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Transmission of Leprosy and Prophylactic Indications*

by Prof. Dr. Adolpho Lutz

The following paper is a summary of a more extensive one, in German, which will appear in the Annals of the Brazilian Academy of Science at Rio de Janeiro and will include a list of literature and an abstract of the newer research on the questions studied here.

The ideas advocated by me have already been brought several times before a more limited public but they evidently have to be repeated, over and over again, so as to overcome old traditions and prejudices.

I do not claim any priority for these ideas but some of my observations and arguments may be found new.

My personal experience extends over a very long period, of more than half a century. During this time the knowledge of nosology has increased enormously so that the old methods of prophylaxis have become antiquated and have had to be completely modified.

I. Transmission

The transmission of leprosy through heredity was formerly a very popular doctrine. This was due to the influence of Norwegian authors, who stated that in Norway (which for a long time was considered the most important focus of leprosy), the disease was propagated only by heredity. They argued with the repetition of cases occurring in the same family during several generations. Had these authors made a comparative study of the expansion of leprosy in other countries, where plenty of new cases appeared among single persons, of different nationalities, not belonging to leprous families, the fallacy of their argument would have soon become apparent to them. In a detailed observation, Dehio showed that cases occurring in the same dwellings are not necessarily connected by blood-ties.

The most important argument against hereditary transmission was furnished by Armauer Hansen, who examined the descendants of numerous Norwegian lepers who had emigrated to Minnesota, without discovering any case of leprosy amongst them. That children of leper parents may be protected from the disease by an early separation has since been amply proved in Hawaii and the Philippines. These arguments are now generally accepted and the theory of heredity may be considered as dismissed.

About the same may be said of the doctrine attributing leprosy to a special alimentation consisting principally of fresh, or badly preserved, fish.

The discovery and demonstration, in most of leprosy manifestations, of a germ, closely similar to that of tuberculosis and stained by the same processes, have led to considering the disease as contagious. It is undoubtedly infectious and may be transmitted from patient to healthy persons, but not by direct contagion. This is proved by the hundreds of non-isolated leprosy cases which have been treated in the hospitals of Paris, London and Vienna without contaminating anybody. This important fact must not be forgotten when people speak of the contagiousness of leprosy.

Contagiousness has been insisted upon in numerous publications, citing an enormous number of cases in support of this view. However those cases only proved the undoubted fact that the disease can be transmitted to people of the surroundings in the countries in which leprosy actually is indigenous.

In other countries no contamination takes place, although in bygone centuries the same regions may have been well known foci of the disease as proved by the existence of former leper-hospitals. Thus we may distinguish between lepra countries and countries free from leprosy. This is another very important fact and can only be explained by the absence of the transmitting elements in non-leprous countries. There is no escaping from this argument.

The germ considered as the cause of leprosy is generally called the bacillus of leprosy or Hansen's bacillus. In reality it is not a true bacillus and already in 1886 I proposed for it and the germ of tuberculosis the genus name Coccothrix which has undoubted priority over name Mycobacterium now generally used.

After intense staining with aniline dyes, Coccothrix appears in the shape of small acid-fast rods, either homogenous or granulated. When other methods of staining are used it takes the form of small coccoid bodies connected with each other by lighter threads. By intenser decolorization the threads may disappear and then be stained in a contrasting color. All the acid-fast bacilli have the same structure and can pass through porcelain filters, as it was first shown by Fontes.

After the discovery of the germ the next step was to try to cultivate it. This, however, proved to be very difficult, so much so that some authors will not admit the existence of any genuine cultures at all. Nevertheless, a few of the cultures may be considered genuine, even if they do not behave quite like the cultures of tuberculosis. Naturally, the cultivated germs and also those found in leprous tissues, were experimented with on animals. At first they gave doubtful results; the lesions produced in monkeys and rodents were not permanent and could not be reinoculated in series, with the exception only of those obtained in white rats, first by Marchoux, then by Catacuzène and Longhin. The Marchoux cultures were obtained by inoculation from a somewhat atypical case of leprosy and those of the others authors by inoculation of leprosy material into rats whose omentum had been blocked by Van Deinses' method. These results are still relatively new and await more extensive confirmation.

Some time ago, even before the discovery of the germ, quite a number of experiments were made on man in order to transmit leprosy, generally by inoculating blood, lymph or fragments of leprous nodules in or under the skin of healthy persons. They all failed with the possible exception of a very few and somewhat doubtful cases. This is in absolute contradiction to the idea that leprosy germs emitted by patients through desquamation,
secretion or excretion may infect other people. It agrees, however, with the observations on the aforecited patients, non-infectious in European cities. These very important facts are generally disregarded by the advocates of direct contagion.

