The mercury principle is believed to be a sound one, and the power could easily be increased by increasing the height of the column of mercury. The conclusion was arrived at, however, that the disadvantages of introducing the cup into the anterior chamber had been underestimated, and for this reason the method was discarded without further trial.

SOME NOTES ON THE TRANSMISSION OF LEPROSY.

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No definite statement can be made with regard to the method of transmission of leprosy, though it is not difficult after consideration of available facts to arrive at a moral certainty as to how the lepra bacillus enters the body.

Many attempts have been made to cultivate the lepra bacillus in vitro and to transmit it to the lower animals, but these attempts have not yet been proved successful. I mentioned the reason for this in a former article in this journal, (Oct. 1921).

Further investigation has led to the belief that healthy human beings living in a healthy climate and with healthy surroundings do not develop leprosy, even when inoculated with it. This conviction has been strengthened by several cases which I have seen lately. The most striking of these was a patient who had two small anæsthetic patches and thickening of the great auricular nerve. These were all the signs of the disease that could be found, but they were sufficient to allow of the diagnosis of leprosy. He had had these same patches for 22 years during which time they had neither increased nor diminished till they had begun to increase slightly during the last two years. In this case the fact that there were three lesions to be noticed in different parts of the body implied that there had once been active leprosy during which there had been metastatic spread of lepra bacilli from the primary lesion. This active state of the disease had produced no symptoms which were sufficient to attract the attention of the patient, an intelligent European, except that he noticed the appearance of the two anæsthetic patches. The thickening of the nerve he had never noticed.

Upon examining the menial staff at the School of Tropical Medicine I found that five out of the total number of sixty or 8 per cent. were suffering from leprosy, though none of them appeared to be aware of the fact. All these cases were of the nerve type of leprosy, had marked anæsthetic patches but were bacteriologically negative and therefore presumably not at that time dangerous from the point of view of the transmission of the disease.

I mentioned in the former article referred to that of 30 lepers attending the leprosy dispensary at the School of Tropical Medicine only two had entered their names in the 1921 census report as lepers, although they were all aware that they were suffering from leprosy. The two chief factors which vitiate the census returns regarding lepers are unwillingness to publish the fact that they are lepers, as in 93 per cent. of the dispensary patients, and ignorance of the fact that they are lepers, as in the five menials referred to above. Between these two factors it is not difficult to come to the conclusion that 102,513, the number given as the total of lepers in India in the year 1921 census report, is necessarily very far short of the right number.

Among the public and to a certain extent among the medical profession there is an idea that pauper lepers, such as those who beg at the street corners, are chiefly responsible for the spread of leprosy, and that the ulcers which they exhibit to the public shed large numbers of bacilli which are a danger to the public. Such was evidently the idea of the framers of the Leper Act of 1898 which is still in force (in so far as any Act is in force), as the 1920 amended Act has not yet been brought into force. In the 1898 Act a leper is only counted as a leper when "a process of ulceration has commenced." Now most of the lepers, who are admitted to Gobra Leper Asylum because of ulcers, have tropic ulcers which have no lepra bacilli and are therefore presumably not a danger to the public. Indeed the majority of begging lepers beg because they have become so much deformed by nerve leprosy that they are no longer able to work. Most lepers suffering from skin (nodular) leprosy are able to go about their vocations and do not need to beg. It is such lepers who are really responsible for most of the transmission of leprosy in a city like Calcutta and even more so in the villages where pauper lepers are comparatively few. If one snips off with the scissors a small piece of skin (not necessarily nodular, only slightly swollen) the size of a small nail paring, makes a smear from it on a slide, stains and examines it under the 1|12th inch objective, every field will show thousands of lepra bacilli in many cases. When the skin of such a patient is ulcerated, or when he has a discharge from his nose, then bacilli are shed by the million; whereas the ulcers of many of the pauper lepers, supposed to be so dangerous, may be searched all day long for lepra bacilli with negative results. During the last 2½ years we have treated at the leper dispensary connected with the Calcutta School of Tropical Medicine over 500 non-pauper inhabitants of Calcutta suffering from leprosy, but we do not flatter ourselves that we have attracted during that time more than a small fraction of non-pauper lepers in the

city. It has been calculated that there are about 1,000 begging lepers in Calcutta. I think it would not be rash to calculate the non-begging lepers at twice that number.

