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EDITORIAL

One of the most difficult problems with which a country can be faced is a high incidence of leprosy. In *Leprosy in India* for October, 1938 (reviewed on p. 188) the problem in Burma is outlined, and the short report on Leprosy in Portugal (p. 185) shows that even in Europe we are not yet exempt. The problem is generally aggravated by lack of funds, for leprosy and poverty tend to go together. Not that large resources are always availing, as witness for instance the lavish expenditure of skilled workers and of money in Louisiana, Hawaii and the Philippines, where leprosy has not been as quickly controlled as was at first hoped.

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If leprosy cannot be eradicated rapidly, is there at least a method available which, however slowly, gets down with a minimum of expenditure to the root of the problem? We believe that one of the most hopeful methods is that outlined in Dr. Davey's Report (p. 171). Not content with a first-class Leper Settlement housing over a thousand patients, he and his helpers have found themselves impelled to go out to the surrounding villages. After gaining the friendship and confidence of the chiefs and elders, they give them practical illustrations of how an insanitary village may be reconstructed and infection avoided. The Settlement itself can never hold more than a small fraction of all the infectious cases, but it may be used as a means to a further end, as the hub of a larger wheel, as a model of simple but effective sanitation, and a centre for training in methods to be gradually applied throughout the province.

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Multiplicity of treatments is a sure sign of the absence of a specific. In our last issue there were articles on the treatment of trophic ulcers, and in this number there is an article by Drs. Oberdorffer and Collier on this subject, which discusses the cause of ulcers and deformities. So-called trophic ulcers and deformities are the result of leprous infection of the nerves supplying the part. Infection results in pressure on the nerve fibres, whether the pressure be exerted by the granuloma, by oedema or by contraction of newly formed fibrous tissue. The question arises as to why blocking or destruction of nerve fibres should cause such conditions as decalcification of bone, ulceration and shortening of the fingers. Are they due entirely to nerve blockage, or in part to irritation of a certain special type of nerve? The authors dismiss the latter possibility for lack of evidence. But it

is difficult to account entirely for the sudden appearance of blisters, blebs and ulcers of hands or feet which sometimes accompany nerve reaction; these acute lesions seem to indicate a positive rather than a negative cause, irritation of nerves rather than mere blockage of trophic nerve supply. The right emphasis is laid on the importance of wisely planned exercises; there can be no doubt that muscle wasting and consequent decalcification, with shortening and deformity of bones, can be prevented to a great extent in this way.

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Dr. Keil's paper on hereditary factors in leprosy raises some interesting points, and we hope that all readers will be on the look-out for leper uniovular twins, with special reference to the type of leprosy. Strangely enough, we published in our last issue an article by Dr. Ryrie in which two such twins were suffering, the one from lepromatous and the other from neural leprosy.

PREVENTION AND TREATMENT OF ULCERS AND DEFORMITIES IN LEPROSY

MANFRED J. OBERDÖRFFER and DOUGLAS R. COLLIER.

The object of this paper is to present our observations and opinions on the subject of ulcers and deformities in leprosy. The importance of the subject is well known to those working in leper colonies and need not be stressed. In order to limit the scope of this paper, it appears necessary to give a short pathogenic classification of the symptoms concerned and to select that group which we intend to discuss.

Ulcers in leprosy may be of various origins :—

1. Granulomas of lepromatous or tuberculoid structure in the skin may ulcerate. All these ulcers, including typical lepra lazarina (rich in bacilli) are a direct consequence of infection with mycob. leprae, and apart from ordinary dressings require the treatment of leprosy itself. They will be omitted from this discussion.

2. Ulcers may be due to injury of anaesthetic parts of the the limbs. While we believe that minor injuries are one of the important factors in the development of all ulcers, we do not in this

paper wish to deal with greater injuries, burns, etc., which require well known, conventional methods of treatment.

3. Ulcerating " trophic " skin lesions may develop in the course of pachydermia, general atrophy of the skin or neurotrophic bullae. Their localisation does not correspond with the type of ulcer with which we are now concerned. Their treatment is essentially the same.

4. Trophic or static ulcers form the group of ulcers the treatment of which we intend to describe. In addition we wish to draw attention to certain deformities of bones and muscular disturbances in limbs, their treatment and prevention.

Before analysing " trophic " deformities and ulcers, we wish to exclude from discussion all those cases in which there is actual formation of lepromatous granuloma in the bones. Such inflammatory foci similar to syphilitic and other bacterial affections of the bone-marrow may of course lead to deformities and mutilations. They are however by no means frequent in leprosy and in our experience are only found in advanced lepromatous cases. Their treatment is the specific treatment of leprosy and need not be discussed here.

We have therefore limited this paper to those symptoms in leprosy which are considered a secondary consequence of lepromatous or tuberculoid infiltration of the large nerve-trunks in the limbs. The well-known symptoms are deformities, mutilations, muscular paralysis and ulcers.

We feel that the term " trophic disturbance " as describing the underlying condition of ulcers and deformities is a very vague one. What is meant is that a disturbance of nerves results in secondary symptoms in the area supplied by the nerve affected. It is presumed, but not proved, that apart from motor and sensory fibres there exist so-called trophic nerve-fibres which regulate the nutrition and the metabolism of the area supplied. We do not deny that such fibres might possibly exist, but we are inclined to base our explanation of observations largely on better established facts. Clinical and pathological analysis of the symptoms concerned reveals the following :—

1. In all of them there is evidence of damage of one or several large nerve trunks, such as the ulnaris, the medianus, the radialis, the peroneus, the musculo-cutaneous, the tibialis posterior. The lesion producing this damage is different in each type of leprosy. (Grieco, Takino, Jermakova, Ermakova, Chatterji). In lepromatous cases there is a more diffuse infiltration with Virchow cells which is not very vigorous and does not destroy many of the nerve-fibres. In marked tuberculoid cases

there is vigorous, well-limited tissue-reaction, sometimes with abscess-formation. In this type the mechanical pressure of the inflammatory focus results in rapid destruction of nerve-fibres. The tissue reaction in the simple neural cases is only a minor degree of what in advanced types is called tuberculoid. Clinically, soft thickening or induration due to scar-formation is found in palpation of the nerves, particularly in certain well-known predilected parts such as the ulnaris above the elbow, etc.

2. The most constant symptom of nerve-involvement is anasthesia to slight touch, pain or temperature. Indeed we do not remember any case of secondary deformity in leprosy in which there was no symptom of sensory disturbance in the area concerned.

3. In all cases with deformities we find various degrees of muscular paralysis, from slight reduction of muscular strength and visible wasting to complete ulnar, peroneal or facial paralysis. We wish to add here—and this holds good for the distribution of acro-anaesthesia as well—that in distinct lepromatous cases anaesthesia and muscular wasting are not extensive and usually without the marked limitation seen in neural-tuberculoid cases. Here, and in the simple neural case which is a minor stage of the same, we find that muscular wasting and anaesthesia is frequently restricted to one small group of muscles and to one well-marked area of sensory disturbance. Moreover, unilateral deformities are frequently seen in neural-tuberculoid, but scarcely ever in purely lepromatous cases. The picture however becomes more complicated in those cases which, while in their preliminary stage they are neural-tuberculoid, later turn lepromatous. As will be seen later, this difference of intensity of fibre-destroying tissue-reaction in the two clinical types of leprosy has an important bearing on the pathogenesis and treatment of deformities.

4. In lepromatous cases we frequently find a diffuse, non-inflammatory oedema of hands or feet which may often persist for a long time and is often, if not regularly, followed by mutilation. (Plate 1). We have never seen this acro-oedema in neural cases. The significance of this symptom will be discussed later when we come to describe the pathogenesis of deformities.

5. Deformities and mutilations are present in various degrees. We find simple contractures of fingers and toes. Later, shortening of hands or feet, while finally mutilation in the form of retraction takes place. In nerve leprosy these mutilations are frequently of a different shape to those in lepromatous leprosy. We have recently studied the Röntgenology of a number of deformed and mutilated cases and agree with the findings of Leloir, Deycke, Hirschberg and Biehler, Businco, Wayson and Garland, Nonne,

Hayashi, Walter, Murdoch and Hutter, Wooley and Ross, Harbitz and Lee, Jame, Jakob and Jude. We found that the essential change is decalcification, and in a few cases we have found lepromatous osteomyelitis and periostitis, as did Beitzge and Hirschberg and Biehler. As noted above, we consider this event to be a rare one. The reason for decalcification has been explained in various ways. There is no agreement in the biochemical findings so far, and the rarity of specific lepromatous infiltration makes one believe that the decalcification must be a secondary process connected with the involvement of the nerves. We exclude here periostitis leprosa and the rare primary affections of joints in leprosy. Our own findings, which have been recently published in detail (Oberdörffer—Collier), give strong evidence for the following idea of pathogenesis of these deformities. We found that in neural-tuberculoid cases the decalcification is most marked in those bones which receive insertions from paralysed or semi-paralysed muscles, while in lepromatous cases decalcification and mutilation is more diffuse and more marked in the small bones at the ends of the limbs which carry insertions of small muscles. From these observations we deduced the following theory.

Decalcification is the direct consequence of complete or partial musculary paralysis. The bones receive their blood-supply not only from the central nutrient artery, but also from the periosteal vessels which enter the bone through the insertion of the muscles. It is known (Häupl) that the process of calcification and decalcification in bones is regulated by the regular intermittent change of hyperaemia and anaemia. This process can be disturbed by the blocking or constriction of the nutritional artery. Such an event leads to the group of diseases called Kienboeck's Disease, or aseptic necrosis. In leprosy we have never seen it. The leprotic affection of the sympathetic nerves which regulate the blood supply through the nutritional artery is not common. Much more does the blood-supply of the periosteal vessels underlie interferences by leprosy. It is well known that active exercise leads to intensive calcification in those bones the circulation of which is supplied by the muscle in training. Leitner has recently described observations which tend to show that in deformed limbs of lepers blood-vessels are generally dilated. This confirms our idea that semi-paralysed or fully paralysed muscles produce a stasis in the periosteal blood-supply of bones, and that the result is decalcification, particularly of those bones which receive muscular insertions from muscles enervated by damaged nerves in leprosy. We do not think that Harbitz's idea of the trophoneurotic origin of deformities in leprosy can be upheld in its full application. Nor do we consider osteoarticular periostitis

(Karaseff, Murdoch and Hutter, Grainger) to be of primary nature in the development of mutilations. Decalcification is in our opinion essentially the consequence of muscular paralysis or semi-paralysis. One may answer then that similar deformities should be expected in cases of infantile paralysis or mechanical destruction of nerves. We think that the particular localised atrophy to a degree of disappearance of parts of the bones is due to the incomplete destruction of nerve-fibres in the different degrees or stages of leprotic involvement of nerves. It is natural that parts of the bones whose muscle insertions are supplied with unparalysed muscular fibres will remain intact, while in others the complete disappearance is due to the constant passive hyperaemia which is increased by functional activity in the unparalysed muscle groups in the vicinity. Details should be read in our original paper on the subject. We think however that this is not the full story. Decalcification of the bones does not occur besides after muscular inactivity in the area adjoining inflammatory or oedematous foci (Sudeck's Atrophy). We have stated above that in lepromatous cases we frequently observe an acro-oedema of hands or feet. We are inclined to believe that such acro-oedema may give rise to increased absorption of bones where a mild degree of inactivity has already prepared the path. This observation would explain the difference of degree and the difference of localisation in mutilations of the neural-tuberculoid and the lepromatous type. It may be added that in later stages secondary infections from penetrating wounds may lead to periostitic and calcified infiltrations. These, in our opinion, are entirely of secondary character except the rare cases mentioned above in which there is specific lepromatous periostitis.

