

CURRENT LITERATURE

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Clinical Course

Alamdarov, I. N. [Brain biopotentials in patients with leprosy in the stage of reaction.] *Vestnik Dermatol. i Venerol.* **42** (1968) 28-33.

Encephalograms were recorded in 14 patients with lepromatous leprosy with the help of the 16-channeled apparatus "ALVAR." Biocurrents were registered for symmetric parts of the lobus frontalis and lobus temporalis, and frontal, central and occipital regions of the brain in unipolar and mediate leads. Ninety-six encephalograms were recorded and analyzed. A transitional type from normal to disease was noted in 3 patients. Disorganization of biopotentials of the brain with evidence of a significant number of slow oscillations with low amplitudes was seen in 7 patients. Regular rhythms with obliteration of zonal differences were observed in 3 patients. Rough irregular or definite pathologic components, including paroxysmal discharges were recorded in 1 patient. In 8 of 14 patients electroencephalograms showed a synchrony and asymmetry of oscillations in some or all investigated parts of the brain (break in simultaneous activity of the two hemispheres); fragmentary character of the curve of biocurrents has been noted. Exacerbation of the leprosy process intensifies pathologic components of the electroencephalogram; this was marked in quiet course of the disease. To the author's mind, acute and spade-like oscillations in the encephalogram of leprosy patients are reflections of pathologic impulses, originating in affected peripheral nerves. The changes described in electroencephalograms in the exacerbative stage can explain the relative frequency of nervous-like states

and features of cerebroasthenia in leprosy patients who have recovered from the phase of leprosy reaction. This article is the second report of this type in Soviet literature. In 1959 A. N. Gordienko, N. A. Torsuev and coworkers reported changes in the electroencephalogram in leprosy patients in the regressive stage of the disease. (*Sbornik nauchnykh rabot po leprologii i dermatologii*, Rostov-on-Don, 12 (1959) 3-17)—N. TORSUEV.

Bolgert, M., Plus, A. and Marcel, G-A. Lèpre évoluant depuis 7 ans, ayant présenté 5 poussées réactionelles á forme rénale. [Leprosy of seven years' evolution with five reactional attacks of renal type.] *Bull. Soc. Dermatol. Syphilig.* **73** (1966) 245-248.

Case report of male patient, 26 years old, hospitalized for 2 years with several distinct types of cutaneous lesion. In addition there was hypertrophy of the cubital nerves, inguinal adenopathy, and thermoanalgesia in parts of the legs. The diagnosis of leprosy was established from nasal scrapings and lymph node puncture, which showed numerous leprosy bacilli. A detailed clinical record is presented, with precise indication of the chemotherapy employed. The histology was that of lepromatous leprosy. In the course of 23 months of hospitalization, 7 reactional episodes occurred, 5 of them important, at times of erythema nodosum character, and at others of polymorphous erythema. There were numerous additional disturbances, of which renal manifestations appeared the most significant. These occurred with each attack of ENL, hematuria being a prominent symp-

tom. Renal biopsy failed, however, to disclose significant departures from the normal. There was no amyloidosis. The renal symptomatology was not like that occurring as a complication of chemotherapy. An allergic reaction was postulated.—E. R. LONG

Ishihara, S. Bulbar palsy appearing in leprosy patients. *La Lepro* 36 (1967) 199. (In Japanese, English summary).

The recent development of bulbar palsy in 4 male leprosy patients is reported. Two of them were lepromatous; the others were respectively of tuberculoid and borderline leprosy. At the beginning of the bulbar palsy the patients complained of headache, pain in the occipital region and the neck, toothache without caries, and double vision. They showed difficulty in speech, swallowing, and mastication. Paralysis of the soft palate and facial palsy were also seen. Disturbance of taste and marked salivation, increasing the anesthesia of the face, were recognized. The patients were treated mainly with cortisone, vitamin B12, and B1. Aspiration pneumonia was prevented by antibiotics. They have been improving progressively and have continued to feel well, except for one patient who complains of salivation. The causes of bulbar palsy in leprosy are not detectable, but the symptoms may be supposed to be from a leprosy reaction.—AUTHOR'S SUMMARY

Califano, A. and Cainelli, T. Ricerche reografiche sulla circolazione epatica nel lebbroso. [Rheographic researches on liver circulation in patients with leprosy.] *Minerva Derm.* 42 (1969) 454-458.

Twenty patients with lepromatous leprosy were studied by a rheographic technic in which flat electrodes were placed on the skin in front of or behind the liver and the electrical conductivity of the liver was measured simultaneously; from this measurement deduction could be made about the blood flow through the liver. In 8 of the patients (40%) the blood flow through the liver seemed to be normal, and in these cases there was little or no clinical evidence

for enlargement of the liver. In the other 12 patients, blood flow through the liver seemed to be much diminished, as shown by diminution in sphygmic amplitude and speed, flattening of the apex of the wave, and disappearance of the dirotic notch and wave. In most of these 12 patients the liver was moderately or greatly enlarged and the lability reaction was positive. It was not possible to detect a rheographic picture specific for lepromatous leprosy, but a distinction can be made between vascular lesions caused by leprosy and those caused by the toxicity of treatment (dapsone, thiambutosine, or sulfalene).—[Abstract by F. Hawking. *Trop. Dis. Bull.* 65 (1968) 639]

Uehara, Y. On fibrinolytic phenomenon in leprosy: With special reference to the fibrinolytic activity in the blood. *La Lepro* 37 (1968) 47-64 (In Japanese, English summary)

Seventy-six cases of leprosy, composed of 46 cases of lepromatous type (L-type) with erythema nodosum leprosum (ENL), 20 cases of L-type without ENL, 5 cases of tuberculoid macular type (Tm-type), and 5 cases of tuberculoid neural type (Tn-type), were examined in the study, in which attempts were made to measure the fibrinolytic activity in the blood, and clarify its pathophysiologic significance. In 10 L-type patients with ENL, the blood specimen was taken in each individual 3 times; first immediately after occurrence of ENL, second during its course of improvement, and third after its subsidence. In 5 L-type patients without ENL, the blood specimen was taken also 3 times; first immediately after the appearance of the nodes, second during its course of improvement following chemotherapy for the leprosy, and third during its stage of subsidence. The fibrinolytic activity in the blood was studied by Lewis and Ferguson's and Ratnoff's tests, and quantitatively, analyzing fibrinogen amounts, by Gramm's method. Examination was also made with a fibrin plate method in 15 cases. Among the 76 leprosy patients, 56 (73.7%) demonstrated increased activity of the blood FES. Blood

FES activity was highest in incidence of cases with increased activity in L-type patients with ENL (43 among 46 cases: 93.5%), Tm-type patients were second (4 among 5 cases: 80%), and L-type patients without ENL third (8 among 20 cases: 40%). In Tn-type patients, the incidence was only 20% (1 among 5 cases). This high incidence of increased blood FES activity in L-type patients with ENL was statistically significantly higher than that of the other patients (the L-type without ENL, Tm-type and Tn-type) and also than that of L-type patients without ENL alone. This significant difference was assumed to be due, as a rule, to the difference in degree of acute inflammatory signs. (1) Among the 76 cases, 32 (42.1%) had a decrease in fibrinogen amount. L-type patients with ENL demonstrated the highest incidence of cases with decreased fibrinogen (26 among 46 cases: 56.5%), then the L-type patients without ENL (5 among 20 cases: 25%), and then the Tm-type patients (1 among 5 cases: 20%). No cases were noted with decreased fibrinogen in the Tn-type. This high incidence of L-type patients with ENL was statistically significantly higher than the incidence in L-type patients without ENL. (2) Thirty-nine among the 76 cases (51.3%) demonstrated increased FES activity. L-type patients with ENL showed the highest incidence (33 among 46 cases: 71.7%). Next were the Tm-type patients (3 among 5 cases: 60%), and then L-type patients without ENL (3 among 20 cases: 15%). Tn-type patients revealed no increased FES activity. This high incidence of the L-type patients with ENL was statistically significantly higher than the incidence of the L-type patients without ENL. (3) Observations were made on the rise and fall of blood FES activity with the occurrence and improvement of ENL in L-type patients. First, a high degree of increased FES activity was noted (highly increased activity in both the plasmin and activator activity, a high incidence of cases with disturbance in the plasmin-antiplasmin balance, and a high incidence of cases with decreased fibrinogen amount) immediately after the occurrence of ENL. This increased FES activity, however, fell with

improvement of ENL, and finally disappeared with subsidence of the ENL. Simultaneously, the increased plasminogen value (the preparatory state for the blood FES activity) also disappeared. The rise and fall in blood FES activity was statistically significant with the improvement of ENL. (4) Observations were made also on the rise and fall of blood FES activity with the occurrence and improvement of the nodes in L-type patients without ENL. No increased blood FES activity was noted immediately after occurrence of the nodes. However, both the plasminogen value and the activator activity were statistically significantly increased at the stage of subsidence of the nodes following chemotherapy. Taking these results into consideration, the following assumptions were made: In L-type patients without ENL, blood FES activity is, as a rule, suppressed by the antiplasmin effect of the leprosy bacilli. However, with improvement of the nodes following chemotherapy, a preparatory state for the blood FES activity occurs gradually, which is due to decrease in the antiplasmin effect of the leprosy bacilli as well as increase in the plasminogen value. This preparatory state is considered to be generally completed in the subsidence stage of the nodes. Thus, when a "trigger" (activated activator) comes, blood FES activity is increased, which is surmised to be closely related with the occurrence of ENL.—E. R. LONG

Ishikawa, M. Putrescine in the blood of lepromatous leprosy patients. *La Lepro* 36 (1967) 238-239. (In Japanese, English summary)

Putrescine, which may be determined by two dimensional chromatography, is always observed in the blood of the lepromatous leprosy patient in whose skin *M. leprae* are found, but is not observed in the blood of the lepromatous or tuberculoid leprosy patient in whose skin no *M. leprae* are found. Consequently, putrescine is considered to be one of the metabolites of *M. leprae*.—

AUTHOR'S SUMMARY

Ishikawa, M. Glutamine in human blood after promine injection. *La Lepro* 36 (1967) 242-243. (In Japanese, English summary)

Promin reduces glutamine promptly to ornithine *in vitro*. But when Promin is injected intravenously, the glutamine in human blood does not react with it readily. In experiments reported, tests were made on 5 ml. samples of blood from patients with lepromatous leprosy. It was thought that the protein might be absorbed by albumin and erythrocytes in the blood.—E. R. LONG

Thiers, H. H., Bouillat, G., Bourrat, C. and Descos, L. Etude électromyographique de deux cas de lèpre nerveuse observés à la Clinique Dermatologique. [Electromyographic study of two cases of neural leprosy seen in the Dermatology Clinic.] *J. Med. de Lyon* 47 (1966) 1811-1813

Two case reports of leprosy patients are presented, one of a male Tunisian 41 years old, and the other of a male 22 years old born in Martinique. In the first case electromyography enabled the discovery of discrete neurogenic atrophy, not detectable clinically, in the regional distribution of the two cubital nerves, which were manifestly enlarged. The speed of conduction, 50 m/s, was within normal range. In the second case electromyography confirmed a neurogenic defect that was relatively discrete clinically. The figure of 39.5 m/s obtained at the level of the external popliteal nerve was slightly below that usually observed in normal subjects in the authors' laboratory. Some variation was observed in successive examinations in this case, manifested by some recovery of muscular force. The apparent paradox was explained on the basis of regression of the edematous infiltration. In summary, the authors note that electromyography may disclose discrete and even subclinical neurogenic defects. Systematic practice of the procedure will reveal nerve defect in leprosy at an early stage.—E. R. LONG

Mayama, A. Studies on erythema nodosum

leprosum (2nd report). Effects of proteolytic enzymes on serum protein of patients with leprosy. *La Lepro* 36 (1967) 207-211. (In Japanese, English summary)

Hydrolytic actions of various proteases (animal pepsin and trypsin; vegetable ananase, ficin and papain; bacterial and fungal pronase and prozyme) on serum protein fractions in leprosy were determined by microelectrophoresis. In most cases of lepromatous leprosy, especially in those with erythema nodosum leprosum, the digestion of serum proteins by proteases was remarkably stronger than in those with tuberculoid leprosy and in healthy persons. It was observed that proteolytic activities of trypsin and prozyme were stronger than those of any other proteases, and the hydrolytic activity became more pronounced by the cross addition of other proteases to serum proteins previously hydrolyzed with trypsin and prozyme. In lepromatous leprosy, the α macroglobulin and hemopexin were very easily digested by the enzymes. The haptoglobin, ceruloplasmin, transferrin and immunoglobulins, however, still remained moderately high after the treatment. The quantity of the antitrypsin and acid glycoprotein decreased slightly by proteolysis. However, even the immunoglobulins and antitrypsin were demonstrated to be strongly hydrolyzed by the proteases in all cases with erythema nodosum leprosum.—AUTHOR'S SUMMARY

Karat, A. B. A., Prathapkumar, C. and Rao, P. S. S. The aldehyde and antimony tests (gel and Chopra) in leprosy. *Indian J. Med. Sci.* 21 (1967) 538-545.