We find leprosy in three phases; the quiescent, during which the bacilli quietly multiply and spread through the lymphatics if the resistance of the tissues is insufficient to stop them; the phase of inflammation or reaction, when the lesions become swollen and erythematous and when there is often fever accompanied by other acute constitutional disturbances; and the phase of resolution, in which the lesions subside and show signs of healing in proportion to the degree of inflammatory reaction which they have passed through.

The remarkable thing about leprosy is that the inflammatory phase is not a sign of rapid increase in the numbers of lepra bacilli. In ordinary bacterial infections inflammation is the immediate result of a rapid increase of numbers of the bacteria. In leprosy, especially in skin (nodular) lesions, the bacilli may increase in numbers to a remarkable extent without any symptoms being noticed. On the other hand a comparatively small number of bacilli may cause a very marked reaction when that phase comes on.

It is chiefly during the reactionary phase that ulceration of the skin and nasal mucosa takes place and that there is most danger of transmission.

We have so far considered the transmission of leprosy from the point of view of the supply of lepra bacilli. We shall now consider the possible modes of entrance of the bacilli into the uninfected.

The facts that early lesions have never been found in the gastro-intestinal tract lower than the pharynx, and that practically no lesions caused directly by the presence of lepra bacilli have been found there, and that early lesions of the mouth and pharynx are also comparatively uncommon are strongly against an oral infection.

A census of lesions first noticed by lepers in leper asylums throughout India showed that in over 1,000 cases the lesions were chiefly on the extensor surfaces of the limbs, that in hilly regions a very large proportion were on the feet. The largest proportion of all was on the face. The scalp, neck and waist were exempt and there were but few on the flexor surfaces. Amongst those who wear what may be called European clothes, in which the body is less exposed to infection, lesions of the nose are found in a larger proportion than are found in those who live in hot climates and having their bodies less covered with clothing.

It would appear therefore that there is a direct infection through the skin of the body and the mucous membrane of the nose. Infection may take place through any breach in continuity of the epithelium which allows lepra bacilli to enter the corium, but probably auto-inoculation by means of scratching is the commonest mode of infection. As has been pointed out by Sir Leonard Rogers (*Transactions of Royal Society of Tropical Medicine and Hygiene*, 15th February 1923) the effect of a hot, moist climate is to cause increased irritation of the surface of the skin due to bites of insects, prickly heat, etc., and thus we have auto-inoculation due to scratching of the irritated parts.

The promiscuous use of beds and bedding which is so prevalent in India even among the better classes, doubtless provides a very likely link in the chain of transmission. The leper lies on his bed, scratches out his bacilli to soothe his irritated skin or discharges them from his ulcerated nose. Some friend or other member of his family lies on the same bed. The bacilli discharged by the leper stick to the exposed parts of the body, especially the cheeks, ears, shoulders and thighs, while the neck, waist and flexor surfaces remain free. To complete the process it only requires the irritation of the bite of a mosquito or bed-bug or the itching of prickly heat, tinea or scabies to induce the reflex of self-scarification and auto-inoculation.

While this is probably the commonest mode of transmission in India there are innumerable other ways in which similar inoculation may take place. The picking of the nose so common as the result of the reflex irritation of intestinal parasites, probably indicates another common channel. Public vehicles, sharp stones in those who go bare-footed and a dozen other paths of entrance readily suggest themselves. Indeed, as one meditates on the subject, the wonder grows upon one that everyone living in an endemic country like India is not infected.

Though absolute proof is wanting there is much presumptive evidence that, as in tuberculosis, only a comparatively small proportion of those infected ever develop the disease, or become aware that they have ever been infected. Natural immunity is doubtless the cause of this. Mankind, like the lower mammals, when living under healthy, hygienic, natural conditions is immune to leprosy, and it is only when the natural body resistance is weakened by other diseases or by unsuitable diet or surroundings, that the inoculated germs find a soil in the human body in which they can multiply, as is well shown in Newman's excellent work on the history of leprosy in Great Britain.

