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EPIDEMIOLOGY OF THE 1930 POLIOMYELITIS EPIDEMIC IN KANSAS

By EARLE G. BROWN, M. D., *Secretary, Kansas State Board of Health, Collaborating Epidemiologist, United States Public Health Service*

Acute anterior poliomyelitis, erroneously called infantile paralysis, is an acute infectious disease, oftentimes difficult to differentiate in its early stages from any other of the acute infectious diseases of childhood. Apparently, the disease is increasing in prevalence in all parts of the civilized world. The name infantile paralysis is not only not descriptive but is misleading, for the reason that adults contract the disease and also because paralysis is not at all constant. Few diseases are known which, in so short a time, as is the case with poliomyelitis, may completely destroy a useful life through permanent and hopeless crippling.

Case and death records of poliomyelitis are available for Kansas since the year 1908. In that year 100 cases were reported, with 33 deaths; while in 1916, the year of the widespread epidemic in the United States, 120 cases were reported, with 26 deaths. The high total number of cases, 694, was reported in 1930, as well as the high total number of deaths, 64. The previous high total number of cases, 196, was reported in each of the years 1910 and 1927, in which years 53 and 49 deaths, respectively, were recorded. The lowest case-fatality rate, 9.1 per cent, was recorded in 1930, and the previous low, 21.6, in 1916. Case reports, numbers of deaths, and case-fatality rates are shown in Table 1.

TABLE 1.—*Poliomyelitis in Kansas*

Year	Cases reported	Deaths reported	Case-fatality rate	Year	Cases reported	Deaths reported	Case-fatality rate
1908	100	33	33.0	1920	26	8	30.7
1909	90	27	30.0	1921	91	33	36.2
1910	196	53	27.0	1922	23	20	86.9
1911	26	8	30.7	1923	149	36	24.1
1912	70	23	32.8	1924	28	12	42.8
1913	16	6	37.5	1925	122	36	29.5
1914	26	13	50.0	1926	66	20	30.3
1915	29	17	58.6	1927	196	49	25.0
1916	120	26	21.6	1928	40	9	22.5
1917	75	17	22.6	1929	26	10	38.4
1918	30	12	40.0	1930	694	64	9.2
1919	60	17	28.3				

A study of case reports of poliomyelitis by months in Kansas for the past 10 years shows only occasional cases for the first 6 months of the year, with a definite increase beginning in early summer. The peak was reached in September in five of the years, in August in four years, and in 1929 six cases were reported in two months—September and October. These data are shown in Table 2.

TABLE 2.—*Poliomyelitis cases reported in Kansas by months, 1921–1930*

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1921	2	4	0	1	2	1	3	16	36	20	4	2	91
1922	5	2	0	0	1	1	1	6	4	1	1	1	23
1923	0	2	2	0	0	1	10	74	29	20	9	2	149
1924	3	2	1	3	2	0	1	4	8	2	0	2	28
1925	0	0	2	0	1	2	15	38	35	19	6	4	122
1926	2	1	2	0	1	3	3	13	22	13	3	3	66
1927	2	0	5	2	3	5	17	34	68	45	11	4	196
1928	3	1	4	1	1	0	3	14	9	3	1	0	40
1929	2	0	0	1	0	2	5	4	6	6	0	0	26
1930	2	2	1	0	1	2	39	185	272	161	25	4	694

During the 5-year period, 1926–1930, 1,022 cases of acute anterior poliomyelitis were reported in the State, 603 males and 419 females, males predominating in the reported cases in a ratio of 6 to 4. Seventy-six and eight-tenths per cent of the total reported cases occurred in persons under 15 years of age. Among males, 73.5 per cent of cases were under 15, as compared with 81.7 per cent of females. Of the males, 29.2 per cent occurred in the age group 0–4 and 29.4 per cent in the age group 5–9 years. While 23.2 per cent of the reported cases were over 15 years of age, 38.9 per cent of the deaths were reported in persons over 15. Among males the largest percentage of deaths, 22.3 per cent, for any age group occurred in the age group 5–9 years, while in females the largest percentage, 26.5 per cent, occurred in persons under 5 years of age. Percentage distribution of reported cases and deaths by sex and age groups are shown in Table 3.

TABLE 3.—*Percentage distribution of poliomyelitis cases and deaths by sex and age groups, in Kansas, 1926–1930*

	Age							
	0–4	5–9	10–14	15–19	20–29	30–39	40–49	Over 50
Cases:								
Total	31.5	28.5	16.8	12.2	7.0	1.5	1.5	0.6
Male	29.2	29.4	14.9	14.2	7.9	1.8	1.6	.6
Female	34.9	27.2	19.6	9.3	5.7	1.1	1.4	.5
Deaths:								
Total	21.7	19.7	19.7	13.1	12.5	5.2	4.6	3.2
Male	19.4	22.3	19.4	15.5	12.6	3.8	4.8	1.9
Female	26.5	14.2	20.4	8.1	12.2	8.1	4.0	6.1

THE KANSAS EPIDEMIC OF 1930

There were 694 reported cases of poliomyelitis in Kansas in 1930, with 64 deaths. During the first six months but eight cases were reported, with date of onset and location by counties as follows:

Johnson	Jan. 11
Wyandotte	Jan. 22
Montgomery	Feb. 11
Douglas	Feb. 18
Crawford	Mar. 2
Atchison	May 2
Shawnee	June 12
Greenwood	June 28

During the first six months of the year, therefore, eight cases were reported from eight different counties. In the three weeks' period following June 30, cases were reported from 12 additional counties and from 3 counties which had reported cases during the first six months. In general, the geographical trend of the incidence was from the southwest to the junction of highways US 54 and US 81. A tendency to scatter rather widely east and north followed, until by the end of September, when 272 additional cases had been reported, the great majority of the counties were represented by one or more reported cases. October had 161 cases, and then came a rapid drop to 25 cases in November and to 4 in December.

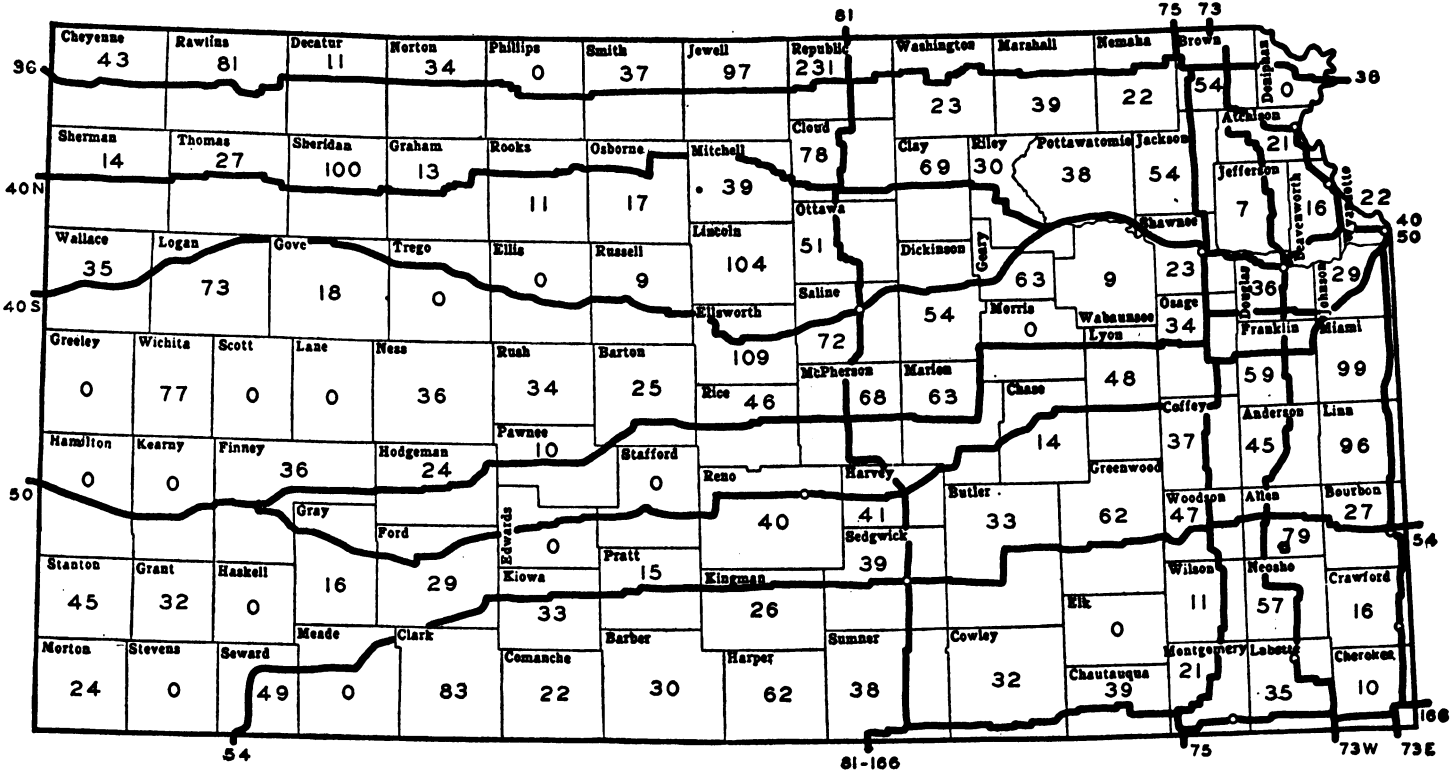
Counties from which no cases were reported included Doniphan, Edwards, Elk, Ellis, Greeley, Hamilton, Haskell, Kearney, Lane, Meade, Morris, Phillips, Scott, Stafford, Stevens, and Trego. Only three of these counties, Doniphan, Elk, and Morris, are in the east half of the State.

In an attempt to secure complete case histories, questionnaires were mailed to each physician who reported cases of poliomyelitis after July 1. Five hundred of the 688 blanks were returned, from which the data we now present are abstracted.