The well known aldehyde and antimony tests for kala azar are now regarded as nonspecific in character, indicating an altered content of protein components of serum with an increase in globulin content. Changes in plasma protein occur also in leprosy. The authors have now carried out tests with the above two reagents on patients with leprosy in South India. Serum from 100 patients, mostly adults, including 67 with lepromatous leprosy, 19 with tuber-

culoid, 8 with borderline and 6 with indeterminate leprosy were examined, and total protein, as well as the amount of the various globulin fractions, separated by electrophoresis, was determined. Because of the possible presence of *Leishmania* in these patients bone aspirates were examined for Leishman-Donovan bodies. Results are presented in tables and a significant relation between gelation and gamma globulin levels was observed. There was no specific pattern based on age or sex of the patients. Gel and antimony tests were invariably negative when the gamma globulin was under 2 gm. % by weight. Above 4 gm. % by weight all sera were positive in both tests. The authors observe that neither test depends upon total protein in globulin content of serum, and that they have no diagnostic significance in leprosy, but merely indicate changes in serum gamma globulin.—[Abstract by J. D. Fulton. *Trop. Dis. Bull.* 65 (1968) 637-638]

Vega-Nuñez, J. Invalidez por lepra. [Disability from leprosy.] Proc. III Mexican Congr. Dermatol., Monterrey, N. L., 1965, pp. 379-394.

Leprosy may cause disability in patients in both physical and social aspects. It is best to prevent this disability. For this it is necessary to educate patients properly about leprosy, including early diagnosis and the permanence of the patients in their own normal way of life. The rehabilitation must be in mental, physical and social aspects. Seven hundred thirty-nine cases at the Dermatologic Center of Morelia, Mexico, were studied by the author; among these 30% presented some form of incapacity. Males were more affected than females. Lepromatous cases showed more social incapacity, while T and I cases had more physical incapacity in the hands and feet. Two cases of blindness were observed. There were no cases of gynecomastia among these patients.—A. SAÚL

Chemotherapy

Garrod, J. M. B. and Ellard, G. A. Appearance of resistance during prolonged treatment of leprosy with thiambutosine. *Leprosy Rev.* 39 (1968) 113-117.

The authors report on the treatment of patients in the East African Leprosy Research Centre, Busia, Tororo, Uganda. Clinical and bacteriologic evidence is presented suggesting the appearance of resistance to thiambutosine in 3 patients from a group of 23 patients who had been treated with the drug for 24 to 45 months. Biochemical studies showed that 2 of these 3 patients absorbed the drug normally, but that the other patient absorbed an unusually small proportion of the dose. Resistance to thiambutosine developed after 28 and 44 months, respectively, in the 2 patients who absorbed the drug normally. It is therefore concluded that, although thiambutosine has a useful role to play in the treatment of leprosy, it would seem unwise to continue treatment with the drug for more than 2 years.—[From authors' summary]

Navarrete, Y. Quimioterapia de la lepra. Estudio comparativo de cinco medicamentos. [Chemotherapy of leprosy. Comparative study of 5 drugs.] Thesis, University of Mexico, 1967, 62 pp.

This thesis deals with the therapeutic evaluation of 5 drugs in lepromatous leprosy: viz., DPT (Ciba 1960), sulfamethoxy-pyridazine (SMP), Isoxyl, RO 4-4393 and DDS. Five groups of 10 patients were set up and clinical, bacteriologic and histologic changes were evaluated. DDS showed the most effective clinical and bacteriologic action; then came RO 4-4393, SMP, Ciba 1906 and, at the end, Isoxyl. From the histologic point of view, the most effective drug was RO 4-4393, followed by SMP and DDS. Leprosy reaction occurred in 60% of the patients treated with DDS, 50% of those treated with DPT and SMP, and 41% of those treated with RO 4-4393. *M. leprae* became resistant to DPT. The final conclusion was that, up to date, DDS is the most effective drug against leprosy

because of such advantages as low cost, absence of toxicity, and very good clinical and bacteriologic action.—A SAÚL

Perez-Suarez, G. and Barba-Rubio, J. La rifamicina en el tratamiento de la lepra. Estudio de dos casos. [Rifamycin in the treatment of leprosy. Study of two cases.] Proc. III Mexican Congr. Dermatol., Monterrey, N. L., 1965, pp. 357-359.

This paper deals with the use of this antibiotic in 2 lepromatous cases. The patients were males, respectively 29 and 38 years old. Both patients had had leprosy for 10 years. They were treated for 1 year and 2 months. Rifamycin has definite action against leprosy, but seems less active than sulfones, although clinical improvement is evident with the antibiotic. It is possible that resistance of bacilli to this drug occurs. Subclinical lepra reaction was observed.—A. SAÚL

Oswald, V. Reacção leprosa e talidomida. [Lepra reaction and thalidomide.] *Revista Pais (Portugal)* 7 (1968) 34.

The author reports the case of a patient with lepromatous leprosy of 48 years' duration, who was treated, after 3 months of constant lepra reactions, with 0.6 gm. of thalidomide daily for one week, with resultant disappearance not only of acute manifestations but also of cutaneous lesions, leaving the skin of normal appearance. During the ensuing 4 months the patient remained well.—F. CONTRERAS

Tarabini-Castellani, G. Tratamiento de las leprorreacciones con talidomida. [Treatment of lepra reactions with thalidomide.] *Rev. Leprol. (Fontilles)* 6 (1967) 719-723.

The author describes favorable results in 107 lepra reactions in 63 leprosy patients, all of them lepromatous with the exception of 5 tuberculoid cases. In 25 of the patients the result was reached within 7 days and in 15 within 10 days, while only 4 were treated more than 45 days. The drug used, that of Grunenthal, contains, besides thal-

idomide, caffeine, phenacetin and aspirin. The initial dose was 75 mgm. daily of thalidomide and the sustaining dose was 37.5 mgm. The results were rapid and obvious. In some cases only, lepra reactions reoccurred; these yielded to retreatment with thalidomide. The author notes that the use of this drug does not influence bacterioscopic positivity, but has a favorable influence on the specific cure.—F. CONTRERAS

Tarabini-Castellani, G. Sobre el uso del ácido epsilon amino caproico en el tratamiento de las leprorreacciones. [On the use of ϵ -amino caproic acid in the treatment of lepra reactions.] *Rev. Leprol. (Fontilles)* 6 (1967) 745-749.

The author has studied the effect of EACA, the drug designated in the title, in 12 cases of lepra reaction, finding a rapid and intense curative action with attenuation and disappearance of symptoms with an average daily dose of 1.4 gm. In 10 cases complete regression occurred, followed by great improvement. EACA is believed to be effective in forestalling the reappearance of lepra reactions.—F. CONTRERAS

Tarle, S. F. Tratamento experimental da lepra com RO-4-4393. [Experimental treatment of leprosy with RO-4-4393.] *Publ. Cent. Est. Leprol. (Parana)* 7 (1967) 12-16.

In antileprosy therapy the author used a sulfa drug of prolonged action, Ro-4-4393 (Fanisul, Roche), in a group of 6 lepromatous patients, in single doses of 1.5 to 2.0 gm. per week. A recession of the bacilloscopic indices was noted in practically all 6, the action of the drug being comparable with that of sulfones. Side effects and acute manifestations were almost absent, and the drug offered the patients the convenience of a single weekly dose. One patient who had shown an aggravation of heart insufficiency due to the use of sulfone, when submitted to this treatment showed excellent general health with no heart insufficiency.—[From author's summary]

Imkamp, F. M. J. H. A treatment of corticosteroid-dependent lepromatous patients in persistent erythema nodosum leprosum. A clinical evaluation of G.30320 (B.663). *Leprosy Rev.* **39** (1968) 119-125.

The author reports from the Liteta Leprosarium, Zambia, on an investigation on the effect of B.663 on patients suffering from persistent erythema nodosum leprosum (ENL). A series consisting of 18 lepromatous patients is reported. All had severe ENL, which was just controllable and only with large doses of corticosteroids. All were initially bed-ridden, severely ill, and steroid-dependent. After an average period of 2 years and 7 months of corticosteroid treatment, they began treatment with G.30320 (B.663) at a dose level of 100 mgm. per day, except for patient No. 1, who began with 200 mgm. daily. It was then possible to stop or withdraw steroids in all patients. Six patients had no recurrence of ENL; 7 patients had some recurrence, which was controlled by a temporary increase of B.663. Five patients were given prednisolone together with 100 mgm. B.663 daily, for relapses early in the trial, but subsequent relapses were controlled by an increase of B.663 dosage alone. Seventeen patients were ultimately controlled with a maintenance dose of 100 mgm. of B.663 per day; one patient required 300 mgm. per day as a maintenance dose. Over a period of 14-18 months, all patients showed a steady improvement in the BI and MI, except for 2 whose BI remained stationary. The patients showed marked clinical improvement. All are now leading a normal life, and some are employed in the leprosarium. Side effects were minimal, and the hyperpigmentation that developed was cheerfully accepted. All patients are most enthusiastic about B.663 treatment. It is believed that this drug represents a real advance in the treatment of ENL in that it will control persistent recurrence of such a degree as otherwise to require high dosages of corticosteroids, at the same time providing active chemotherapy. Three tables give detailed information.—[From author's summary]

Singh, I., Srivastava, M. C. and Anand,

L. C. The anti-inflammatory effect of Indomethacin in lepromatous leprosy. *Leprosy Rev.* **39** (1968) 127-133.

The authors set out to assess the value of Indomethacin, an anti-inflammatory agent in lepromatous leprosy, as to its value in hastening the rate of bacterial clearance by antileprotic drugs. The patients were 20 Indians, all males, service personnel, 23-40 years of age. The duration of lepromatous leprosy was 1-10 months in 19 of the patients, and 18 months in the 20th. All were bacteriologically positive. The patients were paired, one group receiving DDS alone, the other group DDS and Indomethacin. In a controlled (but not blind) trial in 10 patients with bacteriologically positive lepromatous leprosy, within 12 weeks Indomethacin produced striking improvement with respect to skin lesions, edema of limbs, healing of ulcers, and regrowth of eyebrows. Anesthesia and nerve involvement showed negligible response, although comparison of the two groups of patients indicates that improvement in these parameters may occur in time with further Indomethacin treatment. Four of the 10 patients on Indomethacin became bacteriologically negative, a fact that is considered significant for the period of treatment.—N. D. FRASER

Lew, J., Chang, C. H. and Choi, T. K. Chemotherapy of leprosy with newly synthesized thiocarbanilides. *Yonsei Med. J.* **7** (1966) 52-57.

Sixteen leprosy patients (15 lepromatous and 1 tuberculoid) were treated orally with a thiocarbanilide newly synthesized by the authors, designated tentatively as L-4. Clinical improvement and decrease in bacterial index were noted in the patients after relatively short periods of treatment. The drug can be administered safely up to a maximum daily dose of 500 mgm., without significant side reactions. It is suggested that the drug could be used in patients in lepra reaction.—[From authors' summary]

Sahu, K. C. and Jena, D. C. Studies on the use of strontium bromide (Ezkebrol) in eczematoid conditions of filariasis and

reaction of leprosy. *Indian Practitioner* 20 (1967) 121-129.

The basis of the study is the suppressive effect of strontium bromide on allergic manifestations, in this case the allergies of filariasis and lepra reaction. In 13 reactional cases of leprosy, including erythema nodosum leprosum, the drug response was satisfactory. The response in the more progressive reaction of lepromatous leprosy needs further study. In cases of reaction in the tuberculoid variety the response to the drug was not so unsatisfactory and also needs further study.—[From authors' summary]

Stuart, J. Too much of a good thing. *Papua-New Guinea Med. J.* 10 (1967) 97.