Following these ideas and thus stressing the importance of muscular semi-paralysis secondary to nerve-lesions in leprosy, we find no difficulty in confirming the views of Muir *et al.* concerning the pathogenesis of trophic ulcers in leprosy. These ulcers, which are mostly confined to the sole of the foot, originate in the following way. The semi-paralysed muscles of the sole of the foot become thinner and offer less elastic resistance to the bones of the heel, of the big toe, or of the sesamoid bones or of partly necrotic phalanges. These pierce the skin, or produce such local pressure on the skin as to interfere with the blood-supply of the area concerned. This area of thin ischaemic skin will sooner or later give way to local injuries and the ulcer is formed. Secondary infection later may produce sequestration of bones or far-reaching destruction of subcutaneous tissue. The essential pathogenetic condition in the development of ulcers however is semi-paralysis of muscular and elastic tissue resulting in abnormal static pressure

and finally in ulcer-formation. In this instance we see no reason to give undue importance to " trophic " disturbances.

As we intend to include another subject in our therapeutical notes, we wish to mention that facial paralysis is of essentially the same nature as muscular paralysis in the limbs, i.e. it is semi-paralysis rather than a complete one.

We differentiate the following methods of attack in prevention and treatment of secondary deformities and ulcers in leprosy.

(1) Treatment of leprosy by specific methods is the primary object and need not be discussed here. Furthermore it is not within the scope of this paper to deal with general treatment as far as management of diet and conduct and treatment of predisposing diseases is concerned.

(2) Treatment of deformities and ulcers by intravenous injection of Mercurochrome, Synthol soufré (Tisseuil) and other disinfectants has so far not found general acknowledgment.

(3) The one point which should be considered and treated first in these conditions is the localised infection of the large nerve-trunks. A vast number of drugs has been recommended for the subjective relief of nerve-pain in leprosy. So far, Ephedrine gives satisfactory results, though by no means in all cases. We consider the results obtained by De la Plaza, Vegas and Gomez, by De Moroes and Chopra by injection of crotalus toxin as a palliative and probably deplethoric application. The essential aim of therapy in the conditions concerned is, besides subjective relief of pain, the diminution of vigour of the inflammatory reaction in the nerve in order to prevent secondary destruction of nerve-fibres by oedematous pressure and the subsequent development of deformities and ulcers. Several methods are being employed to produce such a diminution of inflammatory reaction. Cochrane and Raj and others have recommended injection of alcohol along the nerve. Gupta tried cloretone in olive-oil, and others inject hynocarpus oil along the nerve. We are inclined to believe that in all these methods there is no specific factor involved, but that there merely occurs a transference of inflammatory reaction from the nerve to the surrounding tissue. Diathering is, according to Dow, of no value in acute nerve-reaction, though very beneficial afterwards. We think that in leper colonies where it is financially possible the use of a vitamin B.1 preparation like Betaxin (Keil) should be given a trial. Though we do not think that vitamin B.1 is a specific therapy for leprosy, the deplethoral action of this drug, particularly on nerve-tissue, might be employed. At present the best method of relieving oedematous pressure in nerve-reaction appears to us to be nerve-decapsulation. This has been recommended and carried out by Chatterji, Gass and others. We are

aware of Dow's sceptical attitude with regard to late results of such decapsulation. Decapsulation may even be harmful, if a too vigorous scar-formation follow the acute stage. We have therefore restricted our activities in this field of late to simple longitudinal splitting of the nerve-sheath, and so far the results have been very satisfactory. Indeed we have made this method the standard treatment of acute nerve-reaction in this leper colony. The restriction of scar-formation by this method to limited areas of nerve-sheath does, in our experience, prevent the fixation of surrounding tissue in a tough ring around the whole nerve, which so frequently occurs after decapsulation.

(4) Deformities without ulceration have so far found only limited interest in the treatment of leprosy. Mobilisation by active and passive exercise has been recommended by Dow, Denny, McIlhenny and Muir. We find however that while such measures as applied to already existing deformities may and do produce beneficial results, too little attention is being given to the preventive power of active exercise in the case of lepers who are still free from deformity. Following our theory on the development of deformities as a consequence of semi-paralysis of muscles following nerve-involvement, we consider it possible, and indeed probable, that active exercise of the particular muscle-groups concerned will prevent the development of deformities in general. We have therefore introduced for every leper here daily exercises as follows :—

The purpose of the exercises is to strengthen and train the small muscles of the hands and feet, namely the lumbricales, the interossei, the adductors and abductors of the thumb, and the corresponding muscles of the feet, the interossei, the flexor, abductor and adductor hallucis. Similarly there are exercises planned to train the facial muscles and the orbicularis oculi. We have used drums and other percussion instruments as a means of keeping time and promoting uniformity.

1. Vigorous opening and closing of the fist, i.e. alternate flexion and extension of the fingers combined with extension and flexion of the arms by a forward movement.

2. Standing on one foot, the other is raised forward and the foot rotated at the ankle. Repeated with the other foot.

3. Rotation of the thumbs. With the hand held forward the thumbs are rotated in as large an arc as possible. The two thumbs may be exercised together or one after the other.

4. With arms extended forward at shoulder height, the first finger of one hand is grasped with the other hand and forcibly extended with a backward bending movement. This is repeated for each finger of both hands.

5. With the palms of the hands together the fingers are interlocked. Then the palms are spread apart and the fingers extended against each other as the hands are slowly raised as far as possible above the head, then brought down to chest level and as low as possible in front.

6. Bending at the waist, the outstretched hands touching the ground just in front of the toes, without bending the knees. This of course is a general exercise, not appertaining to the treatment of this particular disease.

7. Flexion of the toes. Standing on one foot the other is slightly advanced with the heel on the ground and the toes raised. They are then alternately flexed and extended in as large an arc as possible.

8. Deep breathing. With the hands on the hips the lungs are alternately expanded and contracted by deep breathing. This again is a general exercise.

9. Another general exercise. Standing on the toes, hands on hips, the body is lowered as far as possible by bending the knees while keeping the back straight.

10. Facial movements. The mouth is opened widely and closed alternately. Then the mouth is moved laterally from one side to the other.

11. The eyes are alternately opened widely and closed. The movements are exaggerated so as to give the fullest motion possible to the eyelids.

Each of the above movements is repeated about ten times, the exercises occupying about half an hour daily.

Judging from the influence on existing deformities, we find that 70 per cent. of our N.3 cases (cases with deformities) have been considerably improved by the exercises. In the case of facial paralysis we add active massage of the eyelids and find that in a great number of cases this condition also shows marked improvement.

Unfortunately we cannot claim priority for this prevention and treatment of deformities, but are obliged to give full credit to the unknown artist who in the 11th century sculptured the bas-relief in the Bayon at Angkor-Thom in Indo-China. Oberdörffer found that amongst these bas-reliefs there is one depicting a leprous king whose claw-hands and deformities are treated by active exercise.

The underlying idea of the preventive exercise is to produce increased calcification by increasing the activity of those muscles which are most likely to become semi-paralysed by nerve-involvement in leprosy. This is particularly important in those lepromatous cases with acro-oedema in which the oedema forms a second and very potent cause of decalcification.

We think that such exercises, by removing the predisposing cause of ulceration does at the same time in a great number of cases prevent it.

(5) Once ulcers have developed, we are concerned with a quite different problem, and many methods have been devised to deal with it. Various antiseptics and dyes have been recommended by Berny, Floreani and others. In our experience there is, so far, no drug which has found the approval of all leprologists. It goes without saying that in those cases where necrotic septic bone is present amputation or sequestrectomy affords the best results, but even then results are not always satisfactory. Periarterial sympathectomy (Black) has not found many followers. Other surgical methods with quite promising results are the free excision of the edges of an ulcer and skin transplantation. Other authors have reported on the beneficial action of periulceral injection with chaulmoogra preparations. Though we do not doubt the beneficial results recorded, we fail to see how a drug which is supposed to act on the leprosy bacillus should have specific action on a secondary tropho-mechanic lesion. We think that the effect is only an unspecific stimulation of the tissue surrounding the ulcer. In the following we propose a new treatment of ulcers, but we certainly do not want to discredit other methods previously recommended. Indeed we think that our method would form a suitable combination with all other previous ones. We have described above what we consider is the pathogenetic process of ulcer formation. The theory that semi-paralysis of muscles and static disturbances produced thereby are of paramount importance in the production of ulcers leads inevitably to the conclusion that static relief of pressure is the first condition to be fulfilled. We try to do so by padding the sole of the foot in such a way that the weight of the body no longer rests on the ulcer. These pads are made of canvas filled with rice-husk or other suitable material; they can easily be applied and fastened with a tape at each of the four corners. This method has been recommended before, but its importance has apparently been overlooked. In the local treatment of the ulcer we are very conservative. A weekly change of dressing, on which occasion the foot is well bathed in antiseptic fluid, is considered sufficient. The dressing is done with a thick application of the following ointment :

Mercurochrome	2 oz.
Honey	8 ,,
Cod Liver Oil	8 ,,
Zinc Oxide Powder	4 ,,
Bismuth Subnitrate	2 ,,
Vaseline	12 ,,

Mercurochrome 2 per cent. serves as disinfectant; honey is rich in ferments and stimulates scar-formation; cod-liver-oil has been found beneficial in other ulcerating conditions; zinc oxide serves as an absorbent; bismuth subnitricum as a mild astringent; and vaseline as a suitable carrier. The results of this treatment of combined padding and ointment are seen in the photographs. So far all the ulcers here have reacted very beneficially. The padding enables the leper to walk about and to get sufficient general exercise, while the ointment appears to have an unspecific beneficial effect. The experiments with this procedure were carried out without applying any other. We believe that combination with other surgical methods would give still better results.

In addition to our methods of prevention and treatment of ulcers and deformities in leprosy, we want to stress the importance of destroying by caustics or other methods reservoir foci in the nose. We find that cases which are bacteriologically positive in the nose do as a rule show much more advanced deformities than the negative ones.

Ulcers and deformities—those most deplorable consequences of infection with mycobacterium leprae—can be prevented and can be treated, if their pathogenesis is realised and further studied. Surely there is no lack of patience among those who work with lepers. May part of this patience be diverted to watchful prevention and treatment of ulcers and deformities.

We want to thank the Chiengmai Leper Asylum, which is partly subsidised by the American Mission to Lepers, for supplying facilities and funds for this and other investgations.

DESCRIPTION OF PHOTOGRAPHS.

1. Acro-oedema in lepromatous leprosy.
2— 8. Different phases of exercise and band.
9. Padding of ulcers.
10—11. Before and after 2 months of our ulcer treatment.
12. Ulcer treated for 2-3 months. The white line gives the size of the ulcer before treatment.