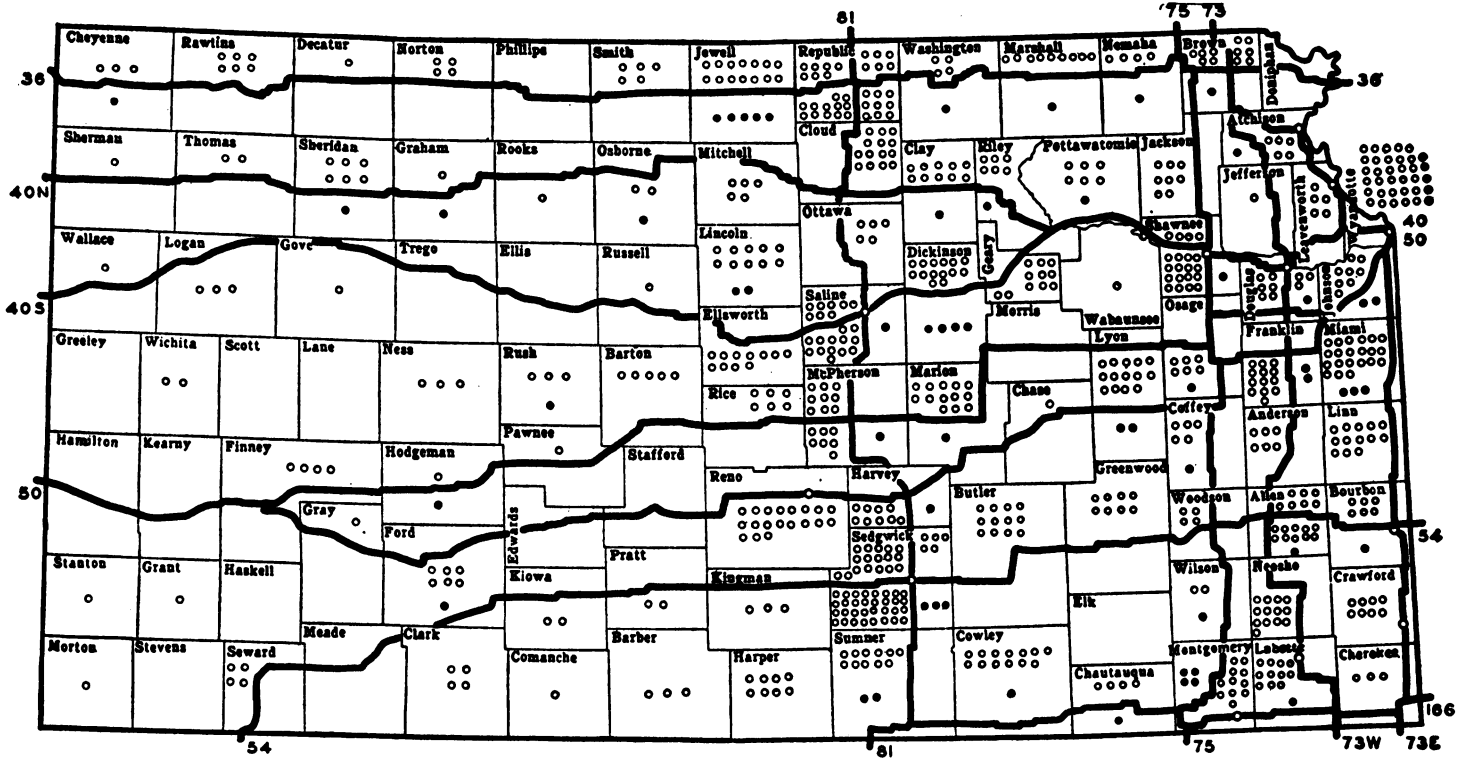
There were 452 cases reported in 433 families with data as to the family composition. In these families there were 1,007 adults and 1,194 children, a total of 2,201 individuals. Records were not secured of the total number of persons comprising the families in 48 cases.

In only 25 cases was report made that there had been a known contact with an acute case. In 12 of these cases, report was made of contact with a member of the family having a definite paralytic case, while the source of contact of the other 13 cases was not given. The source of infection, however, of 11 cases was attributed to exposure in another State, as follows: Missouri, 4; Colorado, 3; Oklahoma, 2; and Nebraska and Wisconsin, 1 each.

Multiple cases were reported in 19 families, with one family having 3 cases. These data are shown in Table 4.



Poliomyelitis case rates per 100,000 population, Kansas, 1930



Poliomyelitis cases and deaths in Kansas, 1930

1903

September 16, 1933

TABLE 4.—*Multiple cases of poliomyelitis in families, Kansas, 1930*

Case No.	Date of onset	Sex	Age	Paralysis
47	Aug. 14	M	16	Left leg.
48	Aug. 8	M	23	Both legs.
67	Sept. 26	M	18	Abortive.
68	do	M	21	Both legs.
120	Sept. 24	F	13	Left arm; both legs.
121	Sept. 30	M	7	Left leg.
124	Oct. 7	F	8	Abortive.
125	Oct. 6	F	10	Right leg.
132	Oct. 14	M	24	Both legs.
133	Oct. 15	M	19	Do.
189	Sept. 13	M	8	Left leg.
189a	Sept. 20	F	10	Not stated.
228	Aug. 1	M	8	Chest (died).
229	July 27	F	18	Both arms; both legs.
241	Not given	M	3	Right leg.
241a	Sept. 8	F	------	Not stated.
256	Sept. 20	F	2	Right leg.
257	Sept. 26	F	4	Do.
263	Sept. 27	M	7	Bulbar (died).
264	Sept. 29	F	9	Both arms; both legs.
270	Oct. 18	F	4	Not stated.
271	Oct. 29	M	21	Chest (died).
349	Aug. 26	F	5	Right arm.
350	Aug. 29	M	8	Do.
352	Oct. 22	F	10	Left arm; right leg.
353	Nov. 3	M	11	Left arm.
356	Sept. 16	M	14	Abortive.
357	Sept. 12	F	11	Left leg.
360	Aug. 30	F	13	Both legs.
361	do	M	10	Abortive.
373	July 24	F	6	Right leg.
374	Aug. 1	M	10	Abortive.
411	Sept. 20	F	6	Both legs.
412	Not given	F	8	Not stated.
413	July 25	F	3	Both legs.
414	July 22	M	8	Not stated (died).
423	Sept. 26	F	11	Left leg.
424	do	M	5	Both legs.
425	Sept. 19	M	14	Do.

The majority of cases had the services of a physician quite early; he was called before the fourth day after onset in 316, or 67.2 per cent, of 469 cases. These data are shown in Table 5.

TABLE 5.—*Days from onset to visit of physician*

	Number	Per cent		Number	Per cent
Same day	164	34.9	9 days	1	
1 day	94	20.0	10 days	2	
2 days	58	12.3	11 days	0	
3 days	41	8.7	12 days	0	2.3
4 days	34	7.2	13 days	2	
5 days	25	5.3	14 days	3	
6 days	16	3.4	Over 15 days	3	
7 days	18	3.8	Not stated	31	------
8 days	8	1.7			

According to reports of the attending physicians, 206 of 445 patients, or 46.3 per cent, went to bed on the same day as the occurrence of the onset of the disease. Only five of the patients were not confined to their bed at some stage of their illness. Data showing period of time elapsing from the time of onset until the patient went to bed is shown in Table 6.

TABLE 6.—*Days from onset to going to bed*

	Number	Per cent		Number	Per cent
Same day	206	46.2	6 days	9	2.0
1 day	80	17.9	7 days	7	1.5
2 days	55	12.3	8 days or over	10	3.8
3 days	29	6.5	Not in bed	5	1.1
4 days	25	5.6	Not stated	55	----
5 days	19	4.2			

For any one 24-hour period the majority of cases developed their paralysis on the fourth day after onset. Report was made that 41 cases, or 9.2 per cent, did not have paralysis, and, therefore, are classed as being of the abortive type. Occurrence of paralysis after onset is shown in Table 7.

TABLE 7.—*Days from onset to time of paralysis*

	Number	Per cent		Number	Per cent
Same day	65	14.7	6 days	14	3.1
1 day	15	3.3	7 days	17	3.8
2 days	79	17.8	8 days or over	14	3.1
3 days	105	23.7	No paralysis	41	9.2
4 days	63	14.2	Not stated	59	----
5 days	28	6.3			

The principal symptoms in order of importance are shown in Table 8.

TABLE 8.—*Occurrence of symptoms*

	Number	Per cent		Number	Per cent
Temperature	487	98.9	Constipation	228	46.9
Headache	372	76.2	Sore throat	180	36.8
Malaise	362	74.3	Sound sensitive	178	36.8
Stiff neck	360	73.9	Pain on swallowing	110	22.6
Nausea and vomiting	323	66.1	Disturbance of vision	100	20.7
Anorexia	322	65.8	Diarrhea	77	15.8

In only 10 cases was report made of the absence of pain during the entire course of the disease. Of the 452 cases reporting on pain, in 154 or 24.0 per cent, the pain was general, while in 111 cases, or 24.5 per cent, pain was present in the neck, back, and legs. The sites of pain are shown in Table 9.

TABLE 9.—*Location of pain*

	Number	Per cent		Number	Per cent
Generalized	154	34.0	Arms (1 right arm)	16	3.5
Neck, back, and legs	111	24.5	Arms and legs	11	2.4
Neck and back	65	14.3	Miscellaneous	17	3.7
Legs (1 right leg, 2 left leg)	35	7.7	Pain absent	10	2.2
Neck, back, and arms	33	7.3	Not stated	48	

The extreme difficulty in recognizing an attack of poliomyelitis without an accompanying paralysis is shown by the total number of paralyzed cases in this series. Without doubt many cases of true poliomyelitis occurred with symptoms so mild, so varied, and so indefinite that the attending physician did not feel justified in making a positive diagnosis. These cases had only a slight indisposition and made a rapid and uneventful recovery. The site of paralysis is shown in Table 10.

TABLE 10.—*Site of paralysis*

	Number	Per cent		Number	Per cent
Legs:			Respiratory, bulbar	47	9.5
Both legs	82	16.7	Throat	7	1.4
Right leg	66	13.4	Both arms, right chest	4	.8
Left leg	76	15.5	Left leg, respiratory	4	.8
Arms:			Both legs, abdomen	2	.4
Both arms	9	1.8	Right arm, right leg, respiratory	2	.4
Right arm	31	6.3	Left arm, left leg, abdominal	2	.4
Left arm	16	3.2	Left leg, abdominal	2	.4
Both arms, both legs	17	3.4	Right arm, respiratory	2	.4
Left arm, left leg	19	3.8	Right foot	1	.2
Right arm, right leg	16	3.2	Right hand	1	.2
Right arm, both legs	10	2.0	Miscellaneous	8	1.6
Left arm, both legs	9	1.8	No paralysis	41	
Right arm, left leg	8	1.6	Not given	10	
Both arms, left leg	5	1.0			
Left arm, right leg	3	.6			

Spinal punctures were reported in 32 cases. Number of cells was not given in 8 cases, but in the remaining 24 the average cell count was 201. The counts ranged from 5 to 1,800. Counts in excess of 100 were reported in 10 of the spinal fluids.

Tonsillectomies were reported as having been performed prior to onset in 76 cases and 13 of these cases had fatal poliomyelitis. In the nonfatal cases, a total of 63, 8 were classed as abortive with complete recovery, while 50 developed paralysis; 5 of them reported as completely recovered.

According to the reports of cases, 138 patients received convalescent serum at some stage of the disease. Information as to the use of serum was not given in six cases.

Of the 138 cases receiving convalescent serum, 13, or 9.4 per cent, resulted fatally, as compared with 51 deaths, or 14.3 per cent, in the group which did not receive serum treatment. However, of the 125 nonfatal cases treated with convalescent serum, it was administered to but 60, or 48.0 per cent, within 48 hours after onset.

Of the 125 nonfatal cases receiving convalescent serum, regardless of the time of its administration, 20, or 16.0 per cent, did not develop paralysis, as compared with but 12, or 3.9 per cent of the 303 nonfatal cases not receiving serum treatment.

Of the 500 cases, 111 were reported as completely recovered.

A STUDY OF TUBERCULOSIS AMONG THE INDIANS IN MONTANA

A Preliminary Report

By J. H. Crouch, M. D., C. P. H., *Director, Division of Communicable Diseases, Montana State Board of Health, Collaborating Epidemiologist, United States Public Health Service*

There are seven Indian reservations in Montana, having a total resident Indian population of 13,230; and these, together with 1,568 scattered Indians, make a total of 14,798 Indians in the State.

It has long been known that tuberculosis is one of the most serious diseases affecting this race, the death rate from which among them being about 15 times as great as it is in the white population, but there had been no systematic study of the disease among Indians in Montana to determine its exact extent or the cause of the high death rate. It has been generally assumed that racial susceptibility is the chief factor, with poor food, bad hygiene, overcrowding, and lack of treatment as contributing causes.

In February, 1931, a general survey of health conditions among school children on one reservation (Fort Peck) was made by the Montana State Board of Health, assisted by voluntary agencies. Both white and Indian children were included in the survey, and special attention was given to tuberculosis. Each child received a skin test, and all those who showed a positive reaction had an X ray of the chest taken and a complete physical examination.

Just prior to the opening of schools in September, 1931, the medical service of the Office of Indian Affairs perfected plans for similar surveys on five other reservations, viz, Fort Belknap, Rocky Boy, Blackfeet, Tongue River, and Crow. The State board of health and the State tuberculosis association assisted in these surveys; the State board of health furnished all laboratory service, and the task of giving the skin tests was assigned to the writer.