In an attempt to simplify their treatment and to avoid taking dapsone tablets twice a week 3 patients suffering from leprosy in New Guinea obtained a supply of the drug and each took a large single dose. One boy aged 10 years took 10 tablets (500 mgm.) without ill effect, but 2 patients aged 16 years took 24 and 29 tablets respectively, which resulted in coma, jaundice, severe abdominal pain and hematuria. One of the patients died. It is suggested that dapsone should be kept under lock and key and that its dangers should be explained to paramedical or lay workers who administer much of the domiciliary treatment in remote areas.—[Abstract by F. I. C. Apted, *Trop. Dis. Bull.* 65 (1968) 772]

Hokibara, H. Treatment of therapy-resistant leprosy (II). Course after treatment, including the shift in immunological activity method. *La Lepro* 36 (1967) 212-217. (In Japanese, English summary)

A total of 67 cases of leprosy, resistant to therapeutic agents heretofore available, were treated by various methods over a period of one year and a definite shift in the condition from p to r and an improvement in 86.5% of the skin eruptions were found; 30 of the cases became bacterianegative. All 9 cases treated by homogeneous, healthy skin grafts (including 2 cases

of follow-up test) showed improvement in the skin eruptions, and a trend toward reduction in the rate of isolation of bacilli was observed. The delay in rejection of the skin grafts was believed to be due to the depressed immunologic activity in leprosy. Although various problems, such as the effect of repeated skin grafts as revealed by the lepromin reaction still must be clarified, it is considered that a shift in immunologic action is shown by this method. The results suggest that not only chemotherapy but also treatment of the host should be studied in the future. In the treatment of leprosy, detailed investigation of prior therapy is required, especially in old cases, and although individual differences are great a rise in therapeutic effect may be anticipated on close cooperation between the patient and the doctor. This will be further accelerated by measures, such as shift in immunologic activity, in the host. At the present stage it is felt that the term therapy-resistant leprosy is not entirely acceptable.—AUTHOR'S SUMMARY.

French, T. M. An injection solution of dapsone. *Leprosy Rev.* 39 (1968) 171.

The author gives details for the preparation of DDS in a water-miscible vehicle, suitable for intramuscular injection.—N. D. FRASER

Glazko, A. J., Dill, W. A., Montalbo, R. G. and Holmes, E. L. A new analytical procedure for dapsone. Application to blood-level and urinary-excretion studies in normal men. *American J. Trop. Med. and Hyg.* 17 (1968) No. 3. 464-473.

A new analytic procedure for the assay of DDS was based upon extraction into organic solvents and measurement of fluorescence in anhydrous ethyl acetate. Men receiving single 100 mgm. oral doses of DDS showed peak plasma levels of 1.1 to 1.5 μ gm. per ml. in 2 to 4 hours; the levels then dropped to half-values in 20.6 hours, and to a few millimicrograms per ml. by the 5th day. Intramuscular doses of DADDS administered in an oil vehicle produced peak plasma levels of about 0.06

$\mu\text{gm.}$ per ml. in 6 days, and "plateau" levels of 0.035 to 0.030 $\mu\text{gm.}$ per ml. within 2 weeks. This level was maintained for about 60 days after dose, and dropped slowly thereafter with an apparent biologic half-life of 42.6 days. The decrease in plasma levels occurred some 50-fold more slowly

ly with DADDS than with orally administered DDS. The urinary excretion of "total" DDS ran parallel to the blood levels in both studies; it accounted for 68% of the oral dose of DDS and about 54% of the intramuscular doses of DADDS.—AUTHORS' SUMMARY

Surgical Treatment and Surgical Specialties

Karat, S., Karat, A. B. A. and Foster, R. Radiological changes in bones of the limbs in leprosy. *Leprosy Rev.* 39 (1968) 147-169.

Fifty-nine photographs and x-ray pictures illustrate radiologic changes observed in the limbs of leprosy patients at the Schieffelin Leprosy Research Sanatorium, Karigiri, S. India. The authors summarize their results as follows: Radiologic changes are broadly classified as primary and secondary. Primary changes are seen in patients with either lepromatous or nonlepromatous leprosy. Secondary changes, the result of anesthesia and/or paralysis, are outlined. Changes in individual bones due to trophic ulceration, as well as general patterns of destruction due to plantar ulcers in the foot, are described. The effect of paralytic deformities in anesthetic limbs is pointed out. The need for maintaining architectural integrity of the foot is emphasized, and illustrated with examples. Fractures and their etiology in anesthetic limbs are outlined and illustrated. An attempt is made to correlate radiologic changes with the clinical course.—N. D. FRASER

Furness, M. A., Karat, A. B. A. and Karat, S. Deformity in the reactive phases in leprosy. *Leprosy Rev.* 39 (1968) 135-141.

The authors state that this paper attempts to study the etiology of deformity occurring during the reactive phases of lepromatous leprosy. It also presents the comprehensive physiotherapeutic management used to prevent, minimize and correct deformity in this period. The detailed study of 42 patients who were admitted to

the Schieffelin Leprosy Research Sanatorium for treatment during the reactive phases of the disease is presented, with 8 tables and 3 photographs; this is followed by detailed advice as to management with particular reference to local physiotherapeutic measures. The authors conclude that if competent physiotherapeutic care is given, both in the acute phase and during the phase of recovery, deformity is prevented and function restored. The accumulated effect of repeated episodes of reaction is tissue damage and diminished function, especially in the small joints of the fingers, and peripheral nerve damage. Complete correction of residual deformity should be attempted during quiescent periods in those patients who suffer from recurrent bouts of reaction. Complications arising in 42 consecutive patients with lepromatous leprosy during reactive phases of the disease are reviewed. Damage to skin, nerve, muscle, bone and joints is recorded, and an attempt is made to study the etiology of deformity relative to these complications. Physiotherapeutic care of the patient during the acute phase and the phase of recovery is described. Specific physiotherapeutic management of stiff joints, "stasis hand," and "stasis foot," ulcerations, neuritis and osteoporosis have also been detailed. Although imperceptible progressive damage and reduced function in muscles and nerves may occur with repeated episodes of reaction, careful comprehensive physiotherapeutic care will minimize the functional loss.—N. D. FRASER

Basset, A., Grosshans, E., Heid, E., Maleville, J. and Dakkel, R. Acropathie

ulcero-mutilante symptomatique d'une lèpre tuberculoïde. [Ulcerο-mutilating symptοmatic acropathy in a patient with tuberculoid leprosy.] Bull. Soc. Dermatol. Syphilig. **75** (1968) 98-99.

Case report. A 57 year old farmer, who had spent some weeks in Belgrade and Naples in 1939-1945, entered a surgical clinic for etiologic study of symmetric perforating plantar ulcers. The patient had had Raynaud's syndrome of the toes for 20 years. In 1963 he had a transmetatarsal amputation of the left foot for osteoarthritis of the great toe with plantar ulcer. He was readmitted in 1965 for a perforating ulcer on the opposite side and new, torpid ulceration at the stump of the previous operation. Diabetes, syphilis and other diseases were ruled out. A diagnosis of tuberculoid leprosy without cutaneous manifestations was made on the basis of a certain amount of hyperthesia of each foot without motor or reflex disturbance. Nerve biopsies disclosed intense perineural fibrosis of the external popliteal and posterior tibial nerves without acid-fast bacilli. The patient was treated for 2 years with sulfamethoxypyridazine (750 mgm. Sultirene every 2 days), and later by surgical neurolyses, with resultant stabilization of the plantar ulcers and partial restoration of sensitivity to pain.—E. R. LONG

Parikh, A. C., Ganapati, R., Kothare, K. B. and Divekar, S. C. Decompression of the ulnar and median nerves in leprosy neuritis. *Leprosy Rev.* **39** (1968) 143-146.

This study was undertaken in the Tata Department of Plastic Surgery, J. J. Group of Hospitals, Bombay, in order to assess the value of partial decompression of the ulnar and median nerves in leprosy to relieve pain due to neuritis and improve muscle function. Three photographs show the advanced degree of caseation that may take place, and the calcification that may occur inside the nerve sheath. Follow-up study of 13 surgically decompressed patients with severe ulnar and median neuritis is presented. In all patients except 3 pain was completely relieved; improvement in mus-

cle function was seen in only one patient, and 4 patients who had visible caseation remained unchanged. Three patients with progressive nerve lesions became progressively worse after surgery.—N. D. FRASER

Arakawa, I. Eyebrow-plasty with single-hair-transplant for alopecia leprosa. *La Lepro* **36** (1967) 218-224. (In Japanese, English summary)

There are various methods for the reconstruction of alopecia leprosa of the eyebrow, and among them, eyebrow plasty with single-hair-transplant, by which the form of the brow and the hair stream can be controlled, appears to be most satisfactory. The method is not popular, however, because of its complexity and inefficiency. In the eyebrow a convergent stream is produced by an upward and a downward hair stream. The shape of the eyebrow can be classified into several types according to the intensity of the accent of the superior edge of the eyebrow and the axis shape with the convergent stream as the axis. By planning the order of implantation of hair with the axis as the base, the desired shape of the brow and the hair stream can be readily and accurately produced. The hair-transplant must be carefully prepared without damaging the hair-follicle end-bulb and then carefully embedded. For this purpose, the use of cold physiologic saline is advantageous: softening of the hair is prevented, so that optimal hardness is maintained, making manipulation easy. In this way a regular plan of procedure has been set up with respect to (1) preparation of the hair-transplant, (2) method of implantation, (3) design of the eyebrow shape and (4) order of implantation. With this procedure the defects of eyebrow-plasty with single-hair-transplant can be overcome and the advantages further enhanced; by following it closely, satisfactory results have been obtained.—AUTHOR'S SUMMARY

Garus, Y. I. On the question of early diagnosis of iritis leprotica. *Ophthalmol. J.* (1968) No. 3, 201-205.

Among more than 600 patients with lep-

rosy who were subjected to examination, 24 patients with lepromatous type, predominantly young, with disease prolonged up to 10 years, and of unfavorable course, showed filiform formations in the anterior chamber (30 eyes), which were fixed to the pupillary margin or to the anterior surface of the iris. In 15 eyes prior to the appearance of these filiform formations no clinical signs of leprosy were observed, while in the other 15 eyes moderately pronounced lesions were found in the anterior segment of the eye. In some cases opacification of the aqueous humor could be observed; this preceded the appearance of the filiform formations, which appeared to represent organized exudations. In most patients, within 1 to 4 years, a complete or partial resolution of the filaments took place, and relatively early well known signs

of leptotic iritis supervened. These were slight deformations and rigidity of pupils, and mushroom-like pigment growth in the pupillary area (most frequently within 2 to 3 years). In those cases in which there were lesions of the eye, and before the appearance of filiform formations in the anterior chamber, further progression of lesions of the eye or appearance of new ones took place. A case of very early involvement of the eye in a leprosy process in a 7 year old boy is presented. It is believed that filiform formations in the anterior chamber of the eye in the lepromatous patients, mentioned above, are pathognomonic for eye leprosy, and constitute one of the earliest clinical signs of lepromatous iritis or a sign of already set progression of a specific process in the eye.—AUTHOR'S SUMMARY.

Pathology

Rueda P., L. A. Citodiagnóstico en la lepra. [Cytodiagnosis in leprosy.] *Medna Cutanea* 1 (1966) 23-27.

The technic to obtain smears for cytodiagnosis is described: 1 small piece of biopsy without any subcutaneous fat is placed between two slides and with a certain pressure and rotation a uniform smear is obtained. Afterward the smear is stained with the Giemsa or Ziehl-Neelsen method. The cytology of the different forms of leprosy has been described. In 73 lepromatous cases, acid-fast bacilli could be demonstrated 73 times with cytodiagnosis, 60 times in smears obtained by the scraped incision method, and 56 times in histologic slides. In 33 nonlepromatous cases, acid-fast bacilli have been found, 4 times in scraped incision smears, 4 times in histologic slides and 16 times in cytodiagnosis smears.—[From author's summary]

Jadin, M., Francois, J., Bisoux, M., Languillon, J. and Morris R. Développement intranucléaire de *Mycobacterium leprae* dans les cellules histiocytaires chez l'animal. [Intranuclear development of

M. leprae in animal histiocytic cells.] *Bull. Acad. Nat. Med.* 152 (1968) 89-91.

M. leprae, multiplying in semisynthetic media (Hanks, Parker and Eagle media) for diploid cells, remain alive and can maintain themselves in histiocytes in the peritoneal cavity in mice and hamsters. They are found in the cytoplasm and in the nuclei of phagocytic cells. This observation confirms what we have learned previously, and our demonstration of the presence of *M. leprae* in the nuclei of dermoid cells in culture.—[From authors' summary]

Murikami, Y. Radiological and histopathological studies on bone changes of feet in leprosy patients. *J. Kumamoto Med. Soc.* 41 (1967) 437-474. (In Japanese, English summary)

Five feet of lepromatous leprosy patients and five of tuberculoid patients were compared with respect to radiographic and histopathologic findings in large preparations of bone. Biopsies were made on some lepromatous patients. Radiography disclosed lepromatous granulation tissue in all

areas with specific bone changes, and most areas with nonspecific change, such as Charcot-like joint, marked bone atrophy, and irregular and sequestrum-like periosteal thickening. Infiltration of lepromatous granulation took place chiefly between articular cartilage and periosteum and into the bone marrow. In general it accompanied blood vessels. No necrosis or caseation was observed. In tuberculoid leprosy no specific bone changes were observed, and less histopathologic change was evident. In biopsy specimens leprosy bacilli were abundant, and globi were found in lepromatous granulation tissue.—[From author's abstract]

Martins, S. R. C. and Seabra Santos, H. Carcinoma espinho-celular en ulcera plantar de lepra. [Prickle cell carcinoma in a plantar ulcer in leprosy.] *Rovisco Pais (Portugal)* 7 (1968) 10.

