



# INTERNATIONAL JOURNAL OF LEPROSY

VOLUME 19, NUMBER 4

OCTOBER-DECEMBER, 1951

## A CLINICAL AND LABORATORY STUDY OF LEPROSY IN LIBERIA

HILDRUS A. POINDEXTER

*Director, U. S. Public Health Mission in Liberia  
Monrovia, Liberia*

### INTRODUCTION

There are about 1,200 easily recognized cases of leprosy in Liberia, a prevalence rate of about 0.6 per 1,000 in a population of about 2 million people (10). This is a relatively low rate for a tropical rain-forest area in which leprosy is endemic. The number of cases without easily observed clinical manifestations is not known. Most of the recognized cases are registered, and are now receiving treatment at the four large special colonies or villages, the several smaller inland dispensaries, and some of the general clinics.

The four principal leprosy colonies and the approximate number of patients under treatment in each are at: Ganta, on the northern border of the Central Province, with nearly 300 patients; Cape Mount Station about 50 miles northwest of Monrovia in Grand Cape Mount county, with between 300 and 400 patients; Cape Palmas, at Harper in the southeastern tip of the country, with 250 patients; and the Maryland County Station about 30-40 miles inland from Cape Palmas, near the boundary between Maryland County and Eastern Province, also with 250 patients. In addition, there is the Mbolona Station in the mid-Central Province between Gbarnga and Ganta, which has no physician but where about 180 transient patients are given chaulmoogra oil intermittently. The Ganta leprosy village is the one with which this article is concerned, it being the source of most of the observations here recorded.

## THE GANTA LEPROSY COLONY

Located in the territory of the Mano tribe, about 165 miles northeast of Monrovia, near the towns of Ganta and Gompa, is the Ganta Mission of the Methodist Church under the superintendency of Dr. George W. Harley, who founded the unit there over 25 years ago. The clinic and dispensary of this mission are the only medical installations under the supervision of a physician within a radius of 75 miles, and patients come here from far and wide in Liberia and from French Guinea. The area served, which has a population of about 130,000 people, has been shown by a recent survey (9) to be highly endemic for malaria, trypanosomiasis, treponemiasis, schistosomiasis, amebiasis, helminthiasis, bacterial diarrheal diseases, and tropical ulcers. Between 175 and 225 patients come to the Ganta dispensaries and clinics daily during the five major clinic days of the week. One or more cases of leprosy are diagnosed from among this group each week.

A small village is set aside near the Ganta clinic where the leprosy cases may remain as residents and receive treatment. It was this village which attracted my special attention in 1947. By permission of the U. S. Public Health Service, I was assigned there on a fulltime basis for five months in that year, and during the last two and one-half years I have continued on a part-time schedule to make clinical and laboratory observations on the patients. Such studies of considerable detail were made on a total of 230 patients.

## VITAL STATISTICS AND BIONOMICS

The climate in Liberia is chiefly of the tropical rain-forest type, with an annual rainfall of 96 inches at Ganta, which is 165 miles from the coast and 1,200 feet above sea level. The average mean temperature is 80°F.  $\pm 2$  along the coast, and 77.4°F.  $\pm 3$  at the Ganta station. The data on temperature and rainfall at that place are given in Table 1.

The colony is located on high ground, with a river nearby. The buildings for the resident patients occupy about 5 of the 160 acres, the rest of the area being set aside for future expansion and for agricultural development; 10 acres have recently been cleared for the planting of plum and avocado pear trees. The 94 dwellings of the patients are all one-room native mud huts, elliptical-ovoid in shape, with a dirt floor about 100 sq. ft. in area. Two to four persons live in each hut, and since

TABLE 1.—Temperatures (Fahrenheit), rainfall in 1947 and humidity averages, 1949, Ganta Station.

Month	Temperature (average)	Rainfall (total)
January	77.4°	1.08"
February	79.1°	3.05"
March	78.7°	3.33"
April	80.9°	1.57"
May	80.2°	9.54"
June	79.0°	19.31"
July	76.7°	13.76"
August	77.2°	10.94"
September	76.7°	22.40"
October	78.0°	6.77"
November	76.9°	3.58"
December	75.7°	2.80"
	Average 78.0°	Total 96.60"

Humidity, January to October, 1949, 2 readings per day:  
 Average daily low reading, 45% saturation  
 Average daily high reading, 80% saturation

all of their indoor activities are confined to this one room there is a considerable degree of over-crowding.