The primary purpose of the survey was to determine the extent of tuberculosis among Indian children; but, in addition, it was hoped that specific information might be obtained on two important phases of the subject.

First: Since Indian children are being placed in the public schools in constantly increasing numbers, thus increasing the contact between

white children and a potential source of infection, what effect, if any, does this have in increasing the incidence of tuberculosis among the white children?

When the Indian Medical Service requested assistance in the survey from the State board of health, it was agreed that all white children in schools on or near an Indian reservation, and in which Indian children were found, should be included in the survey.

Second: How important is racial susceptibility as a cause of the high tuberculosis death rate? When considering the causes of the enormous death rate from tuberculosis among Indians, it has been customary in the past to place racial susceptibility at the top of the list, with poor food, poor living conditions, lack of home and personal hygiene, and lack of treatment as contributory causes.

A number of studies have been made in recent years of the question of racial susceptibility to tuberculosis, and the trend of opinion among the investigators seems to be that high death rates among Negroes, Mexicans, and other races are due to poor living conditions and lack of treatment rather than to racial susceptibility.

In the present survey it was hoped that some information on this point might be obtained by keeping a separate record of the mixed bloods for comparison with the full-blood Indians, it being assumed that living conditions were, in general, the same in the two groups. Incidentally, when inquiry was made on this point, the writer was informed by physicians, nurses, reservation officials, and others who constantly visit the Indian homes that there is usually a noticeable difference in living conditions between mixed bloods and full-bloods. It was stated that the mixed bloods are more intelligent; they have better food; living conditions in their homes are better; their habits of personal hygiene are better; when sick, they consult a physician earlier, and his instructions are followed more intelligently. The writer doubts that there is enough difference in living conditions to account entirely for the difference in findings which are mentioned later, but the fact that there is a difference lessens the value of the findings.

Since the reservation rolls carry three degrees of Indian blood—full-bloods, mixed bloods one-quarter or more Indian, and mixed bloods less than one-quarter Indian—these classifications were observed in the survey.

TUBERCULOSIS DEATHS

As a preliminary to the survey, a study was made of tuberculosis deaths among Indians on the six reservations during the five-year period 1926–1930, with a similar study of deaths among the white population of the six counties in which the reservations are located.

The Indians on the six reservations were found to have a crude death rate of 25.9 per thousand, and 34 per cent of the total deaths among them were due to tuberculosis. The white death rate in the six counties was 5.9, and 4 per cent of the total deaths were due to tuberculosis.

TABLE 1.—*Tuberculosis deaths among Indians, 1926–1930, on six reservations in Montana, and in the white population of the six counties in which the reservations are located*

Reservation	Full-blood Indian		Mixed blood ¼ and more Indian		Mixed blood less than ¼ Indian		White (in county)	
	Population	Deaths	Population	Deaths	Population	Deaths	Population	Deaths
Blackfeet	1,154	74	1,788	16	283	----	2,466	8
Rocky Boy	252	5	343	7	----	----	6,804	7
Fort Belknap	590	71	663	15	30	----	7,630	8
Fort Peck	1,077	72	1,288	33	265	1	8,646	11
Crow	977	45	700	7	68	----	6,119	4
Tongue River	1,148	78	231	7	119	1	6,370	7
Total	5,198	345	5,013	85	765	2	38,035	45
Annual death rate per 100,000	1,327.4		339.1		52.3		23.7	

In Table 1 are listed for each reservation the total deaths from tuberculosis in full-blood Indians, mixed bloods one-quarter or more Indian, mixed bloods less than one-quarter Indian, and in the white population of the adjoining county. The population figures for the Indians are taken from the reservation census of April 1, 1931, and those for the whites from the Federal census of 1930. It will be noted immediately that the death rate is enormously high among the full-blood Indians and steadily decreases with the admixture of white blood.

If the rates were calculated for each reservation, a wide difference would be noted; but the separate population groups are so small that the figures are of doubtful significance. Among the full-blood Indians living conditions seemed to be somewhat better than the average on the Crow and Rocky Boy Reservations, and the tuberculosis death rates were below the average. Living conditions were very poor on the Tongue River Reservation, and the tuberculosis death rate there was above the average. No explanation can be suggested for the extremely high rate on the Fort Belknap Reservation. Living conditions seemed to be average, and the infection rate, as will be shown later, was not unusually high. Among the mixed bloods the death rate on the Blackfeet Reservation was only one-half as high as the average for this group. It was on this reservation especially that there was a noticeable difference in living conditions between mixed bloods and full bloods. Among the white population

the only difference in rate which seemed to be significant was that in Glacier County. The Blackfeet Reservation is located here, and it is the only county of the State in which there are more Indians than whites. The tuberculosis death rate among white people in Glacier County is three times as high as in any other county.

TABLE 2.—*Tuberculosis deaths among Indians, 1926–1930, on six reservations in Montana, by age and degree of Indian blood; also in the white population of the six counties in which the reservations are located*

Race	Age group															
	Under 1	1–4	5–9	10–14	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69	70 and over	Total
Full-blood Indian	11	46	28	32	47	28	31	16	13	14	9	14	14	11	10	21	345
Mixed blood ¼ and more Indian	8	18	7	9	8	13	5	4	4	4	1	2	2	----	----	----	85
Mixed blood less than ¼ Indian	----	----	----	----	1	1	----	----	----	----	----	----	----	----	----	----	2
White, six counties	----	----	----	1	5	1	6	5	2	3	5	6	5	2	----	4	45

In Table 2 the deaths are given by age. The age distribution is very unusual in all groups. In the full-blood Indians one-third of the deaths were in persons under 15 years of age, one-third in persons between 15 and 30 years, and one-third in individuals over 30 years. The large number of deaths in children would seem to indicate gross negligence on the part of open cases in the family, and this is probably one of the most important causes. In this age group we would expect to find intestinal and meningeal types of the disease predominating, but the certificates show that 73 of the 117 deaths were from pulmonary tuberculosis. Every age was represented in the pulmonary cases, as follows: Under 1 year, 5 cases; 1 to 4 years, 24 cases; 5 to 9 years, 21 cases; and 10 to 14 years, 23 cases.

At age 30 there is a sudden drop of 50 per cent in the number of deaths. In the older age groups the number of deaths continues without decrease. The death certificates give very little information about the duration of the disease. If the deaths at older ages were due to prolonged courses of the disease, thus indicating increased resistance, there would still be a gradual decline in number as age advanced. It seems more reasonable to interpret the figures as probably indicating the onset of active tuberculosis at more advanced ages than usually occurs in the white race. Gross infection continues, of course. If we concede that resistance increases with advancing years, this seems to be effective suddenly at the age of 30 years. From then onward, however, there must be little further increase in resistance.

The total number of mixed bloods one-quarter or more Indian included in the study is about equal to the number of full-blood

Indians, being a little over 5,000. They live on the same reservations, in the same general surroundings. Since Indians are incessant visitors, there is very little difference in the amount of exposure. It is said that there is some difference in the living conditions, but this difference is not great enough to be obvious to the casual visitor. In spite of these points of similarity, the mixed bloods have only one-fourth as many deaths from tuberculosis, the exact ratio being 1 to 4.1. The ratio varies widely at different ages; under 15 years it is 1 to 2.8; from 15 to 30 years it is 1 to 4.1; and over 30 years 1 to 7.2. Whatever the factors may be which cause marked reduction in deaths from tuberculosis among the mixed bloods, they are least effective in childhood, and steadily increase in effectiveness as age advances. No deaths from tuberculosis occurred after 60 years.

Among the whites the tuberculosis death rate is extremely low, and the age at death in tuberculosis cases is higher than the average.

MANTOUX TESTS

The first step in the survey of tuberculosis among school children was a skin test of each child for tuberculous infection. The test was given to all Indian children without asking for consent of the parents. With white children, consent of the parents had to be obtained. For this reason, the number of white children included in the survey varied from 50 to 90 per cent of these children in the various localities.

The test used was the intradermal test of Mantoux. The volume of the work made it impractical to give the three tests with increasing strength of solutions. For this reason, only one test was given to each child, and Mantoux's solution B was used, which consists of a 1:1,000 dilution of old tuberculin with the dose 0.1 cc. Thus each child received intradermally 0.1 mg of concentrated old tuberculin. The tests were all given and readings made by the author so as to have the results as nearly uniform as possible. Readings were made in 48 hours in nearly all instances. In a few schools, having a total of about 200 children, readings were after a 72-hour interval.

The readings were recorded strictly according to the Mantoux scale, with one exception. While some tuberculosis authorities recommend that an area of induration less than 5 mm in diameter should be ignored, in the present survey all perceptible reactions were considered positive. Indurations less than 1 cm in diameter were classified as 1+. Many of the reactions so recorded, especially among white children, were not more than 3 or 4 mm in diameter. In the entire survey there were not more than fifteen or twenty 4+ reactions; and for convenience in tabulation these are included with the 3+ group. In Table 3 are given the results of the test on each reservation. Table 4 is a summary of all the children tested, arranged according to degree of Indian blood and age, with degree of reaction and per cent of positives in each group.

TABLE 3.—*Mantoux tests of school children on six Indian reservations in Montana*

Reservation	Full-blood Indian			Mixed blood ¼ and more Indian			Mixed blood less than ¼ Indian			White		
	Number tested	Positive	Per cent	Number tested	Positive	Per cent	Number tested	Positive	Per cent	Number tested	Positive	Per cent
Blackfeet	142	98	69.8	338	177	52.4	55	25	45.5	102	53	52.0
Rocky Boy	34	21	61.8	47	28	59.6	------	------	------	1	1	100.0
Fort Belknap	93	59	63.4	256	143	55.9	9	3	33.3	328	58	17.7
Fort Peck	155	123	79.4	273	128	46.9	29	12	41.4	503	86	17.1
Crow	146	107	73.3	137	88	64.2	31	8	25.8	465	116	24.9
Tongue River	227	190	83.9	55	37	67.3	16	7	43.8	11	4	36.4
Total	797	598	75.0	1,106	601	54.3	140	55	39.3	1,410	318	22.6

Among the white children it was noted that the percentage of positive reactors varied considerably on the different reservations. The variation was even more noticeable in different localities on the same reservation. The lowest percentage of positive reactions among white children was found in several larger towns, where the positives were from 12 to 17 per cent. In the small villages and in some of the rural schools, positive reactions were obtained in from 20 to 35 per cent of the white children. The highest percentage of reactors among white children was found at Browning, where 50 positive reactions were seen among the 96 children tested. The percentage of positive reactions among white children seemed to be correlated somewhat with the percentage of Indian children in the school, but, in addition, contact outside of school and contact with Indian adults are possible factors. In the towns having a low percentage of positives among white children it was learned that practically no Indian families live in the town itself; they live in the surrounding country, and the Indian children are brought to the school in busses. Indian adults visit the towns on business, but contact with the white children is slight. In the smaller villages and rural areas, contact between white children and Indian families is closer, as a number of Indian families live in the villages. There is some visiting in the homes, and casual contact on the streets and in the stores and other public places is greater.

The town of Browning differed from other communities in that its population is about two-thirds Indian. There are 207 Indians and about 100 whites in the public school. In this town there is necessarily rather constant contact between Indian adults and white children.

A total of 1,410 white children were tested, and 22.6 per cent of them were positive. The vast majority of the reactions among white children were slight. Only a little over 3 per cent of the total white children tested gave a reaction greater than 1+, and, as previously stated, many of the reactions recorded as 1+ were less than 5 mm in diameter.

The age distribution and degree of reaction are given in Table 4.

