CURRENT LITERATURE

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

General and Historical

Bechelli, L. M. and Ruffino-Netto, A. Psycho-social and economical aspects of leprosy and tuberculosis. Acta Leprol. **3** (1985) 295–304.

Leprosy and tuberculosis caused in the past serious psycho-social problems to the patients and their families, and had also important economical implications, more pronounced in the latter, due to its higher incidence and high mortality rate. Stigma and prejudice were strong.

Progress in chemotherapy brought considerable benefit to millions of patients and their families, especially in relation to tuberculosis, because this disease may be fought with potent drugs and prevented by a vaccine. Suffering, psycho-social and economical aspects have been greatly attenuated, as well as the prejudice, though still present for leprosy in varying degrees. Control was humanized, simplified and with the same budget a greater number of patients may be treated. With the considerable reduction of death rates (in the case of tuberculosis) and decrease of incapacity or disability by early diagnosis and treatment, and by prevention, manpower is being increased in countries that need the full productivity of the inhabitants to reach a higher degree of development, essential to obtain the desired social improvements, meaning better living standards, better housing, food hygiene and education, and also better health.

It is therefore of the utmost importance that the combined programs and the general health service reach the required level of effectiveness to have an impact on the trend of the disease and to protect the population. If that level is not reached, though bringing benefit to the patients, the programs do not attain their objectives, their returns are seriously decreased, and the control of the diseases is delayed perhaps for a very long period.—(*From* the Article)

Daumerie, D. and Grossetete, G. [The place of personnel training in planning an antileprosy program.] Acta Leprol. **3** (1985) 249–254. (in French)

The training of health officers is an essential component in leprosy control. The West African States included in the Organisation de Coordination et de Cooperation pour la Lutte contre les Grandes Endemies (OCCGE) provide training for specialized health officers called "Specialistes-lepre" and "Controleurs-lepre." However, recent demands for implementation of multidrug therapy (MDT) and the integration of leprosy into general health services have created new concepts and the objectives of this training. To meet these needs, the OCCGE specialized institutions propose theoretical and practical training, based on the need to implement MDT, intended for both medical and paramedical officers, either specializing in leprosy or working in general health care delivery.—(*Adapted from* Authors' English Summary)

Daumerie, D., Husser, J. A. and Nebout, M. [Integration of multidrug antileprosy therapy in the general health service.] Acta Leprol. **3** (1985) 239–248. (in French)

The control of leprosy must include provisions to deal with the difficulties involved in multidrug therapy (MDT) as well as the difficulties involved in the integration of leprosy work into general health services. The implementation of MDT requires clinical and bacteriologic follow up of patients, patient classification, supervision of treatment, follow up of drug compliance, and control of the evolution of the disease. Such

a system must be closely managed in order to avoid the uncontrolled distribution of rifampin. Solutions are proposed in order to increase the efficiency of teams of leprosy specialists and to integrate the tasks of nonspecialist health workers.—(*Adapted from* Authors' English Summary)

Demaitre, L. The description and diagnosis of leprosy by fourteenth-century physicians. Bull. Hist. Med. **59** (1985) 327–344.

Medieval leprosy, to be distinguished from the skin ailment called *lepra* in biblical and classical antiquity, seems to have emerged around A.D. 300 and to have spread over an area stretching from Syria and Alexandria to France and England. The disease apparently reached its peak in Christendom between the first crusade and 1300, and it generally disappeared from Europe, except from Scotland and Scandinavia, by the mid-sixteenth century. A considerable corpus of historical studies has accumulated since the 1870s and 1880s when, coincidentally, the Norwegian doctor Armauer Hansen proposed that *Mycobacterium leprae* was the bacillus which caused the disease and the Belgian missionary Damiaan De Veuster drew worldwide attention to the fate of lepers as outcasts.

In the last decade, two richly documented studies in English have concentrated on the Middle Ages, namely, Saul Brody's *The Disease of the Soul: Leprosy in Medieval Literature,* and Peter Richards' *The Medieval Leper and His Northern Heirs.* Compared with these two studies, the present essay is both more exploratory and narrower in focus. It explores, in a dimension between the literary archetypes emphasized by Brody and the real lives evoked by Richards, the endeavors of physicians to understand and to identify leprosy. My inquiry is focused on fourteenth-century authors because they were witnesses and possibly contributors to the turning of the tide. Their discussions are also more elaborate than the pre-1300 writings which have been cited in virtually every previous study. I have not only consulted major treatises but also examined a dozen shorter texts, most of which are available only in manuscript.—(*From* the Article)

Kumar, A., Durai, V., Sivaprasad, N. and Sirumban, P. Diagnostic efficiency of paramedical workers in leprosy. Lepr. Rev. **56** (1985) 309–314.

The diagnostic efficiency of 9 paramedical workers trained in leprosy was assessed with regard to the misdiagnoses and wrong diagnoses made by them during their involvement in a recent leprosy case detection (survey) program. The workers missed (misdiagnosed) 10.5 leprosy cases per 1000 persons examined by them during the survey. Of the 316 new cases detected by workers, 55 (17.4%) were wrongly diagnosed as leprosy, mostly nonlepromatous (N) type. Among the correctly diagnosed cases, 98% N-type cases were correctly classified by them; 3 out of 9 (33%) borderline tuberculoid (BT) cases were over-diagnosed as borderline lepromatous (BL) type. The clinical activity status of 39 (16.3%) out of 240 leprosy cases, all N-type, was either over-assessed as active (11.7%) or under-assessed as inactive (4.6%). The implications and suggestions to improve the technical skills of workers to achieve optimal efficiency in their work are discussed.—Authors' Summary

Nebout, M. and Grosset, J. [Present difficulties in the fight against leprosy in francophone Africa and proposals to start again.] Acta Leprol. **3** (1985) 233–237. (in French)

Until recently, the control of leprosy was the responsibility of an organization "lutte contre les Grandes Endemies." This organization had responsibility for a number of diseases other than leprosy. Their strategy for leprosy control was based on specialist teams making systematic medical visits to track down patients, provide treatment with monotherapy, and provide annual control of the patients. With the appearance of social and economic difficulties, the activity of these services has greatly decreased, and the control of leprosy has suffered in many countries. This organization is not suitable for implementation of new regimens based on multidrug therapy. Solutions are proposed bearing in mind the scientific and logistic demands made on leprosy control facilities. Without exception, all facilities

should include combinations of mobile teams, fixed centers, educational facilities, etc. This combination of facilities and resources together with motivation of the population and health personnel will assure the success of new programs against leprosy.—(*Adapted from* Authors' English Summary)

Chemotherapy

Acocella, G., Carlone, N. A., Cuffini, A. M. and Cavallo, G. The penetration of rifampicin, pyrazinamide, and pyrazinoic acid into mouse macrophages. Am. Rev. Respir. Dis. **132** (1985) 1268–1273.

The degree of penetration of rifampin, pyrazinamide, and its metabolite pyrazinoic acid in mouse macrophages was evaluated over a period of 24 hr. Cell cultures were exposed to ^{14}C-labeled drugs at concentrations corresponding to peak, trough, and intermediate serum concentrations observed in humans after administration of therapeutic doses. The study was carried out with dead, resident, and stimulated peritoneal macrophages. The results indicated that the 3 compounds penetrate macrophages rapidly. At the lower concentrations, uptake of the 3 drugs is practically complete. With increasing concentrations, the absolute amount in the intracellular compartment increased. Comparison of the degree of penetration of the 3 drugs into dead, resident, and stimulated macrophages seems to suggest that the process of transfer through the macrophage wall is of a passive nature and not related to the metabolic state of the cells. Analysis of the binding of the 3 drugs to intracellular proteins indicated that more binding sites are probably available for rifampin than for the other 2 drugs.—Authors' Summary

Altes, C., Steele, J., Stanford, J. L. and Rook, G. A. W. The effect of lymphokines on the ability of macrophages to protect mycobacteria from a bactericidal antibiotic. Tubercle **66** (1985) 261–266.

Murine peritoneal macrophages protect *Mycobacterium intracellulare* from amoxycillin added to the culture medium. This protective effect is enhanced by the addition of macrophage-activating lymphokines, although in the absence of amoxycillin these lymphokines cause macrophage-mediated inhibition of the organisms. Thus about 10 times more organisms survive exposure to 100 μg/ml of amoxycillin for 3 days in the presence of lymphokine-activated macrophages than in their absence; whereas without amoxycillin the reverse is true.

These findings suggest that in this *in vitro* system lymphokines cause stasis rather than kill of the organisms. The possibility that lymphokine-induced bacteriostasis protects mycobacteria from antibiotics *in vivo* is discussed.—Authors' Summary

Balakrishnan, S., Mester, L., Venkataramaniah, H. N. and Bhatia, V. N. Mouse foot-pad studies with *M. leprae*—effect of desoxy fructo serotonin (DFS) and related compounds. Indian J. Lepr. **57** (1985) 323–328.

Mouse foot pad experiments were carried out to study the effects of deoxyfructo serotonin (DFS) and related compounds on the multiplication of *Mycobacterium leprae.* Of the 25 cases clinically suspected dapsone resistance, 8 were found resistant and 14 sensitive to dapsone by mouse foot pad experiments. Six were resistant to DFS and 16 were sensitive. Deoxyfructo 5-hydroxy tryptophane as well as nutrition anti-leprosy (NAL) diet were also found effective in suppressing the growth of *M. leprae* in mouse foot pad. Of the 2 liposoluble derivatives of DFS tested (DFS LS-I and DFS LS-II), DFS LS-II was found more effective in suppressing the growth of *M. leprae* in foot pads of mice.—Authors' Abstract

Bhasin, D. K., Kumar, B., Broor, S. L., Kaur, S., Malik, A. M. and Mehra, S. K. Effect of clofazimine: detailed studies of small intestine functions. Indian J. Lepr. **57** (1985) 364–372.

Twenty-one patients of leprosy were studied for gastrointestinal symptoms and submitted to detailed intestinal absorption tests and jejunal biopsy before and after the institution of clofazimine therapy. Fifteen patients were administered 100 mg orally daily for 3 months, while 6 patients with ENL received 300 mg of the drug for 6 weeks initially and then 100 mg daily. Mild diarrhea and abdominal symptoms occurred in 4 patients, fecal fat excretion increased in 1 patient but Schilling's and d-xylose tests did not alter. No significant changes were produced by clofazimine therapy in jejunal mucosa. Clofazimine crystals were seen in the lamina propria of 1 patient; the overlying mucosa was normal. No correlation was found between the abnormality in mucosal pattern, crystal deposition, absorption parameters or symptomatology and doses of drug taken.—Authors' Abstract

Carayon, A., van Droogenbroeck, J. and Languillon, J. [Resistance to sulfones and sulfonamides in Senegal. (First experience with 39 cases, 1978–1980).] Acta Leprol. **3** (1985) 317–327. (in French)

In 3 years, 38 cases of resistance to dapsone (DDS) were studied; 28 cases diagnosed on clinical grounds based on bacteriologic criteria with therapeutic trial. Ten similar cases were verified by mouse foot pad inoculation. One very odd case of lepromatous leprosy treated with Fanasil presented after 5 years with a crossresistance to DDS verified in the mouse. The clinical characteristics of the resistant form and the differences in certain forms of ENL are presented in a table as well as the rarity of neuritis (6 cases out of 39). After a discussion of the mechanism of the evolution (by degree) of sulfone resistance preventive therapy, standard today, is outlined.—(*Translated from* Authors' Résumé)

Cartel, J.-L., Gallais, J.-J. and Grosset, J.-H. [Acceptability, attendance, and tolerance of daily multidrug therapy for leprosy in Guadeloupe.] Acta Leprol. **3** (1985) 339–355. (in French)

From January 1980 to December 1984, 418 leprosy patients were treated in Guadeloupe with a daily multiple drug regimen using rifampin as an essential drug. The analysis of the data collected during this period of time gives the possibility of estimating the patients' approval, tolerance and attendance to this treatment. The approval is satisfactory in new cases of leprosy and in old cases relapsed under dapsone monotherapy but less in inactive old patients already treated with dapsone monotherapy. Attendance of the 418 patients to the multiple drug regimen is satisfactory, too, and similar to the attendance of patients treated with dapsone monotherapy in Guadeloupe, and to the attendance of patients with monthly multiple drug regimen in another Caribbean country. Reactions did not occur with more severity or frequency than in patients uunder dapsone monotherapy. The high incidence of hepatitis (14%) due to the toxicity of prothionamide in the combination of rifampin-prothionamide-dapsone make obligatory the monthly assessment of the liver function in multibacillary patients treated with such a drug combination.—Authors' English Summary

Castells, A., Terencio de las Aguas, J., Ramirez, A., Sundal, E. and Bolla, K. Thymopentin treatment in patients with chemotherapy-resistant lepromatous leprosy. Surv. Immunol. Res. **4** Suppl. (1985) 63–69.

Leprosy is a chronic infectious disease caused by *Mycobacterium leprae*; it is chiefly involving the skin and peripheral nerves. In lepromatous leprosy there are widespread loose infiltrates with *M. leprae* multiplying extensively in the skin macrophages and Schwann cells of peripheral nerves. Such patients reveal a decrease of circulating T-helper cells, which is still more pronounced in the cutaneous lesions. Due to the ever-increasing bacterial resistance to classical dapsone and combined chemotherapy as well, an immunomodulatory approach seemed reasonable: Eight patients with long-lasting (5–40 years) disease who had become resistant to combined chemotherapy were treated with thymopentin (the biologically active pentapeptide of the native thymus hormone thymopoietin) 50 mg s.c., 3 times weekly for 5 weeks and thereafter combined with dapsone and clofazimine for 5 months. During the trial a statistically significant increase in E-rosette-

forming cells ($p < 0.05$) was observed, along with a steady improvement of the bacterial status of the nasal mucus. Although the skin lesions did not disappear within the observation period of the study, it is important to realize that long-term improvement of such lesions is always initiated by clearance of bacilli from the nasal mucus; hence, thymopentin treatment appears to be a promising approach to chemotherapy-resistant lepromatous leprosy.—Authors' Summary

Cohn, J. R., Fye, D. L., Sills, J. M. and Francos, G. C. Rifampicin-induced renal failure. Tubercle **66** (1985) 289–293.

Renal failure is a rare complication associated with the use of rifampin for the treatment of tuberculosis, usually occurring well into the course of therapy. The following is a report of 2 cases of rifampin-induced renal insufficiency. In the first case oligoanuric renal failure occurred on the 13th day of treatment, after the patient had taken only 9 doses of medication. The second case occurred in a patient who developed renal failure while on daily therapy in the hospital. A literature review revealed 83 other reported cases of rifampin-induced renal insufficiency. Intermittent or interrupted therapy appears to be a significant risk factor for the development of this complication.—Authors' Summary

de Wit, M., Balakrishnan, S. and Kumar, A. Application of HI test for dapsone in urine under field conditions. Indian J. Lepr. **57** (1985) 318–322.

One-hundred-two specimens of urine collected from leprosy patients attending the field clinics of Central Leprosy Teaching and Research Institute, Chingleput, Tamil Nadu, India, were screened for dapsone by the paper spot and hemagglutination inhibition (HI) tests. A concordance of about 90% was observed between the 2 tests. Both tests showed their merits. The lower sensitivity of the spot test finds more cases of irregular compliance (1–2 days); whereas the higher sensitivity of the HI allows the demonstration of the intake of lower doses and the detection of those cases who have grossly missed their tablets (longer than a week).—Authors' Abstract

George, J. and Balakrishnan, S. A comparative study of the haemagglutination inhibition (HI) test and spot test for detection of dapsone in urine. Indian J. Lepr. **57** (1985) 601–606.

A comparative study of the HI test and paper spot test for screening dapsone in urine was carried out in 692 specimens of urine, 149 from the field and 502 from patients attending the C.L.T. and R.I. clinic or admitted in the wards, and 41 control urines. A very good correlation was noticed between the 2 tests in relation to positivity or negativity as well as DDS concentration. Fifty-one urine specimens showed a specific agglutination, 41 of them were considered HI positive and 10 of them HI negative based on DDS concentration. The results are discussed.—Authors' Abstract

Girdhar, B. K., Girdhar, A., Ramu, G. and Desikan, K. V. Short course treatment of paucibacillary (TT/BT) leprosy cases. Indian J. Lepr. **57** (1985) 491–498.

A study has been undertaken wherein TT/BT cases with less than 5 lesions have been given DDS for 12 months alone or in combination with steroids for the initial 1 month or rifampin for the initial 1 week. It has been found that only about three fourths of the cases become disease inactive in a 12-month period. Follow up of 15–21 months in the post-treatment period has shown a relapse rate of 6.33 per 1000 patient months. There was no difference in the number of relapses occurring in the 3 regimens, i.e., with or without rifampin. Half of the relapses were primarily in the nerves. During the course of treatment, a slightly higher number of patients in the DDS group had nerve problems as compared to the group wherein additional steroids had been given.—Authors' Abstract

Girdhar, B. K., Sreevatsa, Girdhar, A. and Desikan, K. V. Multidrug therapy in lepromatous patients. Indian J. Dermatol. Venereol. Leprol. **50** (1984) 240–244.

The short- and long-term results with 2 multidrug regimens were compared in 40 untreated lepromatous cases. The drug combinations investigated were a) rifampin, clofazimine and DDS, and b) rifampin,

prothionamide, INH and DDS. There was good improvement in patients in both the groups, but no additional benefit was obtained in the form of 1) quickly reaching the point of non-infectivity (when compared with the trials involving use of rifampin alone), and 2) the frequency of persisters at the end of 2 years. No serious side effects were encountered.—Authors' Abstract

Ishihara, S., Hagiwara, S. and Fukuda, T. [Observations of antileprotic drug resistance.] Jpn. J. Lepr. **53** (1984) 200–204. (in Japanese)

Five patients with lepromatous leprosy who have been admitted to Suruga Leprosarium and treated for more than 30 years were clinically suspected as drug resistant. They have been treated with Promin, followed by long-term dapsone. Rifampin (RFP) was used for 3 patients after they were clinically suspected of dapsone resistance. Bacillary specimens obtained from these patients were examined at the Institute for Microbial Disease, Osaka University, and the Department of Bacteriology, School of Medicine, Hiroshima University. The experimental results have shown that 4 cases out of 5 were fully dapsone resistant and 1 case had intermediate resistance. Furthermore, 2 of 3 cases who were treated with RFP have been confirmed to be both dapsone and RFP resistant.—(*From* the Authors' English Abstract)

Jesudasan, K., Bradley, D. and Christian, M. Are defaulters with paucibacillary leprosy a problem? Indian J. Lepr. **57** (1985) 354–359.

