

CURRENT LITERATURE

This department carries selected abstracts of articles published in current medical journals dealing with leprosy and other mycobacterial diseases.

General and Historical

Browne, S. G. How old is leprosy? *Int. J. Dermatol.* **19** (1980) 530–532.

Dr. Browne reviews evidence of the origins of leprosy in Africa, the Middle East, China, and India and concludes that leprosy was most convincingly first described in the sixth century B.C. in India. The troops of Alexander the Great, returning from the Indian campaign, 327–326 B.C., apparently brought leprosy to Greece. Spread of the disease into China may have occurred by overland trade routes with India by the 5th century B.C. The author con-

cludes by considering the antigenic relatedness of *M. leprae* to *M. vaccae*, *M. balnei*, and *M. avium*, speculating that *M. leprae* must have branched off from a common ancestor many millenia ago. "The actual implantation of the first mycobacterium across the epithelial barrier and into proximity with a Schwann cell nucleus in a nerve fiber coursing in the papillary layer of the dermis of a human being who grazed his leg on an African sedge or grass, may have served as the genesis of symbiosis now extending over many centuries."—RCH

Chemotherapy

Chakraborty, A., Gangadharam, P. P., Damle, P., Pratt, P., Wright, P. and Davidson, P. T. Antituberculosis activity of 6 cyclo-octylamino-5,8-quinolinequinone (CQQ). *Tubercle* **62** (1981) 37–42.

The antimycobacterial activity of 6-cyclo-octylamino-5,8-quinolinequinone (CQQ), described as a dual analogue of vitamin K and coenzyme Q, was first discovered in a search for compounds active against *Mycobacterium intracellulare*. However, the compound was found to be even more active against *M. tuberculosis*, and this paper describes its *in vitro* activity against the latter organism.

Ninety-nine strains of *M. tuberculosis* were all inhibited by between 0.5 and 2 µg CQQ/ml, irrespective of their susceptibility to rifampin or other antituberculous drugs. The activity of CQQ was bactericidal at a concentration of 1 µg/ml, virtually sterilizing a culture of H₃₇Rv (which initially contained about 10⁵ organisms/ml after 6 days'

exposure. Naturally occurring resistant mutants were observed to occur at a frequency of about 1 in 3 × 10⁷ cells.

The authors stress that this is a preliminary *in vitro* report; no *in vivo* experiments were performed.—David Greenwood

De Wit, M., Huikeshoven, H., Soeters, A., Eggelte, T., Landheer, J. E. and Leiker, D. L. ELISA inhibition technique for the demonstration of sulphones in body fluids. Comparison of two ELISA methods. *Lepr. Rev.* **52** (1981) 215–220.

A new enzyme-linked immunosorbent assay (ELISA) for sulfones is described. The main tool is a dapsone-enzyme conjugate (E-DDS). The technique is compared with the one described earlier, in which the main tool is a specific antibody-enzyme conjugate (E-Ig). The E-DDS-based ELISA is 50% inhibited by as little as 4 ng DDS/ml, i.e., it is 7.5 times more sensitive for DDS than the E-Ig-based ELISA. In both

ELISAs other sulfones cross-react with DDS, although the patterns are different. Cross-reactions with sulfone analogs, such as sulfonamides, do not occur. The sensitivity of the new ELISA is not reduced when E-DDS is lyophilized. A possible explanation for the difference in sensitivity of the two ELISAs is given, and the practical applicability of the new technique is discussed.—Authors' Summary

Ellard, G. A., Pearson, J. M. H. and Haile, G. S. The self-administration of dapsone by leprosy patients in Ethiopia. *Lepr. Rev.* **52** (1981) 237–243.

In a second investigation of the regularity of dapsone self-administration among outpatients in Addis Ababa, the compliance of patients participating in a trial to assess the ability of combinations of dapsone, thiacetazone, and rifampin to prevent relapse with dapsone-resistant leprosy was compared with that of non-trial patients. Despite the considerable additional time spent on encouraging the trial patients to take their treatment regularly, their level of dapsone compliance was similar to that of the non-trial patients. Only about 60% of the 295 outpatients studied appeared to be ingesting their prescribed dapsone treatment regularly, and the overall level of dapsone compliance resembled that encountered in the first investigation conducted 6 years previously. The taking of thiacetazone by the trial patients whose dapsone treatment was supplemented with this drug was unsatisfactory. The implications of these findings for the outpatient treatment of lepromatous leprosy are discussed.—Authors' Summary

Frey, H. M., Gershon, A. A., Borkowsky, W. and Bullock, W. E. Fatal reaction to dapsone during treatment of leprosy. *Ann. Intern. Med.* **94** (1981) 777–779.

A Burmese boy being treated with dapsone (diaminodiphenylsulfone [DDS]), 100 mg daily, for lepromatous leprosy had a fatal reaction to the drug 3 wk after therapy was started. The clinical symptoms and progression of illness conform well to a "DDS syndrome" first described in the early 1950s. Although the syndrome clinically resembles infectious mononucleosis, nei-

ther Epstein-Barr virus nor cytomegalovirus was implicated as an etiologic agent in this case. The syndrome has been recognized during initiation of dapsone therapy for lepromatous leprosy and has led to the use of a prolonged induction period with initial dosages as low as 25 mg/wk. However, because dapsone resistance has been recognized in some strains of *Mycobacterium leprae*, slow induction of therapy has been replaced with the schedule used for this patient. This report of a fatal reaction to dapsone emphasizes the need for caution when initiating therapy with the drug at full dosage.—Authors' Summary

Gupta, P. N. Antileprotic action of an extract from "anantamul." *Leprosy in India* **53** (1981) 354–359.

Evaluation of antileprotic activity of indigenous drugs has of late become important. With this idea, "Anantamul," an indigenous drug, was for the first time tested on mice infected with *M. leprae*. The results are interesting and encouraging. There seems to be a definite evidence in support of the drug causing a delay in multiplication of organisms in the mouse foot pads.—Author's Summary

Huikeshoven, H., De Wit, M., Eggelte, T. A., Landheer, J. E. and Leiker, D. L. Haemagglutination inhibition technique for the demonstration of sulphones in urine. *Lepr. Rev.* **52** (1981) 229–235.

A hemagglutination inhibition (HI) test for the detection of sulfones in urine is described. The lowest quantity of dapsone (DDS) in urine, detectable by HI, is 1–0.1 µg/ml. In urine samples collected from ten volunteers, sulfones are detectable by HI up to 3–6 days after taking single 100 mg DDS doses. The method is less sensitive than the enzyme-linked immunosorbent assay (ELISA), described earlier, but its advantage is that only one incubation and no washing steps are required. This simple and specific test can be used to monitor self-medication of leprosy patients under field conditions.—Authors' Summary

Huikeshoven, H., De Wit, M., Soeters, A., Landheer, J. E., Leiker, D. L., Niemer, A. Q. H. J. and Warndorff, T. ELISA

inhibition technique for the demonstration of sulphones in body fluids. The use of dried blood on filter paper to monitor leprosy patient compliance. *Lepr. Rev.* 52 (1981) 221–228.

Two enzyme-linked immunosorbent assays (ELISA) for sulfones in body fluids were adapted to measure sulfones in blood dried on filter paper. The more sensitive modification, based on competition between dapsone (DDS) and enzyme-dapsone conjugate, detects sulfone in blood extracts up till 6 days following 100 mg DDS intake. Application to monitor patient compliance is demonstrated, using finger-prick blood from 30 Ethiopian leprosy patients. Results are compared to those in urine, and to statements as regards the last daily dose of 100 mg DDS. Eight negative results were found, and employing serial dilutions of positive controls, this indicated that omissions of more than five doses in succession occurred. Practical aspects of the technique are discussed.—Authors' Summary

Imkamp, F. M. J. H. Clofazimine (Lamprene or B663) in lepra reactions. *Lepr. Rev.* 52 (1981) 135–140.

In view of some confusion in the literature as to the value of clofazimine in the treatment of patients with Type I reactions, due to cell-mediated immune mechanisms, 10 patients with this type of reaction were treated with this drug. The results were unsatisfactory; clofazimine had to be either stopped or withdrawn in favor of treatment and control of the reactions with prednisolone. Two of these cases are described in detail.—Author's Summary

Sreevasta, B. K., Girdhar, B. K. and Desikan, K. V. Persister *M. leprae* after introductory rifampicin followed by dapsone therapy. *Leprosy in India* 53 (1981) 350–353.

Lepromatous patients of "Introductory Rifampicin Therapy" (*Leprosy India* 50 [1978]) who received 300 mg rifampin daily for 3 months followed by 50–100 mg DDS daily for another 21 months are investigated for persisters in the skin. Mouse foot pad results revealed that at the end of 2 years of treatment, viable *M. leprae* are still persisting in three out of six patients.—Authors' Summary

Clinical Sciences

Brandsma, W. Basic nerve function assessment in leprosy patients. *Lepr. Rev.* 52 (1981) 161–170.

Nerve function assessment is important in the prevention of deformities in leprosy patients. Simple nerve function tests are presented which will make it easy for the leprosy worker to make records of nerve damage and will enable him to evaluate changes in nerve function.—Author's Summary

Charosky, C. B., Gatti, J. C., Gabrielli, M., Turjanski, L. and Costagliola, G. Angiografía radioisotópica en cámara gamma. Una técnica de exploración neurológica periférica. (Radioisotope angiography

with a gamma camera. A technique for peripheral nerve exploration.) *Leprológia* 12 (1980) 23–33. (in Spanish)

The authors present a new diagnostic method for peripheral nerve pathology, based in monitoring TC 99m uptake in hands and digits, with a gamma camera, as a measure of perfusion variations secondary to autonomic deficit.

