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LEPROSY WITH TUBERCULOSIS IN HAWAII

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The relation of tuberculosis to leprosy, or its interrelation with that disease, has been a subject which has both intrigued and perplexed students of leprosy for many years. Their interest has been stimulated by analogies between the two causative organisms, between the histopathology of some lesions of leprosy and those of tuberculosis, and because of similarities in the respective clinical courses and manifestations and in the epidemiology of the two diseases.

Clinical findings in patients affected with both diseases offer contrasts and paradoxes which are difficult both to anticipate and to explain. Thus, our observations reveal a seemingly extraordinary proportion of such patients who are very slightly incapacitated, or who exhibit symptoms of a relatively minor degree, though the tuberculous process appears to be established and progressive in them. Remarkable recessions sometimes take place in their leprous lesions during prolonged phases of activity of the tuberculous processes when accompanied with fever, and unexpected abatements or apparent arrests of both affections occur. On the other hand, active progression of tuberculosis may be accompanied by evidences of activity in leprosy of similar or relatively greater intensity. It has also been noted that the frequency of reactions to tuberculin skin tests in cases of the combined affections, as well as in the leprous without tuberculosis, does not conform to that observed in nonleprous persons.

A survey of the household and economic environment of the leprous patients, and of the practices of their family life, suggests that they are of the type that foster a prevalence of "family" or contact diseases, such as leprosy and tuberculosis, when such diseases are introduced. If the two diseases coexist among them, frequently it will be apparent that measures for the treatment of leprosy, as well as for its control and prevention, may be more advantageously directed at the complicating tuberculosis. Hence, in the course of examining and treating the leprous patients at the Kalihi Receiving Station, Honolulu, during recent years, some study has been devoted

to the prevalence of tuberculosis among them, to its effect on the course of the leprosy, and to the responses of the patients to tuberculin skin tests.

TUBERCULIN REACTIONS

The local inflammatory reaction subsequent to the intracutaneous introduction of products of the growth of the tubercle bacillus has been accepted as an indicator of latent or active tuberculous infection, and from its use the conclusion has been reached that a very large proportion of the general urban and semirural population of European countries and of the United States has been, or is, infected, even in childhood and youth. This conclusion has been strengthened more recently by roentgenologic findings which have been interpreted as past or present evidence of such an infection, and by the demonstration of the tubercle bacillus or clinical syndromes which substantiate many of the results obtained by the skin test and roentgenograms. However, even among those with positive tests, the percentage of demonstrable or suspected cases of tuberculosis is small in individuals of the general population 10 to 20 years of age who are not definitely incapacitated by illness.

Similar conditions have been found to obtain also in Hawaii. Doolittle (1) made an examination of about 1,500 pupils of a public school in Honolulu and found that approximately 75 percent of them reacted positively to tuberculin. Further examinations by him (2) of approximately 2,500 more of such pupils in another school yielded a lower number of positive skin tests and brought the average to about 60 percent of the 4,000 children 10 to 20 years of age. There were about 2 percent of those with positive skin reactions who exhibited other signs and symptoms strongly presumptive or suggestive of tuberculosis. Halford (3) made a similar study of the resident pupils of a boarding school in Honolulu, 380 children of Hawaiian blood, from 10 to 22 years of age. He also found about 60 percent who reacted positively to tuberculin, and 2 percent whose condition suggested a tuberculous affection.

Such a study of leprous patients in residence at the receiving station in Honolulu revealed conditions which are at great variance with those previously mentioned, although the leprous patients originated from the same or similar economic and racial groups as the individuals studied by Doolittle and by Halford, and included only those patients who were ambulatory or semiambulatory and not infirm. In that study the methods and technique of Doolittle were carried out, with his close consultation. He furnished the tuberculin from the lot used by him, supervised its administration, and conferred in the interpretation of both the roentgenologic and clinical findings. Halford's examination furnishes perhaps an even better comparison, since his

subjects were resident pupils under medical supervision and hygienic surroundings such as prevail at the receiving station, and his investigations were carried out by the same methods and standards and in consultation with Doolittle.

The records of intracutaneous tuberculin tests on 150 leprous patients ranging from 10 to 65 years of age are grouped by age in table 1.

TABLE 1.—*Tuberculin tests in leprous patients by ages*

	All ages		0–4 years		5–9 years		10–14 years		15–19 years		20–24 years		25–29 years		30–34 years		35+ years	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Total tested	150	100	0	0	7	100	27	100	30	100	19	100	26	100	10	100	31	100
Tuberculin positive	54	36	0	0	0	0	7	26	13	43	4	21	12	46	5	50	13	42
Tuberculin negative	96	64	0	0	7	100	20	74	17	57	15	79	14	54	5	50	18	58

In table 2, data of the tests on the patients 10 to 20 years of age are arranged with the data from the records of the surveys on the pupils of 2 schools.

TABLE 2.—*Tuberculin tests and tuberculosis in leprous patients and in pupils of public school and boarding school, Honolulu, ages 10 to 19 years*

	Tuberculin tests				Tuberculosis among positive tuberculin reactions (20)								Positive tuberculin in those without tuberculosis			
	Total		Positive		Proved cases		Clinical and X-ray cases		X-ray suspects		Total cases and suspects		Without tuberculosis		Positive tuberculin	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Leprous patients	57	100	20	35.1	3	15	6	30.0	0	0.0	9	45.0	48	100	11	22.9
Public school (ages 11–18)	1,473	100	1,086	73.7	0	0	13	1.2	10	.9	23	2.1	1,450	100	1,063	73.3
Boarding school	353	100	239	67.7	0	0	2	.8	4	1.7	6	2.1	347	100	233	67.1

It is apparent that in the small group of leprous patients the proportion who react to the tuberculin skin test is about one-half that in the other groups; and there is a striking difference between the two other groups and the leprous patients in the percentage of those with positive reactions who show other findings of tuberculosis, or presumptive evidence of its presence.

Further divergencies from the results to be expected in the reactions to the skin test are suggested in the detailed records of the leprous group in table 3.

TABLE 3.—*Tuberculosis in leprous patients with positive tuberculin reactions, by ages*

	All ages		0–4 years		5–9 years		10–14 years		15–19 years		20–24 years		25–29 years		30–34 years		35+ years	
	Number	Tuberculin positive	Number	Tuberculin positive	Number	Tuberculin positive	Number	Tuberculin positive	Number	Tuberculin positive	Number	Tuberculin positive	Number	Tuberculin positive	Number	Tuberculin positive	Number	Tuberculin positive
Total patients	150	54	0	0	7	0	27	7	30	13	19	4	26	12	10	5	31	13
Proved tuberculosis	10	8	0	0	0	0	1	1	2	2	1	2	0	0	1	1	2	2
Presumptive tuberculosis, clinical, and X-ray	23	20	0	0	0	0	0	0	6	6	2	1	3	3	3	3	9	7
Suspect tuberculosis, clinical	14	7	0	0	0	0	0	0	1	0	1	0	5	3	0	0	7	4
Suspect tuberculosis, X-ray	6	0	0	0	0	0	1	0	1	0	0	0	2	0	0	0	2	0
Without findings of tuberculosis	97	19	0	0	7	0	25	6	20	5	12	1	16	6	6	1	11	0

It will be noted that but 8 skin tests were positive among 10 cases of active tuberculosis in ambulatory or semiambulatory patients, and, in similar trend, but 20 reacted positively among 23 who presented roentgenologic and clinical findings presumptive of tuberculosis. Two of the 8 positives among the tuberculous and 7 of the 20 among the presumptive cases reacted positively only after having reacted negatively to previous tests in which as much as 0.1 mg, or, in some cases, even 1.0 mg of Old Tuberculin was injected. On the other hand, there were only 11, or about 25 percent, with positive reactions among the 45 who were between 10 and 19 years of age and without findings of tuberculosis; while among the compared groups there were approximately 65 or 70 percent (table 2).

The frequency with which changes occurred from year to year in the degree of the reaction, including that of negative and positive, seemed also of interest. In table 4 the results are recorded of the retests made in successive years on 94 patients in continuous residence at the station for from 2 to 4 years.

TABLE 4.—*Tuberculin tests in leprous patients showing changes in reactions in successive years*

94 patients retested: 22, 1 time; 53, 2 times; 19, 3 times]

Tuberculin reactions								
No change			Changes					
Total	Negative	Positive	Total	Negative to positive	Positive to negative	Stronger	Weaker	Reverse change
66	58	8	28	[1] 11	[1] 7	9	3	2

[1] 2 patients are counted twice because of reverse changes.