This study examined the risk of relapse in 421 paucibacillary patients who had defaulted after varying periods of dapsone monotherapy; short of the recommended course. The 421 patients contributed a total of 2162 person years of risk; 10 patients relapsed, giving a relapse rate of 4.6 per 1000 person years of risk, or a crude relapse rate (RR) of 2.4%. This paper discusses the issue of defaulters with paucibacillary leprosy and the findings of the study suggest that defaulters with paucibacillary leprosy are not a serious problem in terms of leprosy control.—Authors' Abstract

Joseph, M. S. Hypersensitivity reaction to dapsone. Four case reports. Lepr. Rev. **56** (1985) 315–320.

Hypersensitivity reaction to the most commonly used antileprosy drug, dapsone, is becoming an increasingly important problem in the field of leprosy treatment. This undesired reaction to dapsone is more common than was thought previously. In this article 4 cases seen at the Nonsombun Leprosy Hospital during the years 1982–1983 are reported. The 4 leprosy patients (2 cases of BL, 1 case of BT and 1 case of TT) presented with cutaneous and systemic manifestations of hypersensitivity to dapsone. The diagnosis was confirmed by trial dose in 3 cases.—Author's Summary

Katoch, K., Ramu, G. and Ramanathan, U. Chemotherapeutic trials with different regimens containing rifampicin in paucibacillary type of leprosy cases—a preliminary report. Indian J. Lepr. **57** (1985) 499–506.

Different regimens containing rifampin have been tried in treating paucibacillary leprosy patients. In our study, we have studied 3 regimens: Regimen I consists of treating patients with rifampin 600 mg once a month for 6 months combined with dapsone 100 mg daily and treatment is stopped at 6 months. Regimen II is the same as regimen I except that instead of stopping treatment at the end of 6 months, the treatment was continued with dapsone 100 mg daily for another 6 months and treatment was stopped at 1 year. Regimen III is the same as recommended by IAL in which treatment is started with rifampin 600 mg daily for 7 days in the first month to be followed by rifampin 600 mg once a month for 5 more months. This is combined with dapsone 100 mg daily for 1 year. Treatment in this group is also stopped at 1 year. Eighty-one patients in regimen I, 35 patients in regimen II, and 63 patients in regimen III completed the 6-month treatment. It was found that the inactivation index in all 3 regimens was nearly the same. Overall, 29.6% of the cases in regimen I, 34.28% in regimen II, and 36.9% in regimen III remained clinically active at the end of this period. Treatment was stopped in regimen I patients at this point. At the end of 1 year with a follow up

of 23 patients in each regimen, it was found that the inactivity index was 0.82 in regimen I, 0.96 in regimen II, and 1.0 in regimen III; the percentage of active cases was 17.4, 4.71, and 0, respectively. This study shows that 6 months' therapy is insufficient for the treatment of paucibacillary cases and probably 1 year may be adequate for effective treatment. The cases are being followed up and other details will also be noted.—Authors' Abstract

Kaur, S., Sharma, V. K., Kumar, B., Singh, M. and Kaur, I. Multi-drug therapy in bacilliferous leprosy—two year's experience. Indian J. Lepr. **57** (1985) 483–490.

The data of 30 patients who completed 2 years of multidrug therapy (MDT) is analyzed in regard to clinical improvement, occurrence of reactions, bacteriological response, and compliance to therapy.—Authors' Abstract.

Millan, J., Faure, I., Diouf, B. and Languillon, J. [Balance sheet after 7–8 years of multidrug trials in lepromatous patients in Senegal.] Acta Leprol. **3** (1985) 95–102. (in French)

In Senegal, between 1974 and 1976, J. Languillon had conducted a number of multiple drugs therapy trials in lepromatous patients. Different regimens of either 2 (rifampin and dapsone) or 3 drugs (rifampin, ethionamide, dapsone) were used. Thè regimens differed according to dosage of rifampin, periodicity of its administration (once daily, once weekly, or once monthly), and duration of treatment (single doses, 3 and 12 months). Whatever the regimens, the patients were treated thereafter with dapsone monotherapy for life. The immediate results had been recorded as excellent. It was therefore considered useful to proceed to a review after a few years since some of the regimens were quite similar to those presently recommended by WHO.

An attempt was made to localize the patients having participated in these clinical trials. Seven to 9 years later, only 39 patients with clinical and bacteriological records were identified. Seven cases of clinical relapse were observed among them. From the bacteriological point of view, 50% of the patients had a BI >2+, suggesting a reactivation. Although the number of patients studied is small, some conclusions can be drawn. A positive BI in 1983 is not associated with the MDT regimen or with the status of these patients as new or old cases when started on the clinical trials. The only factor showing a relationship is regularity of attendance to sulfone monotherapy following MDT.

The immediate results of the clinical trials had shown that MDT was effective in all patients. This cannot therefore influence the present results. Only the presence of *Mycobacterium leprae* remaining as persisters could provide an explanation for these disappointing results.

It would be necessary to carry out a number of studies within the context of present MDT trials in order to measure the frequency of similar observations and to determine the implications for the surveillance of inactive cases whose treatment was discontinued. It is also essential to study the sensitivity to antibiotics of the strains of *M. leprae* responsible for these relapses.—(*Translated from* Authors' Summary)

Naik, R. P. C., Balachandran, C. and Ramnarayan, K. Fixed eruption due to rifampicin. Indian J. Lepr. **57** (1985) 648–650.

Cutaneous side effects due to rifampin are rare (less than 5%). We report an urticarial type of fixed eruption due to rifampin. Fixed eruption due to rifampin is not reported earlier.—Authors' Abstract

Nair, N. G. K., Radhakrishna, S., Christian, M., Ramakrishnan, R. and Gopi, P. G. A 20-year study of the leprosy control programme at the Hemerijckx Leprosy Centre in Polambakkam in South India. Indian J. Lepr. **57** (1985) 562–574.

The Hemerijckx leprosy center at Polambakkam in South India covers a rural population of about 800,000 and has treated over 40,000 cases of leprosy during the period 1955–1975. Based on a stratified random sample of 25% of the case records, information was obtained about the profile of newly detected cases in various cohorts (1955–1957, 1958–1960, 1961–1964, 1965–1969, 1970–1975), regularity in drug collection, and response to treatment. In

newly detected cases, the ratio of males to females was stable (3:2), but the proportion of adults aged 45 years or more increased from 15% in 1958–1960 to 20% in 1970–1975 and the lepromatous rate decreased from 9% to 6%; the proportion deformed at the time of diagnosis ranged from 11% to 15%. Regularity in drug collection was unsatisfactory even in the first year of treatment, with less than half the patients making 6 (or more) of the 12 monthly drug collections. The clinical status at 4–6 years was known for 70–75% of the patients who started treatment and of those, approximately 60% had inactive or arrested disease. Data from population surveys was sparse; about 60% of the expected numbers were initiated and less than 30% of these had a coverge of 75% or more. The limited evidence, however, showed a decline in the prevalence of about 2 per thousand per annum. Field studies to evolve strategies for better motivation of patients, introduction of short-course regimens, and continuous monitoring of the program are urgently needed.—Authors' Abstract

Pal, S., Ramanathan, U. and Ramu, G. A study of the cause of irregularity of patients attending the outpatient department of CJIL, Agra. Indian J. Lepr. **57** (1985) 607–612.

A study of 195 patients attending the outpatient department with regard to regularity is reported; 71 patients or 36.41% were found to be irregular. The causes of irregularity were found to be predominantly socioeconomic factors. Since irregularity may lead to emergence of drug resistance due to irregular, inadequate and interrupted drug compliance, socioeconomic factors require amelioration.—Authors' Abstract

Pankaj, R., Lal, S., and Rao, R. S. Effect of probenecid on serum rifampicin levels. Indian J. Lepr. **57** (1985) 329–333.

Serum rifampin levels were determined by a microbiological assay using *Staphylococcus aureus* in 22 cases of leprosy after administering the drug with and without probenecid. Most of the patients showed higher serum rifampin levels when probenecid was given along with rifampin. Six patients showed a statistically significant increase in the serum levels of the drug when given in the dose of 300 mg along with 1 g of probenecid 1 hr before breakfast, and these levels were comparable with those obtained following administration of 450 mg of rifampin alone 2 hr after breakfast. Thus, administration of probenecid preceding rifampin may be employed to reduce cost of drug as well as hepatotoxicity in patients requiring rifampin for long duration.—Authors' Abstract

Ramu, G. Multi-drug therapy of leprosy. (Editorial) Indian J. Lepr. **57** (1985) 465–482.

The prevalence of dapsone resistance is not so alarming as to introduce multidrug regimen in a hurry. Primary dapsone resistance has been grossly overestimated and partial resistance is not clinically significant if adequate doses of dapsone are given regularly. While multidrug treatment is ideal, the importance of a good organization, a strong infrastructure, and logistic support are indispensable. Laboratory facilities for skin and nasal smear examination, investigations of the blood and urine to identify possible drug toxicity, and monitoring drug intake should be available. Early case detection, regularity of treatment, and case holding are much more important with multidrug regimen than with DDS monotherapy due to the danger of multidrug resistance emerging with haphazard introduction of multidrug treatment. Complications such as reacting episodes, acute painful neuritis and iridocyclitis, and adverse reaction to drugs should be recognized early and treated. Deformities should be properly handled. Recording system should be streamlined. There should be a good rapport and healthy social interaction between the doctor, nonmedical supervisor, paramedical workers, the patient and the community, all of whom should be motivated. Concurrent operational and epidemiological evaluation of the units should be done by an independent team so that lacunae if any could be cleared and the strategy improved.—(*From* the Editorial)

Sreevatsa, Girdhar, B. K., Ramu, G. and Desikan, K. V. Dapsone resistance in

North India. Indian J. Lepr. **57** (1985) 514–518.

An attempt has been made to screen the resistant strains of *Mycobacterium leprae* in lepromatous patients from the 8 northern states of India. By using the mouse foot pad technique, it was found that in a total of 69 clinically suspected patients, 33 (47.8%) harbored *M. leprae* with some degree of secondary dapsone resistance. A detailed epidemiological study in these parts of the country may reveal the prevalence rate.—Authors' Abstract

Sreevatsa, Girdhar, B. K., Ramu, G. and Desikan, K. V. Parallel dapsone and rifampicin resistance: a prospective study. Jpn. J. Lepr. **53** (1984) 28–31.

Based on the observation that the secondary dapsone-resistant patients were more refractory to treatment with rifampin, the clinically suspected dapsone-resistant cases were screened for rifampin resistance. By the mouse foot pad technique, it was found that out of 5 multibacillary types of leprosy patients who had irregular monotherapy with dapsone for varying periods, 3 patients were resistant to dapsone. Subsequently, these dapsone-resistant patients were also found to be resistant to rifampin. The bacilli from these patients multiplied in mice fed 0.001% dietary rifampin but not in animals receiving 0.01% rifampin.—Authors' Summary

Sreevatsa, Ramu, G. and Desikan, K. V. Prevalence of drug resistance in Dharmapuri and A. Pallipatti areas of Tamil Nadu. Indian J. Lepr. **57** (1985) 376–382.

An evaluation of the leprosy control project was undertaken in Dharmapuri and A. Pallipatti areas of Tamil Nadu, India, to study the prevalence rate of drug resistance among the leprosy patients. At the end of 5 years of assessment, 266 patients were still found to be bacteriologically positive among whom 25 patients were suspected to be clinically dapsone resistant. By mouse foot pad technique, the drug resistant prevalence rate was found to be 1.1% in these two areas.—Authors' Abtract

Traore, I. and Nebout, M. [Results of the experimental animal activity of the Institut Marchoux, Bamako, 1982–1984.] Acta Leprol. **3** (1985) 255–259. (in French)

Results are reported regarding mouse foot pad drug sensitivity studies from the Institut Marchoux in the years 1982 through 1984. Among 17 multibacillary cases, 16 were suspected of being dapsone resistant on clinical grounds. In 9 of these cases, bacilli from skin biopsies did not multiply in mice. In 4 cases, multiplication occurred in untreated control mice but not in mice fed dapsone, i.e., bacilli from these 4 cases were dapsone sensitive. Three cases were resistant to dapsone at all 3 concentrations tested. In 1 case no multiplication occurred in the mice receiving 0.01% dietary dapsone, but multiplication occurred in mice fed 0.001% and 0.0001% dapsone.—(*Adapted from* Author's English Summary)

Vaishnavi, C., Ganguly, N. K., Kumar, B., Kaur, S. and Chakravarti, R. N. Primary dapsone resistance in leprosy. Indian J. Lepr. **57** (1985) 507–513.

Twenty carefully selected untreated patients with bacilliferous leprosy were investigated for primary dapsone resistance by foot pad inoculation. Mice were fed on 0.001g% and 0.01g% of dapsone during the period of study. Mice in the control group were given normal rodent feed only. Animals were sacrificed from the 6th month onward at 6-week intervals up to 9 months. In 2 cases the growth of *Mycobacterium leprae* was not inhibited by 0.001g% concentration of dapsone in diet, but was completely inhibited by 0.01g% of dapsone.—Authors' Abstract

Clinical Sciences

Bulakh, P. M., Ranade, S. M., Chandorkar, A. G. and Muley, P. R. Correlation between serum choline esterase and serum albumin in leprosy. Indian J. Lepr. **57** (1985) 524–528.

The clinical material included 255 cases of leprosy consisting of tuberculoid leprosy (74), lepromatous leprosy (116), lepromatous leprosy with lepra reaction (65). Liver biopsy could be performed on 50 cases of lepromatous leprosy. Specific granulomatous changes and parenchymal cell damage were the significant findings. Serum choline esterase and serum albumin are synthesized in the liver. Serum choline esterase levels in the present study declined gradually and slowly. A possible hypothesis to explain the correlation and uneven fall in activity is discussed at the cellular level.—Authors' Abstract

Chams, H., Assefi, V. and Aalami-Harandi, Z. [Uveal leprosy in Iran.] Bull. Mem. S.F.O. **96** (1985) 242–245. (in French)

250 lépreux ont été examinés. L'uvéite antérieure, souvent discrète et bilatérale, était retrouvée dans 33,48% et l'uvéite active ou séquellaire dans 68,28% des cas. La fréquence d'uvéite augmentait avec la durée de la lèpre: 36,56% après 20 ans. L'uvéite était plus fréquente dans la région nord-ouest (80, 59%) que nord-est (51, 61%). Des lésions du fond d'œil étaient plus rares et souvent atypiques.—Authors' Résumé

Chhabriya, B. D., Sharma, N. C., Bansal, N. K. and Agrawal, G. R. Bone changes in leprosy. A study of 50 cases. Indian J. Lepr. **57** (1985) 632–639.

The radiological bone changes have been studied in 50 patients comprising lepromatous, tuberculoid, mixed (borderline lepromatous, borderline tuberculoid, dimorphous) and polyneuritic (neural) types of leprosy of which the former formed the largest group. The overall incidence of nonspecific bone changes is higher as compared to specific bone changes. These were found to have the highest incidence in the lepromatous type of leprosy, in the occupational group of manual workers and from the 3rd to 6th decade of life. With the longer duration of the disease, the incidence of nonspecific bone changes is also more.—Authors' Abstract

Delmonte, V. [Necrotizing lymphadenitis in leprosy.] Rev. Hosp. Clin. Fac. Med. S. Paulo **39** (1984) 288–289. (in Portuguese)

A case of necrotizing lymphadenitis as a presenting sign of leprosy is described. The lesion corresponds in the skin to type 2 leprosy reaction or erythema nodosum leprosum. Other patterns of necrotizing lymphadenitis must be included in the differential diagnoses, such as systemic lupus erythematosus, atypical mycobacteria, and Kikushi disease. The identification of Virchow cells and the finding of acid-fast bacilli are significant in the final diagnosis.—(*From* Author's English Summary)

Dham, S. K., Kumart, V. and Tutaknet, M. A. Cell mediated immunity in leprosy with neurological complications. J. Assoc. Physicians India **33** (1985) 259–261.

The cell-mediated immunity (CMI) status of 40 leprosy patients with neurological complications and 16 healthy controls, assessed by the lepromin, purified protein derivative (PPD) and dichlorodinitrobenzene (DNCB) skin tests is described. A majority (81%) of lepromatous cases manifested negative lepromin skin responses but only 57% of these lacked delayed hypersensitivity to DNCB and 71% to PPD, implying a specific defect in CMI to *Mycobacterium leprae.* Skin reactivity to *M. leprae,* PPD, and DNCB was positive as a rule in tuberculoid leprosy. A statistically significant correlation existed between the 3 skin tests. However, the extent of neurological complications did not correlate with the degree of CMI, implying that the nerve damage manifested in leprosy is not solely related to the degree of cellular resistance of the host.—Authors' Summary

ffytche, T. J. Ocular leprosy. Trop. Doctor **15** (1985) 118–125.

Leprosy should be considered as a disease causing disabilities of the hands, feet and eyes; sadly, the ocular aspects of the condition have not always received the attention that their importance warrants. The many forms of ocular involvement produce a mosaic of clinical signs which need to be sought since patients, by virtue of their sensory loss, do not necessarily complain of symptoms.

The tragedy is still that many of the blinding conditions that develop in the later stages of the disease can be prevented by relatively simple measures that could be carried out by patients themselves, if they were made aware of the problems and dangers of ocular involvement. This is particularly the case in patients with facial nerve palsy, in whom close attention to care of the eye and supervision by health workers may often be all that is necessary to prevent the complications of corneal damage.

The health worker plays a key role in all aspects of the management of the disease—detection, therapy, and prevention; education and the care of the eyes should receive top priority. The blind leprosy patient has the double disadvantage of loss of sight and of sensation, and the loss of independence has far-reaching effects, not only on the individual but on the community. In areas where the disease is endemic, resources of finance and manpower assigned to leprosy may certainly relieve a considerable socioeconomic burden, but their impact on the reduction of human suffering and on improving the quality of life in this still terrible disease can never be overestimated.—Author's Conclusion

George, M., Bhatia, V. N., Kara, H. K. and Roy, R. G. Anaerobic flora in trophic ulcers in leprosy patients. Indian J. Lepr. **57** (1985) 334–350.

Material from 108 trophic ulcers from leprosy cases were studied bacteriologically. Four cases showed growth of pure anaerobes and 69 showed mixed growth of aerobic and anaerobic bacteria. The predominant anaerobes were *Fusobacteria* (41), anaerobic cocci (30) and *Bacteroides* (25). Clostridia were isolated only in 10 cases. Metronidazole, chloramphenicol, penicillin and ampicillin were found effective against anaerobes in *in vitro* studies.—Authors' Abstract

Jamrozik, K., Lourie, J. A., Riley, I. and Naraqi, S. Histiocytosis X in a patient with leprosy. A case report. Lepr. Rev. **56** (1985) 341–346.