The method has proved to be valuable in allowing for objective demonstration of neural deficit even before anesthesia and palsy become clinically evident.

The present technique should be considered still experimental, but authors are optimistic in reference to the possibility of its definite incorporation in peripheral nerve pathology.—Authors' Summary

Chopra, J. S., Kaur, S., Murthy, J. M. K., Kumar, B., Radhakrishnan, K., Suri, S. and Sawhney, B. B. Vascular changes in leprosy and its role in the pathogenesis of leprosy neuritis. *Leprosy in India* 53 (1981) 443–453.

The arteriographic pattern of left hand vessels was studied in 20 patients with leprosy by percutaneous brachial arteriography. Arteriographic abnormalities noted consisted of occlusion, narrowing, tortuosity, dilation, irregularity and incomplete filling of the lumen by contrast medium. Such abnormal findings were seen in all the arteriograms studied and more than one vessel involvement was noted in over 50% of the cases. This study clearly demonstrated that arterial involvement in leprosy was frequent. No correlation was found between motor weakness and vascular abnormalities. There was no difference in arterial lesions between the patients with and without trophic changes. There was also no correlation between the severity of vascular changes and decline in motor nerve conduction. Degree of histopathological abnormalities in the sural nerve biopsy from these patients showed no features of microangiopathic neuropathy. It is concluded that the observed vascular abnormalities do not contribute significantly in the genesis of neurological deficit in leprosy.—Authors' Summary

Duncan, M. E., Melsom, R., Pearson, J. M. H. and Ridley, D. S. The association of pregnancy and leprosy. I. New cases, relapse of cured patients and deterioration in patients on treatment during pregnancy and lactation—results of a prospective study of 154 pregnancies in 147 Ethiopian women. *Lepr. Rev.* 52 (1981) 245–262.

One hundred and fourteen women with leprosy and 33 women without leprosy were studied during 118 and 36 pregnancies respectively. Two healthy controls developed leprosy during the study period: 12 of 25 women with "cured" tuberculoid leprosy relapsed with new lesions or nerve damage; 46 of 93 women with active tuberculoid or lepromatous leprosy showed increased activity of their leprosy either as a transient phenomenon (21 patients) or due to prob-

able dapsone resistance (28 patients). These occurred chiefly during the third trimester and are thought to be due to decreased host resistance and increased immunological instability during pregnancy.—Authors' Summary

Duncan, M. E., Pearson, J. M. H. and Rees, R. J. W. The association of pregnancy and leprosy. II. Pregnancy in dapsone-resistant leprosy. *Lepr. Rev.* 52 (1981) 263–270.

Sixty-seven women with lepromatous leprosy were studied during 70 pregnancies and followed up during lactation; six patients were already dapsone resistant and an additional four were receiving dapsone 100 mg daily under trial conditions for suspected dapsone resistance. During the study 28 patients including the four already suspected of having dapsone resistance relapsed with probable dapsone resistance. While failure in patient compliance was thought to be important in some cases, recurrent pregnancies, by providing periods of physiological suppression of cell-mediated immunity, could well be the factor in causing the progression of dapsone resistance among women.—Authors' Summary

Gatti, J. C., Cardama, J. E., Ocampo, J. C., Jakim, I. H. and Brusco, J. E. Consideraciones sobre la reaccion reversal. A proposito de un caso. (Considerations about reversal reaction. On the subject of one case.) *Rev. Fontilles* 13 (1981) 9–17. (in Spanish)

A 39-year-old male with clinical, bacteriological, and histopathological diagnosis of lepromatous leprosy was treated for 20 years with dapsone. He had toxidermia medicamentosa after ingesting pirazonol. After resolution of this problem, skin lesions became evident which were compatible with tuberculoid leprosy in reaction. Histologically, the lesions were sarcoidal granulomata with a few granular acid-fast bacilli. The reaction appeared to be typical of a reversal reaction or an upgrading reaction.

The immunodepression seen in Hansen's disease is exclusively one of cell mediated immunity (T lymphocytes) and these are

responsible for mutations in the disease from one pole to the other. Movements toward the tuberculoid pole occur in reversal reactions.

In the first case, histologic examination reveals a diminution in the defensive cells in the lesions and in the T lymphocytes in the cortex of lymph nodes. In the second situation, there is an increase in defensive cells in the lesions and in the T lymphocytes in the lymph nodes on biopsy.

The competence of humoral immunity in HD is clearly demonstrated by the adequate responses to vaccines and by the presence of vasculitis (erythema nodosum leprosum, polymorphic erythema, and the Lucio Phenomenon) which are ineffective attempts to alter the evolution of the disease through antigen-antibody reactions.

We need to clarify why the depression in T lymphocytes does not predispose to the appearance of other infectious diseases, the detailed mechanisms involved in the inability of macrophages to lyse the bacilli, and what type of immunotherapy (known or unknown) which we can apply to favor the mutation of the disease toward a more resistant form.—(Adapted from Authors' Summary)

Gharpuray, S. M., Gharpuray, M. B. and Kelkar, S. S. Liver lesions in reactional states in leprosy. *Leprosy in India* 53 (1981) 413–416.

Liver biopsies were done in 21 adult patients of leprosy in acute reaction. They included ten of lepromatous leprosy, seven of tuberculoid leprosy, and four of dimorphic leprosy. Except for a single case of tuberculoid leprosy, all showed granulomatous lesions of varying sizes and frequency in the liver. The lesions appeared to be unique for reaction and immunologically-based. The sequence of events appeared to be: 1) immunologically-mediated alteration of Kupffer cells with adhesion of lymphocytes and polymorphonuclear leukocytes; 2) small granulomas of proliferating Kupffer cells, lymphocytes, and polymorphs; 3) in some cases, formation of larger granulomas with breaking down of reticulin and liver cell necrosis.—Authors' Summary

Girdhar, A., Girdhar, B. K., Ramu, G. and Desikan, K. V. Discharge of *M. leprae* in milk of leprosy patients. *Leprosy in India* 53 (1981) 390–394.

A quantitative estimation of discharge of *M. leprae* in the milk of 39 female leprosy patients has been made. Twelve of the 39 patients (10LL/BL and 1 each of TT/BT and BB) showed bacilli in their milk. Only one of these patients was on treatment. The AFB count in 10 ml of milk was found to range from 4.3×10^4 to 4.3×10^5 . The significance of discharge of such a large number of bacilli in breast milk is discussed.—Authors' Summary

Moleres Ferrandis, R. *Artropatia Hanseniana*. Valencia: Editorial Facts, Libros y Revistas de Medicina, 1981, 76 pp. (in Spanish)

Osteoarticular changes in leprosy are so far classified as specific and non-specific. Specific ones are due to Hansen's bacilli infection and typified by cystic osteitis. Non-specific ones are not related to Hansen's bacilli and here are included osteoarthritis, acroosteolysis, Charcot joints, osteoporosis, etc.

The study of clinical records and X-ray of 700 patients of leprosy and the review of osteoarticular pathologic changes of 150 patients' specimens show some interesting findings.

The osteoarticular changes show the typical clinical and X-ray manifestations described in medical literature. However, there are intermediate forms suggesting a transition.

These lesions are due to infection of Hansen's bacilli in all clinical forms, the infection being intrinsic and observed in osteoarticular structures but for Charcot joints, in which infection is extrinsic affecting the corresponding nerve. Secondary infection is a complication of plantar ulcer and osteomyelitis may follow.

E.N.L. cystic osteitis, osteoarthritis, erosive arthritis, and osteoporosis are true early forms of acroosteolysis, although the clinical course may stop and even reverse regenerating bone structure, in favorable circumstances.—Author's Summary

Nigam, P., Dayal, S. G., Srivastava, P., Joshi, L. D., Goyal, B. M., Dutt, B., and Gupta, M. C. Diabetic status in leprosy. *Hansen. Int.* 4 (1979) 7-14.

The diabetic status of the local Jhansi patients (120 cases) was established before and after antileprosy treatment. Control studies were performed in normal, healthy subjects (50 persons) without family history of diabetes mellitus. Random normals showed an incidence of diabetes only 2%, while leprosy patients (94 males and 26 females) had incidence of diabetic status of 14.2%. The highest incidence (19.3%) of diabetes was in lepromatous leprosy and lowest incidence (6.4%) in tuberculoid leprosy patients. Repeated studies in leprosy after treatment showed not only clinical improvement for leprosy but also disappearance of the chemical and latent diabetes mellitus and lowering of blood sugar levels in manifest diabetes mellitus. Incidentally it was noted that "diabetic status" was worse among males (82.3%) and with advancing age. Association and improvement of diabetic status with specific treatment would tentatively suggest that *Mycobacterium leprae* lesions are not confined to skin alone but somehow also related to carbohydrate metabolism. A careful management of the chemical and latent diabetes may help in clinical management of leprosy too.—Authors' Summary

Nsibambi, J. K. Leprosy and syphilis: a case report. *Lepr. Rev.* 52 (1981) 171-173.

This is a report on a leprosy patient who was referred from a provincial leprosy clinic to a leprosy hospital because of skin lesions that could not be diagnosed at the clinic. The patient was found to be suffering from secondary syphilis as well as leprosy. Comments are made on the findings that could be common to both leprosy and secondary syphilis.—(From the article)

Radnakrishnan, N. and Albert, S. Blindness due to leprosy. *Indian J. Ophthalmol.* 28 (1980) 19-21.