Twenty-eight, or approximately 30 percent, of these 94 patients showed definite changes in their reactions. Two of them showed a reverse of negative and positive reaction twice during the 4 years. The tests in 1930 and 1931 were made with Old Tuberculin (O.T.), using three successive doses of 0.01, 0.1, and 1.0 mg each. Those of 1932 and 1933 were made with O.T., using the two smaller doses; and parallel tests were made, on the same patients, using a refined proteid of the tubercle bacillus, human strain (MA100 human) furnished by the Research Committee of the National Tuberculosis Association. The initial dosage of this product was 0.0005 mg, and the repeat dose 0.001 mg. The inconstancy of the reactions does not appear to be the result of technical or interpretive errors, since these were carefully checked independently by the same and different experienced observers.

Mariette and Fenger (4) and others have investigated the reactions of individuals of groups of the general population, and of those of sanatoria for tuberculosis, to intracutaneous injections of the refined proteids of different varieties of the tubercle bacillus, and of other acid-fast bacilli, apparently with the purpose of determining the relative specificity of the preparations of the tubercle bacilli. A like examination was made on 56 of the leprous patients at the Kalihi Receiving Station, using in parallel O.T., MA100 human, the proteids of avian tubercle bacillus, timothy bacillus, and an extract of an acid-fast bacillus isolated from a leprous nodule of one of our patients. This extract was prepared by the methods commonly used in making Old Tuberculin. The initial and repeat doses were, respectively, O.T., 0.01 and 0.1 mg; MA100 human, 0.0005 and 0.001 mg; avian proteid, one dose only of 0.001 mg; timothy proteid, one dose only of 0.01 mg; extract of acid-fast (A_3), 0.1 and 1.0 mg. The results were as follows:

Positive reactions

Number tested	O.T.		MA100		Avian		Timothy		A_3 extract	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
56	27	48.2	18	32.1	12	21.4	13	23.2	11	19.6

Mariette and Fenger found, with the doses used by them, that a smaller percentage among tuberculous patients reacted positively to the nonspecific proteids and a larger percentage reacted to the MA100 human than occurred with O.T. Among employees of a sanitarium for tuberculosis, and among the general population, they obtained, universally, a higher percentage who reacted to the MA100 human, and to the proteids of the tubercle bacillus of bovine or

avian origin, and of the timothy bacillus, than to O.T. and a much higher percentage reacting to the nonspecific proteids than to the specific O.T. and MA100 human.

The reactions to O.T. and MA100 in a group of 129 leprous patients examined a year previous to the examination of the above-mentioned group exhibited no significant differences, qualitatively or quantitatively, in the reactions to the 2 products. There were 25.6 percent positive to O.T., and 23.3 percent positive to MA100 human. Thus in both tests on leprous patients the percentage of positive reactions to MA100 was approximately the same as, or smaller than, that to O.T.; and in the latter test the percentage positive to the avian and timothy proteids, as well as to the A_3 extract, was smaller than that positive to the two specific tuberculin products, and one-half to one-third as large as the percentage of positives obtained by Mariette and Fenger in each of their groups.

The results obtained in the test on the leprous patients with the several preparations are in keeping with those presented in tables 1 and 2. In other words, the groups of leprous patients examined exhibited but one-half to one-third the percentage of positive reactions to tuberculin as occurs in groups of the general population of comparable ages and racial composition in the same community; and the percentage of those tested who reacted to the various preparations of the acid-fast bacilli was one-half to one-third of that determined among individuals elsewhere.

INCIDENCE OF TUBERCULOSIS

The comparative frequency with which tuberculosis might be expected in the leprous patients in Hawaii can be reflected only by the expected rate of mortality among them. This must be estimated from the reported deaths from tuberculosis in the general population of the Territory. The annual average reported mortality from tuberculosis in the general population for the 3 years 1931–33 was 378 deaths, or a rate of 99.8 per 100,000 of the average total population (378,663), estimated by the Territorial Board of Health from the United States census of 1930. The numbers of reported deaths from tuberculosis among different races show a wide variation in their respective mortality rates; and an estimation based on these latter rates places the expected average annual mortality rate from tuberculosis at 150 per 100,000 for the leprous patients in residence at the receiving station during those 3 years. The average annual number of deaths from tuberculosis among the average annual number (155) of these leprous patients during the same period was three, or an average annual mortality rate of 1936 (nearly 2,000) per 100,000, as compared with about 100 per 100,000 in the general population, and

150 per 100,000 to be expected of a general population of the same racial composition as that of the leprous patients. Adjustments for the age factor in the comparisons could not be made, but would probably not alter the expected rate significantly.

An index of tuberculosis morbidity among these leprous groups may be gained from the results of a careful study of 101 patients in residence throughout the year of 1932. This group comprised only those who were ambulatory or semiambulatory, relatively vigorous, and neither acutely ill nor aged. A few individuals under 12 years of age were also omitted. They were tested on at least two occasions with tuberculin and were carefully examined roentgenologically and clinically. Thirty-one reacted positively to tuberculin, 8 were proved to be tuberculous by animal experimentation and cultures, and 20 were so diagnosed from clinical and roentgenologic findings. A total of 28, or approximately the same percentage, were thus found to be definitely affected with tuberculosis, or their condition was strongly presumptive of tuberculosis. The morbidity to be expected from the expected mortality rate would be 1½ percent, if it were assumed that there are 10 cases existing to 1 death reported. This assumption is one used by experienced students of tuberculosis in estimating the probable morbidity in other localities.

LEPROUS REACTIONS

It is generally reported that the concurrence of other infections, or affections, in the leprous patient influences the course of leprosy unfavorably, though instances of a favorable influence are also reported. While the validity of this reported observance seems logical, its accuracy can be determined only by the accumulation of carefully controlled clinical experiences. These are made difficult by the protracted course of the disease, through which advances and recessions normally occur, and by the lack of exact criteria by which the progress of cases may be judged. However, the acute leprous reaction is usually a clinical syndrome sufficiently pronounced to permit of relatively easy recognition and classification. The syndrome is customarily initiated by a definite and rather sharp elevation of temperature, together with other evidences of systemic disturbance and the evolution of acute forms of skin eruptions. These may subside with a rapidity suggesting a crisis-like termination, and be followed by a period of clinical quiescence or arrest, or they may slowly recede or pass into a course of subacute progression. The frequency with which such reactions has occurred among the leprous patients who were also affected with tuberculosis seems of decided interest and may be of importance in evaluating the problems of leprosy, since the sequence of the reaction in those with tuberculosis is more often that of subacute progression

of the leprosy. The leprous eruptions occurring in these subacute progressions add a point of further interest, in that they often resemble somewhat those of "erythema nodosum."

An analysis of this frequency among 150 patients who were under observation for periods ranging from several months to 4 years is presented in table 5.

TABLE 5.—*Acute leprosy reactions in tuberculous and nontuberculous persons*

LEPROSY REACTIONS IN TUBERCULOUS AND NONTUBERCULOUS

Patients	Number	Percent	Tuberculous				Nontuberculous, total without any findings	
			Tuberculin positive with or without other findings	Tuberculin negative with other findings	Total with some tuberculous finding			
					Number	Percent	Number	Percent
All	150	100.0	54	17	71	100.0	79	100.0
Leprosy reactions	62	41.3	36	14	50	70.4	12	15.2
Without leprosy reactions	88	58.7	18	3	21	29.6	67	84.8

TUBERCULOSIS IN THOSE WITH AND WITHOUT LEPROUS REACTIONS

Leprosy reactions	62	100.0	36	14	50	80.6	12	19.4
No leprosy reactions	88	100.0	18	3	21	23.8	67	76.2

There are about 41 percent of the patients who had leprosy reactions at some time during the period of their observation, and among these approximately 80 percent reacted positively to tuberculin skin tests or showed other findings of tuberculosis or findings suggestive of its presence. On viewing the results from another angle, there were about 70 percent of those who exhibited some of the evidences of tuberculosis who had leprosy reactions, while among those without any of the above evidences there were 15 percent with leprosy reactions. It is also to be noted that about 30 percent of those with such findings of tuberculosis did not have reactions. In appraising the likelihood of reactions in this latter group, the element of time should probably be considered. A number of these patients were under observation for a period less than a year, and some of those who did have reactions were in residence for periods of 2 or more years previous to their occurrence. Further, it was also determined that the only demonstrable indication of tuberculous infection among 70 percent of the 30 percent without reactions was a positive skin test.