A patient known to have lepromatous leprosy developed multicentric histiocytosis X from which he died. Initial misinterpretation of the histological findings resulted in delay in diagnosis and institution of treatment. The clinical implications are discussed.—Authors' Summary

Kardaun, S. H., Vermeer, B. J., Overbosch, D., Onvlee G. J. and Leiker D. L. A patient with nerve abscesses due to leprosy. Lepr. Rev. **56** (1985) 337–339.

A patient with borderline tuberculoid leprosy who developed nerve abscesses along the line of cutaneous nerves is described. The treatment of choice is surgical removal of the abscess together with combination chemotherapy.—Authors' Summary

Katoch, K., Katoch, V. M., Dutta, A. K., Sharma, V. D. and Ramu, G. Chest infection due to *M. fortuitum* in a case of lepromatous leprosy—a case report. Indian J. Lepr. **57** (1985) 399–403.

Lepromatous leprosy cases may be immunocompromised due to the extensive disease and also because of steroid therapy for repeated reactions. Such patients are likely to be at higher risk for getting opportunistic infection due to various environmental microbes. This paper reports a case of lepromatous leprosy with repeated lepra reaction who was found to have chest infection due to *Mycobacterium fortuitum.* It is suggested that mycobacterial culture and sensitivity should be recommended in cases who are immunocompromised and whose pathological specimens contain acid-fast bacilli. Species identification and sensitivity can be very helpful in proper management of such cases who will otherwise pass off as tuberculosis.—Authors' Abstract

Krishnamoorthy, K. V. Ainhum—a case report. Indian J. Lepr. **57** (1985) 396–398.

Ainhum (spontaneous dactylosis), which has been described as one of the conditions to be differentiated from leprosy, was seen in the field in a village of Andhra Pradesh, India. The condition was found in a young adult male involving both little toes. It was found to be slow progressive associated with pain.—Author's Abstract

Lao, I. O., Waldman, G., Bronson, D. M. and Barsky, S. Pure neural leprosy diagnosed in the United States. Int. J. Dermatol. **24** (1985) 318–319.

A 24-year-old Pakistani man had a 1½-year history of paresthesia of the right foot, generalized weakness, and a weight loss of 10 kg. He had lived in the United States for 2 years. Physical examination showed cord-like thickening of the great auricular nerves and the right dorsal antebrachial cutaneous nerve. Several small areas of anesthesia were present on the dorsal surface of the right foot. The remainder of the findings of physical examination were unremarkable. Normal laboratory values were found for hemoglobin, WBC count, erythrocyte sedimentation rate, reticulocyte count, SMA-18, G6PD, and urinalysis.

A VDRL and tuberculin tine test (PPD, 5 TU) were negative. A chest roentgenogram was normal. Nerve conduction velocity of the right posterior tibial nerve was decreased compared with the left. A biopsy specimen from the right dorsal antebrachial cutaneous nerve showed multiple epithelioid tubercles surrounded by lymphocytes and an occasional plasma cell. Fite stain did not reveal acid-fast bacilli. A diagnosis of pure neural tuberculoid leprosy was made. Therapy with dapsone (100 mg daily) was started.—Authors' Abstract

Lee, C. Y., Jung, S. W., Kim, D. H. and Kim, K. H. [A case of early lepromatous leprosy showing unusual skin manifestations.] Korean J. Dermatol. **22** (1984) 647–650. (in Korean)

The skin lesions of leprosy have a great similarity to various other lesions. Fasal has called it the "great imitator." Sometimes these skin lesions can be misdiagnosed because the physician does not consider leprosy. We report a case of early lepromatous leprosy in a 42-year-old male. His skin lesions were similar to those of secondary syphilis. There were no sensory changes on the skin lesions and no enlargement of the peripheral nerves. Numerous acid-fast bacilli from the skin smear confirmed our diagnosis of leprosy.—Authors' English Abstract

Malaviya, G. N., Mishra, B., Girdhar, B. K., Lavania, R. K. and Desikan, K. V. Calcification of nerves in leprosy—report of three cases. Indian J. Lepr. **57** (1985) 651–655.

Three cases of leprosy showing evidence of calcification of nerve trunks on radiological examination are reported. Two of these had calcified ulnar nerves at the elbow and in one the lateral popliteal nerve was calcified at the knee level.—Authors' Abstract.

Malaviya, G. N., Ramu, G., Mukherjee, A., Hussain, S. and Ramanathan, V. D. Synovial swellings over wrist in leprosy. Indian J. Lepr. **57** (1985) 350–353.

Soft cystic swellings are noticed in leprosy patients during the course of disease and are seen all through the spectrum. The commonest site for these is the dorsum of wrist. At times these are seen over the dorsum and the lateral aspects of ankle as well. These contain straw-colored, sticky but clear fluid. On exploration these appear to arise from the synovial covering of the extensor tendons of wrist and fingers and have no communication with the wrist joint. Histology of the synovium suggests these swellings to be of inflammatory nature.—Authors' Abstract

Mende, B., Stein, G. and Kreysel, H. W. [Ostitis leprosa multiplex cystica—an early sign of lepromatous leprosy.] Hautarzt **36** (1985) 347–350. (in German)

Bone lesions of the finger in a 20-year-old leprosy patient are described to show their diagnostic value. The etiological differences between specific (caused by *Mycobaterium leprae* itself) and unspecific bone changes are morphologically noticeable in Hansen's disease. The X-ray shows cystic

lightening by granulomatous destruction and distal absorption of the bone. These lesions are typical, and radiological investigations might be the first step in the diagnosis of leprosy. In our case, ostitis leprosa multiplex cystica, an early, specific bone lesion, was predominant.—Authors' English Summary

Montserrat, J. M., Pera, E., Blaunstein, A., Salvatella, N., Listosella, E. and Moreno, A. Rhinitis leprosary. Rhinology **23** (1985) 159–163.

Lepromatous leprosy is a rare phenomenon in otorhinolaryngologic practice. We have discussed a case history in which the rhinologist was able to make the diagnosis in spite of several dermatologic symptoms. The definitive diagnosis must ultimately be based on the isolation of the *Mycobacterium leprae* in the nasal smears and the occurrence of histologic changes.—Authors' Conclusions

Nigam, P., Mukhija, R. D., Agrawal, A. K., Sati, T. R. and Kapoor, K. K. Serum cations (calcium and magnesium) in leprosy. Indian J. Lepr. **57** (1985) 529–533.

Serum cations (calcium and magnesium) were studied in 80 leprosy patients and 40 normal healthy individuals to find out the correlation between the clinical status of leprosy with these cations levels in the serum. There was significant decrease of serum calcium in lepromatous leprosy (7.42 ± 0.7 mg%, $t = 14.12$, $p < 0.001$), which seems to be related with the extent of leprosy lesions and duration of illness as few patients (22.2%) with minimal lesions and shorter duration of illness had serum calcium within normal range. Serum magnesium was significantly decreased in all types of leprosy cases, and lepromatous leprosy patients showed highly significant decrease in serum magnesium level (1.02 ± 0.2 mEq/liter, $t = 14.54$, $p < 0.001$).—Authors' Abstract

Obara, A., Harada, N., Matsumoto, S., Kitaichi, M. and Furuta, M. A case report of primary tracheal cancer from leprosy autopsy series with a review of the literature. Jpn. J. Lepr. **53** (1984) 54–60.

Tracheal cancer is noted for its low incidence. We encountered a case of trachael cancer, supposedly related to prolonged use of a metal tracheotomy tube in Oku-Komyoen, a leprosarium. During the past 21 years, there were 181 autopsy-cases in the leprosarium, out of which 39 cases (21.5%) showed malignancy. This ratio is not far different from the incidence of general malignancies. It is peculiar, however, for us to experience such a rare disease as tracheal cancer in our small autopsy series of leprosy patients. Our article reports this rare case of primary tracheal cancer with a review of the literature.—Authors' Abstract

Okhandiar, R. P., Sinha, E. and Sinha, R. K. Leprous lesion with hyperpigmented border. Indian J. Lepr. **57** (1985) 640–643.

Two cases of leprosy—one tuberculoid and the other borderline—are reported. The tuberculoid patch shows a sharply defined hyperpigmented border; whereas in the borderline patient diffuse hyperpigmentation is present around the lesion. The cases are reported for documentation due to rare clinical presentation.—Authors' Abstract

Ottinger, M. L. and Black, J. R. Hansen's disease with pedal involvement. A case report. J. Am. Podiatric Assoc. **76** (1986) 161–163.

The incidence of Hansen's disease in the United States is small. It is unlikely that many podiatrists will see a case during their professional careers. The authors present a case of a patient with Hansen's disease, and discuss the difficulties in making a diagnosis.—Authors' Abstract

Rao, K. N., Gupta, J. D., Sehgal, V. N., Chakrabarti, A. K. and Saha, K. Trace elements in the sera of leprosy spectrum. Indian J. Lepr. **57** (1985) 556–561.

Serum zinc, copper, calcium, and magnesium levels were estimated by atomic absorption spectrophotometry in 56 leprosy patients comprising 14 BT, 12 BB, 11 BL and 19 LL. These findings were evaluated in comparison to 42 normal subjects serving as controls. A significant elevation of serum

copper was recorded, while reduction in zinc, calcium and magnesium was noted throughout the leprosy spectrum. The findings of our study are of considerable importance and need to be taken note of in light of delineating these alterations to be the cause or effect of the disease.—Authors' Abstract

Samuel, N. M., Samuel, S. and Adiga, R. B. Borderline leprosy in a three year old child. Indian J. Lepr. **57** (1985) 628–631.

The greater majority of children diagnosed as leprosy before puberty are indeterminate or tuberculoid cases. We have observed that multibacillary cases are common among the child leprosy patients of the Mongoloid races in the mountain regions of Bhutan and Nepal. In this report, it is clear that the mother is the index case with secondary resistance to dapsone, quite clearly passing on the resistant *Mycobacterium leprae* to the child. The child was a primary dapsone-resistant multibacillary patient. The incubation time of leprosy is accepted to be between 2 to 5 years. In this patient, the incubation period could have been less than 2 years. It is also possible that antigenic material from the mother could have passed *in utero.*—(*From* the Article)

Sehgal, V. N., Gautam, R. K., Srivastava, G., Koranne, R. V. and Beohar, P. C. Erythema nodosum leprosum (ENL) in histoid leprosy. Indian J. Lepr. **57** (1985) 346–349.

The morphological features of erythema nodosum leprosum (ENL) occurring in histoid leprosy are described. Its infrequent occurrence has been emphasized. The possible immunopathogenesis of its occurrence in histoid leprosy is briefly outlined.

ENL is a well-known clinical entity. It occurs usually in lepromatous or borderline leprosy. Its occurrence in histoid variant of leprosy has seldom been reported, though a few authors claimed to have recorded ENL in the course of its therapy. In view of the absence of a well-documented report of ENL in histoid, we are intrigued to document a case seen by us in the recent past.—(*From* the Article)

Shannon, M. M., Lopez, D. A. and Burrows, W. M., Jr. Borderline tuberculoid leprosy presenting with a sporotrichoid pattern. J. Assoc. Mil. Dermatol. **11** (1985) 31–35.

Sporotrichosis, in its cutaneous lymphatic form, is a chronic fungal infection of soft tissues characterized by a primary skin lesion often described as chancriform with secondary nodules along the draining lymphatic vessels. Other cutaneous infections with a similar clinical presentation have been termed sporotrichoid infections. These include primarily the sporotrichoid atypical mycobacterioses. Less frequently, some bacterial, fungal, viral, and parasitic diseases present with an identical clinical picture. We have observed a patient with borderline tuberculoid leprosy presenting in a well-defined sporotrichoid pattern. We were unable to find reference in the literature of leprosy producing such a pattern of infection.—(*From* the Article)

Singh, P. K., Agarwal, A., Rajvanshi, V. S. and Agarwal, U. Lymphadenopathy in leprosy with unusual presentation. Indian J. Lepr. **57** (1985) 373–375.

Lymphadenopathy in leprosy is not an uncommon feature. Various workers have studied the involvement of lymph node in leprosy cases. However, there are different opinions by different workers regarding the involvement of the lymph node with clinical type of leprosy. We present here 2 cases in whom lymphadenopathy was the first presenting symptom. These cases were clinically diagnosed as tubercular lymphadenitis and lymphoma, respectively.—Authors' Abstract

Singh, V. V., Singh, G., Pandey, S. S. and Girgla, H. S. Pattern of leprosy in dermatology outpatient clinic of a university hospital. Indian J. Dermatol. **29** (1984) 1–6.

Two-hundred-fifty new cases of leprosy were studied for their age, sex, occupation, and size of family. The mean age for males was found to be 30.5 years and for females 27.9 years. The majority of patients belonged to the 21–30 years age group but the

difference was not statistically significant. The mean age at reporting of cases for L type was higher, i.e., 34.67, as compared to N type (28.23 years) or N? L type (29.72 years). The male patients = 192 (76.8%) and female = 58 (23.2%). The pattern of the type of disease was similar in most of the occupational groups. The mean size of family for N type was 8.4 members; for N? L type, 8.73 members; and L type, 7.18 members but no significant relation was found in types of disease and size of family.—Authors' Abstract

Suryawanshi, N. Clinical manifestations of iridocyclitis in leprosy. Indian J. Lepr. **57** (1985) 549–555.

Iridocyclitis—an inflammation of the iris and ciliary body—occurs in the lepromatous spectrum of leprosy of long duration. It is usually bilateral, has a very chronic course with acute exacerbations which are suppressed with the help of corticosteroids and other antiinflammatory drugs—a mydriatic to keep the pupil dilated and also an antibiotic to take care of secondary infection which may be present. It is a major cause of blindness due to its secondary damaging effects on the various ocular tissues. Medical and paramedical workers attending these patients must be made aware of the chronicity of the iridocyclitis so that regular referrals for examination of the eyes, including slit-lamp examination, could be done and the activity of the disease and its complications detected early and treated. This chronic variety of iridocyclitis often gets less medical attention because of its insidious onset and minimal clinical signs in early stages, except by slit-lamp examination. Fifty-seven patients suffering from iridocyclitis attending the ophthalmic department of S.L.R. & T. C. Karigiri were followed up carefully over a period of 2½ years to study the clinical manifestations of iridocyclitis, its complications, and management.—Author's Abstract

Suzuki, H., Narita, M., Ohnishi, K., Suzuki, T. and Saito, N. [Serum lysozyme and circulating immune complexes in patients with leprosy.] Jpn. J. Lepr. **53** (1984) 23–27. (in Japanese)

Fifty-eight leprosy patients were tested for serum lysozyme and circulating immune complexes (CIC). Serum lysozyme activities were measured by the lyso-plate method and CIC were detected by C1q solid-phase radioimmunoassay using ^{125}I-labeled protein A. The mean of serum lysozyme activity in lepromatous leprosy patients with ENL was significantly greater than that of healthy controls. The mean values were 30.6 ± 17.0 μg/ml for lepromatous patients with ENL, 12.5 ± 5.2 μg/ml for lepromatous patients without ENL, and 9.9 ± 3.9 μg/ml for tuberculoid patients. Serum lysozyme values were correlated with CIC values in sera of patients with lepromatous leprosy ($r = 0.63$, $p < 0.01$). According to the serial observations of 3 lepromatous cases for about 6 months, it was found the serum lysozyme activities were increased just after the treatment with rifampin and decreased by treatment with steroid or thalidomide. And the degrees of increasing or decreasing of serum lysozyme activities associated with drug therapies were larger than that of CIC. These results seemed to support that serum lysozyme may be a more useful parameter clinically than CIC for treatment and control of ENL reaction.—Authors' English Abstract

Suzuki, H., Narita, M., Onishi, K., Suzuki, T., Sakamoto, Y. and Saito, N. [Studies on circulation immune complexes and anti-*M. leprae* antibody in patients with leprosy.] Jpn. J. Lepr. **53** (1984) 15–22. (in Japanese)

Circulating immune complexes (CIC) in 100 patients with leprosy were detected by C1q solid-phase radioimmunoassay and the value of CIC was compared with the titer of anti-*Mycobacterium leprae* antibody measured by solid-phase radioimmunoassay.

The frequency of detection of CIC in patients with leprosy was 67% and the mean value was 13.5 ± 8.3 μg/ml. In sera of patients with lepromatous leprosy, CIC were more frequently detected (71%) compared with tuberculoid leprosy (30%). In patients with lepromatous leprosy, it was 82% for patients with bacterial index (BI) positive, and 64% for BI negative during 1 to 15 years,

66% for BI negative during over 15 years. On the same, CIC were detected more frequently in sera of patients under treatment with DDS and/or RFP (67%) and patients complicated with ENL (79%) in comparison with untreated patients or patients without ENL. However, there were no significant differences in the mean value of CIC between each subgroup.

The titer of antibody to *M. leprae* in patients with lepromatous leprosy was higher than in patients with tuberculoid leprosy, in contacts, and in healthy controls. The correlation between the amounts of CIC and the titers of anti-*M. leprae* antibody was statistically significant in lepromatous leprosy ($r = 0.66$, $p < 0.01$). These results seem to suggest that CIC detected in leprosy, especially in lepromatous patients, were composed partially of *M. leprae* antigens and anti-*M. leprae* antibodies.

According to the observation of the 3 lepromatous cases complicated with ENL for about 6 months, it was found that CIC in sera of patients with lepromatous leprosy were detectable often by C1q assay although they were not complicated with ENL and the amounts of CIC did not vary very widely even during episodes of ENL.—(Authors' English Abstract)

Tutakne, M. A., Tiwari, V. D., Chakrabarty, N. and Gupta, C. M. Quantification of thermal sensory perception in leprosy. (A preliminary report). Indian J. Lepr. **57** (1985) 360–363.

An instrument called "Thermosense" was designed and developed for quantitative assessment of thermal sensory perception. Preliminary testing on 20 healthy adult males showed that 39°C was perceived as hot in 19 individuals on the forearm and arm. The perception on the fingertips was less than forearms. In 5 cases of leprosy (4 BT, 1 TT) testing showed detectable difference in thermal perception within the lesion, in the skin, in the vicinity of the lesion and the uninvolved skin.—Authors' Abstract

Immuno-Pathology

Antia, N. H., Barros, U. and Shetty, V. P. Demonstration of *M. leprae* and *M. leprae* antigens in nerves of tuberculoid patients. IRCS Med. Sci. **13** (1985) 914–915.