Summary.—The important factors in the transmission of leprosy are as follows:—

(1) The type of the lesions of possible transmitters. It is absurd to classify all those who have been infected with leprosy under the generic term "leper." From the point of view of transmission the line of demarcation

should lie between those in whom lepra bacilli can be found and those in whom after careful and expert search they cannot be found. Only the former are likely to be transmitters, if the lepra bacillus is the true cause of leprosy. As however a non-transmitter may at any time become a possible transmitter, examinations should be made at two or three-monthly intervals.

Voluntary segregation should be urged on all possible transmitters.

Those who can afford it should have a separate room in their house set apart for their use and all clothes, eating utensils and furniture should be kept separate. For the poor, who cannot thus isolate themselves from their families, separate accommodation should be provided by the community and the State.

If the precaution of efficient medical examination is provided for, the non-transmitters should not be isolated nor should they be taken away from their employment. Idleness is one of the chief causes of the increase of the disease, and patients who are in fear of being certified as possible transmitters will be much more careful to carry out treatment with thoroughness. It must be remembered that probably the greater number of those who are infected with leprosy are non-transmitters.

I have noticed the habit which is practised in some leper asylums of mixing all types of lepers together, regardless of whether they are bacteriologically positive or negative. Much harm may result from this.

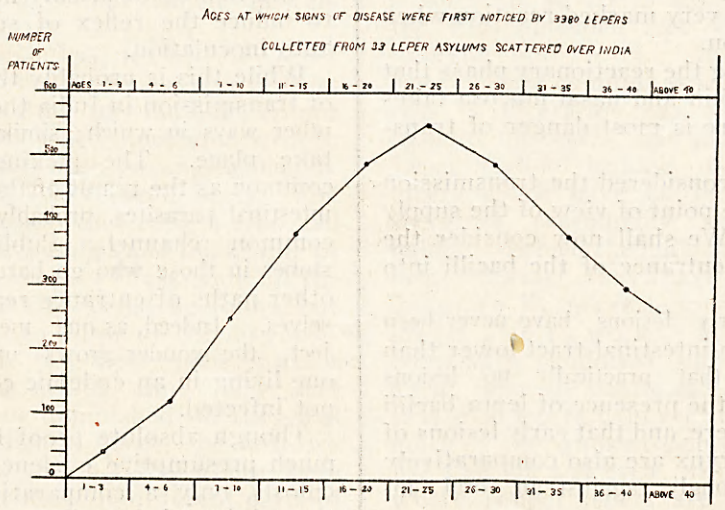
(2) We have tried to show the large number of those suffering from leprosy among all classes and that pauper lepers, the majority of whom are not transmitters, are responsible for only a small fraction of this.

(3) The habits of lepers and of those who come in contact with lepers are largely responsible for transmission, especially in house and bed infections; and a hot, moist climate, by leading to scanty protection of the skin by clothing and to irritation of the skin by insects and certain skin diseases, promotes auto-inoculation.

(4) The degree of body resistance is most important and tends to be higher in temperate, healthy climates and in natural, sanitary surroundings. It is lowered by concurrent or intercurrent diseases, constipation, unsuitable diet, pregnancy and many other causes, and it is commonly in connection with one of these predisposing or exciting causes that leprosy first shows itself.

What stamped leprosy out of England was improvement of sanitation, the introduction of dairy farms and market gardens and the development of individualism.

Suggestions as to the most effective method of stamping leprosy out of India.—While leper colonies and hospitals may segregate several thousands of lepers at a heavy expense to the ratepayers, they cannot hope to attract many early cases or indeed many cases at all except those in the lower strata of society. If progress is to be made the problem must be tackled at the fountain head. In other words those who are in the early stages of the disease must be attracted and brought under treatment before they have had time to become a danger to the community. This object can only be attained by opening dispensaries in endemic areas and putting them in the charge of those who have had sufficient experience and have been specially trained for the purpose.



Such dispensaries must be placed within reach of those who should profit by them, and far advanced cases with much disfigurement should not be allowed to attend lest they should scare away the earlier cases whom it is hoped to reach.

