

CURRENT LITERATURE

This department carries selected abstracts of articles published in current medical journals, dealing with leprosy and other mycobacterial diseases. Abstracts are supplied by members of the Editorial Board and Contributing Editors, or are reproduced, with permission, from other abstracting journals.

General and Historical

- Browne, Stanley G.** The Leprosy Mission. A century of service. *Lepr. Rev.* **45** (1974) 166-169.

During the past 100 years The Leprosy Mission has played a significant role in all the major advances in the treatment of sufferers from leprosy. Sympathetic custodial care was at first the only way of helping the individual and of alerting the conscience of Christendom and of governments. Workers of The Mission have been foremost in the use of modern medication, reconstructive surgery, domiciliary treatment schemes, rehabilitation, and vocational training, and have made important contributions to the literature of leprosy. The emphasis throughout has been compassionate caring for the individual afflicted by leprosy.—Author's Summary

- Harboe, Morten** Hva vet vi om lepra og hva gjør vi? [What do we know about leprosy and where are we going?] *Nord. Med.* **88** (1973) 186-189. (In Norwegian)

The author reviews some of the proceedings of the Bergen congress, particularly as related to leprosy control, social reaction and rehabilitation. These are related to a brief summary of Norway's outreach in leprosy work.—O. K. Skinsnes

- Moser, R.** Holy Man and his disease. *JAMA* **228** (1974) 78-80.

The editor of the *JAMA* reminisces on some of his experiences with leprosy, briefly reviews some of the current developments in concepts of leprosy immunity and speculates on the status of Father Damien's T cells.—O. K. Skinsnes

- Saul, Amado.** Los "handicaps" de la leprología. [The present day handicaps of lep-

- rology.] *Dermatologia (Mex.)* **16** (1972) 363-366. (In Spanish)

The author stresses the big difficulties of leprology still present 100 years after the discovery of Hansen's bacillus.

Diagnosis is made very late, sometimes several years after onset of the disease, because early manifestations of leprosy are very poor and are not recognized by doctors. The patients are afraid of the disease. In some cases it is very difficult to verify the diagnosis even with laboratory aids, thus, when diagnosis is finally made the disease has caused irreparable damage.

Classification of some cases, which has therapeutic and epidemiologic implications, is not easy.

The ideal drug for treatment is not yet available. DDS is very good but is slow-acting and drug resistance has been frequently reported along with lepra reactions. Lamprone and long-acting sulfonamides have important side-effects and rifampicin, which appears to be the most active drug, is very expensive. Lepra reaction is still a problem. Thalidomide is very active, but difficult to obtain, and it is not a harmless drug.

Important advances have been made in the areas of bacteriology and immunology of leprosy, but we are still very far from discovering a vaccination or a method to improve the impaired cell-mediated response in lepromatous cases. The use of transfer factor or lymphocyte B, as well as other immunological processes, are being investigated but no definite results have been obtained.

Regarding epidemiology and the control of leprosy cases, we do not know exactly how leprosy is transmitted. What is the role of genetic factors: why do some people get sick, and why do most of the others remain

disease-free? We can only hypothesize on this.

Prejudice is still one of the biggest handicaps and we have no medicine against it but education.—Author's Summary

Schiferin, E. and Agrest, A. Enfermedad de Hansen en un servicio de clinica medica. [Leprosy in a department of internal medicine.] *Medicina (B. Aires)* **34** (1974) 47-55. (In Spanish)

Epidemiological, clinical and laboratory findings in 11 patients with leprosy were reviewed. Five patients were male and six were female. Their ages ranged from 19 to 80 years old. Seven were born or had lived for a long time in areas where leprosy is endemic and one had worked at a leprosarium for ten years. Leprosy was the chief complaint in only two of these patients. The others were admitted for other diseases or clinical features related to leprosy but not recognized as such. The diagnosis of leprosy was known previous to admission in four patients, made on entering the hospital in two, suggested by the dermatologist consulted in two cases, and an unexpected histopathologic finding in three patients.

Eight patients presented lepromatous leprosy and of these, two suffered from diffuse lepromatosis, one of them with a superimposed Lucio phenomenon. Three patients had the tuberculoid polar type.

The clinical features were found to be typical once the correct diagnosis was reached. Associated diseases were diverse and were often responsible for drawing attention away from the skin lesions of leprosy, thus causing misdiagnosis, as has already been reported. Some diseases were related to leprosy as was amyloidosis in two patients, one of

whom presented acute renal failure and a hypersensitivity type angitis which was later interpreted as a Lucio phenomenon. Other diseases or pathologic findings totally unrelated to leprosy included: duodenal ulcer with gastrointestinal bleeding, gastritis and antral stenosis, cholelithiasis, diverticulosis and diverticulitis of the bladder with cystitis, prostatitis, acute and chronic pyelonephritis, renal sclerosis, chronic renal failure, pleural effusions, purulent bronchitis and bronchopneumonia, pulmonary emphysema, atherosclerotic heart disease and generalized atherosclerosis, rheumatic fever, rheumatic aortic and mitral regurgitation, metastatic carcinomatous disease, systemic moniliasis, pulmonary tuberculosis and infectious mononucleosis.

Hyperglobulinemia, cryoglobulinemia, positive LE cell preparations, anti-nuclear factors, anti-DNA antibodies and latex test for rheumatoid factor, negative serology for syphilis with the Migliano reaction and depression of cellular immunity expressed by the negative response to tuberculin skin testing were the most prominent ancillary findings in some of the lepromatous cases.

The number of patients found among 10,150 patients admitted between 1961 and 1972 was compared to official statistics which showed a prevalence of 0.57 per thousand inhabitants in Argentina. It is concluded that the number of patients suffering from Hansen's disease is much larger than officially acknowledged. The need to keep the disease in mind is stressed, the clinical features of the skin in leprosy, sensory changes, pathologic and bacterioscopic diagnosis, along with the importance of registration and communication of new cases are all emphasized.—(*Adapted from English summary*)

Clinical Sciences

Barton, R. P. E. A clinical study of the nose in lepromatous leprosy. *Lepr. Rev.* **45** (1974) 135-144.

A detailed study of the nose in cases of lepromatous leprosy was undertaken at Victoria Hospital, Dichpalli, India and the results correlated with general clinical findings. The histologic details of the study will

be presented elsewhere. The signs and symptoms of nasal involvement are described and it is stressed that this involvement occurs early in the disease process. The importance of all leprosy workers being aware of nasal involvement is pointed out and it is recommended that facilities for local care of the nose in leprosy should be established wherever the disease is treated.

Possible mechanisms whereby leprosy may be transmitted are discussed.—Author's Summary

- ✓ **Bourrel, P.** Reestablishment of opposition movements of the thumb. Considerations on 52 cases. *Ann. Chir.* **28** (1974) 309-317. (In French)

After the study of a series of 52 cases of opposition paralysis, a simple therapeutic pattern has been outlined:

- A. An isolated paralysis of the lower middle finger: transplantation of the extensor pollicis brevis reflected on the flexor carpi radialis and secured on the extensor pollicis longus, at P1 level; or else Thompson's operation.
- B. In paralysis of the lower middle finger combined with ulnar paralysis: Thompson's operation with forward slide of the flexor pulley and metacarpophalangeal capsule shortening when the flexion deformity of P1-P2 of the thumb is lacking or only slight, and with P1-P2 arthrodesis in cases of flexion stiffness of P1-P2.

Moreover, in lesions of the medianus nerve at the middle third of the forearm with unimpaired functioning of the flexor muscle of the thumb, simultaneous transplantation of the extensor pollicis brevis was propounded: no transient opposition paralysis occurred (one case).

Finally, when recent suturing of the lower medianus nerve has failed, re-exploration of the suture line with resection and re-suturing, can lead to complete recovery.—English Summary

- ✓ **Browne, Stanley G.** Self-healing leprosy: report on 2,749 patients, *Lepr. Rev.* **45** (1974) 104-111.

Self-healing forms of leprosy account for a considerable proportion of patients suffering from diagnosable forms of the disease among the deeply pigmented people of Africa. These lesions are described clinically; they are bacteriologically negative to standard methods of examination, and the histopathology is nonspecific or frankly tuberculous. The frequency is unsuspected unless whole population examinations are regularly undertaken.—Author's Summary.

- ✓ **Campos, Francisco Javier,** *Lepra y depresión. Comunicacion de un caso.* [Leprosy

and depression.] *Dermatologia* **17** (1973) 177-183. (In Spanish)

A parallel is made between leprosy and mental illness according to their pathogenesis and defense mechanisms.

The depressive equivalents and masked forms of depression are emphasized.

The case of a male patient with lepromatous leprosy and unipolar depression is discussed in detail. Comments are made regarding the main psychological features of Hansen's disease patients.—English Summary

- ✓ **Davey, T. F. and Rees, R. J. W.** The nasal discharge in leprosy: clinical and bacteriologic aspects. *Lepr. Rev.* **45** (1974) 121-134.

Nasal discharges containing acid-fast bacilli were studied broadly, in India, in relation to their clinical setting in 363 patients and intensively in London in relation to their bacteriology.

The rarity of such a nasal discharge in borderline leprosy was in striking contrast to its frequency in untreated lepromatous leprosy. In this series the nasal discharge did not develop gradually with the advance of lepromatous leprosy. Highly bacilliferous discharges were encountered in early lepromatous leprosy, indicating nasal involvement far more severe than external appearances suggested. At a later stage the bacteriologic importance of the discharge waned, but became once again of great significance with the onset of recrudescence.