Despite years of research and enormous number of conferences on leprosy, the dis-

ease still remains a major medical problem. Nevertheless, blindness from leprosy can be a thing of the past if an early diagnosis and appropriate treatment is undertaken. Furthermore, recently developed drugs hold an additional promise for improved results. As Wayson has stated "Instead of thinking leprosy as a disease of foul smelling sores and grotesque facial mutilations we shall consider it as a communicable affection of protean manifestations, and do our best for their eye care and prevent the misery of blindness to occur on them."—Authors' Summary

Rao, S. S. L. and Rao, P. R. Immunological status of maculoanaesthetic leprosy: leucocyte migration inhibition test as a measure of cell mediated immune response. *Leprosy in India* 53 (1981) 340-349.

M. leprae-specific cell-mediated immune responses were studied in 36 maculoanaesthetic (MA) leprosy patients using the leucocyte migration inhibition test (LMIT). Twenty-one tuberculoid, 13 indeterminate, 16 borderline, 13 lepromatous, and 20 healthy controls were also studied for comparison. Highly significant differences ($p < 0.001$) in the mean migratory indices (MI) were found between the MA leprosy type and each of the other leprosy types or control groups. The results support the concept that the MA type forms a distinct form of leprosy from the tuberculoid type or any other type of leprosy.—Authors' Summary

Rée, G. H., Martin, F. I. R., Myles, K. and Peluso, I. Hormonal changes in human leprosy. *Lepr. Rev.* 52 (1981) 121-126.

In an attempt to define the extent of disturbances of testicular-pituitary function in leprosy, a study has been carried out on an unselected group of male patients attending a leprosy treatment center who were not obviously suffering from testicular atrophy or gynecomastia. Lepromatous patients had significantly elevated FSH and LH in their plasma and significantly lowered plasma testosterone compared to tuberculoid patients. Mean FSH and LH lepromatous patients were significantly higher than 31 tuberculoid patients. Plasma testosterone

levels were significantly lower in the lepromatous patients. It would seem that in many lepromatous patients testicular damage has been occurring gradually for several years before the actual presentation for treatment.—(Adapted from Authors' Summary)

Rial, R. M. L. La biopsia neural en la enfermedad de Hansen fundamentos y técnica quirúrgica. (The nerve biopsy in Hansen's disease: fundamentals and surgical technique.) *Leprologia* 22 (1980) 11–22. (in Spanish)

The author presents his experience with peripheral nerve surgery as a diagnostic procedure in particular cases of leprosy patients. He reviews the anatomy and points out the preferable biopsy areas for sensory branches.—Author's Summary

Scheinberg, M. A. and Benson, M. D. SAA amyloid protein levels in amyloid-prone chronic inflammatory disorders. Lack of association with amyloid disease. *J. Rheumatol.* 7 (1980) 724–726.

Serum amyloid protein A (SAA) levels were evaluated by a sensitive radioimmunoassay technique in leprosy, juvenile rheumatoid arthritis and chronic osteomyelitis. SAA was elevated in all three groups of patients. The level in each of the patient groups did not reflect the presence of secondary amyloidosis. Our study suggests that serum SAA protein levels should not be considered a routine diagnostic test in patients with chronic inflammatory diseases prone to the development of amyloid disease.—Authors' Summary

Shilo, S., Livshin, Y., Sheskin, J. and Spitz, I. M. Gonadal function in lepromatous leprosy. *Lepr. Rev.* 52 (1981) 127–134.

Gonadal function has been studied in 14 male patients suffering from lepromatous leprosy. Eleven of the patients showed reduction in testicular size. Eight had azospermia and four oligospermia. Gynecomastia was noted in 12 patients. In only two recently discovered cases was this absent.

Twelve of our patients had increased basal and peak FSH responses to LHRH. The LH response to LHRH was heterogeneous.

Four patients had normal basal and peak levels; four had normal basal levels with an increased response to LHRH; four had elevated basal and peak responses and the remaining two had elevated basal levels with normal peak responses to LHRH.

Testosterone was normal in all patients, while estradiol 17 β and estrone levels were significantly elevated. There was no correlation between basal and peak gonadotrophins and testosterone estradiol 17 β , estrone, or any of the clinical parameters.—Authors' Summary

Singhal, A. L., Parvez, M., Chadda, V. S. and Misra, S. N. A study of estimation of serum alpha-1-antitrypsin in various forms of leprosy. *Leprosy in India* 53 (1981) 417–424.

Studies of serum alpha-1 antitrypsin by agar gel electrophoresis were carried out in 25 patients of various forms of leprosy, including nine cases of erythema nodosum leprosum and were compared with findings in 25 healthy controls. The level of serum alpha-1 antitrypsin in healthy subjects ranged from 211 mg% to 602 mg% with a mean level of 290.92 mg% \pm 86.82 mg, while in leprosy patients of various types ranged from 129 mg% to 702 mg% with mean level of 405.84 mg% \pm 152.70. Nine patients of lepromatous leprosy with ENL had marked elevation of serum alpha-1 antitrypsin and the level was 376 to 720 mg% with a mean level of 562.65% \pm 106.62, statistically significant.—Authors' Summary

Sritharan, V., Venkatesan, K., Bharadwaj, V. P. and Girdhar, B. K. Renal functions in lepromatous leprosy patients. *Leprosy in India* 53 (1981) 437–442.

While leprosy does not primarily affect the kidneys, secondary involvement of kidneys has been reported in lepromatous leprosy and especially in lepra reaction. In the present study, the authors have investigated the functional status of the kidneys of lepromatous leprosy patients by focusing attention to parameters like acidification of urine, glomerular filtration rate, and excretion of a foreign dye administered intramuscularly. This study revealed a decreased ability to acidify urine and to excrete the dye as well as a drop in glo-

merular filtration rate in untreated LL patients. The said disturbances were more pronounced in lepra reaction.—Authors' Summary

Tiwari, V. D. and Mehta, R. P. Deformities in leprosy patients of Indian Armed Forces treated/reviewed at Military Hospital Agra (A retrospective study). *Leprosy in India* **53** (1981) 369–378.

Records of 809 cases of leprosy in the armed forces personnel treated at Military Hospital, Agra, were reviewed to study deformities in relation to certain variables. The deformity rate was 9.13% only; 1.5% of the cases developed deformity while on DDS treatment. The deformity rate increased with increasing age. Though lepromatous, borderline, and polyneuritic types were more prone to develop deformities, on treatment tuberculoid types devel-

oped more deformities. Reaction precipitated deformity in 6.75% of the deformed.—Authors' Summary

Verma, N. An assessment of the usefulness and acceptability of eye shields under field conditions. *Lepr. Rev.* **52** (1981) 141–149.

Fifteen patients with varying degrees of lagophthalmos and neuroparalytic keratitis were fitted with eye shields made in the field, and an assessment at 1 and 2 weeks has shown that there is a definite improvement in the eye condition and that the community's acceptance of such a procedure is good. For introduction into the present leprosy control programs, an evaluation of the paramedical workers has shown that they require only minimal additional training.—Author's Summary

Immuno-Pathology

Artz, R. P., Jacobson, R. R. and Bullock, W. E. Decreased suppressor cell activity in disseminated granulomatous infections. *Clin. Exp. Immunol.* **41** (1980) 343–352.

The effect of granulomatous infections upon the activity of a T lymphocyte subclass in human peripheral blood that can be induced by concanavalin A (Con A) to function in a suppressor mode was studied. Peripheral blood lymphocytes (PBL) from eleven patients with disseminated mycotic or mycobacterial infections or from normal controls were preincubated with and without Con A, washed and cultured with allogeneic PBL freshly drawn from healthy donors sensitive to histoplasmin. DNA synthesis was then measured in co-cultures stimulated by Con A, histoplasmin, or by the mixed lymphocyte culture (MLC) reaction alone. As compared with cells preincubated without Con A, the Con A-pretreated cells from ten of eleven normal donors clearly suppressed the response to Con A by normal allogeneic PBL. Conversely, the response of normal PBL was augmented in six of eleven co-cultures to

which Con A-pretreated cells from patients had been added ($p < 0.01$). Likewise, the patients' pretreated cells were significantly less effective in suppressing the responses of normal PBL to histoplasmin ($p < 0.01$), and in a one-way MLC reaction ($p < 0.05$). The Con A-induced suppressor activity of PBL from nine patients with localized granulomatous infections did not differ significantly from that exerted by PBL of normal controls in two of the three co-culture systems employed. These studies suggest that either dysfunction or a reduction of the Con A-inducible T-suppressor cell subpopulation in peripheral blood is frequent among patients with disseminated granulomatous infections.—Authors' Summary

Bach, M.-A., Chatenoud, L., Wallach, D., Phan Dinh Tuy, F. and Cottenot, F. Studies on T cell subsets and functions in leprosy. *Clin. Exp. Immunol.* **44** (1981) 491–500.