If such dispensaries are opened in all provincial towns in which there is a high incidence, they will act not only as centres for treatment, but they will by their presence form centres of public enlightenment where local practitioners

may gain experience of diagnosis and treatment.

Above all the pernicious views that leprosy is a hereditary disease and is incurable, and that its victims are under a special curse of the Almighty, will get their deathblow, and it will be realised that leprosy is a disease which is much more easy to diagnose and much easier to remedy, and therefore much less to be dreaded than the sister disease, tuberculosis. When rational views prevail, patients will come forward for treatment before the disease has got beyond its first stage.

Much of the progress that has been made in recent years in combating tuberculosis has been due to the establishment of dispensaries in the centres of cities, within reach of the sufferers. By means of these dispensaries treatment and instruction regarding the disease have been placed within the reach of all, only a limited number being accommodated in sanitaria. Leprosy is a disease which lends itself to dispensary treatment much more than does tuberculosis. The majority of cases of tuberculosis have reached a stage at which they are a danger to the public before they are diagnosed. In leprosy most cases are diagnosed without any difficulty before they have begun to be a danger to the Public. The problem of transmission can therefore be best solved by placing well-equipped and efficiently manned dispensaries within the reach of all in endemic areas.

The graph curve shows the ages at which 3,380 lepers first noticed signs of the disease. The statistics were collected for me through the kindness of Mr. A. D. Miller from 30 leper asylums scattered all over India. The curve exactly corresponds to a similar curve of 500 leper patients attending the out-patient dispensary in Calcutta.

If the average incubation period be taken at 8 years, then the majority were infected during the first two decades of life, the largest number being during adolescence. Above 40 only 389 cases or 11 per cent. were noticed. The average age of the 2,076 males was 35 and the average age of the 1,304 females was 37.

Of the 3,380 lepers 1,972 had had children, 7,629 in number. Of these children 6,017 were born previous to the first signs of the disease being noticed and 1,612 after. Of the 7,629 children 3,918 were dead and 3,711 are living. Only 241 or about 6 per cent. of the living children have as yet shown signs of leprosy, though the statistics do not show how many of those who died were infected or how many died of leprosy.

Of all the lepers only 58 per cent. remembered contact with lepers previous to their developing the disease. Of these 76 were with grandfathers, 87 with grandmothers, 438 with fathers, 315 with mothers, 227 with brothers, 93 with sisters, 26 with wives, 74 with husbands, 1,077 with other infected relations and other persons.

It is seen therefore that the majority of those who can trace the contagion are house infections, but that a certain proportion are not house infections. Conjugal infections are comparatively uncommon, only 2.9 per cent. Infections from parents form the largest group, showing the great necessity of separating children from infectious parents as early as possible. Where leprous parents are in a non-infective stage, there is no need to separate the children, provided the parents are under strict and efficient medical supervision.

AN AUTOMATIC FLY PROOF LATRINE SEAT.

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THE subject of fly proof latrines is one which presents the greatest interest to tropical sanitarians, and to all others connected with the conservancy of excreta. We know sufficient of the habits of the common fly to realise that his exclusion from human excreta is one of the biggest problems we have to deal with in tropical hygiene. This exclusion to be perfect must begin at the place where the excreta are voided, and continue right through to the point of final disposal. To begin with we must aim at excluding the fly from the latrine, and it is with the object of effecting this, that the latrine seat described below has been devised.

The fly proofing of latrines may be carried out either by proofing the whole structure, using wire gauze over all openings such as doors, windows and ventilation spaces; or by proofing the receptacle which receives the excreta. The former method is expensive, and the wire gauze requires frequent repair, both on account of natural wear and tear, and because of malicious damage. In addition the so-called fly proof doors frequently enable flies to enter, and make their exit difficult; so that in the case of such "fly proof" buildings, whether they be kitchens, markets, or latrines, the arrangement acts as a trap; and the result is worse than if the building had been left freely open. For these reasons it is better to avoid wire gauze in the construction of latrines, and to rely upon reducing to the minimum the attractiveness of the structure to flies, by making the latrine shady and illuminated by a "dim religious light."

The receptacle into which excreta are passed is the part of the latrine which attracts flies. It contains the "bait" without which flies would not be more numerous in a latrine than