The authors describe the reaction or carcinomatous transformation of a leprotic plantar ulcer located in the anterior half of the outer side of the foot in a patient with lepromatous disease.—F. CONTRERAS

Seabra Santos, H. and Martins, S. R. C. Querato-acantoma en doente de lepra. [Keratoacanthoma in a leprosy patient.] *Rovisco Pais (Portugal)* 7 (1968) 3.

The author reports a case of keratoacanthoma in a leprosy patient, and on review of cutaneous tumors in leprosy suggest it is the first case published.—F. CONTRERAS

Matsuo, Y. Transmission of *Mycobacterium leprae* to mouse footpads. Part 3. Effect of some drugs on multiplication of *M. leprae* in mouse footpads. *La Lepro* 36 (1967) 225-231, (In Japanese, English summary)

Mycobacterium leprae was obtained from a relapsed patient with lepromatous leprosy under treatment with 5,200 mgm. of Ciba 1906 for the first 13 weeks and thereafter with 3,100 mgm. of DDS for 2 months. The number of acid-fast bacteria was counted by the microspot method. CFI mice were inoculated with 5.2×10^3 *M.*

leprae in the left hind foot pad. The drug treatment was commenced 53 days and continued up to 266 days after inoculation. Sulfone (dihydrazinodiphenyl sulfone) and isoniazid were given in doses of 1 mgm. orally, and Ciba 1906 and streptomycin, 4 mgm. intragluteally, were given at a time. The drug administration was carried out 6 times a week for the first 5 weeks, and thereafter 3 times a week. Harvests were made at the 176th, 220th, and 266th day of inoculation. Two or three mice from each group were killed, and the inoculated foot pads pooled for each harvest. Multiplication of *M. leprae* in the untreated controls proceeded as expected. Sulfone gave almost complete and continuous suppression of multiplication. Ciba 1906 was found to be as effective as sulfone until 220 days after inoculation, but was less effective later. Streptomycin suppressed multiplication moderately during the early stage of multiplication, and thereafter reduced the number of bacteria as effectively as sulfone. Isoniazid did not suppress multiplication in the early stage, but later prevented further bacillary increase.—AUTHOR'S SUMMARY

Maeda, M., Nakamura, K., Maruyama, K. and Matsumoto, I. Multiplication of *Mycobacterium leprae* in the footpads of mice. *La Lepro* 37 (1968) 15-24 (In Japanese, English summary)

M. leprae was isolated from lepromas of Japanese leprosy patients of lepromatous type by using the mice of some Japanese strains. At present 9 strains of *M. leprae* are maintained for more than 4 generations and 7 strains of *M. leprae* are kept under investigation. In 9 strains of *M. leprae*, 7 strains were isolated from untreated patients and 2 from treated patients. An easy method was used for counting acid-fast bacilli. An emulsion of tissue of mouse foot pad was made by use of pestle and mortar, and one drop of this emulsion was placed on each slide-glass by using the pestle. The number of acid-fast bacilli in this smear was counted microscopically and the average bacillary count could be obtained. Multiplication of bacilli was indicated by the appearance of globus-like findings and this

growth was limited in the foot pad of the mouse. The transmission of *M. leprae* to mice of the next generation may be tried about 6 months after the infection and a bacillary number of more than 10^4 in each foot pad of mouse may be required in subtransmission, because many killed bacilli might be contained in this emulsion of tissue of mouse foot pad. *M. leprae* has been increased by the administration of cortisone, but could not be influenced by injection with Mitomycin C, 6-mercaptopurine and 2-mercaptoethanol. The subcutaneous injection of adjuvant into the foot pads of mice inhibited the multiplication of *M. leprae*.—AUTHORS' SUMMARY

Gay Prieto, J. Transmisión de la lepra humana a la alantoides del embrión de pollo. [Transmission of human leprosy in the chick embryo.] *Anais Inst. Med. Trop.* **22** (1965) 179-183.

Visible nodular lesions in the allantois of chickens inoculated with different types of human leprosy were studied. Histologically, these lesions consisted of leprotic granulomas with vacuolated cells, inside which

were found amorphous masses and acid-resistant particles. Electronic microscope observation demonstrated the existence of some bacilli and showed a structure of the amorphous masses, and acid-resistant particles that suggest a cyclic development of *M. leprae*, which, in some circumstances, may originate large L forms, spheroblasts and probably filtrable particles.—[From author's summary]

Garrington, G. E. Pulp death in a patient with lepromatous leprosy. *Oral Surg., Oral Med. & Oral Path.* **25** (1968) 427-434.

A patient with lepromatous leprosy had dental symptoms in the maxillary anterior teeth. Subsequent histologic examination of an extirpated pulp and of an extracted tooth showed *M. leprae* in the material from the pulp chamber as well as in the dental tubuli. Determination of the most appropriate course of dental management (endodontic vs. exodontic) for patients with dental symptoms caused by leprosy is not possible at this time.—AUTHOR'S SUMMARY

Bacteriology and Immunology

Sato, S. Some problems on the fine structure of *M. leprae* and *M. lepraemurium*. *La Lepro* **37** (1968) 1-11, (In Japanese, English summary)

M. leprae and *M. lepraemurium* have shown various features under the electron microscope in association with clinical states of the host, since they are tissue-dependent mycobacteria. (1) *Differences between human and murine lepromas*: Lack in osmiophilic foamy structure, diffuse and random distribution of bacilli, together with irregular arrangement of microglobi, less intimate relationship to lysosomes, fine fibrinous substance in microglobi, and far less tendency of bacilli to degeneration, etc., were pointed out for discrimination of murine from human leprosy. (2) *Degeneration of bacilli*: Poorly shaped and faintly stained bacilli show

various changes in their consistency with or without swelling of the cell body under the electron microscope, viz., from mottled, beaded, fragmented, vague figures to ghost forms. Cell walls are most resistant, remaining to the last stage of the decomposition. (3) *Peripheral halo*: The presence of a thin and transparent zone surrounding a bacillary body is well known. Besides this, a homogeneously dense zone, varied in thickness, was at times seen surrounding the bacillary body. (4) *Surface structure of M. leprae*: Fine fibrous networks resembling the skin of a melon was clearly shown on the surface of the envelope of *M. leprae* by negative staining (PTA). The results obtained by shadowing technic (Cr and Pt-Pd) were not so satisfactory, showing a different pattern from those obtained by negative staining. (5) *Intracytoplasmic membranous organelles (ICM) or mes-*

osomes and clinical states: In reactional states, in particular in acute lepromatization, *M. leprae* showed various changes in the development of mesosomal apparatus, producing a bundle of tubule-like ICM's running straight or winding along the axis, or making a lump of rolled tubules; some of them occupied the whole width of the bacillus or made concentric circles in transverse sections. On the other hand, many spore-like bodies with a double membrane and central dense part, found just beneath the cell wall, were in various sizes from 20 to 400 m μ in diameter. (6) *Homogenous body*: This body seems to be characteristic of mycobacteria dependent on tissue cells. Its appearance seemed closely associated with clinical states of the host. These bodies were encountered very often in *M. lepraemurium*. (7) *Formation of a lumen in the cytoplasm*: In materials in reactional phase an oval or round shaped hole 100-200 m μ in diameter often appeared punching through the cytoplasm. The hole was bordered with double membranes. Rarely a lumen even 200 x 800 m μ in diameter was formed. *M. lepraemurium* was shown more often to form similar organelles. Whether they are artifacts or not remains for future study. (8) *Mode of cell division*: Several modifications were seen even in a transverse fission, which is the usual mode of cell division. *M. lepraemurium* produced a protective sheath wrapping the site of fission, which formed a homogeneously dense ring, disappearing after completion of cell division. Typical branching was demonstrated in 2 human and 1 murine bacilli. (9) *Enzyme activity*: Reduction phenomenon was clearly shown in thin-sectioned *M. lepraemurium* in lepromas of rats injected with K₂TeO₃ into the leproma or intravenously. The phenomenon was also positive *in vitro*. The activity was found at the cell wall and in cytoplasm, but was not strong in mesosomes. K₂TeO₃ injected into lepromas of 4 patients, could not be demonstrated in *M. leprae*. *ATP-ase*: This activity was proved in both *M. leprae* and in *M. lepraemurium*, being shown as lead precipitations in cytoplasm, especially in the homogeneous body but not especially strong in mesosomes. *ATP-ase* and *SDH-ase*: *M. lepraemurium* were

shown to have both activities, which were stronger, in particular, in mesosomes. (10) *Ribosomal fraction*: A series of experiments were conducted by repeated separation centrifugations, using *M. platypocilus* and *M. marinum*, and concentrated *M. lepraemurium* after disintegration through a French pressure cell or Ribi's apparatus. The ribosomal fraction of every specimen found in the supernates of the last 55,000 rpm (223,209 g) centrifugation was found to be positive for orcin- and negative for diphenylamine-tests, and found to contain particles 150-1,000 Å in diameter by electron microscopy. The fraction of *M. platypocilus* and *M. marinum* showed a peak at 340 m μ wave-length in spectrophotometry, and was found to consist of 33.1 S, 44.4 S and 59.1 S components. Examination of the absorption curve of the fraction of *M. lepraemurium*, and measurement of the "S"-value could not be performed because of scarcity in *M. lepraemurium* harvested by concentration.—[From author's summary]

Nakamura, M. Elongation of *M. lepraemurium in vitro*. *La Lepro* 37 (1968) 11-14. (In Japanese, English summary)

Elongation of *M. lepraemurium in vitro*, first described by Hart and Valentine, is interesting in studies of cultivation of *M. lepraemurium* in cell-free media, but has two disadvantages in centrifugation for collecting the bacilli and deformation of the bacilli by centrifugation. In order to avoid these disadvantages a slide culture method, which has been employed routinely for detecting the growth of tubercle bacilli, was introduced for observation of elongation of *M. lepraemurium in vitro*. The slide culture method proved a simple and available method, and the elongation of *M. lepraemurium* reported by Hart and Valentine was reconfirmed by this method. Elongation occurred especially at pH 6 of the medium. A relationship between elongation and infectious activity was studied. The following relation might be presumed: Elongation of the bacilli appeared to be a first step of fission of the bacilli, until 15 days' incubation in the medium at pH 6, but thereafter elongation might indicate

degenerative deformation of the bacilli, because infectious activity of the bacilli was retained up to 15 days' incubation in the medium at pH 6 and no infectious activity remained after 30 days' incubation.—[From author's summary]

Biryukova, S. V. Détermination de la viabilité des mycobactéries de la lèpre à l'aide du procédé cytochimique. [Cytochemical staining method for determining viability of *Mycobacterium leprae*.] Problemy Tuberk. **45** (1967) 64-47.

A staining method for *M. leprae* is described, which enables a differentiation between viable and nonviable organisms. Films from examined material are prepared in the usual way and fixed over a flame (short exposure to the heat does not affect the staining properties of viable bacteria). Then the film is stained with 1% malachite green warmed to 70°C. The stain is kept on the film for 5-10 minutes at room temperature. Afterward it is washed in water and stained with fuchsin (aqueous solution) for 2-5 minutes. Next the stained film is decolorized with 8% nitric acid, washed in water and dried. Viable bacteria appear as green and nonviable as red bacilli. The structural changes in DNA in nonviable bacteria are related to the loss of ability to retain the first stain. The author carried out experiments on white mice infected with *M. leprae* and by this method found a significant increase of nonviable organisms in animals treated with antimycobacterial drugs (Solutulphol and ethionamide). Owing to difficulties in the cultivation of *M. leprae* this staining method could be used in the evaluation of the effects of chemotherapy in leprosy.—[Abstract by W. Odrzywolski, *Trop. Dis. Bull.* **65** (1968) 769-770]

Matsuo, Y. Enumeration of *Mycobacterium lepraemurium* by the microspot method. Japanese J. Microbiol. **4** (1967) 263-268.