The typical nasal discharge is an inflammatory exudate rich in both *M. leprae* and macrophages displaying every stage in globus development. The exceptionally high BI and high MI often encountered in untreated patients in this series frequently exceeded the highest values found in skin. The nasal discharge was encouraged by moist atmospheric conditions and diminished rapidly with even small doses of dapsone.

Fresh early morning specimens and 24 hour collections of nasal discharges from 31 patients in this series were sent on wet ice to London, together with fresh biopsies of highly infected skin from 11 of these patients.

Bacillary isolates from the nasal discharges of all 31 patients produced growth curves in the mouse foot pad characteristic for *M. leprae*, indisputable proof that this

organism was present in every case. The mean total yield of acid-fast bacilli in the 24-hour collections was 2.4×10^8 , with a MI of 12.8. Single nose-blow collections showed a mean discharge of 1.1×10^8 acid-fast bacilli with a mean MI of 16.9. Comparison between the content of acid-fast bacilli/gm of skin and that of the specimen of nasal discharge from the same patient showed a significantly higher proportion of solidly staining bacilli in the nasal discharge.

In three patients, mouse inoculation tests for dapsone sensitivity of *M. leprae* isolated from nasal discharges and skin biopsies revealed dapsone-resistant bacilli both in the skin and in the nasal discharge.

The capacity of *M. leprae* in nasal discharge to survive outside the body was tested in three cases, by allowing the discharge to dry in the dark at room temperature and sampling for mouse inoculation being undertaken at 1, 1.75, 3, 7, and 10 days. Full survival was found after 24 hours and 10% after 1.75 days, but none after 3, 7 and 10 days, except in one sample in which some growth occurred after seven days.

Similarities with tuberculosis and the significance of both clinical and bacteriologic findings to the transmission of leprosy are discussed.—Author's Summary

Francisco, Cesar Perez de. Lepra y locura. [Leprosy and madness.] *Dermatologia* 17 (1973) 233-236. (In Spanish)

A brief comment about two of the biggest fears of the human being: leprosy and madness, which are included in a poem by Xavier Villaurrutia, "Paradoja del Miedo," stressing the prejudices which exist even today.—(Adapted from English summary)

Gharbi, M. R., Kammoun, R. and Chadli, A. La lèpre intermédiaire en Tunisie. A propos de deux observations. [Two cases of borderline leprosy in Tunis.] *Arch. Inst. Pasteur Tunis* 50 (1973) 67-75.

Two typical examples of borderline leprosy are reported from Tunis where this type is held to be uncommon. Clinical, bacteriologic and histologic findings concur.—S. G. Browne (*From Trop. Dis. Bull.*)

Inoue, N., Ohta, M., Tabira, T., Shida, K. and Goto, I. A case of lepromatous neuritis. *Clin. Neurol. (Tokyo)* 13 (1973) 658-663. (In Japanese)

We reported a case with lepromatous leprosy. This 52-year-old woman first noticed about three years ago, severe tingling pain of the left thumb, spreading to both hands and later to the feet.

Then severe intractable pruritus followed in the above location. One year later she developed erythematous flat skin lesions on face, hands and feet. Following this, she frequently burned both hands and feet without awareness of heat and pain.

Physical examination on admission revealed erythematous lesions on face, hands and feet. There was a small, reddish-brown nodule on the right knee. Neurological examination disclosed bilateral loss of pain, temperature and touch sensations in patchy distribution in forearms and lower legs. Dorsiflexion of the feet was slightly impaired. The deep reflexes were diminished. Peripheral nerves were normal in size on palpation.

Two cutaneous biopsies showed many granulomatous lesions containing innumerable acid-fast bacilli and lepra cells.

Sural nerve biopsy showed many lepra cells in epineurium, perineurium and endoneurium. Myelinated fibers decreased remarkably.

The teased preparation showed mainly the lesions of axonal degeneration. Some segmental demyelination was also found.

The above data were not compatible with the theory that nerve lesions in lepromatous leprosy are essentially the result of Schwann cell degeneration but with interstitial neuritis.—(Adapted from English summary)

Kumar, A., Indraran, A., Isaac, J. J. and Gupta, S. C. Age at onset of leprosy in relation to type of leprosy, site of first lesion and occupation. Observations based on records of patients in Naini Hospital, Allahabad. *Lepr. India* 45 (1973) 167-173.

This study presents an analysis of 1,100 patients diagnosed as suffering from leprosy, who presented themselves during a 12 month period at the Naini Hospital, Allahabad, India. Noteworthy findings in this self-selected group were: the apparent late age of onset (average 34 years); the low proportion (10%) of childhood infections, that is, children aged less than 14 years; and the frequency with which the initial lesion was on the hand (31%). Patients with indetermi-

nate lesions were much younger (16 years) than those with borderline leprosy (36.72 years).

Since this analysis of a highly selected and motivated population depends largely on lay suspicion and poor recall, the conclusions are not necessarily typical of the situation in India or elsewhere.—S. G. Browne (*From Trop. Dis. Bull.*)

✓ **Miranda, R. N. and Miranda, R. P. G.** Uma introdução à odonto-leprologia. Lepra: suas manifestações buco-maxilares no adulto e na criança. [An introduction to odonto-leprology. Leprosy: its buccal and maxillary manifestations in adults and children.] Centro de Estudos Leprológicos "Souza Araujo" da Universidade Federal do Paraná, Curitiba, Brazil, 1973. (In Portuguese pp 3-33; numerous illustrations. In English pp 35-67)

To most English-speaking readers who may be attracted by the title and pretensions of this short monograph, the real "meat" is contained in pages 61 to 66; the short paragraphs reporting original work on "leprotic gingivitis" and "dental leprosy" will repay reading.

The authors have demonstrated *Mycobacterium leprae* in the dental pulp in patients with lepromatous leprosy, and refer to reports of bacilli in periapical granulomata. Leprosy infection of the gums, which incidentally showed impaired superficial sensitivity, was demonstrated by the presence of leprosy bacilli in great numbers in material removed by the scrape-incision technic. The authors make some play of the absence of any stratum in the gingival submucosa corresponding to Unna's band in the dermis.

Infection of the teeth with leprosy bacilli is shown by a specific pulpitis, which may be suspected if the teeth (especially the upper and lower incisors) have a reddish tinge. *M. leprae* have been found also in the small dentin canals and in the vicinity of the odontoblasts.

The rest of the text gives a fair introduction to leprosy intended for medical students. The clinical and bacteriologic photographs are of poor quality.—S. G. Browne (*From Trop. Dis. Bull.*)

✓ **Pandya, Narendra J.** Skin, dartos, and nerve biopsies as aids to diagnosis in leprosy. *Plast. Reconstr. Surg.* **54** (1974) 70-80.

In 49 known cases of leprosy, of various forms and in various stages, biopsies of the skin, of the dartos, and of nerves were taken for histologic study and for homogenization procedures (to concentrate and find acid-fast bacilli). These proved to be reliable and important aids in the diagnosis and management of leprosy.—Author's Summary

Pandya, Narendra J. and Antia, Noshir H. The value of scrotal biopsy in leprosy. *Lepr. Rev.* **45** (1974) 145-152.

Forty-five scrotal skin and underlying dartos biopsies from leprosy patients of varying types, duration and treatment status were examined for quantitative bacteriology and qualitative histology. On homogenization 33% and on histology 34% were positive for acid-fast bacilli. The average bacillary load/gm of positive tissue was 1.5×10^7 . Of scrotal biopsies 45% were positive against 42% of the skin patch when examined for qualitative changes diagnostic of leprosy. These changes were more marked in the scrotal biopsies in the borderline and lepromatous types. They were chiefly restricted to the neurovascular bundles with unaffected smooth muscle. A stained smear obtained from scrotal skin homogenate is recommended for bacteriological diagnosis as a more superior method than routine multiple skin smears or nasal scraping. Repeated use of scrotal biopsies is emphasized when frequent observations of neurological changes are necessary.—Author's Summary

✓ **Ranney, Donald A.** The role of punch grafting in eyebrow replacement. *Lepr. Rev.* **45** (1974) 153-157.

Many technics of eyebrow replacement are now available, each with its own advantages and disadvantages. For complete replacement of eyebrows punch grafting has no particular advantage. However, it can be recommended for restoring hair to the important medial end of an otherwise successful vascular island transfer in anyone distressed by hair loss in this area. Important technical details are described.—Author's Summary

✓ **Rovisco Pais, No. 2** (1973).

Among lesser known journals, Portugal's ROVISCO PAIS is in actuality a distinguished publication. The second 1973 issue presents

a detailed account of the logistics of the "Hospital-Colonia Rovisco Pais for the year 1972," by Americo Barbosa. This is followed by a report on the use of dermabrasion in the treatment of lepromatous lesions by Dr. Joao Veiga Vieira.—G. L. Fite

Saul, Amado. Reacción leprosa VS Eritema Nodosum Leprosum. [Lepra reaction vs erythema nodosum leprosum.] *Dermatologia (Mex.)* 16 (1972) 229-231. (In Spanish)

The author discusses the convenience and inconvenience of using the names of lepra reaction and *erythema nodosum leprosum* (ENL).

The acute symptoms present only in lepromatous leprosy have been called different names: leprosy fever and paroxysmus febrilis. Souza Lima called them lepra reaction in 1923, and almost all Latin-American leprologists have adopted this name which includes general cutaneous and visceral symptoms.

Among cutaneous manifestations, ENL is one of the most common but not the most unique. Erythema polymorphus and Lucio's phenomenon are also present in other cases.