DISCUSSION

The study of these small groups of patients may not warrant broad conclusions concerning leprosy with tuberculosis, but the results obtained are in accord with the impressions gained through the

experiences of the past 5 years in the close supervision and care of about 500 patients in residence within the Honolulu Receiving Station for periods of from 6 months to 4 years.

The interpretation of the observations has included a consideration of the likelihood of leprous affections of the lungs, since both clinical and laboratory findings have been obtained which lend a little support to such a probability. Thus, relatively evanescent symptoms and signs of pulmonary involvement have occurred, not uncommonly, in patients affected with acutely active phases of leprosy. It is evident also that there is a bacteremia in many of such patients, since leprosy bacilli (i.e., acid-fast bacilli, which could not be cultivated on artificial media) have been repeatedly demonstrated in specimens of blood taken directly from their brachial veins. And the lungs of experimental animals sometimes exhibit granulomatous lesions containing acid-fast bacteria subsequent to the inoculation of the animal with leprous material, through any of the customary routes.

Sputum containing acid-fast bacilli was obtained from a number of these patients, but it was impossible to exclude the mucous membranes of the naso-pharynx as the more likely source of the organisms in any one of them, other than in those who were proved to have tuberculosis (the proof consisting of the isolation and cultivation of the tubercle bacillus, and production of tuberculosis in test animals).

It is believed that these experiences are in no wise conclusive of a pathological or clinical entity of pulmonary leprosy in man, nor does the evidence evolved thus far, and known to the author, seem adequate to establish an involvement of the lung as an essential or frequent clinical manifestation of the disease. Hence the roentgenological and clinical findings which are reported, and which are similar to those usually accepted as presumptive of tuberculosis, are so regarded.

The comparatively low percentage of the leprous patients who reacted positively to tuberculin is quite contrary to the results anticipated from the tests of nonleprous individuals, and from our experiments with guinea pigs and white rats. These animals develop a skin sensitivity to antigens prepared from the homologous and the heterologous organisms, after previous inoculation with varieties of tubercle bacilli, leprous material from human and rat sources, and the margarine bacillus.

The explanation of the infrequency of the positive tuberculin test can only be speculative or hypothetical in the light of our present knowledge. Differences in the origin, race, and age of the individuals do not afford a sufficient basis. Typically positive reactions occur in myxedematous or sclerodermic areas of the skin, and thus exclude the interference of lymphatic drainage, or cellular damage as an important cause. On the other hand, an interference with the circulation in the skin suggests itself as an important factor in producing the seemingly

discordant results. Pilcher (5) believes that the diminution in the circulation of the skin is a factor in decreasing the tuberculin reaction in some tuberculous patients.

The various so-called skin tests are composed of an edematous "wheal" surrounded by an erythematous "flare". These seem to be dependent upon the responses of sympathetic, or perhaps sensory, nerve endings in the skin or in its small blood vessels, arterioles and venules, and upon those of the capillaries. Such a reaction is produced by the intradermal injection of histamine. Dale (6) found, in a study of the sympathetic nerves in cats, that the histamine reaction did not occur in the skin whose sensory and sympathetic nerves had been cut. Rodriguez (7) has found that the flare of the histamine reaction does not occur in anesthetic macules of leprosy. Our studies have shown that the flare does not occur in the anesthetic macules of the leprous skin which responds to stroking by dermographia.

Early in leprosy there is both clinical and histological evidence of pathological changes in the small blood vessels of the skin, and clinical evidence of damage to the sensory nerves and strongly suggestive of damage to the sympathetic nerves. These changes are often extensive in area and in degree and are not restricted to the boundaries of individual clinical lesions.

In view of the above observations it would seem logical to conclude that there might be marked interference with the natural responses to the tuberculin skin test in leprous patients.

However, it is to be noted that a considerable proportion of the patients examined did have positive tests. Furthermore, there were typical responses in the anesthetic macules of some patients who exhibited a positive reaction in other areas of the skin whose innervation appeared to be normal. The circulatory changes in the skin cannot, therefore, be the sole determining factor in the low percentage with positive reactions. Other unknown causes must be operating.

The reaction to tuberculin in small doses seemed much more indicative of the presence or subsequent development of clinical tuberculosis in the leprous patients than in those who are not leprous. In other words, these patients seem to have poor resistance to the virulence of the infection when introduced—a condition analagous to that found among Puerto Ricans by Opie (8), and among native recruits to the mines in South Africa (9). If this observation is substantiated, it is apparent that the test will be of great value in the therapeutic management of the leprous patient with an infection of tuberculosis.

Though the whole group of leprous patients, and the number of deaths in it are too small to warrant the accurate determinations of their mortality rates from tuberculosis, there is some evidence that there is a high incidence among them. Such may be expected from

the opportunities for infection afforded by their disregard for personal hygiene in their promiscuous habits of living, under the generally poor economic status which has been found to obtain among their families. A lack of vital resistance to the disease such as that which seems to prevail among some races in primitive surroundings may also play a role.

The frequency of acute leprous reactions in the patients who had tuberculosis is in accord with the opinion that concurrent infections are usually prejudicial to a favorable course in leprosy. And as a corollary to this, and to the high incidence of tuberculosis, it would appear that the prevention of acute leprous reactions, and both the treatment and prevention of leprosy in Hawaii, may be materially advanced by the application of the methods found useful in the handling of tuberculosis.

SUMMARY

This is a study of the tuberculin skin reaction and of that produced by allied substances in leprous patients at the receiving station in Honolulu, together with a consideration of the incidence of tuberculosis among them and the frequency of acute leprous reactions in those affected with the two diseases. The tuberculin skin reaction occurred much less frequently among the leprous patients than among control groups of the general population, and was associated with a greater incidence of clinical tuberculosis. The rates of tuberculosis mortality and morbidity were far greater than those reported in the general population. Acute leprous reactions occurred twice as frequently among those patients with complicating tuberculosis.

The belief is expressed that treatment and prevention of leprosy in Hawaii may be furthered by the application of the methods in use for the control and treatment of tuberculosis.

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PULMONARY INFECTION IN PNEUMOCONIOSIS [1]

II. FUSO-SPIROCHAETAL INFECTION. EXPERIMENTS IN GUINEA PIGS

By H. O. Proske, *Senior Medical Technician (Bacteriology)*, and R. R. Sayers, *Surgeon, United States Public Health Service*

Lung abscess and chronic bronchiectasis of fuso-spirochaetal origin is frequently encountered in individuals exposed to the inhalation of harmful dusts. In this paper an attempt is made to show, on the basis of animal experimentation, that fuso-spirochaetal lesions, comparable to those occurring in man, may be caused by the symbiotic action of certain members of the group of anaerobic organisms commonly found in the upper respiratory passages.

The pathologic material used in this work was obtained from cases of pulmonary abscess and chronic bronchiectasis in miners with silicosis of the first or second stage, uncomplicated with tuberculosis.

EXPERIMENTAL STUDY IN GUINEA PIGS

Fuso-spirochaetal infections have been reported as occurring in various locations of the body, but they occur most frequently in the respiratory system. Pulmonary abscess and gangrene, bloody bronchitis, chronic bronchiectasis, ulcero-membranous angina, sublingual phlegmon, noma, infection of the eye, ear, and nose, and brain abscess have been variously ascribed to fuso-spirochaetal organisms.

[1] From the Office of Industrial Hygiene and Sanitation, U.S. Public Health Service.

Special acknowledgment is made to the Metropolitan Life Insurance Co., which defrayed part of the expenses incurred in this study, and to the U.S. Bureau of Mines, with whose cooperation this work was begun.

The adjective "fuso-spirochaetal" is probably inadequate, because it conveys the impression that the infection is caused by fusiform bacilli and spirochaetes only, while actually other bacterial species (e.g., streptococci and vibrios) are likewise involved, as will be shown below.

The fuso-spirochaetal etiology of the conditions named above appears to have been generally accepted, but very little evidence has been presented that these organisms are actually the primary cause.

Experimental lesions in laboratory animals have been produced by a number of investigators by introducing infectious material from existing lesions, such as pus and pieces of membranes. This material may have contained other pathogenic organisms which might have initiated the infection.

