epicondyle and the olecranon process was 25 mm or less with the elbow extended, and when the interval increased by 50 % on flexion of the elbow. Thus, when the possibilities of recurrent or prolonged entrapment existed, the likelihood of damage to the nerve increased.

As a practical consequence of this study, it is suggested that since "high risk" limbs form a small minority, prophylactic extraneural decompression of the ulnar nerve above the elbow is unlikely to benefit the majority of sufferers from lepromatous leprosy.

S. G. Browne

3. **Correlation between tuberculin sensitivity after 2 months and 5 years among BCG vaccinated subjects,** by O. HORWITZ and K. BUNCH-CHRISTENSEN. *Bull. Wld Hlth Org.* 1972, **47**, 49-58.

The authors found that allergenic response to BCG vaccination persisted virtually unchanged after 2 months and 5 years in groups of school-children tested with 11 different BCG vaccines prepared by several laboratories from different strains.

S. G. Browne

4. **Appearance of acid-fast rods in cultures of *Mycococcus luteus*,** by A. CSILLAG. *Tubercle (Lond.)* 1972, **53**, 221-225.

Mycococci, sometimes referred to as "degraded mycobacteria", grown in nutrient media, eventually after repeated culture produced acid-fast rods, apparently derived from gram-positive

(but not acid-fast) intracellular granules which were liberated when the organisms lysed. By this time (that is, after 14 weeks) the granules had become acid-fast, and after a further 8 to 28 weeks strongly acid-fast, slightly bent, slender rods replaced the granules. These rods were not cultivable in standard media. It was found that repeated subcultivation of the parent mycococcus strain on nutrient agar apparently prevented the subsequent development of acid-fast rods in serum–saline.

S. G. Browne

5. **A test for the determination of competency in clearing bacilli in leprosy patients,** by J. CONVIT, J. L. AVILA, M. GOIHMAN and M. E. PINARDI. *Bull. Wld Hlth Org.* 1972, **46**, 821.

By a study of the reaction to the intradermal injection of a high concentration of killed leprosy bacilli (640×10^6), the authors conclude that the type of cell and the histological picture that develops after 2 weeks are indicative of the capacity of the body to clear the injected bacilli. The response parallels the production of cell-mediated immunity. It is considered that the test will indicate to the clinician the length of consolidation treatment advisable for patients with indeterminate (bacteriologically negative) leprosy, and which Mitsuda-negative contacts should receive prophylactic assistance before facing *Myco. leprae* challenge.

S. G. Browne

6. **Neurofibromatosis and leprosy,** by T. R. Smith. *J. Neurol. Neurosurg., Psychiat.* 1971, **34**, 743-749.

The not infrequent association of von Recklinghausen's disease and leprosy is illustrated by 2 case reports. Both patients had active lepromatous leprosy. *Myco. leprae* were present in enormous numbers in the cells of the neurofibromatous tumours. These cells, thought to be derived from Schwann cells, appeared to offer a preferential nidus for *Myco. leprae.*

S. G. Browne

7. **Leprosy today. International leprosy colloquium held at the Forschungsinstitut Borstel, August 26-27, 1970.** Edited by E. FREERKSEN, E. R. LONG and J. H. THUMIN. *Int. J. Lepr.* 1971, **39**, No. 2, Pt 2, 201-691.

During two extremely full days in August, 1970, well over a hundred practising leprologists and research workers met under the auspices of the Borstel Institute for Experimental Biology and Medicine (and with the financial backing of the Deutsches Aussätzigen-Hilfswerk) to listen to a crowded programme of papers on many aspects of leprosy. As Dr J. Kimming observed in his introductory remarks, the work of hearing and considering the communications presented would be more than enough for several weeks. In this special number of the *International Journal of Leprosy,* all the papers given at this Colloquium are published, some of them amplified from the versions that, because of lack of time, were abbreviated in presentation. The excellent illustrations, like the concentrated text, are best appreciated by perusal in printed form. The Herculean task of preparing the scripts for publication was ably shouldered by Dr E. R. Long.

As is inevitable in such a Colloquium, bringing together–as it did–such a wide range of clinical and pathological interests, the papers vary in novelty and in quality. Perhaps the two most useful features of the publication are, first, the presentation in eminently readable form of much of the newer work that is finding its way into a variety of non-leprosy journals (not all of which are available to practising field leprologists), and second, the summaries of recent work by acknowledged authorities.

Rees (p. 201) set the standard and the bias of the Colloquium with a masterly survey of the impact of experimental human leprosy in the mouse on leprosy research in general, summarizing the bases of the advances made possible by this most useful investigative procedure.

Shepard (p. 340) presented a résumé of the application of this technique to the investigation of the mycobacteriostatic activity of drugs. So far, out of 86 compounds tested, no fewer than 49 have been found to possess some activity in the experimental model. Other workers pursue the same lines of investigation, and make available their results with B1912 (a new rimino-phenazine derivative) and Rifampicin (Hilson *et al.*, p. 349; Rosenfeld *et al.*, p. 358).

The papers presented in the sections on Pathology and Bacteriology were generally of high standard, giving evidence of the application of the newer techniques–electron microscope (Job, p. 251; Klingmüller, p. 269), fluorescent microscopy applied to bony lesions (Coutelier, p. 231), and refined histological methods (Carayon, p. 278). One of the most seminal and significant papers–that by Bonicke (p. 328)–is here reported in brief, since the author died shortly after the Symposium. It gave an account of growth of *Myco. leprae* in artificial medium by taking advantage of a simple physical principle that removed accumulated toxic products and metabolites from the nutrient medium.

The section on Experimental Immunology brought to light some interesting work by Gaugas *et al.* (p. 388) on the reversal effect of thymus grafts in mice that had developed a disseminated mycobacteriosis following thymectomy and total body irradiation. Delville (p. 329) was not able to substantiate Beigelman's claim to distinguish between healthy individuals harbouring macrophages that were either able or unable to lyse *Myco. leprae*.

The activities of research workers on the growing edge of immunology are reflected in papers by Waters *et al.* (p. 417), which attempted to elucidate the mechanisms of reactions in leprosy, by Waaler *et al.* (p. 529) on anti-globulin activity in the lesions of leprosy, and by Sagher *et al.* (p. 541).

Nothing very new came out in the sections on medical and surgical treatment, but useful summaries of recent work were presented.

The preliminary findings of the WHO BCG-vaccination trial in Burma presented by Bechelli *et al.* (p. 609) served as a reminder that the last word has by no means been said on this controversial issue.

The 490 pages of this special number (Volume 39, No. 2, Part 2) of the *International Journal of Leprosy* is certainly a work to be read and subsequently dipped into, representing as it does some of the best of the research results in leprosy over the years immediately preceding and including 1970.

S. G. Browne

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