Tajiri has used the name *erythema nodosum leprosum* to indicate that this syndrome has special characteristics in leprosy and the Anglo-Saxon leprologists have adopted this name to designate a complete acute episode.

The author does not agree with this idea because ENL is only a part of the lepra reaction, and using the name ENL instead of lepra reaction does not mean any advances in the knowledge of this complication of lepromatous leprosy and seems to omit other important symptoms such as erythema polymorphus, Lucio's phenomenon, adenitis, orchitis, iritis and others.—Author's Summary

Temime, P. and Privat, Y. Un cas de lèpre apparemment contractée en France. [A case of leprosy apparently contracted in

France.] *Bull. Acad. Natl. Med. (Paris)* 157 (1973) 444-445.

A gardener, aged 47 years, presented signs of severe iridocyclitis which were associated with unsuspected advanced lepromatous leprosy with all the classical signs. The nasal discharge contained numerous leprosy bacilli, as did the skin.

The interest lies in the source of contagion. The patient had never left France and had had no known contact with anybody from abroad. None of his family had leprosy. The question is raised whether there might be a persistent focus of leprosy in the vicinity of Nice, and the suggestion is tentatively made that he might possibly have been infected through the intermediary of one of the exotic plants which he was in the habit of handling in the course of his work.—S. G. Browne (*From Trop. Dis. Bull.*)

Texier, L., David-Chausse, J., Tamisier, J.M., Gauthier, O., Gauthier, Y. and Boraud, P. Enfermedad de Hansen. Reacción leprosa con intensas manifestaciones articulares. [Leprosy. Lepromatous reaction with intense articular manifestations.] *Medna Cutanea* 7 (1973) 69-70. (In Spanish)

We report the case of a patient with lepromatous leprosy, who for a certain period showed criteria of the Lucio-type leprosy. The incubation was remarkably long. Undergoing treatment with disulone, this patient now showed articular reactions similar to a rheumatoid polyarthritis in addition to the symptomatic leprotic reaction. The presence of BH (Hansen's bacillus) in the liquid of the joint cavity and in synovial cells, leads us to connect these symptoms to Hansen's disease. The facts have only recently come to light and occur in all cases of lepromatous leprosy in the reaction phase. We report the satisfactory therapeutic results obtained with rifampicine.—English Summary (*From Trop. Dis. Bull.*)

Chemotherapy

Browne, Stanley G. Dapsone resistance in leprosy. *Trans. St. Johns Hosp. Dermatol. Soc.* 59 (1973) 225-229.

During the last ten years, drug resistance

in leprosy, demonstrated by feeding mice with known dietary concentrations of drugs and observing multiplication of *M. leprae* in the foot pads, is being reported with disturbing frequency. Intermittent treatment

(the rule, unfortunately, rather than the exception) and low doses of drugs may be the main factors, though serum levels of the drug most often incriminated (i.e., dapsone) attained with low doses appear to be much higher than the minimal inhibitory concentration.

So far, all drug resistant *M. leprae* have proved susceptible to either clofazimine or rifampicin.—Author's Summary

✓ Colwell, W. T., Chan, G., Brown, V. H., DeGraw, J. I., Peters, J. H. and Morrison, N. E. Potential antileprotic agents. 1. Inhibition of a model mycobacterial system by diaryl sulfones. *J. Med. Chem.* 17 (1974) 142-144.

This paper presents a rationale for sequential blocking of the de novo folate pathway in a model system and reports the preparation of a series of DDS analogues and their evaluation as growth inhibitors utilizing *Mycobacterium* species 607 as the test organism. DDS was superior to the test analogues.

The inhibitory activity of the 4'-monoalkylamino analogues seems to be affected by steric and distribution factors. Substitution of nitrogen caused a substantial decrease compared with DDS, while increasing chain length caused a progressive decrease in activity. The 4'-propylamino analogue was an exception (possibly due to experimental variation) to this trend, however. The 4'-hydroxyethyl- and 4'-hydroxylpropylamino compounds were quite active which tends to contradict the steric considerations noted. The 4'-carbomethoxymethylamino analogue was also moderately active, but the carboxylic acid was quite inactive, probably because of inability of the carboxylate ion to penetrate the mycobacterial cell wall. Two dialkylamino analogues, the 4'-diethylamino and diamylamino compounds, were inactive as inhibitors. The 3'-amino and 2'-amino compounds were about one-third and one-fourth as active as DDS, while 3,3'-diaminodiphenyl sulfone and 4,4'-dihydroxydiphenyl sulfone were inactive. None of the compounds tested showed useful activity against the DDS-resistant strain.—O. K. Skinsnes

✓ DeGraw, J. I., Brown, V. H., Colwell, W. T. and Morrison, N. E. Potential antileprotic agents. 2. Inhibition of mycobacterial di-

hydrofolic reductase. *J. Med. Chem.* 17 (1974) 144-146.

This is an initial study of compounds designed to inhibit reduction of dihydrofolate to tetrahydrofolate in the *Mycobacterium* species 607 system. It was found that trimethoprim and pyrimethamine were poor inhibitors of dihydrofolate reductase. Whole cell data showed trimethoprim to be a moderate growth inhibitor while pyrimethamine was a poor one. Aminopterin and methotrexate were found to be powerful inhibitors of the mycobacterial enzyme but inactive as growth inhibitors.

Further approaches to the problem are discussed in detail.—O. K. Skinsnes

✓ Ellard, G. A., Gammon, P. T. and Harris, J. M. The application of urine tests to monitor the regularity of dapsone self-administration. *Lepr. Rev.* 45 (1974) 224-234.

Simple methods are described for determining the regularity of dapsone (DDS) self-administration by outpatients. These methods are based on a comparison of the ratios of the concentrations of DDS to those of creatinine in urine samples collected from outpatients and those from controls given the same daily dose of DDS under strict supervision. These methods were applied to urine samples collected from patients attending some of the mobile clinics in Malawi. They showed that the patients had taken only about half of their prescribed DDS doses in the days immediately preceding their attendance at the clinic. The therapeutic importance of these findings is discussed, and the value of extending these studies to obtain estimates of the regularity of DDS self-administration through the whole treatment period by applying such methods to urine samples obtained by surprise visits to the homes of the outpatients is emphasized.

The mean rate of elimination of DDS determined among a small group of Malawian patients was equivalent to a half-life of about 31 hours. Significant differences were found between patients in the rates at which they eliminated DDS but these differences were unrelated to the extent to which they acetylated the drug.—Authors' Abstract

- ✓ **Gatti, G. G., Cardama, J. E. and Pizzariello, G. E.** Acción de la Imipramina en las reacciones leprosas [Action of Imipramina in leprosy reaction.] *Leprologia* **18** (1973) 141-146. (In Spanish)

In view of the difficulties encountered in the "anti-reaction" treatment for leprosy, we believe that this is an additional tool to be considered under certain circumstances, particularly in our country since at present thalidomide, the antireaction drug "par excellence" is not available.—(Translated from Spanish summary)

- ✓ **Low, S. J. M. and Pearson, J. M. H.** Do leprosy patients take dapsone regularly? *Lepr. Rev.* **45** (1974) 218-223.

Urine dapsone/creatinine (D/C) ratios were determined repeatedly in 15 hospital patients on a supervised daily dosage of dapsone. Figures for the group as a whole covered a wide range, but those for individual patients clustered within that range and were much less variable.

D/C ratios were also determined in 89 outpatients prescribed a daily dosage of dapsone. Thirty-nine patients gave figures lower than any found in the supervised group, and it was estimated that this group of patients had taken about 42% of their prescribed dosage in the previous 24 to 28 hours.

Estimation of the D/C ratio can be utilized to assess regularity of drug taking by a group of patients. Individual patients however can be reliably monitored only if their D/C ratios on supervised treatment are known.—Authors' Abstract

- ✓ **Matsuo, Yoshiyasu.** The effect of rifampicin on *Mycobacterium leprae* in mice. *Japan. J. Microbiol.* **18** (1974) 15-19.

Rifampicin was shown to be highly active against *Mycobacterium leprae* in mice, completely inhibiting the *in vivo* multiplication of this organism at a dosage of 0.1 mg per day by gavage. When drug administration was started after the establishment of *M. leprae* in mice (30 weeks after infection), rifampicin stopped any further bacillary increase. A second inoculation of the organisms from treated mice showed complete loss of viability. Exposure of *M. leprae* to rifampicin for a short period before infection

significantly reduced the viability of the organism.—Author's Abstract

- ✓ **Ozawa, Toshiharu.** Therapeutic effect of rifampicin (RFP) on leprosy. II. The changes of the Morphologic Index of *M. leprae* in patients. *Lepro* **43** (1974) 26-34. (In Japanese)

Seventy-six patients with typical lepromatous leprosy were treated with rifampicin (RFP) and DDS for 12 months, and the Morphologic Index (MI) of 50 of these patients was measured during 0, ½, 1, 3, 6, 9, and 12 months after beginning treatment.

During pretreatment, 28 patients (56%) had more than 3% solidly stained bacilli in their skin smears, but the granular-formed bacilli, generally, had been prominent at the beginning. Most of the cases showed poor recovery by the Bacterial Index though treated with sulfones or other antileprosy drugs regularly for over five years.

In most cases, the MI decreased very rapidly; on the other hand, the granular bacilli quickly increased within a month after treatment was started. After three months of treatment the average value of the GI (granularity index) was 82%; it then gradually increased and most of the bacilli (92%) had become granular at 12 months.

From the results of the MI as an indicator, 9 of 50 patients improved markedly, 21 moderately, 13 slightly, and 7 poorly. As a whole, more than 85% of patients clearly improved their MI including the "resistant cases" in this trial.