This is the first study clearly demonstrating the presence of substantial amounts of non-acid-fast staining bacilli and also of bacillary antigenic material in tuberculoid leprosy. This has been demonstrated indirectly by immunoperoxidase staining with anti-BCG and directly by electron microscopy. The solid staining of the bacilli under the electron microscope shows that osmium tetroxide and carbol fuchsin may be taken up by two different components of *Mycobacterium leprae.* While electron microscopy with its higher resolution has demonstrated bacilli within the Schwann cells, the wider sampling of nervous tissue examined by light microscopy shows that the antigen is localized mainly in the macrophages of the granulomatous infiltrate. It is possible that the antigen originally restricted within the Schwann cell is released and taken up by the epithelioid cells (macrophages), where it is processed and presented to the lymphocytes, thus helping in the formation of the granuloma which eventually destroys the nerve. In summary, we would like to emphasize the observation of the presence of *M. leprae* antigen in tuberculoid nerve granulomas.—(*From* the Article)

Antia, N. H. and Mistry, N. F. Plasma cells in caseous necrosis of nerves in leprosy. Lepr. Rev. **56** (1985) 331–335.

A large number of plasma cells were identified by direct immunoperoxidase staining in caseous nerve abscesses of all 14 borderline, borderline tuberculoid, and polar tuberculoid leprosy patients. The specificity of the secreted antibody appeared to be directed against mycobacterial antigenic de-

terminants. This hitherto unreported observation stresses the role of local humoral immune mechanisms in the pathogenesis of the tuberculoid form of leprosy.—Authors' Summary

Bhatia, V. N., Sudarsanam, D. and Roy, R. G. Use of Whatman chromatography paper for serological studies in leprosy in the field. Indian J. Lepr. **57** (1985) 341–345.

Recently WHO recommended further serological studies on leprosy using samples collected on filter paper strips. A study was therefore taken up at C.L.T. and R.I., Chengalpattu, India, to find out the relative efficiency of the serological tests conducted on sera and filter paper eluates. FLA-ABS and FA-BCG tests were carried out on 100 paired samples. With the former, exactly the same titers were obtained in 42% and with the latter in 52% cases. Most of the others showed positivity at one-dilution-low titers. In 6–8% cases only, the filter-paper technique showed negativity. The correlation coefficient was +0.87 with FLA-ABS and +0.85 with FA-BCG test. The filter–paper technique was operationally more convenient and was acceptable without substantially losing the efficacy.—Authors' Abstract

Brassil, K. E. Staining of *Mycobacterium leprae* in epoxy resin sections. J. Clin. Pathol. **39** (1986) 111–113.

The continuing investigations into the staining characteristics of acid-fast bacilli in epoxy resin sections produced a method for the effective staining of *Mycobacterium leprae.* This method entails the removal of resin by careful treatment with bromine vapor as described in a previous communication concerning *M. tuberculosis.* In this present procedure the above step is followed by treatment with oil, oxidation with acidified potassium permanganate, immersion for 24 hr in ammoniacal alcohol, and then a modified Ziehl-Neelsen technique, which resulted in *M. leprae* and *M. tuberculosis* being stained acid fast.—(*From* the Article)

Britton, W. J., Hellqvist, L., Basten, A. and Raison, R. L. *Mycobacterium leprae* antigens involved in human immune responses. I. Identification of four antigens by monoclonal antibodies. J. Immunol. **135** (1985) 4171–4177.

Four distinct antigens were identified in soluble sonicates of *Mycobacterium leprae* by using a panel of 11 monoclonal antibodies. Crossreactivity studies with other mycobacterial species were conducted by using ELISA and immunoblot assays, and demonstrated that determinants on 2 of the antigens were present in many mycobacteria; whereas the other 2 were limited in distribution. Competitive inhibition experiments with radiolabeled monoclonal antibodies showed cross-inhibition between antibodies identifying 2 of the 4 antigenic bands. These 2 bands, of M_1 4.5 to 6kD and 30 to 40kD, were resistant to protease treatment after immunoblotting. In contrast, the 2 other bands of 16 and 70kD were protease-sensitive. Although all 4 bands reacted with some human lepromatous leprosy sera in immunoblots, the 4.5 to 6kD and 30 to 40kD bands were most prominent. Lepromatous leprosy sera also inhibited the binding of radiolabeled monoclonal antibodies to each of the 4 antigens, with the mean titer causing 50% inhibition being higher for antibodies reacting with the 4.5 to 6kD and 30 to 40kD bands. These findings indicated that all 4 antigens were involved in the human B-cell response to *M. leprae.*—Authors' Abstract

Brown, C. A., Brown, I. N. and Swinburne, S. The effect of oral *Mycobacterium vaccae* on subsequent responses of mice to BCG sensitization. Tubercle **66** (1985) 251–260.

It has been postulated that previous exposure to mycobacteria in the environment may be a contributing factor to the variable efficacy of BCG vaccination in protecting against human tuberculosis or leprosy in different geographical regions. To test this hypothesis, mice were given *Mycobacterium vaccae* in their drinking water for 3 weeks immediately, 27 days, or 54 days before they were injected subcutaneously with BCG. Spleen cells were examined 50 days after injection of the mice for ability to proliferate *in vitro* in response to killed myco-

bacteria added to the cultures. The results show that, depending on the timing of the exposure of the mice *in vivo* to *M. vaccae* before BCG injection and the dose of the mycobacterial challenge *in vitro,* oral administration of this species of environmental mycobacteria can either enhance, mask, or interfere with the expression of sensitization of BCG. Thus, our data from mice support the hypothesis that the results of BCG vaccination for a particular human population are influenced by exposure to indigenous mycobacteria.—Authors' Summary

Cho, S.-N. Chatterjee, D. and Brennan, P. J. A simplified serological test for leprosy based on a 3, 6-di-*O*-methylglucose-containing synthetic antigen. Am. J. Trop. Med. Hyg. **35** (1986) 167–172.

The recent advent of synthetic antigens containing the *Mycobacterium leprae*-specific epitope, *3,6*-di-*O*-methyl-β-D-glucopyranoside, has allowed the development of simple specific serological tests for leprosy. The incorporation of one such product, 8-carbonyloctyl *O*-[4-*O*-(3,6-di-*O*-methyl-β-D-glucopyranosyl)-α-L-rhamnopyranoside]-BSA into a simple "spot" test, diffusion-in-gel enzyme-linked immunosorbent assay (ELISA), allowed an over 90% detection rate of untreated lepromatous leprosy, and the results showed good concordance with conventional ELISA based on the native phenolic glycolipid I.—Authors' Abstract

Collings, L. A., Waters, M. F. R. and Poulter, L. W. The involvement of dendritic cells in the cutaneous lesions associated with tuberculoid and lepromatous leprosy. Clin. Exp. Immunol. **62** (1985) 458–467.

Full-thickness skin biopsies were examined from 12 untreated leprosy patients and included 5 borderline tuberculoid (BT leprosy), 5 borderline lepromatous (BL leprosy) and 2 subpolar lepromatous leprosy cases. The non-lymphoid mononuclear cells present in the dermal infiltrates were analyzed with immunohistological techniques using monoclonal antibodies (Mab) which in normal tissues identify subpopulations of macrophage-like cells in tissue sections; RFD2 (recognizing all monocytes/macrophages), RFD1 (recognizing interdigitating cells), NA1/34 (recognizing Langerhans' cells) and RFD7 (recognizing only mature tissue macrophages).

It was observed that using these Mab no single cell type was unique to a particular state of the disease but that major differences in the proportions of these non-lymphoid mononuclear cells existed between BT leprosy and BL and LL leprosy. In BL lesions RFD2+ macrophages were the major cell type although a significant number (15–30%) of RFD1+ macrophage-like cells were also present. In contrast, in the dermal infiltrates of BT leprosy, RFD1+ cells were the predominant cell type (45–55%). The distribution of NA1/34+ Langerhans' cells and the expression of Class II major histocompatibility (MHC) antigens was characteristically different in BT, BL, and LL leprosy. The relationship between the presence and phenotype of cells considered to be involved in antigen presentation is discussed in relationship to the different clinical states in leprosy.—Authors' Summary

Emmerich, F. and Kaufmann, S. H. E. Human T-cell clones with reactivity to *Mycobacterium leprae* as tools for the characterization of potential vaccines against leprosy. Infect. Immun. **51** (1986) 879–883.

T-cell clones with the T4 phenotype were established from patients with tuberculoid leprosy. The antigen reactivity of these clones ranged from stringent specificity for *Mycobacterium leprae* to broad crossreactivity with other mycobacteria. Killed *M. leprae* had a weak stimulatory capacity which could be enhanced by ultrasonication. Among the 3 candidate antileprosy vaccines, *M. leprae, M. bovis* BCG, and the ICRC (Indian Cancer Research Center) strain, the last was superior in stimulating crossreactive T4 clones. This finding argues for a differential masking of similar or identical membrane antigens in various mycobacterial species. T-cell clones with defined reactivity patterns for mycobacterial antigens could be helpful tools for the charac-

terization of an antileprosy vaccine.—Authors' Abstract

Fujiwara, T., Izumi, S. and Brennan, P. J. Synthesis of 3,6-di-*O*-methylglycosyl disaccharides with methyl 3-(*p*-hydroxyphenyl)propionate as a linker arm and their use in the serodiagnosis of leprosy. Agric. Biol. Chem. **49** (1985) 2301–2308.

The disaccharide, 2,3-di-*O*-methyl-4-*O*-(3,6-di-*O*-methyl-β-D-glucopyranosyl)-L-rhamnopyranose, the distal segment of phenolic glycolipid I, that is a specific antigen from *Mycobacterium leprae,* and some related disaccharides were synthesized as the glycosides of methyl 3-(*p*-hydroxyphenyl)propionate. The methyl 3-(*p*-hydroxyphenyl)propionate was coupled with 2,3,4-tri-*O*-acetyl-L-rhamnosyl bromide, deacetylated, acetonated, coupled with 2,4,6-tri-*O*-acetyl-3-*O*-methyl-D-glucosyl bromide, and converted into a variety of *p*-(2-methoxycarbonylethyl)phenyl 4-*O*-(3,6-di-*O*-methyl-D-glucopyranosyl)-containing disaccharides that are amenable to ready conjugation with protein carriers, thereby providing neo-glycoconjugates for the specific serodiagnosis of leprosy.—Authors' Abstract

Gigg, J., Gigg, R., Payne, S. and Conant, R. The allyl group for protection in carbohydrate chemistry. 17. Synthesis of propyl *O*-(3,6-di-*O*-methyl-β-D-glucopyranosyl)-(1 → 4)-*O*-(2,3-di-*O*-methyl-α-L-rhamnopyranosyl)-(1 → 2)-3-*O*-methyl-α-L-rhamnopyranoside: the oligosaccharide portion of the major serologically active glycolipid from *Mycobacterium leprae.* Chem. Phys. Lipids **38** (1985) 299–307.

Allyl 4-*O*-benzyl-α-L-rhamnopyranoside was converted into allyl 4-*O*-benzyl-3-*O*-methyl-α-L-rhamnopyranoside and this was condensed with 2,3,4-tri-*O*-acetyl-α-L-rhamnopyranosyl chloride to give a disaccharide derivative which was converted into allyl 4-*O*-benzyl-2-*O*-(2,3-*O*-isopropylidene-α-L-rhamnopyranosyl)-3-*O*-methyl-α-L-rhamnopyranoside. This disaccharide derivative was condensed with 2,4-di-*O*-acetyl-3,6-di-*O*-methyl-α-D-glucopyranosyl chloride to give a trisaccharide derivative which was converted into the title compound. This compound represents the oligosaccharide portion of the major serologically active glycolipid from *Mycobacterium leprae* which is required to prepare a synthetic diagnostic agent for leprosy infection at an early stage and to investigate the specificities of monoclonal antibodies directed towards the glycolipid.—Authors' Abstract

Haregewoin, A., Longley, J., Bjune, G., Mustafa, A. S. and Godal, T. The role of interleukin-2 (IL-2) in the specific unresponsiveness of lepromatous leprosy to *Mycobacterium leprae*: studies *in vitro* and *in vivo.* Immunol. Lett. **11** (1985) 249–252.

The role of interleukin-2 (IL-2) in the immunological deficiency of lepromatous leprosy patients toward *Mycobacterium leprae* has been studied further. After initial stimulation with *M. leprae* + IL-2, lepromatous lymphocytes could be restimulated with *M. leprae* alone. The specificity of the responses obtained varied. Some patients gave a stronger response to BCG as compared to *M. leprae,* while in others a stronger response to *M. leprae* as compared to BCG was obtained. Studies of the composition of lymphocytes in dermal infiltrates subsequent to injection of killed *M. leprae* revealed that in both tuberculoid and lepromatous patients, early accumulation of cell staining for both IL-2 receptor and IL-2 were seen. However, with time IL-2 receptor and IL-2 staining lymphocytes diminished in lepromatous infiltrates, while these were maintained in tuberculoid lesions.—Authors' Summary

Jagannath, C., Sengupta, D. N. and Kasinathan, S. Serology of tuberculosis. III. Crossed immunoelectrophoretic analysis of sera from tuberculosis and leprosy patients with antigens from BCG. Tubercle **66** (1985) 277–287.

Sera from tuberculous and leprous patients have been examined for antibody reactivities against components of BCG sonicate (BCGS) antigen. A crossed immunoelectrophoresis with intermediate gel reference system was used in which more

than 40 components of BCGS could be identified. Forty (74.1%) out of 54 tuberculous sera and 68 (90.7%) out of 75 leprous sera reacted with at least 1 component of BCGS. While tuberculosis sera reacted with 9 distinct components of BCGS, leprous sera reacted with at least 12. Components of BCGS precipitated by tuberculous sera were not specific as they were also precipitated by leprous sera.

Overall, nonspecific antibody responses were found to be dominant among tuberculous sera and by comparison, the reactivity of leprous sera with BCGS components was of a higher magnitude. Among tuberculous sera, precipitating activity was maximal among those taken from chronic treated cases with relapse followed by those obtained from treated and untreated new cases. Some components of BCGS to which both tuberculous and leprous sera showed strong reactivity have been characterized.

It is concluded that immunoprecipitation methods with BCG-derived antigens are not useful for the detection of a specific antibody response in tuberculosis or for discrimination between tuberculosis and leprosy.—Authors' Summary

Jesudasan, K., Christian, M., Chacko, C. J. G. and Keystone, J. S. Comparative studies in human and armadillo derived Mitsuda lepromin. Lepr. Rev. **56** (1985) 303–308.

This study is on 2 groups of leprosy patients using the Mitsuda lepromin test. The first group of 37 patients received 0.1 ml of both human (lepromin-H) and armadillo lepromin (lepromin-A) in concentrations of 40 million bacilli per ml. The average readings for lepromin-A and -H were 4.7 mm and 2.1 mm, respectively. Using nested analysis of variance the lepromin-A readings were found statistically significantly (2.2 times) higher than the lepromin-H readings. The second group of 60 patients received 40 M bacilli per ml of lepromin-A and 100 M bacilli per ml of lepromin-H. The average readings for lepromin-A and -H were 6.9 mm and 6.3 mm, respectively. This study suggests that with the paucity in supply of lepromin-H, lepromin-A can be used as a good substitute in concentrations of 40 M bacilli per ml in comparison with the lepromin-H using 100 M bacilli per ml.—Authors' Summary

Kahn, H. J., Thorner, P., Baumal, R., Yeger, H., Bailey, D., Marks, A., From, L., Fisher, B. K. and Lynde, C. Immunohistochemical staining of macrophages in the skin lesions of leprosy: the role of antibody to mycobacteria in human serum and various polyclonal immune rabbit antisera. Histochem. J. **17** (1985) 1009–1020.

Immunohistochemical staining of tuberculoid and lepromatous leprosy skin lesions was performed using various rabbit antisera. Macrophages in both stained with serum containing antibodies against lysozyme and alpha-1-antitrypsin, while macrophages in lepromatous leprosy also reacted with other antibodies. An immunoglobulin fraction of positive serum stained following pepsin digestion, indicating that reactivity was not Fc dependent. Positive serum contained antibody against *Mycobacterium butyricum,* which caused macrophage staining, since affinity–purified antibody did not stain and absorption with *M. butyricum* removed staining. Staining was also produced by serum of subjects with leprosy or a positive tuberculin test. By immunoblotting, the antimycobacterial antibody was directed against surface components of *M. butyricum* of molecular weights 20,000–70,000. Electron microscopy showed *M. leprae* in phagolysosomes of macrophages, while immunoelectron microscopy demonstrated labeling along bacterial cell membranes. Therefore, macrophages in lepromatous leprosy skin lesions stain because they contain *M. leprae,* which reacts with antibody to either *M. leprae, M. tuberculosis,* or atypical mycobacteria in human serum and with antibody to *M. butyricum* in serum from rabbits immunized with various antigens and Freund's complete adjuvant. These results indicate that immunohistochemical studies on leprosy are misleading if performed using intact polyclonal immune sera rather than affinity-purified or monoclonal antibodies.—Authors' Summary

Kaplan, G. and Cohn, Z. A. Cellular immunity in lepromatous and tuberculoid

leprosy. Immunol. Lett. **11** (1985) 205–209.

The depression of cellular immunity in lepromatous patients is not understood. While the blood monocytes of leprosy patients appear to be activated normally by lymphokines, T-cell proliferation and production of lymphokines in response to *Mycobacterium leprae* are impaired in lepromatous patients. Attempts to restore responsiveness in cells from these patients have been unsuccessful in our hands. The addition of exogenous IL-2 to leukocyte cultures does not appear to restore responsiveness to *M. leprae* in cells from nonresponder patients. Rather, some enhancement, often not antigen specific, is observed in cells from patients with a preexisting response. Similarly, depletion of monocytes does not restore responsiveness to *M. leprae* in nonresponder patients, but a nonspecific enhancement of proliferation is observed in monocyte-free cultures from patients who do respond to *M. leprae.* Thus, the defect in lepromatous nonresponder patients does not result from a simple lack of IL-2 production or suppression by monocytes and/or their products. Possibly, there is a low level or lack of *M. leprae* responsive T cells in the circulation of these patients.—Authors' Summary

Kato, H., Sanada, K., Koseki, M. and Ozawa, T. [Identification of lymphocyte subpopulation in cutaneous lesions of leprosy.] Jpn. J. Lepr. **52** (1983) 126–132. (in Japanese)

We investigated 21 cutaneous lesions of leprosy in several clinical stages, using antihuman T, B lymphocyte sera, acid α-naphthyl acetate esterase stain and antihuman T lymphocyte monoclonal antibodies. We found the difference in lymphocyte subpopulation between inflammatory infiltrates in active and inactive lesions of lepromatous leprosy. The mononuclear cell infiltrates in active lesions were composed mainly of T lymphocytes, and spare perivascular infiltrates in inactive lesions were mainly of B lymphocytes. Particularly, the infiltrates in active lesions were composed predominantly of OKT8+ (suppressor/cytotoxic T) cells, and also contained a small number of OKT4+ (helper/inducer T) cells. It is not clear that either suppressor or cytotoxic T cells infiltrated around leproma. These findings suggest lymphocyte infiltrates concerned with immunological tolerance in lepromatous leprosy.—Authors' English Abstract

Klatser, P. R., de Wit, M. Y. and Kolk, A. H. J. An ELISA-inhibition test using monoclonal antibody for the serology of leprosy. Clin. Exp. Immunol. **62** (1985) 468–473.

