

# Editorial

## HOW INFECTIOUS IS LEPROSY?

As Socrates knew, and as his pupils soon became aware, a question may be deceptive in its simplicity and conceal unsuspected snares and pitfalls. But the very actions of formulating a question and of fearlessly pursuing its answer are both stimulating and rewarding.

The question, "How infectious is leprosy?" is being asked today by clinicians and epidemiologists, by microbiologists and immunopathologists, by interested laymen and astute politicians, and it is being asked with increasing awareness of the human problems involved in a world in which leprosy is still not controlled. On the informed reply to the question depend such very practical issues as the type of control measures adopted, the perpetuation of ancient attitudes towards the segregation of leprosy sufferers, the proportion of the health budget that will be devoted to the leprosy programme, and the degree of urgency with which the whole problem of the leprosy endemic is regarded. If leprosy is very contagious, then institutional segregation as for smallpox will be advocated, and apparent success will follow such measures as in Norway and Japan. On the other hand, if leprosy is but slightly contagious, and if that small degree of contagiousness can be reduced to zero within months by the administration of bacteriostatic drugs, or within weeks by high-dose oral rifampicin, then quite different measures will be adopted. Very rarely do workers in leprosy institutions contract leprosy, although there are certain indications that non-medical workers contract the disease more frequently than doctors or nurses. If leprosy were highly contagious, then it would be expected that expatriate staff, especially those of Caucasian origin, would contract leprosy much more frequently than they do.

The question, of course, is no new one: it has been raised, and answered, in succeeding centuries. With naïve illogicality, and an apparent unawareness of the mutual exclusiveness of the propositions, leprosy was at times held to be both an hereditary and a highly contagious disease. Sometimes one or other concept seemed to predominate. Within a few short years of the appearance of the *Report of the (London) Royal College of Physicians*, which came down boldly on the side of the hereditary theory, complacency was shattered by the dual arguments, reciprocally reinforcing each other, of a Father Damien somehow contracting leprosy after exposure to the disease in Hawaii, and Armauer Hansen identifying the suspected causative organism of leprosy. When the full implications of this revolutionary concept were realized, governments of many countries were stampeded to enact legislation requiring the compulsory segregation of leprosy sufferers for the protection of society.

A more humane and enlightened attitude may now prevail in most countries, but nagging doubts concerning the infectiousness of leprosy persist in the minds of many, and these doubts have not been dispelled by any very obvious reduction in the incidence of leprosy on a wide scale. So far, the most effective and

practical measure for reducing rates appears to be the reduction in the *réservoir de virus* by vigorous and regular treatment of all patients with multibacillary disease—"secondary prevention". In the continued and regrettable absence of a specific vaccine, and the logistically impossible large-scale prophylactic medication, such measures have given good results in just those countries where the leprosy prevalence rates, though high, are largely accounted for by patients with paucibacillary disease. So far, generally applicable and reliable methods of "primary prevention" of leprosy, and accurate techniques of identifying individuals at greatest risk after exposure to leprosy challenge, elude us.

Asking the question, "How infectious is leprosy?" thus leads to the raising of a whole series of related questions, which must become more precisely worded as knowledge advances in the realms of the microbiology of *Myc. leprae*, the immunological receptivity of refractoriness of the exposed individual, and all the intervening circumstances of environmental importance. Time was when "consumption" was equated with poverty and undernourishment, with a blighted romance or a broken heart. The heroine, with a hectic flush on her wan cheeks, "went into a decline" and wasted away, succumbing at length after a frightening gush of blood from the lungs. Leprosy is at length emerging from this pre-scientific setting, but many and serious gaps in our knowledge remain. The "infectiousness of leprosy" is related to, but not wholly dependent upon, the transmission of the bacilli. Transepithelial implantation of viable organisms—by droplet infection, by inhalation from contaminated fomites, by the gastrointestinal route, or otherwise—may or may not be followed by overt and recognizable clinical disease, though evidence is mounting that tell-tale changes in the lymphocytes may indicate challenge by *Myc. leprae* some time in the past.

Nor are all patients with leprosy equally contagious—a fact long appreciated. Some doubt still lingers in some minds concerning the demonstration of non-viability by means of the mouse footpad inoculation technique: an optimum micro-environment—which may include the presence of adjuvant biochemical moieties, intact macrophage cell-walls, or symbiotic organisms—might favour the growth of certain puzzling possibilities such as L-forms, aberrant forms, highly refractile spores, non-stainable granules and the like. Mycoplasma-like bodies, diphtheroids, and non-acid-fast rods may prove to be important in the life-history of the taxonomical chameleon that is *Myc. leprae*.

The size and repetition of the invasive challenge must also be an important factor, especially in relation to the presence of a changing degree of immunological refractoriness dependent on heredity, exposure to related mycobacteria, urban residence, age, and other factors.

Many puzzling questions remain unanswered. To judge by the nasal secretion, the presence of viable *Myc. leprae* in the lumina of sweat glands and of pilo-sebaceous glands, and in hair follicles, as well as by the enormous parasitization of the dermis and submucosa of the upper respiratory tract, lepromatous and near-lepromatous leprosy should be many thousands of times as infectious as tuberculoid leprosy. But it is not. Epidemiological surveys would indicate that at certain stages, patients with tuberculoid leprosy may apparently be the source of household infection to an extent quite out of proportion to the extremely scanty (and non-viable) bacillary infection of the dermal nerve fibrils. The family "clustering" of leprosy, too, needs further investigation, as does the pattern of sib infection in households.

The source of infection may frequently remain unrecognized for years: perhaps

it is a patient with barely visible macular areas of very slight hypopigmentation—teeming with organisms; or a patient with early damage to the nasal mucosa. Sometimes it is an old person with wrinkled, corrugated skin, who may be shedding *Myco. leprae* by the thousand every day.

On the other hand, many persons suffering from the late results of neglected neuropathy, and with discharging ulcerations of the extremities, or with progressive deformities, are frequently regarded by laymen as highly contagious. Much public education will be required before such persons are regarded as no longer posing a threat to the community, before ordinary folk are as convinced as are medical men that the exudate from sphacelous ulcers contains no viable leprosy organisms.

The occurrence of carriers, of potentially contagious subjects suffering from no discernible clinical manifestations of leprosy, opens up fascinating and disturbing vistas of epidemiological importance. "Leprosy houses" are part of the folk-lore in many countries: will they eventually prove to be part of the scientifically established pattern of transmission of the disease?

Vectors, also, have from time to time been incriminated, and recent published work indicates a revival of interest in this possibility of transcutaneous implantation of the viable organism. This mode is potentially far more important than tattooing, vaccination or injection as a widespread phenomenon by which the epidermis is penetrated by a pointed "instrument".

We have come a long way in trying to answer the question "How infectious is leprosy?" but if the areas of ignorance are thereby exposed and precise derivative questions are formulated, then, in the process of asking and answering, the frontiers of knowledge and the effectiveness of leprosy programmes will be advanced.