The 230 resident population during my study period there in 1947 comprised 209 adults and 21 children. Of the 137 males, 12 were boys; and of the 93 females, 9 were girls. The ratio of males to females was 3:2; the ratio among children was 4:3; while in the 20-30 years age group it was 2:1.

#### MORBIDITY STATISTICS

Classification of the cases was made on the basis of the clinical and laboratory examinations and review of the clinical charts. The classification used was that of the Cairo congress of 1938 (1), and because of familiarity I have continued to use it rather than the more recent one of the Havana congress of 1948 (6). The distribution of types and subtypes, in order of frequency, was as follows:

N3b ..... 81 cases, 35.0 per cent  
 N1a ..... 39 cases, 16.9 per cent

N2a .....	38 cases, 16.5 per cent
N2b .....	20 cases, 8.7 per cent
N1b .....	18 cases, 7.8 per cent
L1-N2b .....	9 cases, 3.0 per cent
L1-N3b .....	5 cases, 2.1 per cent
L3 .....	5 cases, 2.1 per cent
L1-N1a .....	4 cases, 1.6 per cent
L1-N2b .....	4 cases, 1.6 per cent
N1c .....	2 cases, 0.9 per cent
L2 .....	1 case, 0.4 per cent
L2-N2a .....	1 case, 0.4 per cent
L2-N2b .....	1 case, 0.4 per cent
L2-N3b .....	1 case, 0.4 per cent
L3-N1b .....	1 case, 0.4 per cent

Thus 198 (86%) of the cases were of the neural (N) or maculoanesthetic type, while only 32 (14%) were lepromatous (L); of the latter, 26 (11% of the whole) presented the secondary neural manifestations which lead to the designation "mixed." The occasional tuberculoid (Nt) cases were not distinguished from the regular N group.

A large majority (72%) of the patients in the colony had known that they had leprosy before presenting themselves. Many of them had already tried native remedies, which often modify the dermal lesions and give the patients a false feeling of improvement or cure. The remaining 64 patients (28%) came to the clinic for other illnesses and were found to have leprosy during the routine examinations. The chief complaints of these patients were as follows:

Neuralgic pains .....	12 cases
Headache or "fever" .....	9 cases
Diarrhea .....	9 cases
Stomach ache .....	8 cases
Cough or chest pain.....	7 cases
Nervousness .....	7 cases
Skin conditions (urticaria, ringworm, etc.).....	6 cases
Hernia .....	4 cases
Pain in testes or vaginal area.....	2 cases

Leprosy is a relatively asymptomatic disease in the early stages. Only 29 (12%) of the cases had complained of pain or discomfort directly related to that infection. In only one case were there any symptoms referable to the testes, although nodules were present in the testes or epididymis in nine.

#### BACTERIOLOGICAL FINDINGS

The examinations for *Mycobacterium leprae* involved nasal smears, smears from incisions or scrapings of cutaneous lesions,

and rarely a gland puncture smear or a smear from some mucous membrane lesions other than those of the nose. These smears were stained by a modification of the Ziehl-Neelsen stain.

The formula of the staining solution used is: basic fuchsin, 10 gm.; absolute ethyl alcohol, 100 gm.; phenol, 50 gm.; and distilled water, 950 ml. The fuchsin and alcohol are boiled together under a reflux condenser for 30 minutes and allowed to cool. The phenol is dissolved in the water. The alcohol solution of fuchsin is added to the phenol solution and the mixture is shaken well. A precipitate begins to form at once and continues to form for 3 to 5 days. After that period the mixture is filtered and is ready for use. The stain remains good for one year. It was found highly satisfactory.

The leprosy bacillus is more easily decolorized under acetone or acid-alcohol decolorization. Thus if a decolorization is continued until all the red stain in a Ziehl-Neelsen technique is removed, grossly the Hansen's organism will also be decolorized.

Bacilli from local lesions or nasal scrapings were demonstrated in all of the lepromatous cases, and in 39 per cent of those of the maculoanesthetic forms. Trophic ulcers were present in 28 (12%) of the cases, but only 4 per cent (9 of the ulcer cases) gave positive smears. All attempts to demonstrate acid-fast organisms in the peripheral blood failed, even in smears made of concentrated and digested blood clots; this examination was made in all types of cases, including 2 with lepra fever. From the standpoint of infectivity of the patient, the nasal smear is the most significant; when it is positive, regardless of the clinical type, the patient is obviously infectious. When the nasal smear of a neural case was found negative, 10 drops of liquor potassii iodidi, diluted in water, was given by mouth for activation purposes before the patient was considered to be noninfectious.