There has been no difference between the six day method and the two day method of RFP in obtaining decrease of the MI, and the therapeutic effect has been satisfactory in both methods. During the 12 month treatment no increase in the MI was found in all cases and appearance of RFP-resistant bacilli was not confirmed. Furthermore, the average Bacterial Index decreased very slowly but significantly during treatment.

In conclusion, the decrease of the MI in patients treated with RFP is as rapid as or more rapid than in those treated with other antileprosy drugs.—(Adapted from English summary)

- Russell, D. A., Worth, R. M., Jano, B., Fasal, P. and Shepard, C. C.** Acedapsone in the preventive treatment of leprosy. *Lepr. Rev.* **44** (1973) 192-195.

Acedapsone (diacetyldiaminodiphenyl sulfone), given intramuscularly every 75 days, releases therapeutically active sulfone into the blood stream. A stable Micronesian population of about 1,500 persons living in three villages was given acedapsone in weight-related dosages over a period of about four years. After an initial lag period of six months, during which time the incidence of new cases of leprosy was unaffected, the number of new cases (5) diagnosed was considerably lower than expected. Four of these new patients had received fewer than ten injections, and four developed low-resistant forms of leprosy.

Of the 68 patients who showed signs of active leprosy before the program was instituted, all improved with acedapsone except for six in whom reactivation or immunological shift was associated with irregular therapy.

The use of acedapsone as treatment and prophylaxis in such a circumscribed and co-operative population has decided advantages and points the way to means of effective control.—S. G. Browne (*From Trop. Dis. Bull.*)

✓ **Sasaki, Norisuke and Kawatsu, Kunio.** Therapeutic effect of rifampicin (RFP) on leprosy. III. Histopathological investigation. *Lepro* 43 (1974) 35-44. (In Japanese)

We investigated histopathologically the therapeutic effect of rifampicin on biopsies received from ten leprosaria in Japan. The number of specimens in pretreatment was 70 cases, but it decreased to 40 and 42 cases respectively at six months and one year after initiation of treatment. Cases resistant to or incurable by DDS were in overwhelming majority (65.7%) compared with the other group in pretreatment. Accordingly, the evaluation of the effect of rifampicin was principally carried out on this group rather than comparison with the nontreated control group.

As the size of the leproma in the pretreatment stage differs in each specimen, it was conveniently divided into five types histopathologically according to the shape, extent and size, i.e., large nodular type, diffuse-infiltrated type, scattered-infiltrated type, slight-infiltrated type and minimal-infiltrated type.

It was found that these types transformed rapidly toward smaller nodules during treatment with RFT+DDS, and the number of *M. leprae* in the lepromas decreased rapidly and the form of bacilli changed to granular and finally disappeared completely in some cases. The effective rate of rifampicin was high (75%) and it went far over the limits of sulfone therapy.

Concerning the healing process it was noticed that scar formation or remarkable fibrosis with remnant foci consisting of a few epithelioid cells and/or foamy cells in the corium were present one year after treatment and in some cases foci enlarged temporarily with proliferation of epithelioid cells, lymphocytic infiltration and the appearance of giant cells, i.e., so-called "epithelioid cell reaction" after six months.

However, a few cases were thought to be resistant to rifampicin in that the drug appeared ineffective or the cases deteriorated. Therefore, in the future stricter attention will be paid to those areas.—(*Adapted from English summary*)

✓ **Takeda, M., Arakawa, I., Yokota, T., Kobayashi, S., Yajima, Y., Namba, M., Arai, M., Hazama, S., Ishihara, S., Harada, N., Ozaki, M., Hirano, E., Matsumoto, T., Kumamaru, S., Kasuga, T., Tokuda, H., Arisano, H., Saikawa, K. and Baba, S.** Therapeutic effect of rifampicin (RFP) on leprosy. I. Clinical effect (observations of twelve months). *Lepro* 43 (1974) 8-25. (In Japanese)

This trial was carried out by 13 national leprosaria and the National Institute for Leprosy Research beginning in October 1971. Observations were made clinically, bacteriologically, histopathologically and serologically at regular intervals throughout the trial.

Pure lepromatous cases were selected and divided into the following five groups: Groups A, B, C (C-1, C-2) and D. Group A consisted of untreated new cases and Group B relapsed cases. Group C consisted of so-called resistant cases and was divided into C-1 and C-2 according to the duration of past treatment. Group C-1 consisted of cases showing poor recovery of BI though treated regularly for more than five years. Group C-2 consisted of clinically aggravated cases by regular treatment for more than one year. Group D consisted of cases confronted with

blindness.

The number of cases in this trial totaled 76. The number of cases in each group were as follows: Group A, 4; Group B, 9; Group C-1, 55; Group C-2, 5; and Group D, 3. We administered RFP 450 mg orally before breakfast. Two different methods of administration were compared: twice a week and six times a week. We made a rule to use DDS together with RFP except for Group D. The dose of DDS was gradually increased and reached a maximum dosage of 75 mg or 100 mg daily at the ninth week.

Of the 76 cases, 40 finished the scheduled administration of RFP for 12 months. Seventeen cases dropped from the trial for various reasons. In the remaining 19 cases, treatment had not yet reached the twelfth month. All of the 40 cases receiving RFP for 12 months showed effective results. In Group C-1 with A, B, C-2 and D, even though their numbers were too small to get a clear conclusion, favorable results were also obtained. We could not find statistically significant differences between the two day method and six day method on clinical effects, fall of BI and MI, and frequency of ENL.

The reasons for interruption of RFP administration in 17 cases were as follows: ENL or eye complication in eight cases, borderline reaction in two cases, gastric disturbances in two cases, extra medical reason in one case, and high fever shortly after the intake of RFP in four cases. This symptom of high fever shortly after intake of RFP was observed mainly in the fifth and sixth month after the start of administration. It is notable that these cases were found only in the two day method group. The symptom was suspected to be of allergic nature to RFP, but in some cases it was difficult to distinguish clinically the allergic response from ENL.

Gastric disturbances were the most frequent side effects during the treatment, but they were not too severe. Three cases complained of itching or paresthesia after intake of RFP. Transient increase of S-GOT and GPT values was observed in two cases. One case showed thrombocytopenia which recovered after stopping administration of RFP.

The fall of MI during the treatment was satisfactory in almost all cases. Decrease of BI during the twelve months was slight but statistically significant in Group C-1.—*(Adapted from English summary)*

Immuno-Pathology

Balina, L. M., Fliess, E. L., Cardama, J. E., Gatti, J.C. and Bachmann, A. Cellular immunity in leprosy. *Int. J. Dermatol.* 13 (1974) 300-302.

An immunologic study to compare *in vitro* and cutaneous test results was made with lepromatous leprosy patients, tuberculoid patients, healthy lepromin-negative and positive sons, and healthy lepromin-negative and positive controls. Lymphocytes were cultured and the intradermal reaction to lepromin and the reaction to dinitrochlorobenzene were studied. A decrease in cellular immunity in lepromatous patients and in their healthy lepromin-negative sons was found.

In contrast, the healthy controls, lepromin-negative and positive, and the lepromin-positive sons of lepromatous patients and tuberculoid patients had normal immunologic responses. There is no strict relation between delayed hypersensitivity (DNBC) and

blastic dedifferentiation *in vitro*, but in lepromatous patients the deficit in blastic dedifferentiation was accompanied by a high percentage of negative cutaneous test results with dinitrochlorobenzene.—Authors' Summary

Bernard, Juan C. and Brounstein, Mario. Estudio de la cirrosis hepatica en la lepra. [Study of cirrhosis in leprosy.] *Leprologia* 18 (1973) 123-134. (In Spanish)

This is a study of autopsy cases of cirrhosis in leprosy patients from the Sommer Sanatorium in Argentina. It was observed that this disease is most frequent in people between ages of 45 and 67 years.

The skin was bacteriologically negative in all cases but positive in one case in viscera; such as the liver, parotid gland, lymph nodes, spleen and urinary bladder.

Laennec cirrhosis occurs more frequently than postnecrotic cirrhosis. We concluded that

cirrhosis is an associated disease in leprosy but not specifically related to leprosy and its occurrence is similar to that in the general population.—(Adapted from English summary)

Dastur, Darab K. and Dabholkar, Arun S. Histochemistry of leprosy nerves and skin lesions: acid phosphatase. *J. Pathol.* **113** (1974) 69-77.

Histochemical findings in sensory nerves from ten cases of tuberculoid leprosy and four of lepromatous leprosy, have been presented with special reference to the distribution of acid phosphatase (AcPh) in the nerve constituents. A three-phase activity of AcPh was detected in the tuberculoid nerve: almost no activity in the normal state, increased activity at the stage of early degeneration and fibrosis. The enzyme appeared to be in the Schwann cell cytoplasm as evidenced by the almost constant presence of paired paranodal spots of granular activity extending throughout the breadth of the fiber.

Similar phases of AcPh activity were manifested in lepromatous nerves also, but this was rendered unclear by the dense enzyme accumulation in Schwann cells harboring *M. leprae*. This association between the bacilli and AcPh was even stronger in the inflammatory cells, mainly the macrophages of lepromatous nerves and skin lesions.

In about half the cases, skin lesions were also biopsied and examined for histological and histochemical changes. The reactive cells of tuberculoid nerves and skin lesions, mainly the large mononuclears including epithelioid cells, which do not harbor bacilli, also showed intense activity.