TABLE 4.—*Mantoux tests of school children on six Indian Reservations in Montana (Fort Peck, Fort Belknap, Rocky Boy, Blackfeet, Tongue River, and Crow), October, 1931*

Age	Full-blood Indian						Mixed blood ¼ or more Indian					
	Total examined	Negative	Positive				Total examined	Negative	Positive			
			Total	Degree					Total	Degree		
				1+	2+	3+				1+	2+	3+
3	1	1										
4	2	1	1	1			3	1	2	2		
5	7	3	4	1	2	1	17	14	3	2	1	
6	58	21	37	16	19	2	88	47	41	26	13	2
7	65	25	40	13	17	10	99	57	42	26	12	4
8	79	30	49	22	19	8	107	52	55	25	20	10
9	81	21	60	20	23	17	133	68	65	33	24	8
10	106	31	75	18	33	24	120	58	62	32	17	13
11	77	17	60	18	21	21	120	50	70	28	25	17
12	68	11	57	17	17	23	111	52	59	22	21	16
13	71	10	61	17	22	22	90	32	58	19	22	17
14	62	11	51	18	22	11	74	26	48	22	18	8
15	58	10	48	11	27	10	59	19	40	21	6	13
16	35	5	30	14	8	8	36	12	24	15	7	2
17	17	2	15	4	4	7	25	6	19	7	6	6
18	6	0	6	2	1	3	11	5	6		4	2
19	2	0	2	1		1	9	3	6	1	3	2
20	2	0	2	1	1		4	3	1		1	
Total	797	199	598	194	236	168	1,106	505	601	281	200	120
Per cent positive			75.0						54.3			

Age	Mixed blood less than ¼ Indian						White					
	Total examined	Negative	Positive				Total examined	Negative	Positive			
			Total	Degree					Total	Degree		
				1+	2+	3+				1+	2+	3+
3							2	1	1	1		
4							5	4	1	1		
5	1		1	1			10	9	1	1		
6	10	7	3	3			114	92	22	21		1
7	16	11	5	3	1	1	96	77	19	16	2	1
8	15	7	8	6	2		105	79	26	24	1	1
9	16	6	10	7	3		115	100	15	11	4	
10	13	9	4	1	1	2	132	97	35	32	2	1
11	20	15	5	3	1	1	140	106	34	30	3	1
12	15	11	4	3		1	121	92	29	24	4	1
13	8	6	2	2			120	98	22	17	4	1
14	10	5	5	5			119	92	27	24	1	2
15	5	3	2	2			111	83	28	24	4	
16	6	4	2		1	1	97	74	23	18	3	2
17	2	1	1		1		73	52	21	17	4	
18	3	0	3	2	1		32	24	8	4	4	
19							12	8	4	3	1	
20							6	4	2	2		
Total	140	85	55	38	11	6	1,410	1,092	318	270	37	11
Per cent positive			39.3						22.6			

Among the white children, there was a slight but steady increase in the percentage of positive reactions with the increase in age.

In the record of the tests of the Indian children several points are very noticeable: The percentage of positive reactions steadily increases with the degree of Indian blood, the increase each year in the

percentage of positives is much greater than in white children, and the reactions are more severe. The number tested in the group having less than one-quarter of Indian blood was rather small; only 140 children belonged in this group, and 39.3 per cent were positive. In this group it will be noted also that, as in the white children, most of the reactions were recorded as 1+. In the mixed bloods having one-quarter or more Indian blood, 1,106 children were tested, and 54.3 per cent were positive. Twenty-nine per cent of this group gave a reaction greater than 1+. In the full-blood Indians 797 were tested and 75 per cent showed a positive reaction. Fifty per cent of all the children in the full-blood group gave a reaction greater than 1+.[1] When comparing full-blood Indians with Indians of mixed blood, it was previously stated that there was probably little difference in the amount of infection in the two groups; but the evidence produced by the Mantoux tests opposes this. The percentage of positives is definitely higher in the full bloods and the excess is noted at all ages. The question naturally arises, Is this increase in infection rate sufficient in itself to cause a death rate four times as high? It seems doubtful.

Another interesting point is that after age 17 the mixed bloods show a decided drop in positive skin tests, while the full bloods jump to 100 per cent positive. The number tested is much too small to be of definite significance. It is undoubtedly true that in many infected children the initial lesion is so completely healed that a skin test at a later period will be negative. It is possible that complete healing is less frequent in full-blood Indians.

ETIOLOGY OF TRACHOMA WITH REFERENCE TO RELATIONSHIP OF *Bacterium granulosis* (NOGUCHI) TO THE DISEASE

By Ida A. Bengtson, *Senior Bacteriologist, National Institute of Health, United States Public Health Service*

Since the announcement by Noguchi (1), in May 1927, of the discovery of a new micro-organism isolated from four of five cases of trachoma among American Indians studied at Albuquerque, N. Mex., and designated by him as *Bacterium granulosis*, many attempts

[1] Incomplete records of the X rays and physical examinations show that by far the greatest number of cases having chest pathology are to be classed as "childhood type arrested." In this group of children, all showing practically identical physical findings; that is, with calcified hilum glands, possibly a calcified primary focus, and no activity, there was marked variation in the severity of the skin reaction. The variation in severity is definitely correlated with degree of Indian blood. Eighty-five per cent of the white children had a reaction of 1 plus, and only 15 per cent greater than 1 plus. The mixed bloods were 50 per cent 1 plus and 50 per cent greater. The full-blood Indian children were 25 per cent 1 plus and 75 per cent greater than 1 plus.

Severity of reaction does not seem to coincide with degree of activity. Thirty-seven Indian children were found to have the adult type of the disease with definite activity, and 14 of them, or 40 per cent, had a skin reaction of only 1 plus.

have been made to confirm his findings in various parts of the world. Full details of the methods used for the isolation of the organism were published in August, 1928 (2), and cultures of the organism were made available for distribution by the Rockefeller Institute for Medical Research in April, 1929. Up to that time it was difficult for one studying the disease to identify with certainty any organism isolated with Noguchi's. Though having rather distinctive characteristics which are observable when the culture is at hand, *Bact. granulosis* may easily be confused with other small gram-negative rods which occur on the human conjunctiva from time to time. There was a temporary confusion in regard to its identity for some time after the publication of Noguchi's work, owing to the fact that it was stated that the organism would not develop on ordinary agar, but required the presence of serum or blood for growth. As is well recognized at the present time, the organism grows readily and fairly luxuriantly on plain agar, particularly when freshly prepared and moist.

Confirmation of Noguchi's work has come principally from Finnoff and Thygeson (3), of Denver, Colo., and from workers of the Rockefeller Institute for Medical Research, Tilden and Tyler (4), and Olitsky, Knutti, and Tyler (5), and probably from certain European workers. Many others have failed to isolate the organism from cases of trachoma. The ease with which the organism may be cultivated when once isolated contrasts with the apparent great difficulty of obtaining primary growth or of failure to isolate it at all. It is possible that the organisms are present in the conjunctiva in small numbers or that there are other factors concerned which are not readily discernible which may account for the negative results of a number of workers.

The question has been raised as to whether the organisms isolated in the Old World correspond exactly with *Bact. granulosis*. Up to the present time no comparative cultural study of the various organisms isolated has been reported.

In a critical review of the literature it has been noted that very few workers have given adequate descriptions of their organisms, nor have they employed serological tests such as ordinarily used in the identification of unknown bacteria. An immune serum against *Bact. granulosis* may be prepared without great difficulty by intravenous injections of cultures into rabbits, as shown by Tilden (6). Tilden obtained serums of high titer which were specific, agglutinating 14 strains of *Bact. granulosis* and failing to agglutinate the commonly occurring conjunctival bacteria as well as numerous gram-negative bacteria found on the conjunctiva of man and monkeys. Reports of the isolation of cultures of *Bact. granulosis* in which there is no evidence

that cultures of known organisms were at hand for comparison or in which serological tests are not included may be viewed with some degree of doubt. A number of workers have used the criterion of the production of a granular condition in the conjunctiva of monkeys to identify the organism which they isolated with that of Noguchi's; but identification on this basis is uncertain, owing to the lack of uniformity in results obtained when known cultures of *Bact. granulosis* are used for inoculating the animals, as will be discussed later.

Information concerning the isolation of *Bact. granulosis* or similar organisms is presented in the accompanying table (Table 1), an approximately chronological arrangement being used. In the table are included the name of the investigator, the locality in which the trachoma cases were obtained, the number of cases investigated, the number of cases from which *Bact. granulosis* or a similar organism was isolated, and an evaluation of the results as indicated by the plus and minus signs.

TABLE 1.—*Results obtained by various investigators in attempts to isolate* Bact. granulosis

Investigator and date of publication	Locality	Number of cases investigated	Number of cases from which *Bact. granulosis* or similar organism was isolated	Evidence of isolation of *Bact. granulosis*
Noguchi, 1927, 1928 (2)	New Mexico	5	4	++
Stepanowa & Azarowa, 1929 (7)	Russia (Ukraine)	10	7	+
Finnoff & Thygeson, 1929, 1931 (3)	Colorado, Arizona	29	8	++
Bordonaro, 1929 (8)	Italy	3	2	+
Sabata, 1929 (9)	Czechoslovakia	(a)	0	−
Brückner, 1929 (10)	do	12	0	−
Addario, 1929–30 (11)	Italy	(a)	(a)	++ (1 cult.) [b]
Mayou (referring to work of McCartney), 1929 (12).	England	Many.	0	−
Giani, 1929 (13)	Italy	(a)	1	±
Wilson, 1930 (14)	Egypt	25	0	−
Tilden & Tyler, 1930 (4)	Arizona	20	6	++
Lindner & Rieger, 1930 (15)	Austria	4	2	±
Bietti, 1930 (16)	Italy	16	2	+
Morax, 1930 (17)	France	11	0	−
Kendall & Gifford, 1930 (18)	Illinois	(a)	1	+
Tang, 1930 (19)	China	24	1	±
Weiss	Missouri	(a)	[d]1	++
Melanowsky-Lawrynowitsch, 1930 (21)	Poland	95	0	−
Olitsky, Knutti & Tyler, 1930, 1931 (5)	New York	11	6	++
Morax, 1931 (22)	Algeria	(a)	0	−
Lumbroso and Van Sant, 1931 (23)	Tunisia	29	0	−
Reimann & Pillat, 1931 (24)	China	5	1	±
Cattaneo, 1931 (25)	Sardinia	15	0	−
Wilson, 1931 (26)	Egypt	16	0	−
Thygeson, 1931 (27)	do	[e]16	0	−
Fischer-Ascher, 1931 (28)	Czechoslovakia	60	11	+

(++ indicates unquestionably positive results; + results reported positive, but descriptions not complete; ± doubtful results; − negative results.)

[a] Not stated.
[b] This culture was furnished to the writer through the courtesy of the Rockefeller Institute.
[c] Cases of folliculosis.
[d] This culture was received from Doctor Weiss.
[e] Same cases as preceding.

With reference to the last column in the table, unquestionably positive results in respect to the isolation of *Bact. granulosis* are indicated by the double plus sign (++). These cultures have been adequately described or have been compared with Noguchi's organism or have been received and identified by the writer. Results which have been reported positive but in which the description is not entirely complete are designated by the one plus sign (+), and results which are still more doubtful by the plus-minus sign (±). The designation of the second group by + instead of ++ should not necessarily be considered a final evaluation of the results reported. Some of the cultures referred to may in the final analysis be found to correspond to *Bact. granulosis*; but at the present time, for the reasons stated, the identity of these cultures can not be considered as absolutely certain.

The data presented in the table will be discussed in their geographical relationship.

UNITED STATES

The work of Finnoff and Thygeson (3) furnishes perhaps the most satisfactory confirmation of the results obtained by Noguchi. Their cases were taken partly from Indians living in the same section of the country as those used by Noguchi and partly from clinical cases seen in their private practice and at the opthalmologic clinic of the University of Colorado School of Medicine. Twelve of their cases were white persons, 1 was a Mexican, 2 were Japanese, and 14 were Indians. From these cases eight cultures of *Bact. granulosis* were isolated, conforming with two cultures of Noguchi's organism with which theirs were compared, except for slight variations of some of the fermentation reactions of some of the cultures.