Known numbers of *M. lepraemurium* were inoculated into the foot pads of 10 mice. Thirty minutes later the bacteria were harvested from each mouse and counted by the microspot method. The per-

cent of the original inoculum recovered ranged from 82.5 to 105.4. The difference between the number of bacilli inoculated into a mouse and the number recovered was analyzed statistically. Among the 10 mice this difference was not significant in 7, but significant in the remaining 3. The facility with which *M. lepraemurium* can be counted by the micro-spot method should eliminate much of the labor in experimental leprosy research.—AUTHOR'S ABSTRACT

Matsuo, Y. Transmission of *M. leprae* to mouse foot pads. Part 4. Effect of vaccination on multiplication of *M. leprae* in mouse foot pads. La Lepro **36** (1967) 232-237. (In Japanese, English summary)

Three groups of CFI mice were vaccinated intramuscularly in the back 42 days before challenge with *M. leprae*, and an additional 3 groups 48 days after challenge. The other group constituted the unvaccinated controls. All the mice were inoculated with $(4.2 \pm 0.2) \times 10^3$ *M. leprae* in the left hind foot pads. When the vaccines were given before challenge, living BCG (1 mgm./wet weight, 6.8×10^7 viable units) was the most effective one and provided a continuing suppression of multiplication of *M. leprae* in the mouse foot pads. Heat-killed vaccine of *M. lepraemurium* (the Kurume-42 strain, 7.3×10^7) also provided a continuous suppression, but less so than BCG. Vaccination with heat-killed *M. tuberculosis* (H37Rv, 2 mgm./wet weight) delayed multiplication, but did not produce a continuing type of suppression. When the vaccines were given after challenge, BCG was the sole effective agent, but far less so than when given before challenge.—AUTHOR'S SUMMARY

Pedley, J. C. The presence of *M. leprae* in the breast secretion of a nonlactating woman with lepromatous leprosy. Leprosy Rev. **39** (1968) 111-112.

The author reports from Tansen, Nepal, on finding great numbers of *M. leprae* in the breast secretion of a nonlactating wom-

an, 60 years of age, suffering from highly active and untreated lepromatous leprosy. Two photomicrographs from the Leprosy Study Centre, London, illustrate leprosy bacilli packed in macrophages. In two other young nonlactating women with active untreated lepromatous leprosy, who had borne children, acid-fast bacilli were found in the breast secretion in scanty numbers. These findings provide further evidence that *M. leprae* may be present in human milk of patients with active lepromatous leprosy.—N D. FRASIER

Tello, E. La punción medular en la lepra. Investigación de bacillos. [Bone marrow puncture in leprosy. Investigation of bacilli.] Rev. Fac. Cienc. Med. (Córdoba) 24 (1966) 275-279.

Leprosy bacilli should be sought in bone marrow puncture only in clinically lepromatous cases in which the bacilli have not been found in skin or nasal scrapings. This rule is important in its relation to the discharge of patients from leprosy colonies. In other conditions marrow puncture is believed not necessary.—(From author's summary)

Gay Prieto, J., González, G. and Alonso Puertas, M. L. Las formas sub-microscópicas del *M. leprae*. [Submicroscopic forms of *M. leprae*.] Medna Cutanea 2 (1967) 51-68.

The transmission of different types of human leprosy, lepromatous, tuberculoid and indeterminate, into the chorioallantoic membrane of chicken embryos is described. Inoculation of material provokes the formation of yellowish nodules umbilicated in the center in the allantois of the chicken. These could be transmitted in serial form, in one case up to the 14th passage. Histologically these nodules are composed initially of a dense accumulation of vacuolated, histiocytic cells, similar to those of human leprosy. After the 6th or 7th passage, this structure changes into an accumulation of the histiocyte leprosy of Wade. Only by inoculating bacillary material can one observe any acid-fast bacilli in the first passage and, after the 3rd or 4th

passage, only acid-fast granules and some partially acid-fast material in spherical forms that are larger and irregular. With the electron microscope 3 types of formation can be observed: (1) ovoid bodies, wrapped in membranes, similar to those described by Imaeda in experimental hamster leprosy, which are, perhaps, as this author maintains, degenerated bacilli, (2) formations wrapped in a clearly visible membrane, containing very dark spherical or ovoid forms which could conceivably be large L forms and (3) rounded particles, dark-centered, and surrounded by a light marginal zone, virus-like and possibly small L forms. In bacteriologically positive human leprosy one observes, above all, changes in the mitochondria, which lose their cristae, and myelin formations, particularly intense in lepromatous leprosy. The ultra structure of incipient tuberculoid or indeterminate lesions, in which no acid-fast bacilli appear, but only acid-fast dust, is described. Membrane-wrapped forms are to be found, containing tiny, very dark spherical bodies. At numerous points of the cytoplasm, these forms are loose-floating and almost identical with the virus-like particles observed in profusion in experimental leprosy of the allantois. The hypothesis is advanced that in addition to the typical acid-fast bacillary forms of *M. leprae* inframicroscopic filterable forms also exist, thus explaining the enormous percentage of leprous lesions devoid of bacilli. The allantois of the chicken embryo should prove an exceptionally appropriate form of culture for the development of these forms.—[From authors' summary]

Shepard, C. C. Immunology of leprosy. New England J. Med. 279 (1968) 49 (Letter to the Editor)

There is converging evidence that lepromatous leprosy is characterized by immunologic deficiency. Attempts to overcome it are clearly indicated. There are interesting possibilities for its therapy by transfer of white cells or white cell extracts in order to reconstitute a patient's cellular immunologic status. However, it is important to note that no evidence exists that tuberculoid patients have any more reactivity than per-

sons of the same age who have never been exposed to leprosy. Bullock's results show approximate equality (see abstract Internat. J. Leprosy 36 (1968) 246) in lepromin activity in the 2 groups. Other results show that in lepromatous disease there is deficiency in the induction of delayed hypersensitivity to nonleprosy antigens. Coincidentally lymphocyte transformation *in vitro* to general stimulants is depressed. Rees, *et al.* have found that mice rendered immunologically deficient by thymectomy and x-irradiation are much more susceptible than normal mice to infection with *M. leprae*, displaying histologic manifestations characteristic of lepromatous disease in man.—E. R. LONG

Bonaparte, Y.de, Morgenfeld, M. C. and Rodriguez Paradisi, E. Immunology of leprosy. New England J. Med. 279 (1968) 49. (Letter to the Editor)

The authors' results confirm those of Bullock (see abstract Internat. J. Leprosy 36 (1968) 246). They report briefly experience indicating that the so-called anergic state in lepromatous leprosy, especially to the Fernández reaction, can be modified by transfer factor from sensitive donors. By this means an anergic was converted into a positive state in 5 out of 13 patients so treated.—E. R. LONG

Maeda, M., Nakamura, K. and Katayama, H. Effect of BCG vaccination upon the multiplication of *Mycobacterium leprae* in the foot pads of mice. La Lepro 37 (1968) 25-32 (In Japanese, English summary)

Transmission of *M. leprae* to the foot pads of mice has met success in our laboratory since 1965. The effect of BCG vaccination upon the multiplication of *M. leprae* was studied in the foot pads of mice. BCG was injected subcutaneously, intramuscularly, intraperitoneally and intravenously with a suspension in saline solution or with mixture in adjuvant. Four strains of *M. leprae* were injected subcutaneously into the foot pads of mice. (1) Living or heat-

killed BCG with incomplete adjuvant were injected intramuscularly into mice, and *M. leprae* was injected one month after the vaccination or after infection of leprosy. In these experiments, an effect of BCG vaccination was found in one case, but this could not be seen in the other cases. (2) Vaccination of BCG in mice was more effective on subcutaneous injection into the foot pads, or intravenous injection, than on intramuscular or intraperitoneal injection. (3) Vaccination with BCG mixed in adjuvant was more effective than that with a suspension of BCG in saline solution. (4) BCG vaccination was most effective from one month before to one month after the infection. Under the conditions described above, BCG vaccination was effective upon the multiplication of *M. leprae* in the foot pads of mice. This result in animal experiments might equal the effect of BCG vaccination in epidemiologic investigation, as reported already by several researchers. Therefore, BCG vaccination was considered effective in protection against leprosy.—[From authors' summary]

Shepard, C. C. A comparison of the effectiveness of two freeze-dried BCG vaccines against *Mycobacterium leprae* in mice. Bull. WHO 38 (1968) 135-140.

It has previously been shown that BCG vaccination affords mice protection against *M. leprae* and most of this work was carried out using fresh liquid preparations of a strain originating from S. R. Rosenthal some years ago. In the present study, the effectiveness of the Japanese and Glaxo freeze-dried BCG vaccines was tested, since such preparations would make it possible to administer vaccine of standard viability anywhere in the world, including leprosy-endemic areas. The Japanese and Glaxo vaccines, and the usual fresh liquid preparations were administered in equivalent amounts to mice, which were then challenged with *M. leprae*. All the vaccines provided distinct protection. It was not possible, however, to say which vaccine was most effective, because their optimal activities were not manifested at comparable times.—AUTHOR'S SUMMARY

Mayama, A. Studies on erythema nodosum leprosum (3rd Report) Latex agglutination tests in serum of leprosy patients. *La Lepro* 37 (1968) 41-46. (In Japanese, English Summary)

Latex agglutination tests were made on leprosy sera using cardiolipin, sphingomyelin, nucleoprotein, human gammaglobulin and thyroglobulin respectively as antigens. The tests were made on 24 lepromatous cases with erythema nodosum leprosum (ENL), 46 lepromatous cases without clinical evidence of ENL and 12 tuberculoid cases. In the cases with ENL there were marked positive agglutination reactions of high antibody titer. These serum antibodies in cases of ENL could be detected in 100% against cardiolipin, in 75% against sphingomyelin, in 54% against thyroglobulin and 42% against human gamma globulins. The antibody against nucleoprotein, however, was found only in 4%. In lepromatous leprosy cases without ENL, positive results were observed in 46% against cardiolipin, in 35% against sphingomyelin and in 11% against human gammaglobulin. The antibody titers were of lower level in lepromatous leprosy cases without ENL than in those with ENL. In tuberculoid leprosy cases, the antibody against cardiolipin was found in only 10%, and the antibody against sphingomyelin was found in 30%. The titer of these antibodies were very low. The nucleoprotein and thyroglobulin antibodies have never been found either in lepromatous cases without ENL or in tuberculoid cases. These antibodies in serum from lepromatous leprosy cases, especially from those with ENL, were heat-labile. On heating at 63°C for 10 minutes latex agglutination was no longer visible. The antibodies were found to be sensitive to treatment with mercaptoethanol, as indicated by the complete loss of latex-agglutinating activity. In addition, it was found that the circulating antibodies were present in γ -M-immunoglobulin. Repeated examination revealed the gradual decline of the antibody titer in ENL cases at the stage of convalescence. From the results, it is suggested that the clinical occurrences of arthritis, arthralgia, vasculitis, peripheral neuritis and/or neuralgia, in addition to the skin

eruptions in ENL, at a late stage of lepromatous leprosy, are due to the antigen-antibody reactions against cardiolipin, sphingomyelin, human gammaglobulin or nucleoprotein.—AUTHOR'S SUMMARY

Estrada-Parra, S. and Salazar-Mallén, M. Estudios inmunológicos en la lepra humana. (Immunologic studies on human leprosy.) Proc. III Mexican Congr. Dermatol., Monterrey, N. L., 1965, pp. 415-421.

Since Lowe's studies it has been learned that there is an immunologic dichotomy of leprosy. Lepromatous cases are characterized by extensive lesions, numerous bacilli, no cellular reaction to them with circulating antibodies, no sensitization and no resistance to the infection. The present study confirms the presence in the sera of lepromatous patients of an excess of easily identified circulating antibodies against *M. leprae*. Through the use of 2 sera from lepromatous cases with precipitins against the group polysaccharide "Poly I Nb," it could be demonstrated that "nonviable" forms circulate with antibody united to them. Since tuberculoid patients have neither circulating *M. leprae* nor precipitins in their sera, it may be assumed (but remains to be proved) that tissue damage in lepromatous patients can be due to the noxious effect of antigen-antibody mixtures.—A. SAÚL

Ishikawa, M. Analytical investigation on criteria for reading the skin reactions by Mitsuda and Dharmendra antigens in leprosy patients from the viewpoint of theory of probability. Studies on the lepromin reaction (I). *La Lepro* 37 (1968) 33-36. (In Japanese, English summary)

The zero point neighboring part of a distribution curve of patients arranged in the order of radii of skin reaction, consists of 2 parts; the one being groups of 0 mm. and 1 mm., the other groups more than 2 mm. of radii. The latter is approximated by the Poisson curve. By the Bayes theorem the criteria for reading reactions depends upon the ratio of local lepromatous and

nonlepromatous patients. Subsequently, the radius of the skin reaction has no qualitative character, but is merely a quantity of the group to which the number of the patients corresponds. In other words, radii and the number of patients form a distribution curve, for example, the Poisson curve, which is quite independent of the disease type, lepromatous or nonlepromatous.—AUTHOR'S SUMMARY

Ishikawa, M. and Imi, M. Analytic scrutinization of skin reaction sizes in total some 6,000 leprosy patients, and presentation of a new criterion for the settlement of reading the reactions. Studies on the lepromin reaction (II). *La Lepro* 37 (1968) 37-40. (In Japanese, English summary)

In a preceding paper the author reported on an analytic study of skin reactions in leprosy patients based on the theory of probability. This paper deals with analytic scrutinization of reaction sizes in some 6,000 patients in comparison with their clinical findings, presenting a new criterion for the settlement of reading the skin reactions. It is erroneous to draw a boundary line between lepromatous and nonlepromatous groups uniformly according to the sizes of skin reactions alone. The study led to the following conclusions: (1) For the determination of leprosy types tests with Dharmendra's antigen are superior to those with Mitsuda's; cases showing sizes less

than 8 mm. in diameter for the early reaction are designated as "lepromatous," while those showing sizes more than 9 mm. for the late reaction as "nonlepromatous." (2) Skin reactions due to the Mitsuda antigen seem to be serviceable only for settling the lepromatous type. Cases showing early reactions less than 10 mm. can be classified with the lepromatous type, while cases showing late reactions less than 6 mm. may be counted with the lepromatous with uncertainty.—AUTHORS' SUMMARY

Khaleque, K. A. and Qudratullah, M. Skin test and C.F.T. in leprosy with an antigen prepared from saprophytic acid-fast bacilli. *J. Trop. Med. Hyg.* 71 (1968) 24-26.