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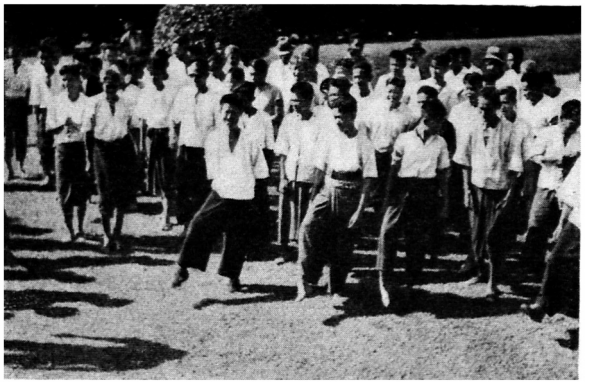

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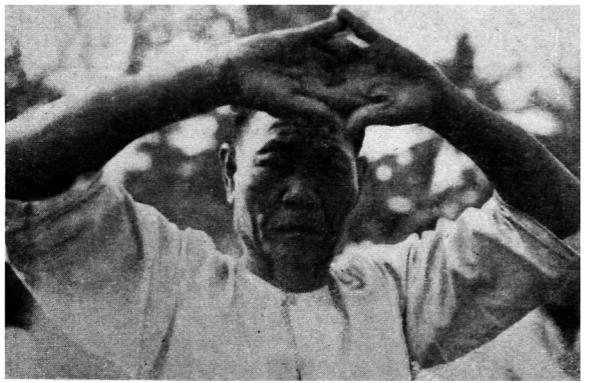

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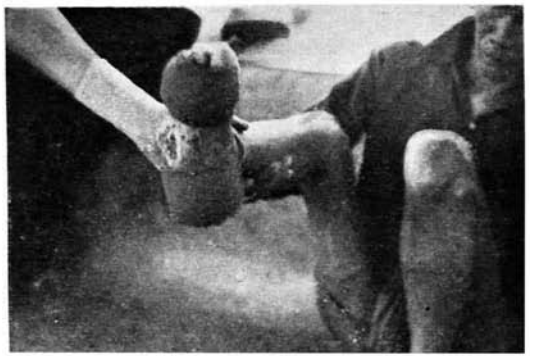

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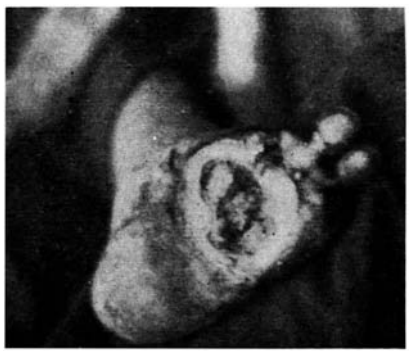

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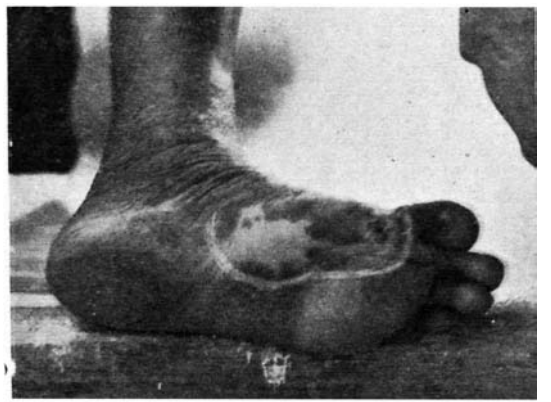

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* HEREDITARY FACTORS IN LEPROSY

ERNST KEIL.

Until a few years ago infectious diseases, under the impress of the great discoveries of the bacteriological era, were looked upon almost exclusively as the result of contagion. It is certainly true that in leprosy the presence of Hansen's bacillus is essential to the existence of a lesion, yet the epidemiology of leprosy clearly demonstrates that mere exposure to infection is not an all-powerful factor in the genesis of the disease, since the number of individuals so exposed who escape the consequences is so great that its significance cannot be disregarded. It is now known that the most adult persons, even when permanently in the most intimate contact with lepers, remain free from the disease, and it is sufficient to recall that doctors, nurses and even matrimonial partners, notwithstanding very heavy daily exposure, rarely become infected.

In the past decade the attention of investigators of this problem has been more especially directed to the sum total of the agencies which, apart from the externally-acting leprous virus, affect the organism and promote the development of a leprous lesion.

* The original article appeared in the Arch für Schiffs und Trop. Hyg. 43-3, 1939; the author has sent in this English translation for publication.

Although the multitude of manifestations makes an assured classification of the extremely complex environment influences very difficult, enquiry into such possible harmful factors as defective nourishment, conditions of life, secondary infections and so forth shows that these may have far-reaching effects upon the visible aspect and spread of leprosy (Rogers and Muir). It is, for instance, generally recognised to-day that the mortality of leprosy falls as soon as the standard of life in the community is raised.

The naturally-constituted counteracting forces, and the principles of heredity associated with these, are of great importance for the progress of a leprous infection; for we know that variability of resistance imposes a certain selectivity of attack, although probably the entire human race is susceptible to invasion by the Hansen bacillus. Daily observation shows that, while many persons, both young and old, when exposed to infection are receptive to the bacillus, yet only few of them contract the disease. The widespread receptivity to the infective organism suggests an analogy with diphtheria where, as a rule, such receptivity leads to the creation of the "carrier" class and comparatively seldom to the clinical event. Predisposition, which forms part of "constitution," explains why the body, when exposed to the infection of a given disease, contracts that disease with more than average probability. Thus, in relation to the general susceptibility of mankind to leprosy, predisposition would seem to indicate something accessory, enhancing, and provocative of the phenomenon of leprosy. This constitutional, individual factor is, in part at least, based upon one or more hereditary peculiarities. These peculiarities, though scarcely responsible for the actual colonisation of the leprosy bacillus, may well exert a wide and even decisive influence on the individual features of the disease, such as the mildness or severity of its course.

As early as the middle of last century leprologists believed that leprosy might have a hereditary basis. At that time the theory which had already been founded at an even earlier date, derived its chief support from the writings of Danielsson and Boeck (1848). These investigators regarded the family group-incidence of leprosy shown in statistics not as the consequence of inter-family infection, but as a manifestation of a hereditary disease transmitted from one human being to another. Among those who held this view of leprosy were Virchow, Babes, Blaschko and Jeanselme, and it remained valid until the 'seventies of last century, when it was relegated to the background by the convincing evidence of bacteriology and epidemiology. Since then there have only been isolated references to the relations of constitution and blood-grouping to leprosy (Süäsk, Suzue and Kawarura, Aoki). The

investigations of Diehl and v.Verschuer, however, have again directed attention to the significance of a hereditary basis for the genesis and progress of infectious diseases. With the aid of research on twin-births these investigators have shown that underlying the aetiology of tuberculosis, a disease recognised as resembling leprosy in many respects, there is a recessively inheritable predisposition which has a clinical manifestation probably of about 80 per cent.

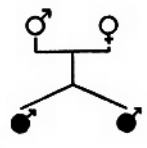
Research on twin-birth has lately acquired increasing importance in the study of individual predisposition based on the principles of heredity. By its aid is now being sought (1) to furnish proof of a specific inheritable predisposition, (2) to evaluate the probability of manifestation of this predisposition, and (3) to discover the effect of peristasis. To gain an insight into what happens biologically in heredity, twin-birth research compares two human groups distinguished from one another solely by dissimilarity of determinant factors. By the keeping of statistical records of twin born from one ovum or from two, it can be ascertained how often a given disease will be found to attack both or one of the pair. The former event is referred to as concordant, the latter as discordant, behaviour. The principle of the comparison is based on the fact that every inheritable disease is encountered more frequently shared in identical (i.e. uniovulary) than in non-identical twins, and again in the latter more often than in subjects not of one family. The concordance-frequency of uniovular twins is, without exception, greater than in biovular twins, and the latter, being non-identical, differ therefore in the same way as ordinary members of a family in certain hereditary factors. The inheritable characteristics of biovular twins must therefore naturally differ more often. The bi-partite uniovular twins must possess identical predispositions, and to this is to be attributed the remarkable similarity of structure, appearance, and vital manifestations of twins born from one ovum.

If an inheritable natural tendency is an essential factor in the genesis of and resistance to leprosy, then we might expect not only a greater but also a far more frequent correspondence of the phenomena associated with leprosy in uniovular than in biovular twins. A concordance in uniovular twins as applied to leprosy, particularly if environmental discordance coexisted, might therefore be looked upon as clear proof for an inheritable predisposition to the disease. The possible courses taken by an infection in uniovular and biovular twins are (1) the disease might pursue a more or less identical course in both twin-partners, (2) both partners might contract the disease but the clinical course would be different, or (3) one of the pair might contract the disease while the other remained healthy.

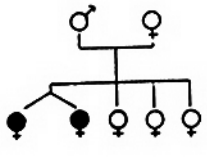
The fundamental principle in research on twin-birth is an accurate diagnosis of uniovularity. The normal method of determining the hereditary equality of twin-pairs of the same sex is the poly-symptomatic parity method of Siemens and v.Verschuer. It is based on the resemblance, so close as often to arouse astonishment, existing between uniovular twins and the dissimilarity between those not uniovular. This external likeness, often photographically exact, can persist until advanced age even under varying environmental influences. In the polysymptomatic method of diagnosis the qualities taken into account are mainly those which in uniovular twins nearly always correspond, but in biovular twins seldom do so. Especially valuable is agreement in inheritable characteristics which peristatically are not variable, such, for instance, as the blood-group. The diagnosis should not of course rest on a few characteristics only, and although a certain amount of unreliability is found to exist in the estimation of uniovular twins, yet in practice the method yields results sufficiently trustworthy. Examination of the placenta and foetal membranes for proof of uniovularity is possible only in exceptional cases; moreover as even uniovular twins with identical predispositions can be born in separate membranes, the value of placental examination is doubtful.

The frequency of occurrence of twin-births varies, according to Diehl and v.Verschuer, in different latitudes, probably in accordance with racial differences, climatic influences, etc. As a generalisation it may be said that proportionately more twins are born in cool than in hot countries; although no statistical record of twin-births in Surinam has been compiled as yet, my enquiries appear to confirm the truth of this statement, for the number is smaller there than, for instance, in Germany. In Surinam the proportion is 1—136, while in Germany, according to Diehl and v.Verschuer, it is 1—85. About 30 per cent of twins born in Germany are uniovular (v.Verschuer).

Among about 400 patients in the Leprosy Polyclinic at Paramaribo five pairs of twins (Nos. 1—5) were found. In Cases 1 and 2 both twin-partners proved to be leprous, in Case 3 only the one partner.



Case No. 1.



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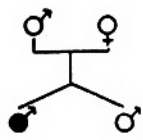
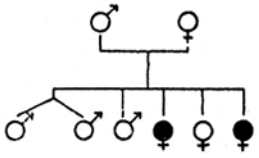
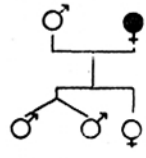


Case No. 3.

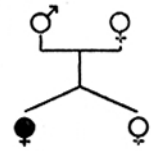
Case 4 shows twins of whom both were free from leprosy, but who lived permanently with two cases of early leprosy in members of the same family. In Case 5 the mother of the twins was leprous, but they themselves were free from the disease. Another two pairs of twins were to be found (Nos. 6 and 7) among the — 550 patients in the Surinam leper colonies; in Case 6 one partner was leprous, while in Case No. 7 both partners were diseased.



Case No. 4.



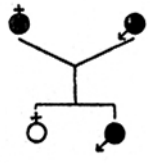
Case No. 5.



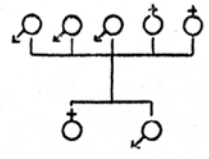
Case No. 6.

Since uniovularity could not be determined with certainty on external grounds in the twin-pairs of the same sex up to Case 7, their description can be passed over. Case 7, however, illustrates the opportunities for observation offered in the investigation of leprosy in twins.

Case No. 7. Twin-pair N. Creoles, born in Paramaribo in 1905. On the mother's side of the family no occurrence of leprosy could be traced. She had five healthy children by a man other than the father of the twins.



