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Editorial

THOSE GAPS

It has become trite to state that serious gaps in our knowledge of leprosy still exist. There are, however, other gaps, gaps that may account for the sobering fact that this disease has, in the world as a whole and up till now, successfully resisted the combined efforts of governments, voluntary bodies and international agencies.

The factual appraisals of the results of leprosy control schemes in different countries which have appeared in the previous issue of *Leprosy Review* and in the present one provide not only encouraging grounds for hope, but also substantial reasons for concern. The crux of the matter has been succinctly expressed by Dr. P. K. Duraiswami, the Chairman of the Hind Kusht Nivaran Sangh, in his report for the year 1968, which has just come to hand: "With far better tools than we have ever had, we have now greater chances than ever to banish leprosy not only from India, but from the whole world. But why then is leprosy still a major health problem with us? The answer lies mainly in the fact that enlightenment of the public and even of the medical profession has lagged far behind medical progress".

The gap between what is known and what is practised, between the research laboratory and the field of action, the gap between the best leprosy control schemes and the worst, between good integrated planning and its almost entire absence—those gaps are patent, and real, and serious. It would be both idle and misleading to attribute these glaring differences entirely or mainly to disparity of the resources available for leprosy control, though at first sight the provision of health care would seem to be less daunting a prospect when $50 U.S. is available per leprosy-patient/day than when $1 U.S. is all that can be spared per head per year for all medical services, including leprosy. Fortunately, leprosy still makes an appeal to charitably-minded people, otherwise the outlook for leprosy control would be bleak indeed.

But there is more to it than that. In a recent paper, Labusquière (1969) refers to the sober optimism now prevailing in some ex-French African territories (with the notable exceptions of Gabon and the Cameroons) regarding leprosy. Mass treatment schemes, mobile teams, resolute case-finding surveys, single standard therapy regimes—these seem to provide the reason for the satisfaction noted. The total numbers of patients under treatment, after progressive annual increases, are showing definite reduction; new cases number less than discharges; the back of the endemic has been broken. But it would unfortunately be unjustifiable to extrapolate these excellent results from a total population at risk of 10 millions or so, to a world where leprosy is a more serious disease, more stigmatizing and more dreaded, a world in which the methods that have achieved such results in West Africa, are, for some valid reason or other, not yet applied, or perhaps not even applicable. There may be a higher prevalence of leprosy in tropical Africa, but the lepromatous/tuberculoid ratio is far lower. As Browne (1968) stated at the Ninth International Leprosy Congress, "In any given context there must be one plan, locally applicable and locally feasible, that is better than all the others". Other countries may with profit *adapt* from West Africa; they do not have to *adopt* an identical plan of campaign. However, in those countries where leprosy is feared, and hidden till it is no longer possible to hide it, where the population is reckoned in hundreds per square mile rather than in tens or even in units, where health services are extremely thin on the ground or even (in rural areas) virtually non-existent, the gap between the ideal and the possible is immeasurable, and at present apparently unbridgeable. It is, for instance, reliably reported from one country that of an estimated total of 80,000 sufferers from leprosy, only 6000 are at the moment receiving treatment: the rest are hiding their infection and their fears until their deformities

drive them to swell the ranks of the beggars. In another country, where repressive legislation still prevents the open diagnosis and open treatment of leprosy, only one leprosy sufferer in 50 has successfully braved official opprobrium and possible incarceration to obtain treatment for his disease.

There are local gaps within countries, vast lacunae of unmet need. The articles appearing in this *Review* have shown what can be done within the framework of the circumstances, the environment, the social background, and the economic possibilities of such countries, but overall coverage is the exception rather than the rule. The success of good planning and good organization is frequently attributable to the personal qualities of the leaders—their knowledge, vision, and enthusiasm. In Brand's words, it is a "matter of caring"—at all levels—and without such attention to such an essential factor, the best plans and the best organization will often go awry.

There is a certain widespread feeling of disillusionment at the slow progress registered in many leprosy control schemes. It is not only the World Health Organization and UNICEF (1965) that have expressed concern at the high continuing cost of many such projects when examined in relation to effective leprosy control, that is, the number of patients rendered non-contagious and a falling number of new infections. Disproportionate sums are still being sunk in constructing costly villages for ex-leprosy patients, where they will evince no desire for social reintegration or rehabilitation. It is surely unjustifiable to devote, in the context of poverty and subsistence farming, sums of $750 U.S. per head for such a project. In the light of leprosy control, this is unrealistic.

The best methods of leprosy control applicable to the local situation are much better, and often less costly than others: they should be applied. Treatment regimes, in some schemes, could with advantage be simplified in the interests of medical effectiveness, spread of effort, and economy. Self-treatment may be the answer in some areas, or less frequent supervisory visits by scarce qualified staff.

Another gap emphasized in these and other reports is that which exists between the progress announced from laboratory and field, and its application to the immediate and pressing problems of leprosy control. If, after some months of treatment, patients with lepromatous leprosy are no longer contagious, it is unnecessary to subject them to costly in-patient segregation and at the same time deprive other patients of the treatment they need because of the resulting lack of funds.

The gap between the research scientist and the field worker is perhaps best exemplified by the increasing sophistication of leprosy research and the increasing specialization and fragmentation of knowledge in this branch of science. This kind of research is very necessary, and very exemplary, provided that we bear in mind Health Minister Robinson's salutary admonition (1968), that we should not allow our "interest in the cellular reaction in the mouse to cloud" our "concern for the human plight of the man". The latter is, of course, the ultimate motivation of much leprosy research, and "pure" research, so-called, not infrequently becomes "applied" research, to the benefit of leprosy patients. The new work in immunology and biochemistry, and the prospects of increasing use of the thymectomized-irradiated mouse in developing a protective vaccine, are examples that come readily to mind. The identification of the point of action of new drugs opens up exciting and intensely practical prospects for the treatment of leprosy and for its control.

It would be unrealistic to expect more money for leprosy, or for leprosy to be accorded a higher priority in terms of government budgetary allocations or staff than it now receives, but it would be wrong not to expect a greater appreciation of the economic cost to the community of this disease and a greater realization of the potential of leprosy study in relation to scientific and clinical investigations of many kinds. And in view of the overriding

importance of the non-medical and non-scientific factors in leprosy control, it would be especially wrong at this time to relinquish efforts to educate doctors and laity alike in the modern knowledge about leprosy.

In many countries those engaged in leprosy campaigns are not reading enough. Pre-occupations, sheer "busyness", language difficulties, lack of professional contacts and stimulus, the laboratory orientation of much published work—all are adduced as reasons for not reading about what other leprosy workers are writing and thinking. But this gap is not unbridgeable. The busiest people somehow find time to record, to review, to analyse, and to write. They also find time to read. *Verb. sap.* Elsewhere, we welcome the appearance of the first number of the *East Africa Medical Bulletin*, whose main purpose is the dissemination of new knowledge to the "man in the field", medically qualified or not. This example might well be followed in other local contexts.

With the continued collaboration with governments of voluntary bodies and international agencies, and a fuller exchange of information at all levels, the aforementioned gaps could and should be bridged. "If only we could together apply existing knowledge, it is not beyond the realms of possibility that leprosy could be controlled in our generation, and eradicated in the next" (Browne, 1968). This task will need more than words and slogans and resolutions at Congresses. Bridge-building is hard work and, in leprosy, urgent work.

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Tenth International Congress, 1973
Preliminary Notice

The Tenth International Leprosy Congress will be held in Bergen, Norway, from 20 to 25 August, 1973. The Congress will thus coincide with the centenary celebrations commemorating the discovery of the leprosy bacillus by Dr. G. Armauer Hansen in 1873.

The Chairman of the local Organizing Committee is: Professor Erik Waaler, Department of Pathology, Gade Institute, University of Bergen, 5000 Bergen, Norway, to whom, for the time being, correspondence may be addressed.

Leprosy in England

The Secretary of State for Social Services has indicated the countries of previous residence of 115 out of the 280 patients notified as suffering from leprosy since January 1964. It will be recalled that, according to official records, no case of indigenously contracted leprosy has been reported in England and Wales since the disease became notifiable in 1957. The countries and numbers were as follows:

Asia

India	33	Vietnam	2	Ceylon	1
Pakistan	15	Hong Kong	2	Malaya	2
Far East	3	Indonesia	1	Thailand	1
Burma	2	Korea	1	Formosa	1

Africa		Rhodesia	1	*West Indies*	
Nigeria	12	Egypt	1	Jamaica	7
Uganda	3	Central Africa	1	Trinidad	5
Ghana	2			Guyana	4
Kenya	2	*Oceania*		West Indies	1
Cameroons	1	Fiji	1	Barbados	1
				St. Kitts	1

Europe

Malta	5	Cyprus	2	Spain	1

No information was available concerning 66 patients, but there were some indications concerning the countries of origin of 99 patients. These were: India 52, Moslem countries 42, Africa 3, China 1, and Greece 1.

World Health Organization

The Report of the Plenary meetings of the Twenty-second World Health Assembly held in Boston, Mass., 8 to 25 July, 1969, recently published (Official Records No. 177), refers in several places to leprosy.

Uganda (p. 52) awaits with interest the report of the WHO consultant on leprosy control.

Trinidad and Tobago (p. 96) report that the leprosy prevalence rate of 1.4 per 1000 remains static, that patients are segregated in a 250-bed leprosarium situated on an offshore island, and that, thanks to an extensive survey carried out by Dr. Oliver Hasselblad, President of the American Leprosy Missions, Inc., an effective leprosy control programme is now being organized.

Sierra Leone (p. 108). Warm tribute is paid to the substantial assistance received from UNICEF and LEPRA. The leprosy control campaign is said to be based on the priorities laid down by the WHO Expert Committee on Leprosy—the treatment of contagious patients, the surveillance of contacts, and the training of auxiliary staff.

Korea (p. 131) expresses appreciation to WHO and UNICEF for technical and material assitance in its leprosy control programme.

Ceylon (p. 142) indicates that the prevalence of leprosy is probably higher than has been suspected of recent years, according to a study by a WHO short-term consultant.

India (p. 326) makes a plea for restoration of the funds previously earmarked for the BCG control project in leprosy, and subsequently deleted from the 1969 budget. There are $2\frac{1}{2}$ million patients with leprosy in a population of 535 million.

The Division of Research in Epidemiology of WHO (p. 327) has undertaken a study to ascertain whether the widely observed discrepancies in the results of protection of children against leprosy by means of BCG vaccination (in Burma, Uganda and New Guinea) were methodological or biological in origin.

(Further reference to this important subject is made on p. 405 of the Report.)

Nepal (p. 76) reports satisfactory progress in leprosy control projects, and refers most appreciatively to the inter-country seminar on leprosy held in Katmandu in March, 1969, considered to be of immense benefit to a land where difficult terrain, illiteracy and poverty combine to thwart the control of all communicable diseases.

Medical Commission of ELEP

The Medical Commission of ELEP (Co-ordinating Committee of the European Leprosy Associations) met in Paris on 17 and 18 January, 1970, under the Chairmanship of Dr. L. P. Aujoulat.

Tribute was paid to the late Dr. Fr. Hemerijckx, who had been an active member of the Commission since its inception.

In order to help voluntary agencies in responding to numerous appeals for financial

help, the members clarified and crystallized their own attitudes on such matters as "The pros and cons of segregation of patients with lepromatous leprosy"; "The technique of barrier nursing applied to patients with leprosy treated in general hospitals"; "Villages for ex-leprosy patients". By transmitting to the members of ELEP their considered opinion on these thorny topics, the Medical Commission hopes to influence the thinking of generous and well-intentioned laymen so that the very considerable sums raised annually for leprosy work in over 600 centres should be used to the best advantage.

Reports were furnished on upwards of 20 specific projects on which medical advice had been sought.

The overall leprosy situation in countries like Zambia, Afghanistan and Indonesia was studied in some detail.

It is to be hoped that the resources of the European Leprosy Associations may increasingly be utilized in furthering the control of leprosy, the training of medical and auxiliary staff, and the prosecution of research.

International Society for Rehabilitation of the Disabled

At the Eleventh World Congress of the International Society for Rehabilitation of the Disabled (I.S.R.D.) held in Dublin from 14 to 19 September, 1969, leprosy was the subject considered at a Sectional Meeting.

Under the genial chairmanship of Dr. Donald Wilson, the well-known President of the Leonard Wood Memorial and formerly Secretary General of the International Society for Rehabilitation of the Disabled, with Professor A. J. Selvapandian (Professor of Orthopaedic Surgery at the Christian Medical College, Vellore, India) as Vice-Chairman, the Section discussed very profitably the problems raised in the 2 papers that were presented. Dr. S. G. Browne dealt with "The Role of Rehabilitation in Leprosy Control"* and Dr. N. H. Antia with "Comprehensive Care of the Leprosy Patient". The Chairman remarked on the presence on the platform of 3 doctors who, having begun their professional careers as surgeons, were becoming more and more involved in the prevention of deformity in leprosy and the elucidation of the causes and consequences of the peripheral neuropathy of leprosy.

In the ensuing discussion, a consensus of opinion among the participants became evident: the rehabilitation of the patient with deformities attributable to leprosy was in general surgically possible but administratively difficult. In most leprosy control schemes, the accent must be on prevention of deformities and on the integration of the leprosy service into the overall planning of control of transmissible disease.

The exhibition stand of greatest interest to visiting leprologists and many others was that of The Leprosy Mission. This displayed some interesting and historic photographs both of the early days of the Mission when its fund-raising activities were based on and confined to Ireland, and also of the development of the riminophenazine drugs in the nearby laboratories of the Irish Medical Research Council, together with results of the clinical application of B 663 (Lamprene, or clofazimine) by the Medical Consultant to the Mission and other doctors in various parts of the world.

Advantage was taken of the presence of several members of the Leprosy Committee of the I.S.R.D. to hold a meeting. With Dr. S. G. Browne in the chair, and Dr. Masayoshi Itoh as Secretary, the Committee reviewed its past activities and made recommendations concerning the adequate representation of leprosy on the committees that will henceforth mould the policy of the parent society, the International Society for Rehabilitation of the Disabled.

* For text of this paper see page 57.

Medical Research

A Round Table Conference on "Medical Research: priorities and responsibilities", organized by the Council for International Organizations of Medical Sciences (C.I.O.M.S.) with the assistance of WHO and UNESCO, was held at WHO Headquarters, Geneva, from 8 to 10 October, 1969.

Eminent scientists and administrators of government research councils from many countries were present, in addition to representatives from many of the international bodies that form the Council. The International Leprosy Association (a member of the Council) was represented by its Secretary-Treasurer (Dr. S. G. Browne).

Several of the subjects discussed have direct relevance to matters that concern both field and laboratory workers in leprosy.

Genetic configuration may determine individual responses to drug metabolism, such as isoniazid inactivation, adverse reactions associated with glucose-6-P.D. deficiency, and sensitivity to certain anaesthetics. Observed variations in response to dapsone, and delayed response to drugs used in leprosy may be gentically determined.

The importance of clinical pharmacology and the experimental approach to therapeutics was repeatedly stressed. Adequately controlled clinical trials point the way forward in leprosy. Since much work is being devoted to research into new drugs, the time is ripe to stress the need to train the coming generation of scientifically orientated leprosy investigators in statistical methods and accurate clinical observation. More work is needed on the resemblances and dissimilarities in the ways in which experimental animals and man metabolize drugs. After all, man is still the final arbiter of the efficiency of drugs used to combat leprosy.

A plea was registered—a plea that will find a ready echo from leprologists—that the accepted results of research be applied in the field. The gap is still far too wide, and the time-lag far too long, between demonstration and application.

The doctor must become increasingly aware of, and take responsibility for, the results of his own successful interventions into the fileds of disease control. In leprosy, it is not enough to render a patient non-contagious; the clinician must see that the "cured" patient is socially as well as medically rehabilitated into society, able to resume his place as a dignified and independent individual. Thus, rehabilitation of the handicapped is seen to be an essential part of treatment.

Reference was also made to the motivation of those engaged in medical research. Public funds have to be carefully allocated, bearing in mind the need for better means of controlling disease and curing patients. It is the individualistic worker filled with an insatiable curiosity and carrying over into adult life his childhood "play", who in the main makes the best investigator. If, in pushing forward the priorities of knowledge he discovers facts of direct benefit to mankind, then his work is doubly rewarding.

The need for greater stress on the scientific approach to epidemiological problems was discussed. With the new investigative models and methods now available, the standard and efficiency of much evaluation of leprosy field research and control programmes should show marked improvement. Leprosy cannot be considered in isolation from other endemic diseases, or apart from the whole human ecological environment. Furthermore, unless workers are able to keep abreast of progress in other branches, leprosy research both in the field and in the laboratory may fail to profit from recent developments in other realms of knowledge; thanks to some such developments, subjects formerly on the fringe have now become crucial.

The Secretary-Treasurer of the International Leprosy Association entered a plea for increased participation of the research centres of the affluent countries in the great problems of the

countries of the "Third World". Such participation would not only become "two-way traffic" in new knowledge and new ideas, but would shed welcome and necessary light on great lacunae of ignorance in matters of nutrition and endemic disease. Identification of a pathogen (and possible vector) is, as we well know in leprosy, but the beginning of wisdom. Visits by research staff, the provision of fellowships and grants, and facilitation of professional contacts would encourage research into the pressing immediate and remote problems facing the developing countries.

The number of research workers in the biomedical sciences has never been as great as today; yet, paradoxically, there is a real dearth of qualified people in certain fields. Leprosy is one of those fields.

International Society of Tropical Dermatology

The Second World Congress of the International Society of Tropical Dermatology was held in Kyoto, Japan, from 15 to 20 August, 1969.

Participating leprologists who are also concerned with tropical dermatology found much to interest them at the Congress, and regretted that the clashing of concurrent sessions deprived them of opportunities of profiting from the papers given by experts on, say, leishmaniases or mycoses or the treponematoses. Many papers listed on the programme were not presented because of the absence of the authors. While no epoch-making new work was reported, the Congress provided a forum for the exchange of ideas and the meeting of workers in related branches of medicine.

By general consent, the sessions on leprosy (accorded a generous allotment of time by the Congress planners) were among the best, and Dr. R. J. W. Rees is to be congratulated on his work in organizing this Sessional Theme. Rehabilitation received scant notice, but therapy was well discussed. Browne reviewed the modern approach to the drug treatment of leprosy, Waters examined the methodology of drug trials in man and the experimental animal, while Gatti, Languillon, Opromolla and Luis made important contributions.

In the session on "Reaction in Leprosy", thalidomide was the only drug reported in detail. "The Pathogenesis of Leprosy" provided excellent papers by Rees, Bullock, Kolener, and Nishimura, which proved of great interest to visitors whose primary concern was with other dermatoses.

The Round Table Conference on "Therapy of Leprosy" under the Chairmanship of S. G. Browne, brought together Languillon, Pettit, Rees and Waters in a discussion which, after a slow start, developed into a very stimulating exchange of views. Far from concluding tamely, the Round Table was prolonged at the request of the audience so as to deal with practical points of low-dose dapsone therapy and the indications for clofazimine (Geigy B 663).

The symposium on "Mycobacterial Infections" under the chairmanship of Professor R. D. Azulay was of great interest to leprologists, bringing together as it did workers experienced in *Mycobacterium ulcerans* infections, sarcoidosis, and other conditions.

Hind Kusht Nivaran Sangh (Indian Leprosy Association) Annual Report, 1968

In the excellent report of the Chairman of Hind Kusht Nivaran Sangh (Dr. P. K. Duraiswami), reference is made to the tremendous efforts put forth year by year to tackle the considerable leprosy problem in India. Despite the availability of curative drugs and the enthusiasm of many medical and paramedical workers in the country as a whole, there is much to discourage. That

"leprosy is still a major health problem with us", according to Dr. Duraiswami, is attributable mainly to the sad fact that "enlightenment of the public and even of the medical profession has lagged far behind medical progress".

The extent of the problem, and the measure of the efforts already being made and still needed, are indicated by the following figures:

No. of leprosy control units	182
No. of S.E.T. (Survey, Education and Treatment) schemes	1130
No. of population covered	77,100,000
No. of persons examined	38,900,000
Total no. of recorded cases	957,340
Total no. under treatment	808,459

It is gratifying to note the co-operation of voluntary organizations with such international agencies as WHO and UNICEF in the national leprosy control programme. Some 34 voluntary organizations, apart from 5 large centres organized by overseas bodies, account for about 17% of the total number of leprosy patients now receiving treatment.

Dapsone prophylaxis will be introduced in selected areas, and BCG vaccination will be undertaken on an investigative basis to ascertain its eventual role in India.

Faced with huge problems of population growth, widespread diseases like tuberculosis and water-borne infections, and under-nutrition, India cannot afford to relax any of her efforts to control the serious and expensive endemic that is leprosy. With under one-fifth of the population surveyed, and new cases of leprosy arising in those already surveyed, the situation in the country as a whole cannot yet be regarded as under control.

The East African Leprosy Bulletin: Vol. 1 (October 1969)

A warm welcome is extended to the first issue of this modest little Bulletin, edited and published in Nairobi by Mr. G. V. W. Anderson, F.R.C.S., and Dr. A. R. B. H. Verhagen. While it is true that the undue multiplication of scientific journals that appeal only to small groups and continue their interests to an ever-decreasing field of knowledge is causing widespread concern, there can be nothing but good wishes for all attempts to stimulate leprosy workers and make available for them advances reported in such established periodicals as *Leprosy Review* and *The International Journal of Leprosy*.

It is to be hoped that other medical schools will profit from the example now being given by Makerere (reported in this first issue of the *Bulletin*), and not only provide theoretical teaching on leprosy for undergraduates and postgraduates, but also organize practical clinical demonstrations at leprosy centres for all medical students at some stage in their course.

Borstel

Borstel: The Forschungsinstitut Borstel will hold an International Leprosy–Colloquium, 26 to 27 August, 1970, at Borstel, in co-operation with the Dermatologische Klinik der Universtität Hamburg and with the Deutsches Aussätzigen-Hilfswerk, Würzburg. The main subjects will be as follows: epidemiology, pathology, bacteriology and hygiene, immunology (including protective immunization and diagnostic reactions), therapy (chemotherapy and immuno-suppressive therapy), clinical, rehabilitation/surgery). Preliminary programmes will be distributed and others are available on request.

Applications and more detailed information may be obtained from the secretariat of the Forschungsinstitut Borstel, 2061 Borstel, West Germany.

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Results of the Leprosy Programme in Japan in the Past 6o Years*

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INTRODUCTION

The National Leprosy Control Programme in its proper sense dates back to 1907, when the Leprosy Prevention Law was enacted in Japan. This law was subsequently amended in 1931 and again in 1953 and has since been in force as amended. Because of advancements made in the treatment of leprosy, new provisions were added by the 1953 amendment to facilitate social rehabilitation of cured patients through education and occupational training.

As implementation of the National Leprosy Control Programme required leprosaria for the admission and treatment of patients, 5 national leprosaria were built in 1909, while 6 more were built in later years, bringing the total number of beds available to 13,020 in 30 years. As a result, the majority of Japanese leprosy patients were admitted to and treated at these national leprosaria. However, until the Japanese Government began to undertake campaigns against leprosy, relief work was mostly in the hands of religious groups composed of foreign missionaries. For this reason, the missionaries may well be considered the pioneers in the relief of leprosy in Japan.

Meanwhile, it was the benevolent acts of the Imperial Household, especially those of the Dowager Empress, which served as the propelling force of anti-leprosy campaigns in Japan. The Imperial Household, as well as other organizations, made frequent charitable contributions to aid the campaigns.

As a rule, all those who are suspected of spreading leprosy bacilli are encouraged to be hospitalized in leprosaria. However, when clinical symptoms of leprosy disappear and the patient is adjudged free from any danger of disseminating the bacilli as a result of treatment given in the leprosarium, he is discharged.

The number of leprosy cases in Japan has gradually decreased as a result of this segregation policy enforced in the past 60 years, and today the number has been reduced to about one-third of what it was 60 years ago. While 30,359 cases of leprosy were found under the National Leprosy Survey made in 1900, the number had decreased to 10,402 by 1966. And the rate of incidence per 10,000 has been decreased from 6.9 in 1900 to 1.0 in 1966.