The C.F.T. (complement fixation test) with the antigen prepared from Kedrowsky's saprophytic acid-fast bacilli for the diagnosis of kala-azar and the skin tests with the said antigen, with Leishmanin and with PPD were carried out in 100 cases of leprosy with varying periods of infection. There was a past history of kala-azar in four of these 100 cases. Fifty-six cases gave positive C.F.T., none of them gave a positive skin test except in 4 cases with a history of past kala-azar. These 4 cases gave positive skin tests with the C.F.T. antigen. It is therefore concluded that neither the C.F.T. nor the skin test with the same antigen is of any value in the diagnosis of leprosy.—AUTHORS' SUMMARY

Epidemiology and Prevention

Contreras Dueñas, F. El problema actual de la prevención de la lepra. [The current problem of the prevention of leprosy.] *Rev. Leprol. (Fontilles)* 6 (1967) 725-743.

This article refers to what the author designates as "the scientific prophylaxis of leprosy." (See *THE JOURNAL* 35 (1967) 420). The concept is covered in five parts: (1) drying up of endemic foci, (2) early diagnosis and continuous and adequate treatment supplemented with rehabilitation in cases of long duration, with social

protection of patients and their relatives, (3) BCG vaccination, and (4) chemoprophylaxis. Results are analyzed and weighed with reference to each of these four elements of control. The bibliography includes 208 references.—F. CONTRERAS

Silva-Mar, F. Descubrimiento de los casos de lepra por medio de exámenes de contactos. [Discovery of new cases of leprosy by contact-examination.] Thesis. University of Mexico, 1967, 56 pp.

The different procedures for finding new

cases of leprosy, such as total census, partial survey, dermatologic examination and contact-examination are noted in the first part of this thesis. The author designates as "contacts" only persons living with a patient with numerous bacilli, i.e., a lepromatous case. Contacts must be examined periodically both clinically and immunologically. Five hundred and four contacts of 139 families with lepromatous patients of the Dermatologic Center Pascua of Mexico City were examined. Among them 10 new cases were found. Three hundred and fourteen Mitsuda tests were made, with 52.8% negative results. Positivity of the Mitsuda test did not seem to be related with sex. On the contrary, it increases with age. These results are attributed to the short length of time during which leprosy has occurred in Mexico.—A. SAÚL

Leiker, D. L. Leprosy in the Netherlands. *The Star* (Carville, La.) 27 (1968) 6.

After World War II many persons from countries with endemic leprosy migrated to the Netherlands. More than 500 cases of the disease from this general source have been registered since the war. Stringent restrictive regulations have not been put into effect. Treatment of recognized patients and careful observation of contacts have been carried out. Few patients have been found who are believed to have been infected in the Netherlands. The disease appears to be only feebly contagious. So far only one patient who never left the country, and who has had no known leprosy contact, has been discovered. Segregation of patients is not practiced. Some 10% of the known patients have been admitted to a small sanitarium for special problems. Complications are treated in general hospitals. Much of the credit for the good control attained is credited to the Gastmann Wickers Foundation, a voluntary organization, which, with the support of the government, has cared for and educated the patients.—E. R. LONG

Dimitrova, I. [The leprosy problem in Bulgaria.] *Dermatol. i Venerol.* (Bulgaria) 7 (1968) 100-107.

Up to 1967 a total of 17 live patients with leprosy have been registered in Bulgaria. The lepromatous form prevails. Modern concepts of treatment, control, and prophylaxis of leprosy are discussed briefly. Leprosy is most wide spread in the villages of Zlatia, Mihailovgrad district, Kamen Tarnovo district, Kardzali district, and some settlements along the Danube river.—**AUTHOR'S SUMMARY**

Dogliotti, M. Situazione epidemiologica, clinica, profilattica e terapeutica della lebbra in Cyrenaica (Libya). Nostre osservazioni durante il settennio 1959-1966. [Epidemiologic, clinical, prophylactic and therapeutic situation in leprosy in Cyrenaica (Libya). Personal observations in the seven year period 1959-1966.] *Minerva Derm.* 42 (1967) 491-505.

This paper is based on the examination of patients and persons engaged in oil exploration or attending the various health departments, clinics, etc., in towns and rural areas. The incidence of leprosy found was about 2 per 1,000 persons. In all, 133 cases were seen out of about 68,000 outpatients; no less than 115 of these were in males. The patients ranged from 23-67 years in age, and no affected children were seen. In many instances family and tribal hostility led to concealment, and where an infective person was found living in a building where children congregated, the aid of the sanitary police sometimes had to be invoked. The author mentions that in the tuberculoid (T) form he saw cases resembling sarcoidosis, which made diagnosis very difficult; however, here the Mitsuda reaction was always strongly positive. The majority of the patients had the lepromatous (L) form. Bullous or phlyctenular lesions on the distal phalanges of the hands and feet were seen frequently and were sometimes the only reason for the patient seeking treatment. These bullae were not painful and appeared to be the result of too close contact with charcoal braziers during the cold of the desert nights; sometimes these became superinfected. Lesions of the mucosae were common, especially of the nose, and liver enlargement was often seen.

In 7 patients liver biopsy showed the characteristic features by which leprosy can be definitely distinguished from any other liver lesion. The histologic features are described in detail. The Mitsuda test was only made on 37 patients (9 T, the rest L) and the results were read after 48-72 hours and again after 15 days; 6 patients with slightly delayed positive reactions all evolved to the multi-bacillary L form. Examinations of nasal mucus and scrapings were mostly negative in the T form but positive in the L form. No lesions of the cranial or long bones were seen, but in the hands and feet early lesions were present as small erosions in the articular heads, and interruption of continuity of the periosteal line with the appearance of semilunar or falciform areas. X-ray control is essential during treatment, so that the progress of bony lesions can be observed. To lessen the lepromatous reactions seen after treatment with dapsons, steroids were given at the same time and the author made extensive use of thiambutosine to a maximum of 500 mgm./day with liver-protective drugs and vitamin B complex. This treatment was well tolerated. He had encouraging results also with sulphormethoxine. In a group of patients and a control group one group was given thiambutosine together with prednisone, 15-20 mgm., or 4-6 mgm. dexamethasone daily alternating with 60 U of ACTH-retard twice weekly for 45-60 days. In the steroid group the lepromatous reactions were slighter and of short duration, with only a slight rise in temperature, marked reduction in neuralgia and of the nodular lesions, and improvement in the patient's general condition. Suspension of the steroid treatment led to recurrence of symptoms, while in the group receiving routine antileprosy treatment only, there were the usual reactions. The author suggests the following scheme of treatment: sulfone or thiourea derivatives up to 500 mgm./day + weekly ACTH, 60 U or more; in open nodular lesions streptomycin or kanamycin twice weekly. Treatment should be given in cycles of 60 days, alternating with periods of complete rest.—[Abstract by W. K. Duncombe, *Trop. Dis. Bull.* 65 (1968) 634-635]

Storkan, M. A. La lepra en la Guinea. [Leprosy in Guinea.] Proc. III Mexican Congr. Dermatol., Monterrey, N. L., 1965, pp. 597-599.

This country, located on the western coast of Africa, has 3,200,000 inhabitants and a leprosy prevalence of 20/1,000, especially of the tuberculoid type. In 1958 Guinea became independent from France, and leprosy control began in 29 outpatient clinics, with mobile units consisting of trained persons. There is a leprosarium 40 km. from Conakry, capital of the country, where 46 families are treated.—A SAÚL

Chao, Y. F. The leprosy problems in Taiwan. *Leprosy Rev.* 39 (1968) 107-109.

The author gives his views on a number of leprosy problems in Taiwan (Formosa). Since 1962, when accurate statistics became available, numbers treated both as in- and outpatients increased from 3,100 to 4,100, but this probably represents a total of 10,000 persons. The regional distribution varies from 35.16/10,000 in Pheng-hu County in the Pescadores Islands to 0.78/10,000 in Nan-tou County in Central Taiwan. The shortage of trained leprologists, and the failure of local physicians to provide treatment, hinder control of the disease. The author lists 6 points for an effective control program, including education, early detection, increased use of local medical personnel for whom scholarships should be made available for special training, better documentation, and the opening of outpatient facilities in all hospitals to leprosy patients. [The author fails to give due credit to the Taiwan Leprosy Relief Association, supported by American Leprosy Missions, Inc., by The Leprosy Missions and other cooperating missions, churches and individuals, which have established, supported and encouraged work along the lines recommended. N. D. F.]—N. D. FRASER

Bolton, J. M. Medical services to the aborigines in West Malaysia. *Brit. Med. J.* 2 (1968) 818-823.

The aborigines in the jungle of West

Malaysia lived in a world of their own until they became politically important as pawns in the Malayan emergency. For military reasons a medical service for the aborigines was started by the Colonial Administration in 1955. This service has been expanded as part of the independent Malaysian Government's big rural development program. There are 45,000 aborigines in the southern Malay Peninsula (West Malaysia). Most live on the jungle slopes of the central mountain range of northern Malaya, and the remainder are scattered over the rest of the peninsula. The aborigines are a miscellaneous collection of ethnic groups whose common factor is that they are all descendants of the original inhabitants of Malaya. Speaking at least 12 different languages, they can, however, be divided into three main groups. The paper gives details of an advanced medical and public health program. This abstract is limited to leprosy. This disease is found only in the aborigines living in the jungle fringe areas, especially where there is some intermarriage with the Chinese community. New cases are discovered at an annual rate of 0.6/1,000, with 2 cases of tuberculoid leprosy to 1 of lepromatous. Five per cent of the cases are early indeterminate lesions. Twice as many cases are diagnosed in males as in females. There are few social stigmata attached to leprosy among the aborigines, and in the majority of cases the patient presents himself for treatment with the correct diagnosis—E. R. LONG.

Rodrique, R. Leprosy control and rehabilitation. *Papua-New Guinea Med. J.* 10 (1967) 83-88.

The author stresses the importance of leprosy control as the main factor in obviating the necessity for expensive projects involving reconstructive surgery, physiotherapy, the provision of footwear, etc. The extent of the leprosy problem in the New Guinea Highlands—with nearly 6,000 known patients in a population of 831,000, and a "leprosy index rate" varying from 10 to 100/1,000—is known with reasonable accuracy, but in other areas exact evaluation awaits the work of the control units now being organized. The author summarizes

the principles of physical rehabilitation now being put into practice. These include surgical units, health education by paramedical staff, occupational therapy, and the provision of protective footwear. The cooperation of voluntary organizations is enlisted at several levels. If the majority of patients with lepromatous leprosy can be induced to take regular treatment for adequate periods, then the quantum of infection in the community will be reduced, transmission of the disease will be interrupted and preventable deformity will be prevented in the subject already infected. Economic resources will then largely determine the kind of rehabilitation program that should be put into effect. [Abstract by S. G. Browne, *Trop. Dis. Bull.* 65 (1968) 774]

Ayala, M. G. Algunos aspectos de la lepra en Argentina. [Some aspects of leprosy in Argentina.] *Proc. III Mexican Congr. Dermatol.*, Monterrey, N. L., 1965, pp. 371-375

Argentina has at present 22 million inhabitants with 11,416 recorded leprosy cases. The prevalence is 0.53/1,000. The disease occurs especially in Misiones, Santa Fe, Corrientes, Chaco and Formosa. Five leprosarías still exist, with 1,500 patients. In 1960 a new campaign began with the help of the WHO and UNICEF, which was called the "National Dermatological Fight." Certain investigative aspects related with the so-called *Bacillus propter-mariam*, discovered by Wilkinson, *et al.*, are noted. Private associations help the government, especially in Chaco, where Giménez has carried out a program based on leprosy education of the entire population.—A. SAÚL

Lopez-Yanez, G. La lepra en Durango. [Leprosy in Durango, México.] *Proc. III Mexican Congr. Dermatol.*, Monterrey, N. L., 1965, pp. 561-566.