Attempts to infect rabbits, guinea-pigs, white rats and white mice all failed, despite the report of Tisseuil (12) of success with rats. From six patients with nodules showing numerous acid-fast organisms, small pieces of freshly excised nodules were planted into the abdominal wall, gluteal region or along the large nerves of the upper extremities of the animals mentioned. The implantation area healed readily, but six months' observation revealed no neoplastic growth in the areas of the transplants—nor did any of the guinea-pigs develop tuberculosis. (We always check guinea-pigs for possible tuberculosis.)

#### CLINICAL FINDINGS

One or more types of changes of the bones or skeletal muscles



related to the infection were found in 113 (49%) of the cases. These changes were:

Loss of fingers or toes.....	58 cases, 25.2 per cent
Recessive changes in fingers or toes without loss of member.....	22 cases, 9.6 per cent
Contractions of hand, "main en griffe"....	23 cases, 10.0 per cent
Changes in bony structures of nose.....	4 cases, 1.7 per cent
Paralytic changes, including "foot drop"	41 cases, 17.8 per cent
Miscellaneous .....	10 cases, 4.3 per cent

Some disturbance in walking due to nerve paralysis, mainly "foot drop," was shown by 41 (18%) of the patients. Of those with foot drop, 61 per cent showed it in the right foot only; in 24 per cent only the left foot was affected; while in 15 per cent this involvement was bilateral. Although some degree of muscular atrophy of the upper extremities and some degree of "main en griffe" due to atrophic ulnar change were rather frequent, well-developed neuromuscular paralysis of the upper extremities resulting in "wrist drop" was not as frequently seen as foot drop.

Easily demonstrable lesions of the nasal passages were found in 44 or 19 per cent of the patients; predominantly in the lepromatous type. The majority of these lesions were small ulcers or scars on the septum, but in 2 per cent of the cases the nasal septum showed complete perforation. Laryngopharyngeal involvement with gross pathology of the vocal cords and adjacent tissues was found in 1.5 per cent. The voices of these patients were hoarse and harsh, associated with difficulty in breathing and swallowing.

Of the maculoanesthetic lesions, 70 per cent were located on the trunk and buttocks, while in about 20 per cent of the cases the predominant lesions were on the face or extremities. The order of prevalence was: buttocks and hips, trunk, arms, legs and face. These lesions varied from 1½ to 5 inches in diameter. They were irregular in shape, generally flat, and light brown in color in an otherwise dark skin.

Because of language difficulties, it was difficult to demonstrate and delineate cutaneous sensory disturbances, especially with respect to the finer differentiations of touch and temperature; the absence of pain sensation was more easily elicited. Some degree of anesthesia to pain could be demonstrated in 134 (58%) of the cases. Localized hyperesthesia or paresthesia in some degree was present in 70 (30%).

With regard to readily palpable peripheral nerve enlargements, the ulnar was enlarged in 101 (44%) of the cases.

Posterior auricular nerve enlargements were present in 54 (23%), and peroneal enlargements in 52 (22%).

The first condition to be considered in the differential diagnosis of the maculonesthetic type without contracture or trophic ulceration is tinea infection. Tinea versicolor was present in 17 per cent of the patients. Among the points of differentiation are (a) the tinea lesions show scales when scraped, and (b) a hanging-drop suspension of these scales in 20 to 30 per cent KOH reveals the spores or mycelial structure of the specific organism. When ulceration and contracture are present, traumatic ulcerations of the lower extremities are often associated with *Tunga penetrans* invasion, followed by secondary pyogenic infections. Syphilis is relatively rare among the hinterland groups from which most of these leprosy cases derived. Yaws, however, is common and is important in the differential diagnosis.

Hyperpigmentation was observed in 5 per cent of the patients, while 2 per cent showed areas of definite depigmentation resembling vitiligo. There was no significant demonstrable correlation between the size of the areas of pigmentation changes and either the hyperesthesia or anesthesia.

Of the lepromatous cases, 20 per cent showed gross lesions on the head, face, trunk, and extremities; 40 per cent showed such lesions on the head, face and trunk; 82 per cent showed them on the head and face only.

Thickening of the supraorbital ridge, most frequently seen in the lepromatous type of the disease, was present in 32 (14%) of the cases. The skin first becomes thickened; the ridges are smooth in texture, while the troughs between them dry and tend to crack. This condition was often associated with alopecia of the eyebrows. Some degree of such alopecia was found in 35 per cent of the cases; in 20 (9%) of them it was complete and bilateral, while in the others it was of lesser degrees, down to slight lateral thinning.