Tilden and Tyler (4) studied 7 cases of trachoma at Fort Defiance, Ariz., in 1929, isolating the organism from 2 untreated cases and failing to isolate it from 5 treated cases. They studied 13 cases at the Leupp Indian School in September, 1929, and the organism was isolated from 4 which had not received recent treatment. They obtained negative results with treated cases at Santa Fe and Albuquerque, no advanced untreated cases being available for cultural study. The 13 cases at the Leupp Indian School were studied at the same time by Thygeson. It is interesting that the 2 cases from which Thygeson isolated his cultures corresponded with 2 of the 4 cases from which Tilden and Tyler isolated their cultures, indicating that slight differences in the preparation of culture media and in individual technique do not necessarily account for the success of certain workers and the failure of others to isolate the organism.

Olitsky, Knutti, and Tyler (5) studied 9 cases of trachoma in alien and American whites in New York City in 1931, the material used consisting of the "affected conjunctiva, removed for curative

purposes." This was ground in a mortar with sterile saline and was used for cultures and direct inoculation of monkeys. By this method *Bact. granulosis* was isolated from 4 of the cases. The organism was also recovered in cultures from 2 other patients, whose tissues were not used in the transmission experiments.

Weiss (20) refers to a culture of *Bact. granulosis* isolated in his laboratory at Washington University, St. Louis, without details as to source or description of cases studied. This culture as received from Doctor Weiss has been found to correspond with Noguchi's organism.

In a discussion of "trachoma and avitaminosis," Kendall and Gifford (18) refer to a culture isolated by them which they used for experimental work on avitaminosis. This culture as received by me from Kendall and Gifford was found to differ in its cultural and serological aspects from Noguchi's cultures of *Bact. granulosis*, though other writers state that it corresponds with Noguchi's organism.

BACTERIOLOGICAL STUDIES OF TRACHOMA BY THE UNITED STATES PUBLIC HEALTH SERVICE

An extended investigation of the bacteriological aspects of trachoma has been carried on by the writer for a number of years at Rolla, Mo., at the trachoma hospital maintained in that locality by the United States Public Health Service. The cases treated at this hospital are drawn principally from the Ozark region of Missouri and to some extent from Arkansas. In this section, trachoma presents the typical picture of the disease, many of the older cases showing the usual sequelæ of scar tissue, deformed tarsi, with entropion, trichiasis, and corneal opacity; and blindness occurs in a comparatively high percentage. Recent figures (29) indicate that the "virulence index" of the disease (computed by taking the number of eyes blind from trachoma seen during the year and dividing it by the number of new cases of trachoma) is considerably higher in Missouri than in Kentucky or Georgia, the index at the trachoma hospital in Rolla being 0.074, at Richmond, Ky., 0.028, and in Bainbridge, Ga., 0.0027.

Though the problem had been under investigation prior to Noguchi's announcement of the isolation of *Bact. granulosis* from Indian trachoma patients, the results did not warrant drawing definite conclusions. Noguchi having produced a granular condition in monkeys simulating human trachoma with his culture, work along the line followed by Noguchi offered the most promising field of investigation, and efforts were therefore directed toward a confirmation of his results.

Material from suitable cases of trachoma as they came into the hospital was made use of and the technique of Noguchi was followed as closely as possible in attempting to isolate an organism corresponding to *Bact. granulosis*. The results have been negative in all cases

studied; referring in particular to those cases which have been studied since 1929, when cultures of *Bact. granulosis* for comparison were made available by the Rockefeller Institute. From this time until July, 1931, 73 cases were studied.[1] Whether failure to isolate the organism was due to failure to collect suitable material for study, to unsuitability of culture media, or to scarcity or absence of the organism is not known. Some cases were also investigated at the trachoma hospital in Richmond, Ky., and in the spring of 1931, a study was made of Georgia trachoma.

Various plans were used for the collection of material. The plan which seemed most feasible and which was finally adopted as a routine method was that of collecting the follicular contents, by means of Noyes forceps, after the subconjunctival injection of novocain as an anesthetic. The material was suspended in about 1.5 c c of 0.5 per cent of NaCl solution and then planted in the Noguchi Leptospira medium and on horse blood agar plates,[2] using the original material as well as dilutions of the same for this purpose. In some cases the method of excising a small amount of conjunctival tissue was employed. The material was ground in a mortar with sterile 0.5 per cent NaCl solution and used for planting the culture media in the same manner as in the case of the follicular contents. It is indicated in some of the work recently reported that material removed in tarsectomy operations has yielded positive results. Possibly the extensive removal of tissue as is done in this operation is more likely to lead to the isolation of *Bact. granulosis* than when smaller amounts of material are used.

The Leptospira medium and the horse blood agar medium were always found to be suitable for growing known cultures of *Bact. granulosis*. During the course of the work several months were devoted at one time to a special study of culture media, some being prepared according to Noguchi's methods and others with certain slight modifications of those methods. For instance, it was found that one particular peptone was more suitable than others, that better growth could be obtained if the Leptospira medium were made with Ringer's solution or broth than with salt solution. Horse serum was decidedly superior both to the rabbit serum called for in Noguchi's formula for Leptospira medium and to human serum. Variations in the H-ion concentration of the media, the effect of increased moisture, and variations in the temperature of incubation

[1] Diagnoses in all cases were made by medical officers of the trachoma prevention work of the United States Public Health Service. (See Acknowledgements.)

[2] The Leptospira medium consists of 8 parts of NaCl solution, 1 part of fresh rabbit serum, 1 part of 2 per cent agar, and 0.1 part of laked rabbit erythrocytes.

The blood agar used for plates consists of hormone agar to which is added 20 per cent of horse blood and a mixture of dextrose, maltose, saccharose, galactose, inulin, and dextrin to give a final concentration of 1 per cent of each carbohydrate.

were studied with a view to improving conditions for the isolation of the organism. However, no modification was of any avail, as the results remained negative. Quite recently the effect of partial CO_2 tension was tested, but it was found that there was less growth in an atmosphere containing 5 per cent CO_2 and much less in one containing 10 per cent CO_2 than in ordinary atmosphere.

As to the organisms isolated, in addition to the usual staphylococci and *C. xerosis* or other gram-positive diphtheroids, a number of miscellaneous organisms have been isolated from time to time. Among these are included several species of gram-negative rods to which special attention has always been paid. It may be stated that, with the exceptions to be noted, none have occurred consistently enough, or frequently enough, to warrant serious consideration. At one time, covering a period of seven or eight months, there were found three or four nonhemoglobinophilic gram-negative rods in nearly all of the cases studied, which it seemed might be of significance. Later it was not possible to isolate any of these, and it is a question just what was their source. It is possible that they may have been concerned in an intercurrent epidemic occurring in the hospital during the time under consideration and that they were carried from patient to patient. In the recent study of trachoma in Georgia, two small gram-negative, nonhemoglobinophilic rods were found very consistently, i. e., in 8 and 9 out of a series of 10 cases studied. The relationship of these to the disease as it occurs in Georgia is still under consideration. One of these organisms corresponded very closely in many respects with *Bact. granulosis* and could easily have been confused with it had not cultures of the latter been available for comparison and had not agglutination tests with *Bact. granulosis* immune serum shown that it was a different organism. Fermentation tests were identical, with the exception that rhamnose was fermented by *Bact. granulosis*, while the organism in question did not ferment this carbohydrate.

Pneumococci and streptococci were isolated only occasionally in trachoma in Missouri, but frequently in Georgia. A gram-negative rod of peculiar morphology and producing a rose-colored pigment has been encountered at various times, though not occurring frequently nor in large numbers. It is easily recognizable on account of its distinctive morphology and pigment and has been seen in trachoma in both Missouri and Georgia.

The bacterial flora of the 22 cases of trachoma studied in Georgia was markedly different from that in Missouri. While case after case in Missouri often yielded only the gram-positive diphtheroids and some staphylococci, a very much more diversified flora was found in the Georgia cases, which included streptococci, pneumococci, Morax-Axenfeld bacilli, and hemoglobinophilic and influenza-like organisms,

in addition to the nonhemoglobinophilic gram-negative rods referred to. It may be emphasized that hemoglobinophilic organisms were rarely encountered in Missouri and appear to have no part in the disease in that section of the country.

In Georgia there occurs in the summer months outbreaks of an affection described as "gnat sore eyes," in which a small black gnat appears to be concerned as a vector in transmitting the condition. This offers a probable explanation of the much more diversified flora seen in that section. This variability does not aggravate the trachomatous condition, but, on the other hand, seems to modify it for the trachoma found in Georgia is much milder than the Missouri type. Considering the severity of the disease in Missouri and the apparent absence of complicating factors, this locality would appear to be the most suitable for etiological studies. As indicated by a few of the cases studied at the Richmond hospital, the bacterial flora of the Kentucky type of the disease is quite similar to that encountered in Missouri.

The persistence and large numbers of *C. xerosis* and gram-positive diphtheroids in many Missouri cases of trachoma is of interest. A comparative study was undertaken to determine whether these organisms were more numerous in trachomatous than in normal eyes. In general it may be stated that such was found to be the case, though occasionally these organisms occur in rather large numbers on the normal conjunctiva. As a rule staphylococci were present but not in large enough numbers to interfere seriously with the isolation of other organisms. In a few cases in which an acute condition existed, staphylococci were sufficiently numerous to suggest that they might be concerned as a complicating factor in bringing about the acute condition.

NORTHERN AFRICA

Egypt.—Studies carried on at the Giza Memorial Ophthalmic Laboratory by Wilson (14) (26) since 1928 have failed to reveal the presence of *Bact. granulosis* in Egyptian trachoma. In the fourth annual report of the Ophthalmic Laboratory for 1929 it is reported that negative results were obtained in 25 cases studied, and again in 1931 Wilson reported that negative results were obtained in 16 cases. These same 16 cases were studied by Thygeson, whose results were also negative. Thygeson (27) states that by using the same technique he was able to isolate the organism from cases in Denver, Colo., on his return to this country. He does not, however, interpret his failure to isolate the organism to mean necessarily that it is not there.

Tunis.—Lumbroso and Van Sant (23) state that they failed to isolate *Bact. granulosis* from any of the 29 cases which they studied in

Tunis during a period of two years. In addition to the usual staphylococci and *C. xerosis* they obtained certain gram-negative cocco-bacilli, small gram-negative rods, gram-negative pleomorphic rods, gram-negative diplococci, and *M. tetragenus*. The gram-negative rods fell into three groups, none of which corresponded with *Bact. granulosis*.

Weiss (30) refers to a culture of *Bact. granulosis* isolated from the tarsus of an advanced case of trachoma in Tunis in 1929. This culture has been under investigation by him for some time and apparently has undergone dissociation, one form corresponding with *Bact. granulosis* and the other being a yellow-pigment producing variant, differing quite markedly from *Bact. granulosis*.

Algeria.—Morax (21) obtained negative results in attempting to isolate *Bact. granulosis* from cases of florid trachoma in Algeria. He states that the number of different bacteria isolated was very small.

CHINA

Tang (19), of Shanghai, studied 24 cases of trachoma in China and isolated only one culture which was at all similar to *Bact. granulosis*. In the words of the investigator, it was a gram-negative rod "which culturally fulfilled Noguchi's description more or less." No reaction was obtained in fermentation tests with any of the carbohydrates studied, including dextrose, lactose, mannite, and saccharose. Since these carbohydrates are all fermented by *Bact. granulosis*, it is probable that Tang's culture was a different organism.