In this study a mouse monoclonal antibody (47-9) is described, which recognized an epitope on the 36kD protein antigen of *Mycobacterium leprae.* The monoclonal antibody showed specificity for *M. leprae.* An ELISA-inhibition test based on the competitive inhibition by antibodies from human test sera of the binding of the enzyme–labeled monoclonal antibody to *M. leprae* was developed. Seropositivity was found in 100% of the multibacillary leprosy patient group and in 91% of the paucibacillary patients. Only 5% of the 223 control sera were positive. Because of the high seropositivity found in both multi- and paucibacillary patients, it is suggested that the epitope on the 36kD antigen is immunodominant. Therefore, the ELISA-inhibition test described herein might well be a suitable tool for the diagnosis of leprosy.—Authors' Summary

Klatser, P. R., van Rens, M. M. and Eggelte, T. A. Specific antigens of *Mycobacterium leprae.* Antonie Van Leeuwenhoek **51** (1985) 431–432.

In this study, the sodium dodecyl sulfate (SDS)-polyacrylamide gel electrophoresis-immunoperoxidase (SGIP) assay was used to characterize the antigenic components of *Mycobacterium leprae* using patients' sera. This technique involved separation of mycobacterial sonicates on SDS polyacrylamide gels, longitudinal sectioning of the gels, incubation with patients' sera, and visualization of the antigen-antibody complexes by the indirect immunoperoxidase technique.

A number of antigens present in *M. leprae* sonicates were recognized by leprosy pa-

tients' sera, some of which were seen in other mycobacteria as well. Antibody-binding to a 33kD antigen, present in both *M. leprae* and *M. bovis* BCG sonicates, was reduced only in the latter after 6 months of multiple drug treatment of one patient. It is suggested that the 33kD antigen is a common mycobacterial antigen with one or more *M. leprae*-specific determinants. Several antigens were identified only in *M. leprae* sonicates, and only by leprosy patients, i.e., 12-, 22-, 28-, 36-, 41-, and 86-kD components. These antigens lost their antigenicity after trypsin treatment, but were heat-stable. They may be useful for immunodiagnosis.—(*From the* Article)

Kolk, A. H. J., Ho, M. L., Klatser, P. R., Eggelte, T. A. and Portaels, F. Production of monoclonal antibodies against *Mycobacterium leprae* and armadillo-derived mycobacteria. Ann. Microbiol (Paris) **136B** (1985) 217–224.

Six monoclonal antibodies to *Mycobacterium leprae* and armadillo-derived mycobacteria were produced. The monoclonal antibodies were characterized by an immunofluorescence assay using 22 mycobacterial strains. One monoclonal antibody, F47-21-3, treated only with *M. leprae*; 2, F45-9 and F45-15, reacted only with 2 armadillo-derived mycobacterial strains. These 6 monoclonal antibodies can be used for the identication of *M. leprae* and armadillo-derived mycobacteria.—Authors' Summary

Laal, S., Bhutani, L. K. and Nath, I. Natural emergence of antigen-reactive T cells in lepromatous leprosy patients during erythema nodosum leprosum. Infect. Immun. **50** (1985) 887–892.

Fifteen lepromatous leprosy (LL) patients undergoing erythema nodosum leprosum (ENL) reactions were compared with 13 stable, uncomplicated, anergic individuals of the same leprosy background. ENL patients showed significant antigen-induced leukocyte migration inhibition (migration index = 0.058 ± 0.01), paralleling the values obtained with a responder tuberculoid leprosy population (migration index = 0.04 ± 0.004). Both phytohemagglutinin-induced general T-cell proliferation and, more significantly, antigen-induced lymphoproliferation were enhanced during the acute phase of the reaction. Suppressor cell activity, monitored by a costimulant assay, showed enhanced antigen-stimulated suppression of mitogen responses. Interestingly, the improvement in *in vitro* T-cell responses was not reflected in dermal reactivity, since 48-hr delayed-type hypersensitivity responses after intradermal injection of soluble *Mycobacterium leprae* antigens continued to be poor. After subsidence of reactional lesions, leukocyte migration inhibition, lymphoproliferation, and suppressor cell activity were reduced to the unresponsive state seen in stable LL patients. Significantly, perturbations of T-cell reactivity are detectable in ENL reactions, indicating the natural but transient emergence of antigen-induced T cells in LL.—Authors' Abstract

Lee, K. H., Haw, C. R. and Lim, S. K. [*In vitro* effect of human alpha–interferon on natural killer (NK) cell activity in patients with lepromatous leprosy.] J. Korean Med. Assoc. **21** (1984) 1033–1040. (in Korean)

Patients with lepromatous leprosy have significantly lower basal levels of natural killer (NK) cell activity than healthy controls in their peripheral blood. They also show varying significant responses to *in vitro* alpha-interferon (α-IFN) stimulation in tissue culture. These responses suggest that with respect to α-IFN stimulation of NK cell activity, we may be able to subdivide lepromatous leprosy patients into several categories. Further analysis with a large number of patients will be needed to secure these considerations.

The authors evaluated the NK cell activity in patients with lepromatous leprosy at a basal level and after IFN stimulation. The results are as follows: a) The mean value at basal level of male lepromatous leprosy patients was 31.1 ± 16.4%, and the mean values of this group treated with 1×10^2 IFN IU/ml, 5×10^2 IFN IU/ml, and 1×10^3 IFN IU/ml were 54.4 ± 15.2%, 61.3 ± 14.1%, and 59.9 ± 12.7%, respectively. b) The mean value at basal level of female

lepromatous leprosy patients was 23.8 ± 17.6%, and the mean values of this group treated with 1×10^2 IFN IU/ml, 5×10^2 IFN IU/ml, and 1×10^3 IFN IU/ml were 49.9 ± 20.3%, 55.8 ± 18.5% and 56.8 ± 18.1%, respectively. These data broaden our concept of the pathologic process of lepromatous leprosy to include not only the immediate and delayed elements of the immune system but the new partner of immune surveillance, the natural killer cell system.—Authors' English Abstract

Mahadevan, P. R. Host-parasite interaction in relation to leprosy. (Editorial) Indian J. Lepr. **57** (1985) 239–257.

In this editorial an attempt is made to present a working concept to explain the disease leprosy, particularly the lepromatous type of leprosy. The concept is based on the idea that there is significant quantum of host-pathogen interaction before the disease can be manifested and clinically identified. In this presentation, a general explanation of this concept based on already recognized rationale for other pathogenic diseases will be attempted and several experimental evidences available from the studies in leprosy disease will be enumerated. The editorial is also aimed at cohering all experimental evidences and data, that at first glance appear contradictory to each other, so as to visualize a unified concept.

I feel I have analyzed all observations that have been made to explain the immune deficiency in lepromatous leprosy patients and published to date and tried to cohere them into a basic idea that merges without great difficulty into the concept that the expression of immune deficiency is the result of interaction between the phagocytic cell of susceptible individuals and live *Mycobacterium leprae* and the host-pathogen interaction leads to negative modulation of immune competence of the susceptible individuals. Such negative modulation is mediated through structural alteration of infected cells and production of soluble factors that immunomodulate the response of the host to the pathogen.—(*From* the Editorial)

Mehta, L., Ridley, M. J. and Antia, N. H. Immunological factors in nasal mucosa of patients with leprosy—immunoperoxidase study. Indian J. Lepr. **57** (1985) 311–317.

The nature of the subepithelial zone (SE) was established. SE shows IgG and IgM activity in tuberculoid group. Lepromatous group did not show any IgM or IgG response. IgE activity was seen in the lepromatous region in exudate and on the surface of macrophages. Lysozyme activity was seen in the mucous acini of lepromatous leprosy.—Authors' Abstract

Mistry, N. F., Birdi, T. J., Mahadevan, P. R. and Antia, H. *Mycobacterium leprae*-induced alterations in macrophage Fc receptor expression and monocyte-lymphocyte interaction in familial contacts of leprosy patients. Scand. J. Immunol. **22** (1985) 415–423.

Macrophage Fc receptor expression and monocyte–lymphocyte interaction in the presence of *Mycobacterium leprae* were examined in familial contacts of leprosy patients. Defective macrophage functions similar to those of borderline and lepromatous patients could be observed in approximately 71% of consanguineous contacts and 43% of spouses of index patients. Although the values in the latter group were markedly lower than those of the consanguineous contacts, they tended to be higher than those of normal individuals (20%). These *in vitro* macrophage functions were independent of age, sex, and age at onset of exposure and were only weakly associated with duration of exposure. The outcome of the monocyte-lymphocyte interaction test paralleled to a large extent the *in vivo* Mitsuda lepromin response. Four contacts with defective macrophage functions also showed signs of leprosy. The value of these *in vitro* tests as markers of "susceptibility" could therefore prove significant.—Authors' Abstract

Mobashir, M., Gupta, M. C., Kumar, S., Ahmad, K. N., Siddiqi, M. A. and Ajmal, M. R. Hepatic changes in leprosy. Clinician **48** (1984) 72–79.

The present study consisted of 40 cases of different types of leprosy. Out of these 40 cases, 27 were of tuberculoid, 8 leproma-

tous, 2 dimorphous, and 3 indeterminate type of leprosy. The clinical diagnosis and classification was based on the recommendation of the International Classification Committee held at Tokyo in 1963. The histopathological changes in liver were found to be present in 38 out of 40 cases (95%). The 2 cases which had normal histology belonged to the tuberculoid type. The changes in the liver were typical of the type of leprosy and corresponded with those observed in skin.—(*From* Authors' Summary and Conclusion)

Mukherjee, R. and Antia, N. H. Adherence of *M. leprae* to Schwann cells *in vitro*: a specific phenomenon. IRCS Med. Sci. **13** (1985) 853–854.

We had earlier demonstrated that, in *in vitro* cultures of dorsal root ganglia, *Mycobacterium leprae* selectively infected the Schwann cells and the neurofibroblasts without directly affecting the neurones and axons. This study provides experimental evidence of adherence of *M. leprae* to the Schwann cells and also demonstrates that among all the species of mycobacteria examined, *M. leprae* has by far the highest adherence rate. The adherence of other species of mycobacteria was insignificant, suggesting that adherence of *M. leprae* to Schwann cells is a highly specific phenomenon possibly requiring specific surface molecules of recognition. These results thus partially explain the basis of the unique involvement of Schwann cells only with *M. leprae* but not the other mycobacterial infections and suggest that adherence may be the first step in the invasion and pathogenesis of nerve damage in leprosy. It is, therefore, important to isolate and characterize these receptors.—(*From* the Article)

Mukherjee, R. and Antia, N. H. Migration and proliferation of Schwann cells in adult human leprous nerve culture. Lepr. Rev. **56** (1985) 321–330.

The migratory and proliferative activities of Schwann cells affected with leprosy were studied in explant cultures of leprous nerves maintained for 4 weeks *in vitro*. In these cultures, it was observed that Schwann cells harboring *Mycobacterium leprae* failed to migrate from the explant, attach to the culture surface, and proliferate. These cells, therefore, were either sloughed off or still localized to the explant region at the end of the culture period. Hence, no outgrowths of Schwann cells were obtained from highly bacilliferous lepromatous nerve cultures. This was a direct inhibitory effect of the intracellular organism on the host. There was no evidence of the effect being mediated through the release of any soluble product. Unparasitized Schwann cells, however, exhibited normal migration, attachment to culture surface, and proliferation. Therefore, a good outgrowth of Schwann cells comparable to that from normal nerve was obtained from tuberculoid nerve cultures. Fewer Schwann cells migrated from the bacteriologically negative lepromatous nerve explant, which displayed a normal proliferative activity. From the borderline tuberculoid nerves, there was migration and proliferation only of unparasitized cells. This study, thus, demonstrates that *M. leprae* inhibits migratory and proliferative activity of the host Schwann cells.—Authors' Summary

Mustafa, A. S., Gill, H. K., Nerland, A., Britton, W. J., Mehra, V., Bloom, B. R., Young, R. A. and Godal, T. Human T-cell clones recognize a major *M. leprae* protein antigen expressed in *E. coli*. (Letter) Nature **319** (1986) 63–66.

Leprosy is a chronic infectious disease caused by *Mycobacterium leprae*. As with other intracellular parasites, protective immunity is dependent on T cells and cell-mediated immunity. In animal models, immunization with killed armadillo-derived *M. leprae* elicits strong T-cell responses, delayed-type hypersensitivity and protection against viable challenge. We have recently shown that killed *M. leprae* can induce delayed-type hypersensitivity in healthy human volunteers. Identification of the *M. leprae* antigens that are recognized by T cells and may be involved in protection has been hampered by the inability to cultivate the organism *in vitro* and by difficulties in antigen purification from limited quantities of armadillo-derived bacillus. Because genes for the major protein antigens of *M. leprae* as seen by mouse monoclonal antibodies

have been isolated, it has become possible to test whether these individual antigens are recognized by T cells. We screened crude λ gt11 phage lysates of *Escherichia coli* containing individual *M. leprae* antigens using *M. leprae*-specific T-cell clones isolated from *M. leprae*-vaccinated volunteers. Using this method, we find that nearly half of the *M. leprae*-specific T-cell clones are stimulated to proliferate by lysates containing an epitope of a *M. leprae* protein of relative molecular mass 18,000.—Authors' Abstract

Narayanan, R. B., Ramu, G., Malaviya, G. N., Sengupta, U. and Desikan, K. V. *In situ* characterization of cells in the dermal infiltrates of lepromin reaction using monocolonal antibodies. Indian J. Lepr. **57** (1985) 265–272.

A study was made on the *in situ* characteristics of dermal infiltrates in the early and late lepromin reaction with monoclonal antibodies defining T-cell subsets, Langerhans' cells and Ia-like antigens. The early reaction (24 hr) was elicited either with standard Dharmendra lepromin or leprosin A and the late reaction (3–4 weeks) was elicited with standard Dharmendra lepromin. In all, 15 biopsies were studied. Most lymphocytes in the infiltrates of both the lepromin and leprosin reactions were positive for OKT11, Leu3a, OKT8 and Ia-like antigens, indicating thereby the presence of activated T cells. A high proportion of OKT6+ cells were also noticed in the infiltrates of these reactions. In the late reaction, the lymphocytes in the granulomas were predominantly activated T lymphocytes expressing OKT11, Leu3a, OKT8 and Ia-like antigens. Leu3a+ cells were scattered diffusely amid the epithelioid cells. In contrast, OKT8+ cells were present mainly in the peripheral region of the granuloma. A small proportion of OKT6+ cells were also seen in these granulomas. Ia-like antigens and T6 antigens were not discernible on the epithelioid cells. No difference in the number of OKT6+ epidermal Langerhans' cells was observed in the various types of reactions.—Authors' Abstract

Narayanan, R. B., Ramu, G., Sinha, S., Sengupta, U., Malaviya, G. N. and Desikan, K. V. Demonstration of *Mycobacterium leprae* specific antigens in leprosy lesions using monoclonal antibodies. Indian J. Lepr. **57** (1985) 258–264.

Cryostat sections of dermal lesions from 13 untreated patients of leprosy were studied by indirect immunoperoxidase using monoclonal antibodies (MLO4 and MLO6), defining *Mycobacterium leprae*-specific antigens. The lymphocytes and macrophages in both the tuberculoid and lepromatous granulomas showed membranous staining with the above antibodies. *M. leprae* organisms in the lepromatous granulomas and the cells in the section of lymph nodes of patients with tuberculosis, or sections of normal skin or psoriatic lesions did not show any staining with these antibodies. These observations suggest that *M. leprae*-specific antigens are present and expressed on the cells infiltrating the granulomas of leprosy lesions.—Authors' Abstract

Ostler, H. B. The immunology of Hansen's disease. Int. Ophthalmol. Clin. **25** (1985) 117–137.

Hansen's disease has a broad spectrum of manifestations that arise as a result of the interaction of the infectious organism (*Mycobacterium leprae*) and the immunological system of the patient. Those patients with the tuberculoid form of the disease have a near-normal cell-mediated immunity; whereas those patients who have the lepromatous form lack cell-mediated immunity against *M. leprae* almost entirely. Nonetheless, the lepromatous leprosy patient has an exaggerated humoral response to many organisms. The deficiency in cell-mediated immunity usually is not present to organisms other than *M. leprae* and *M. tuberculosis,* however, and patients with Hansen's disease combat most infections requiring cell-mediated immunity for recovery just as readily as do patients with other diseases.

The immunological study of patients with Hansen's disease has been hampered by the lack of an animal model and by the failure of the organism to grow on artificial media. Currently, learning is being accelerated with the development of suitable animal models, and much is being ascertained about the immunological mechanisms that play a role in the disease.—Author's Comment

Ottenhoff, T. H. M., Klatser, P. R., Ivanyi, J., Elferink, D. G., de Wit, M. Y. L. and de Vries, R. R. P. *Mycobacterium leprae*-specific protein antigens defined by cloned human helper T cells. (Letter) Nature **319** (1986) 66–68.

Leprosy displays a remarkable spectrum of symptoms correlating with the T-cell-mediated immune reactivity of the host against the causative organism, *Mycobacterium leprae.* At one pole of this spectrum are lepromatous leprosy patients showing a *M. leprae*-specific T-cell unresponsiveness; at the other are tuberculoid leprosy patients displaying both acquired immunity and delayed-type hypersensitivity against *M. leprae* which are thought to be conferred by helper T (T_h) cells. Because well-defined *M. leprae* antigens are crucial for the prevention and control of leprosy, we have cloned *M. leprae*-reactive T cells (TLC) of the helper phenotype from a tuberculoid leprosy patient. As reported here, these TLC show an unexpected diversity in the recognition of *M. leprae* and related mycobacteria, which is different from that exhibited by monoclonal antibodies. Half of these TLC are completely or almost *M. leprae*-specific; whereas the other half are crossreactive with most or all other mycobacteria. A *M. leprae* protein of relative molecular mass (M_r) 36,000 (36K) defined by a *M. leprae*-specific monoclonal antibody stimulates 4 out of 6 TLC tested. Each of these TLC recognizes a different antigenic determinant, one of which is *M. leprae*-specific. The previous paper [Mustafa, *et al.* Nature 319 (1986) 63–66] describes other *M. leprae*-specific T-cell clones, half of which recognize an epitope on a *M. leprae* protein of M_r 18 K.—Authors' Abstract

Ralhan, R., Band, A. H., Roy, A., Hajini, G. H., Sharma, A. K. and Talwar, G. P. An enzyme immunoassay titrating IgM antibody against phenolic glycolipid for diagnosis of lepromatous leprosy. Indian J. Med. Res. **82** (1985) 110–115.