Experimentation with pure cultures of the various fuso-spirochaetal organisms presents a possibility for the successful study of the problem. The earlier investigators were handicapped in this procedure by lack of satisfactory culture methods, and because of the inadequate classification of the organisms, which was largely based upon morphologic characteristics.

These obstacles were virtually eliminated by the cultural studies of the oral spirochaetes by Noguchi (1, 2) and by the serologic classification of fusiform bacilli by Varney (3).

D. T. Smith (4), in 1930, succeeded in producing typical fuso-spirochaetal abscesses in the groin of guinea pigs by the injection of a mixture of pure cultures of spirochaetes (*Treponema microdentium*), small fusiform bacilli, vibrios, and anaerobic hemolytic streptococci. These organisms had been isolated from material of a case of Vincent's angina. Pus from these experimental abscesses caused typical fuso-spirochaetal abscesses in the lungs of rabbits. Smith concludes from this experiment that fuso-spirochaetal disease of the lungs can be caused by the organisms commonly associated with Vincent's angina, and that pulmonary lesions are probably caused by a symbiosis of a spirochaete, a fusiform bacillus, a vibrio, and a coccus. He further states that it is quite possible that any of the spirochaetes of the mouth and a number of the other anaerobes of the oral cavity may replace the ones actually used in his experimental work. This statement is significant in view of the fact that, for example, *Bacterium melaninogenicum* has been reported in pulmonary lesions by a number of authors, and it is quite possible that this organism may have replaced one or the other component of the symbiotic group in their cases.

The mechanism involved in the activity of this harmful bacterial association is not known, but it is probably dependent upon the same biochemical principles which govern the phenomena of biologic symbiosis and commensalism.

TECHNIQUE

Pure cultures of *Treponema microdentium, T. mucosum, T. macrodentium, T. buccale, Vibrio viridans,* anaerobic anhemolytic streptococcus, *Bacillus fusiformis* type I subtype 2 and type II–Varney, *Spirillum sputigenum* and cultures of a fusiform bacillus in which spirochaetes resembling *Treponema vincenti* had developed were used in these experiments. The organisms had been isolated according to a method described in a previous paper (5).

Heavy suspensions of the individual types of bacteria were prepared in sterile 0.85 percent saline and lightly centrifuged in order to precipitate coarse particles of culture medium.

Standardization of bacterial suspensions is more or less unsatisfactory, but reasonably uniform results may be obtained with Wright's method of estimating the number of organisms from the ratio of bacteria to the erythrocytes of an individual with a known red-cell count. Giemsa stain is used for staining preparations containing spirochaetes.

The titer of the individual suspensions was adjusted, as accurately as possible, to 100 million bacteria per cubic centimeter. From these standardized suspensions the various combinations were prepared. Each combination was re-titrated before injection.

The volume of bacterial inoculum used in these experiments was 1 cubic centimeter, containing approximately 100 million bacteria. The number of organisms per type was decreased in proportion to the number of types used. The relatively low number of bacteria per cubic centimeter was purposely used in order to avoid the loss of too many animals from toxic reactions before an abscess would develop.

In the case of the mixed cultures of fusiform bacilli and spirochaetes it was impossible to maintain a numerical proportion; the latter were always less in number.

EXPERIMENTAL RESULTS

In order to determine the degree of pathogenicity of the organisms employed, 1 cc of the individual bacterial suspensions was injected, subcutaneously, into the groin of a series of guinea pigs. The results showed that the treponemata, the fusiform bacilli, and the spirilla were nonpathogenic. The anaerobic streptococci produced mild, transitory inflammation, the vibrios slight induration. Large doses of the latter two types occasionally caused death of the animals, evidently from toxemia, because no pathologic changes were noted upon autopsy.

This observation led to the supposition that the anaerobic streptococcus and the vibrio might initiate the infectious process by preparing the tissues for the invasion of the other organisms. In order to test this theory each species was combined with the other individual

types and inoculated into the groin of a new set of guinea pigs. The results are shown in table 1.

TABLE 1.—*Results of combining organisms in inoculation*

Streptococci (anaerobic)	Vibrio viridans	Treponema				Bacillus fusiformis			Spirillum sputigenum	Results
		Microdentium	Mucosum	Macrodentium	Buccale	Type I sub. 2[1]	Type II[1]	Mixed with spirochaete		
x		x								Moderate inflammation.
x			x							Do.
x				x						Slight transitory inflammation.
x					x					Do.
x						x				Slight necrosis; no odor.
x							x			Do.
x								x		Slight transitory inflammation.
x									x	Do.
	x	x								Slight induration; slight inflammation.
	x		x							Do.
	x			x						Small induration.
	x				x					Do.
	x					x				Moderate induration and inflammation.
	x						x			Do.
	x							x		Small induration; no inflammation.
	x								x	Do.

[1] Serologic type of Varney (3).

From these experiments it will be noted that more severe reactions resulted from the combinations of either streptococcus or vibrio with *T. microdentium, T. mucosum, B. fusiformis* type I sub-type 2 and type II than from those containing *T. macrodentium, T. buccale, Spirillum sputigenum,* and the mixture of the large fusiform bacillus and spirochaete.

It had been previously observed that the reaction from a combination of the streptococcus and the vibrio was much more severe than when either organism was used alone. Therefore a mixture of both was combined with one of the other types and injected into the groin of guinea pigs. The results are presented in table 2.

TABLE 2.—*Results of inoculation of mixtures*

[1 cc of suspension containing approximately 33 million each of anaerobic streptococci, vibrios, and 1 of the other types of organisms]

Streptococci	Vibrio viridans	Treponema				Bacillus fusiformis			Spirillum sputigenum	Results
		Microdentium	Mucosum	Macrodentium	Buccale	Type I sub. 2[1]	Type II[1]	Mixed with spirochaete		
x	x									Cellulitis.
x	x	x								Small abscess; no necrosis; greenish pus; slight, foul odor.
x	x		x							Do.
x	x			x						Cellulitis.
x	x				x					Do.
x	x					x				Small abscess; slight necrosis; greenish, odorless pus.
x	x						x			Do.
x	x							x		Cellulitis.
x	x								x	Do.

[1] Serologic types of Varney (3).

In these experiments, as in those recorded in table 1, *T. macrodentium*, *T. buccale*, *Spirillum sputigenum*, and the mixture of the larger fusiform bacillus and the spirochaete failed to aggravate the reaction produced by the streptococcus and the vibrio. When the latter two types were combined with *T. microdentium* or *T. mucosum* a small abscess without necrosis containing thin, greenish, slightly foul-smelling pus resulted. In combination with *B. fusiformis* type I subtype 2 or type II they gave rise to a small abscess with slight necrosis containing thin, greenish, odorless pus. However, neither of these lesions was comparable with the typical fuso-spirochaetal abscess, and it became apparent that other combinations of the organisms were required to attain this result; but the experimental findings indicated clearly that a harmful symbiotic relationship exists between the anaerobic streptococcus, the vibrio, *T. microdentium*, *T. mucosum*, and the fusiform bacilli type I subtype 2 and type II.

In order to investigate this relationship a new series of guinea pigs were injected with various combinations of these organisms. The results are presented in table 3.

TABLE 3.—*Results of inoculation with various combinations*

Streptococci	Vibrio viridans	Treponema		B. fusiformis		Results
		Microdentium	Mucosum	Type I sub 2	Type II	
x	x	x	x	x	x	Typical large abscess with necrosis, greenish-gray, foul-smelling pus.
x	x	x	x	x		Do.
x	x	x	x		x	Do.
x	x	x		x	x	Do.
x	x	x		x		Do.
x	x	x			x	Do.
x	x		x	x	x	Do.
x	x		x	x		Do.
x	x		x		x	Do.

The results of these experiments show that a uniform mixture of anaerobic streptococci, *Vibrio viridans*, *Treponema microdentium*, *Treponema mucosum*, fusiform bacillus type I subtype 2 and type II (Varney) is capable of causing a typical fuso-spirochaetal abscess with necrosis and greenish-gray, extremely foul-smelling pus from which the causative bacteria may be recovered. The results also show that *T. microdentium* and *T. mucosum* may be substituted for each other in the symbiotic combination. This is also true for *B. fusiformis* type I subtype 2 and type II.

It was noted that the fetid odor of the pus was much more pronounced when *T. mucosum* was represented in the microbic association.