Reimann and Pillat (24) studied 5 cases in northern China and report the following: "A bacillus corresponding in many respects to *B. granulosis* was recovered from one patient. Only 1 colony of this bacillus was found on 1 of 12 blood agar plates inoculated with a mixture of follicle contents and scraped off epithelial cells * * *. Bacilli of this variety were never encountered on the platings made from leptospira medium tubes inoculated with trachomatous material." The description of the organism is insufficient to identify it certainly with *Bact. granulosis*.

EUROPE

England.—In regard to the work of McCartney in England, Mayou (12) reports that *Bact. granulosis* has not been isolated from any cases in that country, though many fresh cases have been examined.

France.—Morax (17) states that he never was able to isolate an organism resembling *Bact. granulosis* from 11 cases which he studied in France.

Poland.—Melanowsky-Lawrynowitsch (21) studied fresh untreated trachoma in 95 children in Warsaw and failed to isolate *Bact. granu-*

losis. The organisms isolated included staphylococci, hemolytic and nonhemolytic streptococci, sarcinæ, *M. tetragenus*, *C. xerosis*, and two chromogenic organisms. Morax-Axenfeld and Koch-Weeks bacilli were not found.

Italy.—Italian workers have apparently been more active in the investigation of trachoma than have those of other European countries. Reports have been published by Giani (13), Bietti (16), Bordonaro (8), Addario (11), and Cattaneo (Sardinia) (25). All of these investigators, with the exception of Cattaneo, report having isolated *Bact. granulosis* or a similar organism from trachoma. Cattaneo studied 15 cases in Sardinia with negative results.

Addario's work is often referred to as confirming the results of Noguchi. Full details of his work do not seem to be available, though he reported to the Italian Ophthalmological Society in March, 1929, that he had succeeded in isolating *Bact. granulosis*. A culture from Addario has been available to me through the Rockefeller Institute. It corresponds with Noguchi's organism culturally, morphologically, and serologically.

The description of one organism isolated by Giani is not sufficiently detailed to identify it with *Bact. granulosis*. He states that his organism bears a close resemblance to the one isolated by Noguchi, though there is a difference in regard to motility.

Bietti reports the isolation of two cultures of *Bact. granulosis* from 16 cases of trachoma which he studied. The morphological and cultural reactions agree with those of *Bact. granulosis*, but no information is given regarding serological reactions, nor is it evident that cultures of Noguchi's organism were used for comparison. The cultures were tested in *Macacus rhesus* monkeys with negative results.

Bordonaro reports the isolation of two cultures resembling *Bact. granulosis*. As in the case of the preceding investigators, no information is given regarding serological tests nor comparison with Noguchi's original cultures.

Czechoslovakia.—Sabata (9) reports negative results in Czechoslovakia, the number of cases studied not being stated. Brückner did not succeed in isolating *Bact. granulosis* from 12 cases studied.

The most recent report is one by Fischer-Ascher (28), who studied 60 cases of trachoma obtained at the ophthalmic clinic at Prague. From 11 of these cases a small bacillus was isolated having the characteristics of *Bact. granulosis*. The author does not state whether fermentation tests were carried out. As in the case of other workers, a more detailed description of the cultures would have been more satisfying, though cultures of *Bact. granulosis* were at hand for comparison. These were used in tests on *Macacus rhesus* monkeys with rather definite results, though results were negative with the author's cultures.

Russia.—Stepanowa and Azarowa (7) were the first workers to state that they had succeeded in confirming the work of Noguchi. They obtained 7 strains of an organism which they consider identical with *Bact. granulosis* from 10 cases of untreated trachoma. The only publication found regarding the work of these authors is a preliminary report in which details are not given and in which no serological tests are reported. A recent report (31), however, describes results obtained with a polyvalent vaccine of *Bact. granulosis* pointing to specificity in comparison with control vaccines of pneumococcus, Koch-Weeks, and Morax-Axenfeld bacilli.

Austria.—Lindner and Rieger (15) isolated an organism twice which they consider identical with *Bact. granulosis* from four cases of folliculosis. The data given are insufficient to identify their cultures certainly with Noguchi's organism.

It is apparent from the preceding review of the literature that the results obtained by various workers are far from being in accord as regards the isolation of *Bact. granulosis* from trachoma. Many negative results have been reported, and some results reported as positive are doubtful. It is probable that there have been many negative results which have not been reported. A study of a collection of representative cultures from all workers who have reported the isolation of *Bact. granulosis* would be of interest. More detailed and definite information in published reports as to cultural behavior, immunological tests, and comparison with Noguchi's cultures are desirable, as has been pointed out.

EXPERIMENTAL PRODUCTION OF GRANULAR LESIONS IN MONKEYS AND APES BY MEANS OF INOCULATION WITH CULTURES OF *Bact. granulosis*, BY PASSAGE FROM ANIMAL TO ANIMAL AND BY DIRECT TRANSMISSION TO ANIMALS FROM CASES OF HUMAN TRACHOMA

Results obtained by various workers in inoculation experiments in monkeys and apes using cultures of *Bact. granulosis* are contradictory. Dating from the discovery of the organism, we now have records of the results produced in some 300 monkeys and apes. These range from those positive in greater or less degree in all cases to those entirely negative. Since the condition produced in monkeys and apes differs in certain respects from that seen in human trachoma, it is somewhat difficult to interpret the lesions which do develop.

Before discussing the subject more in detail the evidence at hand may be summarized as follows, referring in particular to *Macacus rhesus* monkeys: These animals are comparatively refractory to direct transmission of the disease from human cases, as they are also to inoculation with cultures of *Bact. granulosis*. A number of workers have been unsuccessful in producing a definite progressive type of

lesion lasting over a considerable period following inoculation with cultures. Such lesions have been produced by workers of the Rockefeller Institute, however, and by Finnoff and Thygeson. This definite type of lesion when once established is easily transmissible from animal to animal, as will be discussed later.

Inoculation experiments with cultures of *Bact. granulosis* are summarized in the accompanying table. By far the greater number of animals used have been *Macacus rhesus* monkeys. A few chimpanzees and a few of the lower forms have also been used.

Results of inoculations of monkeys and apes with cultures of Bact. granulosis

Investigator	Number of animals	Species	Results
Noguchi (2)	17	16 *Macacus rhesus;* 1 chimpanzee.	4++++, 5+++, 1++, 3+, 3±, 1−.
Finnoff and Thygeson	13	*Macacus rhesus*	1++++, 3+++, 3++, 2±, 2−, 2 died.
Tilden and Tyler	77	74 *Macacus rhesus;* 3 chimpanzees.	15++++, 11+++, 5++, 6+, 40−.
Olitsky, Knutti, and Tyler (5)	6	*Macacus rhesus*	4 "characteristic granular conjunctivitis"; 2 negative.
Wilson (26)	7	1 *Cercopithecus aethiops;* 3 *Macacus sinicus;* 3 *Macacus rhesus.*	7 negative.
Weiss (20)	43	32 *Macacus rhesus;* 1 baboon; 2 *Macacus inuus;* 5 chimpanzees; 1 Callitriche.	16 mild and transient lesions persisting up to 4 months; 27 negative.
Bietti (44)	7	*Macacus rhesus*	2 follicles persisting more than 3 months; 3 indefinite at end of 2 months; 2 sl. hyperemia in 30 days.
Bengtson	19	*Macacus rhesus*	2++, 10+, 3±, 4− (++ mild transient lesions lasting 3 to 4 months).
McKinley (32)	24	12 *Macacus rhesus;* 12 *Cebus olivaceous.*	24 negative.
Fischer-Ascher (28)	9	*Macacus rhesus*	2 conjunctival secretion, redness and diffuse infiltration of conjunctiva and semilunar fold. Some follicles on tarsal conjunctiva. Alternate periods of activity and quiescence; 7 negative.

Noguchi used + + + + to indicate "very extensive lesions showing no retrogression in 8 months; + + + less extensive lesions becoming stationary in about 4 months; + + moderate lesions receding in about 3 months; ± mild lesions lasting 2 months or longer." The same designations were used by Tilden and Tyler.

It seems probable that positive results in animals are more likely to result with recently isolated cultures than with those which has been on artificial culture media for an extended period. This may at least partly explain the reason why those who have used old cultures have failed to produce the definite chronic type of lesions which has been obtained by the workers of the Rockefeller Institute and by Finnoff and Thygeson who have isolated cultures.

TRANSMISSION OF GRANULAR CONDITION FROM ANIMAL TO ANIMAL

A number of transmission experiments were performed by Noguchi (2), and these were continued through a fourth passage from the animals originally infected with the culture. Similar experiments were carried out by Tilden and Tyler. The results of these experiments and those of others are shown in the following table:

Investigator	Number of animals and method of inoculation	Results
Noguchi	59 (inoculation of suspension of affected tissue).	14++++, 9+++, 3++, 12+, 1±, 20−.
Tilden and Tyler	36 (inoculation of suspension of affected tissue).	8++++, 3+++, 3++, 22−.
Wilson	2 (inoculation of suspension of affected tissue).	2 "unquestionably positive results with marked follicle formation."
Olitsky, Knutti, and Tyler	2 (swabbed 6 times over period of 8 days).	2 "characteristic granular conjunctivitis."
Bengtson	7 (swabbed a single time)	7++++.

Attention is called to the fact that in the tests carried out by the writer the definite granular progessive type of lesion was transmitted from animal to animal in all cases by swabbing a single time.[3] In all of the transmission experiments carried out by Noguchi and by Tilden and Tyler, tissue was removed, ground, suspended in salt solution, and injected subconjunctivally. Olitsky, Knutti, and Tyler report positive transmission by swabbing monkey secretions six times. A record of my transmission experiments is shown in the following table:

Monkey No.	Date of transmission	Transfer from monkey No. —	Passage	Uninoculated eye involved	Results
521	May 24, 1931	D	First	Aug. 1, 1931	++++, receding March, 1931.
520	Aug. 1, 1931	521	Second	Aug. 20, 1931	++++, active March, 1932.
245	Aug. 17, 1931	521	do	Sept. 24, 1931	Do.
464	Oct. 30, 1931	520	Third	Dec. 4, 1931	Do.
467	do	245	do	Nov. 18, 1931	Do.
453	do	521	Second	do	Do.
535	Nov. 18, 1931	453	Third	Dec. 4, 1931	Do.

The lesions were definite and extensive, consisting of numerous rather large follicles in the retrotarsal fold of both the upper and lower lids and in some cases extending over the tarsus, the blood vessels often being obliterated. Evidence of congestion and beginning follicle formation was seen as early as seven days after the transmission in some cases. It thus appears that a simple and easy method of transmission of the granular condition from animal to animal is available. It is probable that the propagation of the condition may be continued indefinitely.

[3] I am indebted to Dr. Phillips Thygeson for furnishing the successfully infected monkey from which this series was started.

The ease with which the granular condition may be transmitted from animal to animal when once established is also shown by the fact that in many cases it occurs spontaneously in the uninoculated eye (Noguchi (2), Tilden and Tyler (4), Olitsky, Knutti, and Tyler (5), Finnoff and Thygeson (3)), and also that it is transmitted by contact, i. e., placing untreated monkeys in a cage with those which have developed the condition. Contact experiments have been reported by Olitsky, Knutti, and Tyler (5), Finnoff and Thygeson (3), and Wilson (26). In these experiments six animals were exposed and four developed lesions.

ATTEMPTS TO TRANSMIT TRACHOMA DIRECTLY FROM MAN TO VARIOUS MONKEYS AND APES

While a considerable number of attempts were made to transmit trachoma directly from man to monkeys and apes prior to Noguchi's isolation of *Bact. granulosis*, apparently rather few efforts have been made since that time to carry out such experiments, though a comparison of the lesions produced would seem to be of value as an aid in determining whether the condition produced by the inoculation of *Bact. granulosis* is the counterpart of human trachoma.