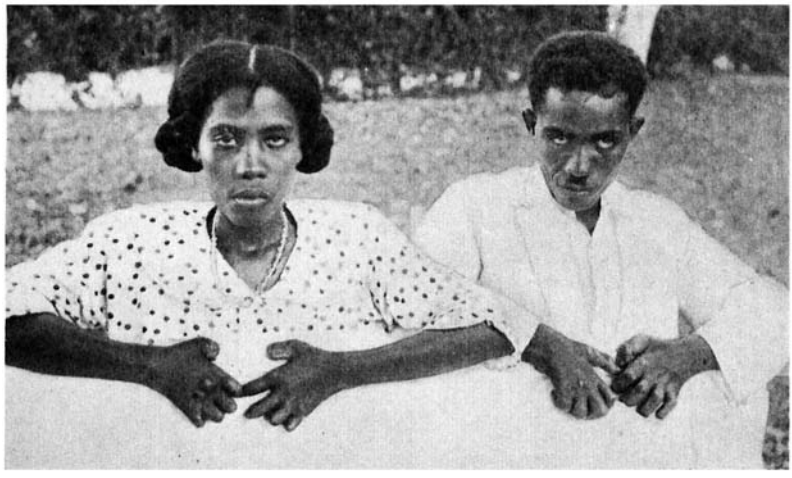
Case No. 7.



Case No. 8.

Three years after the birth of the latter the father died in a Surinam leper colony, of a severe type of nodular leprosy from which he had suffered for several years. While the female twin had been sent to live with the maternal grandmother, the male had remained with the mother, though the brother and sister had frequent opportunities of meeting. Of contact with lepers, particularly with their father in the leper colony, nothing certain could be ascertained. The first signs of disease were seen in the female at the age of 7, in the form of patches on both cheeks, and in the boy at the age of 11, of patches on the right gluteal region. In both the patches increased in number and extent as the years went on. Hyperaesthetic and, later, anaesthetic areas, thickening of the ulnar nerve, and other nervous symptoms made their appearance at the same rate and at much the same time in both

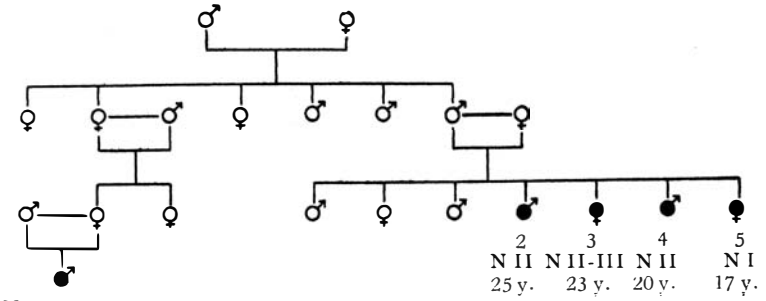
patients. About the year 1930 both began to develop muscle-atrophy and contractures of the fingers; at the time of the last examination in 1935 both showed definite atrophy of the thenar and hypothenar muscles and interossei, with deformities of the terminal phalanges, contracted position of the fingers, and claw hand. In the male there was also a left-sided facial paresis and abduction of the thumbs. Both patients were consistently bacteriologically negative. They now exhibit the picture of *Lepra nervosa* in the third stage. The course of the disease is obviously highly concordant.



Twin-birth investigation needs to be supplemented by methodical family research; for comparison between healthy and diseased members of a family can also contribute to disclose the significance of heredity where exposure to infection is sufficiently equalised as to lie within a safe margin of probability. Leprosy, like tuberculosis, is not merely a disease of isolated individuals, but, even if at times subject to great oscillations, can frequently be traced in the same family for generations. The familiar grouping of leprosy cases in families can certainly be attributed, in part at least, to increased intrafamilial exposure due to the greater bacillary dissemination, and also to the concentration of other environmental influences shared in common. Yet the remarkable fact remains that, in spite of equality of surrounding conditions within a family, different degress of susceptibility to leprosy infection obviously exist. Under the primitive conditions of life obtaining in leper countries all children in a leper family are fairly uniformly exposed to infection, since for months and years they often share the same room and even the same bed with the diseased; in spite of this, however, by no means all

children contract leprosy. The high incidence of leprosy in the ascendancy of certain tribes also points to the fact that the genesis of leprosy is favoured by factors which do not have their origin in environment. It might be thought that the inability for immunisation also occurs in family groups. We know that the children of leprous parents, owing to a certain lack of vigour, are attacked by other infectious diseases more often than children of similar age belonging to the healthy population (Hopkins, v.Duering), and the supposition is that the greater mortality from leprosy among descendants of leper families is also connected with this circumstance (Aycock and McKinley). In leper families those persons are usually attacked who resemble the leprous member, while those who do not resemble them are able to resist the disease. Human beings who resemble one another in both physical and psychical respects, such, for instance, as parents and children, are known to exhibit similar pictures in illness under approximately similar outward and inward circumstances; in the same way it may happen that within a family circle leprosy takes a course which is peculiar to that family. An example of this is shown in Case 8 (Majella Leper Colony at Paramaribo) where all the five members diagnosed as leprous developed in the course of years a uniformly pure type of nervous leprosy.

Tisseuil describes eight cases of familial leprosy in which the course of the disease in parents and children was strikingly similar. The clearly shown tendency of leprosy to attack certain organs in members of the same family has given rise to the assumption of a familial organic predisposition. In one case observed by Gougerot and Ruppet the leprous skin lesions of father and son were so alike as to appear " traced "; both suffered from the maculo-anaesthetic type. Jordan also describes in father and son a close resemblance in type and extent of maculo-anaesthetic leprous foci. This agreement in localisation could be interpreted as implying that inheritance of specific qualities in the terrain is



Case No. 8.

possible, and that in some circumstances a localised predisposition to attack by the leprosy bacillus can be inherited.

It is essential for research on heredity in leprosy that the greatest possible number of characteristic cases of twin-pairs and the genealogical trees of leprous families should be assembled. The greater the number of investigations included in the statistical matter the less will be the error inherent in the small number. The study, extending as far back as possible, of blood-related families should take stock not only of descent in the direct line but of collateral descent also. Of particular value are twin pairs the partners of which grow up separated from one another under dissimilar surrounding conditions. Pairs from a leprous milieu, even if they themselves are free from leprosy, also come within the scope of the investigation. The cases should not be specially selected, neither in twin-birth nor family research, as a selected clinical material tends as a rule to collect in a leper colony. It may be mentioned that in compiling such statistical records the investigator often encounters a not unnatural opposition in the families concerned; tact and mutual understanding is therefore essential.

As stated earlier in this paper, the causal complex underlying leprosy is made up of exogenous, specific infective, and peristatic factors. How far the inheritable constitutional factor is involved remains an open question. There is much in support of the conjecture that in leprosy—as in tuberculosis—the infective organism, environment, and heredity stand in reciprocal relation to one another, and that in a given assemblage of factors each of these three primary factors can decide the issue and determine the course of the disease. So much is certain, that so complex a process as leprosy infection cannot be elucidated by exploration of a single avenue; only by scrutiny of the event as a whole can we safeguard ourselves against giving undue weight to the one or the other possibility. An understanding of the aetiological dynamic of leprosy would be very greatly advanced, if the share of each of the three primary factors could be exactly estimated, and the principal and secondary causes ascertained in individual cases. It would seem that research on heredity, and particularly on twin-birth, can thus furnish a valuable contribution to knowledge of the aetiology and pathology of leprosy. The study of the question whether individual hereditary predisposition is an underlying factor in the disease will assist an understanding of the occurrence of leprosy in its individual determinants. To stimulate this study, in default of the possibility of further work by the present writer, is the main purpose of this paper.

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UZUAKOLI LEPER COLONY

T. FRANK DAVEY.

During the year 1938 the work of the Colony was maintained in all departments, but as a comprehensive report was submitted a year ago, it is proposed on this occasion chiefly to indicate the changes and new developments which have occurred during the year. Particulars are given under their respective heads.

ADMISSION AND DISCHARGE OF PATIENTS.

There has been little change in the total population of the Colony, as I consider that a figure in the neighbourhood of a thousand is the maximum which is consistent with any real degree of personal attention. This figure had been attained at the beginning of the year, and in consequence the Colony was closed to the admission of all except a few special and needy patients for the greater part of the year.

All Native Administration quotas have been constantly full and have indeed been exceeded in two instances. The authorised total remains at 510 patients.

At the beginning of the year a number of so-called paying patients had reached the end of their resources and for some time they were supported by private contributions. In September the District Officer, Bende, agreed to give all lepers the right of free

court action against their relatives if these failed to provide for them. This decision has been recommended to other Divisions. Seeing that they would be supported at home, all insolvent lepers were discharged, and during 1939 most of them will be able to receive treatment in the neighbourhood of their homes.

The admission of paying patients is almost at a standstill, but a few have been admitted and a charge of £5 has been made, this amount to cover the cost of such patients for two years.

Statistics. The following are the statistics for the year :—

Patients resident December 31st, 1937—

Males	773
Females	379
Total	1152
Patients admitted ...	79
Patients discharged ...	111
Discharged cured ...	16

Discharged for other causes, including symptom free people, 95

Deaths	43

Number remaining on December 31st, 1938 :—

Males	779
Females	358
Total	1077

Use is made of the word " cured " in describing certain cases discharged, as distinct from " symptom free ". There is a reason for this. It is now common experience in Nigeria to find that there is a high relapse rate among patients discharged when all visible signs of leprosy have disappeared. There is an increasing number of symptom free people in the Colony, and before any are discharged, a probationary period of at least six months is required. At the end of this time they may be discharged as " symptom free " if they so desire.

During the year, the iodide reaction has been introduced, and patients at the end of their probationary period have been submitted to the test. By this means any latent focus of leprosy is revealed, and patients who prove negative to the test may be considered as free from their disease, and it is therefore legitimate to use the word " cured " in their case. The number of such cases is low, but it is not anticipated that there will be relapses among them.

It is a complete fallacy to assess the usefulness of the Colony by the number of people discharged annually. If none but suitable cases were admitted it would be possible to render 100 per cent of them symptom free. There has been a considerable change in policy at Uzuakoli during the last 18 months in regard to this matter. The Colony is not an isolated unit the sole purpose of which is to render lepers symptom free. Seeing that not more that two per cent of the lepers in the Province can be treated at Uzuakoli, and no increase in the number of such Colonies can be contemplated, it is surely the duty of the Colony to serve the

leper population in the best possible way. For this reason, the work of the Colony is rapidly becoming specialised, and admissions are being confined to certain types of case. Ultimately, it is intended that the Colony shall consist of the following types of case only :—

1. *Cases needing hospitalisation.* All kinds of surgical and medical conditions arise in lepers, and at the Colony there are facilities for proper hospital treatment of all descriptions.

2. *Educated lepers* who can be trained for work in a scheme of leprosy control in the Province.

3. *Destitute and infirm lepers* whose lot involves considerable suffering and who can receive special care at the Colony.

4. *Infectious cases.*

5. *Children*, particularly those without proper guardians. These are numerous, and at the Uzuakoli Colony they can have careful treatment, proper diet, facilities for education and exercise, and oversight at a time when it is especially needed.

6. Sufficient strong and able-bodied lepers to carry out essential services, farming, etc. This must approximate to 50% of the whole.

It will be seen that when the population of the Colony is specialised in this way, statistics relating to discharges and deaths etc. offer no clue to the degree of usefulness of the Colony. As opportunity arises, new admissions to the Colony are made to conform to the new plan.

MEDICAL WORK.

The medical work of the Colony is on a tremendous scale. Every week, 2,300 leprosy treatments are given, and if dressings and the treatment of ailments other than leprosy are included, the figure approaches 4,000.

In every way, efforts are constantly made to render the medical service as efficient as possible, and for the most part there is now little to be desired.