AcPh appears to be a reliable marker for the detection of lysosomal activity in cells of nerves and skin lesions of leprosy. The apparently contrary relationship between lysosomes and *M. leprae* in the two main types of leprosy is stressed; their capacity to dispose of the few organisms in tuberculoid leprosy, and their inability to deal with the excessively heavy bacillation in lepromatous leprosy, is discussed. It is suggested that lysosomal activity is evoked by some product of interaction of bacilli with host cytoplasm, and that an additional cellular factor is required for control of bacillary growth in lepromatous leprosy.—Authors' Summary

Etemadi, A. H. and Convit, J. Mycolic acids from "noncultivable" mycobacteria. *Infect. Immun.* **10** (1974) 236-239.

Chromatographic analysis, coupled to mass spectrometry with a high-resolution mass spectrometer, of materials isolated from skin lesions of patients with lepromatous leprosy, allows the recognition of characteristic mycobacterial products, mycolic acids. This finding indicates that the "non-cultivable" bacteria responsible for leprosy are mycobacteria.—Authors' Abstract

Godal, Tore. Growing points in leprosy research. 3. Immunological detection of subclinical infection in leprosy. *Lepr. Rev.* **45** (1974) 22-30.

The evidence for the presence of subclinical infection in leprosy, based on information acquired by the lymphocyte transformation test (LTT) and the leukocyte migration inhibition test (LMIT), is reviewed. These methods appear to have sufficient specificity to be useful as monitors of immune responses elicited by *Mycobacterium leprae*. The results obtained suggest that subclinical infection commonly follows exposure to *M. leprae* and therefore indicate that leprosy is more highly infectious than denoted by prevalence and incidence rates. Some observations imply that the intensity of exposure may modify host responsiveness to *M. leprae*.—Author's Summary

Godal, T., Myrvang, B., Stanford, J. L. and Samuel, D. R. Recent advances in the immunology of leprosy with special references to new approaches in immunoprophylaxis. *Bull. Inst. Pasteur* **72** (1974) 273-310.

The picture that emerges from these studies is of an infectious disease which only hits a minority of those who become exposed to the causative germ. In the great majority, the evolution of cell-mediated immunity appears to arrest the multiplication of *M. leprae* at the subclinical level. This efficiency of the immune system is not only related to the strength of response which ultimately is reached, but perhaps even more to early recognition and rapid augmentation mechanisms.

However, if the immune system fails to

mount an effective response within a limited period of time after exposure, immune responses to *M. leprae* causes damage to the host tissues. With an intermediate level of bacillary load, such as that seen in tuberculous and borderline patients, cell-mediated immune responses to *M. leprae* appear to be the main pathogenic mechanisms involved, while in lepromatous patients with extensive bacillary invasion cell-mediated immunity to *M. leprae* is usually suppressed. These patients, however, often develop acute attacks of immune complex disease.

The immunologic failure in lepromatous leprosy appears to be located in T cell function and shows specificity for *M. leprae* antigens. Attempts to correct this defect by single injections of transfer factor, BCG or allogeneic leucocytes have failed, while preliminary studies indicate that repeated injections of BCG and allogeneic cells may increase the elimination of *M. leprae* in these patients. However the therapeutic potential of these approaches is still not clear.

The recent establishment of *in vitro* methods which have proved to be correlated to cell-mediated immunity *in vivo* has provided new tools which promise a rapid increase in research related to immunoprophylaxis in leprosy. The possibility of using a closely related cross-reactive organism or, alternatively, killed *M. leprae* in an appropriate adjuvant may now both be pursued.—(From text, pp 304-305)

✓ **Kahn, Pauline and Scott, T.** The pathology of a radial nerve biopsy in leprosy: light and electron microscopy. *J. Pathol.* **114** (1974) 97-100.

Light and electron microscopy of a radial nerve biopsy in a patient with long-standing leprosy and treated for four years, showed that in the nerve the end result of prolonged infection is loss of nerve fibers, severe endoneurial fibrosis, and lamination of Schwann cell processes and collagen. These appearances resemble the "onion bulb" whorls seen in other chronic peripheral neuropathies. Several bacilli and fragments of degenerate organisms were demonstrated, which illustrates the difficulty of eradicating reservoirs of organisms which may persist in spite of prolonged treatment.—Authors' Summary

Khorobrykh, V. V., Tarkhanova, I. A., Yuri-na, B. L., Kulberg, A. Ya. and Kaulen, D. R. A comparative analysis of nonspecific methods of suppression of the antigen-fixing capacity of immune lymphocytes. *J. Microbiol. Epidemiol. Immunobiol.* **9** (1974) 105-107. (In Russian)

A study was made of the action of 2-mercaptoethanol and polyadenylpolyuridylic acid on the antigen-fixing capacity of the splenic cells of mice immunized with sheep erythrocytes. It was shown that under the action of polyadenylpolyuridylic acid and 2-mercaptoethanol there was a cut by half of the number of rosette-forming cells of the spleen obtained from mice on the 5th or 13th day after the immunization with sheep erythrocytes. This effect was caused by the action of the mentioned reagents on the immune lymphocyte receptors since the viability of the treated cells remained unchanged. Polyadenylpolyuridylic acid and 2-mercaptoethanol acted on the same cells whose antigen-fixing receptors could be blocked by the serum to mouse immunoglobulins and partially by monoreceptor serum to mouse heavy IgM chains.—Authors' English Summary

Kreisler, M., Arnaiz, A., Perez, B., Fernandez Cruz, E. and Bootello, A. HL-A antigens in leprosy. *Tissue Antigens* **4** (1974) 197-201.

HL-A phenotype frequencies were studied in 30 patients with leprosy and in 149 healthy controls. Leprosy patients had a significantly higher frequency of HL-A14. In addition, a majority of the HL-A14 patients gave a negative response to leproma antigen using the Mitsuda test.—Authors' Abstract

✓ **McLeod, J. G., Prineas, J. W. and Walsh, J. C.** The relationship of conduction velocity to pathology in peripheral nerves. A study of the sural nerve in 90 patients. *In: New Developments in Electromyography and Clinical Neurophysiology*, vol. 2, J. E. Desmedt, ed., Basel: S. Karger, 1973, pp 248-258.

Nerve conduction studies have been carried out on the median, ulnar and lateral popliteal nerves of 90 patients in whom sural nerve biopsy was also performed. There was no abnormality in the sural nerve in nine of ten patients in whom conduction studies

were normal. The histologic finding of axonal degeneration or regeneration was almost invariably associated with only mild or moderate slowing of conduction. Gross slowing of conduction was always associated with histologic or electron microscope evidence of segmental demyelination. However, gross slowing of conduction did not occur in all cases in which segmental demyelination was the major pathologic abnormality, and when segmental demyelination was present there appeared to be some relationship between the proportion of abnormal fibers and the degree of slowing of conduction.—Authors' Summary

✓ **Nath, I., Curtis, J., Bhutani, L. K. and Talwar, G. P.** Reduction of a subpopulation of T lymphocytes in lepromatous leprosy. *Clin. Exp. Immunol.* **18** (1974) 81-87.

A reduction in number of a subpopulation of T lymphocytes was noted in lepromatous leprosy cases with high bacillary load. Tuberculoid and treated lepromatous patients, who were bacillary negative, had normal levels of these cells. B cell numbers were high in lepromatous patients irrespective of treatment and bacillary load.—Authors' Summary

✓ **Nath, R. L. and Saha, D.** A thermostable serum alkaline phosphatase. *Clin. Chim. Acta* **55** (1974) 5-9.

A more sensitive modification of the King-Armstrong method of determination of serum alkaline phosphatase has been utilized to determine the total serum alkaline phosphatase and its thermostable fraction in normal subjects and in some diseased subjects. The thermostable fraction is increased above normal in tuberculoid leprosy, but with no significant change in thalassaemia and lepromatous leprosy. Total serum alkaline phosphatase behaved oppositely with respect to these conditions.—Authors' Summary

✓ **Navalkar, R. G.** Immunologic studies on leprosy. 2. Antigenic studies of *Mycobacterium leprae*. *Z. Tropenmed. Parasitol.* **24** (1973) 66-72.

Antigenic mosaic of *M. leprae* was determined first by analyzing sera from leprosy patients in various stages of infection by the use of antigenic preparations derived from a

number of mycobacterial species. These studies led to the detection of two serologically distinct types of antibodies and the antigens reacting with these antibodies were found to be shared by a number of other mycobacterial species. Further extension of these observations was carried out by preparing antiserum against tissue separated *M. leprae*. The analysis of the *M. leprae*-anti-*M. leprae* system showed the presence of five detectable antigens, two of which were the same as those seen in earlier studies with the sera. Chromatographic separation of *M. leprae* antigens resulted in obtaining a number of fractions, some of which gave immunoprecipitates when tested against the antileprae serum. These fractions were tested in animals sensitized with *M. leprae* and other mycobacteria to determine their hypersensitivity eliciting potential. Preliminary results indicated that a few of the fractions were able to elicit hypersensitivity in the homologously sensitized animals. These studies are in progress for further confirmation of the specificity of the reactions noted.—(From Trop. Dis. Bull.)