Now what may this element be, which exits in lepra countries and which has disappeared from European regions where leprosy previously prevailed as shown by former existence of ancient leper hospitals. There is absolutely only one answer to the question. It must be a living agent which after sucking the blood or lymph from leprous patients under suitable conditions can infect other persons. This infection need not take place immediately, but only after a period of transformation and multiplication.

We now know more than thirty different parasitical diseases of man and domestic animals (some of them very important and carefully studied), which are only propagated by blood or lymph-sucking arthropodes, i.e. insects or arachnoids. In many of them the blood of the patients contains abundant germs of the disease and can reproduce it when injected in other individuals. Under natural conditions the transmitter does not become infectious immediately but only after a period of incubation, which may last nearly two weeks, as for instance in dengue and yellow fever.

Though many leprosologists fail to see the decisive importance of these arguments and thus ignore the teachings of modern nosology, quite a number of other workers have made experiments on the role of arthropoid transmitters. Most of them overlooked the fact that all ubiquitous bloodsuckers, such as fleas, lice, bugs, the itch-mite and the *Demodex folliculorum* must be discarded, because they are found in countries free from leprosy as well as in lepra countries.

The only bloodsuckers which can be considered are the Diptera and among them chiefly the mosquitoes. These occur in enormous numbers in most infected countries and are absent from the large cities cited above as free from indigenous cases. Mosquitoes must have been much more common in European countries in former times, when malaria and *Miliaria epidemica* prevailed. That malaria is transmitted by mosquitoes no one doubts. *Miliaria*, as I concluded from the observation of a small epidemic, also has the essential characters of a mosquito-born blood-disease.

Every new notion in pathology meets strong opposition from the people who are satisfied with the often quite inadequate, explanation given before. For malaria, yellow fever, and dengue this opposition has now been conquered, on account of the evidence furnished by experiments.

The idea of the transmission of leprosy by mosquitoes has also lost its apparent strangeness by now. Experimental proof should not be necessary, considering that circumstantial evidence is so clear.

About fifty attempts to transmit the disease by direct inoculation of leprous tissues have failed, and hundreds of lepers existing in European cities did not produce any new infections.

Even so, many authors believe that life in common, as lived in the family, specially between mothers and small children, and the use of the same clothes, or sleeping in the same bed with lepers, may lead to an infection, though they give no adequate reason why this should be so.

But admitting, for the sake of argument, that this may be the case, what shall we say to the fact, that young girls of good European families, coming from non-leprous countries, acquired the disease without ever having seen lepers, still less having had any sort of
intercourse with them. These girls did not even go to public schools, nor did they walk barefoot outside their homes. They showed the first localisations on the face or on the arms. I myself have witnessed several such cases in places like São Paulo and Rio where the disease was not in rapid expansion, but where there were badly isolated lepers in hospitals or private houses. In other more heavily infected countries they must be even more frequent.

Among older persons, who acquire the disease in leper countries there are also many who have never known lepers and show the same localisation. Such cases can be accounted for by transmission through mosquitoes; I do not see any other plausible explanation.

In Hawaii, where I was from 1889 to 1900, both mosquitoes and leprosy were introduced many years after the discovery of the archipelago. They were both so foreign that there was no Hawaiian word for either of them, although every plant indigenous to the islands has its own native name. Once introduced, however, mosquitoes multiplied greatly owing to the fact that the most important vegetables are planted under water. The result was that the Hawaiian Islands became one of the most important foci of leprosy, although there were only two kinds of blood-sucking Diptera found, Stegomyia fasciata and Culex fatigans, now generally known as Aëdes aegypt and Culex quinquefasciatus.

Numerous experiments have been made with both of these mosquitoes, but they were not properly conducted. The fact that acid-fast rods may or may not be found in the gut of the gnats shortly after sucking lepers is of small importance, because we cannot expect the infection to take place immediately. Nor will it be vehiculated by the mosquitoes’ excrements, which contain the germ in the same non-infectious form used in the unsuccessful experiments of transmission from man to man. As far as I can see, the question of an ulterior development of the lepros germ in the mosquito has never been investigated.

It must not be forgotten that the virus exists also in a granular (perhaps not always acid-fast) form which may prove to be more infectious.

It is not advisable to make such experiments with the germ of leprosy, but other Coccothrix species might be substituted. There are now a considerable number of Coccothrix known; some of them are found in a saprophytic state, while others are parasites of various animals. Some of them are closely allied to the human tuberculous bacillus and produce bovine and avian tuberculosis or a similar disease in coldblooded animals. Others are more like the germ of human leprosy and occur in much larger numbers without producing the alterations peculiar to tuberculosis. One of these produces an intestinal infection of cattle, known as Johne’s disease, another is found in small birds and a third one was described by Sticker, from sea fish sold on the market of Bergen.