In addition to the above experiments all possible combinations of the 10 types of organisms under consideration were investigated ex-

perimentally, but only the types described in table 4 were capable of causing typical fuso-spirochaetal lesions.

Although the number of bacteria of the individual types differed in the various combinations, the same reactions were obtained when as few as 10 million organisms of each type were used in the combinations. The lesions can be transferred from guinea pig to guinea pig, but after a few passages the organisms become so virulent that the animals die from toxemia before a lesion can develop. Such organisms, originally nonpathogenic, are now capable of setting up local reactions when inoculated separately. This has not been observed with *T. macrodentium*, *T. buccale*, or *Spirillum sputigenum* when they have been recovered from lesions produced by the harmful combination.

SUMMARY

1. Fuso-spirochaetal lesions comparable with those occurring in man may be caused by the symbiotic action of *Treponema microdentium* or *mucosum*, *Bacillus fusiformis* serologic type I, subtype 2 or type II (Varney), anaerobic anhemolytic streptococcus, and *Vibrio viridans*. Original cultures were taken from cases of pulmonary abscess and chronic bronchiectasis in miners with silicosis.

2. *Treponema macrodentium*, *T. buccale*, *Spirillum sputigenum* and a larger fusiform bacillus growing together with a spirochaete resembling *T. vincenti*, take no part in the symbiotic action.

3. The anaerobic streptococcus and the vibrio, by virtue of their mild but definite pathogenic properties, appear to render the tissues susceptible to the destructive action of the other types of organisms.

4. This experimental study furnishes evidence in support of a conclusion of Smith's (4) that pulmonary lesions may be caused by a symbiosis of a spirochaete, a fusiform bacillus, a vibrio, and a coccus.

5. Further investigations are indicated as to whether any pathogenic organisms (anaerobic or aerobic) of the upper respiratory tract may replace one or the other of the members of the harmful symbiotic group just described.

REFERENCES

(1) Noguchi, H.: Cultural studies on mouth spirochaetae (Treponema microdentium and macrodentium). Jour. Exper. Med., **15**: 81 (1912).

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(3) Varney, P. L.: The serologic classification of fusiform bacilli. Jour. Bact., **13**: 275 (1927).

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COURT DECISION ON PUBLIC HEALTH

Action against city because of sewage disposal.—(Indiana Appellate Court; *Zabst* v. *City of Angola*, 190 N.E. 891; decided June 20, 1934.) The plaintiff brought an action against the defendant city in which he sought to abate permanently an alleged nuisance created by the disposition of sewage by the city and to recover damages alleged to have been occasioned by reason of the existence and continuation of the said nuisance. The plaintiff alleged that he owned a farm located a short distance east of the defendant city and that he also owned a house and lot within the city, where he made his home; that the city collected, conveyed, and disposed of its sewage in such a manner that the raw sewage flowed from the sewers into a public ditch a short distance from the plaintiff's farm; that the ditch passed through his farm and the raw sewage was carried by its waters, unless the ditch was dry, and was deposited upon the banks and bottom throughout the course of the ditch through plaintiff's property; that, in connection with the sewerage system, there was a filtration plant; that said system was negligently constructed and operated; that the city willfully abandoned the filtration plant and deliberately emptied the sewage collected by the system into the said ditch; and that the conditions created thereby constituted a nuisance and were injurious to the plaintiff and his property.

The case was carried to the appellate court by the plaintiff when the trial court overruled his demurrer to the second paragraph of the answer filed by the city. This paragraph alleged in substance that the plaintiff was the owner of a modern home in the defendant city in which he resided with his family and others; that this home was equipped with modern plumbing which was connected with the defendant's sewerage system; and that thereby the plaintiff contributed to and helped to cause the damage of which he complained and was, therefore, precluded from a recovery in his action. With the plaintiff's demurrer to this paragraph of the answer, which demurrer was upon the ground that the paragraph did not state facts sufficient to constitute a cause of defense, were some specifications stating his reasons why the said paragraph was insufficient for want of facts. Certain of these specifications were as follows: The paragraph failed to allege any facts showing the negligent, careless, wrongful, or unlawful acts of plaintiff and their contributing to the injury complained of; the paragraph failed to allege any facts showing how the plaintiff, by his conduct, contributed to the injury complained of, to wit: The unlawful, negligent, and careless construction and operation of the sewer system and the unlawful, negligent, and careless disposal of the sewage once it was collected; the paragraph did not allege how or in what manner the plaintiff could control or

direct the actions or conduct of the defendant in the collection or disposal of its sewage.

The appellate court said that it thought that the paragraph of the answer in question was clearly insufficient to state a cause of defense for the reasons pointed out in the specifications mentioned. Said the court:

* * * There are no allegations in said paragraph of answer which would, if true, amount to an estoppel against the appellant, or which would show or even tend to show that he, in any manner, contributed to the injury of which he complains, or that he, in any manner whatever, by his use of the sewage system of the appellee city, had anything to do, any more than the rest of the home owners of said city, in causing the conditions of which complaint is made. * * *

The judgment was reversed, with instructions to sustain the plaintiff's demurrer to the second paragraph of the answer and for further proceedings not inconsistent with the opinion.

DEATHS DURING WEEK ENDED SEPT. 22, 1934

[From the Weekly Health Index, issued by the Bureau of the Census, Department of Commerce]

	Week ended Sept. 22, 1934	Corresponding week, 1933
Data from 86 large cities of the United States:		
Total deaths	6,901	7,017
Deaths per 1,000 population, annual basis	9.6	9.8
Deaths under 1 year of age	565	567
Deaths under 1 year of age per 1,000 estimated live births	53	[1] 50
Deaths per 1,000 population, annual basis, first 38 weeks of year	11.4	10.9
Data from industrial insurance companies:		
Policies in force	67,200,682	67,704,198
Number of death claims	11,238	10,972
Death claims per 1,000 policies in force, annual rate	8.7	8.5
Death claims per 1,000 policies, first 38 weeks of year, annual rate	10.0	9.9

[1] Data for 81 cities.

PREVALENCE OF DISEASE

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

CURRENT WEEKLY STATE REPORTS

These reports are preliminary, and the figures are subject to change when later returns are received by the State health officers

Reports for Weeks Ended Sept. 29, 1934, and Sept. 30, 1933

Cases of certain communicable diseases reported by telegraph by State health officers for weeks ended Sept. 29, 1934, and Sept. 30, 1933

Division and State	Diphtheria		Influenza		Measles		Meningococcus meningitis	
	Week ended Sept. 29, 1934	Week ended Sept. 30, 1933	Week ended Sept. 29, 1934	Week ended Sept. 30, 1933	Week ended Sept. 29, 1934	Week ended Sept. 30, 1933	Week ended Sept. 29, 1934	Week ended Sept. 30, 1933
New England States:								
Maine	---	1	---	5	---	3	0	0
New Hampshire	---	---	---	---	11	---	0	0
Vermont	1	---	---	---	---	2	0	0
Massachusetts	10	21	---	---	5	15	2	0
Rhode Island	1	2	---	---	4	2	0	0
Connecticut	---	4	1	1	17	1	1	0
Middle Atlantic States:								
New York	30	41	[1] 3	[1] 7	60	41	3	4
New Jersey	20	22	12	10	18	15	2	0
Pennsylvania	49	52	---	---	105	23	5	3
East North Central States:								
Ohio	61	57	32	60	28	15	5	1
Indiana	34	29	15	33	22	2	1	3
Illinois	42	32	4	15	54	15	2	2
Michigan	10	19	---	2	44	34	1	1
Wisconsin	2	4	16	20	47	33	1	3
West North Central States:								
Minnesota	9	4	---	---	24	5	1	0
Iowa [2]	9	7	---	---	4	3	1	0
Missouri	45	51	41	1	51	4	4	2
North Dakota	2	3	---	---	6	15	2	0
South Dakota	2	2	---	---	13	1	0	0
Nebraska	6	5	---	---	1	---	0	0
Kansas	9	5	---	3	8	3	0	3
South Atlantic States:								
Delaware	---	1	---	---	---	---	0	0
Maryland [2]	7	29	35	10	11	1	0	1
District of Columbia	10	6	---	---	2	1	0	0
Virginia [3 4]	57	98	---	---	14	8	1	0
West Virginia	55	62	11	7	21	1	3	1
North Carolina	104	117	---	46	12	23	0	0
South Carolina	13	31	142	142	3	22	0	0
Georgia [4]	60	53	---	---	---	10	1	2
Florida [4]	12	15	---	---	1	---	0	0

See footnotes at end of table.