T cell subsets and T cell functions were explored in 31 leprosy patients with the following methods: 1) determination of the per-

centages of the different T cell subpopulations defined by monoclonal antibodies directed at total T cells, helper T cells and suppressor/cytotoxic T cells; 2) measurement of the *in vitro* proliferative responses to mitogens; 3) study of the concanavalin A-induced suppressive activity, assessed on MLC; and 4) measurement of delayed-type hypersensitivity by skin testing. A comparison was made among 1) lepromatous leprosy patients without erythema nodosum leprosum (ENL), 2) lepromatous patients with ENL, and 3) tuberculoid leprosy patients. Unexpectedly, groups 1 and 3, although differing strongly in their clinical status and their sensitivity to lepromin (absent in group 1 and strong in group 3), showed a similar immunological profile with a normal percentage of T cells and a normal distribution of T cells among the major T cell subsets. Both groups 1 and 3 showed a moderate decrease of proliferative responses to mitogens and impaired delayed-type hypersensitivity reactions. Lepromatous patients with recent ENL reaction (group 2) showed elevated responses to mitogens, often above those of normal controls, imbalance between helper and suppressor T cells in favor of the former, and in some, but not all cases, a drastic decrease of the Con-A-induced suppressor T cell activity. Our ENL patients showed high mitogen responsiveness despite the fact that most of them had a heavy bacterial load. It is suggested that this imbalance between T cell subsets contributes to the occurrence of ENL reactions in lepromatous patients.—Authors' Summary

Gaulier, A. Lépromes à cellules fusiformes de topographie périneurale rapports avec la lèpre histioïde de Wade. (Spindle shaped leproma cells arising from perineurium, a link with Wade's histoid leprosy, one case.) Arch. Anat. Cytol. Path. 28 (1980) 277–282. (in French)

In an untreated lepromatous patient, surgical excision was performed on large subcutaneous nodules which were attached to nerve trunks or developing from small nerve branches. Routine histology showed spindle shaped cells with many full stained bacilli and occasional middle sized vacuoles. Transition aspects were seen between

typical onion skin perineurium involvement, histoid perineurium transformation, and larger infiltrations by spindle shaped cells developing around fibrous structures looking like destroyed endoneurium. An ultrastructural study showed numerous homogenous bacilli inside individual vacuoles in histiocyte-like cells, fibroblasts and endothelial cells, a lot of them being non-homogenous, with degenerating aspects. The nature of spindle shaped cells is described, as "histoid leprosy" for which we prefer the term of histoid lesions in bacilliferous patients. This observation emphasizes the hypothesis that such an infiltration occurs where local immunity is low, perineurium in our case, and illustrates the "blood nerve barrier" concept.—Author's Summary

Han, S. H., Kuo, S.-L., Hu, S.-C. and Lu, S.-T. The granulomatous response of leprosy patients to lepromin and killed BCG. Chinese J. Microbiol. Immunol. 13 (1980) 121–127.

The volunteers studied included 6 tuberculoid and 11 lepromatous leprosy patients (Ridley and Jopling). Each received intradermally 0.1 ml of lepromin (Wade method) and 0.1 ml of autoclaved BCG (grown on Dubos medium) at two separate sites on the left upper arm. Observations were made at weekly intervals, and biopsy specimens were taken at the fourth week (wk). Within 3 to 4 wk all six tuberculoid patients responded to lepromin with typical granulomas (five of which measured 5 mm or more in diameter) composed of epithelioid cells, lymphocytes and giant cells. In contrast, 8 of the 11 lepromatous patients remained negative; the other three developed tiny papules less than 3 mm in diameter which disappeared after 2 wk. Biopsy specimens taken from injection sites at the fourth wk showed essentially normal histology. All 17 patients developed typical granulomas to heat-killed BCG (none were less than 5 mm in diameter and most were larger) consisting of epithelioid cells, many lymphocytes and a few giant cells. The reaction in tuberculoid leprosy was stronger than that in lepromatous leprosy and the reaction to BCG in tuberculoid leprosy was stronger than that to lepromin, but the differences

were not very remarkable.—Authors' Summary

Harboe, M. and Closs, O. Immunological aspects of leprosy. In: Fourth International Congress of Immunology 80. Progress in Immunology IV, Vol. 3. Fougereau, M. and Dausset, J., eds. London: Academic Press, 1980. p. 1231–1243.

Leprosy may to a great extent be considered as an immunological disease. The causative organism, *Mycobacterium leprae*, is virtually nontoxic and may occur in great numbers in the skin with almost no clinical symptoms. Most symptoms of the disease are due to immune reactions against the bacilli. Complications such as nerve damage, which is responsible for the deformities so often associated with the disease, are directly due to immune reactions. The case is the same for erythema nodosum leprosum (ENL), which is a classical example of an immune complex disease in man. It has become increasingly apparent that leprosy offers unique opportunities for studies of the relationship between host and parasite during a chronic infection, particularly development of clinical symptoms due to immune reactions against antigenic substances liberated from microorganisms. Leprosy is thus developing as a "model disease" which provides essential information on the importance of immune reactions in several chronic infectious diseases.

In this position paper, we present our view on the current state of knowledge on essential immunological features of leprosy. We have deliberately focused attention on areas where current concepts may need to be challenged and where the available information is incomplete, thus pointing to areas in need of further work.—Authors' Introduction

Koya, G., Narita, N. and Arakawa, I. Histopathological findings of serial preparation including the total length of nerve of extremities thoracica in leprosy. Japanese J. Lepr. 49 (1980) 1–9. (in Japanese)

Most reports on the histological changes in the peripheral nerves in leprosy have been made from the study of biopsy spec-

imens. A study of bigger nerves, in their entire length, including the spinal cord, has been made occasionally as this is possible only at autopsy. We have undertaken a detailed study of the peripheral nerves in lepromatous leprosy by which an addition to modified embedding method of their entire length was made. In addition, a detailed histological examination of the spinal cord was undertaken. Histological examination of peripheral nerves of the upper extremities, including the plexus and the roots of origin from the spinal cord dissected from three autopsy cases, showed a greater degree of destruction of the axis cylinders and myelin sheaths in a spindle-like form and moderate destruction of them in proximal parts. Lepa bacilli, besides being present all among the peripheral nerves, were found to be concentrated in a spindle-like form part.

The examination of the spinal cords in three cases of lepromatous leprosy both histopathologically as well as by the staining method for the bacilli by Harada failed to reveal acid-fast organisms. It is concluded, therefore, that the lepra bacilli travel along the peripheral nerves to the roots, but fail to enter the spinal cord and it degenerates only secondarily.—From the article

Løvik, M. and Closs, O. Delayed type hypersensitivity to mycobacterial antigens without protective immunity: a failure to produce the right specificity or the right type of immune reaction? Scand. J. Infect. Dis. Suppl. 24 (1980) 224–227.

In C57BL mice live MLM bacilli induced strong local reactivity to a challenge with live bacilli but no measurable DTH against a sonicate of the same bacilli. Resistance against reinfection was induced. In this strain sonicate immunization induced strong DTH against sonicate but only weak local reactivity against live bacilli. Sonicate immunization did not seem to confer protective immunity, but to accelerate the development of such immunity.

In C3H mice the bacilli could be present and multiply at a normal rate without evoking a local reaction in animals that showed strong DTH against a sonicate of the same bacilli. Immunization with sonicate and development of DTH did not lead to the development of protective immunity in C3H

mice. Neither did the DTH reaction against sonicate elicited repeatedly in the infected foot pad reduce the multiplication of bacilli in C3H mice. MLM sonicate apparently induced immunity against antigens not presented by live MLM. The failure of the DTH reaction against sonicate to affect the multiplication of bacilli might have its explanation in that it was directed against the wrong antigens, that it was a wrong type of immune reaction, or that the effector mechanisms in C3H mice might be defective.

The marked discrepancy between DTH to soluble bacillary antigens and resistance to infection in murine leprosy represents an interesting parallel to the discrepancy between hypersensitivity to PPD and resistance to infection with *M. tuberculosis* in man and animal reported by several investigators.—Authors' Summary

Rée, G. H. and Talonu, M. T. Hepatitis B antigen and antibody in Papua New Guinea patients with leprosy. *J. Infect.* **3** (1981) 41–44.

A study of hepatitis B surface antigen and its antibody in non-institutionalized males with leprosy has shown no significant differences between lepromatous and tuberculoid patients. It is suggested that the immune defect in lepromatous leprosy does not extend to hepatitis B.—Authors' Summary

Rook, G. A. and Cameron, C. H. An inexpensive, portable, battery-operated photometer for the reading of ELISA tests in microtitration plates. *J. Immunol. Methods* **40** (1981) 109–114.

Enzyme-linked immunoassay methods have come into widespread use in the past few years, and many tests have been designed for disease surveillance in developing countries. An inhibiting factor in the acceptance of the method has been the lack of a cheap, convenient photometer.

In this paper a simple, cheap, portable photometer is described. Results were broadly comparable with those obtained on a high precision spectrophotometer, and it was perfectly adequate for ELISA tests. This machine nicely complements the kits of reagents for ELISA tests and is espe-

cially suitable for developing countries.—A. Voller

Shannon, E. J., Miranda, R. O., Morales, M. J. and Hastings, R. C. Inhibition of *de novo* IgM antibody synthesis by thalidomide as a relevant mechanism of action in leprosy. *Scand. J. Immunol.* **13** (1981) 555–562.

Thalidomide is well documented to be an effective treatment for erythema nodosum leprosum (ENL) occurring in lepromatous leprosy. To be beneficial, thalidomide must interfere with one or more of the several essential steps in the pathogenesis of this syndrome, which is presumed to be a clinical manifestation of an Arthus-type hypersensitivity. Since complexes of antigen and antibody would initiate these events, thalidomide could exert its most direct influence on reactants in this essential step. To determine whether thalidomide affected *de novo* antibody synthesis, the effect of the drug on the antibody response to sheep erythrocytes in mice was determined. Thalidomide significantly inhibited IgM antibody formation when fed to mice for 5 or 7 days before immunization with sheep erythrocytes. There was also a selective decrease in serum IgM concentrations among leprosy patients being treated with thalidomide for ENL. A clinically relevant site of action of thalidomide in ENL appears to be on the synthesis of IgM antibody. The target site of the drug among the macrophage, antibody-forming, and helper or suppressor lymphocytes remains to be elucidated.—Authors' Summary

Smelt, A. H. M., Rees, R. J. W. and Liew, F. Y. Failure to induce delayed-type hypersensitivity to *Mycobacterium leprae* in long-term treated lepromatous leprosy patients. *Clin. Exp. Immunol.* **44** (1981) 507–511.