The year has seen the introduction of a more accurate investigation of newcomers. When a patient is admitted he is now submitted to a thorough clinical and bacteriological examination, and as a routine, laboratory tests are carried out on his blood and excreta, while the Kahn test is applied to all cases.

As a result of this scientific investigation preliminary treatment is instituted which differs from one individual to another, but which meets the need of each. It is thus certain that every patient begins his specific leprosy treatment with everything possible in his favour.

Leprosy treatment is given twice weekly, intradermal injections being given on one occasion, and subcutaneous injections on the other. A variety of mixtures has been in use, and at present the experimental use of mixtures containing creosoted hydnocarpus oil without esters is being practised. Dosage is carefully regulated by the response of the patient.

The Hospital. Throughout the year the hospital has been

full to overflowing, and with a change in the type of case admitted to the Colony, the hospital work will increase even further. During the year, numerous operations have been performed, and many types of medical case have received attention.

The Dressing Station. Early in the year, a permanent dressing station was erected in close proximity to the living quarters of the patients. This building, provided through the generosity of a friend in England, has proved a great boon to patients needing medicines and dressings who now receive treatment near their homes. At the same time congestion at the hospital has been relieved. A special staff of nurses is attached to the dressing station whose duty is to care for all weak and aged people in the Colony. An N.A. Dispenser is in charge.

Training of nurses and attendants. Considerable attention has been given to the training of leper nurses, and there is now a well trained staff of 25 nurses, many of whom are skilled at the art of giving injections for the treatment of leprosy both by the intradermal and subcutaneous routes. In the hospital nurses have received experience in the nursing of general diseases and constant teaching has been given by Mr. Lansdowne.

The development of village work has created a demand for trained attendants for out-station clinics, and a number of intelligent patients are receiving instruction in the principles of hygiene and sanitation, in the technique of leprosy treatment and in simple medicine.

Treatment centre. At present all leprosy treatment has to be given at the hospital, and the congestion which has resulted has been a serious problem. During the year, a grant was received from the British Empire Leprosy Relief Association for the building of a treatment centre. This building will be devoted to leprosy treatment and examination only, and when it comes into use early in 1939, it will place that side of the medical work on a new level.

Infectious disease. There has been very little infectious disease during the year. In October the leper chief contracted smallpox and the entire Colony was vaccinated. No further cases developed. Apart from this, and with the exception of a very occasional case of amoebic dysentery, the isolation houses remained empty throughout the year. It may be noted that the incidence of amoebic dysentery in the Colony is without doubt lower than it is in the surrounding country. During the last four months there has never been a single week when treatment for amoebic dysentery was not being given at the non-leper dispensary.

Out Patients. As reported last year, out-patient treatment at Uzuakoli had been discontinued for the following reasons :—
1. Adequate medical control of the out-patients was quite

impossible. They were seen once a week, and their response to injection treatment could not be ascertained, as no record of their temperature could be obtained during the intervening days. Dosage was therefore of necessity low, and progress very slow. No case was known which had been rendered symptom free during 2½ years treatment. 2. The very fact of their having treatment was diminishing the fear of the patients in the minds of healthy people. Contacts were permitted which would have been avoided if the lepers were not having treatment. It was thus probable that out-patient treatment was actually spreading leprosy in the neighbourhood. Survey work during the later part of 1938 provided further illustrations of this side of out-patient treatment. In the village of Akeolu Iodu one man had so constructed his house that the only means of access to it was through the house of his father, a leper of an infectious lepromatous type. When the folly of this was pointed out to him he replied that his father had been having treatment and was therefore no longer dangerous.

During the latter part of 1938, outpatient treatment was restarted in response to hundreds of appeals from the lepers in the neighbourhood. One condition was imposed before treatment was permitted, and that was that patients receiving treatment must have segregated themselves in some way. A new outpatient department has now sprung up, in which there are 92 lepers who declare that they have fulfilled the condition. As opportunity arises they will be visited in their homes to ascertain the degree of isolation which they have imposed upon themselves. Lepers from villages which have been surveyed are also attending for the time being, pending arrangements for segregation and treatment in their own neighbourhood.

Laboratory. The laboratory has witnessed a very striking advance during the year. There are now three able non-leper workers attached to it, and most valuable work is being done. Perhaps the most important introduction has been the Kahn Test. This test has been applied to every person in the Colony. Every person admitted to the Colony is subjected to the test, and it is also used in connection with cases sent for diagnosis. No less than 1199 Kahn tests have been carried out during the year. The year end has seen the introduction of the Laughlen Reaction, a simplification of the Kahn Test.

A considerable amount of bacteriological work has been done. All cases admitted are properly tested, and at intervals the examination is repeated. Before any case is discharged, at least two examinations made at an interval of six months must prove negative.

The laboratory fulfils an important need for assistance in

diagnosis, not only in the case of leprosy but in many other diseases. Numerous examinations and tests of blood, excreta, sputum and pathological fluids have been made. The following list includes the more important tests :—

Kahn Tests, year 1938 ...	1199
Blood counts	25
Blood smears	29
Bacteriological tests, lepers ...	454
,, ,, others ...	23
Examination of stools	109
Iodine provocation tests ...	19
Sedimentation index	16

Alterations in the building have resulted in a commodious laboratory where good work is possible. A dark room has been built, and in future a photographic record of each case will be made, as this is the only scientific method of recording leprosy cases. A commencement has been made in histological work.

WORK AMONG UNINFECTED CHILDREN.

In last year's report it was suggested that the closing of the babies' creche may be advisable. The children are sent home, healthy and apparently strong at the age of three, and then the majority of them die (five out of seven sent home during two years).

The decision to close the creche has not been taken. In the first place it is felt that whatever may be the fate of the children when they leave the creche, its very presence is an important means of education in the prophylaxis of leprosy. It is now proposed to retain the children until they are six years of age, when they will be much better equipped to face the rigours of village life.

In itself, the creche at Uzuakoli is a model one. Children are removed from their infected mothers at birth, and are brought up on artificial foods from the start. Scrupulous care and oversight are needed, and during the year Mrs. Miller gave a considerable amount of time to this work with very great success, as there have been no deaths from marasmus or diarrhœa. The appointment of a sister is expected during 1939.

At the year end there are 14 children in our care, their ages ranging from 1 week to four years. The older children are not coddled. Mosquito nets are not permitted, and every effort is made to let the children develop as naturally as possible. Two small girls are employed to play with them and help them to walk and talk.

AGRICULTURE AND INDUSTRY.

When the Colony was founded, the amount of land acquired was insufficient to support the total number of patients for whom

the Colony was intended. Each year it has been necessary to supplement the produce obtained from the farms by a weekly subsistence allowance, the total cost of which has been in the neighbourhood of £1000 a year. During the year, negotiations have been in progress for the acquisition of new land for farming purposes. The need for this was imperative, for even with the meagre lots allowed to the patients, there is not enough land to provide a proper farming cycle, and it is necessary to rent land outside the Colony for farming purposes in 1939. Up till the end of the year no progress had been made, but at the beginning of 1939, negotiations are well in hand for the acquisition of a further 200 acres of very useful land.

There has now been a most important development in the organisation of the agricultural side of the Colony. Beginning in 1939, the active co-operation of the Agricultural Officer, Umuahia, is being obtained, and from 1940 onwards, the Colony is to become a large scale demonstration of new farming methods. The whole of the farm land will be in use at one and the same time. Proper manuring is being ensured by the introduction of a small herd of cattle and the preparation of compost. A transformation in the present farming arrangements is thus hoped for, and adequate farm land will make the present scale of subsistence allowance unnecessary, and so a very useful saving will be accomplished.

During 1938 the individual system of farming was again employed with satisfactory results.

Oil Palm Plantation. This is thriving and some of the trees are bearing. For three months in the year the needs of the Colony are being met from our own trees. During 1939 a further 25 acres are being planted.

Raphia Palms. A plantation of raphia palms was commenced in 1937 in the valley around the lake, and this is in excellent condition. Coconut palms and bamboos and also sisal have been planted during the year.

Industry. The Colony is becoming more and more a self-contained unit as far as the occupations of the people are concerned. The majority of the every-day wants of the people can now be supplied within the Colony, and every effort is made to encourage this internal industry. Carpenters provide all doors, windows, and furniture. Bedmakers, weavers, basket makers, tailors, all find scope for their skill. There are some excellent building gangs, who are becoming skilled in cement work, and these do all the building work in the Colony. The palm oil industry as has already been mentioned is growing but is not a commercial proposition at the present time.

SOCIAL WORK.

The active share played by the Methodist Missionary Society in the Colony continues, and substantial grants both by the official organisation and by private individuals have been received. A new school and a dressing station have been built out of funds given in this way.

Children. There are almost 200 children in the Colony, and scarcely a week passes but some child applies for admission because he has been more or less deserted by his relatives. A system of foster-parents exists in the Colony whereby an adult may receive a child into his house on giving an undertaking to care for that child. The subsistence allowance is then paid to him. When the children attend for treatment careful observation of their general condition is made, and if any child shows signs of neglect his guardian forfeits the right to care for him or any other child. The school has made great strides during the year. With a new building and a certificated teacher as headmaster, the teaching has been revolutionised, and the school which has 8 teachers and classes up to standard three, has now been recognised and is visited by the Education Supervisor of the Methodist Mission. Ample facilities for sport are provided for teachers and children. The football field is in constant use, while running track and ring tennis courts are available.

Arts and crafts. Native arts and crafts receive every possible encouragement. At regular intervals, competitions are held. Houses are artistically polished and decorated. At Christmas time an exhibition was held at which there were 500 entries, specimens of carving, weaving, clay modelling, pottery, Uri drawing, and painting, being submitted.

Christmas Celebrations. Christmas celebrations were on a record scale. Through the generosity of a friend, a substantial feast was provided and 11 head of cattle and half a ton of rice were consumed. All received gifts on December 26th, and the annual sports day on December 27th passed off with record success, and some excellent athletic achievements.

The church continues to exercise a great influence in the Colony, promoting happiness and harmony. Contributions from the leper church people themselves have been made on behalf of destitute persons needing treatment.

THE COLONY AND ITS ENVIRONMENT. WORK IN THE SURROUNDING COUNTRY.

The Uzuakoli Colony is situated in an area where the incidence of leprosy is probably higher than in any other part of Nigeria,

It is scarcely an exaggeration to say that only one leper in 50 in the Owerri Province is receiving treatment at Uzuakoli, and there are few places in the world where the incidence of leprosy is higher. This is not surprising to anyone who has been actually among the people and seen how they live. A dense population, serious over-crowding in insanitary villages, houses without ventilation, in many cases a poorly balanced diet, debilitating diseases rife, these are the conditions par excellence in which leprosy spreads, and in those parts of the Bende and Okigwi Divisions with which I am familiar, they are unfortunately universal. It is difficult to find words strong enough to describe the misery of lepers in these areas. Compared with them the Colony is a veritable lepers paradise.

The leper meets with no sympathy whatever from healthy people. If he is a child he is commonly driven from the village and his fate can be imagined. If he is a strong adult he will be tolerated in the village as long as his disease is not very noticeable, especially if he is well-to-do. If, as is usual, his disease advances, toleration gives place to ostracism, and he is either forced to leave the village and live in the bush, or else he remains in the village, an object of scorn, blamed for every evil that befalls the community. Women, like children, often receive short shrift and are liable to expulsion.