Some type of easily-demonstrable ocular pathology was present in 56 (24%) of the patients. They were, in the order of prevalence, as follows:

Keratitis .....	26 cases, 11.3 per cent
Arcus senilis .....	10 cases, 4.3 per cent
Ectropion .....	3 cases, 1.3 per cent
Conjunctivitis .....	3 cases, 1.3 per cent
Exophthalmos .....	2 cases, 0.9 per cent
Scleritis .....	2 cases, 0.9 per cent
Dacryoma .....	2 cases, 0.9 per cent

Staphyloma .....	1 case,	0.4 per cent
Miscellaneous .....	4 cases,	1.7 per cent

One-hundred and eight (47%) of these patients showed some degree of superficial adenopathy. The average temperature by mouth was 97°F.

The blood pressures of 193 of the adults in the study gave a median figure of 105 mm. of mercury, and a median diastolic figure of 70 mm. Systolic pressures of over 125 mm. occurred in only 30 (15%) of these adults; twice as many women as men gave such readings. The mean pulse rate was 80 per minute. This high rate is to some extent related to the anxiety some natives have during a physical examination.

The mean basal metabolic rate reading of the entire group was plus 4, with the highest plus 29 and the lowest minus 17. Readings below zero were shown by 20 per cent of the patients, while 80 per cent showed readings above zero. Even in those with thyroid enlargement—this being found in 9 per cent of the cases, mostly nontoxic goiter—there was very little or no increase in the basal metabolic rates.

The heart was normal in all but 14 (6%) of the cases. The abnormalities encountered were:

Tachycardia .....	6 cases
Systolic murmur .....	2 cases
Extra systoles .....	2 cases
Arteriosclerotic disease .....	2 cases
Doubtful pathology .....	2 cases

By physical examination, the lungs were free from gross pathology in 96 per cent of the cases. The tuberculin patch test was positive in 18 (8%) of them. There was one case of active pulmonary tuberculosis with a Gaffky V positive sputum. Râles of various types were present in 8 cases, attributed to amebic hepatitis or bronchitis. There was asthmatic breathing in 1 case. Two showed active lung pathology, apparently secondary to the leprosy infection, with specific lesions in the laryngopharyngeal region.

The abdominal examination of 154 patients (67%) revealed nothing abnormal to palpation, while in 76 patients (33%) there were palpable or easily demonstrable abnormalities of the abdominal cavity or wall. These were:

Splenomegaly .....	37 cases
Hernias .....	11 cases
Enlargement of or tenderness over liver.....	7 cases
Pelvic tenderness .....	6 cases



Pregnancy .....	5 cases
Tumor of bladder .....	2 cases
Miscellaneous .....	8 cases

## OTHER FINDINGS

With regard to blood findings, 138 (60%) showed normocytic or hypochromic anemia. Leucopenia, especially neutropenia, was present in 104 (45%). The average erythrocyte count was 4,000,000 per cu. mm.; the average white cell count was 6,100. The average hemoglobin level was 70 per cent by the Tallqvist method.

The differential blood smear counts were abnormal in 147 (64%) of the cases. The predominant abnormalities were:

Relative eosinophilia in .....	10 per cent
Relative eosinophilia and neutropenia in.....	20 per cent
Relative eosinophilia and monocytosis in.....	18 per cent
Relative monocytosis in .....	18 per cent
Relative lymphocytosis in .....	23 per cent
Other, in .....	11 per cent

The apparently high frequency of eosinophilia is misleading, because on an absolute scale the number of eosinophiles would be less than 300 per cu. mm., and thus would not be an absolute eosinophilia. In some cases, more than one abnormality of the white-cell count appeared in the same smear. In more than 50 per cent of the smears, the ratio of the filament to nonfilament cells was less than 8 to 1.

Treponemiasis was present in 71 (31%) of the 230 cases. In 216 (94%) of them there were one or more intercurrent parasitic infections. The percentages of the entire group of people with the various infections of this type were:

Hookworm .....	158 cases, 68.8 per cent
Ascaris lumbricoides .....	95 cases, 41.3 per cent
Endamoeba histolytica .....	84 cases, 36.5 per cent
Plasmodium falciparum .....	71 cases, 30.8 per cent
Schistosoma hematobium .....	35 cases, 15.2 per cent
Trypanosoma gambiense .....	19 cases, 8.3 per cent
Trichocephalus trichura .....	19 cases, 8.3 per cent
Schistosoma mansoni .....	4 cases, 1.7 per cent
Enterobius vermicularis .....	2 cases, 0.9 per cent

The average duration of the recognized lesions in the male was 42 months; the longest period was 17 years, the shortest 7 months. The average duration in the female was 54 months, the range being from 14 years to 2 months. An analysis of the individual ages when the first superficial lesion was observed

agrees with the reports of most investigators that childhood is the most susceptible period. So far as the United States is concerned, Elliott (3) concluded that the infection is generally acquired before the age of 5 years.