The number of leprosy patients hospitalized for treatment gradually increased as more leprosaria were established, and, as shown in Table 1, more than 93% of the total number of cases, 10,220, had been hospitalized by the end of 1967.

TABLE 1

Total number of patients and the number hospitalized

Year of survey	*No. of patients registered*	*No. of patients hospitalized* (%)	*Prevalence rate per* 10,000 *population*
1919	16,216	1559 (9.1)	2.92
1925	15,351	2225 (14.5)	2.57
1930	14,263	3272 (22.2)	2.21
1935	15,193	5265 (32.0)	2.19
1940	15,763	9190 (58.3)	2.16
1950	11,094	8325 (75.0)	1.3
1955	12,169	11,057 (90.9)	1.3
1960	11,587	10,645 (91.9)	1.2
1965	10,607	9874 (93.1)	1.0
1967	10,220	9537 (93.3)	1.0

*Received for publication 4 August, 1969.

NEWLY DISCOVERED CASES

The number of newly discovered cases has markedly decreased in the past 60 years. For instance, cases newly discovered in the 22 years between 1947 and 1966 have fallen from 607 in 1947 to 87 in 1968, as shown in Table 2. Also comparison of a yearly average of 637.6 cases discovered in the 5-year period 1947-51 with the yearly average of 113.8 cases discovered in the 5-year period 1964-68 shows that the number has been reduced to between one-fifth and one-sixth that of the original value.

TABLE 2

Decrease in the number of newly discovered cases

Year	*No. of patients newly discovered*	*Ratio per 100,000 population*
1947	607	0.8
1948	712	0.9
1949	778	1.0
1950	604	0.7
1951	487	0.6
1952	326	0.4
1953	315	0.4
1954	333	0.4
1955	331	0.4
1956	283	0.3
1957	361	0.4
1958	362	0.4
1959	295	0.3
1960	257	0.3
1961	235	0.2
1962	211	0.2
1963	175	0.2
1964	135	0.1
1965	125	0.1
1966	106	0.1
1967	116	0.1
1968	87	0.1

SHIFT IN AGE GROUPS IN THE ONSET OF LEPROSY

The age group 10 to 19 years exceeded all other groups in the number of new cases admitted to national leprosaria during the period 1935-57, as shown in Fig. 1. However, the highest figure of 47% for 1935 had dropped to 35% in 1957, and the rate of onset had shifted to higher age groups. In particular, reduction in the rate of onset in the age group 0 to 9 years was conspicuous, as the rate of 15% in 1935 had fallen to only 6% in 1957.

Incidentally, comparison of the average value (percentage) of the number of new cases of leprosy by age groups between 1964 and 1968 with the 2 onset groups mentioned above shows not only a marked decrease in new cases but also complete elimination of the peak for the age group 10 to 19 years, which had

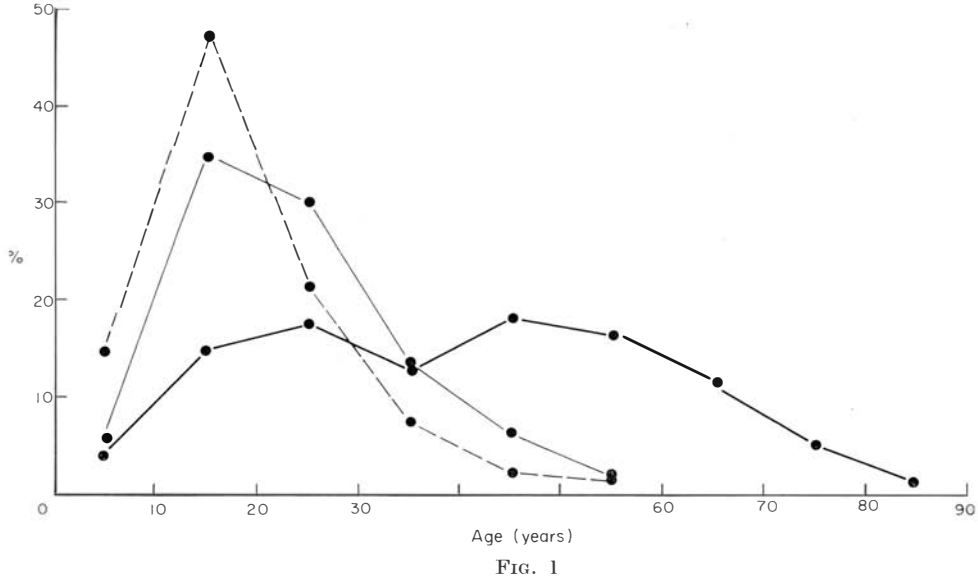

FIG. 1

Shift in the age group of the onset of leprosy; - - -, 1935; —, 1957; **—**, 1964-68 (average value).

previously shown the largest number of new cases, and a tendency towards increased onset in those of higher age groups, particularly among those aged 40 to 49 years.

RATIO OF MALES TO FEMALES

In Japan, also, the number of male patients has always been larger than that of females. This difference, however, has gradually become smaller, and the ratio of 3.3 : 1 in 1905 had been reduced to 2.54 : 1 in 1920, to 2.22 : 1 in 1940, to 1.75 : 1 in 1957, and to 1.66 : 1 in 1967.

TYPE OF DISEASE

When the patients admitted in the past 50 years are classified into those with the lepromatous type and non-lepromatous type of disease, the lepromatous type accounted for 70 to 75% of the total, though it has depended on the year examined. In recent years, however, no significant change in the ratio of the 2 types suggestive of any reduction in the lepromatous type has been seen.

SHIFT IN THE AGE DISTRIBUTION

As approximately 93% of leprosy patients are hospitalized in Japan, the Tama Zenshoen, one of the oldest national leprosaria in the country, was taken as a fair example of the age distribution, at 10 to 20 year intervals, of the patients admitted there between 1914 and 1968. As shown in Fig. 2, the age distribution of Japanese leprosy patients is shifting to higher age groups. The age group 21 to 30 years occupied the highest percentage in 1914, but this had shifted to the 30 to 40 age group in 1934, and in 1958 and 1968 a shift to still higher age groups was evident.

This shift to higher age groups is considered to be due to the decrease in the number of new cases of leprosy among the younger generation as well as to the remarkable reduction in the death rate ascribable to such diseases as pulmonary tuberculosis, nephritis, and others. On the other hand, geriatric changes such as cerebral haemorrhage, circulatory disturbances, and cancer, have become the main causes of death concomitant with the advancement in age of the hospitalized patients.

PATIENTS WITH ARRESTED DISEASE

The number of patients whose leprosy has become quiescent and who, having been adjudged free from recurrence as a result of admission to and treatment in leprosaria, have been discharged, is increasing annually as shown in Table 3. The criteria for diagnosing arrested disease as employed at the Japanese leprosaria are as follows: The lepromatous lesion must be

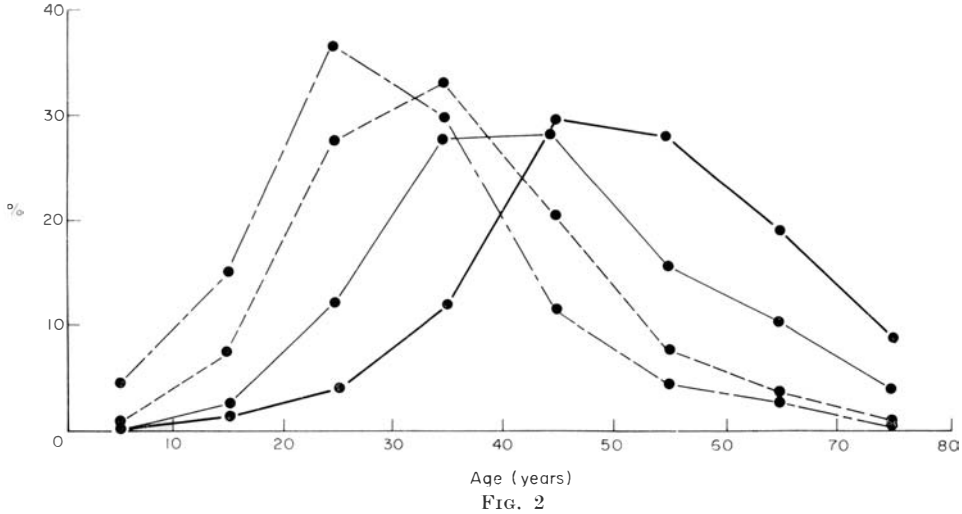

FIG. 2
Shift in the age distribution of leprosy patients (National Leprosarium Tama Zenshoen), — · —, 1914; - - - -, 1934; —, 1958; —, 1968.

TABLE 3

Increase in the number of the arrested patients discharged

Year	*No. of arrested patients discharged*
1953	49
1954	80
1955	79
1956	72
1957	86
1958	108
1959	163
1960	216
1961	166
1962	134
1963	125
1964	119
1965	91
1966	117
1967	117

completely absorbed and no leprosy bacilli must be present in smears taken from different parts of the skin and from nasal mucosa. Also, neither leprosy bacilli nor active cell infiltration should be evident in biopsy specimens taken from suspicious areas of the skin. When the above state has continued for more than 2 years without any charge, ophthalmological and rhino-laryngological examinations are carried out, and any patient passing these examinations successfully is entered on the list of arrested cases.

After discharge, DDS is, as a rule, continuously given for more than 2 years. A discharged patient visits the leprosarium every 3 months for consultation and is given sufficient DDS tablets for the following 3 months.

REHABILITATION

Most discharged patients fortunately suffer no advanced physical damage and are capable of supporting themselves by pursuing their own occupations with the help of their relatives or friends. The Japanese Leprosy Foundation also extends a helping hand to them in the recommendation of jobs and in other ways.

On the other hand, there are many disabled patients in Japanese leprosaria. In fact, such patients account for nearly 80% of all the hospitalized cases. Patients with curable stigmata or deformities are treated by plastic surgery and receive physiotherapy as well as job-training to prepare them for future social rehabilitation. The problem, however, is how blind patients with arrested disease and those with advanced physical handicaps difficult to treat should be cared for in the future. This question, in fact, constitutes a serious problem for the Japanese Government and leprosaria.

CONCLUSIONS

The National Leprosy Control Programme of Japan has now been in force for 60 years and during this time the number of patients has gradually decreased until today it is reduced to one-third of the former total. In particular, the number of new cases of leprosy has shown a marked decrease in the past 20 years (to one-fifth or sixth). On the other hand, leprosaria are burdened with an increasing number of seriously disabled patients as well as those who have lost the desire to rehabilitate themselves and try to remain in hospital permanently. Although the treatment of such patients poses serious problems, it can truly be said that Japan's leprosy control programme has achieved positive results.

In all, 11 national leprosaria have been established in the 60 years since 1907, and when private facilities are included, the total number of beds available has reached 13,300 or more. Patients with active leprosy who represent a danger by spreading bacilli are segregated in these leprosaria, and as a result of treatment the number of sufferers capable of infecting others is gradually decreasing in society at large. This is considered to have rapidly reduced the chances of leprosy spreading among close contacts, particularly among children of the patients' households.

The tendency towards a rapid decrease in new cases of leprosy in Japan, however, cannot be considered to arise solely from the segregation policy followed; the improvement in national living conditions after World War II and the

spread of up-to-date knowledge of sanitation and public health must also be considered as being important contributory causes.

Incidentally, it is hoped that the question of a possible relationship between BCG vaccination, which since 1948 is now given to all persons with a negative tuberculin reaction from the time they are babies, and the effect of the reduced number of new leprosy cases will be investigated in detail.

ACKNOWLEDGEMENTS

I wish to express my appreciation of the advice and aid provided by Dr. S. Hazama of the National Leprosarium, Tama Zenshoen.

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Leprosy Control in South Africa*

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INTRODUCTION

When leprosy was found to be increasing in South Africa in the latter part of the 19th and early half of the present century, measures were introduced to isolate patients in institutions. Today, patients who are bacteriologically positive and with active disease are still treated in institutions. The annual numbers of new cases and of patients in the institutions have both declined steadily. In 1968 the number of new cases was 2.0 per 100,000 and the estimated number of active cases in the country 14.5 per 100,000.

HISTORY

Leprosy is thought to have spread to the southernmost parts of Africa from the north before the Cape was colonized by Europeans in the latter half of the 17th century. The Hottentont tribes were particularly affected and the Bantu to a lesser extent. The number of cases was subsequently augmented by trade with the West and East Indies (Impey, 1895). Leprosy was first mentioned in the Cape archives in 1756, when 2 white farmers were found to be suffering from the disease; they and their families were isolated in their homes. By 1817 the number of cases had increased to such an extent that a proclamation was issued directing all "lepers" to be removed to a settlement in the Caledon district, where detention, however, was voluntary. In 1845 the patients were removed to Robben Island. Only patients who were unable to care for themselves were accommodated and they could leave when they wished (Impey, 1895). In 1883 a Leprosy Commission concluded that the disease was spreading steadily among both the white and coloured races and that segregation was necessary to stamp out the disease. A Leprosy Repression Act was passed in 1884 but was not promulgated until 1892, after a Select Committee appointed by Parliament had reported a further increase in the disease which necessitated the provision of additional accommodation at Robben Island. In the meantime leprosy had been found to be increasing in Natal, the Orange Free State, and the Transvaal. Measures were gradually introduced to control further spread. Coloured patients from the Orange Free State were sent to Robben Island and Whites were segregated within the territory. In the Transvaal, Westfort Institution was completed by 1898. In 1903 a segregation camp was set up in Natal on the Zululand coast. Subsequently additional leprosy institutions were established in Pondoland and in Tembuland in the Transkei and also in the Northern Transvaal.

Legislation for the control of leprosy was first promulgated in Natal in 1901, in the Transvaal in 1904, and in the Orange Free State in 1909. After Union of the 4 provinces in 1910, leprosy control was administered by the Department of the Interior. In the Public Health Act of 1919 leprosy was declared a notifiable disease for which compulsory institutional treatment could be enforced. Before 1923, patients who were committed to leprosy institutions were confined there for the rest of their lives. In that year leprosy was taken over

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by the Department of Health and large numbers of patients in whom the disease was arrested were discharged from the institutions. In 1932 all patients from Robben Island were transferred to the institutions on the mainland. Up to 1944 the numbers of patients admitted to the institutions increased. Thereafter there was a sustained decrease in the number of admissions and in 1952 the total number of patients had decreased to such an extent that it was found possible to utilize half of the available accommodation in 3 of the leprosy institutions for patients with tuberculosis and later to close the institution in the Northern Transvaal. In 1968 the cost to the Government of maintaining the 4 institutions (including accommodation for 340 tuberculosis patients) was R258,000.

PRESENT POLICY

Since leprosy is a notifiable communicable disease in the Republic of South Africa, persons found to be suffering from it must be admitted to one of the 4 existing institutions for treatment until the disease has become "arrested" and the patient considered non-infectious. Patients who are bacteriologically positive are kept in the institutions until smears have been negative for 12 consecutive months, while those already bacteriologically negative are kept in the institutions until clinical activity has ceased. Discharged patients are required to return to the institution for follow-up examinations at 2 years and 6 years respectively after their discharge. Formerly these examinations were undertaken by the district surgeons (Government medical officers) of the magisterial district in which the patient resided. Patients are notified by the institutions when they are due for re-examination and are provided with free transport to the institutions. It has been found that about 60% of discharged patients return for the first follow-up examination, but only 20% for the second. All patients, particularly those with lepromatous leprosy, are advised to continue taking dapsone, which is supplied by the institution, for the rest of their lives. The average duration of stay in Westfort Institution of patients discharged in 1968 was 4 years 8 months for lepromatous cases, $2\frac{1}{2}$ years for borderline cases, $10\frac{1}{2}$ months for tuberculoid cases, and $8\frac{1}{2}$ months for indeterminate cases.

The Government assumes all financial responsibility for leprosy. Paid employment is available for all patients who are able and wish to work, while those unable to work are given an allowance. If a patient is a breadwinner his dependants receive a maintenance grant. Relatives of patients are provided with free transport, food and accommodation while visiting the institutions. Children born to lepromatous mothers are cared for in a crèche until suitable arrangements can be made for them to be looked after by relatives or foster parents.

All contacts of patients are statutorily required to be examined by a district surgeon or other Government medical officer. After the initial examination they are required to be re-examined 2 and 5 years later. Registers of contacts previously maintained by the magistrates of each district are now kept by the leprosy institutions. At present the Regional Directors of the State Health Services in the 6 health regions into which the Republic is divided, assist the district surgeons in their tracing of contacts by providing the services of technical field-workers. These field-workers attend courses in leprosy in order to be able to recognize suspected cases. This arrangement has been operating since May 1967, is working successfully in the Southern Transvaal, and is being extended to all the other regions. Since May, 1967, 7% of contacts of patients admitted to Westfort since that time have been found to be infected.

Increasing use is being made of BCG vaccination for tuberculosis control. It is hoped that this will prove to be a value in leprosy control as well. All child contacts of leprosy patients are given BCG vaccination.

At the largest institution—Westfort—lectures and demonstrations are given for undergraduate and postgraduate medical students, mission doctors, district surgeons and nurses.

PREVALENCE OF LEPROSY IN SOUTH AFRICA

Between the years 1845 and 1891, a total number of 1059 patients were admitted to Robben Island, the highest annual number being 52. In the following 2 years the total number of admissions exceeded 700 (Impey, 1895, 1896). In 1897 Impey reported at the First International Leprosy Congress, held in Berlin, that the total number of patients in the territories now comprising the Republic of South Africa was 1917 (Jeanselme, 1934). Thereafter the number of known patients rose steadily, and in 1908 the total number of patients in the country was estimated to be 2790 (Mackay, 1908). After formation of the Union in 910 the number of cases in the institutions totalled 1805 (Rogers and Muir, 1940). The annual number of new cases admitted and total number of patients in the institutions at 4-yearly intervals from 1912 to 1968 are shown in Table 1. Up to 1957 the figures available for the total number of admissions to the institutions included a small proportion of patients with inactive disease and even some non-leprosy patients. From 1957 onwards the figures are in respect of new active cases only. In the decade 1959 to 1968 the average number of active cases admitted annually was 478. In the same period the total number of patients in the institutions declined from 1551 to 1115. It is evident that in spite of an increase in the population of South Africa, the total number of active cases and of patients under treatment in the institutions declined.

TABLE 1

New cases and total number of leprosy patients in institutions in South Africa

Year	*No. of population*	*No. of new cases*	*Total no. in institutions*
1912	6103	528	2226
1916	6547	478	2286
1920	6838	389	2250
1924	7489	448	2141
1928	8190	537	2405
1932	8898	590	2208
1936	9618	704	2218
1940	10,353	695	2347
1944	11,081	680	2398
1948	11,957	574	2114
1952	13,058	632	1994
1956	14,421	617	1715
1960	15,925	538	1412
1964	17,457	509	1330
1968	19,167	383	1115

Figure 1 shows the number of new cases per 100,000 of the population from 1928 to 1968. It will be seen that the number of new cases declined from 6.6 per 100,000 in 1928 to 2.0 per 100,000 in 1968. In estimating the number of cases of active leprosy in the Republic we have multiplied the number of patients in the institutions by 150%, on the assumption that the results of our case finding programmes are "fair" (Bechelli and Martinez Dominguez, 1966). The total number of patients in the institutions does not reflect the true number of active cases under treatment as it includes burnt-out cases kept in the institutions on humanitarian grounds and also patients admitted for treatment of ulcers, etc. It will be seen in Fig. 1 that the estimated number of patients with active leprosy per 100,000 of the total popluation declined from 73.4 in 1928 to 14.5 in 1968. For each population group the figures in 1968 were 20.5, 3 9, 1.7 and 0.8 for the Bantu, Coloured, Asiatics and Whites respectively.

TIME BETWEEN ONSET AND DETECTION OF LEPROSY

The Annual Report of the Department of Health for 1924 stated that in the previous 15 years the average period of time elapsing between onset of leprosy and the patients' isolation had been about $6\frac{1}{2}$ years. For patients admitted to Westfort Institution the average duration between onset and diagnosis was $4\frac{3}{4}$ years in 1938, 2 years in 1948 and 1958, and $1\frac{1}{2}$ years in 1968.

DISCUSSION

If the early reports can be believed, leprosy spread quite rapidly in Cape Colony before isolation measures were introduced. This apparent spread may have been due to improved case finding and increased public awareness of the disease. In the early days institutional

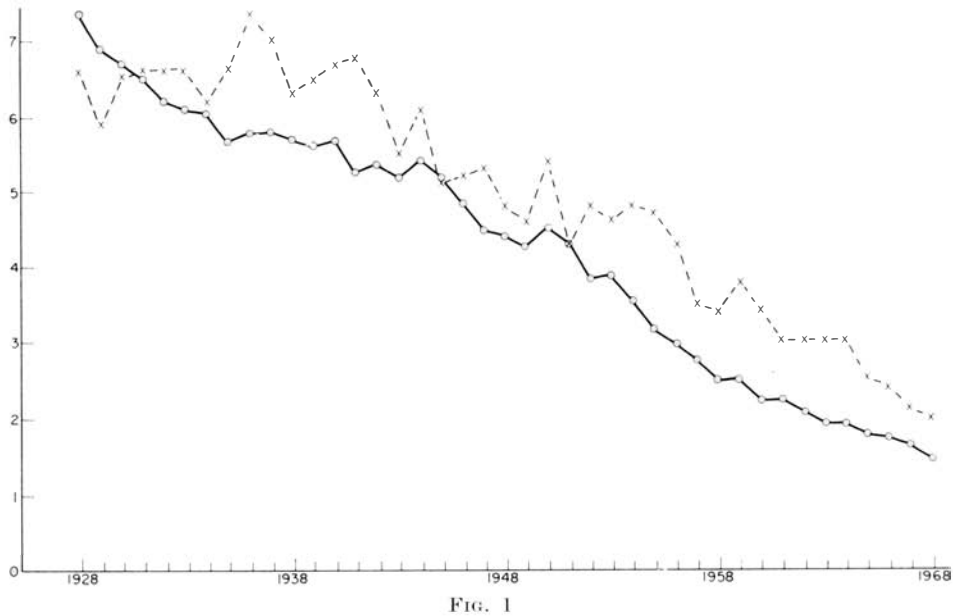

FIG. 1

Incidence and prevalence of leprosy in South Africa, 1928-68. o—o—o, Estimated no. of cases of active leprosy per 1,000,000 population; x—x—x, no. of new cases per 1,000,000 population.

accommodation was inadequate, and isolation of patients was strictly applied only from 1923 onwards. Following a visit to South Africa in 1939, Muir (1940) said that it could be stated with some degree of certainty that the numbers of patients with leprosy outside the institutions had decreased considerably during the period 1918 to 1938. He stated: "There seems little doubt that if the present system is persisted with it will succeed in the end."

In spite of the fact that all patients with active and bacillary-positive leprosy are institutionalized, it is found that a large number of sufferers present themselves voluntarily for treatment. In fact, it is not uncommon for ex-patients to bring relatives and friends suffering from the disease for admission because they realize that leprosy is curable today.

The steady decrease in the time between onset of the disease and admission is attributable to improved case-finding procedures. In spite of increased case-finding measures, since May, 1967, the incidence of new cases has continued to decline.

Although we consider our case finding is fairly good and the treatment of patients in institutions is good, the follow-up of patients and contacts could be greatly improved. This could best be done by employing mobile teams to visit discharged patients and contacts in their homes at regular intervals. The acute shortage of doctors in South Africa is likely to continue for at least another 10 years or more, until such time as the proposed new medical faculties have been established. Until an adequate service whereby patients can be visited in their homes is available, it would be inadvisable to shorten the stay of the patients in the institutions, as most of them cannot be relied upon to continue treatment at home.

In view of the declining prevalence of the disease even before the introduction of sulphones, one may conclude that the isolation of patients as practised in South Africa has played an important part in controlling the disease, although improvements in standards of living must also play a role. In South Africa it has been possible, because of favourable economic circumstances and the small number of cases, to carry out a humane policy of compulsory

isolation. The institutionalization of all patients with active leprosy, apart from controlling the spread of the disease, also insures that patients receive adequate treatment.

ACKNOWLEDGEMENTS

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Pilot Survey of a Group of Remote Villages in Masasi District, Tanzania*

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This survey revealed that about 40% of the patients with leprosy in the area were not coming forward for treatment.