Lepromatous leprosy (LL) patients whose bacillary load has decreased to almost undetectable levels by long-term chemotherapy failed to develop delayed-type hypersensitivity (DTH) to *Mycobacterium leprae* antigen following immunization with killed armadillo-derived *M. leprae*. When these LL patients were immunized with killed *M.*

leprae in a mixture with live BCG, only DTH to purified protein derivative (PPD) was induced. These results are further evidence that immunological unresponsiveness to the leprosy antigen of patients with lepromatous leprosy is antigen-specific and non-reversible.—Authors' Summary

Smelt, A. H. M., Rees, R. J. W. and Liew, F. Y. Induction of delayed-type hypersensitivity to *Mycobacterium leprae* in healthy individuals. Clin. Exp. Immunol. 44 (1981) 501–506.

Delayed-type hypersensitivity (DTH) to a soluble *Mycobacterium leprae* skin test antigen (SML) was successfully induced in healthy volunteers following immunization with 2×10^8 killed armadillo-derived *M. leprae*. No better sensitization was obtained by a mixture of live BCG and killed *M. leprae*. The relative specificity of the DTH reaction to SML has been demonstrated in this study, since little cross-reactivity was observed to PPD, after immunization with BCG or *M. leprae* alone, or combined. Moreover, armadillo-derived *M. leprae* readily induced a specific hypersensitivity with the time course DTH response associated with protective immunity, suggesting that this bacterial preparation may be a candidate for an effective antileprosy vaccine.—Authors' Summary

Tarabini-Castellani, G., Tarabini-Castellani, G. L., and Mohamed, F. A. Mitsuda Test con lepromina «A» en sujetos pretratados seis meses antes con una mezcla de lepromina «A» y «BCG.» (The Mitsuda test with lepromin-A in cases pretreated for 6 months with a mixture of lepromin-A and BCG.) Rev. Fontilles 13 (1981) 43–48. (in Spanish)

Thirty-nine school-age children were simultaneously injected with lepromin A and BCG: to 14 of them (group I) the two antigens were administered as a single mixture; the remaining 25 (group II) were injected, simultaneously but separately, with BCG and lepromin A, and they reacted to lepromin A as follows: negative, 19.23%; positive, 1+: 65.38%; 2+: 11.53%; 3+: 3.84%. The total number of cases with ulcerated nodules represented 15.83%.

Six months later the test was repeated, using lepromin A alone, on all of the 39 children and a reading was taken on the 27th day.

The results of this second test indicated that the two groups showed an equivalent response, which was stronger than 6 months earlier (data comparable only for group II):

Group I (14 children) negatives: 14.28%; positives 1+: 57.14%; 2+: 21.42%; 3+: 7.14%. Total ulcerated nodules: 33.71%.

Group II (25 children) negatives: 12%; positives 1+: 60%; 2+: 12%; 3+: 16%. Total ulcerated nodules: 24%.

It was further observed that many nodules, though not ulcerated, had a sclerosed appearance (taut thin skin, scaly or shagreened) in proportion of 35.71% (group I) and 40% (group II).

In previous studies, the sensitizing action of BCG used alone had appeared to be greater than its combination with lepromin A; on the other hand, the response to lepromin A administered 6 months after the combined inoculation appeared to be almost the same as in the subject inoculated with BCG alone.

In our opinion, therefore, it is not to be excluded that the lepromin A/BCG combination is effective, and may even determine a more specific and beneficial immunity against *M. leprae*, greater than the non-specific immunity conferred by BCG alone.—(Adapted from Authors' Summary)

Tarabini-Castellani, G., Tarabini-Castellani, G. L. and Nuti, M. El test de Mitsuda con lepromina de armadillo de sujetos sanos vacunados y no con la vacuna antituberculosa BCG (+). (The Mitsuda test with lepromin-A [lepromin from the armadillo] in healthy vaccinated cases who were not vaccinated with the antituberculous BCG.) Rev. Fontilles 13 (1981) 29–35. (in Spanish)

The number and intensity of positive responses to the lepromin A test have been found to be higher among BCG vaccinated subjects as compared with the non BCG vaccinated group.

The total number of persons tested with lepromin A was 3096, out of which 1399 had been given BCG.

The basic findings are as follows:

Mitsuda negative:

BCG vaccinated, 6.43%

Non BCG vaccinated, 37.36%

Mitsuda positive:

BCG vaccinated, 45.46%

Non BCG vaccinated, 11.66%

The authors are of the opinion that the greater intensity of Mitsuda reactivity associated with BCG is of the non-specific type. On the other hand, it should not be forgotten that some antigens are common to *M. tuberculosis* and *M. leprae*. Rather than discarding the use of BCG for purposes of leprosy control, it would be worthwhile to investigate ways to supplement its antigen-deficiency in relation to *M. leprae*.—Authors' Summary

Tarabini-Castellani, G., Tarabini-Castellani, G. L. and Nuti, M. La vacuna BCG y la lepromina de armadillo suministrada contemporaneamente sea en asociacion sea separadamente (+). (BCG vaccination and lepromin-A administered contemporaneously seen in a separately positive association.) Rev. Fontilles 13 (1981) 37–41. (in Spanish)

A total of 42 children, aged 6 to 14, were subjected simultaneously to the lepromin A test and BCG vaccination. Readings were taken on the 30th day. The 16 children who were administered the two antigens jointly in a single injection all showed a highly positive response, with ulcerated nodules, on the 30th day. A second test using lepromin A alone and investigating the response of T lymphocytes to the lepromin antigen will tell us to what extent BCG affected, from the point of view of specificity, the immunizing action of lepromin A.

As to the 26 children who were administered the two antigens separately, it was observed that in all of them BCG caused an ulcerated nodule, while the response to lepromin A was negative in five cases, and positive in the remaining 21, the ulcerated nodules appearing in four subjects only. The authors' comment on the influence which BCG may have had on the lepromin response and on their future research programs.—Authors' Summary

Tarabini-Castellani, G., Tarabini-Castellani, G. L. and Yaaqub, C. X. Sobre inoculacion de lepromina «A/BCG» en sujetos negativos a tres test leprominicos sucesivos. (On the inoculation of lepromin-A-BCG in cases that are negative to three successive lepromin tests.) Rev. Fontilles 13 (1981) 51–55. (in Spanish)

Three young women, none of them suffering from leprosy or tuberculosis of the lungs, responded negatively to three consecutive lepromin tests.

Two of them were then administered a single mixture of lepromin A/BCG. When next subjected to the lepromin test, the response was highly positive in two subjects pretreated with BCG (12 mm ulcerated nodule) and uncertain in the third girl used as control (the nodule was in fact small, 4 mm, and left no scar).—(Adapted from Authors' Summary)

Villa, S. Z., del Real Sanchez, J. H., Alcaraz, E. R., Cardenas, A. C. and Bartell, M. G. Tratamiento de la lepra lepromatosa con BCG. (Treatment of lepromatous leprosy with BCG.) Alergia 27 (1980) 121–138. (in Spanish)

Seven patients with a clinical and histopathological diagnosis of lepromatous leprosy were studied to evaluate the immunological response and therapeutic usefulness of BCG in this type of patient. The BCG was given in two periods of time: a) The first period of time consisted of high doses; one ampule of BCG from Glaxo Laboratories was diluted in 2 ml of distilled water. Every patient received 100 one-tenth ml doses by scarification every week for six doses; b) The second period of time consisted of lower doses; one-tenth ml was administered subcutaneously every week for 8 months.

Before, during, and at the end of the first period of treatment, delayed hypersensitivity skin tests were applied using lepromin, PPD, and candidin. Determinations of immunoglobulins were performed and biopsies were taken from the sites of lesions. Most of the patients developed erythema nodosum in association with the administration of the high doses of BCG. This

could be well-tolerated with a lowering of the dose of BCG. Clinical improvement was evident in most patients, and this correlated with the results of skin testing for delayed hypersensitivity. The Mitsuda test

became positive in six of the seven patients treated. There were no significant changes in immunoglobulins or in the histopathological appearance of the lesions.—(Adapted from Authors' Summary)

Microbiology

Ishaque, M., Adapoe, C. and Kato, L. Energy coupling mechanisms in host-grown *Mycobacterium lepraemurium*. Can. J. Biochem. **59** (1981) 75–82.

Energy coupling mechanisms of *Mycobacterium lepraemurium* isolated from Sprague-Dawley rats lepromata were investigated. Cell-free extracts catalyzed phosphorylation coupled to the oxidation of generated NADH, added NADH, and succinate yielding P/O ratios of approximately 0.8, 0.6, and 0.4, respectively. Ascorbate oxidation alone or in the presence of cytochrome *c* or *N,N,N',N'*-tetramethyl-*p*-phenylenediamine was not coupled to ATP synthesis.