This is especially true with respect to the relatively asymptomatic maculoanesthetic type in adults, whose life expectancy in hinterland Liberia is about 43 years. Crude analysis of the time that untreated individuals have lived after recognition of their leprotic condition has shown that it is not materially different from that of the nonleptous individuals of the same villages.

Histories of known exposure to other cases of leprosy in the home or village, prior to the development of the disease, were obtained in 97 (42%) of the cases studied. In 90 (38%) of them there were intimate contacts which are considered as the probable sources of infection. The family relationships of the intimate contacts and probable sources of infection are as follows:

Sibling .....	30 cases
Parent .....	28 cases
Unrelated adults in household.....	11 cases
Unrelated children in household.....	6 cases
Spouse .....	6 cases
Son-in-law .....	4 cases
Children .....	3 cases
Uncle .....	2 cases

From a series of questionnaires, we have concluded that the reproductivity of leprosy patients is diminished, in terms of children reaching an age of economic usefulness. For every 100 products of conception among female patients over 30 years of age, 63 were born alive and 37 died *in utero* or were stillborn. Of the 63 children born alive, 35 died during the first two years of life, chiefly of diarrheal diseases and malaria, malnutrition being a major contributing factor. Of the 28 that were still alive at the age of 2 years, another 10-15 died during the next 8 years from gastrointestinal, respiratory and insect-borne diseases.

It thus appears that only about 10 per cent of the products of conception reach 10 years of age, and thus become adolescents and economically useful. These figures suggest that unless the female conceives more than 10 times during her child-bearing period, the progeny of leprosy persons will progressively decline. For effective propagation of leprosy families, each female would have to conceive 15 times, a figure which appears to be about

50 per cent above the actual average number for women of the hinterland. The average number of living children of adults, male and female, over 30 years of age, is 1.4 siblings for each family in which the mother or father has leprosy.

#### TREATMENT WITH CHAULMOOGRA OIL

For economic reasons, less than 10 per cent of the patients in the Ganta leprosy village were, at the time of writing, receiving sulfone treatment. The therapeutic sheet-anchor for leprosy in Liberia continues to be chaulmoogra oil or one of its derivatives. In some of the adjacent French colonial areas, caloncoba oil and extract of the seed of a species of *Oncoba*, is used with results similar to those we obtained from chaulmoogra oil injections.

There are many therapeutic complications in prolonged chaulmoogra treatment unless the professional supervision and technical skills are good. An analysis of the results of twelve months of treatment of the patients in the Ganta village who were receiving regular chaulmoogra oil injections shows that 61 per cent had one or more complications. These conditions and their frequencies have been recorded in a previous report (10) and are not repeated here. More is said later of this matter of treatment with chaulmoogra.

#### TREATMENT WITH DIASONE

Two years ago, the Ganta colony received diasone sufficient for nine months' treatment of 12 bacteriologically positive patients, 8 of neural and 4 of lepromatous or mixed type. Since no more of the drug was received, the condition of the patients treated with that drug was appraised at the end of that period in comparison with 12 other patients with comparable types of lesions who had remained on chaulmoogra oil therapy. The difference in favor of the diasone group was striking.

The dosage schedule of diasone was one tablet (0.33 gm.) daily for the first two weeks, one twice daily for the second two weeks, and one three times daily thereafter. Total red-cell counts, hemoglobin determinations and urinalyses were made on each patient before therapy was started and periodically thereafter, with the usual precautions with respect to anemia found before or developing during treatment, and in the presence of albuminuria or hematuria.

All of the diasone-treated patients showed subjective and objective improvement. Six of them became entirely bacteriologically negative, in smears from the nose and elsewhere; 3 became bacteriologically negative and clinically improved to the

extent of being considered arrested, and they are remaining under observation; and 8 became bacteriologically negative by nasal smears although acid-fast organisms could still be found in the skin lesions of 2 of them. Two lepromatous cases became bacteriologically negative but not clinically arrested. Nothing comparable to these changes were seen in the chaulmoogra-treated group. Three months after cessation of treatment examination showed no signs of relapse, bacteriologically or clinically.