The treatment of patients with leprosy has been carried out in the Masasi District of Southern Tanzania (Fig. 1) for at least 40 years, thanks to the efforts of Mission medical staff and support from the major leprosy associations. As a result of this, and especially due to the work of the present worker from the British Leprosy Relief Association (LEPRA), a very effective Dispensary treatment scheme has been constructed. The designation of the Mission hospital at Mkomaindo as the Masasi District Hospital (in 1965) brought together, under one administration, all the Local Council and Mission Dispensaries, and thus centralized the control of leprosy work throughout the whole district. The treatment scheme now consists of 24 dispensaries in an area of 6000 sq. miles (15,400 sq. km.), 3 strategically placed holding units each with a few beds for acute or "surgical" cases, and the District Hospital which also has a 10-bedded holding unit for patients with severe reactions or those needing surgical care not treatable elsewhere (Fig. 2).

When the statistics for this scheme were collected it was obvious that even allowing for possible error in the detailed figures, the incidence of leprosy was high. In Masasi District, with a population of 130,000 and 4000 leprosy patients under treatment, the incidence is 3%. At this stage no work, such as school surveys or village surveys, had been done in terms of finding patients. With a well-established treatment scheme this was the obvious next step. However, it was felt that in order to plan the direction of future work it was necessary to have at least a rough assessment of the number of undiagnosed cases within the community. A pilot survey was therefore indicated. In parts of the District there had developed over the last few years a gradual drift of the population away from the Rovuma river and towards the main road, largely for economic reasons. This population movement, it was felt, would complicate any survey, and it was therefore decided to perform the pilot survey in a more remote area of the District in which the old village system still operated and where there was little population movement and a fairly good leprosy treatment system already existed. The area selected comprised a group of villages dependent on the Dispensary at Nakopi (see Fig. 2). These villages form an independent group (Fig. 3) with definite boundaries, thus making it possible to keep the survey within circumscribed limits. Also, by using the system of Balozi (10 House Chairmen) it was possible, provided all the Balozi co-operated, to be certain that the whole population had been seen. Thus, the initial step was for 2 members of the survey team to visit each village, call a meeting of the Balozi—whose names had already been obtained from official sources—and explain to them the purpose of the survey. All eventually consented. At the dates and times arranged the survey team returned and over a period of 2 weeks systematically examined the population, inspections being carried out in small grass cubicles which had been constructed by the people themselves.

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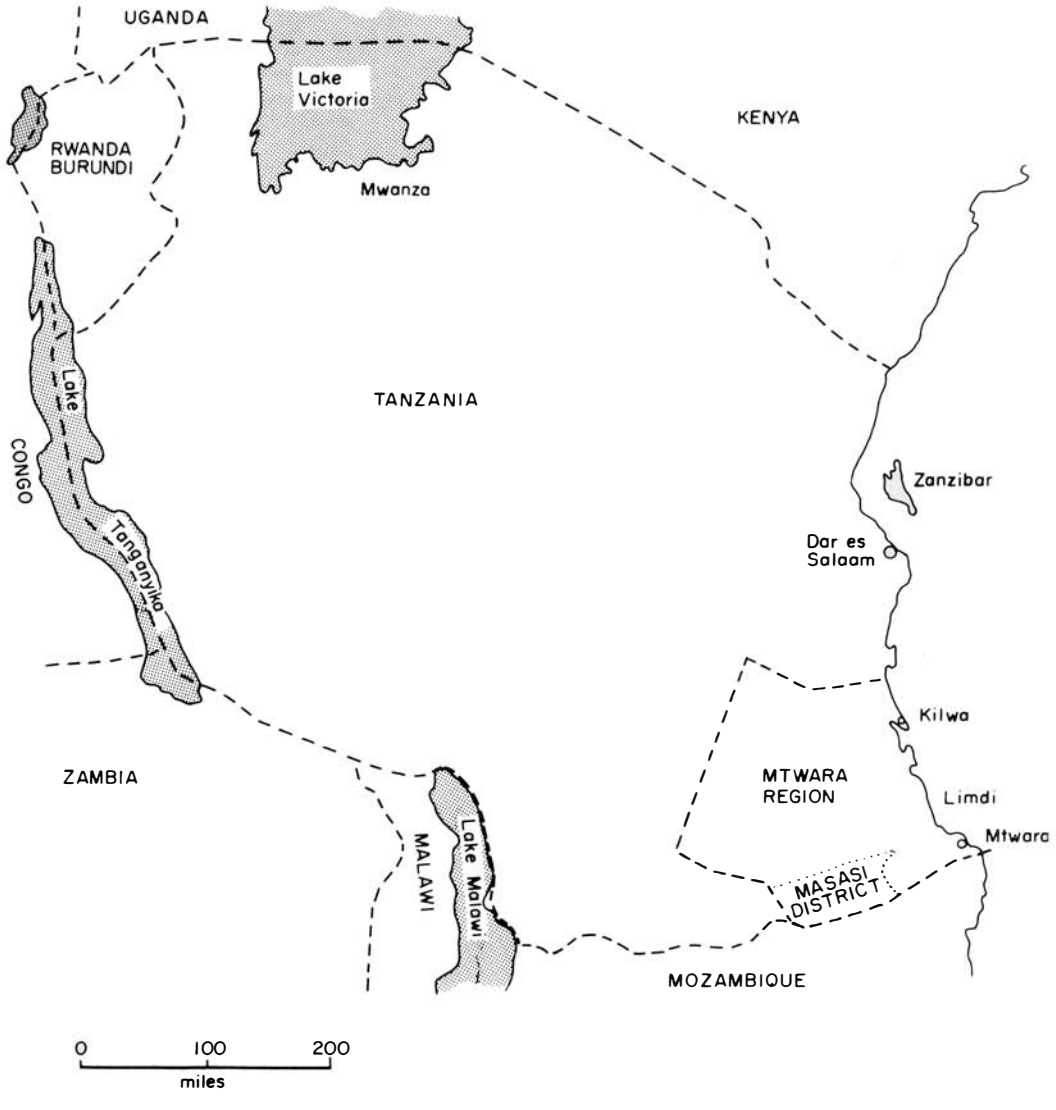

FIG. 1

RESULTS

The findings were noted according to sex, age (adult or child), and type (lepromatous, tuberculoid or indeterminate). Smears were taken in any doubtful cases. The results are shown in Tables 1 and 2.

DISCUSSION

As expected, most of the cases are on the tuberculoid side of the spectrum; no new lepromatous cases were found. Sex distribution in adults was found to be predominantly male, in contrast with the general tendency to a

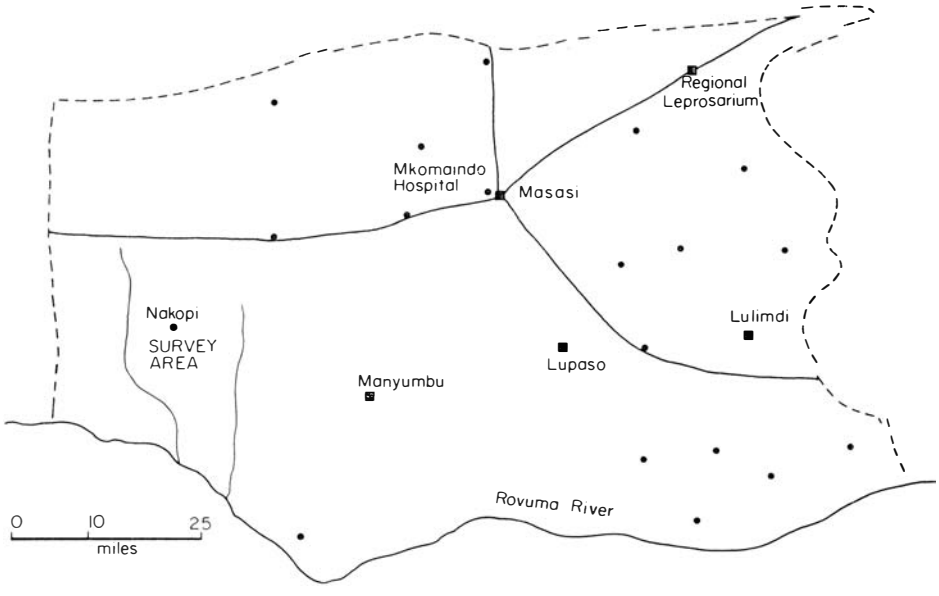

FIG. 2

Masasi district. —, Main roads; ■, main centres with holding units; ●, dispensaries.

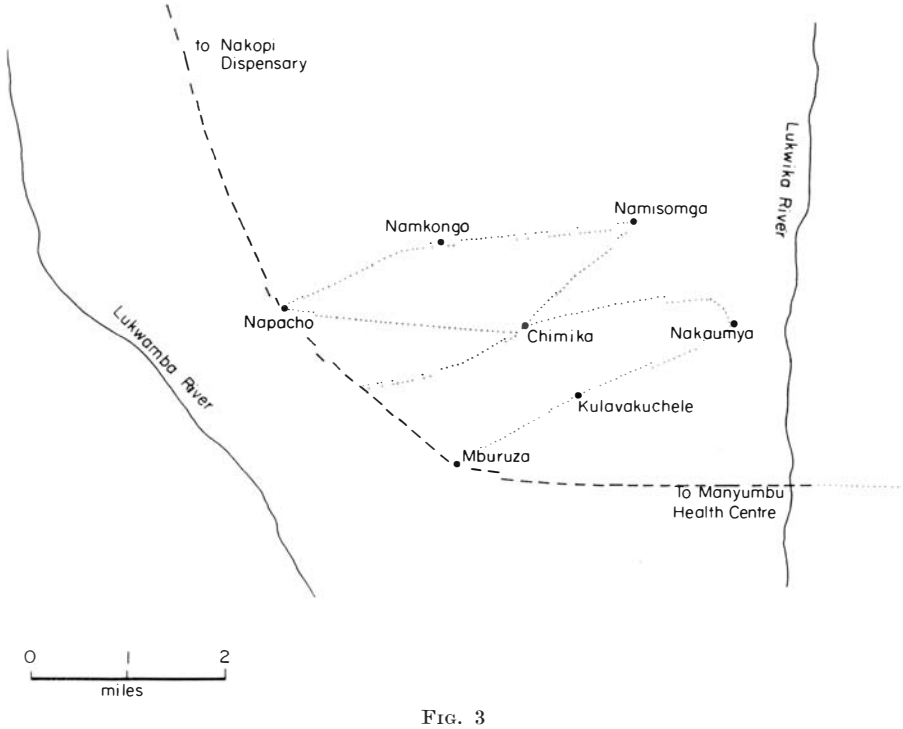

FIG. 3

Survey area. – – –, Track; ....., footpaths.

TABLE 1

Village	*Adults*	*Children (under 14 years)*	*Total examined*	*Total new cases found*
Napacho	73	40	113	2
Mburuza	120	57	177	1
Namkongo	39	13	52	2
Chimika	127	59	186	6
Nakaunya	60	44	104	3
Namisonga	40	20	60	0
Kulavakuchele	49	28	77	3
Total	508	261	769	17

TABLE 2

Type of leprosy	*Children*		*Adults*		*Total*
	Male	*Female*	*Male*	*Female*	
Tuberculoid	–	–	8	4	12
Indeterminate	–	4	–	1	5
Lepromatous	–	–	–	–	0
Total	–	4	8	5	17
Numbers examined	128	133	233	275	769

majority of females among patients under treatment in the district as a whole. This may merely reflect a reluctance on the part of the men to come forward for treatment, but a more extensive survey would be needed to confirm this. There is no obvious reason for the absence of new cases in male children. All the new cases in female children were of indeterminate type, thus differing from the usual slight preponderance of tuberculoid cases among children under treatment. This is possibly because mothers are familiar with the minor tuberculoid lesions but not with those of the indeterminate type and therefore tend not to take the child for treatment until more definitive lesions appear. The finding of 17 new cases in a total examined population of 769 thus gives an incidence of previously undiagnosed leprosy in the community of just over 2%. This compares with a total of 29 patients already under treatment for leprosy in the same community, which gives an incidence of "patients under treatment" of 3%, which is in keeping with the rest of the district. If these figures are taken as typical then, in spite of an extensive leprosy treatment scheme working for many years and being efficiently run, some 40% of patients with leprosy are not coming forward for treatment. It also shows an overall incidence of 5% for the district, thus putting the area among the higher endemic areas in Africa.

The survey confirmed the need to carry out a diagnostic search in the villages and schools, despite an apparently effective leprosy treatment scheme already in operation, and it has also demonstrated the size of the problem in this area. Even allowing for the fact that it has proved possible to discharge from the dispensaries about 15% of patients as clinically cured after 5 years' treatment, if all the potential patients are found and brought for treatment this will produce a considerably increased work load for the already hard-worked clinics. This is, however, a problem which, now that its potential size is known, must be accepted and overcome if the Masasi Leprosy Scheme is to be successful, as also must be the man-power problem for the necessary survey work. As a direct result of the present survey a new visiting point has been established between Napacho and Mburuza (see Fig. 3).

The relatively small numbers involved in this pilot survey could possibly give a slightly false picture. However, initial surveys carried out in schools in the district have also given a figure of about 2% for previously undiagnosed cases; it would seem therefore that this figure is at least of the right order. It is hoped that the survey may be repeated in about 3 years' time for comparison with the present findings.

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First Results of Treatment of Leprosy with Rifadin*†

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The authors present the first published results obtained with Rifadin (rifampicin) in the treatment of 7 patients with lepromatous leprosy. The drug had a marked effect on the infecting bacilli. They conclude that Rifadin is an effective anti-leprotic drug which merits further and more extensive trials.

INTRODUCTION

Rifadin (Rifampicin) is a new "semi-synthetic" antibiotic, belonging to the group of rifamycins. Rifamycin S.V., isolated in 1957 from *Streptomyces mediterranei* n. sp., has shown anti-tuberculosis and anti-leprosy properties (Opromolla, 1963; Merklen and Cottenot, 1963). Opromolla (1965) concluded that rifamycin is remarkably active clinically but the histopathological and bacteriological results do not always correspond with the clinical evaluation. The incidence of ENL reactions is moderate. No toxic effects have been found.

A disadvantage of rifamycin is that the drug has to be administered daily by injection. This is probably one of the reasons for the limited use of the drug in anti-leprosy treatment. The activity of rifadin against *Mycobacterium tuberculosis* is claimed to be even grater than that of rifamycin. Results of treatment of leprosy with this drug have not yet been reported. Rifadin has the great advantage that it can be administered orally in one dose daily.

Rifadin has shown activity *in vitro* and *in vivo* against various Gram-positive and some Gram-negative bacteria. It is inactive against fungi. In tuberculosis studies a very low toxicity has been found. In a series of 500 tuberculous patients treated with 450 to 600 mg of rifadin daily, only one patient developed an allergic skin rash and a few patients complained of minor gastric distress; the gastric disturbances all occurred in patients receiving associated treatment with other drugs. In 15% of 150 tuberculosis patients drug resistance has been reported after treatment with rifadin for periods of 3 months or more.

In the present paper the first results of the treatment of 7 patients with lepromatous leprosy with rifadin are reported; 2 of these patients were clasified as "borderline lepromatous". The lepromin reaction in all the patients was negative with the exception of one borderline lepromatous patient who showed a Mitsuda reaction of 3 mm. All the patients were strongly bacteriologically positive with a high percentage of non-granular bacilli. Treatment consisted in 600 mg of rifadin daily, administered before breakfast in one dose. With one exception treatment was not interrupted during the reactive phases which occurred in some of the patients. The duration of treatment varied from 10 to 20 months.

METHOD OF EVALUATION

The patients were examined clinically at regular intervals and all reactions were recorded. The

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†The preliminary results of treatment of these patients were presented in a paper read at the Scientific Conference on Mycobacterial and Related Diseases, held at Dar es Salaam, Tanzania, in January, 1969.

patients were asked to report any side-effects of the drug. Biopsy specimens were taken at regular intervals, in 6 cases at monthly intervals for the first 3 months of treatment and thereafter at 3-monthly intervals, and in the seventh patient at 3-monthly intervals only. The biopsy specimen was taken on each occasion from the same lesion, near to the site of the previous biopsies but avoiding the scars of these biopsies. The biopsy specimens were all processed in one laboratory (Amsterdam) and assessed by one assessor who at the time of examination had no information on the results of previous examinations. The bacteriological index (B.I.) (Ridley's scale), and the percentage of intact (solidly stained), of fragmented (somewhat unevenly stained, but not yet granular), and of granular bacilli was calculated.

CASE HISTORIES

Patient No. 1 (*R*)

Male, aged 23, West Indian, had borderline lepromatous leprosy with onset in 1953. He received irregular treatment with DDS between 1953 and 1967. Relapse in 1967 was followed by one month of treatment with thiambutosine. Rifadin treatment was started in October, 1967. At that time the patient showed multiple erythematous, moderately raised infiltrates on the face, trunk and extremities. Clinically and histopathologically a case of borderline lepromatous leprosy. The patient was strongly bacteriologically positive. Globi were present, and 59% of the bacilli were non-granular. After a few months of treatment the erythema had disappeared and the lesions had become flat. By March, 1968, the lesions were hardly still visible. During the 19 months of treatment no reactions had occurred and no side-effects had been observed. At the end of July, 1969, however, the patient complained of pain in the right arm, rapidly followed by muscle weakness. The right ulnar nerve was enlarged and painful. Rifadin was withdrawn and prednisone was administered. The neuritis rapidly subsided and one month later the paresis of the hand had disappeared.

Patient No. 2 (*Sl*)

Male, aged 25, West Indian, with lepromatous leprosy. Onset in 1966. He had had one month of treatment with 100 mg of DDS weekly. Treatment with rifadin was started in February, 1968. at which time numerous erythematous nodules and small plaques were present on the face, trunk, and extremities. Clinically and histologically the patient was classified as having non-diffuse lepromatous leprosy, bacteriologically strongly positive with globi and 53% non-granular bacilli. After one month of treatment the lesions had become less erythematous and less raised, while after 3 months they had further subsided and had become hyperpigmented; one month later they were nearly flat. In July, 1968, however, the lesions suddenly became erythematous and raised again, though no new lesions appeared. The patient had no fever and no other complaints. The biopsy specimen showed no intact bacilli nor any decrease in the percentage of granular bacilli. The pseudo-exacerbation subsided spontaneously within one month, but 6 months later a similar pseudo-exacerbation was seen; however this also subsided rapidly and spontaneously. No other reactive phases have occurred during 20 months of treatment, and no other side-effects have been noticed.

Patient No. 3 (*Tj*)

Male, age 34, West Indian, with lepromatous leprosy. Onset in 1954. Between 1954 and 1959 irregular DDS treatment. Relapse in 1965. Treatment with DDS was continued but often was interrupted by repeated ENL reactions. Rifadin treatment started in February, 1968.

At that time patient showed vague, diffuse infiltration of face and trunk and multiple nodular lesions on the extremities, in particular on the thighs and buttocks. The lesions were slightly erythematous. Clinicially and histologically the patient was classified as non-diffuse lepromatous. The patient was strongly bacteriologically positive, with globi and 67% non-granular bacilli. After one month of treatment the erythema had disappeared. After 3 months of

treatment the lesions had become hyperpigmented and nearly flat. After 9 months of treatment only slight residual hyperpigmentation was visible. No reactions occurred during 12 months of treatment. No side effects have been noticed. Because patient decided to leave the country rifadin treatment was replaced by thiambutosine.

Patient No. 4 (*B*)

Male, age 30, West Indian, also had lepromatous disease, with onset in 1962. Between 1963 and 1967 he had had irregular treatment with DDS with repeated reactions. Treatment with rifadin was started in February, 1968. At that time the patient showed the picture of advanced, active, nodular lepromatous leprosy. In addition to extensive diffuse infiltrations and numerous firm erythematous cutaneous nodules, many deeply located nodules and plaques were also present. The lower legs were markedly swollen, indurated and painful. Smears were strongly bacteriologically positive, with globi and 63% non-granular bacilli. This was clinically and histologically a case of non-diffuse lepromatous leprosy.

In the first 2 months of treatment the erythema disappeared and the lesions subsided slightly. One mild erythema nodosum leprosum (ENL) reaction occurred. The patient complained of severe pains in his lower legs and feet, but refused further treatment because he thought that the drug aggravated the pain in his legs. One month later, however, he agreed to continue treatment again and in the next 6 months the lesions slowly subsided. During this period he had 3 mild to moderately severe ENL reactions and one attack of iridocyclitis. Although the patient still complained of pain in his legs, the induration of the legs gradually became less. In November, 1968, after 9 months of treatment, many deeply located nodules became painful and some more superficially located nodules became erythematous and a few ENL nodules appeared. The patient had fever and felt very ill. The reaction was treated with thalidomide and subsided within one week. During the following months the induration of the legs became markedly less. One mild and one moderately severe reaction, with painful deep nodules but without ENL lesions, occurred. The other infiltrates, although still conspicuous, had subsided markedly. During 19 months of treatment no other side-effects were observed. The condition of the patient has significantly improved.

Patient No. 5 (*MW**)

Female, age 45, Indo-European, lepromatous. Onset in 1964. Patient had had no previous treatment. Treatment with rifadin was started in October 1968. At that time slight vague, diffuse, symmetrical, copper-coloured but rather inconspicuous infiltrations were present. The face was puffy and the ear lobes were slightly swollen. Smears were strongly positive, with globi and 51% non-granular bacilli. The patient was classified as having diffuse lepromatous leprosy. After a few months of treatment with rifadin the erythema had disappeared and the infiltration had subsided. During 12 months of treatment no reactions occurred. No other side-effects have been seen and the clinical signs of leprosy have largely disappeared.

Patient No. 6 (*M*)

Male, age 33, West Indian, suffering from borderline lepromatous leprosy with onset in 1942. From 1942 to 1944 he had treatment with diasone, followed by very irregular treatment with DDS until 1965. In this period several exacerbations occurred. In 1968 the patient had a severe relapse, and rifadin treatment was started in October, 1968. At that time the patient showed numerous, nearly symmetrically distributed, fairly well-defined, reddish brown plaques and nodules on the face, trunk, and extremities. Some very well-defined, shiny nodules were present on the neck. The ears showed moderate infiltration. The eyebrows

*Serial biopsies of this patient have been received from Dr. A. H. Klokke of the Dermatological Department, University of Utrecht, whose kind co-operation we gratefully acknowledge.

were only slightly thinned. Both hands showed moderate muscular atrophy and slight contractures of both fifth fingers. All major peripheral nerve trunks were markedly enlarged. The ulnar nerves were very thickened and painful. Bacteriologically, smears were strongly positive, with globi and 32% non-granular bacilli.

After one month of treatment with rifadin the skin lesions had become less erythematous and the nerve pain had subsided. After 3 months of treatment, however, the patient complained of pain in his neck, and the great auricular nerve was found to be very thickened and painful. He also complained of irradiating pains in the arms and legs. The neuritis subsided completely after 3 days of treatment with thalidomide. Similar attacks of neuritis were seen in February and March, 1969, but again quickly responded to thalidomide. In May another attack of neuritis was accompanied by fever and some ENL nodules. This reaction also responded rapidly to thalidomide. In July a mild reaction in the great auricular nerve occurred, but in the last 3 months no reactions have been seen. During the 12 months of treatment the skin lesions have subsided markedly.

Patient No. 7 (*K*)

Male, age 38, West Indian, with lepromatous leprosy. Onset in 1948. He had received irregular treatment with DDS between 1948 and 1966, but suffered an exacerbation in 1968. Treatment with rifadin was started in December, 1968. At that time the patient presented the picture of advanced secondary nodular lepromatous leprosy. Smears were bacteriologically strongly positive, with globi and 35% non-granular bacilli. After 3 months of treatment the lesions showed signs of improvement; they became hyperpigmented and slightly wrinkled. In April, 1969, the patient complained of pain in his right arm. The ulnar nerved was found to be markedly enlarged and slightly painful on palpation. In May he developed fever and a few ENL nodules were seen. The reactions responded quickly to treatment with thalidomide. In July the patient had another attack of fever, but without ENL nodules. No other cause was found. The reaction again responded rapidly to thalidomide. A similar reaction was seen in August. During the 10 months of treatment with rifadin the skin lesions have markedly subsided and have become strongly hyperpigmented. No other side-effects have been noted.