The oxidative phosphorylation was completely uncoupled by 2,4-dinitrophenol, 2,6-dibromophenol, pentachlorophenol, *m*-chlorocarbonyl cyanide phenylhydrazine, dicumarol, and gramicidin at concentrations which did not cause any inhibition of oxygen uptake. While the NADH oxidation and associated phosphate esterification was markedly sensitive to rotenone and other flavoprotein inhibitors, these inhibitors had no effect, however, on the phosphorylation coupled to succinate oxidation. The respiratory chain inhibitors such as antimycin A or 2-*n*-heptyl-4-hydroxyquinoline-*N*-oxide, and cyanide were the potent inhibitors of the phosphorylation associated with the oxidation of NADH and succinate. The ATP formation coupled to the oxidation of NADH and succinate was also inhibited by oligomycin as well as by the thiol-binding agents, *p*-hydroxymercuribenzoate and *N*-ethylmaleimide. The results indicated that NADH and succinate oxidation by *in vivo* grown *M. lepraemurium* was mediated by oxidative enzymes involving first and second energy coupling sites.—Authors' Summary

Katoch, V. M. A report on the biochemical analysis of *Mycobacterium W*. Leprosy in India **53** (1981) 385–389.

A mycobacterial strain known as mycobacterial strain W was analyzed for its growth characteristics and biochemical traits. This strain was found to be a rapid grower, with luxuriant growth on Lowenstein-Jensen medium, Dubos agar, Middlebrook's agar and Sauton's medium. Colonies were smooth, convex, and nonpigmented. Some of the colonies which appeared rough were similar to smooth colonies at least in biochemical characteristics. This organism was tolerant to a wide range of temperatures and to chemical substances like thiophene-carboxylic acid hydrazide, isoniazid, sodium chloride but not to bile salts. It was negative for niacin production, for various amidases, urease production, 3 day arylsulfatase test, and also for Tween 80 hydrolysis. On the other hand, this strain was found to be positive for semiquantitative catalase, heat resistant catalase, nitrate reduction, sodium salicylate degradation, tellurite reduction, 14 day arylsulfatase test, and fermentation of fructose. This organism could utilize sodium nitrite and sodium nitrate as sources of nitrogen but did not exhibit any utilization of fructose and arabinose as the only sources of carbon. The significance of these findings is discussed.—Author's Summary

Portaels, F. Study of unclassified dapsone sensitive mycobacteria isolated from the environment in Zaire. Ann. Soc. Belge Med. Trop. **60** (1980) 381–386.

Three new groups of mycobacteria isolated from the environment in Zaire are described. They are slowly growing mycobacteria developing after 2 to 3 weeks on

Löwenstein-Jensen medium. Their optimal growth temperature is 33°C while no growth occurs at 37°C.

Five of these strains are very sensitive to dapsone with a MIC of 0.03 mg/l, a value

very close to that of *M. leprae* in mice and rats, and may therefore be useful in studies concerning the mechanism of action of dapsone.—Author's Summary

Experimental Infections

Curtis, J., Adu, H. O. and Turk, J. L. A lack of correlation between antigen-specific cellular reactions and resistance to *Mycobacterium lepraemurium* infection in mice. *Immunology* **43** (1981) 293–301.

Following infection subcutaneously in the foot pad with 10^7 *Mycobacterium lepraemurium* organisms C57BL mice were able to limit multiplication of organisms at the infection site for the 6 months studied and to limit organism spread to the draining lymph node. Large numbers of organisms were present in the footpad and draining lymph node of BALB/c mice at 6 months. In spite of this difference in local immunity the changes in cellular reactivity to specific antigen as assessed by the delayed foot pad response and the *in vitro* proliferative response of draining lymph node cells were similar in the two strains over the time studied.—Authors' Summary

Kaur, S., Ganguly, N. K., Kumar, B., Sharma, S., Kaur, M., Chakravarti, R. K. and Mitra, S. K. *M. leprae* infection in normal, thymectomised irradiated and thymus transplanted mice. *Leprosy in India* **53** (1981) 425–431.

Normal mice and thymectomised, X-irradiated, and thymic transplanted groups of mice were challenged with 10^3 *M. leprae* in the foot pad. The course of the infection was studied for a period of 7 months by sacrificing animals every month and counting the bacilli from the pooled tissues. In the thymectomised irradiated group the counts showed a plateau from the fifth month onward, whereas in the control and the thymus implant group, the counts rose in the sixth and seventh months.—Authors' Summary

Epidemiology and Prevention

Belda, W. and Lombardi, C. Situação da hanseníase no Estado de São Paulo em 1978. (Situation of endemic Hansen's disease in the state of São Paulo in 1978.) *Hansen. Int.* **4** (1979) 15–25. (in Portuguese)

The authors describe the situation of endemic Hansen's disease in the state of São Paulo in 1978, presenting the prevalence and incidence rates of the disease in the several Regional Health Divisions of the State. An attempt to evaluate the Hansen's disease control program, carried out since 1976, is also presented, through the participation of the Health Units of the State in the activities of epidemiologic surveillance of the program.—Authors' Summary

Chandra, S., Singh, G. and Kaur, P. Role of school survey in the control of leprosy. *Indian J. Dermatol. Venereol. Lepr.* **47** (1981) 42–44.

Students attending high school in two community blocks in district Varansi were examined for evidence of leprosy. Among the 995 students surveyed, 20 cases were detected. There was no case of lepromatous leprosy. In endemic areas, repeated examination of school children will help considerably in early detection of leprosy and its control.—Authors' Summary

Guha, P. K., Singh, G. and Kaur, P. Genetic diathesis for leprosy. *Leprosy in India* **53** (1981) 432–433.

Innate incapacity to elaborate a protective cellular immunity has been thought to underlie the evolution of the disease process of lepromatous leprosy. Although both family and twin studies were suggestive of the involvement of some genetic factors, they have so far not been evaluated fully. Keeping this in view, the present study, conducted at the family level, was designed to evaluate the role of genetic factors in determining the type of leprosy in a patient. The distribution pattern of the disease types detected in contacts, in relation to that in the index cases, has been analyzed in the light of genetic diathesis.

Our observations do not tend to indicate the existence of a lepromatous diathesis in the first degree relatives of lepromatous leprosy patients included in this study. In other words, genotype did not appear to be a significant contributory factor in determining the type of leprosy in lepromatous patients.—Authors' Summary and Conclusion.

Harahap, M. Leprosy in Indonesia. *Lepr. Rev.* **52** (1981) 155–159.

The leprosy control program in Indonesia is discussed. The epidemiological situation of leprosy is assessed from the statistics of the registered cases and through comparison of several leprosy surveys. In a certain province, leprosy showed a marked decline, while in other provinces the prevalences are still high. We need to recognize the limitations of the present measures employed to control leprosy, and to accept that if we want to control the point of eradication, the only hope lies in immunization.—Author's Summary

Lehrer, A. B. and Bonnucci, N. E. Lucha antileprosa en Sante Fe-departamento rosario. (The antileprosy battle in Sante Fe [Argentina] in the state of Rosario.) *Leprologia* **12** (1980) 45–50. (in Spanish)

An evaluation of the endemic evolution of leprosy in Rosario Department (Sante Fe, Argentina) between 1976 and 1978 is presented.—Authors' Summary

Mani, M. Z. and Mathew, M. Leprosy in Punjab. An analysis of 4 years of O. P. D. Data. *Lepr. India* **53** (1981) 395–405.

One hundred eighty-five new leprosy cases were seen, of whom 52 (28.2%) were Punjabis and 133 (71.8%) were non-Punjabi patients. A minimum of 13 (25%) Punjabi leprosy cases were indigenous. The Punjabi cases were drawn from several districts in Punjab. Among the Punjab patients, the mean age at onset of leprosy was 43.6 years, and 30.8% of them had an infectious type of leprosy. BT was the most common type of leprosy (38.5%), and the age of onset was also highest in BT (49.8 years) among the Punjabi patients. The migrant laborers from Bihar and Eastern U.P. are the probable source of leprosy in Punjab.—Authors' Summary

Mathur, N. K., Bhargava, R. K., Gupta, B. K. and Zai, M. U. Leprosy in Jaipur (Rajasthan). A clinical and epidemiological study. *Leprosy in India* **53** (1981) 406–412.

An analysis of 537 patients of leprosy registered in the Leprosy Clinic attached to the S.M.S. Medical College and Hospital Jaipur from March 1977 to May 1980 has been made. An incidence of 4.1 per 1000 patients attending Skin Outpatient Department was found. Lepromatous leprosy (30%) was the most common form. Three hundred and thirty-five (62.3%) cases were in the age group of 30–59 years. Males were affected twice as frequently as compared to females. Five percent of affected families showed multiple cases.—Authors' Summary

Nsanzumuhire, H., Aluoch, J. A., Karuga, W. K., Edwards, E. A., Stott, H., Fox, W. and Sutherland, I. A third study of case-finding methods for pulmonary tuberculosis in Kenya, including the use of community leaders. *Tubercle* **62** (1981) 79–94.

Five methods of identifying tuberculosis suspects were investigated in the Machakos District of Kenya by: 1) 3-monthly interrogation of the Community Elders, 2) interrogation of household heads, 3) identifying suspects among outpatients attending local health units, 4) examination of patients registered during the previous 10 years in the District Tuberculosis Register and also 5) their close contacts. Sputum

was bacteriologically examined by smear and culture from suspects found by all the methods.

The initial interrogation of the Elders yielded 216 suspects, of whom nine were culture-positive, including six smear-positive. Reinterrogating the Elders four times at 3-monthly intervals produced a further 114 suspects, including four culture-positive cases (3 being smear-positive). The examination of a second sputum specimen from suspects after a 3-month interval yielded four further culture-positive cases (all smear-negative), but the examination of a third specimen after a further 3 months yielded no further cases.