✓ **Pletsity, D. F., Fomina, V. G. and Pletsity, K. D.** The effect of excessive amounts of vitamins on natural immunity. Report 1. Changes in the activity of some mechanisms of natural immunity under the effect of massive vitamin A doses. *J. Microbiol. Epidemiol. Immunobiol.* **9** (1974) 108-111. (In Russian)

Experiments were conducted on rabbits and albino mice. The effect of prolonged administration to animals of massive vitamin A doses on humoral and cellular mechanisms of natural immunity was studied. Under the effect of the action of vitamin A a marked fall of all the indices under study (bactericidal activity of blood serum, properdin and lysozyme content in it, titers of serum and tissue anti-influenza inhibitors, leukocyte phagocytosis) was recorded from the seventh day of the experiment. The period of depression of the protective functions under the effect of massive amounts of vitamin A lasted not less than two weeks.—Authors' English Summary

✓ **Vizirenko, L. V. and Vershigora, A. E.** Palatine tonsils and immunity. Report 2. Synthesis of antibodies by lymphoid cells of

the palatine tonsils in *in vitro* culture. J. Microbiol. Epidemiol. Immunobiol. **10** (1974) 44-47. (In Russian)

In the lymphocyte cultures of the palatine tonsils removed in 57 patients suffering from chronic tonsillitis (adults and children aged 3-5 years) a study was made of *in vitro* pro-

duction of immunoglobulins of three principal classes. After secondary stimulation *in vitro* with staphylococcus and streptococcus antigens, lymphoid cells of the palatine tonsils synthesized antibodies of G class. The level of antibody formation correlated with the intensity of blast transformation and mitotic activity.—Authors' English Summary

Microbiology

✓ **Drutz, D., O'Neill, S. and Levy, L.** Viability of blood-borne *Mycobacterium leprae*. J. Infect. Dis. **130** (1974) 288-292.

Noncultivable acid-fast bacilli that circulate in the bloodstream of patients with untreated lepromatous leprosy are viable as judged by their capacity to multiply in the mouse foot pad in a manner typical for *Mycobacterium leprae*. The continuous presence of up to 10^5 viable leprosy bacilli/ml of blood both reflects and helps to explain the extreme widespread nature of infection in patients with lepromatous leprosy. Rifampin "kills" *M. leprae* (i.e., inhibits multiplication in the mouse foot pad) much more rapidly than does dapsone, but leprosy bacteremia persists for at least 12-16 weeks with either form of therapy. Circulating *M. leprae* are viable for up to six weeks after initiation of dapsone, but for fewer than four weeks after rifampin. Either dead *M. leprae* continue to circulate in treated patients, or the foot pad technic is not sufficiently sensitive to detect low concentrations of viable *M. leprae*.—Authors' Abstract

✓ **Kanai, Koomi and Kondo, Eiko.** Chemistry and biology of mycobacteria grown *in vivo*. Japan. J. Med. Sci. Biol. **27** (1974) 135-160.

The present review surveys briefly the literature of the chemistry and biology of mycobacteria harvested directly from infected tissue without the use of culture media. From this it was concluded that many characteristics of mycobacteria known from the studies on those grown *in vitro* are possessed also by those grown *in vivo*. This fact is rather surprising when we think of the physical and chemical differences between *in vivo* and *in vitro* environments where mycobacteria grow.

Mycolic acids have been identified from

in vivo mycobacteria in six laboratories, particularly in the form of arabinose mycolate which is known as a basic building block of the cell wall structure of mycobacteria grown *in vitro*. A fairly large amount of tuberculostearic acid and esters of mycoseric acid were also identified in some species of mycobacteria grown *in vivo*. Probably, these long-chain fatty acids may be essential metabolites elaborated by mycobacteria regardless of environmental and nutritional conditions.

On the other hand, it has been established that the chloroform-soluble wax content is much lower in mycobacteria grown *in vivo* than those grown *in vitro*. This fact is of particular importance in view of the immunological activities of wax D. However, it needs a comment as to whether chloroform-soluble wax may or may not easily be released into surrounding tissue from the surface of mycobacteria grown *in vivo*. In fact, this was found to be true with the case of mycoside C of *M. lepraemurium*.

Furthermore, *in vivo* degradation of mycobacterial constituents and interaction between the degradation products and tissue cells have not yet been investigated in any detail and are certainly an area that deserves extensive investigation. These aspects are closely associated with the problems of sensitization and protection in mycobacterial infection, and are left to be studied in the future.—(Adapted from authors' summary)

Kheifets, L. B., Staroverova, N. S. and Kozlova, N. E. Reproduction dynamics as an index of intracellular activity of bacteria (on a model of *M. tuberculosis*). J. Microbiol. Epidemiol. Immunobiol. **10** (1974) 3-7. (In Russian)

Staining by modified Murohashi's method has made it possible to differentiate the true

reproduction of mycobacteria (*M. bovis*) in a peritoneal macrophage culture from redistribution. Reproduction with the formation of microcolonies in the cytoplasm of macrophages occurred between the 2nd and 7th-9th day; after this time mycobacteria began to perish in the microcolonies as well. Between the 2nd and 4th week the cell culture was free of mycobacteria as a result of intracellular digestion and elimination of a part of the disintegrated macrophages with bacteria contained in them. Two indices reflected the true reproduction dynamics, i.e., the number of bacteria in the cells (when over ten), and the number of microcolonies.—(Adapted from English summary)

✓ McCarthy, C.M. and Schaefer, J.O. Response of *Mycobacterium avium* to ultraviolet irradiation. Appl. Microbiol. 28 (1974) 151-153.

The survival response of *Mycobacterium avium* to ultraviolet irradiation demonstrated the presence of a photoreactivating repair system.—Authors' Abstract

✓ Ogawa, T., Uchida, M. and Hiraki, M. Studies on murine leprosy bacillus. X. Rapid growing mycobacteria isolated from experimental murine leprosy mice. Lepro 43 (1974) 102-109. (In Japanese)

In the course of primary cultivation, not only the supposed murine leprosy bacillus but also pigmented colonies of acid-fast bacilli were isolated from the tissues of mice in experimental murine leprosy. Of 612 specimens from the mice previously infected with the Hawaiian strain, 11 yielded such colonies and three cultures were also obtained from among 306 specimens with the Keishicho strain.

In these experiments the animals with the Hawaiian strain were killed during the period of 1 to 11 months after inoculation and the mice with the Keishicho strain were killed at from 3 to 13 months. These pigmented colonies, however, were obtained only from the mice of long-standing, that is, from those which were sacrificed 6.5 months or more after inoculation. In the case of the mice with the Hawaiian strain,

the tissues from which such colonies were isolated were the spleen, the liver and lungs; most often from the latter. With the Keishicho strain, however, they were isolated only from superficial lymph nodes and local sites of injection.

All of the above isolates were found to belong to Runyon's Group IV organisms. Their colonies grown on Ogawa's egg and egg yolk media were uniformly S type and yellow-colored. Drug sensitivity tests on seven strains revealed that they were in general less susceptible to the antituberculous drugs than the tubercle bacillus. Virulence tests on the same strains were made by inoculating mice intravenously with 0.1 mg of the bacilli. The animals were killed after a period of one to six months and evaluation was made according to gross involvement, spleen weight per gram of body weight, and the results of quantitative culture from the lungs and spleen. There was no gross evidence of disease, except that the spleens of a few animals at one month were found to be suggestive of being swollen. It is noted that the bacilli of four strains disappeared from the tissues by three months after injection, while the ones of the other three survived there till three to six months later.—(Adapted from English summary)

✓ Olitzki, A.L. The relations between morphological changes of *Mycobacterium leprae* and its multiplication in different media. Boll. Ist. Sieroter. Milan. 53 (1974) 24-31.

Elongation and multiplication of *Mycobacterium leprae* in cell-free media was investigated. No changes were noted on incubation with amino acids but the addition of extracts of *M. smegmatis* caused marked elongation followed, after about two months, by division. The effect of mycobacterial extracts was inhibited by the addition of several amino acids, notably tryptophan, and was enhanced by glutamic acid and by cysteine. High concentrations of streptomycin were inhibitory, but at low concentrations some stimulation was noted. The results suggest that the noncultivability of *M. leprae* may be due as much to the presence of inhibitors in media as to the lack of growth-promoting substances.—S. G. Browne (From Trop. Dis. Bull.)

Experimental Infections

Crawford, C. L., Evans, D. H. L. and Evans, E. M. Experimental allergic neuritis induced by sensory nerve myelin may provide a model for nonlepromatous leprosy. *Nature* **251** (1974) 223-225.

Experimental allergic neuritis was induced in rabbits and rats by injection of human sural nerve antigen and Freund's complete adjuvant. Skin lesions marked by loss of hair and without ulceration appeared from one to six months later and somewhat later in rats. The skin lesions persisted for as long as three months. On biopsy a few of the skin lesions showed "granuloma" formation with mononuclear cells surrounded by lymphocytes. Dermal nerves showed mononuclear infiltrates. By comparison with somewhat different results using mixed (sciatic) nerve antigen and by consideration of reported differences in biochemical determinations and ultrastructural appearances, as well as variations in electrophoretic protein patterns of myelin from different parts of the CNS, the authors surmise that there are differing antigenic potentials among differing types of peripheral nerves. They note that skin lesions such as they achieved have not been reported with such other preparations and liken the lesions they found to those of nonlepromatous leprosy. They dismiss the concept of nonlepromatous lesions being a cell-mediated immune response to *M. leprae* on the basis that injection of *M. leprae* into mice fails to produce such skin lesions and flatly state that "the skin lesions of nonlepromatous leprosy are therefore essentially an autoimmune response to sensory cutaneous peripheral nerve." [*From disregard of what is known of variations in animal immune response and disease susceptibility, and from conclusions based on unestablished analogy, may the saints preserve us!*] —O. K. Skinsnes

✓ **Ogawa, Tatsuji and Hiraki, Minako.** Studies on murine leprosy bacillus. VIII. Reproduction test of the diseases in mice using graded doses of the sixth subculture of the supposed Hawaiian strain of *Mycobacterium lepraemurium*. *Kitasato Arch. Exp. Med.* **46** (1973) 1-13.