Phenolic glycolipid-I (PGL-I) from *Mycobacterium leprae* used as antigen in an enzyme immunoassay (EIA) provides clear discrimination between lepromatous leprosy, tuberculosis and normal healthy subjects. Sera from 50 subjects each of 3 categories were analyzed at 1:300 dilution for the presence of glycolipid reacting antibodies. Both IgG and IgM type antibodies were determined. While no statistically significant differences were observed for IgG type antibodies among the 3 groups, the determinations based on IgM antibodies were discriminatory. IgM anti-glycolipid antibody levels at 1:300 dilution of sera as determined on 50 lepromatous leprosy (LL) patients were significantly higher (A_{492} 0.580 ± 0.395) as compared to that of active tuberculosis patients (0.052 ± 0.039) and healthy controls (0.059 ± 0.035). The titers of IgM antibodies were low in LL patients treated for prolonged periods. Sera from 15 tuberculoid leprosy patients had IgM anti-glycolipid antibody values of 0.131 ± 0.061 indicating the inability of EIA based on PGL-I to diagnose this form of leprosy in a clear-cut manner.—Authors' Abstract

Rao, S. S. L., Stanley, J. N. A. and Pearson, J. M. H. Suppression of *Mycobacterium leprae*-induced leucocyte migration inhibition following lepromin injection in healthy contacts of leprosy. Preliminary observations. Lepr. Rev. **56** (1985) 291–295.

Lymphokine production to PHA and *Mycobacterium leprae* was measured using the leukocyte migration inhibition test before and after lepromin skin testing in 7 healthy contacts of leprosy patients. There was suppression of responses to *M. leprae* following lepromin injection, but the responses to PHA were unaffected: this may indicate the presence of protective immunity to leprosy in these subjects.—Authors' Summary

Reitan, L. J., Closs, O. and Harboe, M. Characterization of the immune response to an epitope on *Mycobacterium leprae* antigen 7 defined by a monoclonal antibody. Scand. J. Immunol. **22** (1985) 711–720.

A mouse monoclonal antibody (038D-C6) was shown by crossed immunoelectrophoresis and radioimmunoassay to react with an epitope on the *Mycobacterium leprae* antigen 7. This epitope was highly crossreac-

tive with BCG/*M. tuberculosis* and of a non-arabinogalactan–arabinomannan nature. A solid-phase radioimmunoassay (SPRIA) was applied, based on competitive inhibition by human sera of antigen binding by this anti-*M. leprae* monoclonal antibody. Inhibitory activity determined by this assay decreased markedly upon treatment in both lepromatous and tuberculoid leprosy patients. A correlation was found between the bacterial load of the patient and the inhibitory activity measured in the SPRIA assay. Serum-inhibitory activity could therefore perhaps be used as a follow-up test for patients on treatment or as a screening method to detect infective cases. A dot enzyme-linked immunosorbent assay based, like the SPRIA assay, on competitive inhibition by human sera, was explored as an inexpensive and technically simple alternative also applicable under field conditions.—Authors' Abstract

Reitan, L. J., Closs, O. and Jantzen, E. Further characterization including preliminary chemical analysis of antigen MLW1 from *Mycobacterium leprae.* Int. Archs. Allergy Appl. Immunol. **78** (1985) 269–276.

MLW1, an antigen preparation from *Mycobacterium leprae* previously shown to have a high content of *M. leprae* antigen No. 7 (ML7), was found to contain the typical cell wall constituents arabinose, galactose, and mannose. The fatty acid composition of MLW1 was largely comparable to that of undisrupted cells. The capacity of MLW1 to stimulate lymphocytes was further studied. Good correlation was obtained between the *in vitro* lymphocyte responses to MLW1 and human-derived *M. leprae,* indicating similar specificity of the two antigen preparations in this test. The stimulatory activity of MLW1 was not significantly influenced by batch-to-batch variations, was well preserved during storage and most of it was heat stable. Attempts to remove the ML7 antigen indicate that this component plays a dominant role in inducing *in vitro* lymphocyte stimulation.—Authors' Abstract

Saito, H., Tomioka, H., Sato, K. and Watanabe, T. Abilities of human oligodendroglial cells and mouse Schwann cells to phagocytose *Mycobacterium leprae* and other mycobacteria. Infect. Immun. **51** (1986) 157–162.

Human oligodendroglial KG-1-C cells derived from human cerebral mixed glioma and mouse Schwann cells derived from dorsal root ganglion were studied with respect to their abilities to phagocytose various mycobacteria, especially *Mycobacterium leprae,* and other microorganisms. KG-1-C cells phagocytosed *M. leprae* at a markedly higher rate than BALB/3T3, BHK 21, HeLa S3, mKS-A TU-7, XC, TSV-5, N-18, and Schwann cells but at a lower rate than peritoneal macrophages. Schwann cells also exhibited substantial phagocytic ability against *M. leprae,* and their phagocytic rate against *M. leprae* was much higher than that of N-18 cells, derived from neurons. KG-1-C and Schwann cells phagocytosed mycobacteria other than *M. leprae,* and their phagocytic patterns with various mycobacteria were similar, thereby suggesting that their abilities to phagocytose mycobacteria were based on the same cellular mechanism. The time course of phagocytosis of *M. leprae* by KG-1-C cells markedly differed from that by macrophages, indicating differences in the cellular mechanisms of *M. leprae* phagocytosis. KG-1-C cells also ingested microorganisms other than acid-fast bacilli, such as *Staphylococcus aureus, Listeria monocytogenes, Bacillus subtilis,* and *Escherichia coli* but not *Candida albicans.* They also phagocytosed latex beads (0.8-μm diameter) but not sheep erythrocytes. Microscopically, most mycobacterial cells were ingested in the perikaryon of KG-1-C cells and Schwann cells.—Authors' Abstract

Saito, H., Tomioka, H., Watanabe, T. and Sato, K. Mechanisms of phagocytosis of *Mycobacterium leprae* and other mycobacteria by human oligodendroglial cells. Infect. Immun. **51** (1986) 163–167.

The mechanisms by which human oligodendroglial cells, KG-1-C cells, phagocytose mycobacteria, especially *Mycobacterium leprae,* were studied. The ability of glial cells to phagocytose *M. leprae* was inhibited by azide, dinitrophenol (inhibitors of oxidative phosphorylation), and iodo-

acetamide but not fluoride (both are inhibitors of glycolysis). Thus, the energy metabolism dependency is somewhat different from that of peritoneal macrophages and polymorphonuclear leukocytes, the phagocytic capacities of which are mainly dependent on glycolysis. Phagocytosis of *M. leprae* by KG-1-C cells was markedly suppressed by a microfilament inhibitor (cytochalasin B) but not microtubule inhibitors (colchicine and vinblastine), as with macrophages. The phagocytosis of *M. leprae* by KG-1-C cells was dependent on the lipid and somewhat on the sugar ligands of the organism. Moreover, the phagocytosis of a given mycobacterium by KG-1-C cells correlated well with its hydrophobicity, thus revealing the importance of some lipid moieties on the surface of bacteria in the establishment of rigid binding interaction of bacteria with KG-1-C cells, before the onset of engulfment. Electric charge of a given microorganism did not correlate with its phagocytosis by KG-1-C cells.—Authors' Abstract

Samuel, N. M., Neupani, K., Loudon, J. and Samuel, S. Vaccination of leprosy patients and healthy contacts. Indian J. Lepr. **57** (1985) 288–296.

The overall objectives of this study were to investigate the ability of *Mycobacterium leprae* plus BCG to induce sensitivity to leprosin A skin test in a) multibacillary leprosy patients (BL/LL), b) indeterminate patients, and c) healthy contacts. In the present communication, results obtained with *M. leprae* plus BCG are reported with emphasis on leprosin A skin test reactions, clinical and histopathological changes observed in the vaccinated sites.—(*From* the Article)

Samuel, N. M., Silwal S., Samuel, S. and Loudon, J. Identification of lymphocyte subsets in leprosin A positive sites following vaccination. Jpn. J. Lepr. **54** (1985) 18–24.

In leprosy a skin test has been prepared by Rees from armadillo tissues carefully freed from armadillo antigen. This reagent is called leprosin A. Several healthy normals, contacts and leprosy patients negative to leprosin A were vaccinated with a mixture of *Mycobacterium leprae* plus BCG. Forty-four leprosin A positive sites were biopsied following the vaccination. Immunoperoxidase techniques with monoclonal antibodies have been used to identify T cells, T helper cells, and T suppressor cells. Enumeration of the T-cell subsets shows that the large number of cells infiltrating the positive skin test sites are of the T helper-inducer subset. Multibacillary leprosy patients following vaccination demonstrated large numbers of T helper-inducer lymphocytes. We speculate that the T-helper cells are due to the immunostimulating properties of the *M. leprae* plus BCG.—Authors' Abstract

Sharp, A. K. and Banerjee, D. K. Hydrogen peroxide and superoxide production by peripheral blood monocytes in leprosy. Clin. Exp. Immunol. **60** (1985) 203–206.

Peripheral blood monocytes from 18 leprosy patients in India (representing all stages of the disease spectrum) and 4 healthy control subjects were tested for ability to produce H_2O_2. Very small amounts were produced by resting cells, but the quantity produced was increased by stimulation of the cells with *Mycobacterium leprae* or, to a greater extent, with phorbol myristate acetate. There were, however, no differences in production of H_2O_2 between monocytes from tuberculoid, lepromatous or control subjects. Similar results were obtained for superoxide production. Macrophages in leprosy patients thus appear to have normal activity with regard to these 2 bactericidal metabolites.—(C. A. Brown, Trop. Dis. Bull.)

Singh, N. B., Gupta, H. P., Mathur, I. S., Kumar, A. and Chakraborty, S. K. Leucocyte migration inhibition response of *Mycobacterium habana* with sensitized animals and cells from leprosy patients. Indian J. Lepr. **57** (1985) 273–277.

Response of *Mycobacterium habana*-sensitized mouse cells against habanin (sonicated extract), lepromin (Dharmendra), and tuberculin has been studied in the leukocyte migration inhibition test. The homologous antigenic response has evoked maximum inhibition as compared to heterologous an-

tigens but close antigenic association has also been observed with lepromin and tuberculin. With human cells from leprosy patients, these antigens have evoked analogous responses indicating cross immunogenicity of *M. habana* with leprosy sensitized cells.—Authors' Abstract

Singh, N. B., Srivastava, Gupta, H. P., Sreevatsa and Desikan, K. V. Immunological potential of a cultivable mycobacterial strain *M. habana* against leprosy bacillus in mouse foot pad. Indian J. Lepr. **57** (1985) 278–281.

A strain of a typical mycobacteria *Mycobacterium habana,* originally afforded protection against *M. tuberculosis* challenge in mice, was tested for its immunological potential against leprosy bacillus in the mouse foot pad. The vaccine strain *M. habana* has arrested the growth of *M. leprae* in the mouse foot pad better than BCG (Phipps) and unvaccinated control.—Authors' Abstract

Young, R. A., Mehra, V., Sweetser, D., Buchanan, T., Clark-Curtiss, J., Davis, R. W. and Bloom, B. R. Genes for the major protein antigens of the leprosy parasite *Mycobacterium leprae.* (Letter) Nature **316** (1985) 450–452.

Leprosy, a chronic infectious disease afflicting between 10 and 15 million people, is caused by the obligate intracellular parasite *Mycobacterium leprae.* Although *M. leprae* was the first identified bacterial pathogen of man, basic biochemical, immunological, diagnostic and therapeutic investigations have been severely limited because it remains one of the few human pathogens that have not been cultured *in vitro.* An *M. leprae* recombinant DNA expression library was constructed to provide a source of genes encoding proteins relevant for such studies. Monoclonal antibodies directed against *M. leprae*-specific antigens have been used to isolate the genes encoding the 5 most immunogenic protein antigens of the leprosy bacillus. We report here that *M. leprae*-specific epitopes recognized by all of 13 monoclonal antibodies tested were produced by recombinant phage in *Escherichia coli.*—Authors' Abstract

Microbiology

Dhople, A. M. and Green, K. J. Adenosine triphosphate and ^{3}H-thymidine as indicators of metabolic status and viability of *Mycobacterium leprae.* IRCS Med. Sci. **13** (1985) 779–780.

Both DH and Mahadevan media supported the maintenance of growth potential of *Mycobacterium leprae* for at least 8 weeks. There was a 15–30% drop over the original in ATP levels and [^{3}H]-thymidine uptake at the end of 4 weeks of incubation, which can be considered as the lag period. However, after between 4 and 8 weeks of incubation the bacilli recovered their metabolic integrity in these media. The bacilli attained the original levels of ATP and [^{3}H]-thymidine uptake by the end of 6 weeks. This can be interpreted as a result of the capacity of these two media for maintaining the original growth potential of *M. leprae* and also the viability of *M. leprae* (as demonstrated by their ability to grow at normal rates in the foot pads of mice even from 4-week-old cultures). On the other hand, the effects of incubating *M. leprae* in either Murohashi-Yoshida, Dubos or Middlebrook 7H11 were disastrous. In Murohashi-Yoshida medium, by the end of 4 weeks the ATP levels and the ability to take up [^{3}H]-thymidine had dropped to 50% of the original and declined steadily thereafter. The cells were removed at 4 weeks and later failed to multiply in the foot pads of mice indicating that they had lost their viability also. The situation was even worse in the remaining two media. Thus, the results suggest an excellent correlation between metabolic activity (ATP levels and ability to take up [^{3}H]-thymidine) and viability of *M. leprae.*—(*From* the Article)

Kannan, K. B., Katoch, V. M., Bharadwaj, V. P., Sharma, V. D., Datta, A. K. and

Shivannavar, C. T. Metabolic studies on mycobacteria—II. Glyoxylate by-pass (TCA cycle) enzymes of slow and fast growing mycobacteria. Indian J. Lepr. **57** (1985) 542–548.

Glyoxylate by-pass of tricarboxylic acid cycle (TCA) comes into prominence during survival of microorganisms under oxygen limitations and the study of these enzymes may contribute to understanding of the physiology of "persisters" in various mycobacterial diseases. The enzymes of glyoxylate by-pass have been assayed in the extracts of various mycobacterial species, namely, *Mycobacterium tuberculosis* H37Rv, *M. tuberculosis* H37Ra, *M. flavescens, M. vaccae, M. smegmatis* and *Mycobacteria "w." Mycobacteria "w"* has been included because of its close antigenic resemblance to *M. leprae.* It has been found that all of the above investigated species possess isocitrate lyase and malate synthetase, the key enzymes of glyoxylate by-pass. The presence of the enzymes is being reported for the first time in *M. flavescens, M. vaccae* and *Mycobacteria "w"* whereas these were earlier shown to be present in *M. tuberculosis* and *M. smegmatis.* It was also demonstrated in *Mycobacteria "w"* where acetate alone could not serve as the sole source of carbon but in the presence of glycerol stimulates the activity of glyoxylate pathway enzymes. The importance of these findings has been discussed.—Authors' Abstract

Lee, Y. N. and Colston, M. J. Adenylate kinase activity in *Mycobacterium leprae.* J. Gen. Microbiol. **132** (1986) 561–563.

Adenylate kinase (ATP:AMP phosphotransferase, EC 2.7.4.3) was detected in partially purified preparations of cell-free extract of *Mycobacterium leprae.* The apparent K_m values of *M. leprae* adenylate kinase for ADP and Mg^{2+} were 1×10^{-4} M and 4×10^{-4} M, respectively. The enzyme was heat-labile; loss of activity by 80% at 45°C and over 90% at 60°C occurred within 5 min. *M. leprae* adenylate kinase was distinct from armadillo adenylate kinase in respect to affinity for substrate and heat-sensitivity.—Authors' Abstract

Lee, Y. N. and Colston, M. J. Measurement of ATP generation and decay in *Mycobacterium leprae in vitro.* J. Gen. Microbiol. **131** (1985) 331–337.

The intracellular ATP content of *Mycobacterium leprae* isolated from armadillo tissue was approximately 1.5×10^{-16} g per bacillus. During *in vitro* incubation of bacilli at 4°C, 33°C or 37°C, there was an exponential decrease in ATP content, the rate depending on the medium and the temperature. *M. leprae* incorporated phosphate into ATP and into other nucleotide materials during *in vitro* incubation.—Authors' Abstract

Nakamura, M. and Takeda, T. [An attempt to modify the Hanks bacillary counting method: Hanks sea-sand method.] Jpn. J. Lepr. **52** (1983) 142–146. (in Japanese)

The Hanks bacillary counting method is useful for evaluating the growth of *Mycobacterium lepraemurium in vitro.* However, when the growth of bacilli is remarkably stimulated and clusters are formed, the Hanks method is inappropriate to use because complete dispersion of the cluster is not performed by the method. The present paper describes an attempt to improve the Hanks method in which sea sand was used as a mechanical dispersion substituted for chemical treatment, chloroform. The results obtained indicated that the sea-sand procedure was slightly superior to the Hanks method, but that dispersion of the cluster was not enough even if the sea-sand procedure was employed. In addition, a combination use of sea sand with chloroform significantly reduced acid-fastness of *M. lepraemurium,* consequently, the number of bacilli was underestimated. A more efficient method for counting mycobacterial growth should be established in the future.—Authors' English Abstract

Prabhakaran, K. and Harris, E. B. A possible metabolic role for *o*-diphenoloxidase in *Mycobacterium leprae.* Experientia **41** (1985) 1571–1572.

Among mycobacteria, *Mycobacterium leprae* is unique in its ability to oxidize a variety of diphenols to quinones *in vitro.* What physiologic role *o*-diphenoloxidase

has in the organism remained unknown. Reducing substrates like NADPH, NADH and ascorbic acid reacted with the quinone formed from DOPA (3,4-dihydroxyphenylalanine); the substrates were oxidized and the quinone was reduced back to diphenol in the process. Since the quinone undergoes reversible oxidation-reduction, diphenoloxidase might serve as an alternative respiratory mechanism in *M. leprae* for the utilization of other substrates, as has been reported in plants.—Authors' Summary

Saha, K., Jain, M., Mukherjee, M. K., Chawla, N. M., Chaudhary, D. S. and Prakash, N. Viability of *Mycobacterium leprae* within the gut of *Aedes aegypti* after they feed on multibacillary lepromatous patients: a study by fluorescent and electron microscopes. Lepr. Rev. **56** (1985) 279–290.