A single interrogation of 1093 household

head suspects yielded 22 culture-positive cases, including 11 smear-positive.

The response in five health units covering a population of about 24,500 was poor. During a two-year period only 109 suspects were recorded; seven were culture-positive, including three smear-positive. Of 61 cases of tuberculosis registered during the previous 10 years, eight were currently culture-positive, five being smear-positive. Of 318 household contacts of these cases, six were culture-positive cases, two being smear-positive.

The problems presented by different active case-finding methods are discussed, identifying those that appear promising and those unpromising.—Authors' Summary

Rehabilitation

Brand, P. W., Beach, R. B. and Thompson, D. E. Relative tension and potential excursion of muscles in the forearm and hand. *J. Hand Surg.* 6 (1981) 209–219.

Muscle strength varies enormously from person to person and even from time to time, but the ratio of strength from muscle to muscle within the same limb varies much less. The mass or volume of a muscle is proportional to its work capacity, and the fiber length of a muscle is proportional to its potential excursion. By dividing the fiber length into the volume of each muscle, the cross-sectional area of the muscle was determined, and a list of relative tension capacities of forearm and hand muscles was prepared. Although based on a small number of specimens, this list has the first data on forearm and hand muscles which should be of practical use in planning the operation of tendon transfer.—Authors' Summary

Cardama, J. E., Gatti, J. C., Charosky, C. B., Gatti, F. and Selva, J. S. Alteraciones óseas en la enfermedad de Hansen. (Bone alterations in Hansen's disease.) *Rev. Argentina Dermatol.* 62 (1981) 95–101. (in Spanish)

The authors submit a classification of bone pathology in Hansen's Disease, dis-

cussing each of the entities from the clinical and X-ray point of view. Their relative frequency is discussed. Finally, reference is made to differential diagnosis. The need of early detection is emphasized in order to avoid severe mutilation of limbs in patients with leprosy.—Authors' Summary

Charosky, C. B. Protocolo neurológico simple para uso en leprología. (A simple neurological protocol for use in the study of leprosy.) *Leprológia* 12 (1980) 35–38. (in Spanish)

A simple neurologic protocol is presented to allow for uniform evaluation of peripheral nerve pathology in leprosy patients and make comparisons feasible between different researchers.—Author's Summary

Chauhan, N. S. and Dhar, U. The psychodynamic side of leprosy. A Children's Apperception Test (CAT) Study. *Leprosy in India* 53 (1981) 379–384.

The present investigation attempts to study the personality characteristics of children suffering from leprosy. A group of 11 children was selected from the Central Jalma Institute for Leprosy and Kusht Seva Sadan at Tajganj, Agra. The Indian adaptation of Leopold Bellak's Children's Ap-

perception Test (CAT) was employed for collecting the data. The most salient features which were charted out are that they have a general craving for sociogenic needs like love and affection, security, affiliation, cooperation, etc. Their anxiety level tends to be high due to certain conflicts. The obvious fact has been that leprosy appears as a somatic devastation in the presence of highly active psychogenic starvation of personality.—Authors' Summary

de Mesquita, A. P. Hanseníase: imagem, educação, integração e relacionamento médico-paciente. (Hansen's Disease: image, integration, and doctor-patient relations.) *Hansen. Int.* 4 (1979) 36–39. (in Portuguese)

Although still used in fund raising campaigns, the serious aspects of hanseniasis are less common now, thanks to early diagnosis and treatment. This new image of hanseniasis should be propagated by health education, especially directed to patients and contacts. Integration should refer not only to hanseniasis but also to leprologists, who became also "segregated," due to the pejorative "leprosy." The good relationship with the patient depends on the psychological capacity of the physician revealed as soon as the diagnosis of the disease is made.—Author's Summary

Goncalves, A. Incapacidade em hanseníase: um estudo da realidade em nosso meio. (Incapacities in Hansen's Disease: a realistic study.) *Hansen. Int.* 4 (1979) 26–35. (in Portuguese)

Considering the importance of rehabilitation in the policy for the control and prevention of hanseniasis, results of an investigation of incapacities in a population of affected individuals in São Paulo are presented. Discussion of these data and the identification of the potential resources for solving the problem lead to basic considerations about programs for rehabilitation of such patients.—Author's Summary

Malaviya, G. N. Surgery of foot drop in leprosy by tibialis posterior transfer. *Leprosy in India* 53 (1981) 360–368.

In the surgery of foot drop the common method of correction is by transfer of the tibialis posterior muscle, either to the joint capsule in the middle of the foot (Selvapandian's method) or a double transfer to the toe extensor tendons (Srinivasan's method). A retrospective study was done to compare the results of surgery done by those two methods at the Sacred Heart Leprosy Centre, Kumbakonam, with a follow-up ranging from 1–9 years where 78 feet had tibialis posterior transfer by Srinivasan's method and 20 by the Selvapandian-Brand method. Restoration of the normal heel-toe gait was the criterion taken to evaluate the results. Good results were obtained by either method in nearly 70% of cases. The post-operative findings and the causes of failure are analyzed in detail. The pre- and post-operative physiotherapy methods which mainly contribute a successful result are described and stressed.—Author's Summary

Other Mycobacterial Diseases and Related Entities

Bhardwaj, O. P., Shriniwas, Srivastava, V. K. and Balakrishnan, K. Soluble antigen fluorescent antibody (SAFA) test in serodiagnosis of disseminated and extra-pulmonary tuberculosis. *Indian J. Med. Res.* 73 (1981) 150–156.

The suitability of modified soluble antigen fluorescent antibody (SAFA) procedure for diagnosis of extra-pulmonary and disseminated forms of tuberculosis was examined in 53 cases of tuberculosis and 67

control subjects. One control subject gave false positive results. In extra-pulmonary tuberculosis, SAFA test was positive in 50% of the cases. In disseminated tuberculosis, only 29% were reactors. Fluorescence coefficients were higher in those who had received short trial of chemotherapy than in the untreated cases. It would appear that results of SAFA in these groups need a careful interpretation.—Authors' Summary

Bhuyan, U. N. Histological and biochemical assessment of severity of renal amyloidosis. *Indian J. Med. Res.* 73 (1981) 430-438.

Analysis of 110 cases of renal amyloidosis revealed an incidence of 4.8% in routine renal biopsies and 1.2% in autopsies. Tuberculosis was the most frequent cause, accounting for 47%, followed by chronic suppuration in 19% of the cases. Polyarthritides, including rheumatoid arthritis, contributed to another 9% of the cases. Division into three progressive stages of histological severity on the basis of combined glomerular and tubular damage showed partial correlation with biochemical severity like raised blood urea. An increased occurrence of hypertension was found in association with high blood urea; but the overall incidence was 8.2%. Twenty-seven patients died within 6 months of observation. The most frequent cause of death was renal failure followed by infection and heart failure.—Author's Summary

Frimodt-Moller, J., Acharyulu, G. S. and Pillai, K. K. A controlled study of the effect of a domiciliary tuberculosis (chemotherapy) programme in a rural community in South India. *Indian J. Med. Res.* 73 (Suppl.) (1981) 1-80.

To study the efficacy of a domiciliary drug therapy program in the control of tuberculosis in a rural community, an investigation was set up in 1958 under the auspices of the Indian Council of Medical Research in 12 towns with populations ranging from 6000 to 25,000, all within 160 km of Madanapalle (Andhra Pradesh). The prevalences of bacillary and radiological cases of pulmonary tuberculosis in adults (aged 15 years or more) were estimated in each town by carrying out a base-line random sample survey in 1959; also, the prevalences of tuberculous infection in all school children aged 5 to 9 years were estimated. These three indices of prevalence were used to rank the 12 towns and then randomly allocate them into two comparable groups of six towns each, designated as "treatment" and "control" towns. In treatment towns, intensive case finding was undertaken by means of two X-ray surveys

(survey I during 1960-61 and survey II during 1962-64) covering all adults, sputum examinations by microscopy and culture when indicated, and periodic follow-up of all "suspect" cases with X-ray and sputum examinations. All bacillary cases were offered domiciliary treatment for one year with isoniazid and PAS in the three treatment towns (selected at random) and with isoniazid alone in the other three towns. Of 1482 cases eligible for treatment in the six treatment towns, 15% refused treatment, and 29% discontinued chemotherapy prematurely. In the control towns, no special facilities for diagnosis or treatment were introduced, and patients were left to the routine treatment facilities available locally. A tuberculosis prevalence survey (survey III) covering all adults was carried out in all 12 towns during 1965-68, and this was followed by a random tuberculin sample survey during 1966-69.

The overall results of treatment at the end of 1 year were: 1) among cases initially positive by microscopy, 10% died, 33% remained sputum-positive, and 57% became sputum-negative in INH-PAS towns, the corresponding percentages for INH towns being 15, 48, and 37%, respectively; 2) among cases initially positive by culture only, 6% died, 26% remained sputum-positive, and 68% became sputum negative in INH-PAS towns, the corresponding percentages for the INH towns being 7, 38, and 55%, respectively.

All the bacillary cases (treated or untreated) were followed up and their status at the end of 5 years was 40.4% dead, 18.2% sputum-positive, and 41.4% sputum-negative. Sputum status at 1 year had considerable prognostic value. Of 532 sputum-negative cases at one year, 18% were dead, 16% sputum-positive, and 66% sputum-negative 5 years afterwards, whereas the corresponding percentages for the 379 sputum-positive cases at one year were 56, 20, and 24, respectively.