One hundred and eighty-one leprosy cases have been registered in this state of Mexico. The campaign against leprosy in Durango began in 1930, but no active program has been established. Relatively few persons have been interested in the prob-

lem, and it is supposed that a larger number of cases occur throughout the state.—A. SAÚL

Dickerson, M. S. Leprosy in Texas. *Texas Med.* **64** (1968) 39-41.

Concern about leprosy in Texas is reflected in a series of legislative enactments dealing with its detection and care. Texas has more cases of leprosy than any other state in the U. S. A. Reporting of leprosy to the health department started in 1921. There has been a general increase in the number of cases reported annually. Specific case-finding surveys have netted large numbers of cases. Evidence indicates that the apparent increase in prevalence is the result of actual increase, as well as improved case-finding. Since 1921, 704 cases have been recognized. Most of the patients found live in the southern part of the state in the Rio Grande Valley and along the Gulf coast. Three well defined foci traceable to original Spanish importation are recognizable. A few foci are traceable to immigrants from Bavaria and Moravia. There is a small Negro focus in the Galveston-Houston area. Some migration from a French focus in Louisiana has resulted in a small focus in eastern Texas; no secondary cases have developed. The Anglo-Saxon cases are increasing, constituting one-fourth of all the new cases. Although some of the Texas patients reside outside the endemic areas they appear to have acquired their infections in the areas where the disease is endemic. Texas has a predominance of lepromatous, dimorphous, indeterminate and bacillus-positive tuberculoid cases. No other endemic area in the world has such a high percentage of leprosy cases open at the time of diagnosis, i.e., nearly 90% [*This is a surprising statement that should lead to further comparisons.*—EDITOR] Of 16 active cases in Texas Negroes, 12 are lepromatous and 4 tuberculoid, the reverse of the usual ratio in Africa. Contact examinations yield, on the average, one new case per 50 contacts examined. Although the step-up in case-finding in the last 5 years has increased the number of cases registered, there is no clear evidence that the disease is being found in earlier stages than former-

ly. The disease, traditionally associated with poverty, crowding, and lack of hygiene, is obviously moving into higher social and economic levels in Texas. There has been little success in determining the sources of these cases. Altogether sources have been determined in only a third of the cases. Presumably there are still numerous unknown cases capable of spreading the disease.—E. R. LONG

Breslow, L. Leprosy in California. *California Med.* **108** (1968) 81-82.

Leprosy is not a major health problem in California, but sporadic cases occur, largely as a result of immigration. Occasionally, new cases are detected on routine examination of leprosy contacts who have never left the state. The newly diagnosed cases are of wide ethnic origin. The largest single group is made up of Caucasians. Filipinos are next, followed by Mexicans. One patient apparently acquired the disease in Minnesota; he was the last case discovered among the third generation descendants of original Scandinavian immigrants with leprosy in the 19th century. In California 2 outpatient clinics provide diagnostic and treatment centers for leprosy, one of them in San Francisco and the other in Los Angeles. The former provides inpatient care also. The San Francisco clinic has close to 200 patients on its register. At the time of writing there were 16 inpatients.—E. R. LONG

Lew, J. and Kim, Y. S. Chemoprophylaxis of leprosy contacts with DDS. *Yonsei Med. J.* **7** (1966) 47-51.

Previous experience at various preventoria with DDS chemoprophylaxis in 760 children born of leprosy parents is reviewed (Lew, J. and Lee, K. S. *Korean Lep. Bull.* **1** (1960) 33-50). Two groups were set up, an experimental group of 325 patients, treated with DDS orally in dosages ranging from 50 to 300 mgm. weekly according to child age, and a control group without DDS, but similarly observed. No leprosy developed in the first group, but 31 cases (7.1%) developed in the control group. A second experiment, similarly con-

trolled, was set up to determine the effect of leprosy prophylaxis in dosage of 300-400 mgm./week on leprosy contacts in the home. In the treated group 778 contacts have revealed no incidence of leprosy during the observation period of 1 to 7 years. In the control group of 749 household contacts, 13 cases of leprosy (1.7%) developed in corresponding observation periods. All

13 patients were in contact with cases of lepromatous leprosy. Five among these 13 were identified within 1 year after treatment of the index cases was started. Four cases were identified in the second year, 2 in the third, 1 in the fourth and 1 in the fifth. Ten of the 13 cases were indeterminate, 2 were tuberculoid and 1 was lepromatous.—E. R. LONG

General and Historical Subjects

Sousa e Silva, A. J. Dois mil e quinhentos anos de tratamento de lepra. [Twenty-five hundred years of treatment of leprosy.] *Rovisco Pais* (Portugal) 7 (1968) 34.

Historical review, devoted principally to the different medicaments used in the treatment of leprosy.—F. CONTRERAS

Goerke, H. Ein Leprabericht eines Linnéschulers aus dem Jahre 1765. [Report on leprosy by a student of Linnaeus in 1765.] *Ztschr. Haut. u. Geschlechtskrank.* 42 (1967) 161-166.

The history of the beginnings of modern understanding of the nature and etiology of leprosy is reviewed. The author notes, however, that both in Norway and in Sweden contributions to the subject were made in the 18th century. The distinguished Carl Linnaeus, celebrated for his pioneer work in the field of botany, included medicine in the subjects assigned to his students. He had a personal interest in leprosy, and a report by one of his students, Isaac Uddman, in 1765, is described. In this report the history of leprosy and its spread, as known at that time, is reviewed. Linnaeus himself inclined to the view that leprosy might be caused by small forms of life (*Kleinlebewesen*). The author refers to the use of mercury in the treatment of leprosy in this connection. Uddmann went into general practice in later years. Linnaeus was fortified in his interest and understanding by other papers published about this time.—E. R. LONG

Figueredo, N. Leprosy control. *Indian Practitioner* 20 (1967) 105-109.

General review, covering education, case finding, treatment, isolation and prophylaxis.—E. R. LONG

Young, R. L., Lordon, R. E., Krumholz, R. A., Harkleroad, L. E., Branam, G. E. and Weg, J. G. Pulmonary sarcoidosis I. Pathophysiological correlations. *American Rev. Resp. Dis.* 97 (1968) 997-1008.

Thirty-four patients with clinical and histologically proven sarcoidosis without other pulmonary disease were studied by chest roentgenograms, pulmonary function studies, and needle biopsy of the lung. The diagnostic yield of needle biopsy was very high in patients with disease of less than 1 year's duration, viz., 95%, as compared with a 45% yield in patients with disease of more than a year's duration. Alveolar membrane thickening was a consistent finding in all biopsies. There was evidence that the functional abnormalities associated with the concept of alveolar-capillary block are related to membrane thickness. No single function study or x-ray finding, however, was a reliable indication of the severity of either parenchymal changes or abnormality of diffusion. The degree of impairment of vital capacity did give a rough estimate of the degree of pathologic change in the lung parenchyma.—[From authors' summary]

Lordon, R. E., Young, R. L., Shapiro, S. S., Smith, R. E. and Weg, J. G. Sarcoidosis II. A clinical evaluation of the alteration

in delayed hypersensitivity. *American Rev. Resp. Dis.* **97** (1968) 1009-1016.

Fifty patients with sarcoidosis were evaluated with respect to their delayed hypersensitivity response to various antigens. Skin tests with a low reaction rate in normal populations to such antigens as intermediate strength PPD, coccidioidin and histoplasmin, did not show an appreciable dif-

ference in sarcoidosis patients. A generalized hyporeactivity to the more commonly reactive antigens of *Trichophyton*, mumps, *Candida albicans* and second strength PPD was demonstrated. The atypical mycobacterial antigens showed a more pronounced hyporeactivity and continued to be negative in spite of repeated applications at various stages of disease activity.—[From authors' summary]

Other Mycobacterial Diseases

Salzer, K. E., Votteler, T. P. and Dorman, G. W. Surgical management of cervical adenitis due to atypical mycobacteria in children. *J. American Med. Assoc.* **204** (1968) 103-106.

Cervical adenitis caused by atypical mycobacteria has been described in the last 11 years. The grouping of these mycobacteria was proposed by Timpe and Runyon in 1954. Since then, others have suggested certain points of clinical differentiation between cervical adenitis caused by atypical mycobacteria and that caused by human tuberculosis. The present study was initiated in order to afford better recognition of this disease entity and establish surgical management with antituberculosis drug coverage as the preferred method of therapy. Thirty-eight cases of cervical adenitis in children, with infection due to atypical mycobacteria, have been seen at the Children's Medical Center, Dallas, Texas, U. S. A. The clinical picture of this infection can be established as a specific entity. This consists of unilateral submandibular lymphadenopathy in the submaxillary gland area, usually associated with erythema of the overlying skin and abscess formation. The age group affected is characteristic. The children have minimal systemic symptoms and normal roentgenograms of the chest. Skin tests for atypical organisms are strongly positive; skin tests for *Mycobacterium tuberculosis* are usually weakly positive. Surgical management is advocated and consists of total excision of involved lymph nodes and skin, closure without

drainage, and postoperative drug therapy with paraaminosalicylic acid and isoniazid. **AUTHORS' SUMMARY**

Wolinsky, E. and Ryneerson, T. K. Mycobacteria in soil and their relation to disease-associated strains. *American Rev. Resp. Dis.* **97** (1968) 1032-1037.

Several lines of circumstantial evidence point to the soil as a possible reservoir of human "atypical" mycobacterial infections. Soil samples from 4 states, including several varieties of soil, were cultured for mycobacteria, and the recovered strains were classified by microbiologic and biochemical tests. These results were compared with those obtained from a study of similar strains recovered from well studied patients and categorized as casual or disease-associated. Eighty-six per cent of the samples yielded at least 1 strain of mycobacteria; *M. fortuitum* was isolated from 64%, scotochromogens from 54%, and *Group III* organisms from 42% of the samples. There was a trend toward a higher yield of scotochromogens from mud and of *M. fortuitum* from clay. Most of the disease-associated scotochromogens were members of the *scrofula* subgroup (strong catalase, negative Tween 80 hydrolysis, and positive urease), while the soil and human casual scotochromogens showed the reactions of the tapwater subgroup. Among the *Group III* strains, those associated with human disease were usually of the Battey-avian variety, but only 7 of 31 soil strains fell into this group. One of these 7 was probably an

M. avium strain. Unless it can be demonstrated that biochemical reactions of mycobacteria can be altered by residence in soil or in tissue, these results make it doubtful that the soil is the usual reservoir for human infection with "atypical" mycobacteria.—AUTHORS' SUMMARY

Nagai, A., Suzuki, S. and Imi, M. Attempts to detect acid-fast bacilli in the skin of nonleprosy persons, and in the skin, lymph node and viscera of untreated mice. Possible mycobacterial contamination from instruments and its countermeasure. *Sci. Rep. Res. Inst. Tohoku Univ.-C.* **14** (1967) 72-77.

No acid-fast bacilli were demonstrable in apparently healthy skin obtained from 33 nonleprosy persons. Very few acid-fast bacilli were found in the skin, lymph nodes and viscera of more than 200 mice, which had been raised in good condition, except for a few cases, chiefly mice with skin ulcers. In general there is no need to fear spontaneous mycobacterial contamination among mice in experiments on leprosy, when well administered mice of a known strain are employed under well controlled conditions. Instruments, particularly a blender, used for experimental work can be a source of mycobacterial contamination. The boiling of a blender in a 5% NaHCO₃ solution for 5 minutes proved enough to remove mycobacterial carcasses adherent to it without doing any significant damage to the blade.—[From authors' summary]

Chapman, J. S. and Speight, M. Isolation of atypical mycobacteria from milk. *American Rev. Resp. Dis.* **98** (1968) 142.

Raw milk may contain atypical mycobacteria resistant to 30-minute's pasteurization. Nine milk samples out of 329 random samples tested in Dallas, Texas, U. S. A. were positive for mycobacteria (1 *M. fortuitum* and 8 isolations of *Group III* mycobacteria as determined by colonial morphology and biochemical tests).—[From authors' summary]

Johnson, W. G., Jr. and Nicholson, D. P.