This paper describes the viability of *Mycobacterium leprae* within the gut of mosquitoes after they have bitten bacilliferous lepromatous patients. In the test experiments prestarved female *Aedes aegypti* were allowed to feed on bacilliferous leprosy patients, while in the control experiments mosquitoes were fed on a glucose-water-lepromin mixture containing dead *M. leprae.* The insects were sacrificed for 7 consecutive days, their guts were dissected out and excreta were collected. These preparations were mounted and examined for acid-fast bacilli (AFB) by: 1) fluorescent staining technique; 2) by a light microscope using acid-fast staining technique; and 3) also by scanning as well as transmission electron microscopes. AFB were found in the gut and also in excreta but more abundantly in the earlier days after blood meal.

The fluorescent staining technique showed that AFB within the gut of mosquitoes became non-viable (red stain) after 4 days of blood meals. It also demonstrated multiplication of the viable bacilli (green stain) during early days. It was further observed that most of the solid bacilli quickly became granular and non-viable (red stain). Ultrastructural studies confirmed these findings and demonstrated membrane-bound dividing bacteria within the gut of the insects mostly within 72 hr after a blood meal. No such cell division was found in the gut of mosquitoes artificially fed on the glucose-water-lepromin mixture.

These data together with light microscopic findings lend support to the transient multiplication of viable *M. leprae* within the gut of the mosquitoes after the bacilli were taken up from the circulation of lepromatous patients at least during the early period following a blood meal. However, the possibilty of transmission of the illness into humans by mosquito bites seemed to be remote because of the short viable time, quick fragmentation, and elimination of the ingested bacteria from the gut of the insects.—Authors' Summary

Sharma, V. D., Katoch, V. M., Datta, A. K., Kannan, K. B., Shivannava, C. T. and Bharadwaj, V. P. Metabolic studies on mycobacteria—I. Demonstration of key enzymes of glycolysis and tricarboxylic acid cycle on polyacrylamide gels. Indian J. Lepr. **57** (1985) 534–541.

The polyacrylamide gel electrophoresis (PAGE) technique was standardized to demonstrate some key enzymes of glycolysis, hexose monophosphate (HMP) pathway, and tricarboxylic acid cycle in slow-growing mycobacteria (*Mycobacterium avium, M. gastri*) as well as in fast-growing mycobacteria (*M. vaccae, M. phlei*). The enzymes studied were lactate dehydrogenase (LDH), glucose-6-phosphate dehydrogenase (G6PD), aconitase, isocitrate dehydrogenase (ICD), succinic dehydrogenase (SDH), fumerase and malate dehydrogenase (MDH). All three pathways were found to be operative in slow- as well as fast-growing mycobacteria. Using this technique, *M. leprae*-specific MDH activity was demonstrated in the cell-free extract of *M. leprae.* Its (MDH) electrophoretic mobility on gels lies in the range shown by other mycobacterial species studied and was distinct from that of host MDH. It appears that PAGE offers a useful tool for metabolic characterization of *M. leprae* using infected tissues.—Authors' Abstract

Tsukiyama, F. and Matsuo, Y. [Use of the fluorescent staining method for determining the viability of *Mycobacterium leprae.*] Hiroshima Med. J. **34** (1986) 105–107. (in Japanese)

A cell suspension of *Mycobacterium leprae* obtained from a mouse foot pad was exposed to heating at 40°C to 70°C for various lengths of time. The percent green fluorescent cells by a modified fluorescein diacetate (FDA)-ethidium bromide (EB) staining method was calculated and compared with the infectivity of the organisms for mice. *M. leprae* cells were harvested 280–290 days postinjection. The results were analyzed by determining the "most probable number" of viable bacilli. The decrease in green–stained *M. leprae* cells was associated with the loss of infectivity.—Authors' English Abstract

Experimental Infections

Chehl, S., Job, C. K. and Hastings, R. C. Transmission of leprosy in nude mice. Am. J. Trop. Med. Hyg. **34** (1985) 1161–1166.

Nude mice in groups of 10 were exposed to *Mycobacterium leprae* by subcutaneous injection and topically through the nose, lungs, mouth, stomach and skin, broken and unbroken. Animals injected subcutaneously and those topically exposed to *M. leprae* through the nose developed localized disease which in the course of time became generalized. The nose seems to be the site of entry of *M. leprae* in this model. To the extent that these results can be generalized to humans exposed to *M. leprae,* it would seem that leprosy bacilli impact topically on the nasal mucosa or are inoculated subcutaneously.—Authors' Abstract

Dhople, A. M., Howell, P. C., Williams, S. L., Zeigler, J. A. and Storrs, E. E. Serum angiotensin-converting enzyme in leprosy. Indian J. Lepr. **57** (1985) 282–287.

Serum angiotensin-converting enzyme activity was measured in 91 adult healthy and lepromatous armadillos before inoculation with *Mycobacterium leprae* and at necropsies. Mean ACE values were significantly elevated in armadillos with leprosy and the degree of elevation was roughly proportional to the extent of infection. There was also significant difference in the serum ACE levels between Florida and Louisiana armadillos. The dapsone treatment resulted in bringing these levels to normal. Serial assays of serum ACE provided information on the response of armadillos to dapsone therapy.—Authors' Abstract

Kawaguchi, Y. [Attenuation of virulence of *M. lepraemurium* after serial mouse passages during long years. VIII. Clinical features of subcutaneous and visceral lesions, at the 50th generation of Hawaiian M and Hawaiian B strains, in mice.] Jpn. J. Lepr. **54** (1985) 25–33. (in Japanese)

Mycobacterium lepraemurium, strain Hawaiian, has been maintained by mouse passage in our laboratory since 1955. This strain was divided into 2 substrains, Hawaiian M (HM) and Hawaiian B (HB), the former being attenuated and the latter having original virulence. Following subcutaneous infection, the clinical features of the subcutaneous and visceral lesions, at the 50th generation, were observed in 8 inbred mouse strains: CBA/J, C3H, C3H/He, BALB/c, KK, C57BL/6, DDD, and DBA. As a result of the observations, the virulence of the HB strain was still maintained as the original one; whereas that of the HM strain was found to be attenuated and assumed to be stable because the lesions of the 50th generation were nearly the same as those of the 40th generation.—(*From* the Author's English Summary)

Kohsaka, K., Yoneda, K., Miyata, Y., Ito, T. and Tanabe, S. [Susceptibility of rhino mouse to *Mycobacterium leprae.*] Jpn. J. Lepr. **52** (1983) 195–199. (in Japanese)

It was important to find out the suitable animal which is a laboratory animal and susceptible to *Mycobacterium leprae.* Kohsaka, *et al.* previously reported the establishment of experimental lepromatous leprosy with the congenitally athymic nude mouse. It was interesting to use the rhino mouse which is an immune-deficient ani-

mal with disappearance of the thymus in early stage. Therefore, an attempt to inoculate *M. leprae* into the rhino mouse was carried out. Eight- and 5-month-old rhino mice (rh^{rh}) of genetic background A/H were inoculated with *M. leprae* in order to find another model of experimental lepromatous leprosy with a laboratory animal other than the nude mouse. All of the inoculated rhino mice indicated the multiplication of the bacilli in the foot pads at the site of inoculation bacteriologically and histopathologically, even though the proliferation was not so remarkable as in the nude mouse. Rhino mice could survive for more than 15 months under conventional circumstances, but there is no significant proliferation of *M. leprae* as compared to the nude mouse, and it is suggested that the rhino mouse is not so useful for leprosy research because of the difficulties of its rearing and breeding.—Authors' English Abstract

Vaishnavi, C., Kaur, S., Kumar, B., Thakur, M. and Ganguly, N. K. Levels of the third component of complement in *Mycobacterium leprae*-infected intact and immune compromised mice. Indian J. Lepr. **57** (1985) 519–523.

Normal and immunosuppressed mice were infected with *Mycobacterium leprae* and the bacillary counts were made from the foot pads at 3, 6 and 9 months post-inoculation. A decrease in the serum C3 level was observed in the infected groups of animals compared to controls.—Authors' Abstract

Epidemiology and Prevention

Al-Qubati, Y., Ostler, H. B. and Noordeen, S. K. Leprosy in the Yemen Arab Republic. Lepr. Rev. **56** (1985) 347–349.

The present situation with regard to leprosy control in the Yemen Arab Republic (North Yemen) is briefly reviewed. It is believed that there are currently about 1800 registered cases, of whom 1200 have active disease. The authors estimate that there are between 6000 and 8000 cases in the country. There is a 130-bed hospital in Taiz, called the City of Light, which acts as a central leprosarium. Facilities for diagnosis and treatment are also available in other parts of North Yemen, but the overall situation with regard to the competence of health staff, laboratory facilities, chemotherapy, reactions, eye complications, deformities, and rehabilitation is far from satisfactory. A plea is made for the appointment of a leprosy specialist and the urgent development of a national leprosy control program, including the appropriate training of personnel.—Authors' Summary

Alvarez Mesa, M. [Epidemiologic analysis of the evolution of the new program for leprosy control at "10 de Octubre" Municipality, 1977–1982.] Rev. Cub. Med. Trop. **36** (1984) 223–232. (in Spanish)

An epidemiologic analysis was performed during the 6 years following the introduction of the new program for leprosy control, relating it to incidence and prevalence of leprosy at "10 de Octubre" Municipality in former years. Clinical changes and manifestations of bacteriologic and morphologic indexes of cases, and incidence and prevalence of disease are pointed out, as well as disabilities observed at the time of diagnosis of the cases.—Author's English Summary

Bale, U. M., Contractor, N. M. and Bhatia, H. M. HLA segregation study in families of leprosy patients. Indian J. Med. Res. **82** (1985) 198–201.

Seventeen families of leprosy patients were studied for HLA haplotype segregation. It was found that 46.5% of the members of the family suffered from leprosy, 89.5% of them having tuberculoid leprosy. A significant increase in identical HLA haplotypes was observed in the siblings affected with tuberculoid leprosy only when

both the parents were healthy. No non-random segregation of parental haplotypes was observed on analyzing families with 1 or 2 healthy sibs older than the youngest affected sibling.—Authors' Abstract

Cartel, J.-L., Naudillon, Y., Artus, J.-C. and Grosset, J. H. [The epidemiology of leprosy in Guadeloupe from 1970 to 1983.] Bol. Of. Sanit. Panam. **98** (1985) 535–547. (in Spanish)

A study was made of the prevalence and changes in the annual incidence of leprosy in Guadeloupe between 1970 and 1983. Analysis of the data compiled in the leprosy control service yielded a prevalence of 380 per 100,000 inhabitants in 1981 based on the number of patients with active dossiers in the departmental files for 12 years in the case of paucibacillary patients and for the length of their lives in the case of multibacillary patients. From 1970 to 1983 the annual incidence declined from 24.0 to 13.0 per 100,000 inhabitants. The decline was greater for paucibacillary than for multibacillary leprosy, and much greater among persons under 15 years of age than among those older ones. Investigation of case-finding methods showed that 80% of the patients had been found by passive search (symptomatic patients who appeared for clinical consultation); 10% were found by searches among the school population, and 10% by searches among the household contacts of known patients. Starting in 1980, mice were inoculated with *Mycobacterium leprae* taken from biopsies of multibacillary patients in order to grow cultures and study the sensitivity of the microorganism to dapsone and rifampin. The 16 strains of *M. leprae* obtained from relapsed multibacillary patients exhibited resistance to dapsone, and 15 of them were highly resistant. Of 19 strains of *M. leprae* taken from new, untreated cases, only 8 were sensitive to dapsone. All strains of *M. leprae* from both relapsed and from new patients proved sensitive to rifampin. In general terms, the different parameters considered indicate that the epidemiological situation with respect to leprosy has improved in Guadeloupe. Therefore, the present infrastructure and organization for leprosy control should be maintained, although the frequency of resistance to dapsone mandates strict use of combination chemotherapy.—Authors' English Summary

Du, J. K. [Epidemiology of leprosy in Zi-Gong district of Sichuan Province.] Chun **6** (1985) 92–94. (in Chinese)

Zi-Gong district of Sichuan Province, having a population of 1,685,716, was a low epidemic area of leprosy, because totally 97 cases were reported in this city since 1949. There were 24 patients suffering from leprosy (e.g., 20 hospitalized cases, and 3 new cases and 1 relapsed case confirmed during the survey in 1982); the morbidity was 1.4 per 100,000. The distribution, sex, age, profession, duration, types of transmission, prognosis, and epidemiological trend of the disease were analyzed and discussed. The epidemiological trend of leprosy in the city has been going down, and control of leprosy among the members of the family should be emphasized in order to prevent the infection.—Author's English Abstract

Ganapati, R., Revankar, C. R. and Dongre, V. V. Prevalence of leprosy in slums in Bombay including a leprosy colony. Indian J. Lepr. **57** (1985) 383–388.

Transmission of leprosy which is related directly to the total quantum of infection in the community as a whole is decided by the existence of patients suffering from progressive and infectious forms of leprosy and their movement from place to place. This information is of great importance in cities like Bombay to identify the priority areas as targets toward which control efforts should be directed. In this presentation an attempt has been made to compare the leprosy survey figures from 3 different situations in the city. Selection is arbitrary, not made on statistical basis.

The data of particular importance are from a leprosy colony located in North Bombay representing a hyperendemic situation and a normal slum adjacent to this colony, movement of population between these two colonies being free. Age-specific prevalence rates of leprosy after examining more than 80% of the population from these colonies are compared with data derived from normal slums situated elsewhere in the

city. The figures reveal varying prevalence rates marked by an increasing trend in the prevalence figures, leprosy colony representing the largest pool of infection. These figures indicate that wider statistically planned investigations on similar lines in urban areas may provide epidemiological data useful for planning control measures on a more rational basis.—Authors' Abstract

Grunert, L. R., Castellazzi, Z. and Ortlieb, V. P. [Immunological study in Easter Island to detect leprosy.] Rev. Med. Chile **113** (1985) 183–185.

Results of skin testing with *Mycobacterium leprae* soluble antigen and of enzyme-linked immunosorbent assay with soluble antigen and glycolipid on 218 individuals on Easter Island led the authors to conclude that the circulation of leprosy bacilli in the community was minimal or nonexistent. One person was identified with probable subclinical leprosy.—(C. A. Brown, Trop. Dis. Bull.)

Joseph, B. Z., Yoder, L. J. and Jacobson, R. R. Hansen's disease in native-born citizens of the United States. Public Health Rep. **100** (1985) 666–671.

This paper presents a statistical analysis of data on 1309 Hansen's disease (HD) patients born in the continental United States during the 50-year period 1932–1981; 56% of them were born in Texas. The cases of 66% were classed as multibacillary, 31% were considered paucibacillary, and the type was unknown for 3%. Blacks and whites appeared to be equally susceptible to Hansen's disease. Thirty percent had a history of contact with Hansen's disease. The age at diagnosis has increased an average of 2.7 years per decade, and the increase has accelerated in the last 2 decades. If the present trend continues, Hansen's disease among native-born citizens of the United States will ultimately disappear.—Authors' Summary

Orege, P. A. and Owili, D. M. The epidemiology of leprosy in Yimbo location Siaya district. East Afr. Med. J. **62** (1985) 65–70.

In 1982 a cross-sectional point prevalence survey was conducted for cases of leprosy in Yimbo location in Siaya district, Kenya; 4858 people were physically screened out of a total population of 20,076. Forty-five people were found to be clinically positive for leprosy. This yielded a leprosy prevalence rate of 9.26 cases per 1000. Out of all the patients screened 78.8% were females and 71.1% were tuberculoid (TT) and borderline tuberculoid (BT); 53.3% of the cases were 40 years and above; 68.9% of the cases had positive histories of contact, while 80% of the cases were found to be BCG negative. The data suggest that Yimbo location is hyperendemic for leprosy, and that the majority of the leprosy cases are paucibacillary.—Authors' Summary

Pollack, M. S., Ching, C., Pandey, J. and Reichert, E. HLA antigen frequencies and HLA and Gm haplotype segregation in Filipino leprosy patients in Hawaii. Disease Markers **3** (1985) 119–129.

Studies of 16 leprosy families and 11 additional unrelated Filipino leprosy patients in Hawaii confirm previous suggestions that there is a significant association of HLA DR2 [and MB1 (now DQw1)] with the lepromatous form of the disease, although the frequency of DR2 is very high in healthy Filipino controls. Preferential segregation of DR2 in children with the lepromatous form of the disease and the observed segregation of HLA haplotypes in children with either tuberculoid or lepromatous leprosy are consistent with the presence of a recessive, HLA-linked susceptibility factor(s) with moderate penetrance; in families with 2 or more affected children, the patients share an excess of parental haplotypes. The segregation pattern of a very unusual Gm haplotype in 1 family further suggests that a Gm-linked susceptibility factor may also be involved.—Authors' Summary

Ramu, G., Pandian, T. D., Rajaram, N., Sithambaram, M. and Bharati, R. A sample survey of leprosy in the ELEP Leprosy Control Project, Dharmapuri, Tamil Nadu. Indian J. Lepr. **57** (1985) 575–587.

A sample survey of the Dharmapuri Leprosy Control Project was undertaken in 1983; a population of 60,855 was enumerated out of which 51,205 were examined. The sampling procedure which was followed consisted of stratifying the sub-centers according to prevalence and classifying the villages by the size of the population. Villages were selected by random allocation; 10 leprosy inspectors participated in the survey examining 626 to 774 persons per day; 859 active cases were detected giving a prevalence of 16.77 per thousand. The child prevalence was 6.19 per thousand. The number of lepromatous and BL cases detected were 70, giving an infectivity rate of 8.15%. The prevalence of leprosy as found in the last survey conducted in the different areas in the project approximate to those of the sample survey. Therefore, it could be said that the prevalence has decreased in this project from 19.94 per thousand as observed in the first survey. The child prevalence has likewise decreased from 9.40 to 4.09 in the project.—Authors' Abstract

Schauf, V., Ryan, S., Scollard, D., Jonasson, O., Brown, A., Nelson, K., Smith, T. and Vithayasai, V. Leprosy associated with HLA-DR2 and DQw1 in the population of northern Thailand. Tissue Antigens **26** (1985) 243–247.

A study of the frequency of HLA-DR2 and DQw1 was performed in leprosy patients and controls in northern Thailand. HLA-DR2 was found in 100% (17/17) of patients with sporadic tuberculoid leprosy and in over 90% (30/32) of all tuberculoid leprosy patients, as compared to 62% (20/32) of controls ($p = 0.02$). These strong associations had relative risks of 21.4 for sporadic and 7.4 for all tuberculoid leprosy, and etiologic fractions of 1.0 and 0.84, respectively. There was also a statistically significant and strong association between tuberculoid leprosy and DQw1. These data add to the growing body of evidence that products of HLA class II determinants or closely linked genes may play a role in determining the clinical manifestations of *Mycobacterium leprae* infection.—Authors' Abstract

Wilson, G. T., Horton, P., Stevens, W. C. and Shake, R. E. Absence of leprosy-like disease in the nine-banded armadillo (*Dasypus novemcinctus*) in and around Taylor County, Texas. Texas J. Sci. **36** (1984) 73–79.