The early literature bearing on this subject has been reviewed by Heymann (32), Axenfeld (34), Noguchi (2), and Morax and Petit (35). The workers preceding Noguchi considered chimpanzees and baboons more suitable for transmission experiments than *Macacus rhesus* monkeys, and most of their tests were made with these animals. Bajardi (36) attempted transmission of trachoma to one *Cercopithecus* and three *Macacus* monkeys. He reports mild but rather definite lesions, which reached their height in seven or eight weeks. Bertarelli and Cecchetto (37) produced what they describe as trachoma in a large *Macacus* (*Inuus cynomolgus*), using unfiltered material from a trachoma case. The condition reached a maximum in 45 days, resembling florid trachoma in man. It persisted for some time, but was healed at the end of nine months.

Noguchi (2) was unsuccessful in his attempts to transmit trachoma directly to *Macacus rhesus* monkeys from the cases of trachoma among American Indians from which he isolated his cultures of *Bact. granulosis*, attributing his failure to the possibly small number of organisms in the material used for the experiment.

Olitsky, Knutti, and Tyler (5) report the successful transmission of trachoma to *Macacus rhesus* monkeys from human cases. The material used was "affected conjunctivae, removed for curative purposes," which they refer to as material from a tarsectomy operation in commenting on one case. This was ground in saline solution and injected

subconjunctivally, only one eye of the animal being used. The results of their experiments may be summarized thus:

17 *Macacus rhesus* monkeys---------- 5 characteristic experimental disease passing to uninoculated eye;
4 follicles in both eyes;
8 negative.

In another series of tests the secretions from 2 cases were transferred to monkeys by means of cotton swabs, 9 swabbings from one case being used and 7 from the other. The results may be summarized as follows:

6 monkeys---------- 4 developed characteristic granular conjunctivitis;
1 negative;
1 died.

In none of this series did the uninoculated eye become involved. The writers state that both in the animals inoculated and in those swabbed the clinical appearance of the condition produced was identical with that induced by cultures of *Bact. granulosis*, as were also the microscopic changes in the conjunctiva.

Weiss (20) reports a direct transmission experiment with one chimpanzee, using this animal as a control on two other chimpanzees inoculated with cultures of *Bact. granulosis*. He states that the results with fresh trachomatous material were strikingly different from those obtained in the animals inoculated with cultures. The latter two animals developed a few small transient follicles on the tarsal and palpebral conjunctivæ, while the one inoculated with the human material developed a condition much more like human trachoma clinically and histologically.

Wilson (26) inoculated two *Cercopithecus æthiops* and two *Macacus rhesus* monkeys with human trachomatous material. The former species developed marked lesions involving the uninoculated eye. These later subsided into a condition indistinguishable from folliculosis in monkeys. The latter developed lesions only in the inoculated eye and these also were indistinguishable from the spontaneous folliculosis of monkeys.

I have attempted direct transmission to 23 *Macacus rhesus* monkeys from trachoma cases in Rolla, Mo., Richmond, Ky., and Bainbridge, Ga. The methods used were those of subconjunctival inoculations of excised tissue suspended in salt solution, transplanting of excised tissue from human conjunctiva to monkey conjunctiva, and repeated swabbing. The results of these experiments may be summarized as follows:

(*a*) Subconjunctival inoculation of suspension of trachomatous tissue—
2 monkeys---------- 1++, 1+; uninoculated eyes not affected.

(*b*) Grafts of human trachomatous conjunctiva on monkey conjunctiva—	
6 monkeys	1+++, 2++, 3+; uninoculated eye affected in 1 (++).
(*c*) Repeated swabbings—	
15 monkeys	2+++, 3++, 3+3±, 2−, 2 died; uninoculated eye affected in 5 (1+++, 2++, 2±).

(+++ indicates congestion, hypertrophy of conjunctival tissue and follicle formation persisting for three months or more; ++ indicates a few follicles persisting for about three months; + congestion of conjunctiva and indefinite follicle formation; and ± congestion of conjunctiva persisting for several months.)

The transplanting of tissue was performed by Acting Asst. Surg. Gordon B. Carr, in charge of the trachoma hospital in Rolla. A diamond-shaped section of conjunctiva was snipped with a small pair of scissors from the upper lid of the trachoma patient. This was immediately transplanted to the lid of the monkey, which was in readiness, a section of the conjunctiva of approximately the same size and shape having been removed under ether anesthesia. The transplanted conjunctiva was held in place by sutures at the four corners. In all cases the grafts remained in position and there was no sloughing. The resultant reaction was rather severe, the whole conjunctival surface becoming congested and oedematous. This acute reaction subsided in 2 or 3 weeks. One animal developed rather definite follicles, which persisted for about three months, and there were a few follicles in the uninoculated eye. Two others developed transient follicles in the inoculated eye.

On the whole, the results of our experiments in attempting to transmit trachoma directly from the human conjunctiva to the conjunctiva of *Macacus rhesus* monkeys have not yielded very striking results. No very marked lesions persisting over a long period have developed, as compared with the lesions which developed in the 7 monkeys referred to in the discussion on the transmission of the condition initiated by the inoculation of cultures of *Bact. granulosis*. As previously stated, in these monkeys definite, progressive, and chronic lesions developed; and these could be transmitted to other monkeys by merely swabbing a single time. It has been the hope that similar lesions might be found to result by direct transfer from human trachoma to *Macacus rhesus* monkeys and that it could then be determined whether the condition was as easily transmissible as that referred to. Passage to other monkeys by swabbing was attempted with the monkeys with +++ lessions, but only slight or indefinite results were obtained.

The question as to whether the condition produced in monkeys by direct transfer from human trachoma can be continued by passage has a bearing on the rôle of *Bact. granulosis* in trachoma. With the exception of Nicolle and his coworkers (38), who used chimpanzees

and baboons, no one has succeeded in maintaining a granular condition in animals produced by transfer of human trachomatous material beyond the second or third passage. Hess and Römer (39) produced a granular condition in a baboon and transmitted the affection to another baboon three weeks after the lesions appeared. In this baboon, lesions appeared in 14 days and remained stationary for 4 months. An attempt to accomplish a third passage to two other baboons resulted only in some microscopic follicles. Negative results were also obtained when an attempt was made to transfer the condition from the inoculated to the uninoculated eye. If it can be shown that the condition produced in *Macacus rhesus* monkeys by direct transfer from cases of human trachoma is as definite and as easily transmissible as that induced by inoculation with *Bact. granulosis*, then we would feel more certain of the relationship of *Bact. granulosis* to the human disease.

HUMAN INOCULATIONS WITH CULTURES OF *Bact. granulosis*

The inoculation of the human conjunctiva with *Bact. granulosis* has been advocated as a means of determining the relationship of the organism to the disease. A limited number of such experiments have been performed; but with one or two exceptions the results have been indefinite or negative. It seems quite probable that not all persons are susceptible. We know that all members of the same family do not necessarily contract the disease under natural conditions. The human inoculations reported include those by Weiss (3), Wilson (26), Proctor, Richards, and others (40), Bietti (44), Lindner and Rieger (15), Addario (43), Nicolle and Lumbroso (41), and Proctor, Finnoff, and Thygeson (45). The results of these experiments may be summarized as follows:

Investigator	Number of subjects	Results
Proctor, Richards et al	2	1+++, 1±.
Weiss	4	4−.
Wilson	4	2± acute conjunctivitis of short duration.
		2−.
Bietti	1	1−; result indefinite.
Lindner and Rieger	1	1± (cultures isolated from case of folliculosis).
Addario	1	1++++.
Nicolle and Lumbroso	2	2−.
Proctor, Finnoff, and Thygeson	1	1−.

The case reported by Addario was that of a blind subject inoculated with one of Noguchi's cultures. The eye developed what Addario considered all the pathognomic symptoms of trachoma, the lesions persisting over 10 months. Proctor and Thygeson (45) saw this case and report that at 18 months the subject showed a MacCallan III trachoma (beginning cicatrization).

One of the cases reported by Proctor, Richards, and collaborators was that of Doctor Richards, who volunteered himself as a subject. One eye was inoculated with 5 strains of *Bact. granulosis* and the other with mixed infected monkey's tissue and a culture of *Bact. granulosis* isolated from a *Macacus rhesus* monkey inoculated with the organism. Follicles, induration, and thickening of the conjunctiva developed, the condition being considered by the writers to be indistinguishable from beginning trachoma. An acute flare-up occurred on the fifty-fourth day and treatment with silver and copper was begun. After six weeks of treatment the eyes returned practically to normal.

It may be said, on the whole, that the results of human inoculations have been almost as inconclusive as those carried out on monkeys. Whether it will be possible to determine more definitely the relationship of the organism to the disease would seem to depend to some extent on the use of freshly isolated cultures tested on a sufficiently large number of suitable subjects, though it is quite probable that some other factor is concerned. It appears that the organism in its normal habitat on the conjunctiva may be in such condition that it is capable at times of inciting infection when secretion containing it is transferred directly to the conjunctiva of another subject, whereas if transferred from an artificial environment, such as the culture media we use, it loses its power to infect readily. This has been shown to be true in monkeys; for it is very difficult to initiate an infection with *Bact. granulosis*, but easy to transmit it when once established. There is considerable evidence to indicate that trachoma is transmissible by transfer of secretion from trachomatous to nontrachomatous subjects. The literature on this phase of the subject has been well covered by Morax and Petit (35), who cite a number of instances of accidental infection of normal subjects from trachoma cases as well as reports in the literature of successful attempts to transmit the disease experimentally. Taboriski (42) recently reported his results in attempting to transfer the disease from trachomatous to normal conjunctiva and states that in 5 attempts all were successful in spite of the constitutional variations in the subjects. Many cases of trachoma have been reported among soldiers of the Russian and Austrian armies, who voluntarily infected themselves by transferring the secretions from trachoma cases to their own eyes, by means of cotton swabs, in order to avoid military service.

SUMMARY

A review of the literature bearing on the subject of the isolation of *Bact. granulosis* from trachoma in various parts of the world shows a wide variation in the results obtained. Noguchi's results appear to have been satisfactorily confirmed by two groups of workers in

this country—Finnoff and Thygeson, of Denver, and by several workers of the Rockefeller Institute for Medical Research in New York. The results of the work carried out by the writer in Missouri, under the auspices of the United States Public Health Service, have been negative as regards the isolation of *Bact. granulosis*. In other countries positive results have been reported by workers in Russia, Italy, and Czechoslovakia, but their evidence is not entirely convincing. Negative or doubtfully positive results have been reported from Egypt, Algeria, Tunis, England, Poland, France, Czechoslovakia, and China.

It is pointed out that other gram-negative organisms are encountered in trachoma which may be confused with *Bact. granulosis*. In order to identify organisms isolated with Noguchi's organism it is necessary to have known cultures of *Bact. granulosis* with which to compare the organisms isolated, or to carry out agglutination tests with *Bact. granulosis* immune serum.

Conflicting results have been reported by various workers regarding the effect of inoculation of *Bact. granulosis* in *Macacus rhesus* monkeys and chimpanzees. At times a definite, chronic, and progressive type of lesion, which is unmistakable, results. At other times indefinite or entirely negative results are obtained. On the whole it may be said that successful implantation of *Bact. granulosis* in the conjunctiva of *Macacus rhesus* monkeys is difficult and uncertain. It is probable that for the most part success has been attained with recently isolated cultures.

Attention is called to the fact that when once successfully induced by the inoculation of *Bact. granulosis*, the definite, chronic type of lesion is very easily transmissible. The writer has transferred the condition from infected to normal monkeys in all cases attempted by merely rubbing the affected conjunctiva once with a sterile cotton swab, then rubbing this into the conjunctiva of a fresh monkey. Previous workers have for the most part used the method of injecting subconjunctivally tissue removed from the infected monkey.