With regard to therapeutic complications in the diasone group, as compared with those which occur during chaulmoogra treatment, the differences were also remarkable. Only three transient therapeutic complications occurred, namely, headache, albuminuria and anemia. In all but one case, that of a patient with persistent albuminuria who had to be removed from this treatment, these conditions yielded to the usual measures.

#### DISCUSSION

The leprosy rate in Liberia is relatively low for a tropical rain-forest country where the disease is endemic. Of the half-million estimated cases in Africa, between 1,200 and 2,000 of them reside in this country. In this study of 230 cases in the Ganta leprosy village the standard criteria for diagnosis were used, excepting the histological studies of biopsy specimens listed as a cardinal point in differential diagnosis by Johansen, Erickson and Ross (7). Although such specimens were frequently taken, the technical facilities were not very good. In other respects the examinations to which these patients were subjected were unusual in scope and detail, being—so far as I am aware—without parallel for any leprosy institution in Africa.

Of this group of patients, only 14 per cent were of the highly infectious and minimally resistant type, according to the criteria of Canizares (2). The fact that the great majority of them were of the relatively noninfectious neural type reflects a rather stable community reaction to the disease, and from the epidemiological point of view represents either attenuation of the infecting microorganism or a considerable degree of resistance, or "herd immunity," on the part of the population, such as frequently occurs in diseases of long endemicity.

From the public health point of view, with respect to control of the disease in the region, the fact that so many cases were of the neural type and found bacteriologically negative on rigorous

examination suggests that the expense of their maintenance in the colony is not justified except on humanitarian grounds. From that point of view it would be useful for the individuals concerned if they could be subjected to active treatment with one of the more effective drugs, to overcome the infection and prevent the late development of crippling secondary changes, or to halt the progression of such changes which have begun insofar as such treatment can do that.

At the end of the epidemiological analysis of these patients, an attempt was made to determine the infective and clinical status of each of them, using as the criteria the bacteriological findings, the changes of the superficial lesions, and the psychological attitudes of the patients. It was concluded that 55 (24%) of them were clinically and socially cured, or were arrested cases. Since we believe that these individuals are not infectious at present, and that at their ages they probably will not become infectious, we recommend that they be allowed to return to their villages and community life. The recommendation that these cases and other noninfectious ones might be relieved of resident restrictions, but continue to return for weekly treatments or monthly checks, was made on the same principle on which Simons (11), Fox (5), and others have concluded that rigid segregation of noninfectious and arrested cases is unnecessary. Some of these patients, however, elected to stay at Ganta as their haven of refuge.

A factor of importance in treatment, of whatever kind, being the general condition of the patients there is significance in the anemia and neutropenia found in these cases. These conditions were significantly related to dietary deficiencies: low animal protein intake, absence of fresh vegetables, and low vitamin content in the diet, which consisted of salted fish as the main source of animal protein, with polished rice, cassava or maize mixed with palm oil making up the rest. Whereas we found definite neutropenia in 45 per cent of these patients, Kiang and Choa (8) found it in only 5 per cent of a series of cases in China. Their article did not give in detail the diet of their group.

Also of significance, of course, is the high frequency of parasitic infections in the Ganta patients, no less than 94 per cent of them having one or more such infections. The most important were hookworm (69%), ameba infection (36%), and malarial parasites in the blood (31%); other such infections, including schistosomiasis and trypanosomiasis, amounted to a material total.



Improvement of diet and sanitation and the treatment of intercurrent and concurrent diseases would seem indicated, whatever the kind of antileprosy treatment may be available. The leading causes of death among persons with leprosy in Liberia are not tuberculosis and nephritis, as are frequently the cases elsewhere, but diarrheal diseases, hematozoal fevers and *Schistosomia hematobium* infections.

With regard to the use of chaulmoogra oil in the treatment of these patients, the depressive effects of its prolonged use, with the slow subjective therapeutic results and frequent complications, are reflected in the spirit of resignation and mental apathy seen in so many of the patients. The wisdom of continuing this line of treatment, even when for financial reasons the sulfones cannot be given, is questionable.

As for sulfone treatment, little more than the observations recorded can be said from the limited experience with diasone at Ganta. The review of Faget and Erickson published in 1948 (4) with respect to promin, diasone and promizole, and much which has appeared in the literature since then, leave no doubt of the superiority of these drugs in lepromatous leprosy over anything else that has been used heretofore. Recent experience with the much cheaper parent substance, to which a great deal of attention has been given of late, would seem to offer hope for patients in institutions like the Ganta colony, where medical supervision is available but the financial support is slender.