There is of course considerable variation in this treatment of lepers from one village to another. On one extreme a village may be found where every leper is expelled as soon as his sickness is known to his fellows. On the other hand I have found villages where no efforts whatever are made to remove lepers, but all villages are united in the total lack of sympathy which lepers may expect. The end of the story is pitiful. Neglected by his friends, fed for a time perhaps by his companions in trouble, the leper is fortunate if some intercurrent infection supervenes and saves him from starvation.

Now I do not consider that the Uzuakoli Colony justifies its existence unless some effort is made to alleviate the condition of lepers in the surrounding country. There is only one ideal solution to the problem and that is the multiplication of Colonies such as Uzuakoli. For financial reasons that is out of the question, and the discovery of some economical but sound scheme is a very difficult if not impossible proposition. Experiment is needed, and during 1938 an experimental scheme has been elaborated which is already being put into practice.

In a nutshell, the scheme consists of four consecutive phases, 1 Investigation, 2 Segregation, 3 Treatment, 4 Control.

1. *Investigation.* The first essential is to assess the size of

the problem by means of accurate study. If anything is to be done both for the lepers themselves and also for the prevention of leprosy in the villages, all lepers must be known and the conditions obtaining in the villages must be studied. The only way by which this can be achieved is by means of thorough surveys, following the lines of approach laid down at the Cairo Conference. This entails the examination of the entire population with the taking of a census. Specially trained workers are essential, and bacteriological as well as clinical examination of both lepers and suspects is necessary. Experience is the only guide in the method of survey adopted.

2. *Segregation.* The only satisfactory methods of controlling leprosy which are known involve the segregation of lepers. After surveying a village, lepers are to be segregated. In some instances all lepers will be dealt with in this way, in others insistence will only be made on the segregation of bacteriologically positive cases. I am however not convinced that these are the only infectious cases, as temporary infectious phases are I believe possible in lepers who are bacteriologically negative when examined once only.

The actual method of segregation adopted will vary. In the case of a small clan with a low incidence of leprosy, good land and the possibility of oversight, a clan colony may be possible. In many instances a village colony will be preferable, while where the incidence of leprosy is high, it may be necessary to segregate lepers outside their compounds. All methods will be tried, the extent of the experiment depending upon the time and personnel available.

I am in total disagreement with the erection of large segregation centres. A community of 20 or 30 is I consider the maximum which should be permitted in the absence of resident European oversight, and it is proposed to build units of this size. Efforts are to be made to make these leper hamlets a model to the neighbourhood in village construction. As far as possible, mud block houses, proper incinerators and salga latrines will be insisted upon. The materials for building will be provided by the parent village, with the possible exception of doors and windows, etc. It is proposed to send trained leper builders from the Uzuakoli Colony to act as headmen in charge of building operations, and when the leper village is being built, a Toc H man from the Colony will plan the work and supervise the building. It may be suggested that village chiefs may not be willing to provide the assistance asked of them in the nature of materials, etc. In each case so far that has not been the case, chiefs being eager to assist when lepers are to be removed from

the community. If such a case did arise, leprosy relief work would be stopped altogether in that village until such time as the chiefs had acquired a little wisdom.

3. *Treatment.* Every effort must be made to overcome the hopeless outlook of the lepers themselves. This will in part be achieved by new conditions of living, but it is considered that treatment should be given, not only for leprosy itself, but for ulcers, etc. For this purpose a chain of leprosy clinics will be instituted. These will be built of the cheapest materials, permanent buildings being most undesirable, as they may have to be moved to another site if the scheme passes out of the experimental stage and becomes general. Visits will be paid to these clinics every week by a responsible person from Uzuakoli, either the doctor or a Toc H man, and leprosy treatment will be given to the lepers who are segregated in the area. Associated with each clinic there will be an attendant, himself a leper, who has been trained at Uzuakoli, and he will actually give the injections. It is proposed to receive into training lepers who will work in the neighbourhood of their own homes, who will not only give injections at the local clinic, but who will be able to dress ulcers, attend to minor ailments, and visit the leper hamlets to ensure their cleanliness.

From what has been said under the head of "Out-patients," It will be seen that I have but little faith in injections per se as a means of leprosy control. It is a part, but not a fundamental part of the scheme, more insistence being given to the segregation of infectious cases.

4. *Control.* In its further working out the scheme will be concerned with the villages from which lepers will have been segregated. With segregation accomplished, the Leprosy Ordinance must be invoked. A proper census having been taken, all contacts will be known and will be examined periodically. Finally, at intervals of 2 years the village will be resurveyed, and in this way the success or otherwise of the scheme will be determined.

CONSIDERATIONS IN MANAGING THE SCHEME.

1. *Support of segregated lepers.* It may be stated that if we segregate lepers we make ourselves responsible for their upkeep if by segregation we have disturbed their means of livelihood. It is proposed that in no case will lepers be segregated more than one or at most two miles from their former homes. Able bodied lepers will thus be able to continue their former means of livelihood. With regard to feeble lepers, these at present die miserably. A local arrangement has been made in the Bende

Division whereby all lepers unable to support themselves are made chargeable to their relatives. This is quite reasonable, is in line with the Ibo idea of family responsibility, and should be made a definite law, applying to other Divisons as well. If properly applied, this arrangement considerably simplifies the question of the support of feeble lepers. It will to be seen whether it is satisfactory in practice.

2. *Children of Lepers.* It may be objected that segregation will probably increase the number of children born to lepers. I very much doubt this. At present the husbands of leper wives usually lose interest in them, even if they are not driven from home, and if they are going to have children, children will be born whether the women are segregated or not.

Children born in leper hamlets will remain with their mothers until they are at the weaning age. To remove them earlier is to take them to certain death. If at the age of two years a child shows no signs of leprosy, he may be brought back to the parent village, provided that during those two years no suspicious signs have occurred, and also provided that his presence in the parent village is permitted only if he is examined at regular and frequent intervals. If this cannot be assured he should stay in the leper hamlet. This means that he will probably contract leprosy, but however unpleasant that may be, the alternatives are even worse. It is clear from these considerations that leprosy will not be eradicated in one generation, but that it is a case of accepting the better of two very undesirable alternatives.

3. *Co-operation of Government Departments.* The active co-operation of Government Departments is vital to the scheme. We have already found that although there is a general willingness to co-operate in segregation on the part of the people, there is very little desire for lepers to receive treatment. Provided the leper is removed, his further welfare is immaterial. There has already been active opposition to the building of clinics, and in matters such as this, the co-operation of the Administration is vital. With regard to the building of leper hamlets, the co-operation of the Health Authorities is desirable with respect to the site, and again the Administrative Authorities can assist with the question of land tenure and ownership. Sanitary inspectors should receive special training in the diagnosis of leprosy, as it will fall to their lot to examine contacts and any children in the parent village who have been exposed to infection.

4. *Financial Considerations.* From a financial point of view the scheme is most economical. There are five heads under which expenditure is incurred.

(a) Salaries of trained non-leper surveyors and laboratory workers. This is not high and is relatively constant.

(b) Transport costs. This is the largest item, and will vary with the amount of work done.

(c) Salaries of leper clinic attendants. These will be low, in the neighbourhood of £6—£9 per annum for each man.

(d) Cost of drugs and dressings. The specific leprosy drugs (hydnocarpus oil, etc.) are supplied free of charge, but at every clinic there attend cases of leprosy with urgent needs for other treatment, particularly in the matter of dressings for ulcers, and treatment for these is inevitable if we are to be of material assistance to the lepers. With the extremely limited financial support available, it will be necessary to exercise the utmost economy. We have estimated for an expenditure of £10 under this head for 1939.

(e) Cost of building materials. Where it is necessary, windows, doors, etc. will be made at the Uzuakoli Colony, and thus the cost of materials alone will be required. The amount spent under this head will be low.

It must again be reiterated that the scheme is experimental, that it is far from the ideal, but I believe that it offers the best hope of facing the problem with the resources that are available, and is in line with well informed medical opinion concerning the control of the disease.

5. *Relation of the Uzuakoli Colony to the scheme.* It will be seen that the Uzuakoli Colony bears a vital relationship to the scheme, for it is the centre from which the scheme will be directed. Non-leper workers are trained here. Leper clinic attendants are already receiving instruction. Leper builders will be sent to leper hamlets.

Reference has already been made to the types of case for whom the Uzuakoli Colony will cater in the future. They may be enumerated again as follows :—

(a) Destitute lepers without relatives.

(b) Lepers needing hospitalisation.

(c) Infectious lepers.

(d) Educated lepers who may be trained for village work, nurses, etc.

(e) Children, who can receive special oversight.

(f) Sufficient able-bodied lepers to manage the work of the Colony.

The functions of the Colony will be :—

1. Appropriate care for those types of case segregated there.

2. Hospital work, surgical and medical.

3. Training of leper workers, nurses.

4. Research. In this connection it must be noted that the village scheme is futile unless accurate records are kept and all examinations are thorough. A special record room has been reserved at the Colony.

5. Education. By demonstrating the best methods of treatment known, by the babies creche, and in many other ways, it is hoped that education concerning the disease can be disseminated. Courses of study for sanitary inspectors in training are already being arranged, and instruction in schools in the neighbourhood has already been given.

THE PROGRESS OF THE SCHEME.

On the return of the Medical Superintendent from leave, letters were addressed to all the clan councils in the Bende Division, and also to one or two in the Okigwi Division. The Councils were asked to state their attitude to surveys, segregation, and clinics, and within a short time, replies had been received from 15 out of 17 clans in the Bende Division. Visits were then made to most of these, and the full details of the scheme were expounded. In every case great eagerness was shown for the early start of this work, and full co-operation was promised. The following is the present position.

Nkporo. A survey was carried out last year. The people already segregate the majority of their lepers in villages which are appallingly bad. A clinic has been opened with 200 patients from the immediate neighbourhood, and a leper village is to be built immediately on the lines already laid down.

Alayi. A clinic was started but was wrecked by a near-by village the people of which objected to lepers having treatment at the site selected. The chiefs have found a new site and the clinic has been reopened.

Ohuhu Clan. A survey is in progress, after which a clinic is to be erected and segregation arranged.

Umuimenyi Clan. The village of Akaelu Lodu has been surveyed. At present the lepers are attending at the Uzuakoli Colony for treatment, but segregation will be achieved during this year. Other surveys are pending in this clan.

Oboro Clan. A survey has been arranged, to take place in March. A clinic and leper village will follow.

Ibeku Clan. A survey has been requested and a site for a leper village offered. The same is true of the *Ozuitem Clan.*

Igbere Clan. A leper village was visited in the Igbere area and was the worst I have seen. A clinic is to be started and new villages built after survey.

During the coming year it is hoped to open clinics at *Ovim* and also at *Umuduru*.

The survey of all these areas will take a considerable time, and they probably represent the maximum that can be achieved with present staff and financial resources.

Acknowledgments.

I have to acknowledge with thanks the following :—

1. A grant of £50 from B.E.L.R.A., Nigerian Branch.
2. A grant for a treatment centre from B.E.L.R.A., Head Office.
3. Numerous gifts from interested people in England, the majority of whom are associated with the Methodist Church.

My grateful thanks are also due to Toc H colleagues for unstinting service during the year, to Dr. D'Amien and to Dr. Miller, who acted as relief, and also to Mrs. Miller for her assistance in the babies creche.

LEPROSY IN PORTUGAL

Sr. J. S. Vieira reports that in a survey he discovered the existence of 3,000 lepers scattered in different parts of the country, wholly without care or treatment of any kind, often living in indescribable poverty and wretchedness. In one village alone there are no less than 200 lepers. The only attempt to segregate lepers is that made in Lisbon where those in an advanced stage of the disease are housed in a pavilion belonging to one of the hospitals. He hopes to start a leper dispensary near Pombal which is central for the most affected area. The following is a quotation from the C.S.S.M. Magazine :—

"Away back in the Middle Ages, Portugal (in consequence of there being a prince who was a leper) had what, for those days, was a very thorough system of segregating and caring for her lepers; while, as a preventive measure, they were kept apart from other folk, they were not treated as though they were little better than corpses, as was the case in the countries of Central Europe.