BACTERIOLOGICAL EVALUATION

In all the cases here described some increase in the percentage of granular bacilli was seen within one month of starting treatment. In 5 out of the 7 patients (see Table 1) after 3 months of treatment the great majority of the bacilli had become granular. In one of the patients who had stopped treatment for one month a delay was seen, but the percentage of granular bacilli increased rapidly again soon after treatment had been resumed. In another patient, however, it took almost 9 months before

TABLE I

Bacteriological progress in 7 patients treated with rifadin, showing percentage of bacilli intact (I), fragmented (F), and granular (G)

Patient number	1				2				3				4				5				6				7			
		Percentage				*Percentage*				*Percentage*				*Percentage*				*Percentage*				*Percentage*				*Percentage*		
	B.I.	*I*	*F*	*G*	*B.I.*	*I*	*F*	*G*	*B.I.*	*I*	*F*	*G*	*B.I.*	*I*	*F*	*G*	*B.I.*	*I*	*F*	*G*	*B.I.*	*I*	*F*	*G*	*B.I.*	*I*	*F*	*G*
Onset	5.5	15	44	41	6.0	3	50	47	6.0	6	61	33	6.0	9	54	37	5.0	1	50	49	4.0	0	32	68	6·0	2	33	65
1 month	5.0	2	20	78	5.0	1	44	55	5.0	0	17	83	6.0	0	20	80	5.0	0	33	67	4.0	0	0	100	6.0	0	3	97
2 months	5.0	0	16	84	4.5	0	15	85	5.0	0	9	91	6.0	0	30	70	5.0	0	17	83					6.0	0	3	97
3 months	4.5	0	14	86	5.0	0	1	99	5.0	0	1	99	5.0	0	15	85	5.0	0	0	100					6.0	0	4	96
6 months	4.5	0	13	87	6.0	0	1	99	4.0	0	0	100	4.0	0	0	100	5.0	0	2	98	4.0	0	0	100	6.0	0	6	94
9 months	4.0	0	1	99	4.0	0	0	100	6.0	0	0	100	6.0	0	1	99	5.0	0	6	94	6.0	0	1	99	6.0	0	1	99
12 months	3.5	0	0	100	6.0	0	3	97	6.0	0	3	97	6.0	0	0	100	6.0	0	1	99	6.0	0	0	100	5.5	0	0	100
15 months	3.0	0	0	100	5.0	0	0	100					6.0	0	2	98												
18 months	4.0	0	6	94	3.0	0	1	99					4.0	0	3	97												

most of the bacilli had become granular; no explanation can be offered for the delay in this case. In conclusion, the decrease in the morphological index in patients receiving treatment with rifadin is at least as rapid as in those treated with sulphones and other anti-leprosy drugs. In the first 6 months of treatment a satisfactory decrease in the Bacterial Index (B.I.) was seen in several of the patients. The average B.I. did not decrease significantly in the second half-year. In 3 of the patients an increase in the B.I. occurred. These findings could be explained by the rapid clinical response to rifadin. In most patients the size of the lesions substantially diminished, resulting in concentration of the bacilli. The possibility of drug-resistance has also been considered. In none of the patients, however, have intact bacilli reappeared, nor has the percentage of granular bacilli increased significantly, nor have any clinical signs of relapse been found. Histopathologically no evidence of relapse has been seen.

SIDE-EFFECTS

In 5 of the 7 patients reactions of some kind were recorded. In most cases the reactions were mild to moderately severe. In all but one patient (No. 1) treatment with rifadin was continued during these reactions. No evidence that continuation of rifadin treatment during reactions had an aggravating effect on the reactions was found. No other side-effects of the drug were observed.

DISCUSSION

Usually the bacteriological status of a patient is given by the morphological index, which is the percentage of solidly stained, presumably viable bacilli. All other bacilli are regarded as non-viable. Our method of assessment is different. In our opinion it is often difficult to distinguish with certainty between completely and evenly stained bacilli (intact) and bacilli which are slightly changed (fragmented) but not yet granular. Therefore 3 instead of 2 percentages are given. We regard the intact bacilli as definitely viable. Since one of us (D.L.) has obtained growth of *Myco. leprae* in the footpads of mice from material taken from a patient with 6% fragmented and 94% granular bacilli, a proportion of the fragmented bacilli must have been viable. A high percentage of our fragmented bacilli would be included by other workers in the group of solid bacilli. The percentage of viable bacilli in all our patients in this study was therefore high at the onset of the trial. The most spectacular observation in this trial was the very rapid decline in the percentage of viable bacilli in most of the patients, more rapid than has been seen in patients treated with other anti-leprosy drugs. The manufacturers claim that rifadin is a bacteriocidal drug. The findings in this trial confirm this statement. The elimination of dead bacilli in the first year of treatment with rifadin seems to be slow. After treatment with other drugs the average annual fall in the B.I. is about 1+. There was, however, a rapid reduction of the degree of infiltration, resulting in a concentration of bacilli in the lesions. Besides, all these patients were very highly bacilliferous. As 6+ is the maximum in our scale, meaning 1000 or more bacilli per microscope field, and as the number of bacilli in our patients was far above 1000 per field, a possible reduction in the number of bacilli could not be accurately measured. Probably the rate of elimination of dead bacilli in patients treated with rifadin does not differ from those treated with other anti-leprosy drugs.

It is concluded that rifadin is an effective anti-leprosy drug meriting further investigation, especially in respect of the incidence and severity of reactions and of the development of drug resistance.

SUMMARY

A first report on the treatment of 7 lepromatous patients with rifadin, a new antibiotic with anti-tuberculosis properties, related to rifamycin S.V. Significant clinical improvement was seen in all patients after administration of 600 mg of rifadin daily for periods of between 12 and 20 months. In all cases some increase in the

percentage of granular bacilli was seen already after one month. In all patients this percentage increased rapidly in the months that followed. In one patient, however, it took almost 9 months before nearly 100% of the bacilli had become granular. Although a satisfactory decrease in the average B.I. was seen after 6 months of treatment, in the second half-year no further average decrease was seen; this could be explained as being due to a greater concentration of bacilli in lesions which had rapidly subsided. In none of the patients has conclusive evidence of drug-resistance been found so far. In 5 patients reactions occurred; these were mild to moderately severe and rifadin treatment was continued during the reactions. There was no evidence that the reactions were aggravated by rifadin. No other side-effects were observed. It is concluded that rifadin is an effective anti-leprosy drug which merits further investigations, especially with regard to the incidence of reactions and the development of drug resistance.

ACKNOWLEDGEMENT

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Composite Skin Contact Smears: A Method of Demonstrating the Non-emergence of *Mycobacterium leprae* from Intact Lepromatous Skin*

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The author's method of preparing composite skin contact smears is fully described. From the microscopical examination of a large number of these smears, taken from various sites on patients with lepromatous leprosy but with intact skin, he concludes that the main source of infection in such cases is not the intact skin, on which very few leprosy bacilli were found, but the nasal mucus.

INTRODUCTION

It is well known that patients with lepromatous leprosy in an advanced and untreated state, whose skin, by reason of open sores, is not intact, discharge large number of *Mycobacterium leprae* from both the skin and the lining of the nose (as is shown in the report of Case 12). But what of the lepromatous patient, whether in an early or later stage of the disease, whose skin is intact? Is it still correct to link the intact skin with the lining of the nose as a source of infection? One has only to read the literature on leprosy to find that this is often done, the number of bacilli thought to be discharged from "skin and nose", even in a very early case, being referred to as "large", "enormous", or "innumerable" (to quote some of the adjectives used). I have not been able to discover from the literature if this belief is hypothetical or whether it is based on definite evidence.

The following is an account of an attempt to estimate the number of bacilli shed from the intact skin of patients suffering from varying degrees of active and untreated lepromatous leprosy, ranging from the early to the more advanced state of the disease. The method employed is what the writer calls Composite Skin Contact Smears (C.S.C.S.).

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METHOD

A square centimetre is outlined on the middle of a glass slide with a blue glass pencil. The opposite surface of the square is pressed firmly against the skin in different places, superimposing one smear upon another until 10 superimposed smears, contained in the one square centimetre, have been taken. After every second or third superimposed smear, the slide is heat-fixed. Thus, in the preparation of a composite skin contact smear, heat-fixing is employed 4 or 5 times. The writer has proved that this amount of heating does not in any way alter or destroy the bacilli. This was done by preparing 2 skin slit scrape smears from the same site (e.g. an earlobe) of a patient with active lepromatous leprosy. One slide was heat-fixed once, and the other 10 times. After staining, it was impossible to detect any difference in the bacilli of the 2 slides. When staining, in order not to run the risk of dislodging the smear, special care must be taken not to wash the slide under running water, but rather to wash it by gently dipping it in and out of a container full of water. Because the secretion from sebaceous glands tends to be acid-fast (but not alcohol-fast) decolorization, especially of a composite smear from the face, is always done with 0.5% hydrochloric acid in 70% alcohol. Sometimes, for control staining, one skin slit

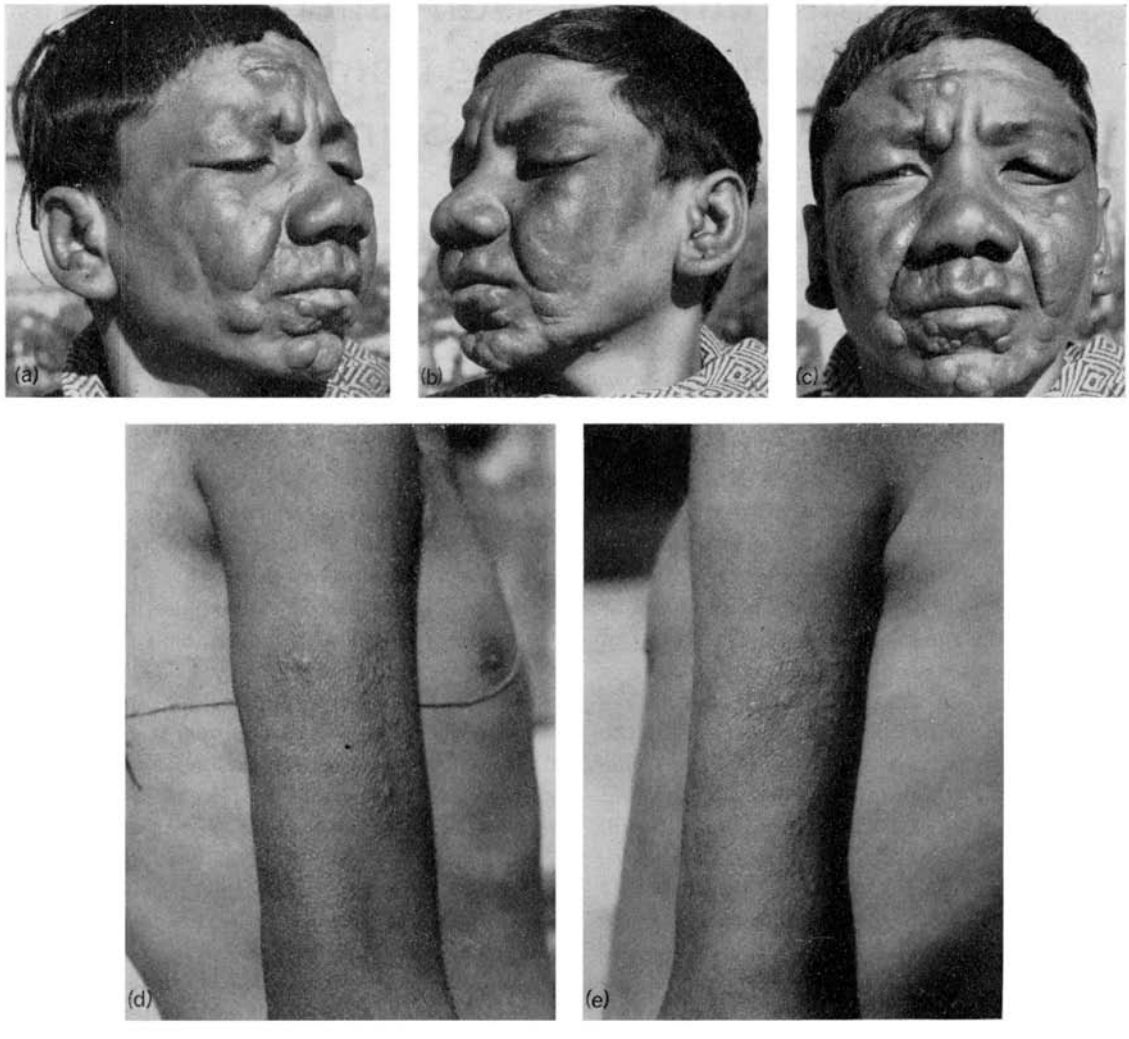

FIG. 1

A study of 4 composite skin contact smears representing 40 sq. cm of the surface of maximum infiltrated skin, taken from (a) earlobes (6); (b) cheeks (2) and lower lip (2); (c) forehead (10); (d) right upper arm (10); and (e) left upper arm (10).

scrape smear is placed on the slide well away from the test square centimetre, and is stained at the same time. The patient's maximum infiltrated areas of skin are selected for making these composite skin contact smears.

The search for bacilli in the 1 sq. cm is made easier by the blue pencil outline on the under-surface of the slide which marks the limit for the back-and-forth excursion of the microscope stage. It is reckoned that a thorough search of a 1 sq. cm smear involves examining approximately 1000 microscopic fields, and takes quite 30 to 40 min. For this kind of work it is, of course, essential to use a binocular miscroscope with an accurately moving stage and interior lighting.

CASE DESCRIPTION

There now follows a description of 11 cases of lepromatous leprosy in patients with varying stages of the disease, all with intact skin. Case 12, in which the skin was not intact, is added as a contrast. A careful study of the report of these cases will reveal that if there are bacilli to be found on the skin, this composite skin-contact-smear method will pick them up (see Cases 3, 8, 10 and 12). In each case a nasal *mucus* smear was examined, rather than a nasal mucosa-scrape smear, because: (a) the latter is always unpleasant for the patient, and (b) it is not such a good index of the patient's infectivity as a mucus smear. The mucus for the smear was either gently taken from the mucosal surface with a platinum loop, or the patient was asked to blow his nose on a piece of paper and a smear made from the mucus on the paper.

CASE 1

Name: Than Bahadur. Male, aged 18 years. Hospital No. 47470. *History:* 2 years. Untreated. *Diagnosis:* advanced lepromatous leprosy.

Investigations

(1) *Composite skin contact smears*
Four such smears, each 1 sq. cm in size, and each containing 10 superimposed smears taken from maximum infiltrated areas of skin as follows:
(i) Earlobes (6), cheeks (2), lower lip (2).
(ii) Forehead (10).
(iii) R. upper arm (10).
(iv) L. upper arm (10).
These 4 composite skin contact smears represent 40 sq. cm of maximum infiltrated skin surface.
Result of search (4000 microscopic fields, approximately). No bacilli found.

(2) *Skin slit scrapes*
R. earlobe 4+, 60% solid rods.
L. earlobe 3+, 40% solid rods.
R. upper arm 3+, 60% solid rods.
L. upper arm 3+, 60% solid rods.
Result: BI 3.3+ (max. is 4+); MI 55%.

(3) *Nasal mucus smear*
Frequent globi and groups of bacilli in parallel arrangements, also looser scattering of bacilli, 40% judged to be solid rods.

Conclusion
In spite of his appearance, the patient is infectious only by reason of his infected nasal secretion.

CASE 2

Name: Ruke. Female, aged 30 years. Hospital No. 47583. *History:* face becoming swollen—1 year. Untreated. Lactating. *Diagnosis:* lepromatous leprosy with nodules.

Investigations

(1) *Composite skin contact smears*
Four such smears, each 1 sq. cm in size, and each containing 10 superimposed smears taken from:
(i) Face (forehead, brows, earlobes, cheeks, *not* lips) 10
(ii) Forearms (skin very infiltrated with some nodules) 10
(iii) L. breast area (appearance of skin—normal) 10
(iv) R. breast area (appearance of skin—normal) 10
These 4 composite skin contact smears represent 40 sq. cm of skin surface, of which 20 sq. cm from the face and forearms was very infiltrated in appearance.
Result of search (4000 microscopic fields, approximately). No bacilli found.

(2) *Skin slit scrapes*
Upper right eyelid 3+, 5% solid rods (approximately).
Upper left eyelid 4+, 5% solid rods (approximately).
Right forearm 3+, occ. solid rods.
Right breast area 2+, no solid rods.
Result: BI 3+ (max. is 4+); MI 3%.

(3) *Nasal mucus smear*
Smear loaded to capacity with globi and innumerable bacilli. *Result:* nasal BI maximum; nasal MI 90%.

Conclusions
This woman is infectious only by reason of the heavily infected nasal secretions. Often she will remove mucus from her nose between finger and thumb and a moment or two later she will remove mucus from her child's nose in the same way, or she will wipe her nose

FIG. 2
A study of 4 composite skin contact smears representing 40 sq. cm of skin surface, each smear containing 10 superimposed smears. One composite skin contact smear was taken from (a) the face and (b) the patient's husband and 2 children, the younger at the breast.

FIG. 3
A study of 3 composite skin contact smears comprising 26 sq. cm of the surface of maximum infiltrated skin in face, arms and legs.

on the cloth wrapping the baby (see Fig. 2) and then wipe the baby's nose with the same cloth. The child was 5 months old when the photograph was taken and from the time of his birth (when the mother's MI was perhaps much higher) it has probably ingested bacilli in the milk in very significant numbers (see References).

CASE 3

Name: Govind. Male, aged 56 years. Hospital No. 603. *History and Diagnosis:* Treated for 6 years for lepromatous leprosy; disease became completely arrested and in state of bacillary negativity. Patient then failed for 4 years to continue maintenance dose of DDS and relapsed into state of advanced lepromatous leprosy with numerous nodules.

Investigations

(1) *Composite skin contact smears*
Three such smears, each 1 sq. cm in size and each containing a number of superimposed smears taken from maximum infiltrated areas of skin as follows:

(i) Face — 6 superimposed smears, each taken over summit of different nodules on forehead, brows, malar areas.
(ii) Arms— 10 superimposed smears of which 8 were taken from summits of different nodules and 2 over very infiltrated areas of skin.
(iii) Legs — 10 superimposed smears, of which 8 were taken over summits of different nodules and 2 over very infiltrated areas of skin.

These 3 composite skin contact smears represent 26 sq. cm of maximum infiltrated skin surface.
Result of search (3000 microscopic fields, approximately). Only 2 somewhat solidly staining bacilli found in the face smear. The 2 smears from arms and legs were negative.

(2) *Skin slit scrapes—taken from 11 sites*
6 from the same nodule summits on the face from which the composite smear was made. *Result:* BI maximum, MI 60%.
3 from arms, in 2 nodules and 1 infiltrated area from which the composite smear was made. *Result:* BI maximum, MI very high, estimated 70%.
2 from legs, in 2 nodules from which the composite smear was made. *Result:* BI maximum, MI 60%.

(3) *Nasal mucus smear*
This was made from one platinum loopful of mucus. Frequent globi, sometimes several in a microscopic field, also groups of closely packed bacilli in parallel arrangements, a high proportion of which appear to be in solid rod form. MI 60%.

Conclusion
In his present stage of unbroken skin this patient is infectious only by reason of the infected nasal secretion, whence the 2 bacilli in the face composite smear probably came.

CASE 4

Name: Dhan Bahadur. Male, aged 56 years. Hospital No. 2072. *History:* Lepromatous leprosy treated several years until became arrested. Defaulted for 18 months and relapsed. *Physical examination:* Skin of face shows some raised erythematous papules and small plaques with diffuse infiltration of the skin. Many such small nodules on back and front of chest and abdominal wall (see Fig. 4).

Investigations

(1) *Composite skin contact smears*
Four such smears, each 1 sq. cm in size and each consisting of 10 superimposed smears taken from:

(i) Face—summits of small plaques and low papules (Fig. 4a, b).
(ii) Back of neck (Fig. 4c).
(iii) Back of L. shoulder (Fig 4d).
(iv) Breast areas and abdominal wall (Fig. 4e).

These 4 composite skin contact smears comprise 40 sq. cm. of maximum infiltrated skin.
Result of search (4000 microscopic fields approximately). No bacilli found.

(2) *Skin slit scrapes*

R. ear	BI Max.,		MI	20%.
L. ear	,,	,,	,,	10%.
L. brow (not nodule)	,,	,,	,,	40%.
L. brow (nodule)	,,	,,	,,	40%.
L. upp. arm (papule)	,,	,,	,,	60%.
Nape of neck (papule)	,,	,,	,,	20%.
Back L. shoulder (papule)	,,	,,	,,	15%.
Back L. shoulder (papule)	,,	,,	,,	40%.
R. breast area (papule)	,,	,,	,,	40%.
Abdominal wall (papule)	,,	,,	,,	40%.

Result: BI Max., MI 31%.

(3) *Nasal mucus smear (from nose-blow)*
Loaded with bacilli, many in globi arrangement. MI 70% to 80%.

Conclusion
Infectious only by reason of heavily infected nasal secretion.

CASE 5

Name: Thik Bahadur. Male, aged 58 years. Hospital No. 46470. *History:* Thinks he may have had leprosy for 18 months. Has noticed thickening of skin of face, loss of feeling in the hands and feet, and slight redness of skin of chest. *Diagnosis:* Finely diffuse lepromatous leprosy.

Investigations

(1) *Composite skin contact smears*
Three such smears, each 1 sq. cm in size, the site of each and number of superimposed smears is as follows:

(i) Both earlobes (2 superimposed smears).
(ii) Backs of both wrists (4 superimposed smears).
(iii) Front of both thighs (4 superimposed smears).

These 3 composite skin contact smears comprise 10 sq. cm of fine, diffusely infiltrated skin surface.

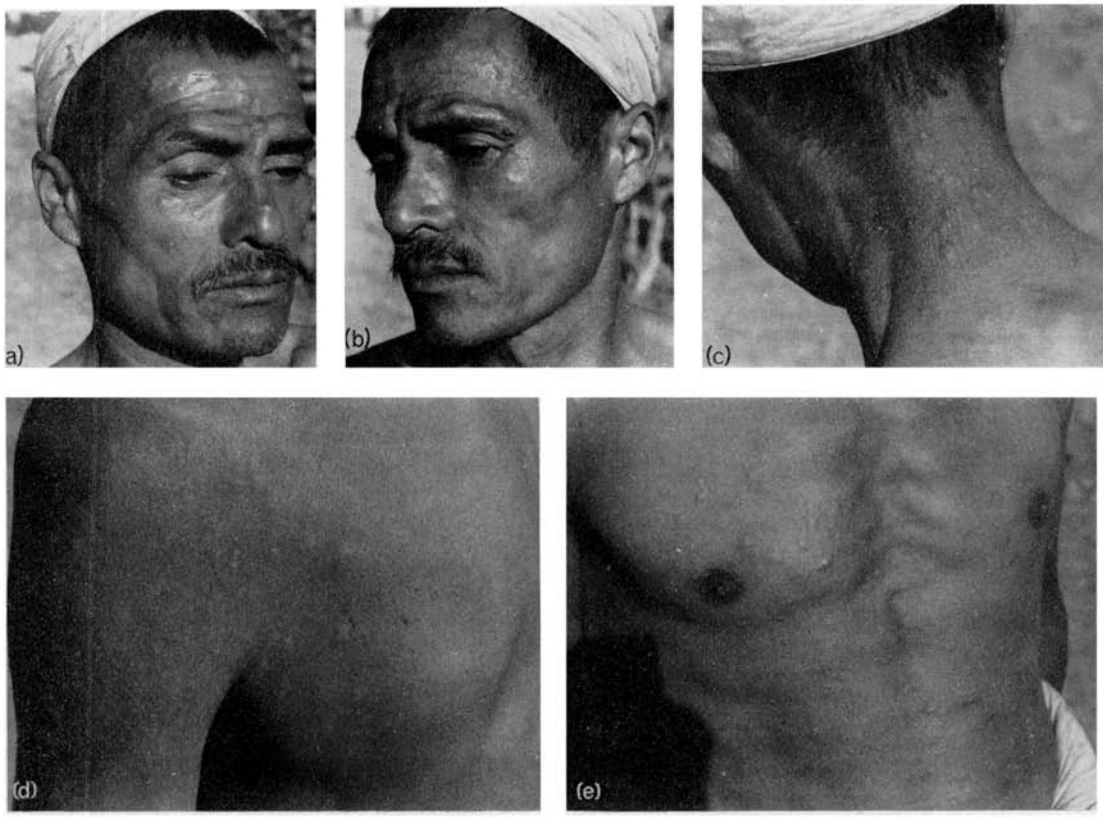

FIG. 4
A study of 4 composite skin contact smears comprising 40 sq. cm of maximum infiltrated skin.