There was an interval of about 2½ years between survey I and survey II and about 4 years between survey II and survey III in the six treatment towns. The prevalence of bacillary cases in these surveys was age-standardized, considering separately cases found by microscopy and cases found by culture only. The mean prevalence of cases

positive by microscopy in the six treatment towns was 6.81 per thousand in survey I and it decreased significantly ($p < 0.01$) to 5.01 in survey II and 4.83 in survey III. Change of culture technique during the course of the investigation complicated the interpretation of prevalences of culture-positive cases.

Between the 1959 base-line survey and the resurvey in 1965–68, the prevalence of smear-positive tuberculosis decreased from 5.92 per thousand adults to 4.78 in the six treatment towns, and similarly from 5.72 to 4.21 in the six control towns. The prevalence of "culture only-positive" cases was 3.85 and 2.44 per thousand adults in the treatment and control towns respectively at the base-line survey and (with the more sensitive culture technique) 4.92 and 4.82 per thousand adults at the resurvey in 1965–68. Lastly, the tuberculin survey in 1966–69 did not reveal any significant differences between the treatment and the control towns.

The inability of the domiciliary treatment program to make an impact on the prevalence of tuberculosis in the rural community around Madanapalle is a finding that has considerable significance in the context of the tuberculosis control program in India; the reasons for the failure and its implications are discussed.—Authors' Summary

Krishnaswami, K. V., Somasundaram, P. R., Tripathy, S. P., Vaidyanathan, B., Radhakrishna, S. and Fox, W. A randomized study of two policies for managing default out-patients collecting supplies of drugs for pulmonary tuberculosis in a large city in South India. *Tubercle* 61 (1981) 103–112.

A randomized controlled study was undertaken to compare two policies of default management in outpatients with smear-negative pulmonary tuberculosis attending a large chest clinic in Madras city. All the patients were due to collect monthly supplies of drugs for a year, for daily self-administration at home. In the routine (R) policy, if a patient failed to collect the drug supply on a due date, a reminder letter was posted on the fourth day and, if necessary, a health visitor visited the home a week later.

In the intensive (I) policy, a health visitor visited the home on the fourth day and, if necessary, a week later and at 2 months.

The main analyses concern 150 patients (75 R, 75 I), of whom 16 R and 15 I patients had a positive culture. A total of 29 patients (11 R, 18 I) did not default at any time. For the remaining 64 R and 57 I patients, the mean numbers of defaults were 3.0 and 2.3, and the mean numbers of defaulter retrieval actions were 4.3 and 3.8 respectively. The home visit as the first action (I series) was successful in retrieving defaulters in 56% of 193 occasions, while the reminder letter (R series) was successful in 56% of 193 occasions ($p = 0.1$). Following the second action, which was a home visit in both series, these proportions became 80% and 84% respectively. In the I series, 22 third and 18 fourth actions were taken, but the patient was retrieved in only four and zero instances respectively.

The mean number of drug collections during the year was significantly higher in the I series (9.8) than in the R series (8.6). Finally, the proportions of patients who made 12 collections in a 15-month period, a satisfactory target under Indian Program conditions, were 69% and 52% respectively ($p = 0.07$).—Authors' Summary

McCray, M. K. and Esterly, N. B. Cutaneous eruptions in congenital tuberculosis. *Arch. Dermatol.* 117 (1981) 460–464.

Systemic tuberculosis with morphologic skin lesions that were essentially identical developed in two infants who were born of tuberculous mothers. In each patient, the infection induced erythematous papules with central crusted dells, noted 4 and 8 weeks after birth, respectively. In each case, the diagnosis of tuberculosis was made by examination of tissue that was obtained at laparotomy. In neither patient was *Mycobacterium tuberculosis* found in the skin lesions. The conditions of both patients responded well to antituberculous therapy. This article reviews the possible categorization of the skin lesions in these infants.—Authors' Summary

Madan, N., Talwar, N., Maheshwari, A. and Sood, S. K. Incidence of glucose-6-phosphate dehydrogenase deficiency in

a hospital population of Delhi. *Indian J. Med. Res.* **73** (1981) 425–429.

A total of 2016 adult subjects (1171 males and 845 females) from the outpatient department and blood bank donors of this hospital were screened for G-6PD deficiency by three tests *viz.* ascorbate-cyanide test, fluorescence spot test, and methemoglobin reduction test. All blood samples giving positive results by any of the screening tests were subjected to quantitative spectrophotometric assay for G-6PD. The study revealed an incidence of 1.37 percent of G-6PD deficiency in males, with a high preponderance in Punjabis, among whom 3.75 percent were deficient. As many as 0.71 percent of the females were also found deficient, the incidence being 0.93 percent among the Punjabis.—Authors' Summary

Patra, S. B., Jhala, C. I. and Patra, B. S. Serum electrophoretic pattern in amyloidosis complicating pulmonary tuberculosis. *Indian J. Med. Res.* **73** (1981) 258–265.

In 50 patients of pulmonary tuberculosis studied for the presence of amyloidosis by various diagnostic methods like intravenous Congo red test and liver biopsy, the incidence of amyloidosis was found to be 16%. Paper electrophoretic pattern of the serum was compared with that of patients of pulmonary tuberculosis without amyloidosis and normal healthy individuals. A marked reduction of total protein value, reduction of albumin fraction to one-fourth of normal value and marked rise of α_2 fraction were observed in patients of pulmonary tuberculosis with amyloidosis. In patients with pulmonary tuberculosis without amyloidosis, the total protein was found to be higher, albumin fraction was only reduced to half of normal value, and α_2 globulin rise was only slight. There was a significant percentage rise of globulin content in patients with amyloidosis as compared to patients without it. Albumin/ α_2 ratio of less than 2 was a remarkable finding in patients of pulmonary tuberculosis with amyloidosis, which should arouse suspicion of amyloidosis in patients of pulmonary tuberculosis before other diagnostic procedures are undertaken. In pa-

tients of pulmonary tuberculosis without amyloidosis, it was 4.37, whereas in normal health individuals it was 11.27.—Authors' Summary

Sengupta, L. K., Talukder, G., Sharma, A. and Panja, S. K. Cell mediated immunity in cutaneous tuberculosis. *Indian J. Med. Res.* **73** (1981) 746–750.

Cellular response was studied in 48 subjects (26 males and 22 females) diagnosed clinically as cases of cutaneous tuberculosis (*lupus vulgaris*, *tuberculosis verrucosa cutis*, and *scrofuloderma*) at the Dermatology Outpatient Department, SSKM Hospital, Calcutta. The age of the patients ranged from 3 to 65 years. The immunological status of the patients as observed from lymphocyte blastogenesis assay with PHA, PPD, and *Candida albicans* extract by peripheral blood leucocyte culture and skin test with 2,4-dinitrochlorobenzene showed no apparent impairment in general body immunity, as compared to normal controls (44 individuals, including 26 males and 18 females) subjected to the same tests.—Authors' Summary

Seth, P. and Srinivas, R. V. Circulating immune complexes in cervical cancer: simple method for detection and characterization. *Indian J. Med. Res.* **73** (1981) 926–929.

A simple and rapid test based on the selective precipitation of antigen-antibody complexes by polyethylene glycol 6000 has been developed for the detection of circulating immune complexes in small serum samples to facilitate the clinical diagnosis of immune complex disorders. The results were compared with those of complement consumption test and the presence of cryoglobulins. A correlation of 70 and 82 percent respectively was observed among these tests. Polyethylene glycol precipitation, being easy to perform, less time-consuming, and very economical, is suited for routine use.—Authors' Summary

Shah, K. C. Clinical evaluation of clofazimine in vitiligo. *Indian J. Dermatol. Venereol. Leprol.* **47** (1981) 40–41.

In a purely clinical unbiased study, 50

patients with multifocal extensive vitiligo were given oral clofazimine therapy for 6 months and another 50 patients were kept as controls. All the patients were exposed to sunrays for 30 min daily. Significantly more patients in the treated group developed pigmentation of the patches compared to the control group. But the pigment disappeared soon after stopping the treatment. It may be tried in extensive multifocal vitiligo cases only where known therapeutic agents are not effective.—Author's Summary

Singapore Tuberculosis Service/British Medical Research Council. Clinical trial of six-month and four-month regimens of chemotherapy in the treatment of pulmonary tuberculosis: the results up to 30 months. *Tubercle* 62 (1981) 95–102.

In a study in Singapore, Chinese, Malay, and Indian patients with pulmonary tuberculosis received 2 months of daily treatment with streptomycin, isoniazid, rifampin, and pyrazinamide followed by daily isoniazid, and rifampin either with pyrazin-

amide (SHRZ/HRZ) or without it (SHRZ/HR), allocated at random. Both regimens were given for either 6 or 4 months by random allocation.

All 330 patients with drug-sensitive tubercle bacilli pre-treatment had a favorable bacteriological response during chemotherapy. After chemotherapy, none of 78 SHRZ/HRZ patients and only 2 of 80 SHRZ/HR patients treated for 6 months relapsed bacteriologically, but 9 (11%) of 79 SHRZ/HRZ and 6 (8%) of 77 SHRZ/HR patients treated for 4 months relapsed. Of 33 patients with bacilli resistant to isoniazid, streptomycin, or both drugs pre-treatment, only one had an unfavorable response during chemotherapy; none of nine patients treated for 6 months and 2 of 22 treated for 4 months relapsed bacteriologically after stopping chemotherapy.—Authors' Summary

Editor's Note: In all, 291 of the patients had adverse reactions, including 11 (3%) with hepatitis, all with jaundice.—RCH