Marchoux infected white rats with rat leprosy, as well by friction through the shaved abdominal skin, as through the conjunctival sac. Moreover he states that he has produced
a similar disease in white rats by inoculation from an atypical case of human leprosy. Marchoux is evidently inclined to consider the bacillus of Stefansky as a form of the human leprosy bacillus. Up to now there is no other indication that Stefansky’s bacillus will infect man with human leprosy.

II. Prophylaxis

The idea of direct contagiousness of leprosy is a very old one, although it has been abandoned during long periods, from time to time. It leads naturally to the attempt to isolate lepers which is also very old. In China, for instance, it is said to have been put into practice for over four thousand years in a very severe form, but it has evidently not given the desired results as China is still one of the most intense foci of leprosy. After the discovery of the germ of leprosy, the practice of isolation, which existed in the Middle Ages, was revived in Europe and other parts of the world.

The enforced isolation of all patients suffering from leprosy is a very harsh measure and consequently not only unpopular but conducive to opposition and concealment. Therefore it has probably never been carried out in a really complete fashion, the more so as the diagnosis of light and incipient cases may be very difficult. The only way of discovering all cases would be the periodic examination of everybody, from head to toes, with all known means of investigation, and that is hardly practicable.

At any rate, the surroundings of isolated patients ought to be made as pleasant as possible so that they and their families may become more willing to submit. In reality it often happens that well-to-do patients are allowed to remain in their own homes, sometimes on condition of following certain rules of hygiene which are of rather doubtful value and are certainly not always obeyed by them. While the non-observance of the rules in non-leprous countries does not endanger anyone, their value in leper countries is more than doubtful, as they are generally based on the fallacious idea of direct contamination.

We have no certain indications at the present moment as to what kind of patients are infectious, but it is permissible to suppose that cases in active progress, with fever and new eruptions, are the most dangerous, as in some form or other, the germ must circulate in the blood, though perhaps not in large numbers. Quiescent cases may be harmless, but we cannot be quite sure of this.

To an impartial observer, it is quite evident that isolation under the conditions in which it has been so extensively practiced, has not given satisfactory results. It is true that in many countries leprosy has disappeared, but it has been a very slow process and was certainly not due to the imperfect isolation used. We have already seen that such countries are now not only free from leprosy but even that the numerous introduced cases fail to propagate the disease.

Although leprosy is by no means limited to the poorer classes, they are more generally affected. Consequently, in all leprous countries, without special legislation or strict law enforcement, a great number of lepers become beggars and lead a migratory life. It is eminently desirable to abolish this and to avoid their exhibiting their often hideous lesions in public, by providing adequate hospitals where they can be cared for. Such hospitals must, however, not be placed in populous centers. It is not enough to prevent the patients from circulating among healthy persons but they must be protected from mosquito-bites by all means known to modern prophylaxis, just as is done for yellow fever cases.
In some countries there is a tendency to put leper colonies on uninhabited islands. This may ensure somewhat better protection of the general public against transmission, but one often sees that the healthy people living there with the lepers get contaminated. This is due to the fact that in those places there are any amount of mosquitoes, as well as of other vermin, to be found.

The first rule of all leper colonies ought to be keep them entirely free from every possible carrier of diseases.

This would make isolation really efficacious, though it will never become popular in itself, even under the best of conditions. Isolation in out-of-the-way places would not be really necessary if mosquito prophylaxis were perfect but that also is very difficult to obtain.

III. Mosquito Prophylaxis

We need not insist on the description of all the measures that should be used against mosquitoes, as they are well known owing to malaria and yellow fever. Briefly, they consist in exterminating adults in the house, specially in the bed-rooms and preventing them from entering again; in extinguishing all breeding places and killing the larvae they hold. This can all be quite well accomplished by means of a properly trained and sufficiently numerous body of workers. All windows ought to be screened and the use of mosquito-nets on beds is also to be recommended, though they are hard to bear on really hot nights in the tropics. A judicious use of ventilators will prove helpful in remedying this.

All leper hospitals and colonies must be distant from other dwellings and their premises must be kept dry and free from larvae. The necessary containers of water must also be mosquito-proof. The beds of febrile patients ought to be specially protected and isolated. Here also every window should be screened. It is quite absurd to shut the doors on the patients and leave the windows open and unprotected for the mosquitoes to come and go.

Considering that the number of lepers in the world is estimated at two or more millions, which might correspond to nearly a 100,000 new cases year, it is not permissible to neglect out of carelessness, measures that might prevent a considerable proportion of them. The merely theoretic objections have been answered and the riddance from mosquitoes is a benefit in itself.

It is not just to postpone mosquito-prophylaxis any longer, on the plea that experimental proof has not been given. The nature of leprosy renders experiments impracticable but the analogy with other diseases is clear. All other prophylactic measures have proved insufficient. Consequently it is high time that new methods be tried.