A sample of 30 nine-banded armadillos (*Dasypus novemcinctus*) collected in and around Taylor County, Texas, U.S.A., was examined for presence of naturally acquired leprosy-like disease. No evidence of mycobacteriosis was evident in any of the animals examined. The 8 counties of central Texas involved in this study lie outside the region of Texas in which human leprosy is endemic.—Authors' Abstract

Rehabilitation

Beine, A. Modified suture technique for six-tailed fascia lata graft to slim palmaris longus tendon. A preliminary case report. Indian J. Lepr. **57** (1985) 393–395.

A modified suture technique is described which allows the joining of a very slim tendon palmaris longus (below 3 mm wide) with a many-tailed fascia lata graft (15 mm wide). This technique is useful in case of ulnar palsy in children, where palmaris longus many-tailed graft is desired as lumbrical replacement and where Brand's anastomosis is considered too difficult. One successful case is also shown.—Author's Abstract

Beine, A. Partial flexor carpi radialis many-tailed transfer for correction of claw fingers. Indian J. Lepr. **57** (1985) 624–627.

The method described shows that correction of claw fingers is possible using a portion of the flexor carpi radialis as motor. Usually, this method is indicated whenever it is desired to do a palmaris longus many-

tailed transfer in the absence of palmaris longus (e.g., for correction of hyper-mobile claw fingers).—Author's Abstract

Boillot, F. [*Present aspects of neuropathy in Hansen's disease. An experience of 13 months in Senegal.*] Doctor of Medicine thesis, Grenoble, 1985. (in French)

This work has two purposes. First, it presents an updated review of the bibliography on neuropathy in leprosy. Second, it reports the results of single corticotherapy in patients from Senegal.

According to recent discoveries in immunology and regarding the nature of lepra reaction, the neuritis seems to be due at the same time to the infection and to immune mechanisms. Its evolution is aggravated by local and regional factors. It is precipitated during lepra reaction. The treatment is medical, using antibiotics and corticoids. The indications of surgical decapsulation are discussed.

From this study one can conclude that the recovery is better and faster in tuberculoid than lepromatous patients. Moreover, the type of antibiotherapy seems to have an influence on the recovery.

The importance of an early detection of the neural damages is stressed.—(*Translated from* Author's Résumé)

Bourrel, P. [Test for metacarpophalangeal stability, interest in surgery of the hands in leprosy.] Acta Leprol. **3** (1985) 281–285. (in French)

In a claw hand with ulnar-nerve and median-nerve paralysis, if the digits are stabilized to prevent over-extension at the metacarpophalangeal joints, the long extensor alone could fully extend all phalanges. From the proximal interphalangeal stiffness evaluated by this test (on more than 200 claw hands I operated 20 years ago) I propose a simple therapeutic scheme for palliative surgery.—Author's English Summary

Kulkarni, V. N. and Mehta, J. M. Observations of tarsal disintegration in the cases operated for foot-drop. Indian J. Lepr. **57** (1985) 598–600.

Fifty cases operated for foot-drop during the years 1971–1982 were called for follow up. Out of 50, 20 cases were reported to the hospital. Three cases among the 20 were found to have changes of tarsal disintegration. The changes were found more confined to the talo-navicular junction. X-ray changes both in non-weight and weight bearing were studied. Their line drawings (tracings from actual radiographs) are presented. It is concluded that due attention should be given to the pre-operative evaluation, operative procedure used, and post-operative management, particularly the weight bearing and proper footwear.—Authors' Abstract

Oberlin, C. Zancolli's "lasso" operation in intrinsic palsy of leprous origin. A study of twenty-six cases. Ann. Chir. Main **4** (1985) 22–30.

Twenty-six cases of Zancolli's "lasso" procedure are presented. They were part of a series of 122 operations performed for leprosy in Central Africa. Nineteen cases with a follow up of more than 6 months were reviewed. Fifteen of these patients had good or very good results. When claw hand deformities are supple, 1 flexor superficialis tendon may be used for 2 fingers; when the fingers are partially stiff, 1 tendon for each finger should be used. The "lasso" procedure is simple and the results are satisfactory, particularly in this series of patients who did not follow any rehabilitation program.—Author's Summary

Pal, S. and Girdhar, B. K. A study of knowledge of disease among leprosy patients and attitude of the community toward them. Indian J. Lepr. **57** (1985) 620–623.

A study has been undertaken to evaluate knowledge about disease among leprosy patients and attitude of family and neighbors toward patients; 310 O.P.D. patients attending this hospital have been interviewed and their answers have been analyzed. It is observed that less than one fourth of the patients knew the causes of the disease, while 40% feared that their children were more prone to get leprosy. Interestingly, 75% of patients did not encounter any adverse reaction from the other family members, or

neighbors even though most of them knew about the disease.—Authors' Abstract

Palande, D. Neurolysis in leprosy as an emergency. Quad. Coop. Sanit. **1** (1985) 109–118.

Neurolysis is required in certain cases of trunk nerve involvement in leprosy when the non-surgical measures fail to control the nerve damage and when signs of nerve injury by physical factors continue to persist. Early neurolysis in such cases results in nerve recovery or stoppage of nerve damage in majority of such cases. The sense of urgency is more in cases of acute nerve abscess. Adequate skill in surgery is of course essential.—Author's Abstract

Shetty, J. N., Shivaswamy, S. S. and Shirwadkar, P. S. Knowledge, attitude and practices of the community and patients regarding leprosy in Mangalore—a study. Indian J. Lepr. **57** (1985) 613–619.

To get acquainted with the knowledge, attitude and practices of the community and the patients toward leprosy so as to evolve a suitable health education program, a study was conducted in Mangalore as per the schedule prepared for the purpose. The information so collected has been summarized. Very few people among the community know that leprosy is caused by a germ (8%). Knowledge regarding this was slightly better (22%) among patients. Only 15% of the community members and 42% of the patients were aware of the early signs of the disease; 54% of the community members and 41% of the patients felt that leprosy is contagious; 60% of the community and 86% of the patients were of the opinion that leprosy is curable. Many believe that leprosy is associated with deformities and disabilities (community 64%, patients 76%). Most of the community members (79%) and patients (88%) said it is necessary to attend a hospital for treatment when leprosy is suspected; 60% of the community members and 56% of the patients felt that it is necessary to segregate leprosy patients.—Authors' Abstract

Srinivasan, H. Dermadesis and flexor pulley advancement: first report on a simple operation for correction of paralytic claw fingers in patients with leprosy. J. Hand Surg. **10A** (1985) 979–982.

A simple operation is described for correcting the intrinsic minus finger deformity commonly seen in patients with leprosy. It consists of shortening the palmar skin at the level of the MP joint and flexor pulley advancement. This produces an acceptable flexion contracture of not more than 40% of the MP joint, as in Zancolli's capsuloplasty, and optimizes the balance of forces around the finger joints in favor of improved MP joint flexion and PIP joint extension. A preliminary evaluation of 11 hands of patients with leprosy with ulnar or ulnar and median nerve paralysis who underwent this surgery and were followed for 7–17 months after surgery shows that this operation satisfactorily corrects claw deformity and improves intrinsic minus disability. The most important advantages of this procedure are that it is technically simple and does not require postoperative reeducative therapy.—Author's Summary

Verma, H. S., Gupta, U., Gupta, D. K., Seth, B. L., Siddiqui, S. D. and Saxena, J. S. Osteoarticular complications in anaesthetic foot. Indian J. Lepr. **57** (1985) 593–597.

A clinico-radiological comparative study of complications in the anesthetic foot in 60 patients (48 leprosy and 12 spinal injuries) was done. It has been observed that these groups behave differently.—Authors' Abstract

Other Mycobacterial Diseases and Related Entities

Beck, J. S., Potts, R. C., Kardijto, T. and Grange, J. M. T4 lymphopenia in patients with active pulmonary tuberculosis. Clin. Exp. Immunol. **60** (1985) 49–54.

The numbers of cells bearing the T3 (pan-T cell), the T4 (putative helper/inducer cells), the T8 (putative suppressor/cytotoxic cells) and B cell phenotypic markers were counted in venous blood samples from

26 newly diagnosed pulmonary tuberculosis patients and 29 healthy controls from East Java. The absolute T-cell count was lower in the patients and T4 cells were fewer in patients (mean 748/mm^3) than in controls (mean 1043/mm^3), but there were no significant differences in total T8 cell and B cell counts between patients and controls. The T4:T8 ratio was not disturbed in many patients, but it was less than 1.6 in 11 of 26 patients and in only 3 of 29 controls: this ratio was less than 1.2 (the lower limit of "normal") in 6 patients but no controls. The intensity of the T4 lymphopenia was unrelated to the extent of the lesion seen radiologically or the size of the skin test reaction to PPD. Levels of interferon-α were not elevated in the serum of any of the patients or controls. It is suggested that the T4 lymphopenia was a reaction to the mycobacterial infection and not a manifestation of underlying secondary (acquired) immune deficiency.—(A.S., Trop. Dis. Bull.)

Chitambar, S. D., Band, A. H. and Talwar, G. P. An *in vitro* test for assessment of intracellular viability and growth of mycobacteria. Indian J. Med. Res. **82** (1985) 292–303.

A number of radioactive precursors measuring different metabolic pathways were investigated to monitor, with higher sensitivity and consistency, the growth and metabolic activity of mycobacteria resident in human monocyte-derived macrophages. ^{14}C-acetate was found to be incorporated more rapidly and in higher amounts as compared to ^{3}H-thymidine, ^{3}H-uracil, ^{3}H-leucine and ^{14}C-glucose by the 2 cultivable mycobacteria, *Mycobacterium "w"* and *M. vaccae.* Since ^{14}C-acetate incorporation is not restricted to mycobacteria, and could be seen in the host cell, an experimental procedure was devised to obtain a differential response. The assay enables the discrimination between killed and live, drug resistant and sensitive mycobacteria and also measures with fair accuracy even small number (approx. 0.5×10^6) of mycobacteria. The system may be useful to evaluate the influence of lymphokines and other agents on the growth of intracellular mycobacteria.—Authors' Abstract

Collins, F. M. Protection to mice afforded by BCG vaccines against an aerogenic challenge by three mycobacteria of decreasing virulence. Tubercle **66** (1985) 267–276.

Specific pathogen-free mice were vaccinated subcutaneously with 10^7 CFU of BCG Pasteur or BCG Glaxo, and 30 or 90 days later the mice were challenged aerogenically with *Mycobacterium tuberculosis* (Erdmanna or South Indian strains) or with *M. avium.* Both vaccines induced substantial levels of resistance to tuberculosis and tuberculin hypersensitivity. There was no detectable difference in the host response to the 3 aerogenic challenges which could be related in any way to the immunogenicity of the BCG strain or to the mouse virulence of the challenge organism. These results do not support the hypothesis that the protective activity of BCG vaccines varies, depending upon the virulence of the infecting organism.—Author's Summary

Daniel, T. M. and Olds, G. R. Demonstration of a shared epitope among mycobacterial antigens using a monoclonal antibody. Clin. Exp. Immunol. **60** (1985) 249–258.

An IgM monoclonal antibody designated TB-C-1 which is broadly reactive with mycobacteria has been studied to characterize the antigens with which it reacts. Enzyme-linked immunosorbent assay (ELISA) demonstrated reactivity not only with culture filtrates of several mycobacterial species but with several purified antigens of *Mycobacterium tuberculosis,* including protein antigens 5 and 6 and polysaccharides arabinogalactan and arabinomannan. Immunoblotting demonstrated reactivity with 4 distinct components of *M. tuberculosis.* Reactions with components of similar molecular weight were demonstrated for several other mycobacterial species, although fewer components bound with TB-C-1 in these other mycobacteria than in *M. tuberculosis.* Immunoabsorbents were prepared from TB-C-1 and used to isolate antigens with which the antibody reacted. Multiple antigens were identified in the eluates from *M. tuberculosis,* including protein antigens 6 and 7, arabinomannan, and

arabinogalactan. Fewer components were recovered from other species of mycobacteria. Affinity of binding of immunoabsorbents was similar for all antigens bound. These results indicate that a common epitope is widely shared among antigens of *M. tuberculosis* and other mycobacteria, and they suggest that species specificity of mycobacterial antigens may rest with individual epitopes rather than intact antigenic molecules.—(A.S., Trop. Dis. Bull.)

Gibbels, E., Schaefer, H. E., Runne, U, Schröder, J. M., Haupt, W. F. and Assmann, G. Severe polyneuropathy in Tangier disease mimicking syringomyelia or leprosy. J. Neurol. **232** (1985) 283–294.

Polyneuropathy in Tangier disease can be divided into 3 clinical types. The most severe form (type III) with a syringomyelia-like syndrome has been described in 3 cases only. Here, a fourth case of this type is presented. Because of unusual trophic disturbances even leprosy was suspected. Electrodiagnostic findings, including evoked cerebral potentials in this case, were suggestive of a generalized neuropathy with some degree of primary or secondary demyelination and implied possible impairment of central structures. Sural nerve biopsy, including electron microscopy and quantitative analysis, revealed a predominant reduction of smaller myelinated and unmyelinated fibers. The main morphological feature was the abundance of abnormal nonmembrane-bound vacuoles in Schwann cells, mostly of the unmyelinated type, and in some endoneurial fibroblasts, macrophages and perineurial cells. There was no inverse relationship between lipid vacuoles and axons in Schwann cell complexes as suspected by others. An excess of endoneurial collagen as well as an increased fascicular area were obvious. In 5 skin biopsy specimens of different regions, typical vacuoles were noted in Schwann cells, histiocytes, nevus cells, and rarely in perineurial cells.—Authors' Summary

Hong Kong Chest Service; India, Tuberculosis Research Centre; U.K., Medical Research Council. A controlled trial of 2-month, 3-month, and 12-month regimens of chemotherapy for sputum-smear-negative pulmonary tuberculosis: results at 60 months. Am. Rev. Respir. Dis. **130** (1984) 23–28.

Short-term (2 or 3 months) multidrug treatment (streptomycin, isoniazid, rifampin, pyrazinamide) did not provide adequate therapy for patients with positive initial sputum cultures. Over a 60-month period, 32% of patients on a 2-month and 13% on a 3-month treatment regimen relapsed. The authors suggest that in patients with a high immunity a significant proportion of dormant/semidormant bacilli are present and these required longer chemotherapy.—(M. Hooper, Trop. Dis. Bull.)

Kailasam, S., Jayasankar, K., Kannapiran, M., Krishnamurthy, M. S., Krishnamurthy, P. V. and Sarma, G. R. Serum protein profile in patients with pulmonary tuberculosis. Indian J. Med. Res. **81** (1985) 551–557.

A detailed study of the alterations in the serum protein fractions following commencement of effective anti-tuberculosis treatment was undertaken in 511 patients with pulmonary tuberculosis. The concentration of serum albumin was 20–30% higher ($p < 0.001$) and that of α_1, α_2 and γ-globulins significantly lower at the end of treatment than on admission ($p < 0.01$), the magnitude of decrease being 7–17% for γ-globulin, 19–30% for α_1-globulin and 35–38% for α_2-globulin. In all, 481 patients had a favorable response to treatment, 46 of whom had a bacteriological relapse within 18 months of stopping treatment. The likelihood of a relapse was found to be greater with higher α_2-globulin concentrations at the end of treatment, the proportions of patients who relapsed being 3, 9, 13 and 15% with α_2-globulin concentrations of <0.40, 0.40–0.59, 0.60–0.79 and ≥ 0.80 g/dl ($p = 0.02$).—Authors' Abstract

Narain, R., Krishnamurthy, M. S., Mayurnath, S. and Gopalan, B. N. Correlation between prevalence rates of pulmonary tuberculosis, tuberculous infection and non-specific sensitivity. Indian J. Tuberc. **31** (1984) 109–113.

In a trial of BCG vaccination in Madras in 1968–1971, the entire population aged 1 year or over was tested with 3 TU of PPD-S and 10 TU of PPD-B. The findings have already been published and are not repeated here, but they are now analyzed in order to examine the correlation between the prevalence rate of pulmonary tuberculosis, tuberculous infection and nonspecific tuberculin sensitivity. In the population studied 77% were Mantoux tested, 82% of those over 10 years were given X-ray examination, and 93% had sputum examined.

It emerged that the correlation between the prevalance rates of disease and of infection was positive and highly significant and that the correlation between the prevalence of nonspecific tuberculin sensitivity and disease was negative and highly significant. It was concluded that if there is a high rate of tuberculous infection (as judged by the reactor rate), the number of cases of pulmonary tuberculosis in a community is also likely to be high. The numerical values of the coefficient of correlation were not large, which reflects the fact that the disease may develop during a greatly varying period of time after infection, which may be long. Many of the original infectors might have died or been cured or left the area before the tuberculin survey, and some of those infected might have been infected elsewhere. The inverse relationship found between the prevalence of tuberculosis and of nonspecific tuberculin sensitivity is taken as support for the opinion that previous infection by a nonspecific mycobacterium protects against later infection by *Mycobacterium tuberculosis.* In the authors' opinion tuberculin surveys could be a cheaper method of examining changes in the tuberculosis situation than expensive tuberculosis prevalence surveys.—(H. G. Caldwell, Trop. Dis. Bull.)

Thole, J. E. R., Dauwerse, H. G., Das, P. K., Groothuis, D. G., Schouls, L. M. and van Embden, J. D. A. Cloning of *Mycobactrium bovis* BCG DNA and expression of antigens in *Escherichia coli.* Infect. Immun. **50** (1985) 800–806.

A gene bank of *Mycobacterium bovis* BCG DNA in *Escherichia coli* was constructed by cloning *Sau*3A-cleaved mycobacterium DNA fragments into the lambda vector EMBL3. The expression of mycobacterial antigens was analyzed by Western blotting with hyperimmune rabbit sera. Among 770 clones tested, several were found that produced various mycobacterial antigens in low amounts, with concentrations generally close to the detection limit. One particular clone was chosen for further investigation. This clone produced a 64-kD antigen. By placing the lambda promotor P_L in front of the structural gene of this antigen, an overproducing *E. coli* strain was obtained. Rocket-line immunoelectrophoresis experiments showed that antigens crossreacting with the 64-kD protein are present in a wide variety of mycobacteria and also in so-called purified protein derivatives which are routinely used for skin tests. Preliminary experiments indicate the presence of antibodies against the 64-kD antigen in sera from tuberculosis patients.—Authors' Abstract