Using bacterial suspensions prepared from sixth subculture of supposed *M. lepraemu-*

rium, Hawaiian strain, three groups of ddN strain male mice were injected subcutaneously with doses of 2×10^{-1} , 2×10^{-2} and 2×10^{-3} mg. Another three groups were injected intravenously with 10^{-1} , 10^{-2} and 10^{-3} mg doses respectively, making a total of six mice groups. At 4, 6, 9 and 11 months after infection, one or two animals from each subcutaneous injection group and one to three from each intravenous injection group were autopsied and the spleen weights recorded. The presence and degree of lesions were determined grossly by macroscopic observation of the various organs, superficial lymph nodes and site of injection, as well as partly by histopathologic examination. The bacterial counts and size and number of globi of the specimens were also determined. From various organs of mice in the reproduction test, recovery of the organisms was tried by cultivation. In both subcutaneously and intravenously injected mice, lesions were observable irrespective of inoculum dosage. Increases in bacterial numbers and numbers of globi were also observed. Organisms were recovered from various specimens by culture; the isolated bacilli being the same as those utilized in the test organism.

These results indicate that the reproduction test of the disease in mice was successful even when small doses of inoculum were administered.—(*Adapted from authors' abstract*) [*This paper was also published in La Lepro* **42** (1973) 218-227—*Editor*]

✓ **Ogawa, Tatsuji and Hiraki, Minako.** Studies on murine leprosy bacillus. IX. Reproduction test of the disease in mice using graded doses of the second subculture of the supposed Keishicho strain of *Mycobacterium lepraemurium*. *Kitasato Arch. Exp. Med.* **46** (1973) 15-27.

The bacillus employed for the test was the second subculture, three months old, on 1% egg yolk medium, of the supposed isolate of Keishicho strain. Male mice of ddN strain were divided into six groups of twelve each and the groups were inoculated either subcutaneously or intravenously with three different doses (10^{-1} , 10^{-2} and 10^{-3} mg) of the bacillus. The mice subcutaneously inoculated were sacrificed at the end of 3, 6, 8,

10 and 13 months and the mice intravenously inoculated at the end of 3, 6 and 8 months.

Observations of gross disease were made at necropsy. Spleens were weighed and their weight per gram of body weight was recorded. The internal organs, superficial lymph nodes and local lesions were removed, homogenized, and then submitted to microscopic examination and cultural recovery. The Ziehl-Neelsen stained smears rated not only for the number of acid-fast bacilli under oil immersion but also for relative numbers and maximum sizes of globi under low magnification. In some instances histopathologic examinations were also performed.

The results indicated that in the mice inoculated with each of the subcutaneous or intravenous doses there was gross and bacteriologic evidence of infection, supported in some by histopathologic evidence. The findings were more pronounced in animals intravenously inoculated than those subcutaneously. In either case, however, they showed a tendency to become more marked in the course of infection. It seems reasonable to conclude that the disease in mice was fairly consistently reproduced with the test organisms.—(Adapted from authors' abstract) [This paper was also published in *La Lepro* 42 (1973) 228-237—Editor]

✓ **Ogawa, Tatsuji and Hiraki, Minako.** Studies on murine leprosy bacillus. XI. Interaction *in vivo* between the supposed Hawaiian strain of murine leprosy bacillus and strain H11 of rapid growing mycobacteria being inoculated concurrently. *Lepro* 43 (1974) 110-114. (In Japanese)

During the primary isolation of murine leprosy bacillus, rapid growing mycobacteria were sometimes isolated from the tissues of mice in experimental murine leprosy. To know whether these rapid growers exert any effect on the murine leprosy bacillus or whether they exist under an influence of the disease, the following experiment was performed using ten animals for each group:

- | | |
|-------|--|
| Group | Intravenous Injection of Bacilli (inoculum: 0.1 mg per mouse) |
| I. | The supposed Hawaiian strain of murine leprosy bacillus, singly. |
| II. | Strain H11 of the rapid grower, singly. |
| III. | The supposed Hawaiian and strain H11, concurrently. |

The animals were killed 3, 5, 6, and 7.5 months after inoculation. Gross involvement and spleen weight per gram of body weight were recorded at necropsy. The spleen, liver, lungs, and kidneys were removed aseptically and submitted to cultivation for re-isolating each of the bacilli inoculated. An *in vivo* effect of the strain H11 on the supposed Hawaiian strain was estimated by comparison between Groups I and III, and the reverse effect by comparison between Groups II and III. It may be summarized that: 1) a somewhat growth-inhibitory effect of strain H11 on the supposed murine leprosy bacillus was noticed in the spleen and the liver but obscure in the lungs and the kidneys; 2) in the spleen the Hawaiian strain was slightly growth-promoting, seemingly, at first but later growth-inhibitory against the strain of the rapid grower. There were no marked tendencies in the liver, lungs and kidneys.—(Adapted from English summary)

Pattyn, S. R. and Verdoolaege-Van Loo, G. The result of inoculation of *Mycobacterium leprae* in the goldfish (*Carassius auratus*). *Acta Zool. Pathol. Antverpiensia* 58 (1974) 109-116.

M. leprae injected intramuscularly into goldfish (*Carassius auratus*) may survive for some time in diminishing numbers: there was however no evidence of multiplication.

Follicles are built around the bacteria, which are gradually disintegrated with production of black pigment. There is no generalization or other visible harmful effect of this condition on the host.—Authors' Summary

Rees, R. J. W., McDougall, A. C. and Weddell, A. G. M. The nose in mice with experimental human leprosy. *Lepr. Rev.* 45 (1974) 112-120.

Normal and immunologically deficient mice inoculated with *M. leprae* 1) locally in the foot pad or ear, 2) intravenously, and 3) intraperitoneally, were killed 1 to 2.5 years later and their tissues examined bacteriologically and histologically. Quantitative bacterial assessments showed that by 1.5 years a high proportion of all animals had a countable number of bacilli ($>5 \times 10^4$) in uninoculated ears, foot pads or nose. Of these sites the nose on the average was most frequently infected and contained significantly higher yields of bacilli.

Moreover, nasal smears from a proportion of the mice showed acid-fast bacilli. Histology of the nose showed a variable number of bacilli within macrophages deep to the nasal mucosal epithelium but also bacilli within the overlying ciliated columnar-epithelial cells. In contrast bacilli were very rarely seen in the overlying squamous epi-

thelial cells of the skin in the nasal vestibule and elsewhere, however heavily infected was the underlying dermis. These findings in the mouse are discussed. Attention is drawn to the frequent involvement of the nasal tissues and the excretion of large numbers of bacilli in the nasal mucus.—Authors' Summary

Epidemiology and Prevention

- ✓ **Agius-Ferrante, A., Depasquale, G., Bonnici, E., Paris, C. and Grima, W.** The leprosy eradication project of Malta. *Z. Tropenmed. Parasitol.* **24** (1973) 49-52

A determined effort is being made to eradicate leprosy from the Maltese Islands. Out of a total of 225 patients (in a population of 320,000) 210 are at present under treatment with a triple-drug regimen, composed of rifampicin (10 mg/kg), ethionamide (5 mg/kg), a sulfone-sulfonamide complex (2-20 mg/kg) and isoniazid (5 mg/kg). Whatever their initial bacteriologic status or clinical classification, all patients have been placed on this treatment.

Excellent cooperation is reported, and the early results—bacteriological and clinical—are said to be encouraging.

With such a relatively controllable problem and given adequate financial resources and medical supervision, there is reason to hope that the objectives of the program will be achieved.—S. G. Browne (*From Trop. Dis. Bull.*)

- ✓ **Agoitia, L., Arenas, R. and Estrada, R.** Commandos contra la lepra en los estados de Guerrero, Guanajuato y Morelos. [Commands against leprosy in the Mexican states of Guerrero, Guanajuato and Morelos.] *Dermatologia (Mex.)* **18** (1974) 59-64. (In Spanish)

Leprosy is still a medical and social problem in some regions of Mexico. Since the official activity against leprosy is insufficient, the Asociación Mexicana de Acción contra la Lepra, A. C., has organized work teams since 1971. Such teams, made up of dermato-leprologists and social workers, have traveled to the endemic regions of Guanajuato, Guerrero and Morelos, three of the most affected states of Mexico.

The groups live for several days in small

towns carrying out various activities such as: dermatologic and general consultations, visits to leprosy patients, contact examinations, educational lectures on leprosy and other skin diseases frequently found in those regions, such as scabies.

The authors believe that the leprosy problem in Mexico is too big for such small groups to handle and more dedicated enthusiastic volunteers are needed who love the work and give for the pleasure of giving.—A. Saul

- ✓ **Browne, Stanley G.** Leprosy programs in the context of endemic disease control. *Lepr. Rev.* **45** (1974) 201-204.

The present disillusionment regarding the general lack of success of most leprosy treatment programs in effecting a progressive decline in incidence of the disease, makes imperative a critical examination of the methods adopted in various countries for dealing with the problem of leprosy. Local circumstances will determine the details of the best practicable plan, but economic and social factors must not be overlooked.—Author's Abstract

- ✓ **Hennequin, M.** La lutte contre la lèpre en République Centrafricaine. [Leprosy control in the Central African Republic.] *Med. Trop.* **33** (1973) 289-296. (In French, English summary)

This paper provides a useful review of the leprosy campaign in the Central African Republic over the past 12 years. In 1958, the Republic had the unenviable distinction of reporting the highest prevalence rates in francophone Africa, i.e., 55 per thousand. The distribution of the disease is low in the hot and dry northwest, but very high in the humid southern districts bordering on Zaire.

