liquid cultures grown for 12 and 16 weeks. In parallel, hindfoot pads of five nude mice were also infected with the suspension (containing 1×10^7 bacilli) prepared from foot pad lesions of nude mice previously infected with *M. leprae*. It was observed that the hindfoot pads of all of the mice infected with the above-mentioned preparations were slightly swollen after about 8 months of infection. Experience has shown that such mice will develop full lepromatoid lesions on the food pads 13–16 months postinfection.

An important aspect of this study is the role of palmitic acid for the growth of the bacilli in the synthetic medium in the presence of air. The use of any gas mixture is quite tedious, time-consuming and laborious. The use of palmitic acid in the presence of air for *in vitro* cultivation trials of *M. leprae* eliminates the use of any gas mixture.

Recently, water-soluble palmitic acid has become available ([5]), and further studies are in progress to compare the role of insoluble and water-soluble palmitic acid in metabolic studies and in cultivation trials of *M. leprae*.

—Mohammed Ishaque, Ph.D.

Professor
Applied Microbiology Research Centre
Institut Armand-Frappier
University of Quebec
C.P. 100, Laval, Quebec
Canada, H7N 4Z3

Acknowledgment. This study was supported by grants from Le Secours aux Lépreux, Canada, Inc., and the Military and Hospitaller Order of Saint Lazarus of Jerusalem, Canada.

REFERENCES

1. Franzblau, S. G. Oxidation of palmitic acid by *Mycobacterium leprae*. J. Clin. Microbiol. **26** (1988) 18–21.
2. Ishaque, M. Direct evidence for the oxidation of palmitic acid by host grown *Mycobacterium leprae*. Res. Microbiol. **140** (1989) 83–93.
3. Ishaque, M. Growth of *Mycobacterium leprae* under low oxygen tension. Microbios **64** (1990) 7–17.
4. Kato, L. A multifactorial culture medium with growth factors from leprosy-derived mycobacteria proposed in cultivation trials for *Mycobacterium leprae*. Int. J. Lepr. **54** (1986) 310–311.
5. Kato, L. Water soluble complexes of palmitic acid and palmitates for metabolic studies and cultivation trials of *Mycobacterium leprae*. Int. J. Lepr. **60** (1992) 105–107.
6. Prabhakaran, K. Oxidation of 3,4-dihydroxyphenylalanine by *M. leprae*. Int. J. Lepr. **35** (1967) 42–51.
7. Shepard, C. C. and McRae, D. H. A method for counting acid-fast bacteria. Int. J. Lepr. **36** (1968) 78–82.
8. Wheeler, P. R., Bulmer, K. and Ratledge, C. Enzymes for biosynthesis *de novo* and elongation of fatty acids in mycobacteria grown in host cells: is *Mycobacterium leprae* competent in fatty acid biosynthesis? J. Gen. Microbiol. **136** (1990) 211–217.

Leprosy; Another Possible Source of Transmission

To the Editor:

Armadillos, sooty mangabey monkeys, chimpanzees and other primates have been examined by various workers at various times using clinical and experimental methods ([1, 4, 11–13]) for affliction with leprosy and for their possible role in transmission. According to Meyers, *et al.* ([7]), ". . . there seems ample justification for undertaking, forthwith, carefully designed surveys for enzootic leprosy in some of the major endemic areas." These authors suggest that such surveys should be initiated in the natural habitats of the mangabey monkey and the chimpanzees in West Africa. As a means of understanding the behavior of *Mycobacterium leprae,* this is an excellent suggestion. However, any hypothesis regarding transmission of leprosy from nonhumans to humans must, of necessity, take into consideration a "most common factor" which should be consistent with regard to time and place. For example, sooty mangabey monkeys, chimpanzees, and armadillos simply do not exist in some of the most endemic areas of leprosy today. They could not have figured in the transmission in Norway before it disappeared completely, after making

a brief comeback in the early part of this century.

To explain the occurrence of leprosy worldwide, a more universal hypothesis based on a "most common factor" needs to be made. This hypothesis should take into account, for example, the Norwegian experience, the incidence of indigenous leprosy in the southern states of the United States of America, the lack of an appreciable drop in annual incidence figures in well-organized, MDT-based, control programs in places such as Karigiri, India, and the incidence of leprosy in China, Africa and the Far East.