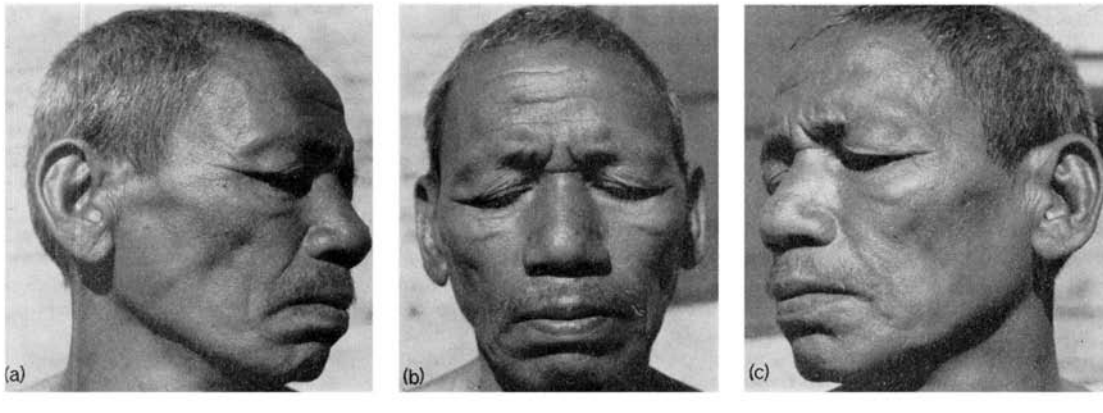

FIG. 5
A study of 3 composite skin contact smears comprising 10 sq. cm of the surface of fine, diffusely infiltrated skin taken from face, arms and legs. Note fine diffuse infiltration of skin, enlarged earlobes, and madarosis—a type of case which is sometimes referred to as non-apparent lepromatous leprosy.

Result of search (3000 microscopic fields approximately). No bacilli found.

(2) *Skin slit scrapes*

R. earlobe	3+	MI 5% approx.	
L. earlobe	3+	,, ,, ,,	
L. brow and R.	3+ each	,, ,, ,,	each
R. wrist (back)	4+	,, ,, ,,	
L. thigh	4+	,, ,, ,,	

Result: BI 3.3+ (max. is 4+), MI 5%.

(3) *Nasal mucus smear*
Negative.

Conclusion
It is very doubtful if, in his present stage, this man is infectious.

CASE 6

Name: Shadhu. Male, aged 40 years. Hospital No. 47346. *History:* Patient thinks he has had leprosy for 3 years. Untreated. *Diagnosis:* Lepromatous leprosy fairly active.

Investigations

(1) *Composite skin contact smear*
Two such smears, each 1 sq. cm in size, and each composed of 10 superimposed smears taken from different sites on the forehead, cheeks, and chin. Thus, these 2 composite smears comprise 20 sq. cm of infiltrated skin of the face.
Result of search (2000 microscopic fields, approximately). No bacilli found.

(2) *Skin slit scrapes*
R. earlobe BI maximum, MI 15%.
L. earlobe BI maximum, MI 18%.

(3) *Nasal mucus-blow smear*
Moderate number of bacilli, often in globi arrangement, in almost every field or alternate fields, the majority appear to be solid staining. MI 80%.

Conclusion
Infectious only by reason of infected nasal mucus.

CASE 7

Name: Jagat Bahadur. Male, aged 26 years. Hospital No. 46967. *History:* Skin of face becoming thick over last 6 months. "Pins and needles" sensation in hands and feet for 2 or 3 years. *Diagnosis:* Diffuse lepromatous leprosy. Untreated.

Investigations

(1) *Composite skin contact smears*
Two such smears, each 1 sq. cm in size (each consisting of 10 superimposed smears), both taken from:
(i) Face (forehead).
(ii) Face (both earlobes, both malars, both cheeks).
These 2 composite smears comprise 20 sq. cm of maximum infiltrated skin of face.
Result of search (2000 microscopic fields, approximately). No bacilli found.

(2) *Skin slit scrapes*
R. earlobe 3+, 24% solid rods.
L. earlobe 3+, 24% ,, ,,
R. forearm 2+, 15% ,, ,,
R. thigh 3+, 15% ,, ,,
Inter-brow 4+, 60% ,, ,,
Result BI 3+ (max. is 4+), MI 30%.

(3) *Nasal mucus smear* (*from a nose-blow*)
Quite frequent bacilli in almost every field, including some globi; the large majority appear to be in solid rod form.

Conclusion
Infectious only by reason of infected nasal secretion.

CASE 8

Name: Pahal Singh Pun. Male, aged 36 years. Hospital No. 46837. *History:* 1 to 1½ years. Untreated. *Diagnosis:* Non-apparent active lepromatous leprosy.

Investigations

(1) *Composite skin contact smears*
Three such smears, each 1 sq. cm in size, taken from maximum infiltration areas of skin as follows:
(i) 6 superimposed smears from face: both R. and L. earlobes, brow, and cheeks.
(ii) 11 superimposed smears from the limbs as follows: 2 from each forearm, 2 from right thigh, in coppery coloured area infiltrated skin, and 5 from left thigh in similar coppery coloured area infiltrated skin.
(iii) 6 superimposed smears from slightly infiltrated coppery coloured patches distributed symmetrically over the back.
These 3 composite skin contact smears represent 23 sq. cm of maximum infiltrated skin surface.
Result of search (3000 microscopic fields, approximately). In (iii) I found 3 irregularly stained acid-fast organisms shaped like short rods. No bacilli were found in (i) and (ii).

(2) *Skin slit scrapes*
R. earlobe +2, 40% solid rods.
L. earlobe +3, 40% ,, ,,
L. brow +2, 40% ,, ,,
R. cheek +1, 25% ,, ,,
R. forearm Negative.
R. thigh +2, 30% solid rods.
Result: BI 1.8+ (max. is 4+), MI 35%.

(3) *Nasal mucus smear* (*not scrape*)
Negative.

Conclusion
If this patient is infectious it would only be by reason of very scanty bacilli in the nasal mucus secretion, which further smears might have revealed.

CASE 9

Name: Hari Bahadur. Male, aged 37 years. Hospital No. 47376. *History and clinical findings:* Patient complains of rash, developing over 9 months, on back forearms and thighs; very itchy. Clinically, it consists of numerous small, slightly raised pale papules with very slight erythema, some coalescing, symmetrically distributed on lower back, lower abdominal wall, forearms, and inner aspects of thighs; no loss of sensation. Superficial nerves show no enlargement. Skin

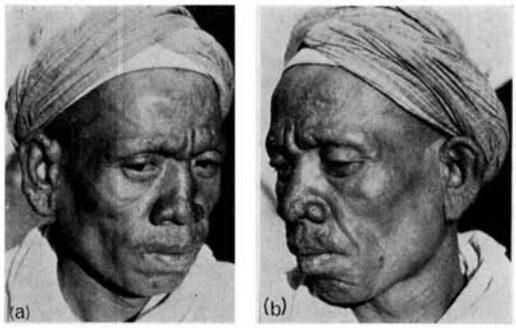

FIG. 6
A study of 2 composite skin contact smears comprising 20 sq. cm of infiltrated skin of face.

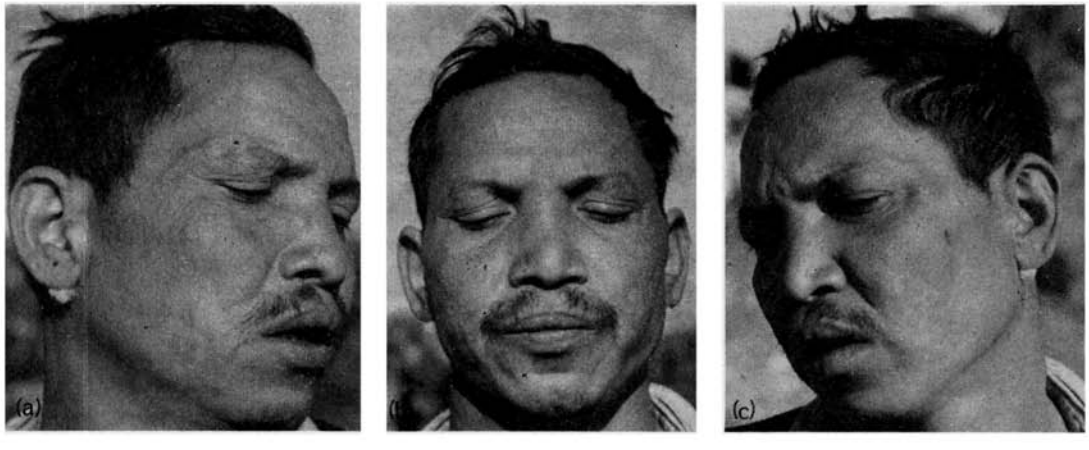

FIG. 7
A study of 2 composite skin contact smears comprising 20 sq. cm of infiltrated skin of face. Not very apparent diffuse lepromatous leprosy with some loss of eyebrows.

FIG. 8
A study of 3 composite skin contact smears representing 23 sq. cm of the surface of maximum infiltrated skin. Note: These bacilli may be *Myco. leprae*, but my Japanese colleague, Dr. Ivamura, a very experienced bacteriologist, tells me that they could be an acid-alcohol-fast mycobacterium, present in the soil, which closely resembles *Myco. leprae* and can be picked up by sleeping on a mud floor.

of face looked normal on first examination, and it was not until after result of skin slit scrapes was known that I thought I could detect both a very faint erythema and very fine diffuse infiltration of the skin [see Fig. 9 (a), (b), (c)]. *Diagnosis:* Non-apparent lepromatous leprosy (i.e. so far as the exposed parts of the body were concerned when fully dressed).

Investigations

(1) *Composite skin contact smears*
Three such smears, each 1 sq. cm in size, and each comprising 10 superimposed smears taken from:
(i) and (ii) Face (different sites: earlobes, both cheeks, brows and forehead).
(iii) Forearms (from the surface of numbers of papular lesions).
These 3 composite skin contact smears comprise 30 sq. cm of skin surface, beneath which lay many bacilli, a considerable proportion of them in solid staining form.
Result of search (3000 microscopic fields, approximately). No bacilli found.

(2) *Skin slit scrapes*

R. and L. earlobes, each	BI 3+, MI 35%.
L. brow	BI 3+, MI 10%.
R. cheek	BI 3+, MI 30%.
R. forearm (in one of the papules)	BI 3+, MI 35%.

Result: BI 3+ (max. is 4+), MI 29%.

(3) *Nasal mucus smear*
Microscopic fields showing scattered bacilli, singly, in small groupings, or clusters and in globi formation, not in every field but in every third or fifth field. A very high proportion of them in solid staining form. MI 70%.

Conclusion
How infectious is he? This man would appear to be slightly infectious only by reason of the moderate infection of his nasal secretion, which would soon be rendered negative after a few months on DDS, 50 mg per week.

CASE 10

Name: Chandra Singh. Male, aged 26 years. Hospital No. 47288. *History:* Thickening of skin of face and appearance of nodules during 6 months. Untreated. *Diagnosis:* Lepromatous leprosy.

Investigations

(1) *Composite skin contact smears*
Two such smears, each 1 sq. cm in size, taken from:
(i) Face—forehead, brows, cheeks (5 superimposed smears).
(ii) Upper lip (4 superimposed smears).
Result of search (2000 microscopic fields, approximately) of (i) 15 acid-fast organisms found, of which 6 were solid staining rods; of (ii) negative.

(2) *Skin slit scrapes*

R. earlobes	3+, occasional solid rods.
L. earlobe	2+, ,, ,, ,,
L. earlobe	2+, ,, ,, ,,
R. brow	4+, MI 20%.

Result: BI 2.7+, MI 5% approximately.

(3) *Nasal mucus smear*
Smear loaded with bacilli and many globi. BI maximum, MI 70%.

Follow-up note
When seen again 9 weeks later, after taking 30 mg of DDS per week, a repeat nasal mucus smear was negative.

Discussion
A very infectious case by reason of heavily infected nasal secretion, which, however, was soon rendered almost negative by DDS treatment. It is doubtful if the bacilli found in the face composite skin contact smear were shed from the skin—they more likely got there from the nasal secretion.

CASE 11

Name: Dhali Ram. Male, aged 30 years. Hospital No. 41529. *History:* Suffered from leprosy for about 3 years. Treated 1 year. Disfiguring nodules removed from right ear and chin. *Diagnosis:* Lepromatous leprosy in nodular stage.

Investigations

(1) *Composite skin contact smears*
Four such smears, each 1 sq. cm in size and each containing 10 superimposed smears taken from maximum infiltrated skin areas, thus:
(i) Forehead and brow. (ii) Both cheeks. (iii) Both forearms. (iv) Both thighs.

(2) *Skin slit scrapes*
From 6 sites: forehead, brow, both cheeks, right forearm, and thigh (5 sites shown by cotton wool—see Fig. 11).
Result: BI almost maximum, MI zero.

(3) *Nasal mucus smear*
Negative. (N.B.: A year previously when DDS was started, it was highly positive with MI 50% to 60%.)

(4) *Biopsy of skin from chin*
Confirmed bacillary findings, both as regards number and morphology.

Conclusion
Not infectious.

CASE 12

Name: Um Bahadur. Male, aged 40 years. Hospital No. 49299. *History:* 6 years. Untreated. *Diagnosis:* Advanced lepromatous leprosy with numerous skin ulcers.

Investigations

(1) *Composite skin contact smears*
Six such smears, each 1 sq. cm in size, and each containing 10 superimposed smears taken from maximum infiltrated areas of skin as follows: 2 sites on face, 2 sites on back, and one site on each arm. These 6 composite skin contact smears represent 60 sq. cm of maximum infiltrated skin surface.
Result of search (6000 microscopic fields, approximately). 112 bacilli found, also one globus arrangement filled with granular acid-fast organisms (from back: 108; from face: 3; from arm: 1).

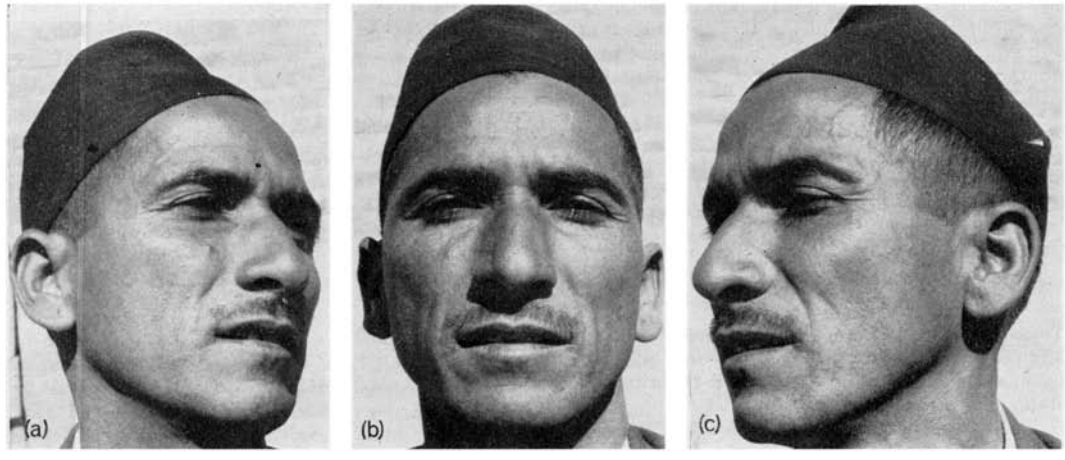

FIG. 9

A study of 3 composite skin contact smears comprising 30 sq. cm of skin surface beneath which lay many bacilli—a fair proportion in solid staining rod form. Non-apparent lepromatous leprosy.

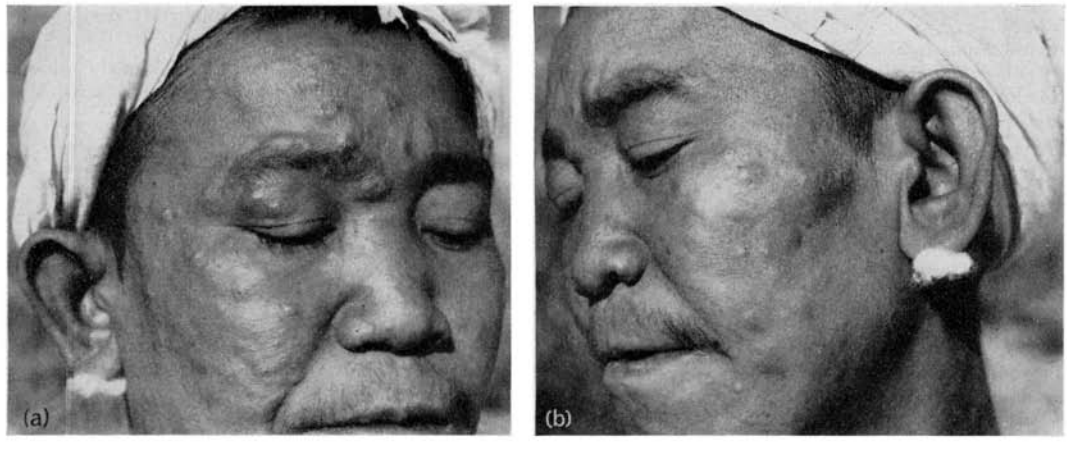

FIG. 10

A study of 2 composite skin contact smears representing 9 sq. cm of maximum infiltration of skin of the face.

(2) *Skin slit scrapes*
Five sites: R.E., L. brow, L. cheek, R. forearm, L. back: each smear showed maximum BI and MI 20% to 30%.

(3) *Nasal mucus smear*
Loaded with bacilli, many globi—several in almost every field. MI 30% approximately.

(4) *Smear made from discharge of open sore, L. upp. arm*
Many bacilli and globi, a considerable proportion of the bacilli are in solid rod form, MI 30%.

Conclusion

A very infectious case by reason of bacilli being shed from both nasal secretion and discharge of skin sores. This case clearly demonstrates that if bacilli are lying on the skin they will be picked up in a composite skin contact smear.

Immediate treatment should be directed (1) at rendering the nasal secretion non-infectious, and (2) by a vigorous course of antibiotics and antiseptic applications to get the skin ulcers healed in order to restore the skin to an intact state.

DISCUSSION

Taking the first 11 cases together, a surface of 298 sq. cm (or an area little larger than a square with a side 17 cm long) of maximum infiltrated skin was searched for the presence of bacilli. This search consisted in examining 34 composite skin contact smears (34,000 microscopic fields, approximately) and took about 20 hours of microscope work. Now, if it is true to say that "enormous" numbers of bacilli are being discharged from the intact skin ofl epromatous patients, then one would certainly have expected to find many more bacilli than were found in the course of this study. In the total area examined only 20 acid-fast organisms were found, as follows:

Case 3: 2 fairly solid rods—in composite smear from the face.

Case 8: 3 irregularly stained rods—in composite smear from the back.

Case 10: 6 solid rods and 9 irregularly stained rods—in composite smear from the face.

How many of these 20 bacilli were discharged from the skin? It is highly probable that the 17 bacilli found in Cases 3 and 10 were not discharged from the skin, but found their way on to the surface of the face from the highly infected nasal secretion present in both these cases.

An explanation of the 3 rather doubtful acid-fast organisms found in Case 8 is given in the case notes.

CONCLUSIONS

(1) It appears that the number of *Myco. leprae* discharged from the intact skin of a lepromatous patient, if any, is very small and these few are inactive.

(2) It follows, therefore, that a lepromatous patient with intact skin ceases to be infectious (or to be classed as an "open" case) when the infected *nasal* secretion is rendered negative by treatment.

(3) It can be deduced that so long as the skin of a lepromatous patient is intact, the morphological index of skin slit scrapes remains an index of the activity of the disease, but not of the infectivity of the patient.

The above conclusions have an important bearing on the question:

IS DOMICILIARY TREATMENT SAFE?

The following considerations will help to provide an answer:

(1) Very few bacilli, if any (and these would probably be inactive), are shed from the intact skin of a lepromatous patient.

(2) Highly infectious nasal secretion can be rendered non-infectious by several months' treatment with DDS. Therefore it is of great importance to make initial and periodical checks of the *mucus* secretion, as *this* is the index of the patient's infectivity.

(3) The members of a patient's household can be protected by taking DDS prophylactically.

SUMMARY

An attempt to estimate the number of *Myco. leprae* discharged from the intact skin of patients with lepromatous leprosy, ranging from a very early to a more advanced state of the disease, is described. The method used is by

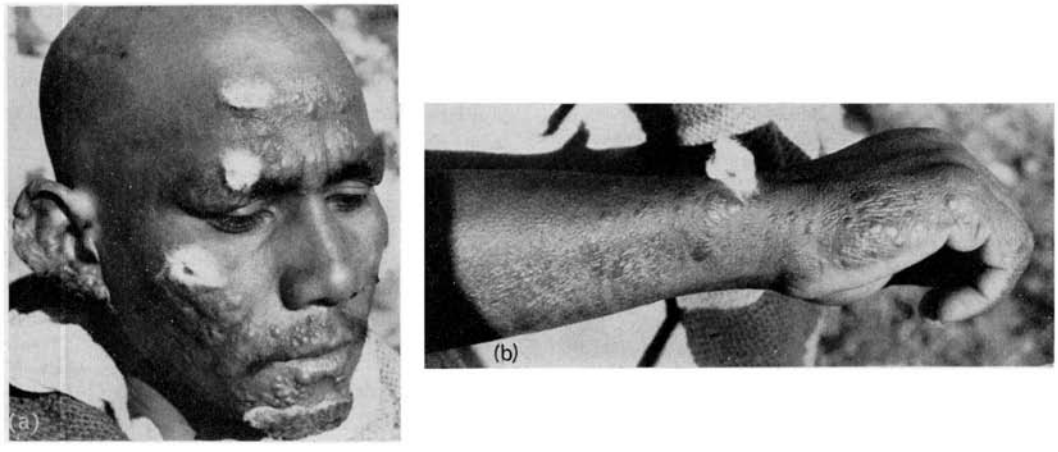

FIG. 11

A study of 4 composite skin contact smears comprising 40 sq. cm of surface of maximum infiltrated skin taken from (a) the face, and (b) the forearms and thighs (similarly infiltrated).

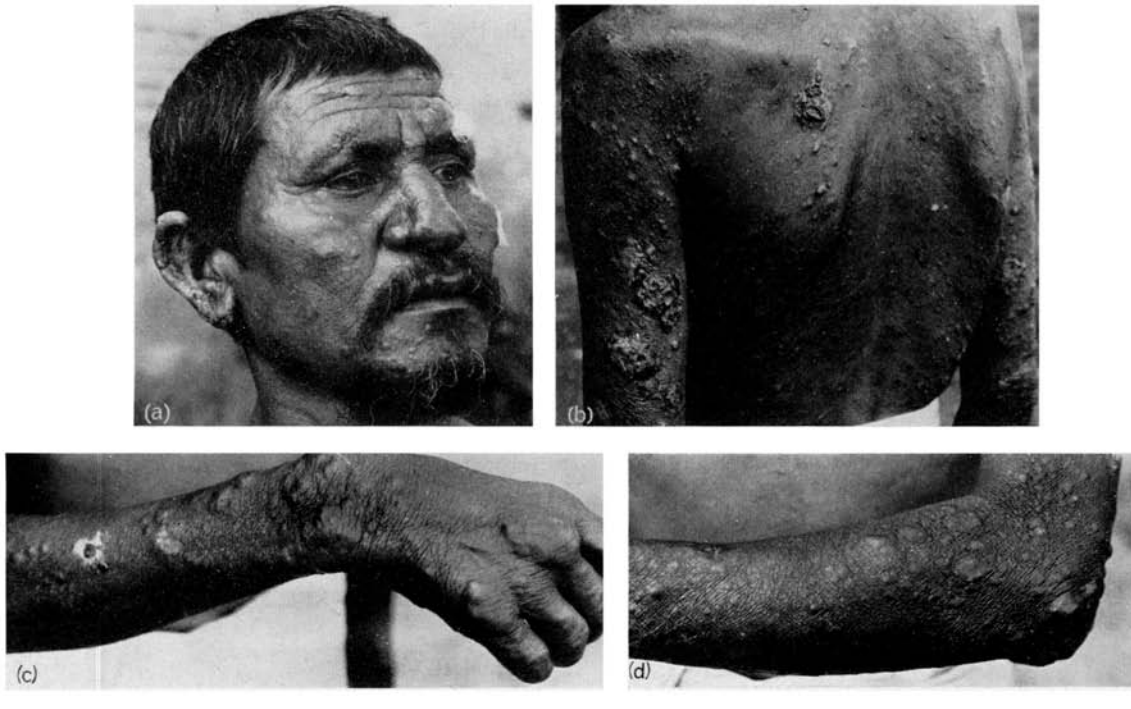

FIG. 12

Untreated lepromatous leprosy with skin ulcerations. A study of 6 composite skin contact smears comprising 60 sq. cm of maximum infiltrated skin surface from (a) face (20 sq. cm); (b) back (20 sq. cm); (c) right forearm (10 sq. cm); and (d) left forearm (10 sq. cm).

taking "composite skin contact smears" from areas of the patient's maximum infiltrated skin. The conclusion is reached that very few bacilli, if any (and these would probably be inactive), are discharged from the intact skin of a lepromatous patient.