The proportions of the different types of leprosy resemble those found in neighboring countries, only 8.4% of patients having lepromatous leprosy.

Case finding is mainly by polycompetent teams, to which are attached auxiliaries experienced in the diagnosis of leprosy. These teams cover the whole country (population approximately three million) every two years. Their work is supplemented by auxiliaries responsible for treatment, who examine patients and their contacts, especially in those years when the survey teams are not at work in the district concerned. Follow-up is considered to be satisfactory.

Most of the patients are given either dapsone or a long-acting oral sulfonamide. Treatment is brought to each village by the regular weekly or biweekly visit of an auxiliary cyclist. The few "runs" that have been attempted by motor vehicles have proved disappointing by reason of frequent breakdowns. In addition, a small proportion of patients are treated at 11 all-purpose dispensaries, 22 leprosy dispensaries and 7 private institutions. A small pilot scheme for self-treatment has recently been established; the results of this experiment are awaited with interest.

The author advocates the segregation of patients with "contagious" forms of leprosy, and claims that, after six months' treatment with sulfonamides, half the patients in three hospitals were rendered bacteriologically negative. [This controversial opinion will not meet with universal acceptance or approval.]

The results of the campaign over the past 12 years are distinctly encouraging: the number of patients under treatment has dropped from 64,719 to 23,070; 32,346 have been discharged symptom-free, and the prevalence has fallen from 57 per thousand in 1959 to 14 per thousand in 1971.—S. G. Browne (*From Trop. Dis. Bull.*)

✓ **Ishihara, S., Hagihara, S., Fukuda, T. and Enomoto, W.** On the specific skin clinic in Aichi Prefecture for the last ten years. *Lepro* 43 (1974) 97-101. (In Japanese)

This special skin clinic in Aichi Prefecture has been held for the last ten years. The purpose of the clinic is to follow up discharged patients from the leprosarium and to take

care of those treated at home. The clinic is open every three months and 121 patients have been registered: 80 patients were treated regularly in 1973. This clinic is not yet officially recognized, but the patients are coming regularly at each opening. This proves that they actually feel the need for such a clinic.—(*Adapted from English summary*)

✓ **Lew, Joon.** Leprosy in Korea over the last 25 years. *Lepro* 42 (1973) 76-82. (In Japanese)

The control of leprosy. At present, the total number of leprosy patients in Korea is estimated to be between 70,000 and 80,000; 34,030 of which are registered cases.

Until 1967 there existed five national and three private leprosy hospitals. However, in 1968 two of the national leprosaria were transformed into resettlement villages and the number of inpatients was also reduced. There were 18,307 patients in the leprosaria and colonies by the end of 1961 but by the end of 1971 only 5,000 patients remained in the two national hospitals with 2,000 cases in five hospitals for the crippled. By the end of 1972, 23,000 ex-leprosy cases had been resettled in 87 resettlement villages under the self-support program.

There are 13 stationary outpatient clinics, 13 mobile units and 102 paramedical leprosy case workers attached to the local health centers. These units have been actively engaged in case finding and the treatment of domiciliary patients (27,500 cases by 1972).

Reconstructive surgery has been performed since 1962 and, in addition, the program for the prevention of deformities is being greatly emphasized.

Since 1960, gradual yet significant increases have been observed in the number of new leprosy patients, and these increases indicate that the public understanding of leprosy has been promoted greatly year by year.

Epidemiologic studies. The ratio of lepromatous type leprosy has increased yearly and has become greater than that of tuberculoid type leprosy. In 1968, the classification of the disease types revealed that the lepromatous type occupied 80.5%, the tuberculoid 18.7% and the indeterminate group 0.8%. Bacteriological examination of leprosy inpatients showed that 15.2% were bacteriologically positive in 1968, and 12.3% in

1972. These findings are interpreted to indicate that the epidemicity of leprosy in Korea has been decreasing, general immunity to leprosy in the community has been lowered, number of cases under treatment has decreased, and chemotherapy of leprosy has been highly effective.

A survey of the age of onset of the disease established that the peak age group was 15-19. The peak of present age was in the range of 50-54 years in 1968. In the past, the present age group was 30-35. This delay in the peak of the present age clearly indicates significant progress in the control of leprosy in Korea. The stationary outpatient clinics, mobile units, and the integration of the leprosy campaign into the general public health network through the health centers for early case finding and domiciliary treatment, have proven to be an effective system for the control of leprosy in Korea. In addition, the resettlement program for the recovered leprosy patients under the self-supporting schemes and institutions for the crippled for the far advanced cases significantly facilitates their social rehabilitation and provides greater relief from the age-old accumulated leprosy problems in Korea.

In conclusion, the leprosy control campaign has been progressing well and the prospects for the overall control of leprosy in this nation appear to be quite bright.—*(Adapted from English summary)*

✓ **Merklen, F. P., Pennec, J. and Horner, C.** Raréfaction, mais possibilité persistante, de lèpres contractées en France métropolitaine. [The rarity of endemic leprosy in France, but its possible persist-

ence.] *Bull. Acad. Natl. Med. (Paris)* **157** (1973) 439-443.

The authors provide a useful summary of the numbers of cases of leprosy arising in metropolitan France for each decade since 1923. The totals were 13 and 12 for the first two decades, but have been 5 for each of the last three. Despite the influx during recent years of leprosy sufferers from abroad (especially the West Indies), the number of infections apparently contracted in France itself shows a progressive decline. It is, of course, difficult to establish without doubt that patients who develop the first signs of leprosy while living in France did not actually become infected during a period of military service overseas.

In 1973, four new cases were reported: three from the neighborhood of Lyons and one from Nice. The authors indicate that indigenous foci of leprosy in France, quite unknown and perhaps unsuspected, may exist and utter a salutary warning that doctors should be made aware of this possibility.—S. G. Browne (*From Trop. Dis. Bull.*)

NURSING JOURNAL OF INDIA **65** (1974) 11-22.

This issue presents an 11 page section on leprosy relating to the role of the nurse in leprosy control by Helga Johansen and by A. John; care of the hands by N. Palani; social reaction by N. M. Gnanadhas; rehabilitation by T. N. Jagadisan; therapy and prevention by K. Ramanujam; control by V. Vellut. The concluding portion of this section presents a listing of some of the occasions when Gandhi championed the cause of leprosy.—O. K. Skinsnes

Rehabilitation

✓ **Manzi, R. O., Rozenwurcel, H. J., Li Mau, L., Baudino, R. A. and Marzetti, A. A.** Integración de la rehabilitación en leprosy. [Integration of rehabilitation in leprosy.] *Leprológia* **18** (1973) 135-138. (In Spanish)

1. Las acciones de prevención y tratamiento de incapacidades o de rehabilitación de los enfermos deben ser parte de la atención básica leproológica.

2. La integración de pacientes en los servicios o centros polivalentes de rehabilitación

es encomiable, pero deberá ser selectiva, progresiva, veraz y cuando las condiciones de aceptación estén dadas (educación de la comunidad, conocimiento de los profesionales y personal de todo nivel, del problema leproológico).

3. La existencia de centros o servicios específicos de rehabilitación en lepra variará con los recursos disponibles, la prevalencia del mal y la demanda de servicios, debiendo en todos los casos trabajar en forma coordinada con los servicios asistenciales

regionales.

4. La integración total de los servicios leprológicos en los servicios básicos de la salud, en la faz del ataque del programa antileproso es utópica.

Los fracasos experimentados en distintos países son significativos a favor de acciones inicialmente verticales. Podría efectuarse in-

tegración en la faz de consolidación y sólo cuando estén dadas las condiciones favorables, por lo cual terminaremos recordando una irónica "ley" de salud pública: "A medida que un programa de control de enfermedades se acerca al objetivo final, o sea la erradicación, es más probable que se erradique el programa que a la enfermedad."—Authors' Conclusions

Other Mycobacterial Diseases and Related Entities

North, Robert J. T cell dependence of macrophage activation and mobilization during infection with *Mycobacterium tuberculosis*. *Infect. Immun.* **10** (1974) 66-71.

Mice made T cell deficient as adults by thymectomy and lethal irradiation, and infected with *Mycobacterium tuberculosis*, showed a greatly reduced capacity to develop nonspecific resistance to challenge with a heterologous bacterium. The capacity to develop nonspecific resistance was restored, however, by an infusion of syngeneic thymocytes. Evidence was presented which showed that the capacity of mycobacteria-infected mice to resist a lethal challenge with a heterologous organism rested on the capacity of macrophages existing at the time of challenge to reduce the number of challenge organisms to a sublethal level within 8 hours. This antibacterial activity of macrophages was substantially reduced in T cell deficient mice but could be restored by an

infusion of syngeneic thymocytes. It was concluded that T cell deficient mice have a reduced capacity to mobilize and activate macrophages because of their reduced capacity to respond immunologically to antigens of *M. tuberculosis*.—Author's Abstract

Runyon, E. H. Ten mycobacterial pathogens. *Tubercle* **55** (1974) 235-240.

Ten species-complexes comprise all the presently known mycobacterial pathogens of man. Many other species names and methods to identify them appear in the literature, but have no clinical importance. The clinical laboratory program and reporting may be much improved by confining attention to the ten pathogens here designated and briefly characterized. The categories are the following: *M. leprae*, *M. ulcerans*, *M. tuberculosis* complex, *M. kansasii*, *M. marinum*, *M. simiae*, *M. szulgai*, *M. avium-scrofulaceum* complex, *M. xenopi* and *M. fortuitum* complex.—(Adapted from author's paper)