#### SUMMARY

Leprosy is endemic in Liberia. There are only about 1,200 clinically recognized cases of the disease, about 0.6 per 1,000 of the population, and perhaps a total of 2,000. The environmental factors of a tropical rain-forest belt, with an annual rainfall between 160 inches along the coast to 96 inches in the hinterland, a relative humidity of 80 per cent for almost seven months of the year, and a mean temperature between 77° and 80°F., operate toward the continuation of the disease.

A detailed clinical and laboratory study was made in one of the leprosy villages, that of the Ganta Mission, where there were 269 resident patients in 1947, with follow-up observations thereafter. The findings in 230 of these cases are given in this report.

There are more clinical cases among males than females. The ratios are for all adults 3 males to 2 females; for young adults between ages 20 and 30 years, 2:1; and for children, 4:3.

Applying the Cairo classification, 86 per cent of the cases

were of the maculoanesthetic (neural) type and only 14 per cent lepromatous, most of the latter being of the "mixed" class. All of the lepromatous type were found bacteriologically positive, and 39 per cent of the maculoanesthetic cases. Thus a majority (53%) of the entire group was negative.

With respect to clinical findings, some degree of skeletal pathology related to the infection was found in 49 per cent of the patients. Contraction or loss of a digit or other parts of the extremities, and peripheral nerve paralysis resulting in foot drop, were the predominant changes.

Pathological lesions of the nose or nasal cavity were found in 19 per cent. The most common external lesions were nodulations, and the chief internal ones were ulcerations and perforations of the septum, occasionally with collapse of the bridge.

In 10 per cent of the maculoanesthetic cases the first lesions were observed on the trunk or buttocks, with the buttocks predominating.

Palpable nerve enlargement could be demonstrated in more than 50 per cent of the cases, in several of them in more than one area. The ulnar nerve was affected in 44 per cent, the posterior auricular nerve in 23 per cent, and the peroneal nerve in 22 per cent.

The average mean blood pressures in the adults were low. The systolic pressure was 105 mm. of mercury, the diastolic pressure 70 mm.

Although thyroid enlargement was found in 9 per cent of the patients, the average basal metabolism rate was low, and no evidence of thyrotoxicosis was observed.

A large variety of types and varying degrees of severity of pathological conditions not related to leprosy were found. Several of these conditions not only increased the severity of the clinical picture, but also interfered with the effectiveness of the drug used for the treatment of leprosy. It was, therefore, necessary in many instances to treat the concurrent or intercurrent infection or correct other defects before the results of the more specific treatment for leprosy could be appraised.

Regarding other laboratory findings, 60 per cent of the patients showed significant anemias, primarily nutritional or associated with helminthiasis, and 45 per cent showed neutropenia. All but a few (94%) had one or more parasitic infections, the most important of them being helminthiasis, amebiasis, malaria, trypanosomiasis and schistosomiasis. Nearly one-third (31%) had treponemiasis, mostly yaws.

Observations indicate that leprosy reduces the procreative power of both sexes, more in the male than the female. Nodular leprosy causes twice as many unproductive marriages as the anesthetic type. It also appears that little more than 10 per cent of the products of conception in patients over 30 years of age survive to adolescence.

The opinion is expressed that, considering the frequent therapeutic complications of chaulmoogra treatment, the depressive effects of prolonged treatment with that drug, and the poor results obtained with it, the continuation of that mode of treatment is doubtful wisdom.

#### ACKNOWLEDGMENTS

The writer wishes to express appreciation to Dr. John B. West, former director, U. S. Public Health Mission in Liberia, who arranged his relief from other duties for varying periods totalling seven months so that he could continue these observations; to the Honorable Gabriel L. Dennis, secretary of state, and James B. Dennis, assistant secretary of treasury, Republic of Liberia, for their special interest in the work; to Rev. Willis J. King, bishop of the Methodist Church in Liberia, Dr. George W. Harley, superintendent of the Ganta Methodist Mission and administrator of Ganta colony, Miss Mildred M. Black, principal of the Mission School at Ganta who gave valuable sociological and laboratory technical aid; and to the technician staff of the U. S. Public Health Mission in Liberia. The several courtesies of many others not specifically mentioned here are also acknowledged.