With the dawn of the Renaissance, Portugal began to devote all her energies to discovering and conquering unknown lands overseas, and her home problems (among them that of her lepers) became sadly neglected. The result was that leprosy soon began to spread, until at the present day Portugal is of all European countries the one where leprosy is most prevalent, there being over 3,000 lepers in her population of six and a half millions.

The authorities have been doing practically nothing for them, and Portuguese lepers mix freely with other people. It is not realized what a terrible risk this involves, and they live for the most part in want and squalor, repulsive to themselves and to those who see them, constituting a truly appalling problem."

HOW TO USE CREOSOTED HYDNOCARPUS WIGHTIANA (CHAULMOOGRA) OIL MIXTURE

[In Nigeria hydnocarpus oil is imported from India in bulk, is creosoted and sterilised at the Government laboratory, and distributed free to all approved institutions throughout the country. Along with the oil are sent these instructions. It is suggested that other countries in which there are several leprosaria might follow this example, and thus secure a uniform and cheap form of treatment. The Cairo International Congress stated: " No proprietary preparation of hydnocarpus oil or esters, or any other proprietary preparation is more effective that the pure oil and esters prepared in institutions."—Editor].

Storage of oil mixture. The mixture consists of pure hydnocarpus oil with creosote added in the proportion of four per cent; the whole has been sterilized by heat. This mixture is intended for injection, and should be stored in tightly corked bottles in as cool and dark a place as possible. Kept thus it should remain tolerably painless on injection for at least twelve months. Shaking and contact with air tend to make the oil irritant; therefore once a bottle has been opened it should be used up as soon as possible. Supplies of oil mixture should be renewed at least once a year.

Oil to be injected warm. Pure hydnocarpus oil is believed to be at least as effective in leprosy as the esters prepared from it. It has the advantage of being much less expensive, but it has the disadvantage of being more viscid. This disadvantage is partly overcome by adding creosote, but the oil can be made still thinner by heating and injecting at a temperature as high as possible short of injuring the tissues, say at 45 degrees centigrade (113°F). To do this the oil has to be heated to at least 50°C. as it will cool in the process of drawing into the syringe and injection. It is important to make the oil as thin as possible because of the greater ease of injecting, and in order that it may infiltrate the tissues without tearing them.

When a large number of patients have to be injected the oil can be put in a glass flask which is placed in a water bath. Below is placed a paraffin lamp protected from the wind. The wick is regulated to give the desired temperature which is recorded on a thermometer placed in either the water, or preferably the oil.

Method of filling the syringe. A simple method is as follows. Through the cork of the flask containing the oil mixture, insert two thin glass tubes. One tube which is short and plugged with sterile cotton admits air to the flask as the mixture is withdrawn;

the other tube, up which the mixture is drawn, reaches to the bottom of the flask and has the socket of an injection needle firmly fixed with rubber tubing to its upper end. The oil is drawn up into the barrel of the syringe after attaching the nozzle to the needle socket. The nozzle is then withdrawn and a fresh needle fitted to the syringe.

Methods of injection. Injections of oil mixture may be made intramuscularly, subcutaneously or intradermally, but never intravenously. In making intramuscular or subcutaneous injections it is important to divide up the dose, not more than one cubic centimeter being injected at any one point. The needle is inserted through the skin and pushed successively in the directions of the points of the compass, without withdrawing it through the skin; fractional quantities are injected at each point. The warm mixture should be injected slowly (10 seconds to 1 c.c.) so as to give it time to infiltrate the tissues.

Intradermal injections. Intradermal injections are most suitably given in macules, and especially in tuberculoid lesions. One drop to a square centimeter, or three drops to an area the size of a sixpence, is about the right amount to give, an area of 5 to 10 square centimeters being infiltrated with 1.5 to 6 cubic centimeters of the mixture. Intradermal injections may be made with a short guarded needle by multiple punctures; or by means of a long thin needle which is inserted to the hilt horizontally through the skin, the mixture being gradually injected as the needle is withdrawn. Whichever method is used, the sign that the mixture has been injected correctly *into* and not *under* the skin is the appearance of a wheal at the point of injection, or, if the long needle has been used, along the line of injection.

Dosage. Never give injections to patients who are weak or not physically fit. The maximum dose of the oil mixture is ten cubic centimeters once or twice a week, though few patients can stand more than six. It is best to begin with one c.c. and gradually increase the dose. The signs of excessive or too frequent injections are pain at the site of injection for more than 48 hours, a rise of temperature, a gradual increase in the sedimentation rate when tested once a week, any discomfiture or deterioration of the health of the patient. The more physically fit the patient is and the firmer his muscles are, the better will he stand the treatment and the more benefit will result. Remember that great harm can be done by excessive injections.

Sterilization of syringes and needles. This is best done in oil heated to a temperature of 125°—135° centigrade; if hotter, the solder of the needle may melt. At this temperature there is almost instantaneous sterilization. Any bland oil can be used.

A good sterilizer is an enamelled mug with a perforated metal tray fitted to remain just below the surface of the oil. Into the tray the needles are dropped; they can easily be seen and picked out again. All-glass or Record-type syringes can be sterilized by sucking up the oil into the syringe and expelling once or twice. The temperature is regulated by inserting a 200°C. thermometer in the oil, and by placing underneath a lamp similar to that used for heating the injection oil.

REVIEWS AND ABSTRACTS.

Leprosy in India. Vol. X, No. 4, Oct. 1938.

A. Speight writes on the *Serum-Formalin Reaction* and examines its correlation with the sedimentation test. He concludes that though the test may be of no very definite diagnostic or prognostic value, it does indicate changes in the serum of many leprosy patients.

J. Lowe writes on *The Leprosy Problem in Burma.* Apart from the Arakan Hill tracts, where the incidence is given in the census (probably mistakenly) as 4½ times higher than in Burma as a whole, the central dry zone has the highest incidence.

"It is very much more difficult to get an accurate idea of the incidence of leprosy than of the distribution of leprosy. Surveys carried out by the Special Leprosy Officer in three different areas have indicated an incidence of about 1.6% of population in these areas. Our findings made during the tour suggest that while in some parts of Burma the incidence of leprosy is no doubt much lower than this, in other parts of Burma the incidence is probably considerably higher . . . . . It is impossible to give any very definite opinion regarding the age distribution, but our work shows clearly one thing, namely, that the incidence of leprosy in children is very much higher than has been realised. Several times during our tour we visited villages where the headman had been asked to report the number of cases, and where a medical man had checked his report, but we found that the cases reported by both these officers were only the marked cases in adults, and that by examining village children we could find up to 10% of them showing signs of leprosy. The findings quoted indicate that the leprosy problem in Burma is a very serious one, there are probably large parts of middle Burma where the incidence of leprosy in villages averages 2 or 3%, or even higher. A great many of the patients are infectious cases, the disease is spreading as shown by the high percentage of children infected with leprosy. All this indicates a very serious public health problem."

Regarding the possible methods of control, Dr. Lowe writes:—

"The problem is a very great one, the resources are not very abundant. Nevertheless I think that a campaign against leprosy, properly planned and organised, might within a period of 10 or 20 years have a very beneficial effect. The only method of control of leprosy which is likely to meet with any success at all, is that of arranging for the isolation of infectious patients, particularly from children and young people. Other

measures, treatment clinics etc. are merely rather ineffective forms of leprosy relief, and can never control the disease. In the control of leprosy in Burma many different measures have to be considered. These include legal provisions, leper asylums, colonies, arrangements for village isolation, diagnostic and treatment centres, etc."

Among the measures suggested are the following:—

" Arrangements for notification of cases of leprosy should be made. At present the headman of the village is responsible for reporting cases of leprosy in the village, and this arrangement should be continued and more rigidly enforced . . . . There are at present several leper asylums in Burma which are isolating cases of leprosy at a cost of about Rs. 9 per head per month to the local and Government authorities. Most, but not all, the patients in these institutions are infectious cases and I think that these institutions should be used as far as possible for such cases . . . . I think that they should be maintained, but they might possibly be maintained at a smaller cost to Government and local authorities. . . . . One of the most striking and encouraging things about the leprosy problem in Burma is the cheapness with which leper colonies can be established and maintained. The cheapness of buildings of wood and bamboo, and of food in Burma makes this possible. Really good houses for 8 patients can be built apparently for about Rs. 400. . . . Another thing that seems clear is the willingness of many patients to be admitted to such colonies. I think there is no doubt whatever that a very sound policy of anti-leprosy work in Burma would be a development of these simple rural leper colonies. . . . To whatever extent the system of colonies is developed, the colonies can never provide for all the infectious cases of leprosy in the country. There already is in many villages an attempt on the part of the village people to isolate cases of leprosy, and this village isolation should be developed and encouraged, and possibly made compulsory."

Dr. Lowe also recommends that arrangements be made for treatment centres chiefly to facilitate the work of isolation, propaganda, etc., and for following up patients from the clinic to the village.

A second paper by J. Lowe is a *Note on Racial Variations in Leprosy with Particular Reference to Indian and Burmese Races.* In Burma there is a mixed population of Indians and Burmans living under the same climatic conditions. As there is a considerable incidence of leprosy, it is possible to make a comparative study of the disease in the two races. In the Rangoon Leper Asylum the percentage of lepromatous type cases (compared with neural) was 75 among Burmans and 39 among Indians; in the clinics the percentages of lepromatous cases were 56 and 31. In the villages of India the proportion of neural cases was found to

be three or four times as great as those of Burma. In the Rangoon Asylum, 71 per cent of Burman lepers and 40 per cent of Indians were under thirty.

"A considerable number of cases were seen in which the lesions were either 'reacting' tuberculoid lesions in which smears showed an abnormally large number of bacilli, or else were lepromatous lesions developing from a previously existing tuberculoid lesion. In addition, there were many patients in whom the lesions were definitely of lepromatous type, but the peculiarly localised nature of the lesions and their peculiar distribution, and the fact that involvement of cutaneous nerves supplying the lesions was found, indicated very strongly that these lepromatous lesions had developed from previously existing tuberculoid lesions. This phenomenon, tuberculoid reaction being followed by lepromatous change, is sometimes seen in Indians, but in Burmans it appears to be much more common. . . . It is in the lepromatous type of lesion that the differences between the Indian and Burman leprosy are most marked. In Indians, leprosy of this type is usually diffuse and not localised, and not infrequently there is infiltration of the skin of the whole body without the presence of definite nodulation anywhere. In Burmans, however, this is much more rarely seen, and there is a far greater tendency to the production of marked local lesions without any apparent general skin involvement. Even when there is such a general involvement, marked nodulation in certain sites is a striking feature of the disease. Such cases are sometimes seen in Indians, but not nearly so commonly in Burmans. The term 'nodular,' previously used of leprosy of the lepromatous type, is not open to much objection when applied to leprosy in Burmans."

Regarding the cause of this difference between the two types, Dr. Lowe writes:—

"When we try to give a reason for racial variations of leprosy, we step into the realm of conjecture for little is known of the subject. It has been suggested that climatic, social, economic and dietetic conditions may help to cause these differences. The influence of climate in producing these differences in Burma can be disproved by the fact that in this country, different races show leprosy in forms varying with the race, the climatic conditions being constant.