Cases of certain communicable diseases reported by telegraph by State health officers for weeks ended Sept. 29, 1934, and Sept. 30, 1933—Continued

Division and State	Diphtheria		Influenza		Measles		Meningococcus meningitis	
	Week ended Sept. 29, 1934	Week ended Sept. 30, 1933	Week ended Sept. 29, 1934	Week ended Sept. 30, 1933	Week ended Sept. 29, 1934	Week ended Sept. 30, 1933	Week ended Sept. 29, 1934	Week ended Sept. 30, 1933
East South Central States:								
Kentucky	66	116			9		1	1
Tennessee	60	77	7	11	3	14	1	1
Alabama [4]	51	97	6	23	25	5	0	2
Mississippi [3]	30	36					1	0
West South Central States:								
Arkansas	14	25	9	1	2	17	0	0
Louisiana [4]	12	28	3	6	3		1	2
Oklahoma [5]	12	52	37	12	2	2	1	0
Texas [4]	34	108	45	83	5	31	0	2
Mountain States:								
Montana		2	8	11	4	1	0	0
Idaho			2	1	1		0	0
Wyoming [3]				3	1	2	0	0
Colorado	4	1			5	4	0	0
New Mexico	2	10			2	4	1	0
Arizona		2	10	2	10	4	0	0
Utah [3]		1		1		7	0	0
Pacific States:								
Washington	7	3			40	30	0	1
Oregon		3	26	19	3	9	1	1
California	32	31	22	35	47	71	0	1
Total	984	1,365	487	570	748	499	43	37

Division and State	Poliomyelitis		Scarlet fever		Smallpox		Typhoid fever	
	Week ended Sept. 29, 1934	Week ended Sept. 30, 1933	Week ended Sept. 29, 1934	Week ended Sept. 30, 1933	Week ended Sept. 29, 1934	Week ended Sept. 30, 1933	Week ended Sept. 29, 1934	Week ended Sept. 30, 1933
New England States:								
Maine	1	0	20	4	0	0	5	11
New Hampshire	0	2	1	11	0	0	0	0
Vermont	0	3	7	5	0	0	2	0
Massachusetts	2	13	88	86	0	0	3	6
Rhode Island	0	2	4	15	0	0	2	0
Connecticut	1	7	9	26	0	0	1	1
Middle Atlantic States:								
New York	12	77	113	148	0	0	26	31
New Jersey	4	13	38	52	0	0	6	8
Pennsylvania	4	30	187	168	0	0	67	70
East North Central States:								
Ohio	23	43	294	305	0	0	50	56
Indiana	7	1	62	103	0	1	9	20
Illinois	12	15	245	133	1	0	49	27
Michigan	14	8	92	128	0	0	24	10
Wisconsin	10	7	141	28	1	1	8	1
West North Central States:								
Minnesota	4	23	55	16	4	0	4	2
Iowa [3]	0	2	33	42	0	0	20	14
Missouri	1	1	43	51	0	7	37	12
North Dakota	0	5	11	12	0	0	2	2
South Dakota	2	3	12	7	1	1	1	2
Nebraska	0	1	13	8	0	0	0	0
Kansas	3	1	40	54	1	0	4	10
South Atlantic States:								
Delaware	0	0	1	11	0	0	4	3
Maryland [3]	1	3	36	52	0	0	18	23
District of Columbia	1	1	17	15	0	0	0	7
Virginia [3 4]	1	2	51	102	0	0	21	20
West Virginia	5	4	79	73	0	1	34	47
North Carolina	0	3	91	113	0	0	25	16
South Carolina	0	2	6	10	0	0	21	31
Georgia [4]	0	0	8	20	0	0	19	17
Florida [4]	0	1	5		0	0	12	1

See footnotes at end of table.

Cases of certain communicable diseases reported by telegraph by State health officers for weeks ended Sept. 29, 1934, and Sept. 30, 1933—Continued

Division and State	Poliomyelitis		Scarlet fever		Smallpox		Typhoid fever	
	Week ended Sept. 29, 1934	Week ended Sept. 30, 1933	Week ended Sept. 29, 1934	Week ended Sept. 30, 1933	Week ended Sept. 29, 1934	Week ended Sept. 30, 1933	Week ended Sept. 29, 1934	Week ended Sept. 30, 1933
East South Central States:								
Kentucky	7	3	49	138	1	0	43	47
Tennessee	3	4	72	71	0	0	28	43
Alabama [4]	1	2	31	52	0	1	22	27
Mississippi [2]	0	0	15	18	0	0	7	8
West South Central States:								
Arkansas	0	0	3	13	0	0	9	9
Louisiana [4]	0	1	9	9	0	0	9	19
Oklahoma [5]	1	4	15	12	0	1	17	55
Texas [4]	7	3	24	40	7	5	41	74
Mountain States:								
Montana	24	0	6	9	0	0	7	6
Idaho	4	0	3	5	0	2	7	0
Wyoming [3]	0	1	8	-------	1	0	5	0
Colorado	0	0	40	13	4	0	4	11
New Mexico	3	1	13	15	0	1	19	23
Arizona	2	1	6	13	0	0	1	8
Utah [3]	1	2	4	5	0	0	0	2
Pacific States:								
Washington	25	14	20	13	12	6	7	3
Oregon	10	2	32	22	0	0	6	7
California	45	5	120	118	0	12	9	9
Total	241	316	2,272	2,364	33	39	715	799

[1] New York City only.
[2] Week ended earlier than Saturday.
[3] Rocky Mountain spotted fever, week ended Sept. 29, 1934, 5 cases, as follows: Virginia, 4; Wyoming, 1.
[4] Typhus fever, week ended Sept. 29, 1934, 48 cases, as follows: Virginia, 1; Georgia, 21; Florida, 2; Alabama, 16; Louisiana, 2; Texas, 6.
[5] Exclusive of Oklahoma City and Tulsa.

SUMMARY OF MONTHLY REPORTS FROM STATES

The following summary of cases reported monthly by States is published weekly and covers only those States from which reports are received during the current week:

State	Meningococcus meningitis	Diphtheria	Influenza	Malaria	Measles	Pellagra	Poliomyelitis	Scarlet fever	Smallpox	Typhoid fever
August 1934										
Alabama	4	113	13	1,055	195	29	15	45	0	179
California	8	100	42	22	266	9	423	346	3	74
Kansas	4	37	3	4	31	-------	23	67	0	69
Louisiana	-------	62	19	738	46	14	4	31	0	115
Maryland	-------	16	649	3	41	-------	8	61	0	80
Montana	-------	6	18	-------	52	-------	164	25	1	43
Oklahoma [1]	-------	20	17	116	6	6	1	35	2	131
Oregon	1	1	40	3	22	-------	6	68	3	10
Puerto Rico	-------	44	71,520	1,408	31	-------	0	-------	0	50
South Dakota	1	12	8	-------	56	-------	9	16	-------	26
Washington	2	2	17	-------	73	-------	224	50	26	12

[1] Exclusive of Oklahoma City and Tulsa.