ACKNOWLEDGEMENTS

I wish to express my thanks both to Dr. S. G. Browne, Director of the Leprosy Study Centre in London, and to Dr. D. J. Harman for encouragement received in the writing of this paper and for the biopsy reports referred to in the case notes.

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The Timing of Reconstructive Surgery in Relation to the Course of Leprosy*

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In this discussion of the effects of reconstructive surgery on the state of the disease in leprosy patients the author concludes, from experience with his own cases, that the timing of surgery is important, in that surgical stress can have an activating effect on the leprosy, and conversely that activity of the leprosy may have a deleterious effect on the surgical results.

INTRODUCTION

Some years ago I was puzzled when a patient with seemingly quiescent dimorphous leprosy developed a papular rash after undergoing a tibialis posterior transfer operation for foot-drop. The eruptions did not respond to anti-histaminics, or to topical applications. When smears were taken from the lesions, *Mycobacterium leprae* were found in large numbers and the bacteriological index (BI) was over +3. This and similar events turned my attention to the effect which surgery might have on the morbid status of the disease. Conversely, the question arose whether the morbid status of the disease might influence the results of surgery. If either of these effects could be demonstrated, then the timing of surgery in the course of leprosy would become more important than has hitherto been allowed for.

In the literature on reconstructive surgery in leprosy this problem is either not mentioned at all, or dealt with only in passing, and then in somewhat vague, general terms. The Report of the Panel on Physical Rehabilitation of the Eighth International Leprosy Congress (1963) makes no mention of the timing of surgery. (This paper was written before the Ninth International Leprosy Congress.) Andersen (1963) recommends that the BI should have come down to +1 or lower before surgery is undertaken. Lennox (1965) writes that in foot-drop the pattern of paralysis should have become stable and remained so for 6 months before surgical correction. This may or may not imply an inactive state of the disease, but he does not expressly say so. According to Antia (1964) the correction of facial deformities should be deferred until the disease is quiescent. Brand (1964*a*) states: "Rebuilding of the face should be delayed until the leprosy is completely under control and skin tests no longer reveal bacilli, otherwise good surgical results may be spoilt by further damage. Hands and feet, however, may often be repaired earlier in the disease, so long as the local tissues do not show any infiltration. This is because damage in the limbs is due mainly to nerve paralysis and is to be corrected by the transfer of muscles which do not become paralysed even if the leprosy continues to advance. The tissues of leprosy patients heal well if ordinary aseptic surgical techniques are used." He reiterates the second point when he says (Brand, 1964*b*): "The presence of the disease itself need not contra-indicate operations on the hand, but if there is . . . any sign of local or general hyperactivity of the disease, surgery should be postponed."

From the foregoing, the following conclusions may be drawn: (1) in facial deformities reconstruction should wait till the disease is quiescent; (2) in surgery of the extremities not much importance is attached to the state of the disease. If this is considered at all, it is only with

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a view to the influence which active disease may have on surgical results; the possible effect of surgery on the course of the leprosy is not taken into account. I therefore started studying the problem from both aspects, namely, the effect of surgery on the morbid status of leprosy, and of the morbid status of leprosy on surgical results.

EFFECT OF SURGERY ON LEPROSY

Materials and methods

If surgical stress has an effect on the state of activity of the disease one would expect signs of increased activity after the operation when compared with the activity of the disease before operation. As indicators of activity we used the bacteriological index (BI) and clinical signs, such as exacerbation and dissemination of skin lesions, neuritis, iritis, erythema nodosum leprosum (ENL) and lepra reaction. In bacilliferous leprosy the BI was found to be the best and most readily comparable criterion, and was used as the main indicator of activity, supported by signs of clinical activity. In non-bacilliferous cases we relied mainly on clinical signs of activity, in addition to routine bacteriological examination.

Further, it appeared important to distinguish between the different types of leprosy, and also between active and inactive states of the disease. Preliminary evaluations showed that the age and sex of the patient had no influence on the outcome of the study, therefore no attention was paid to these factors. Patients with complications such as secondary infection or intercurrent disease were excluded, as these complications are known to be potential causes of exacerbation. All major surgical procedures, mainly reconstructive, but also other operations, were included in this study. Patients with bacilliferous leprosy were classified into lepromatous and dimorphous, and subdivided into 3 groups: (1) *Arrested*, that is, BI negative and no clinical signs of activity for 12 months or more. (2) *Quiescent*, same criteria as (1), but of less than 12 months' duration. (3) *Active*, BI positive and/or clinical signs of activity.

Non-bacilliferous cases were classified into tuberculoid and indeterminate leprosy (there were no polyneuritic cases) and subdivided into 2 groups: (1) *inactive* patients who showed no signs of clinical activity; and (2) those with *active* lesions.

All patients who came up for operation and could be categorized as described above without any doubt were included in this study. They came from 2 hospitals and over various periods, namely from Purulia Leprosy Hospital between 1963 and 1965, and from Chevayur Leprosy Sanatorium in the period 1962-65. Before operation they were given a complete clinical check-up, including history of their leprosy, and skin smears were taken according to the "slit-and-scrape" method and read on the 0—6 scale of Ridley. The same procedure was repeated 2 and 4 weeks after operation, in some cases also later. Cases were included only if all the necessary data were available. The numbers, classification, and subdivision of patients studied are shown in Table 1.

TABLE 1
Distribution of the various types of leprosy

Classification	*Arrested*	*Quiescent*	*Active*	*Total*
Lepromatous	7	14	31	52
Dimorphous	4	6	9	19
		Inactive	*Active*	
Tuberculoid		21	6	27
Indeterminate		12	1	13
Total	11	53	47	111

Results

The results are shown in Tables 2 and 3. As several patients underwent more than one operation, the total number of operations (146) is higher than the number of patients (111). Among the patients who were affected by surgery some showed only a rise in the BI, some showed signs of increased clinical activity in addition, and some showed signs of increased clinical activity only. Therefore the total of affected cases is less than the total of the 2 former categories.

(1) *Lepromatous and dimorphous leprosy.* (a) *Arrested:* In the great majority of this group no reactivation was found. There was, however, one lepromatous patient who had been bacteriologically negative for more than one year (tested on 5 occasions) and whose BI rose to +0.25 again after one operation. (b) *Quiescent:* In this group also the disease in the majority of patients remained inactive after surgery, but 4 patients became bacteriologically positive postoperatively after being negative for various periods. One lepromatous patient had been negative for nearly one year, but his BI became +0.875 and he developed temporary paralysis of the flexor longus sublimis muscle after a series of 5 operations.

TABLE 2

Number of operations with effects of surgery on activity of leprosy (lepromatous and dimorphous)

Group	*Arrested*	*Quiescent*	*Active*	*Total*
Lepromatous				
No. of operations	10	18	35	63
Affected: BI	1	2	13	16
clinically	0	2	6	8
total	1	2	19	22
Unaffected	9	16	16	41
% Affected	10%	11%	54%	
Dimorphous				
No. of operations	5	7	10	22
Affected: BI	0	2	4	6
clinically	0	1	3	4
total	0	2	5	7
Unaffected	5	5	5	15
% Unaffected	0%	31%	50%	

(c) *Active:* Of the patients subjected to 35 operations in the lepromatous group 19 showed a rise in the BI or an increase of clinical activity after operation. In the most spectacular case the BI, which was +1 before operation, rose after a series of 3 operations to +4 and then to +4.125, without any signs of acute reaction. Six patients had reactions and/or ENL; none of these episodes was accompanied by a rise in the BI. Other patients showed no rise in the BI at all and many continued to improve, as in the following case in which the BI fell from +1.5 to +0.88 with DDS treatment and after operation improved still further to +0.5 and +0.375. It should be mentioned here that most patients continued specific treatment during surgery, except when reactions developed. The percentage of affected cases is about equal in lepromatous and dimorphous leprosy.

(2) *Tuberculoid and indeterminate leprosy.* (a) *Inactive:* In none of these cases was any sign of reactivation seen. (b) *Active:* Only 10 operations were performed on patients in this category. Of these, one tuberculoid patient showed temporary paresis of the wrist extensors of the operated hand after operation. One patient with indeterminate disease who had mild signs of activity before surgery showed exacerbation, with erythema in old lesions and a number of fresh macular lesions one month after a series of three operations. His BI remained negative throughout. None of these cases became bacteriologically positive.

TABLE 3

Number of operations with effects of surgery on activity of leprosy (tuberculoid and indeterminate)

Group	*Inactive*	*Active*	*Total*
Tuberculoid			
No. of operations	34	7	41
Affected	0	1	1
Unaffected	34	6	40
% Affected	0%	14%	
Indeterminate			
No. of operations	17	3	20
Affected	0	1	1
Unaffected	17	2	19
% Affected	0%	33%	

(3) *The rise in the BI.* This varied a great deal; in some cases it increased only from +0.12 to +0.25, but in others from +1 to +3 or more. The average deterioration is shown in Table 4, separately for lepromatous and dimorphous leprosy, and separately for all cases with a positive pre- and/or postoperative BI, and all deteriorated cases only.

The increase of the BI in absolute figures and as a percentage of the preoperative level is much more marked in dimorphous than in lepromatous leprosy.

TABLE 4

Average increases in the BI in lepromatous and dimorphous leprosy, after surgery

All cases with positive BI	*Lepromatous*	*Dimorphous*
Pre-op. average BI	41.00 : 38 = 1.08	6.97 : 12 = 0.58
Post-op. average BI	42.02 : 38 = 1.10	10.59 : 12 = 0.88
Difference	0.02	0.30
in %	1.85%	51.70%
Deteriorated cases only		
Pre-op. average BI	14.94 : 16 = 0.93	3.75 : 6 = 0.63
Post-op. average BI	23.90 : 16 = 1.50	8.87 : 6 = 1.48
Difference	0.57	0.85
in %	61%	135%

(4) *Clinical activity.* Table 5 shows the number and percentage of cases in which clinical activity increased after surgery. All these cases occurred in the active or quiescent stages of the disease, none in the arrested stage.

TABLE 5

Number and percentage of cases showing increased clinical activity

Group	*Inactive* Nos.	(%)	*Active* Nos.	(%)	*Total*
Lepromatous	2	12	6	17	8
Dimorphous	1	11	3	30	4
Tuberculoid	0	0	1	17	1
Indeterminate	0	0	1	33	1

Among the 14 cases the highest percentage occurred in dimorphous leprosy. The degree of activation ranged from mild to severe. There were 3 lepra reactions, 2 of them being associated with a rise of BI, and 3 reactions with ENL but no rise of BI. Three times ENL appeared or increased after operation, without a rise of BI. Three cases showed dissemination of lesions, in 2 accompanied by an increase of BI. In 2 cases, one lepromatous and one tuberculoid, there was temporary motor nerve damage in the operated arm. It is noteworthy that out of 14 manifestations of increased clinical activity only 6 were associated with a rise in the BI.

The 2 cases of motor nerve damage merit closer scrutiny. Both occurred in patients with active leprosy and after multiple operations, and both had been operated on with a tourniquet on the arm on which the damage occurred. One cannot be sure whether the nerve damage was due to surgical stress or to the pressure of the tourniquet on a still actively diseased nerve. In any case it seems advisable to operate on patients with active disease without a tourniquet and on the elevated hand operation table, or in the case of the lower extremities in Trendelenburg's position. This causes little inconvenience to the surgeon and reduces the danger to sensitive nerves, saves anaesthetics, and minimizes surgical stress.

(5) *Multiple operations.* It was interesting to observe the effect of more than one operation. Operations which followed a previous one within 2 months or less were considered as multiple operations. A typical case is the following: A lepromatous patient with a BI of +2.62 underwent a temporalis transfer on the right eye. After the operation the BI came down to +2.25; 5 weeks later he had a tarsorrhaphy to the left eye, and 2 weeks after that the BI rose to +3.00. The second operation, though small, had a definite cumulative effect, adding to the stress of the first. An evaluation of all multiple operations is shown in Tables 6 and 7.

TABLE 6

Showing effect of multiple operations on activity of leprosy, with number of cases affected

Type	*Group*	*Arrested*	*Quiescent*	*Active*	*Total*
Lepromatous	No. of operations	2	3	7	12
	Affected	0	2	5	7
Dimorphous	No. of operations	1	2	0	3
	Affected	0	1	0	1
Tuberculoid	No. of operations	9		1	10
	Affected	0		1	1
Indeterminate	No. of operations	4		1	5
	Affected	0		1	1

TABLE 7

Average deterioration of BI after multiple operations in patients with active lepromatous leprosy

	All cases	*Deteriorated cases only*
Pre-op. average BI	9.965 : 7 = 1.42	5.84 : 4 = 1.47
Post-op. average BI	13.435 : 7 = 1.92	10.62 : 4 = 2.66
Difference	0.50	1.19
% difference	35%	81%

Although the numbers are small it would appear that the percentage of affected cases and the degree of deterioration of the BI is considerably higher than in single operations.

(6) *Comparison between different types of leprosy.* The percentage of affected cases is markedly higher in bacilliferous leprosy than in non-bacilliferous leprosy. There is hardly any difference between lepromatous and dimorphous leprosy in this respect, but dimorphous leprosy shows a decidedly higher average deterioration of the BI, and also a higher percentage of clinical signs of increased activity, than does lepromatous leprosy. The figures regarding the effect of multiple operations are too small for comparison. The impression that dimorphous leprosy is more sensitive to surgical stress is not surprising, but confirms the well-known fact that dimorphous leprosy is more unstable than lepromatous leprosy. The number of operations on patients with active tuberculoid and indeterminate leprosy is too small to allow of any firm conclusions, but it would seem that non-bacilliferous leprosy is more stable than both lepromatous and dimorphous leprosy.

(7) *Metaplastic bone formation.* This is an effect of surgery which needs separate consideration. Because of the uncertainty of its pathogenesis I did not include this phenomenon with the other signs of increased clinical activity. It occurs occasionally at the proximal phalanx of operated fingers in the scar of the insertion of the tendon graft, and often in more than one finger of the same hand. In the present study it occurred in 7 cases, 2 in active lepromatous, 2 in active dimorphous, and 3 in active tuberculoid leprosy. Clinically it appears as a hard, bony, immobile lump, closely resembling an exostosis, and starting 7 to 10 weeks after operation. It may recede later or may persist for years. It may also seriously interfere with the functioning of the graft. X-ray examination shows more or less massive bone apposition to the phalanx in this area. Histologically it consists of proliferating fibroblasts, proliferating cartilage, and osteoid tissue consistent with a hypertrophic scar undergoing metaplastic changes.

The pathogenesis of this phenomenon is not at all clear. It has been suggested that it is something like myositis ossificans which would involve trauma to the periosteum. But this cannot be the only reason, if indeed it plays any role at all. Often in a particular patient more than one finger may be affected, whereas many other patients undergoing similar operations show no such reaction at all; one does not cut or scratch the periosteum in several fingers in one patient and not at all in many others. Some other factor must be involved. Reviewing our patients we found that at the time of operation all of them showed signs of active disease, more especially disease in the healing phase. Histologically, there is no specific granulation tissue in these lumps. It could be a "specific alteration of tissue reactivity" associated in some way with an hyperergic response to a paucibacillary infection (Browne, 1965). Whatever it is, it may seriously interfere with the results of surgery.

RESULTS OF SURGERY IN DIFFERENT STATES OF LEPROSY

This part of the study was carried out in order to determine whether the morbid status of the disease at the time of operation has any influence on the results of surgery.

Materials and methods

To a large extent the same patients as for the first part of the study were included in the second part, making sure that there were no postoperative complications other than increased

TABLE 8
Sample studied

Group	*Inactive*	*Active*	*Total*
Short term	22	38	60
Long term	12	29	41
Total	34	67	101

activity. Only patients who underwent reconstructive surgery were included, as we were concerned with the results of this procedure. The patients were divided into active and inactive cases, the latter group including the quiescent and arrested state of bacilliferous leprosy. The results of the operation were assessed 3 months and 12 months after operation, and here referred to as short-term and long-term results respectively. The assessment was made in most cases by the same experienced assessor and independently of the surgeon, and 5 categories were designated, namely excellent, good, fairly good, fair, and poor. Not all the patients were available for long-term assessment and therefore the number of short-term assessments is larger than of long-term ones. The total number of operations assessed was 60, all of which received a short-term assessment, while the number of long-term assessments was 41; 34 were done on patients with inactive leprosy, and 67 on patients with active leprosy. The distribution of the sample studied is shown in Table 8.

The results of the assessments are shown in Table 9, with the number of operations and percentage in each category. There is an unmistakable tendency to less favourable results in operations performed in active leprosy, and somewhat more marked in long-term than in short-term assessments. The numbers are too small to draw more elaborate conclusions, but the tendency is there.

TABLE 9
Results of surgery in active and inactive states of leprosy

	Short-term				*Long-term*			
	Inactive		*Active*		*Inactive*		*Active*	
Result	*Nos.*	(%)	*Nos.*	(%)	*Nos.*	(%)	*Nos.*	(%)
Excellent	2	(9)	3	(8)	2	(17)	2	(7)
Good	13	(59)	15	(39)	5	(41)	7	(24)
Fairly good	5	(23)	11	(29)	2	(17)	5	(17)
Fair	2	(9)	9	(24)	1	(8)	8	(28)
Poor	–	–	–	–	2	(17)	7	(24)
Total	22	(100)	38	(100)	12	(100)	29	(100)

CONCLUSIONS

The trauma of surgery is a definite stress that may, and in many cases actually does, activate or reactivate the disease process in leprosy. Often the only manifestation is a slight, temporary, rise in the BI, or a mild local or general exacerbation. But in some cases the deterioration is marked, causing a serious setback in the healing of the disease. This is actually not surprising. It is well known that periods of stress such as pregnancy and the puerperium, intercurrent disease, mental strain, even smallpox vaccination, may cause an exacerbation of existing leprosy. As in tuberculosis and other chronic infectious diseases, overstrain and surgery are best avoided in the florid stage of the disease.

Dimorphous leprosy is somewhat more liable to react to surgical stress than is lepromatous leprosy. Tuberculoid leprosy seems to be less sensitive, but because of the small number of operations performed on patients with active tuberculoid leprosy, definite conclusions cannot be drawn on this point.

Several operations in quick succession are a greater stress than one single operation.

In inactive leprosy, reactivation of the disease due to surgical stress is rare, although this possibility should be borne in mind.

Results of surgery may be adversely influenced by an active state of the disease. This seems true not only in facial surgery, in which it is an accepted fact, but also in surgery of the extremities. Again, in view of the relatively small number of observed cases, one has to be careful not to draw definite conclusions too quickly. But further investigation of this relationship seems to be indicated.

In order to avoid unwelcome reactions to

reconstructive (and general) surgery it is advisable to observe the following precautions:

(1) When reconstructive surgery is indicated, a careful assessment of the morbid status with examination of the whole patient, not only the affected limb, should be an important part of the considerations which lead to the determination of the time of operation. This examination includes assessment of the BI, a search for clinical signs of activity, a history of reactions, or of nerve activity, or of eye involvement.

(2) In selective surgery it is best to wait until the disease has become inactive. In bacilliferous leprosy this means 3 months of a negative BI and the absence of clinical activity. In non-bacilliferous leprosy, the absence of clinical activity for the same period.

(3) In emergency operations like tracheotomy, keratitis in lagophthalmos, strangulated hernia, etc., a flare-up of the disease could possibly be avoided or controlled by cautious use of anti-inflammatory agents.

(4) In all cases, surgery should be as gentle as possible, avoiding all unnecessary stress. This includes a sparing use of anaesthetics and judicious use of tourniquets.

SUMMARY

(1) A study of the effects of surgery on the course of leprosy, and of the effects of the morbid status of leprosy on the results of surgery is presented.

(2) It is shown that surgical stress has a definite activating or reactivating effect on leprosy.

(3) An active state of the disease has possibly an unfavourable effect on surgical results.

(4) Conclusions are drawn and precautions suggested regarding the timing of reconstructive surgery in relation to the morbid status of the disease.

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Classification of Disabilities Resulting from Leprosy, for Use in Control Projects*

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Among leprologists there has been an increasing interest in the prevention of disabilities as a part of each leprosy control project. This may be due in part to a recognition that, in addition to any direct benefit to the patient, the attention to disabilities has a favourable influence on attendance at treatment clinics and thus on the control of leprosy.

Both the International Leprosy Association in its congress reports and the WHO Expert Committee on Leprosy have emphasized the importance of including a programme of disability prevention in leprosy-control projects and to this end the WHO Expert Committee on Leprosy (see References) called for a simple and practical classification of disabilities which would be easy to understand and to apply under field conditions.

The WHO classification of disabilities which had been adopted by the WHO Expert Committee on Leprosy (see References) has been used by a number of groups in an attempt to assess the size and the nature of the problem. The WHO Leprosy Epidemiological Team (1960-67), for example, applied the classification in all its studies and collected a great deal of interesting data relating the development of disabilities to many variables in leprosy. The work of this team supported by other workers has made it possible to compare the frequency of different types of disability in various parts of the world, and has given some idea of the magnitude of the problem and of the burden which leprosy disability places on the countries where leprosy is common.

It is from this background of existing surveys on a limited scale that WHO has set itself the task of preparing a simplified classification that may be more widely applied.

The medico-legal definition of a disability is "loss of function or earning power" and is graded only by the extent to which it interferes with a person's ability to earn his living or to enjoy a normal life. The WHO classification of disabilities mentioned above was not an attempt to identify the type of disability but was only a method of grading the severity of disability. Because it involved the summation of various types of disablement, the classification was not suitable for detailed record-keeping. For the same reason it was found to be rather complicated for use by those who were not trained to assess disabilities.

In preparing this new classification the following requirements were taken into account:

(1) To have a classification so simple and practical that it could be used by auxiliary health workers.

(2) To have a classification that would also be a guide to the auxiliary health worker and to the doctor with regard to the need for special preventive measures or treatment.

(3) To have a classification that would also be useful for collecting and classifying information concerning disabilities in the field, so that data from different countries could be compared.

On the other hand, there are many factors that should be investigated and for which precise information on a world-wide basis is

*This memorandum was drawn up by P. W. Brand, Chief, Rehabilitation Branch, U.S. Public Health Service Hospital, Carville, La., U.S.A.; L. M. Bechelli, Chief, Leprosy, World Health Organization, Geneva, Switzerland; and V. Martinez Dominguez, Leprosy, World Health Organization, Geneva, Switzerland, after consultation with the leprologists whose names are shown in the acknowledgements at the end of this memorandum.

needed, but which would be difficult for an auxiliary medical worker to assess in the field. It is recognized that many workers will certainly use more detailed records both for research work and for follow-up of cases under treatment. Therefore, the proposed standard WHO field classification must emphasize simplicity and functional value with the hope that it will also be useful for comparisons of the frequency of disability in various parts of the world.