One such hypothesis based on a "most common factor" is that *M. leprae* may be spread through bovine milk. Bovine milk is and has been a universal phenomenon in Africa, Asia, Norway, the southern United States and, indeed, anywhere in the world. Milk processing, consumption habits, and customs, however, vary from region to region and from home to home. In parts of India, for example, a common belief is that boiling of milk destroys its nutritive value, and so it is consumed raw.

Armadillo and human milk samples have yielded *M. leprae* ([7, 9]). Mycobacteria have been isolated from pasteurized milk ([3]) and from raw milk ([5]). These studies used culture techniques to characterize and classify these organisms. *M. leprae* that may have been present would have been excluded automatically by virtue of its noncultivability. No studies confirming or negating the presence of *M. leprae* in milk have been reported so far, possibly because conventional techniques used for the identification of *M. leprae* have required large numbers of viable organisms.

The advent of the polymerase chain reaction (PCR) technique, in 1984, represents a quantum leap in our ability to detect small amounts of *M. leprae* with great certainty ([2, 6, 8, 10]). An attempt to exclude *M. leprae* from among the acid-fast organisms found in milk, using PCR, could well prove to be an interesting exercise.

—Jayanth K. Devasundaram, M.B.B.S.
N/1 Adyar Apartments
Kotturpuram
Madras 600085, Tamil Nadu, India

Acknowledgment. Mr. P. T. Chavan, Senior Laboratory Technician, Richardson Leprosy Hospital, Miraj, Maharashtra, India, is thanked for his interest, enthusiasm and cooperation while checking milk samples from the field during the formulation of this hypothesis.

REFERENCES

1. Binford, C. H., Storrs, E. E. and Walsh, G. P. Disseminated infection in the nine-banded armadillo (*Dasypus novemcinctus*) resulting from inoculation with *M. leprae*; observations made on 15 animals studied at autopsy. Int. J. Lepr. **44** (1976) 80–83.
2. Bloom, B. R. An ordinary mortal's guide to the molecular biology of mycobacteria. (XIII Leprosy Congress State of Art Lecture) Int. J. Lepr. **58** (1990) 365–375.
3. Chapman, J. S. and Speight, M. Isolation of atypical mycobacteria from pasteurized milk. Am. Rev. Respir. Dis. **98** (1968) 1052–1054.
4. Donham, K. J. and Leininger, R. J. Spontaneous leprosy-like disease in a chimpanzee. J. Infect. Dis. **136** (1977) 132–136.
5. Jones, R. J., Jenkins, D. E. and Hsu, K. H. K. Raw milk as a source of mycobacteria. Can. J. Microbiol. **12** (1966) 979–984.
6. Marx, J. L. Multiplying genes by leaps and bounds. Science **240** (1988) 1408–1410.
7. Meyers, W. M., Gormus, B. J. and Walsh, G. P. Nonhuman sources of leprosy. Int. J. Lepr. **60** (1992) 477–480.
8. Mullis, K. B. The unusual origin of the polymerase chain reaction. Scientif. Am. April (1990) 56–65.
9. Pedley, J. C. The presence of *M. leprae* in human milk. Lepr. Rev. **38** (1967) 239–242.
10. Stackebrandt, E. and Kazda, J. Further evidence for the exclusiveness of the *Mycobacterium leprae*-specific DNA probe. Int. J. Lepr. **58** (1990) 130–133.
11. Truman, R. W., Job, C. K. and Hastings, R. C. Antibodies to the phenolic glycolipid-I antigen for epidemiologic investigations of enzootic leprosy in armadillos (*Dasypus novemcinctus*). Lepr. Rev. **61** (1990) 19–24.
12. Walsh, G. P., Storrs, E. E., Burchfield, H. P., Cottrell, E. H., Vidrine, M. F. and Binford, C. H. Leprosy-like disease occurring naturally in armadillos. J. Reticuloendothel. Soc. **18** (1975) 347–351.
13. Wolf, R. H., Gormus, B. J., Martin, J. N., Baskin, G. B., Walsh, G. P., Meyers, W. M. and Binford, C. H. Experimental leprosy in three species of monkeys. Science **227** (1985) 529–531.