August 1934

	Cases
Actinomycosis:	
California	2
Kansas	1
Anthrax:	
California	2
Louisiana	1
South Dakota	2
Chicken pox:	
Alabama	12
California	160
Kansas	5
Louisiana	3
Maryland	18
Montana	4
Oklahoma [1]	2
Oregon	24
Puerto Rico	19
South Dakota	13
Washington	42
Dengue:	
Alabama	10
California	1
Diarrhea:	
Maryland	127
Dysentery:	
California (amoebic)	31
California (bacillary)	96
Kansas (amoebic)	1
Kansas (bacillary)	1
Louisiana	12
Maryland	64
Oklahoma [1]	56
Oregon	3
Puerto Rico	73
Washington (amoebic)	3
Dysentery and enteritis:	
Montana	40
Filariasis:	
Puerto Rico	2
Food poisoning:	
California	94
German measles:	
Alabama	2
California	111
Kansas	4
Maryland	3
Washington	7
Granuloma, coccidioidal:	
California	4
Hookworm disease:	
Louisiana	30
Impetigo contagiosa:	
Kansas	4
Maryland	19
Oklahoma [1]	4
Oregon	17
South Dakota	2
Washington	2
Jaundice, epidemic:	
California	1
Leprosy:	
California	2
Puerto Rico	2
Lethargic encephalitis:	
California	3
Kansas	3
Oregon	2
Washington	1
Mumps:	
Alabama	10
California	201
Kansas	37
Maryland	20
Montana	5
Oklahoma [1]	5
Oregon	25
Puerto Rico	54
South Dakota	11
Washington	111
Ophthalmia neonatorum:	
Alabama	1
California	4
Maryland	2
Puerto Rico	5
Paratyphoid fever:	
California	7
Louisiana	3
Oregon	1
Puerto Rico	1
Puerperal septicemia:	
Puerto Rico	2
Washington	1
Rabies in animals:	
Alabama	71
California	85
Louisiana	9
Washington	8
Rabies in man:	
Alabama	1
South Dakota	1
Washington	1
Relapsing fever:	
California	7
Rocky Mountain spotted fever:	
Maryland	18
Montana	1
Oregon	1
Washington	1
Scabies:	
Oklahoma [1]	1
Oregon	3
Septic sore throat:	
California	6
Kansas	6
Louisiana	3
Maryland	6
Montana	14
Septic sore throat—Con.	
Oklahoma [1]	35
Oregon	5
South Dakota	1
Washington	1
Tetanus:	
Alabama	2
California	10
Kansas	4
Louisiana	9
Maryland	1
Oklahoma [1]	3
Puerto Rico	21
Tetanus, infantile:	
Puerto Rico	9
Trachoma:	
Alabama	2
California	6
Kansas	2
Montana	1
Puerto Rico	1
South Dakota	11
Trichinosis:	
California	1
Tularaemia:	
Louisiana	2
Montana	2
Typhus fever:	
Alabama	35
Louisiana	2
Maryland	1
Undulant fever:	
Alabama	10
California	18
Kansas	6
Louisiana	7
Maryland	3
Oregon	2
South Dakota	1
Washington	2
Vincent's infection:	
Kansas	5
Maryland	9
Oklahoma [1]	1
Oregon	7
Whooping cough:	
Alabama	126
California	735
Kansas	97
Louisiana	38
Maryland	361
Montana	127
Oklahoma [1]	33
Oregon	98
Puerto Rico	269
South Dakota	70
Washington	196
Yaws:	
Puerto Rico	1

DENGUE IN SOUTHEASTERN STATES

For the week ended September 29, 1934, 54 cases of dengue were reported in Georgia.

On September 28, 1934, it was estimated that there were approximately 800 cases of dengue in Miami, Fla. Twenty percent improvement over the preceding week was reported.

At Key West, Fla., it was estimated that 30 cases were present on October 2, 1934.

[1] Exclusive of Oklahoma City and Tulsa.

Cases of dengue were reported in Florida during the week ended September 29, 1934, as follows:

Locality	County	Number of cases	Locality	County	Number of cases
Fort Lauderdale	Broward	2	Near Miami	Dade	1
Fort Pierce	St. Lucie	5	Miami	do	41
Homestead	Dade	1	Ojus	do	2
Jacksonville	Duval	1	Orlando	Orange	1
Lake Worth	Palm Beach	1	Tampa	Hillsborough	8

WEEKLY REPORTS FROM CITIES

City reports for week ended Sept. 22, 1934

[This table summarizes the reports received regularly from a selected list of 121 cities for the purpose of showing a cross section of the current urban incidence of the communicable diseases listed in the table. Weekly reports are received from about 700 cities, from which the data are tabulated and filed for reference]

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Maine:											
Portland	0		0	0	3	2	0	0	0	2	21
New Hampshire:											
Concord	0		0	0	0	0	0	0	0	0	6
Nashua	0		0	0	0	1	0	0	0	0	
Vermont:											
Barre	0		0	0	0	0	0	2	0	0	3
Burlington	0		0	0	0	1	0	0	0	0	9
Massachusetts:											
Boston	2			1		13	0		3	23	164
Fall River	1		0	0	0	0	0	1	1	5	32
Springfield	0		0	0	0	2	0	0	0	6	27
Worcester	0		0	0	5	6	0	3	0	6	41
Rhode Island:											
Pawtucket	0		0	0	0	0	0	0	0	0	10
Providence	0		0	0	3	4	0	0	2	14	60
Connecticut:											
Bridgeport	0	1	0	0	1	0	0	1	0	0	30
Hartford	0		0	3	0	0	0	1	0	0	24
New Haven	1	2	0	0	1	0	0	0	0	0	34
New York:											
Buffalo	0		0	0	8	8	0	1	1	25	115
New York	12	6	2	10	63	26	0	74	11	216	1,168
Rochester	0		0	7	0	1	0	2	0	6	56
Syracuse	0		0	4	3	3	0	1	0	24	47
New Jersey:											
Camden	1	1	0	0	1	2	0	2	0	5	22
Newark	1		0	1	9	5	0	8	1	43	82
Trenton	0		0	0	1	1	0	0	1	1	14
Pennsylvania:											
Philadelphia	3		3	3	16	19	0	20	9	125	379
Pittsburgh	11	1	1	2	8	22	0	10	7	14	136
Reading	0		0	0	0	1	0	0	0	17	26
Scranton	1			0		1	0		0	1	
Ohio:											
Cincinnati	4		1	0	5	22	0	12	0	2	125
Cleveland	3	10	0	3	3	17	0	9	2	51	162
Columbus	0		0	0	1	15	0	3	2	20	70
Toledo	2		0	0	2	4	0	6	1	10	67
Indiana:											
Fort Wayne	2		0	0	0	0	0	1	0	0	14
Indianapolis	4		0	3	13	13	0	1	3	5	
South Bend	0		0	18	0	1	0	1	0	0	13
Terre Haute	0		0	1	0	0	0	1	0	1	12
Illinois:											
Chicago	2	2	1	11	23	82	0	28	7	72	585
Springfield	2	3	0	0	2	1	0	0	1	5	19
Michigan:											
Detroit	7		1	3	14	23	0	8	1	67	225
Flint	0		0	1	0	6	0	3	1	14	13
Grand Rapids	0		0	1	0	4	0	0	0	0	26

City reports for week ended Sept. 22, 1934—Continued

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Wisconsin:											
Kenosha	0		0	0	0	0	0	0	0	3	7
Milwaukee	1		0	5	3	53	0	1	0	26	68
Racine	0		0	0	0	5	0	1	0	1	10
Superior	0		0	0	0	0	0	0	0	0	7
Minnesota:											
Duluth	1		0	12	1	0	0	1	0	2	19
Minneapolis	2		1	5	2	6	0	0	1	4	69
St. Paul	0		0	0	7	1	0	1	0	5	51
Iowa:											
Davenport	0			0		0	0		0	0	
Des Moines	0			0		7	0		8	0	22
Sioux City	0			0		3	0		0	2	
Waterloo	1			0		0	0		0	2	
Missouri:											
Kansas City	0		0	0	8	4	0	7	0	1	94
St. Joseph	4		0	0	1	0	0	1	0	0	28
St. Louis	20	2	0	1	5	4	0	7	1	17	162
North Dakota:											
Fargo	0		0	0	2	1	0	0	0	35	8
Grand Forks	0			0		0	0		0	0	
South Dakota:											
Aberdeen	0			0		0	0		0	8	
Sioux Falls	0			0		0	0		0	0	7
Nebraska:											
Omaha	1		0	0	6	2	0	1	0	0	51
Kansas:											
Topeka	0		0	2	1	1	0	0	0	0	21
Wichita	0		0	0	1	0	0	0	0	3	21
Delaware:											
Wilmington	0		0	0	0	1	0	0	1	1	39
Maryland:											
Baltimore	2	1	0	3	16	16	0	15	3	43	188
Cumberland	0		0	0	0	0	0	0	0	0	8
Frederick	0		0	0	0	0	0	1	0	0	2
District of Columbia:											
Washington	10		0	0	10	8	0	5	5	3	125
Virginia:											
Lynchburg	2		0	0	0	0	0	1	0	2	11
Norfolk	0		0	0	1	1	0	1	1	5	34
Richmond	0		0	0	2	3	0	1	0	0	47
Roanoke	3		0	0	1	4	0	0	0	0	12
West Virginia:											
Charleston	6		0	0	0	1	0	0	0	6	18
Huntington	8			0		4	0		0	0	
Wheeling	0		0	0	1	8	0	0	2	1	18
North Carolina:											
Raleigh	2		0	0	1	1	0	0	0	2	8
Wilmington	0		0	0	2	0	0	1	0	1	8
Winston-Salem	13		0	0	0	7	0	0	1	7	13
South Carolina:											
Charleston	0	7	0	0	1	0	0	2	1	0	17
Columbia	0		0	0	3	0	0	0	0	0	29
Greenville	1		0	0	0	0	0	1	0	0	
Georgia:											
Atlanta	4	6	0	0	6	7	0	2	0	0	72
Brunswick	0		0	0	0	0	0	0	0	0	1
Savannah	1	10	0	0	1	0	0	2	2	3	26
Florida:											
Miami	2		0	0	1	1	0	2	0	0	24
Tampa	0		0	0	2	1	0	1	1	2	28
Kentucky:											
Ashland	1			0		4	0		2	0	
Lexington	1		0	0	1	2	0	1	1	0	14
Louisville	12	1	0	0	7	9	0	3	4	1	
Tennessee:											
Memphis	2		0	0	1	1	0	4	1	14	80
Nashville	1		0	0	3	1	0	5	0	8	51
Alabama:											
Birmingham	4		0	0	3	2	0	3	3	1	77
Mobile	2		0	0	0	1	0	2	0	1	19
Montgomery	0			0		0	0		0	0	
Arkansas:											
Fort Smith	0			0		0	0		0	2	
Little Rock	1		0	0	0	0	0	0	0	0	