A follow-up of 99 patients with pulmonary disease caused by *M. kansasii*. *American Rev. Resp. Dis.* **98** (1968) 141-142.

The course of 99 patients treated by various therapeutic measures was followed for periods ranging from 6 months to 10 years (average 3.0 years). Underlying chronic lung disease was present and symptomatic in 38%. Of 91 patients followed a year or more 74% had sputum negative for *M. kansasii* within 6 months. In 57 patients treated with drugs alone isoniazid sensitivity or partial sensitivity to 1.0 µgm. was associated with almost uniform success. Isoniazid resistance to 1.0 µgm. led to more treatment failures. Isoniazid resistance and underlying lung disease proved the two most important indicators of adverse prognosis.—[From authors' summary]

Fischer, D. A., Lester, W. and Schaefer, W. B. Infections with atypical mycobacteria. Five years' experience at the National Jewish Hospital. *American Rev. Resp. Dis.* **98** (1968) 29-34.

During the 5-year period from 1 January 1960 through 31 December 1964, there were 1,185 consecutive admissions to the tuberculosis service at the National Jewish Hospital. Among these admissions were 50 patients who consistently excreted atypical mycobacteria. The classification of these infecting organisms and a comparison of the results of management of these patients are presented. Of the 50 patients, 29 had organisms classified as *Runyon Group I*, all of which were *M. kansasii* identifiable by cultural characteristics and serotyping. One patient excreted *Runyon Group II* organisms, and the remaining 20 *Group III* organisms. By the serotyping technic of Schaefer, these latter mycobacteria were heterogeneous and consisted of at least 10 separate serotypes. Of the 29 patients with *Group I* infection, 26 received chemotherapy, and 22, or 85.5%, achieved stable "culture-negative" status. The patient with *Group II* infection was not treated. Sixteen

of the 20 patients with *Group III* infection had chemotherapy and 6 (37.5%) became "culture-negative."—AUTHORS' SUMMARY

Zykov, M. P., Roulet, H. and Gaya, N. Non-tuberculosis mycobacteria in Africa. 1. Isolation and identification. Bull. WHO 37 (1967) 927-938.

In tropical and subtropical countries, the presence of nontuberculosis mycobacteria may invalidate case-finding programs; experience has shown that many of the acid-fast bacilli discovered on examination of sputum specimens are nontuberculosis mycobacteria—either photochromogens, scotochromogens, unpigmented or rapid growers (Groups I to IV, respectively, of Runyon's classification), or saprophytes. Studies have recently been undertaken to determine the frequency of various types of nontuberculosis strains in different parts of Africa. This paper describes the first of these studies, devoted to the isolation and identification of nontuberculosis mycobacteria from 7 countries. Of 18,568 cultures examined at the Central Tuberculosis Laboratory, Nairobi, in 1961-64, 1.9% were nontuberculosis strains. However, valid conclusions as to prevalence cannot be drawn from this figure, since some specimens came from tuberculosis patients and others from general population surveys. An earlier comparison, based on 7,580 cultures from tuberculosis patients and 657 from a random survey, had shown a significant difference in the frequency of nontuberculosis strains, the figures being 1.1% and 19.8% respectively. Of the identification tests studied, the formamidase test was found very useful for differentiating saprophytic mycobacteria from the other nontuberculosis mycobacteria, particularly the rapid growers. This test is discussed in greater detail in the third study of the series—AUTHORS' SUMMARY

Zykov, M. P., Donec, Ju.I. and Godovannyi, B.A. Non-tuberculosis mycobacteria in Africa. 2. Sensitivity to mycobacteriophages. Bull. WHO 37 (1967) 939-946.

In this, the second of a series of studies on the prevalence of nontuberculosis myco-

bacteria in Africa, the susceptibility of 228 cultures of nontuberculosis mycobacteria isolated at tuberculosis laboratories in Nairobi, Kenya, and Lagos, Nigeria, to 7 laboratory strains of mycobacteriophages was examined. Of the 51 cultures found to be phage-sensitive, just over half (29) were saprophytic. In the cultures from East Africa, phage-sensitive strains were observed only among the saprophytes, whereas in those from West Africa such strains occurred also among unpigmented mycobacteria (Runyon's Group III). All but one strain of nontuberculosis mycobacteria isolated from domestic animals in East Africa were found to be resistant to all 7 phages used. Unfortunately, the patterns of phage sensitivity showed such variety that it was concluded that phage-typing alone was unsuitable for the classification of nontuberculosis mycobacteria.—AUTHORS' SUMMARY

Zykov, M. P. and Roulet, H. Non-tuberculosis mycobacteria in Africa. 3. Formamidase activity. Its evaluation and practical application. Bull. WHO 37 (1967) 947-951.

The third study in a series of the prevalence of nontuberculosis mycobacteria in Africa is devoted to the investigation of the formamidase activity of 288 cultures of mycobacteria, already typed by a battery of standard tests as pathogenic or atypical (184 strains) and saprophytic (104 strains). Of the latter, 96 (92.3%) were formamidase-positive, as compared with only 6 (3.3%) of the former. A close correlation was observed between the speed of growth on Loewenstein-Jensen medium and formamidase activity, 98 (96.1%) of the positive strains showing visible growth within 1-3 days. The relation between formamidase activity and growth on nutrient media was less clear cut, however, and it was concluded that for the routine differentiation of saprophytic from other mycobacteria the formamidase test should be combined with simple tests such as speed of growth on L-J medium and ability to grow on nutrient media. Russel's method and Nessler's reagent for the detection of ammonia in the formamidase test were compared; the authors consider the former

to be preferable, since the reaction is easier to read.—AUTHORS' SUMMARY

Fogan, L. A survey of atypical mycobacterial disease in Oklahoma. *American Rev. Resp. Dis.* **98** (1968) 141.

Atypical mycobacteria were isolated from 239 of 2,930 persons listed in the Oklahoma (U. S. A.) State Health Department's Central Tuberculosis Register. Of these, 52 fulfilled the author's criteria for diagnosing atypical mycobacterial disease: the criteria included clinical, radiologic, and bacteriologic examinations. Disease caused by Battey-type organisms was diagnosed most commonly (26 patients). *M. kansasii* was responsible for disease in 20 persons, and scotochromogens in 16. Pulmonary involvement predominated, but extrapulmonary involvement occurred in 11.5% of the study group. There was an overlapping in skin sensitivity in 91.4% of cases tested. The patients responded, on skin test, to more than 1 antigen. The multiplicity of reactions limited definite distinction between cross reactions and multiple mycobacterial reactions. Results of this study discourage sole dependence on mycobacterial antigen skin test batteries in differential clinical diagnosis.—[From author's summary]

Suzuki, S. Antigen-antibody analyses in mycobacteria, in particular, mycobacteria of fish origin with special reference to mutual relationship among those and *M. tuberculosis*, *M. leprae* and *M. lepraemurium*. *Sci. Rep. Res. Inst. Tohoku Univ.-C.* **14** (1967) 61-71.

Antisera of rabbits to *M. tuberculosis* and *M. balnei*, and 9 mycobacterial stains of fish origin including *M. marinum* and *M. platypoecilus* were used for antigen-antibody analyses among mycobacteria by means of Oudin's and Ouchterlony's gel diffusion-, and Scheidegger's microimmunoelectrophoresis-technics. Culture filtrates, bacillary extracts, and 0.25%-sucrose extracts of disintegrated human and murine lepromas were used as antigens. Immunoelectrophoresis with extracted bacillary antigen gave the best results. Antigenic

constituents included *M. tuberculosis*, human leprosy bacilli, murine leprosy bacilli, *M. balnei*, and mycobacteria of fish origin. In immunoelectrophoresis these antigenic constituents moved chiefly to the cathode (negative). None moved only to the anode (positive), but a few moved to the region between the two poles. Generally speaking, the immunologic group reaction was marked among these mycobacteria, especially so among mycobacteria of fish origin. Because of poor extraction technic we observed only one constituent common to human leprosy bacilli and the antiserum of one fish strain. There was no relation between the immunologic group characters or the number of common antigens and biologic properties, including pathogenicity.—[From author's summary.]

Pejovic, I., Dunbar, F. P. and Cacciatore, R. Experimental infections with multiple species of mycobacteria. *American Rev. Resp. Dis.* **98** (1968) 111-113.

As indicated by colony counts from spleens, experimental infection with a *Group III* strain of mycobacteria was about as effective as BCG in conferring protective immunity to challenge infection with *M. tuberculosis* H37Rv. This effect was not increased in mice infected with both strains before H37Rv challenge. BCG populations in mouse spleens were not influenced by previous infection with this *Group III* strain.—AUTHORS' SUMMARY

Juhasz, S. E. Bacteriophage: An important factor in mycobacterial variation. *American Rev. Resp. Dis.* **98** (1968) 138-139.

Hereditary changes in bacteria due to phage were first established by d'Herelle in 1917. Host-phage interactions in mycobacteria have revealed the extent to which phage determines changes in the enzymatic activity of *M. smegmatis*. Phage-induced changes in colonial morphology, pigmentation, and growth rate of *M. phlei* have been reported. The author describes changes in *M. phlei* mutants obtained by lysogeny with the phage designated B2h; they represented mutations to (1) slow growth and

colony size, (2) complex nutritional requirements, and (3) thiamine deficiency. Characteristics associated usually with pathogenic rather than saprophytic organisms, such as slow growth or nutritional deficiency, could be induced in *M. phlei* by phage B2h. These findings, together with the observation that a naturally occurring lysogenic strain of *M. smegmatis*, isolated from a patient, showed highly increased virulence for mice and rabbits, warrant further investigation with respect to the origin of virulence in mycobacteria.—[From author's summary]

Mankiewicz, E. and Dernuet, S. Bacteriophage typing and chemical and biologic tests in the classification of mycobacteria. A comparative study. *American Rev. Resp. Dis.* **98** (1968) 35-40.

Redmond's phage typing scheme for the classification of mycobacteria into tubercle bacilli of human and bovine varieties and as *M. kansasii* was applied to 87 recently isolated strains of mycobacteria. The designation of 9 strains as *M. kansasii* by their phage type pattern was supported by *in vitro* tests, which included their colony morphology and pigmentation; their niacin, catalase, peroxidase reactions; their reduction of nitrate, and their amidase activities. The phage type pattern of human strains of tubercle bacilli was shown by 16 strains that would have been similarly qualified according to the results of the *in vitro* tests and animal experiments. Sixty-two strains of mycobacteria showed the phage pattern of bovine strains. This bacteriologic diagnosis was supported by the amidase reactions of these strains, but it was in disagreement with many results of the nitrate reduction tests and the 2-thiophenecarboxylic acid hydrazide inhibition studies. Although all these strains showed marked pathogenicity for the guinea-pig, only half of the rabbits inoculated with one of the strains of the bovine phage type showed the type of lung lesions usually produced by bovine strains. The information provided by phage typing suggests the

necessity of a revision of the unicist concept of *M. tuberculosis* var. *hominis*.—**AUTHORS' SUMMARY**

Mankiewicz, E. and Redmond, W. B. Lytic phenomena of phage LEO isolated from a sarcoid lesion. *American Rev. Resp. Dis.* **98** (1968) 41-46.

A phage active on human and other mycobacteria was isolated from a sarcoid lesion. No mycobacteria could be isolated from this lesion. The phage, designated LEO, produced 3 types of plaques on the human H37Rv strain. Phage isolated from each plaque type produced all 3 plaque types when propagated again on H37Rv. One phage type, LEO-TT, was carried through 18 serial isolations and propagations on H37Rv. It retained its capacity to produce the 3 plaques. Transfer to ATCC 607 resulted in a single-plaque type. After 8 serial isolations and transfers on 607, it was returned to H37Rv; again all 3 plaque types appeared. This appears to indicate the presence of a factor (or factors), probably a defective prophage, in H37Rv bacilli that influences the production of LEO phage in these bacteria. One or more of the types of phage produce changes in the colony appearance and in the physiology of H37Rv. These bacteria become resistant to LEO phage and are induced to lyse by actinomycin C, but no phage has been isolated, a condition which indicates a defective lysogenic strain.—**AUTHORS' SUMMARY**

Thomson, D. S. and Wallace, A. Sensitivity testing of mycobacteria to the riminophenazine B.663. *Tubercle* **49** (1968) 42-47.

The sensitivity of mycobacteria (*M. tuberculosis*, *M. bovis* and *M. avium*) to the riminophenazine B.663 can be tested in liquid medium without Tween 80, by use of form-dimethylamide as solvent. The inoculum should be a 1:10 and/or a 1:100 dilution of the culture in liquid medium with Tween 80, and the tests should be read at 3 weeks.—**AUTHORS' SUMMARY**