In the preparation of this proposed classification, the opinions of a large number of leprologists (listed at the end of this memorandum) were sought and their suggestions are gratefully acknowledged. The suggested new classification owes much to the scheme proposed by Dr. P. Laviron who has used a similar pattern in his work in Africa.

It is proposed to record separately the various factors that were summated together in the previous WHO classification, but to simplify the final grading system to 3 grades instead of 5. This grading will apply only to hands, feet and eyes. Each grade is related both to severity of disability and also to the possibility of useful action, by the staff in the field. The grades are as follows:

(1) mild disability; warning of possible trouble in the future; need for education;

(2) moderate disability; therapeutic action needed to prevent severe disability;

(3) severe disability; may be too far advanced for effective treatment under field conditions.

The new classification is then as follows:

Hand

1 = Insensitive hand.*
2 = Ulcers and injuries and/or mobile claw hand and/or slight absorption.
3 = Wrist drop or fingers clawed and joints stiff and/or severe absorption* of fingers.

Foot

1 = Insensitive foot.*
2 = With trophic ulcer and/or clawed toes or foot drop and/or slight absorption.
3 = Contracture and/or severe absorption.*

*See notes on insensitivity, absorption and stiffness.

Eyes

1 = Redness of conjunctiva.
2 = Lagophthalmos and/or blurring of vision and/or inflammation of globe.
3 = Severe loss of vision or blindness.

It will be noted that in each of the categories hands, feet and eyes, it is the grade 2 that is the most important for therapeutic action. This is the patient who most needs advice and attention or referral to the doctor or supervisor, and in each case there is some action that the field auxiliary can take. Each limb and each eye should be assessed separately and disabilities may be classified as in the following examples:

TABLE 1

Hands	*Feet*	*Eyes*
L R	L R	L R
2 1	2 2	1 3

USE OF CLASSIFICATION OR OF FORMS OR BOTH

It is suggested that field auxiliaries should be provided with standard forms on which they can record details of each of their patients. The form, which should be part of the leprosy patient card, provides a simple and minimal record of the level of disability, by noting each of the factors that make for disability (see Table 2).

Alternatively, in those programmes in which it is felt that the task of entering details on such a form could not be carried out by the auxiliary, the grading may still be used without any record of the details of the disability. In such cases, absorption of the fingers will immediately be allocated to grade 3 without the need to consider either paralysis or insensitivity. It is hoped that by this simplification, every control project may at least begin to assess and record the frequency of disabilities, as a part of a programme of prevention. The use of record forms will provide better opportunities for observers to follow the progress of efforts to improve the situation.

Finally, it should be pointed out that the usefulness of the same basic form may be extended by those who have definitive pro-

TABLE 2
Form for recording disabilities from leprosy

Grades	*Hand*			*Foot*			*Eye*			
	Sign	*L*	*R*	*Sign*	*L*	*R*	*Sign*	*L*	*R*	
										Involvement of larynx
Grade 1	Insensitivity			Insensitivity			Conjunctivitis			☐ Yes ☐ No
Grade 2	Ulcers and injuries Mobile claw hand Slight absorpotion			Trophic ulcer Clawed toes Foot-drop Slight absorpotion			Lagophthalmos Iritis or keratitis Blurring of vision			Collapse of nose ☐ Yes ☐ No
Grade 3	Wrist-drop Stiff joints Severe absorption			Contracture Severe absorption			Severe loss of vision Blindness			Facial paralysis ☐ Yes ☐ No
Maximum grade										

grammes for the study of disability. This may be done by keeping the same sequence of factors (insensitivity, paralysis, etc.) but making a finer anatomical subdivision of the hands and feet and recording separate digits, different parts of the foot and so on.

To use the form, each square in the section on hand, foot and eye should be marked if the disability is present, or left blank if it is absent. At the bottom of each column the grade (1, 2 or 3) should be noted, the most severe disability of that limb or eye being recorded.

In the last section, involvement of the larynx, collapse of the nose and facial paralysis, there is no grading, only a check-mark is entered for the presence of the disability.

It may seem strange to classify a hand as grade 3 if only one finger is absorbed. However, in this simplified system only a qualitative estimation is possible. For those who wish to collect more precise information, the same form may be used with the inclusion of additional vertical columns to subdivide, for example, each hand into ulnar and median parts or into individual digits.

NOTE ON INSENSITIVITY

The purpose of this assessment is to find out if the patient has lost *protective* sensation. The loss of light touch is not really a disability, but if a patient cannot localize a firm touch, he is liable to suffer frequent injury. Therefore, to test for insensitivity, the examiner may use the point of a pencil. The pressure should be firm enough to dimple the skin but not enough to move the patient's finger or hand; the patient's hand must be supported while it is tested. The blindfolded patient should point to the place where he believes he has been touched; pointing to the wrong place that may be as little as 2 cm from where he is touched is a sign of insensitivity. It has been shown that failure to localize firm touch is a useful sign that the patient is now in danger from mechanical injuries and burns.

NOTE ON ULCERS AND INJURIES

Haematomas, blisters and wounds are all signs of misuse of an insensitive hand. They indicate the need for education and the presence of any of them demands a grade 2 classification.

NOTE ON ABSORPTION

Absorption refers to a significant or manifest absorption. If only the tips of fingers are absorbed, a hand may still be classified as grade 2. In the foot, if as much as one-fifth of the sole area is lost this would be considered as grade 3.

NOTE ON STIFFNESS

The auxiliary worker should attempt to move the flexed fingers. If the fingers have a good range of passive movement, even though not quite 100%, they may still be regarded as mobile but if they have 25% of their passive range they are classified as stiff.

NOTE ON INFLAMMATION OF EYE

The auxiliary worker should be taught to distinguish between the generalized redness of the conjunctiva in conjunctivitis and the circumcorneal redness indicating inflammation that involves the iris and the visual area of the eye. The latter is a grade 2 disability and demands urgent action. Photophobia or pain in the eye may also indicate iritis, while haziness or ulceration of the cornea should be marked as keratitis and also classified as a grade 2 disability.

NOTE ON VISION

It is recognized that the testing of vision is time-consuming under field conditions. However, commencing blurring of vision in lepromatous leprosy may be a vital sign of a reversible iritis.

It is suggested that the auxiliary worker should carry a card on which is drawn a split circle or C drawn to the dimensions of a letter on the 6/6 row of Snellen's Test Type. The card may be about 10 cm by 10 cm and the split circle drawn in the centre. The circle is 9 mm in diameter, consisting of a black band 2 mm wide with a 2 mm gap on one side (see Fig. 1).

FIG. 1

A normal eye can see the gap in the circle when the card is held at a distance of 6 m. A medical auxiliary may hold the card 3 paces from the patient and ask him to point to the side of the circle in which there is a gap. Failure to see the gap at a distance of 3 m is recorded as blurring of vision. By turning the card in various ways, patients may be rapidly screened for poor vision in a very short time. Each eye is covered while the other is tested.

In this grading, the eye may be recorded as "severe loss of vision, grade 3", if the patient cannot see the gap in the circle, even when the card is held directly in front of his face. The eye is recorded as blind if there is no perception of light.

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The Role of Rehabilitation in Leprosy Control*

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Fashions change in medicine, just as they do in other spheres. Medical fashions are determined by scientific advances, public pressures and personal enthusiasms. Time was when it would have been unthinkable to use either of the terms "rehabilitation" and "control" in reference to leprosy, for the leprosy victim could look forward to nothing brighter than the merciful Lethe of death, and leprosy itself was not considered to be amenable to measures successfully applied to transmissible diseases in general. The leprosy sufferer could not be "rehabilitated", and the disease did not lend itself to "control".

Today we can, with some measure of justification, refer in the same breath to the rehabilitation of the individual and the control of the disease, but it would be idle to suppose that these two ideas in practice belong to the same conceptual world, or share the same vocabulary and techniques. In several respects, to change the figure, the reconstructive surgeons have all too few dealings with the epidemiologists, and prosthetists have even fewer with the therapists. Their backgrounds and objectives are different, and their approach to leprosy in the individual and in the community shows considerable divergencies. They speak different languages, and employ different techniques to reach different goals.

It will be our contention in this paper that the moment has come for the objective evaluation of the rôle of rehabilitation in leprosy control. If this evaluation is not begun soon, two dangers will become more apparent than they are today: first, medical planners and administrators may decide, mainly on economic grounds, that poor developing countries simply cannot afford to include in leprosy control measures expensive schemes for the rehabilitation of leprosy patients; and second, isolated and non-integrated schemes for such rehabilitation—depending for the most part on private initiative, and the drive of dedicated individuals —will continue to provide the services for an overprivileged minority, while the leprosy endemic remains unchecked and preventable disabling deformity continues to occur.

A summary glance at recent history will clarify the reasons for the present situation. Until 25 years ago, the serious forms of leprosy were generally considered to be untreatable and inexorably progressive, deformity was the rule, and the idea of rehabilitation could not be entertained, either on social or on medical grounds. In the typical "Home" in India, devoted Christian missionaries laboured with self-sacrificing zeal and love, ministering to the hopelessly deformed and blind and outcast sufferers from leprosy or its sequelae and aftermath. While here and there some attempt at occupational therapy was made, no real vocational rehabilitation was contemplated, or, indeed, considered possible. There they were, and there they stayed. Cure of active serious leprosy was not on the agenda, and the physical deformities of leprosy were thought to be in some way unique and inevitable and not amenable to the standard surgical techniques employed, say, in poliomyelitis, or in trauma and infection of bones and soft tissues.

That situation is now outmoded, in two respects: first, medicinal treatment has become available that has transformed the outlook of the individual patient and has made possible

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the control and eventual eradication of leprosy; second, Paul Brand and others have shown conclusively that the principles of reconstructive surgery can be successfully applied to the deformities that result mainly from peripheral nerve damage in leprosy. In addition, scientifically established knowledge in many aspects of leprosy—in particular, its low infectivity and its curability—is slowly penetrating the offices of the health planners and the lecture halls of the medical schools. But the uncertainty and hesitation regarding the confusing and competing claims of leprosy control and leprosy rehabilitation continue unabated. The situation has not been clarified, either, by the advocacy of the representatives of the old *status quo* of "Homes" and asylums and the impatience of the champions of mass treatment. Furthermore, the trumpets of international agencies have given an uncertain note that has not prepared the willing warriors for battle.

THE PRESENT POSITION

Of the 15 million leprosy sufferers in the world only some 3 million are having treatment. A total of about 4 million have some physical deformity or sensory deficit attributable to leprosy. An unknown number, amounting probably to 3 millions or more, are in need of rehabilitation in some form or other. In general, where leprosy work has been established longest and has the most impressive buildings, the old outlook tends to persist. Within the institution, the care of the patients may be exemplary, and some occupational therapy may be given, but there has been little or no impact on the prevalence of leprosy in the surrounding villages. It is only of recent years that many such "Homes" are becoming centres for the purposes of leprosy control of an area. On the other hand, the mass treatment schemes spread thin over vast areas, are making deep inroads into the leprosy endemic in the areas concerned, but they offer no formal rehabilitation to the crippled or handicapped ex-patient: since he is no longer contagious, the mass treatment campaign tends to ignore him and his personal problems.

THE PLACE OF REHABILITATION IN A CONTROL PROGRAMME

We will accept the WHO comprehensive definition of rehabilitation as applied to leprosy: "The physical and mental restoration, as far as possible, of all treated patients to normal activity, so that they may be able to resume their place in the home, society and industry".

As I see it, two complementary conceptions have to be "sold" to two different kinds of government planning services and of medical units (whether the latter be separate leprosy institutions or polyvalent medical services). The first does not concern us primarily here, but must be mentioned for completeness' sake; it is, to persuade institutions where the emphasis has been disproportionately accorded to in-patient care and reconstructive surgery that these measures can only be justified as they are part of a leprosy control programme, integrated as far as possible into the overall policy for the control and treatment of transmissible diseases. That this is no theoretical consideration may be gathered from the observation that, in more than one country, schemes for leprosy control are languishing because workers (especially, let it be admitted, those working under voluntary agencies) have been concentrating latterly too much on dramatic and fashionable and professionally gratifying reconstructive surgery to the detriment of leprosy control. Leprosy sufferers, with progressive (and contagious) disease, are themselves developing deformities that are in the main preventible by adequate medical treatment, and they are at the same time transmitting leprosy to susceptible contacts. Patients with stigmatizing deformities will walk miles to seek surgery at distant shrines far from the peering eyes and gossiping voices of their own families and neighbours. Physiotherapy and surgical operations and education may together provide the basis for rehabilitation; but, on the other hand, impressive lists of operations performed at such a centre may bear little or no relation to the actual rehabilitation of the series composed of individual patients. At the "receiving end", in point of fact, and in the absence of a

leprosy control service, the result may well be a confirmation that "leprosy can be cured by operation" and that this is all there is to it. True rehabilitation, including reconstructive surgery, must be part of a leprosy control programme, or it may fail in the long run as well as in the short.

A further point concerns the creation and development of medically excellent facilities that are unfortunately out of touch with, and divorced from, the whole life of the people and official medical policy. While it may be difficult to resist professional pressures for ever-rising (and progressively expensive) standards of accommodation and equipment, the resources of the country should not be overstrained in the interests—legitimate though they be—of a small section of the population. If $80 per head per year were available, and not $1—for *all* health services—bigger and better rehabilitation services for all, including leprosy patients, could be provided.

The other complementary conception that has to be "sold" to the government planners and the voluntary agencies engaged in the anti-leprosy campaign is the one that concerns us principally here; viz., that rehabilitation really forms an essential component of any leprosy policy and project, that a well-thought-out plan is generally feasible, that it need not be prohibitively expensive, and that it possesses considerable advertising value.

ESSENTIAL

"Rehabilitation" in the conventional sense should ideally not be necessary if under a leprosy control scheme every person suffering from leprosy is detected early and treated adequately through a domiciliary service, which may (or may not) be integrated into general public health measures. Thus, if society does not discriminate against the leprosy patient, the patient will never be in need of rehabilitation—for physical, psychological or social reasons. He will not become deformed, since nerve damage is not the inevitable accompaniment of or sequela of leprosy; he will not become psychologically disrupted or isolated, since the environment will not necessarily induce such an attitude; and he will not be socially dislocated, because he will continue to be accepted as a member of the family, the village, the guild and the caste.

However, where this ideal of early diagnosis and adequate treatment is not yet attained, the idea of rehabilitation must be introduced from the outset of treatment, and everything done to instil the principle of prevention—not only prevention of deformity, but prevention of the mental attitude that will make rehabilitation in some form or other necessary. To this end, the doctor in charge and all those who work with him must be enthusiasts, and informed and competent enthusiasts at that. It goes without saying that treatment must follow diagnosis immediately, and that education goes hand in hand with treatment. The grouped patients are instructed in the care of insensitive extremities, how to avoid burns, cuts and abrasions, and damage by stones and thorns and nails in footwear.

The trained medical auxiliary accompanies the doctor and other team-members on survey and treatment journeys, and not only examines the patients for damage to vulnerable hands and feet, but also takes the opportunity to instruct the patients. Sometimes, plaster casts are applied on the spot, or protective footwear distributed, or sponge-rubber fixed to implements so as to reduce damage by friction and pressure.

Some patients, discovered on the first case-finding survey, already need more than "first-aid" or prevention. They are directed to or brought to the central hospital, where their special needs can be dealt with. The whole population can see that, whatever the stage leprosy has reached, the individual can be helped back towards normality. The stigma of the disease is slowly dispelled; false notions about the inevitability of deformity, the contagiousness of the discharge from neuropathic ulcers, the essential chronicity of such ulcers, and the uniqueness of leprosy in all its aspects, are gradually undermined.

Unless some kind of rehabilitation service is grafted on to leprosy control measures, sooner or later the backlog of mutilated sufferers will become vocal and demand the impossible, restoration of function of lost digits and grossly deformed feet.

FEASIBLE

The actual sophistication possible in such a service depends mainly on finance: how much money can be made available, due consideration having been given to an objective evaluation of the benefits likely to be derived from the proposed service. Leprosy is only one of the crippling diseases—although it may be the most serious in point of numbers. Those handicapped by leprosy cannot really take precedence over others (despite their appeal on humanitarian grounds), and the crippled—especially if ageing—cannot demand a disproportionate share of available resources.

Government planners are understandably unco-operative when they are presented with blueprints for costly installations for rehabilitation requiring a large slice of the medical budget and staff for upkeep. Reconstructive surgeons, physiotherapists, occupational therapists, prosthetists, medico-social workers are all in short supply in developing countries, and they are expensive. But an installation suited to the Western world, and appealing to the Western-trained medical worker, may be quite out-of-place and ill-adapted to the needs and possibilities of a country with a huge leprosy problem.

INEXPENSIVE

The answer is severely practical: cut your coat according to your cloth, having made sure that the cloth is the best you can afford, the most hardwearing and best suited to the climate and the people. In other words, the rehabilitation service may begin simply with a polycompetent medical auxiliary attached to the leprosy survey team and to the domiciliary treatment scheme. His job is the prevention of deformity and education (in its broadest sense) in the setting of the family and the farm, or the community and the town.

With more money, the staff can be increased, and simple treatment given (such as plaster casts), simple operations performed (e.g., sequestrectomy), and simple protective footwear supplied (made from locally available materials, acceptable, cheap, long-lasting and repairable). Some patients with longstanding deformity require more than treatment given in the course of infrequent visits by the mobile team. Facilities for in-patient treatment should be provided in conjunction with the all-purpose rural dispensaries, the medical assistants in charge having had some instruction in leprosy and its management. This practical co-operation between the leprosy control service and rehabilitation and the general public health service demands little in the way of extra finance or specialized staff.

The next requirement is the creation of a rehabilitation unit where reconstructive surgery can be performed. Here again, it is preferable from many standpoints to include leprosy patients (or ex-patients) within the overall scheme. There is in general no need for separate institutions, though it is readily admitted that some specialized knowledge and constant practice are necessary if highly sophisticated surgical treatment is contemplated. However, much may be done by general surgeons, or general orthopaedic surgeons, if they have the time, the inclination and the facilities for pre- and post-operative physiotherapy, and the co-operation of makers of splints and footwear, and occupational therapists with local knowledge and the right outlook.

It is in this respect that the vision and initiative and flexibility of voluntary agency staff come into the picture. Provided that their work can be integrated practically into the leprosy control service, perhaps over a wider area than that immediately under the purview of the local control officers, then the additional burden on government funds should not be excessive. Central workshops for mass production of protective footwear, central schools

for giving medical auxiliaries the extra specialized knowledge they need; and a modest central institute for correlation of records and research, may in the long run amply repay the investment. If the dangers of over-sophistication are avoided, and the staff continue to keep in touch with the needs of the average patient, then costs are kept down and standards kept up.

The value and practicability of vocational rehabilitation in developing countries faced with many urgent medical and social problems are matters for discussion. The nearer to the patient's life and livelihood such schemes are, the greater their chance of making a real contribution to rehabilitation. Thus, model farms are admirable: despite his handicaps, the leprosy ex-patient becomes a better and more successful farmer, after a short course here, than his healthy fellow-villagers. Soil preparation, composting, fertilizers, grafting, seed selection, contour ploughing, market gardening can all be taught to the great advantage and profit of the patients whatever the disease that caused their disability. The breeding of chickens, rabbits, goats, pigs, etc., may provide a good living.

In general, separate villages for ex-patients are not to be recommended, just as segregation villages often serve to perpetuate false notions about leprosy. An ex-patient who has some economic advantage to bring to the village is usually welcome, despite his deformity and despite the stigma attaching to the disease he has had.

THE PROPAGANDA VALUE

At every stage of the leprosy control programme, rehabilitation offers considerable propaganda or advertising advantages. It brings back the leprosy patient not only into the family, but also into the economic community. It helps to convince reluctant patients that something definite can be done for even the serious deformities caused by leprosy. And rehabilitation serves as a stimulus to unveiling of concealed leprosy: patients at earlier stages are brought out of hiding when their relatives see others who are managing to cope successfully with life despite the incubus of past leprosy. The sight of established deformity, now partially remedied, may be used as a salutary warning to patients who neglect to take treatment regularly.

Any measure that helps the leprosy control campaign to function more effectively should be welcomed. Rehabilitation is one of these measures, and not the least in importance or significance.

Lepr. Rev. (1970) **41**, 62-63

Letter to the Editor

Ten years ago I ventured to write a letter on reactions in leprosy in an effort to clarify a subject which at that time seemed very confused, and I suggested that we should refer to tuberculoid reaction, borderline reaction, and lepromatous reaction Type 1 and 2 (Jopling, 1959). Since then there have been many studies on this subject, the latest being that of Ridley (1969). His paper has served a useful purpose in differentiating "reversal reactions" and "downgrading reactions", but his classification consisting of 4 types of reaction is, I fear, too academic to be generally accepted by leprosy workers.

If I may be permitted to modify his classification for general use, I should like to suggest that the term "lepra reaction" be used to cover all types of reaction, and that this be described under 2 headings since 2 fundamentally different pathological processes are at work. In one there is a rapid change in the host-parasite relation—in some cases for better, and in other cases for worse. The clinician sees a rapid development of erythema and swelling of one or more leprosy lesions, often associated with enlargement of the nerves, pain and there may be oedema of the extremities. This may occur in any of the determinate types of leprosy (tuberculoid, borderline, or lepromatous). The histologist can tell us if the reaction is a "reversal" ("upgrading") reaction with the defence mechanism gaining the upper hand, or a "downgrading" reaction with the invasive mechanism in the ascendant. I would call this "Type 1 reaction".

TABLE I

Classification of lepra reaction (reaction in leprosy)

Name of reaction	*Type of leprosy involved*	*Main clinical features*	*Main histological features (in dermis)*	*Main haematological findings*
Type 1 reaction	Tuberculoid Borderline Lepromatous	Erythema and swelling of some or all of the leprosy skin lesions Nerve swelling and pain Oedema of extremities	In "reversal reaction" there is oedema, diminution in number of acid-fast bacilli, and increase in defensive cells such as lymphocytes, epithelioid cells, and giant cells In "downgrading reaction" there is oedema, increase in acid-fast bacilli, and diminution in the number of defensive cells	Nil
Type 2 reaction	Lepromatous Some cases of borderline-lepromatous	Any of the following, singly or in combination: erythema nodosum leprosum, nerve pain, bone pain, joint pain, fever, malaise, lymphadenitis, rhinitis, epistaxis, iridocyclitis, epididymo-orchitis, proteinuria. In severe cases, erythema nodosum leprosum lesions may become vesicular or bulbous and break down	Oedema. Polymorphonuclear infiltration of dermis. Swelling of capillary endothelium. In necrotizing reactions there is capillary necrosis with fibrinoid patches in and around affected vessels	Polymorphonuclear leucocytosis. Raised erythrocyte sedimentation rate. Increased serum gamma globulin. Anaemia sometimes

On the other hand, those suffering from lepromatous leprosy, and some borderline-lepromatous (BL) patients, may undergo an antigen-antibody reaction with features similar to the Arthus phenomenon and/or to serum-sickness (Wemambu *et al.*, 1969). These include *erythema nodosum leprosum* (ENL), pain in nerves, bones and joints (with or without effusion), rhinitis, epistaxis, iridocyclitis, epididymo-orchitis, lymphadenitis, fever, malaise, and proteinuria. Here there is no question of upgrading or downgrading, nor of cell-mediated immunity, and to the clinician the leprosy lesions appear unaltered (although the histologist may note some oedema in them). The term ENL is widely used to describe this type of reaction, but is unsatisfactory since some of the above-mentioned manifestations may occur *without* ENL. In such cases the term ENL is clearly a misnomer. I would call this "Type 2 reaction".

Table 1 is designed to clarify the above remarks.

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1st December, 1969

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Book Reviews

Epidemiological Studies of Some Tuberculosis Control Measures in a Developing Country, by TAGE EGSMORE. Munksgaard, Copenhagen. 1969. Price: Dan. Kr. 30.00.

This 113-page publication, which is a thesis "accepted by the Medical Faculty of the University of Copenhagen to be defended in public for the medical doctorate", embodies the results of field investigations conducted by the author in Kenya from 1961-66. Although these studies are primarily concerned with BCG vaccination for the prevention of tuberculosis, they offer valuable hints to leprologists who will be increasingly concerned with measures of mass vaccination of populations exposed to both tuberculosis and leprosy. Since in many developing countries it is impossible at present (and in the foreseeable future), because of sheer lack of men and money and medical infrastructure, to provide treatment for more than one-tenth of the "open" cases of pulmonary tuberculosis, the only feasible control measure is prophylaxis. It is well recognized now that massive and repeated challenge will overcome the resistance to tuberculosis induced by BCG vaccination, and that severe undernutrition may preclude the development of vaccine-induced allergy. Notwithstanding these and other adverse factors, BCG provides the least expensive and most hopeful method for the control of tuberculosis in the inhabitants of the developing countries.