City reports for week ended Sept. 22, 1934—Continued

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Louisiana:											
New Orleans	11	3	0	0	7	1	0	13	4	0	124
Shreveport	0	----	0	0	1	0	0	2	0	0	25
Oklahoma:											
Oklahoma City	0	----	0	0	3	0	0	0	0	2	30
Tulsa	0	----	----	0	----	0	0	----	0	2	----
Texas:											
Dallas	5	----	0	0	4	0	0	2	1	1	62
Fort Worth	0	----	1	0	0	2	0	1	0	0	34
Galveston	0	----	0	0	2	0	0	0	0	0	20
Houston	2	----	0	0	4	0	0	3	0	0	68
San Antonio	1	----	0	0	1	3	0	4	1	0	41
Montana:											
Billings	0	----	0	1	0	0	0	0	0	0	7
Great Falls	1	----	1	0	1	0	0	0	0	0	6
Helena	0	----	0	0	0	2	0	0	0	0	3
Missoula	0	----	0	0	1	0	0	0	0	0	4
Idaho:											
Boise	0	----	0	1	0	0	0	0	0	0	8
Colorado:											
Denver	3	49	1	7	2	19	0	5	0	16	66
Pueblo	0	----	0	0	0	0	0	0	0	2	6
New Mexico:											
Albuquerque	0	----	0	1	1	2	0	4	0	1	20
Utah:											
Salt Lake City	0	----	0	0	3	8	0	0	2	19	44
Nevada:											
Reno	----	----	----	----	----	----	----	----	----	----	----
Washington:											
Seattle	0	----	0	1	2	2	3	3	1	13	90
Spokane	0	1	1	0	0	0	0	0	0	2	25
Tacoma	0	----	1	0	0	1	0	1	0	4	27
Oregon:											
Portland	0	----	0	2	4	15	0	2	1	1	69
Salem	0	1	----	0	----	0	0	----	0	0	----
California:											
Los Angeles	7	8	0	8	6	20	0	17	1	18	278
Sacramento	0	----	0	0	2	2	0	2	0	1	28
San Francisco	0	4	0	3	7	11	0	12	0	5	153

State and city	Meningococcus meningitis		Poliomyelitis cases
	Cases	Deaths	
Maine:			
Portland	1	0	0
Massachusetts:			
Boston	0	0	2
Connecticut:			
Bridgeport	0	0	1
New York:			
Buffalo	0	0	5
New York	0	0	4
Rochester	0	0	2
Pennsylvania:			
Philadelphia	3	0	0
Pittsburgh	1	0	0
Ohio:			
Cleveland	0	0	5
Illinois:			
Chicago	5	1	4
Michigan:			
Detroit	0	0	7
Grand Rapids	0	0	1
Wisconsin:			
Milwaukee	0	0	1
Missouri:			
St. Louis	2	0	0
North Dakota:			
Fargo	0	1	0
South Carolina:			
Charleston	1	0	0
Georgia:			
Atlanta	0	0	1
Texas:			
San Antonio	0	0	1
Montana:			
Billings	0	0	1
Helena	0	0	1
Colorado:			
Denver	0	0	1
Utah:			
Salt Lake City	0	0	1
Washington:			
Seattle	0	0	12
Spokane	0	0	6
Tacoma	0	0	2
Oregon:			
Portland	0	0	3
California:			
Los Angeles	0	0	19

Dengue.—Cases: Savannah, 13; Miami, 74; Birmingham, 1.

Lethargic encephalitis.—Cases: New York, 2; Newark, 1; Pittsburgh, 1; Cincinnati, 3; Columbus, 1; Toledo, 9; Indianapolis, 2; Chicago, 2; Superior, 1; Birmingham, 1.

Pellagra.—Cases: Philadelphia, 1; Washington, 2; Charleston, S.C., 1; Savannah, 4; Miami, 1; Montgomery, 1.

Typhus fever.—Cases: Savannah, 4; Montgomery, 4; Dallas, 1.

FOREIGN AND INSULAR

CANADA

Ontario Province—Poliomyelitis.—A report recently received stated that there had been more than the usual seasonal increase in the incidence of poliomyelitis in Toronto and the Province of Ontario since the last week of August 1934. Sixteen cases of the disease were reported in Toronto during August, and 38 cases from September 1 to 28. In Ontario Province, 136 cases of poliomyelitis were reported from August 1 to September 28, 1934.

CHILE

Typhus fever.—A report dated September 12, 1934, states that 1,736 deaths from typhus fever had occurred in the city of Santiago during 1934, as compared with 1,998 deaths from January 1 to September 5, 1933. The regions most affected by the disease, besides Santiago, were said to be the interior of the northern province of Tarapaca, the city of Concepcion, and Valdiva, a port in south central Chile. Efforts to check the disease were continuing, and disinfecting structures and concentration camps were to be built.

CUBA

Habana—Communicable diseases—4 weeks ended August 25, 1934.—During the 4 weeks ended August 25, 1934, certain communicable diseases were reported in Habana, Cuba, as follows:

Disease	Cases	Deaths	Disease	Cases	Deaths
Diphtheria	4		Poliomyelitis	[1] 14	2
Malaria	[1] 48	4	Tuberculosis	34	4
Measles	2		Typhoid fever	[1] 71	15

[1] Includes imported cases.

Poliomyelitis.—According to a recent report, 5 new cases of poliomyelitis, with 1 death, had been reported in Habana and vicinity from September 1 to 6, 1934. Opening of the schools in Habana had been postponed until October 1, as a precautionary measure.

YUGOSLAVIA

Communicable diseases—August 1934.—During the month of August 1934, certain communicable diseases were reported in Yugoslavia, as follows:

Disease	Cases	Deaths	Disease	Cases	Deaths
Anthrax	133	10	Poliomyelitis	11	1
Cerebrospinal meningitis	12	4	Scarlet fever	275	9
Diphtheria and croup	838	64	Sepsis	8	5
Dysentery	849	84	Tetanus	57	18
Erysipelas	164	10	Typhoid fever	885	57
Measles	94	4	Typhus fever	27	1
Paratyphoid fever	46	1			

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER

(NOTE.—A table giving current information of the world prevalence of quarantinable diseases appeared in the PUBLIC HEALTH REPORTS for Sept. 28, 1934, pp. 1154–1167. A similar cumulative table will appear in the PUBLIC HEALTH REPORTS to be issued Oct. 26, 1934, and thereafter, at least for the time being, in the issue published on the last Friday of each month.)

Plague

China—Manchuria.—A report dated August 17, 1934, states that from June 15 to August 15, 1934, plague has been reported in the Mukden area, Manchuria, as follows: Ch'angling, 2 cases; Chienan, 7 cases; Nungan, 64 cases, 44 deaths; Tungliao, 36 cases, 36 deaths.

Yellow Fever

French West Africa—Guinea—Kindia.—On September 13, 1934, 1 imported case of yellow fever with 1 death was reported in Kindia, Guinea, French West Africa.