#### 528 ABSTRACTO

En Liberia, país de selva tropical, alta temperatura, alta humedad relativa y grandes lluvias, hay alrededor de 1,200 casos conocidos de lepra y quizás un total estimado en unos 2,000. En la colonia de la misión Ganta, en la frontera nordeste, el autor hizo un estudio extraordinariamente detallado de 230 casos en 1947, y continuó observándolos a intervalos subsiguientes.

Había más varones que hembras, en proporción de 3:2. En la década de los 20-30 años, la proporción era de 2:1. Sólo el 9% de los pacientes eran niños, la proporción sexual entre ellos era de 4:3.

Solo el 14% de los casos eran del tipo lepromatoso, todos bacteriológicamente positivos, la mayoría con lesiones neurales secundarias. De los casos maculoanestésicos (neurales), el 39% fueron bacteriológicamente positivos. Así que la mayoría (el 53%) de todos los casos eran bacteriológicamente negativos.

Otros hallazgos de laboratorio tienen que ver con estudios hematológicos e infecciones parasitarias. Anemias, principalmente de origen nutricional o asociadas a helmintiasis, se observó en el 60% de los casos, y el 45% demostró tener neutropenia. No menos del 94% tenía una o más infecciones parasitarias, las de más importancia siendo helmintiasis, amebiasis, malaria, tripanosomiasis y esquistosomiasis. Treponemiasis, especialmente frambesia, se halló en el 31%.

En el aspecto clínico, casi la mitad de los casos, (49%) demostró tener cambios tróficos o paralíticos. Lesiones nasales se observaron en el 19%. Nervios periferales palpables se encontraron en más del 50% siendo el nervio ulnar palpable en el doble del número de casos que el auricular posterior o el peróneo.

La cuarta parte de los pacientes tenía cambios oculares. Se observaron y anotaron cambios en el corazón, pecho y abdomen. La tensión arterial en adultos era baja, 105/70 mm.Hg. El metabolismo basal también era bajo, en general, aunque un 9% de los pacientes tenía bocio no-tóxico.

Parece ser que la lepra reduce el poder de procrear en ambos sexos, más en el varón que en la hembra, y en el tipo lepromatoso el doble de el tipo maculo-anestésico. También parece ser que de 100 embarazos en pacientes de 30 años o más, menos de las 2/3 partes dan a luz niños vivos, y más de 1/3 de éstos muere antes de los 2 años de edad; solamente 1/10 de ellos llegan a la adolescencia y a ser útiles a la comunidad.

#### REFERENCES

1. [CAIRO] Resolutions and Reports of the International Congress of Leprosy, held in Cairo, March 21st-27th, 1938. *J. Egyptian Med. Assoc.* **21** (1938) 138-189; *Internat. J. Leprosy* **6** (1938) 377-469.
2. CANIZARES, O. New official classification of leprosy. *Arch. Dermat. & Syph.* **59** (1949) 584-586.
3. ELLIOTT, D. C. Leprosy, a disease of childhood. *J. Pediat.* **35** (1949) 189-196.
4. FAGET, G. H. and ERICKSON, P. T. Chemotherapy of leprosy. *J. American Med. Assoc.* **136** (1948) 451-457.
5. FOX, H. Cutaneous manifestation of some tropical diseases. *Arch. Dermat. & Syph.* **59** (1949) 127-144.
6. [HAVANA] Resolutions and Reports of the International Congress of Leprosy, held in Havana, April 3rd-11th, 1948. *Internat. J. Leprosy* **16** (1948) 187-253; *Mem. V Congr. Internac. Lepra, Havana, 1948; Havana, 1949.*
7. JOHANSEN, F. A., ERICKSON, P. T. and ROSS, H. The diagnosis of leprosy. *Trop. Med. News*, Dec. 1949 Supplement.
8. KIANG, S. and CHOA, G. H. The blood picture in leprosy. *American J. Med. Sci.* **217** (1949) 269-276.
9. POINDEXTER, H. A. A laboratory epidemiological study of certain infectious diseases in Liberia. *American J. Trop. Med.* **29** (1949) 435-442.
10. POINDEXTER, H. A. A note on leprosy in Liberia. *Internat. J. Leprosy* **18** (1950) 369-372.
11. SIMONS, R. D. G. P. Modern conception concerning the compulsory isolation of lepers. Contagious malignant morbus Hansen vs. non-contagious benign hansenide. *Proc. Roy. Soc. Med.* **41** (1948) 751-754.
12. TISSEUIL, J. Sur 3 inoculations positives de la lèpre humaine au rat d'élevage. *Bull. Soc. Path. exot.* **41** (1948) 649-652.