These studies have their lessons for leprologists, and emphasize the advantages that would follow the linking of leprosy with tuberculosis in the initial planning, the execution and the statistical evaluation of schemes for mass prophylaxis by BCG vaccination. Perhaps it is not too late to assess critically the value of some schemes, already under way in several countries, and their effect on the future incidence of leprosy in the growing child populations of these countries.

Cell-mediated Immune Responses: Report of a WHO Scientific Group, Geneva, 1969, 61 pages (Wld Hlth Org. techn. Rep. Ser., No. 423). Price: 8s./$1.25/Sw. fr. 4.0.

Two classes of immune response are recognized at present: one humoral, mediated by specialized cells that synthesize and secrete humoral antibodies of the various immunoglobulin types; the other mediated by specifically sensitized cells of the lymphocyte series. This report is concerned with the second type of response, which is increasingly thought to play a crucial role in defence mechanisms and disease processes of great clinical importance such as transplant rejection, defence against neoplastic growth, resistance to certain types of bacterial, viral, mycotic, and parasitic agents, and autoimmune processes.

The report outlines present knowledge of the phenomena of cell-mediated immunity, indicates where further knowledge is needed, and points out the problems to be solved. Beginning with a discussion of the source of the cells responsible for the phenomenon, it then deals with delayed-type hypersensitivity reactions, the toxic effect of lymphocytes on target cells *in vitro*, antibodies and cell-mediated immunity, the relevance of such immunity to pathogenesis, and the modification and control of cell-mediated immune responses.

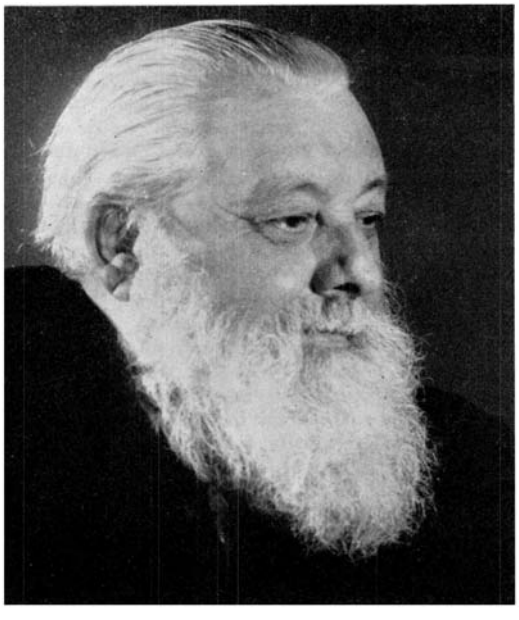
The report clearly brings out the relevance of cell-mediated immunity to a large number of medical disciplines in which its importance is only gradually becoming understood. To assist readers in a subject about which so little is known generally, a select bibliography is appended, grouped according to the topics covered in the report.

Reprinted from *WHO Chronicle*, 1969, **23**, 543.

Obituary Notice

FRANZ HEMERIJCKX, 1902-69

Dr. Frank Hemerijckx died in Louvain, Belgium, on 15 October, 1969, at the age of 67.



Hemerijckx was born in the Flemish town of Ninove. After completing his medical studies, he went to the Congo in 1929. The first physician to be appointed in Tshumbe Sainte Marie, a remote station in the Kasai, he found himself responsible for the medical care of the whole population in an area where sleeping sickness, yaws, onchocerciasis and malnutrition were all highly prevalent. Adding leprosy to the list, at a time when out-patient treatment for this disease was unheard of, he organized a settlement at Dikungu with the specific aim of allowing leprosy patients to lead a normal village life. This was later to develop into an important treatment and rehabilitation centre.

Appointed Provincial Leprologist in 1947, he took advantage of the availability of sulphones to launch an extensive leprosy control programme based on early diagnosis and out-patient treatment in dispensaries and general hospitals. By 1952 over 60,000 patients were under regular treatment.

In 1955, on retirement from the Belgian Colonial Service, he began a second career in South India. Settling in Polambakkam, Tamil Nadu, in July, 1955, he opened his first clinic with 167 patients. Five years later, thanks to his remarkable flair for personal contacts, his aptitude for meticulous planning, and his constant preoccupation to train auxiliary workers, over 20,000 patients were being regularly treated or followed up at the clinics "under the trees".

In 1961, Dr. Hemerijckx was appointed WHO Consultant in Leprosy to the Government of India.

After retiring from field activities in 1965, he remained very active in Belgian and various European agencies connected with leprosy (ELEP, FOPERDA and The Damien Foundation) and made several trips to the Far East, South-East Asia, and Africa.

Retaining a very lucid mind up to the end, he never ceased to insist on the need for a more complete integration of leprosy activities in the general health services. Dr. Hemerijckx had been a member of the International Leprosy Association since 1934. He was presented with the Damien-Dutton Award on the occasion of the Ninth International Leprosy Congress in London in 1968.

A phenomenal worker, a man of strong convictions, able to make decisions, and always ready and willing to apply new knowledge and new approaches for the benefit of leprosy patients, Franz Hemerijckx had a contagious enthusiasm that welcomed new attitudes towards leprosy and greatly facilitated the development of leprosy control programmes in various parts of the world.

Dr. Hemerijckx is survived by his wife and four children, to whom we extend our deepest sympathy.

(We are indebted to Professor Michel F. Lechat for this tribute.)

Lepr. Rev. (1970) **41**, 66-69

Abstracts

The following 3 abstracts are reprinted, with permission, from *Trop. Dis. Bull.*, 1969, **66**, 8:

1. **Trial of B 663 in the treatment of lepromatous leprosy,** by A. RENDERS. *Ann. Soc. Belg. Méd. Trop*, 1968, **48**, 625.

The author treated 34 dark-skinned African patients suffering from lepromatous or near-lepromatous leprosy, with B 663 (Geigy), a riminophenazine derivative, at doses ranging from 50 to 300 mg daily, with 1 rest day in 7. The great majority of the patients showed considerable, even remarkable, improvement. In 18 patients with untreated lepromatous leprosy, the results were excellent (5), very good (8), good (3), unchanged or equivocal (2). Only 2 slight reactional episodes were noted in these 18 patients treated for from 3 to 18 months, 14 of them for 18 months.

All 8 patients in continuous reaction, given 50 to 100 mg daily of B 663, showed remarkable improvement. However, 4 patients with acute erythema nodosum treated for an unspecified time with an unspecified dose of B 663 showed no improvement.

Out of a group of 8 patients suspected on clinical grounds of harbouring dapsone-resistant *Mycobacterium leprae*, 7 responded very well and rapidly to B 663.

In these dark-skinned patients, the ruddiness and darkening of the skin did not reduce the acceptability of a drug that was so obviously beneficial.

The author considers that even better results might be achieved by giving B 663 with other active compounds, such as dapsone or thiambutosine.

S. G. Browne.

2. **Unsatisfactory results with thalidomide as a specific treatment for leprosy,** by J. SHESKIN, F. SAGHER, M. DORFMAN and H. W. VON SCHRADER-BEIELSTEIN. *Israel J. Med. Sci.*, 1968, **4**, 901.

Because they had observed a beneficial action of thalidomide in lepra reactions, the authors treated 24 patients with various forms of leprosy with thalidomide for periods of 3 to 19 months. Twenty-one had received previous anti-leprosy treatment. In 11 patients the disease became worse, in 8 there was no change, and although there appeared to be clinical improvement in 5 lepromatous cases, there was no bacteriological improvement. Side-effects included constipation, drowsiness, dryness of oral and nasal mucosa, peripheral oedema, dizziness, erythema of face and chest, skin rashes, and psychiatric disturbance. Two patients suffered from neurological disturbances of uncertain causation.

W. H. Jopling.

3. **Enhancing effect of antilymphocytic globulin on human leprosy infection in thymectomized mice,** by J. M. GAUGAS. *Nature, Lond.*, 1968, **220**, 1246.

Administration of heterologous antilymphocyte serum (ALS) to mice has been shown to enhance their susceptibility to infection by *Mycobacterium tuberculosis* and *Myco. lepraemurium* (*Nature, Lond.*, 1968, **219**, 408), and the author now reports a similar effect in infections by *Myco. leprae* in thymectomized mice.

Thymic ablation was carried out on mice aged 6 weeks, and 2 weeks later 10^4 *Myco. leprae* were inoculated into both hind footpads. Beginning 2 months after infection, 0.2 to 0.3 ml of antilymphocytic globulin (ALG) was injected subcutaneously at weekly intervals and 9.5 months after infection the numbers of bacilli in the footpads were counted.

The results showed that in normal mice bacillary multiplication ceased when the number of bacilli reached 10^6 *Myco. leprae* and, whereas thymectomy alone produced only a slight increase, thymectomy plus ALG-treatment markedly increased susceptibility to the infection so that the number of bacilli in the pads became approximately 30 times higher than in the intact animals.

Histological studies showed that, although the enhanced lesions contained many heavily parasitized macrophages, they were unlike those of the intact mice for they were almost devoid of lymphocytes. The parasitized cells were mainly beneath the layer of epidermal cells and in a variety of connective tissues, and some bacilli had invaded nerves and formed globi. There was no evidence of the infection having spread to other regions of the body.

The author suggests that this method, along with that of thymectomy plus irradiation, for producing progressive *Myco. leprae* infection will provide a hitherto elusive means for detailed study of the pathogenesis of nerve and tissue damage as well as the antimicrobial therapy of leprosy.

S. R. M. Bushby.

The following 4 abstracts are reprinted, with permission, from *Trop. Dis. Bull.*, 1969, **66**, 9:

4. **A seminar on leprosy held at the Central Leprosy Teaching and Research Institute, Chingleput, on February 10 to 11, 1968,** by INDIAN ASS. LEPROLOGISTS. *Lepr. India*, 1968, **40**, 106.

(a) K. RAMANUJAM and G. RAMU. *Two decades of sulphone therapy in leprosy*, p. 106.

The authors provide a useful summary of the use of the sulphones in leprosy treatment, beginning with a concise historical account and giving a salutary

warning against over-enthusiastic advocacy of very low doses of dapsone. They confess themselves disappointed with alternative drugs given when patients are intolerant of dapsone, and draw attention to the not inconsiderable proportion of patients with leprosy whose management continues to present serious problems. Toxic reaction to dapsone are surprisingly rare: 4 examples of accidental poisoning in children (with one fatal outcome), allergic reactions (5 patients). Only a single case of dapsone resistance has been personally encountered by the authors.

(b) C. VELLUT. *Ten years follow-up of lepromatous leprosy patients and DDS treatment*, p. 111.

The author paints a somewhat rosier picture of the results of treatment of patients with serious lepromatous leprosy than is the experience of others. In fact, she reports that of the 142 patients (126 males, 16 females) admitted 10 years ago to hospital from roadside clinics, in the throes of acute exacerbation, 104 of those actually followed up (121) are now negative bacteriologically, and 94 are clinically quiescent. Only 6 patients can be regarded as therapeutic failures.

The standard treatment has been dapsone in all but 8 patients, but the doses prescribed both immediately after the reactional phase has subsided, and subsequently, have varied greatly. In general, the doses have been higher than those now generally recommended.

The author asks a very important question (still unanswered): Why do many patients now experience recurrence of the symptoms of acute exacerbation on doses of dapsone as low as 20 or 30 mg weekly? She also offers some excellent advice. Any recommended scheme of anti-leprosy treatment for leprosy patients who have passed through phases of acute exacerbation should be flexible, so that medical auxiliaries may be encouraged to prescribe doses adapted to the requirements and susceptibilities of the individual patient. She also emphasizes the importance of bacteriological examination of the patient whose leprosy infection is quiescent, and recommends continued therapy for such patients.

(c) S. K. NOORDEEN. *Chemoprophylaxis in leprosy*, p. 115.

This thoughtful paper continues the statistically controlled work instituted by the author and his colleagues at Chingleput (*Trop. Dis. Bull.*, 1967, **64**, 1332). The object of the enquiry was to discover if dapsone, given prophylactically to child contacts of infectious index cases of leprosy within the family, would afford protection against the development of signs of leprosy infection. Among a population of 210,000, over 4000 persons with leprosy were discovered, and 360 of these were suffering from multibacillary forms of the disease and had children in the same household. These children, numbering 718, were divided randomly into 2 similar groups: one received prophylactic dapsone at an age-related dose twice weekly.

The follow-up of contacts after an average period of 170 weeks has disclosed 67 cases of leprosy, 21 among the dapsone-prophylaxis group and 46 in the placebo group, giving an annual incidence rate of 1.78 and 3.94% respectively. The efficacy rate of dapsone prophylaxis is about 55%. It is to be noted that treatment for leprosy was given in the index cases throughout the period of investigation.

The author records some important observations concerning the pros and cons of the general applicability of his findings. For instance, chemoprophylaxis aimed at protecting children from leprosy infection, and probably protecting only one-half of them, would do nothing to prevent leprosy in adults, who represent nearly nine-tenths of those at risk (known or unknown) actually contracting leprosy. Only in exceptional circumstances could total mass chemoprophylaxis be advocated, and even then, experience with other diseases in which protective compounds have to be taken for shorter periods, does not engender an easy optimism with regard to the outlook for the mass chemoprophylaxis of leprosy.

(d) R. GANPATI and S. S. NAIK. *Urinary excretory pattern of DDS in leprosy patients*, p. 119.

The authors confirm the accepted findings that patients vary enormously in the rate they excrete in the urine orally ingested dapsone. Routine anti-leprosy treatment was stopped before a test dose of 100 mg dapsone was given, no dapsone having been found in the urine after a minimum of 10 days and a maximum of 30 days after the last dose taken by the mouth. While most patients (about 65%) excreted from 35 to 55 mg during the first 24 hours after the 100 mg test dose, some few excreted less than 10 mg or more than 80 mg. The pattern for the individual patient seemed more or less constant when reassessed after 1, 3 or 12 months. The urinary excretion rates bore no observable relation to clinical improvement or to the occurrence of episodes of acute exacerbation in the various forms of leprosy.

(e) S. BALAKRISHNAN. *Blood and urinary levels of DDS in relation to dosage*, p. 125.

Repeating previously reported work (*Trop. Dis. Bull.*, 1966, **63**, 655; 1968, **65**, abstr. 584), the author confirms that there is no detectable difference in blood sulphone levels in patients receiving dapsone orally once weekly and those receiving it twice weekly, particularly in the dose range of 100 to 150 mg. Clinical improvement seemed comparable in patients receiving low doses (25 mg twice weekly) and higher doses (150 mg twice weekly). A blood sulphone level of 0.2 mg/100 ml is associated with clinical improvement. (The minimum figure may well be lower. The level of serum sulphone at any one time bears no necessary relation to the anti-leprosy activity of the drug at the tissue site where bacilli are present and multiplying.)

By the method employed (Bratton-Marshall technique, modified by Simpson) dapsone is detectable in the blood 7 days after ingestion of 100 to 150 mg once weekly, and in the urine 14 days after ingestion.

(f) S. M. MUKHERJEE. *Ulcer care at C.L.T. & R.I.*, p. 133.

This paper summarizes the routine care of neuropathic ulcers at the Central Leprosy Teaching and Research Institute at Chingleput and includes practical advice to patients on how to live with anaesthetic extremities and keep them free from ulcers.

(g) S. L. GUDE. *Problem of ulcers of anaesthetic limbs of leprosy patients*, p. 146.

The author provides a practical, racy, and sound review of the ulcer problem as seen by a working leprologist in charge of the medical and surgical supervision of a busy leprosy hospital (1849 admissions) and out-patient service (12,206 patients). He advocates forefoot amputations for patients with badly adherent scars, and microcellular rubber protective footwear to prevent not only the first ulcer in the ulcer-prone foot, but subsequent ulcers as well. He greatly favours soaking in water for the dry and cracked skin of patients with leprosy.

(h) H. W. WILLIAMS. *Rehabilitation's biggest problem in leprosy*, p. 157.

By applying the standard procedures of plastic surgery to the deformities and neuropathic ulcerations associated with long-standing leprosy, the author has achieved considerable success. In particular, total excision followed by split skin grafting has given very good results in his hands, in the case of large foot ulcers, perhaps recurrent, where there is no involvement of the underlying bone. Various orthopaedic operations are referred to, such as those for removing unhealthy bone, or stabilizing the foot by arthrodeses (standard or adapted), and tibialis posticus tendon transfer for footdrop.

The propaganda and educative value—to students and villagers—of a successful surgical rehabilitation department in a busy general hospital has been proved.

S. G. Browne.

5. **Experience with the demonstration of *Myco. leprae* by the ' thick drop'' method according to Markianos, and nasal swab preparations,** by J. PAPAVASSILIOU and G. ANTONIADIS. *Zentbl. Bakt. I. Orig.*, 1968, **208**, 260.

The microscopic recognition of *Mycobacterium leprae* is still the only reliable method of bacteriological diagnosis, and of assessing the results of treatment. In 100 patients with leprosy, specimens were examined for acid-fast bacilli from nasal smears, ear lobe and leprous lesions. For nasal specimens, the mucosa of both nostrils was scraped with a platinum loop, the specimen smeared on a slide which was then fixed by heat. The ear lobe and skin lesions were punctured with a needle, and a thick drop of fluid 3 mm in diameter was allowed to exude onto a slide. This was dried for 24 hours at room temperature, haemolyzed with ethanol diluted 1 in 3 for 15 min. and then washed with absolute alcohol and flamed. All preparations were stained with Ziehl-Neelsen.

Acid-fast bacilli were found in 44 patients. Positive findings were:

Nasal smear only: 5 weakly positive.

Ear lobe only: 5 weakly positive.

Leprous lesion only: 8 weakly positive.

Ear lobe and leprous lesions positive, nasal smear negative: 8 patients.

Ear lobe lesions and nasal smear positive, leprous lesions negative: 1 patient.

Ear lobe, leprous lesions and nasal smear all positive: 17 patients.

As controls, specimens from the ear lobe of 100 students were examined and all were negative. The authors consider it necessary to examine all 3 specimens from each patient.

(Nasal smears were not taken from the control subjects. This is the most probable source of false positives.)

R. L. Vollum.

6. **Diagnosis and management of ocular leprosy,** by D. P. CHOYCE. Reprinted from *Br. J. Ophthalmol.*, 1969, **53**, 217.

This article opens with the suggestion that the world total of patients with leprosy may well be 15 to 16 millions; that it is possibly increasing, and that at least 4 million of these patients required skilled eye treatment.

The manner in which the various structures of the eye may be involved is described and the author makes the observation that the eyeball is rarely involved by direct spread from neighbouring lepromatous tissues.

A clinical description, with illustrations, is given serially of the lesions of the lids, corneae, sclera and uveal tract. Chronic plastic iridocyclitis in which the bacilli invade and then destroy the ciliary body, insidiously and inexorably, is stated to be the principal cause of blindness in ocular leprosy. Lesions of the posterior segment are rarer and may take the form of refractile waxy deposits at the periphery or, less frequently, discrete pedunculated nodules similar to iris lepromata or "pearls".

The writer advocates a routine examination of the eyes every 3 months by a trained observer, if possible with a corneal microscope. An error in the diagnosis may arise because of the resemblance of some of the corneal changes to those found in syphilitic interstitial keratitis.

In exposure keratitis, early tarsorrhaphy or, later, the temporalis-sling operation are advocated. In iridocyclitis, treatment is directed at the prevention of synechiae, or operation when ring synechiae threaten secondary glaucoma. Uveitis in the reactive phase may be brought about by the liberation of foreign proteins by bactericidal drugs such as B 663.

Intercurrent diseases are dealt with on their merits. Cataract operations can be performed with relative impunity and the leprous eye stands up well to keratoplasty.

The author ends on a gloomy note in stating that ocular lesions develop in spite of modern general treatment; that there are not enough trained workers; and that the number of blind leprosy patients is likely to increase.

(This paper is a useful, lucid summary. For the sake of completeness the nylon purse-string suture, as described by Axenfeld, is useful in some cases of lagophthalmos; and the Kühnt-Dimmer operation is often effective in taking up the slack of a paralysed lower eyelid.

The gardener who resumed work after a successful scleral resection is quoted. May the abstracter quote one of his cases of bilateral leprous iritis: the patient who developed cataract and who, after bilateral cataract operations, played golf better than he had ever done before?)

A. McKie Reid.

7. **The treatment of lepra reaction with thalidomide,** by J. Terencio de las Aguas and F. Contreras Duenas. *Revta Leprol. Fontilles*, 1968, **7**, 1.

The authors relate their experience of using thalidomide in the treatment of 88 patients with leprosy reactions. The starting dose was usually 100 to 400 mg daily. Sixty-eight patients had generalized lepra reactions, 15 had intense neural reactions, 2 had iridocyclitis, 2 orchiepididymitis and 1 a pseudolepromatous reaction. The drug was used for a total of 123 reactional episodes; in all the cases the reaction disappeared and the drug tolerance was excellent. The length of time for which the drug was used depended upon the intensity of the original reaction; the initial dose was gradually diminished as symptoms regressed. In many cases thalidomide ameliorated the static reactional state when the patient had been treated for some years with corticosteroids.

R. A. Wiseman.

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8. **Statistical studies on the leprosy patients treated in Kyoto University in the last 20 years,** by H. Takikawa and M. Ozaki. *Lepro*, 1968, **37**, 323 (in Japanese).

An extract from the English summary appended to the paper is as follows:

"The number of new cases of leprosy diagnosed in our institute has remarkably decreased in the past 20 years. In 1906 new cases in our institute were 154, whereas in 1967 the number decreased to only 8. 362 new cases in 1948–67 were compared with 1852 new cases in 1903–16.

The following statistical features were found. The ratio of the tuberculoid cases to the lepromatous ones has decreased; 4.18 : 1 in 1903–16 and 1.02 : 1 in 1948–67. The female cases have relatively increased; the ratios of male cases to female ones are 3.85 : 1 in 1903–16 and 2.12 : 1 in the last 20 years. There were decreased young new patients, but relatively increased aged ones in these 20 years. Especially new cases in advanced age with tuberculoid type of leprosy have curiously increased in number."

9. **Enhancing effect of antilymphocytic serum on mycobacterial infections in mice,** by J. M. Gaugas and R. J. W. Rees. *Nature, Lond.*, 1968, **219**, 408.

The antilymphocytic serum (ALS) used in these experiments was raised in New Zealand rabbits by the intravenous injection of thymocytes from CBA mice and when injected into CBA mice it trebled the survival time of skin grafts from the "A" strain of mice.

In CBA mice infected intravenously with *Mycobacterium tuberculosis*, the subcutaneous injection of ALS on 1, 4, 7 and 10 days after infection produced miliary spread of the disease and reduced the average survival time of the animals from about 35 days to 18 days. The ALS retained its activity when diluted 1 in 4, and prior treatment of the mice with normal rabbit serum had a "sparing" effect on the ALS, presumably due to immunological paralysis by the gamma globulin of the normal serum (see Lance and Dresser, *Nature, Lond.*, 1967, **215**, 488).

In mice infected intravenously with *Myco. lepraemurium*, weekly injections of the globulin fraction of 0.2 to 0.3 ml ALS reduced the number of bacilli trapped in the spleen, compared with those in the liver, and increased the rate of multiplication of the bacilli.

In view of these results, the authors suggest that the administration of ALS to man might reactivate quiescent tuberculosis. The effect on the multiplication of *Myco. leprae* in mice is being determined.

S. R. M. Bushby.

10. **Ainhum in a patient suffering from lepromatous leprosy,** by R. L. Usandivaras, E. H. de los Rios, B. A. Alperovich and J. A. Lope. *Leprologia*, 1968, **13**, 23.

A patient who had been suffering from lepromatous leprosy for nearly 40 years developed typical ainhum of the left fifth toe. The authors are uncertain if the condition in this patient is to be regarded as coincidental or related to the long-standing leprosy infection.

S. G. Browne.

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