The diet of the average Burman is in many ways similar to that of the average Indian, being based on rice, but the average Burman seems to be better fed, owing probably to food being more abundant. Also Burmans, not being vegetarians, probably have a more balanced diet with a greater protein and fat intake. One peculiarity of the Burman diet is the consumption of 'nappi,' a stale fish product. (This fact reminds one of Sir Jonathan Hutchinson's theories in their various forms). It seems to me unlikely that diet is an important factor in causing racial differences.

The social and economic conditions of villages seem on the whole better in Burma than in India. The general health also does not seem to have any important influence on the problem. The great health problem of Burma is malaria, but, in the parts of Burma where leprosy is most common, malaria is less common than elsewhere.

Another possible cause of variations in leprosy in different races and countries is a variation in the pathogenicity of different strains of the causative organism. The evidence, however, is against this idea. Indians infected in Burma and other countries apparently develop the forms of leprosy characteristic of the disease in India. Thus it appears that the lack of resistance to leprosy of Burmans is racial and hereditary.

Regarding racial resistance to leprosy, little is known. Long endemicity of other diseases in any country is often followed by a gradual diminution in the incidence of the disease and in the severity of the symptoms. This is often attributed to the development of racial immunity. Can such a phenomenon be demonstrated in leprosy? It has been suggested that this is the reason why leprosy practically disappeared from most of Europe at the end of the middle ages.

The history of leprosy is uncertain, but it has been surmised that

leprosy originated in Africa and spread early to India, and later to the far east. It seems that there is a considerable evidence to suggest that in Africa and in India the disease is generally seen in a relatively mild form, but that as one travels farther east one sees the disease in forms steadily increasing in severity. These are suggestions and not really proved facts. Can these ideas be proved? Is it possible that in countries and peoples which have more recently been infected, the disease shows itself in its severer forms owing to the lack of time for the development of racial immunity?

On the other side, it may be argued that there is no proof that leprosy originated in Africa and spread to the far east via India; that leprosy has been prevalent for thousands of years in the far east, probably far longer than it was prevalent in Europe; and that racial immunity, if it occurs at all, had adequate time to make itself felt in far eastern countries. It may also be argued that in recently infected countries, e.g. Nauru, the disease does not necessarily appear in a severe form.

It must, however, be accepted that racial differences in leprosy are seen. It is just possible that a study of racial susceptibility in relation to the history of leprosy in the affected races may give interesting results."

Leprosy in India. Vol. XI, No. 1, Jan. 1939.

J. J. Joseph summarizes the *Factors Influencing the Incidence of Leprosy in the Madras Presidency* as follows:—

" The chief foci of infection in the Madras province are the north-east and in the south-west, the former coastal and the latter inland. A hot humid climate is favourable for the spread of leprosy, while a hot and dry or cold and damp climate is unfavourable; a high altitude and low vapour tension are also unfavourable for the spread of leprosy. Customs—chiefly caste and marriage—favour the spread of leprosy, and these help to account for the endemicity of the disease. Among those studying in schools and colleges, the incidence is highest among those below the age of 12, especially among those who belong to the ' scheduled ' classes. The nearer the villages are located, the larger the village population and greater the industrialisation and inter-village communications, the more the incidence. The financial status of the district is no criterion of the incidence of leprosy, but it is the economic condition of the labouring classes which appears to influence markedly the incidence of leprosy."

An article by J. Lowe and S. N. Chatterji deals with *Scarification, Tattooing etc. in Relation to Leprous Lesions of the Skin.* Leprous lesions often appear on the sites of old scars, tattoo marks, etc. While it is possible that this may be the result of inoculating the germs by means of dirty instruments, it is probably more frequently a localisation of a previous infection, due to damaging the skin. Scarification is a frequent household form of treatment of leprosy, but the lesion may later spread beyond the area scarified. Illustrations of several cases under these two categories are given.

International Journal of Leprosy. Vol. 6, No. 4, Oct.-Dec., 1938.

A. J. Leitner writes on *Leprous Ostio-arthropathies of the Foot.* He discusses the cause of decalcification and deformity of the bones of the foot. In three cases examined arteriography showed normal arteries of the foot; but the bones were decalcified

and deformed and in one case there was fracture of the calcaneum. The author suggests that the condition must be due to affection of the sympathetic nerves, causing contraction of the vessels. The ischaemia causes decalcification and osteoporosis, while pressure and tension on the weakened bone causes deformities, etc. He confirms his hypothesis by good results in one case after right femoral sympathectomy.

Novocaine Blockade in the Treatment of Leprosy is the subject of a paper by A. A. Vishnevsky, Jr. The author injects from 70 up to 150 c.c. of a 0.5 per cent solution of novocaine, either into the perirenal fascia (patient lying as for renal operation) or for circular blockade of the nerves of the extremities. The results are restoration of sensation, healing of lepromatous ulcers, diminution of swelling and tension of the tissues and general improvement. The author has used this method for two years in one hundred cases. He claims that the immediate therapeutic effect is more rapid than any other well known method of treatment. "All our patients had been subjected to different kinds of 'specific' treatments, but with less results than after the blockade."

F. Hayashi writes on *The Age Distribution Curve in Leprosy.* His investigation has been chiefly in Japan, but he also compares curves in Japan with those in India and Norway. He finds that at the onset of a leprosy epidemic the age curve is to the left and that as it declines the curve shifts to the right. The incidence among military conscripts was found to have diminished from 600 cases in 1900 to between 100 and 200 cases in 1935, but the number of lepers in the censuses had not similarly diminished. The author was surprised at this, till he prepared age curves which showed that younger lepers are decreasing, as is indicated by the military statistics, while the older ones are increasing. [This would be a useful line of investigation in other countries.]

P. D. Strachan writes on *Statistical Evidence Indicating the Predominance of Abortive or Stationary Leprosy in Basutoland.* This is summarised as follows:

"During ten years, 61 per cent of the untreated N1 cases of leprosy at the asylum appeared to undergo spontaneous arrest. In a thorough survey of a certain area made by Germond at the end of 1936, only extremely light cases were found, and these actually exceeded in number the total number of cases from the same area in the asylum, in all stages of the disease. If these light cases were all such as become progressively worse in the absence of treatment, we should expect the total number of surviving sufferers today to be from five to seven times as great as it actually is. The majority of early neural cases of leprosy either remain stationary or become spontaneously arrested. This fact is revealed by a thorough survey of the whole population in an endemic area and is marked in institutions in which all patients receive treatment."

J. R. Innes contributes a paper on *A Leprosy Survey in the Island of Malaita, British Solomon Islands.* A summary account of this survey appeared in *Leprosy Review,* Vol. IX, p.122-128.

A paper by W. Gavrilov and A. Dubois on *L'Infection Experimentale du Rat par le Bacille de Stephanski Observée en Belgique* is summarised as follows:—

"Our attempt to culture Stephanski's bacillus has resulted in micro-cultures up to the fifth generation, sometimes producing colonies just visible to the naked eye. The pathogenic character of the bacillus of Stephanski when inoculated into animals did not remain as classically described; it was difficult to preserve the infection and abnormal forms of the bacillus were evolved."

South America and Leprosy is the subject of an interesting seven page editorial by H. W. Wade. There is said to be no leprosy in Chile and very little in Peru, except in the Amazon basin where there are 150 patients in an asylum and probably more outside. Bolivia is said to have occasional cases on the Amazon side. Of the other countries, Ecuador may have several thousands; Colombia has 8,000 cases in three leprosaria and a possible total of 25,000 in a population of 8 millions; in Venezuela there are 1,000 patients in two leprosaria, only a minority of the total cases; in British Guiana about 700 lepers (2 per 1,000); in Surinam, 800 known cases (5 per 1000); in French Guiana, 200 cases (4 per 1000). "An interesting feature of these and similar regions is that the disease is said not to affect the primitive Indian population." In Paraguay there are said to be 2000 or more cases, and in Uruaguay, though the number is not known, more than 500 cases.

In Argentina, which is well within the temperate zone, the disease seems to be increasing rapidly, but the leading dermatologists have for years made earnest efforts to stimulate action, though the authorities have shown reluctance to do much about it. An official estimate is 8000 cases, but others state two or three times as many (2 per 1000). Only 300 of the most advanced cases are in institutions, and that through the aid of a woman's organization, the Patronato de Leprosos.

"Brazil is a conspicuous exception to the rest of the Continent, in that it is taking seriously its leprosy problems—said in one report to be 'admittedly the most pressing' public health problem in the country." The most recent estimates give 50,000 cases (more than 1 per thousand). "The northern focus (Amazonas, Acre, Parâ and Maranhao), together with the Guianas, Venezuela and Colombia, constitute the great tropical leprosy area of South America." The anti-leprosy activities, as in Japan, are partly Federal and partly State; in some of the least developed states only Federal, while the state of Sao Paulo accepts little such

aid. The credit of the Federal action is largely due to Prof. Ed. Rabello and Dr. H. C. de Souza-Araujo. It is estimated that the country needs accommodation for some 240,000 cases, whereas in 1936 only 10,000 were isolated. In Rio de Janeiro there is the Centro Internacional de Leprologia, organised in 1934 by the Brazilian Government and the League of Nations, with financial assistance from Sr. Guilherme Guinle, where much research and teaching is done.

"In the Federal District there are 150,000 lepers now known, with presumably an equal number not known, about one-half of the total coming from neighbouring states. The Leprosarium can accommodate only a part of the open cases. For all of the others, the city has been divided into twelve districts and at a centre in each of them treatments are given and the patients are recorded and supervised by visiting nurses in a manner more thorough than the writer has ever seen elsewhere. Last June there were 639 patients, mostly non-contagious, on the nurses' visiting lists. It is from among such non-isolated cases that are drawn most of those that are studied at the Centre. . . . In Sao Paulo, wealthy when the coffee market was good, there are some seven million inhabitants and more than 11,000 known lepers, of whom over 6,500 were in segregation in 1937. To cope with the problem there was created several years ago the Departmento de Prophylaxia da Lepra, headed by Dr. Salles-Gomes. This department is unique in several respects, one being that it is independent of the health service. It controls the five leprosaria (one in each of the leprosy districts into which the state is divided), the two preventoria for the children of lepers, a creche in the city for young infants, and the numerous dispensaries. . . . With regard to the central organization of the department, there are three distinct units in the city of Sao Paulo: (a) The central office, with a truly remarkable system, its own supply department and even its own engineering staff for construction work; also a couple of lawyers who take care of the personal difficulties of segregated patients. Records of every one of the 14,000 lepers that have been registered since 1924 are immediately available, and also cards for the 28,000 and more contacts that have been examined in late years. (b) The laboratory section, for routine bacteriological, pathological and related work, supported in part by a charitable organization. Four girls are required for the preparation of histological slides alone, and five or six people do only smear examinations. The antileprosy drugs for the state are prepared here, and there is a well-equipped department for gross and micro-photography. The whole is decidedly impressive, and yet it is pointed out to the visitor that this is essentially a routine laboratory; funds have already been secured to build a research institute at the nearest of the leprosaria. (c) The library, where surprise becomes astonishment. Here is a collection of leprosy literature that unquestionably is without equal in any similar special unit anywhere. A keen librarian has been given a free hand in acquiring leprosy items and it would be difficult to name one that is not available. A card index contains references for all pertinent articles written by present-day workers. At intervals, members of the department staff receive from the library mimeographed lists of titles in current literature, and any article that a field man wants to read is copied for him by typewriter—no publication being allowed to leave the library."

Dr. Wade finishes his editorial by stating that Brazil can no longer be left out of the itinerary of the traveller who sets out to acquaint himself with the men and materials in the leprosy centres.

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