The question is raised whether the condition induced by direct transmission from human cases to *Macacus rhesus* monkeys is as easily transmissible as that initiated by inoculation with *Bact. granulosis*. No one has yet reported continued passage of a granular condition in a series of monkeys in which the condition was initiated by direct passage from cases of human trachoma. Further work along this line and a comparison of the lesions induced by the two methods of infection is desirable. This has a bearing on the question of the relationship of *Bact. granulosis* to human trachoma.

In attempts by the writer to accomplish direct transmission of trachoma from human cases to *Macacus rhesus* monkeys by various means, an appearance somewhat suggestive of that induced by *Bact.*

granulosis has been obtained in a few of the 23 animals used, but the lesions have been much less extensive and of comparatively short duration. An effort is being made to determine whether more extensive lesions may be produced and whether these can be transmitted by passage through a series of monkeys.

Results obtained in human inoculations with *Bact. granulosis* as described in the literature have for the most part yielded negative or doubtfully positive results. In one instance the definite, chronic progressive lesions persisting over a considerable period were observed. It is not possible to draw conclusions on this phase of the problem at the present time.

It must be conceded, however, that the finding of *Bact. granulosis* in certain sections of this country and perhaps in other parts of the world merits its consideration as an etiological factor in trachoma. It has been possible with this organism to produce a granular condition in *Macacus rhesus* monkeys which may correspond with human trachoma and which is easily transmissible from animal to animal. The negative bacteriological findings of many workers remain to be explained. More efficient methods for demonstrating the organism than those now in use are greatly to be desired. On the other hand, there is a possibility that the organism is not present and therefore not the etiological factor concerned in the disease in certain localities. Certainly a difference in the bacterial flora is manifest in different localities, as has been noted by the writer in studies of trachoma in the States of Missouri and Georgia.

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COURT DECISION RELATING TO PUBLIC HEALTH

City of Newport News held authorized to discharge untreated sewage into tidal waters.—(Virginia Supreme Court of Appeals; Commonwealth ex rel. Atty. Gen. *v.* City of Newport News et al., 164 S. E. 689; decided June 16, 1932.) A suit was brought by the State of Virginia, at the relation of the attorney general acting under the authority and direction of the governor, against the city of Newport News and the members of the city council to restrain the city from discharging untreated sewage into tidal waters. The gist of the complaint was that the discharge of untreated sewage in any considerable volume at any point in any manner into the waters of Hampton Roads or its estuaries was illegal because it polluted the waters and rendered shellfish and fish taken therefrom unfit for human food and thereby subsequently impaired and in effect destroyed the right of fishery in those waters. The plaintiff contended that the State held the tidal waters and the lands thereunder upon a trust for the people of the State so that they could enjoy the use thereof not only for purposes of navigation but also for the purpose of taking fish and shellfish therefrom, and that, therefore, the State had no right or power to authorize or suffer them to be used for any purpose or in any manner which would destroy or substantially impair the use thereof by the people for fishery. The supreme court of appeals stated that, "if it be not established either that the State or that the State legislature is without power to authorize, permit, or suffer the tidal waters and their bottoms to be used for any purpose which has the effect of taking away or substantially impairing the use thereof by the people for taking fish and shellfish therefrom," the case was controlled by certain former decisions of the court, one of which had been affirmed by the United States Supreme Court.

After a lengthy discussion the court concluded that the legislature, in the absence of any constitutional provision on the subject, had the right to take away the right of fishery in tidal waters or to authorize, permit, or suffer its tidal waters or their bottoms to be used for purposes which impair or even destroy their use for purposes of fishery and could lease or sell to private persons portions of its tidal bottoms with the right to use them for private purposes to the exclusion of the

use of the waters thereover for purposes of fishery. It was then pointed out that the only constitutional provision which contained any restriction upon the power of the legislature to dispose of the tidal bottoms of the State and the waters above them was one which read as follows:

> The natural oyster beds, rocks, and shoals in the waters of this State shall not be leased, rented, or sold, but shall be held in trust for the benefit of the people of this State subject to such regulations and restrictions as the general assembly may prescribe, but the general assembly may, from time to time, define and determine such natural beds, rocks, or shoals by surveys or otherwise.

The reasonable and proper construction of this provision was declared by the court to be that it related to private uses and not public uses, and that it had no application to restrict the power of the legislature to authorize, permit, or suffer tidal waters, including those over natural oyster rocks, to be used for any public purpose to which they were at common law subject or the legislature should deem it to be for the benefit of the people to authorize or suffer. The court declared that the use of tidal waters for the discharge into them of sewage was a public use, and, in holding that the city of Newport News had the right to discharge untreated sewage into tidal waters, concluded its opinion with the following language:

> Our conclusion is that the general assembly has the power to authorize, permit, or suffer sewage to be discharged into Hampton Roads and its estuaries and to subject the discharge of sewage into these waters to no restrictions relative to its injury to fishery therein or to such restrictions as it may deem proper; that it has authorized and permitted the city of Newport News to discharge the raw, untreated sewage into these waters; and that to what extent these waters may be used for the purpose of sewage disposal and to what extent they shall be devoted to purposes of fishery and the restrictions and limitations to be placed on these several uses are questions committed by the constitution to the discretion of the legislature free from the control or interference of either the executive or judicial department of the government.

DEATHS DURING WEEK ENDED AUGUST 27, 1932

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

	Week ended Aug. 27, 1932	Corresponding week, 1931
Data from industrial insurance companies:		
Policies in force	71,074,390	74,972,336
Number of death claims	11,304	12,281
Death claims per 1,000 policies in force, annual rate	8.3	8.5
Death claims per 1,000 policies, first 34 weeks of year, annual rate	9.8	10.1
Data from 85 large cities of the United States:		
Total deaths	6,612	6,682
Deaths per 1,000 population, annual basis	9.4	9.7
Deaths under 1 year of age	578	640
Deaths under 1 year of age per 1,000 estimated live births [1]	48	49
Deaths per 1,000 population, annual basis, first 34 weeks of year	11.4	12.8

[1] 1932, 81 cities; 1931, 77 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 September 3, 1932, and September 5, 1931

Cases of certain communicable diseases reported by telegraph by State health officers for weeks ended September 3, 1932, and September 5, 1931

Division and State	Diphtheria		Influenza		Measles		Meningococcus meningitis	
	Week ended Sept. 3, 1932	Week ended Sept. 5, 1931	Week ended Sept. 3, 1932	Week ended Sept. 5, 1931	Week ended Sept. 3, 1932	Week ended Sept. 5, 1931	Week ended Sept. 3, 1932	Week ended Sept. 5, 1931
New England States:								
Maine	3	1	9	----	5	2	0	1
New Hampshire	----	----	----	----	----	----	0	0
Vermont	3	----	----	----	1	----	0	0
Massachusetts	19	38	2	1	32	26	0	2
Rhode Island	----	1	----	----	3	12	0	0
Connecticut	11	6	----	2	7	5	0	0
Middle Atlantic States:								
New York	38	60	[1]4	[1]4	80	80	3	6
New Jersey	9	17	2	----	39	13	1	1
Pennsylvania	41	71	----	----	51	59	5	6
East North Central States:								
Ohio	15	25	6	1	24	18	4	1
Indiana	23	11	10	8	7	4	0	2
Illinois	34	54	25	11	20	20	1	4
Michigan	8	17	----	----	39	13	3	1
Wisconsin	12	12	39	13	29	17	2	1
West North Central States:								
Minnesota	4	7	2	----	4	6	1	5
Iowa	3	4	----	----	----	1	0	0
Missouri	20	20	----	----	2	5	0	1
North Dakota	1	1	----	----	2	----	0	0
South Dakota	----	3	----	----	----	1	0	0
Nebraska	4	4	----	----	3	1	0	0
Kansas	14	10	----	1	8	4	2	3
South Atlantic States:								
Delaware	1	1	----	----	----	1	0	0
Maryland [2 3 4]	7	11	1	3	4	8	1	1
District of Columbia	2	2	----	----	----	1	1	0
Virginia	20	----	----	----	5	----	0	----
West Virginia	35	10	----	11	18	10	0	0
North Carolina [3]	41	81	12	----	20	10	1	2
South Carolina [3]	14	23	102	134	2	10	0	0
Georgia [3]	23	13	19	5	1	----	0	0
Florida [3]	25	3	3	----	3	3	0	0
East South Central States:								
Kentucky	42	42	4	----	4	----	1	1
Tennessee	37	46	6	8	1	4	1	2
Alabama [3]	50	19	6	1	1	5	2	1
Mississippi	23	63	----	----	----	----	0	1

See footnotes at end of table.

Cases of certain communicable diseases reported by telegraph by State health officers for weeks ended September 3, 1932, and September 5, 1931—Continued

Division and State	Diphtheria		Influenza		Measles		Meningococcus meningitis	
	Week ended Sept. 3, 1932	Week ended Sept. 5, 1931	Week ended Sept. 3, 1932	Week ended Sept. 5, 1931	Week ended Sept. 3, 1932	Week ended Sept. 5, 1931	Week ended Sept. 3, 1932	Week ended Sept. 5, 1931
West South Central States:								
Arkansas	23	16	6	----	6	2	0	0
Louisiana [3]	20	31	6	8	3	1	3	2
Oklahoma [3]	39	36	5	19	----	2	1	0
Texas [3]	87	34	16	----	4	1	0	2
Mountain States:								
Montana	----	----	----	----	27	8	0	3
Idaho	----	----	----	----	----	----	0	0
Wyoming [4]	1	1	1	----	3	2	0	0
Colorado	6	10	----	----	5	2	0	0
New Mexico	8	1	----	----	----	----	1	0
Arizona	3	2	1	----	3	2	0	2
Utah [3]	2	1	----	6	2	2	0	1
Pacific States:								
Washington	3	1	----	----	7	9	0	2
Oregon	2	1	11	7	8	4	0	2
California	13	31	82	20	23	57	1	0
Total	789	841	380	263	506	431	35	59

Division and State	Poliomyelitis		Scarlet fever		Smallpox		Typhoid fever	
	Week ended Sept. 3, 1932	Week ended Sept. 5, 1931	Week ended Sept. 3, 1932	Week ended Sept. 5, 1931	Week ended Sept. 3, 1932	Week ended Sept. 5, 1931	Week ended Sept. 3, 1932	Week ended Sept. 5, 1931
New England States:								
Maine	0	5	9	5	0	0	3	5
New Hampshire	0	2	2	0	0	0	1	0
Vermont	0	6	5	0	0	1	0	0
Massachusetts	2	184	55	99	0	0	9	8
Rhode Island	0	14	3	11	0	0	0	3
Connecticut	3	162	9	12	0	0	2	2
Middle Atlantic States:								
New York	20	554	77	76	8	1	45	47
New Jersey	33	84	26	40	0	0	11	8
Pennsylvania	113	20	134	86	0	0	92	56
East North Central States:								
Ohio	6	6	144	69	0	5	100	59
Indiana	0	4	20	24	1	4	20	16
Illinois	11	42	58	68	2	9	35	40
Michigan	7	107	46	73	1	4	23	20
Wisconsin	1	69	15	9	0	2	8	7
West North Central States:								
Minnesota	11	50	17	9	0	0	3	0
Iowa	3	6	5	10	2	3	8	1
Missouri	0	3	28	14	0	1	30	15
North Dakota	0	2	4	2	0	4	8	8
South Dakota	1	2	3	9	0	0	3	3
Nebraska	0	5	7	6	0	1	1	4
Kansas	6	1	19	8	1	0	24	8
South Atlantic States:								
Delaware	3	0	4	2	0	0	1	4
Maryland [2 3 4]	1	5	30	14	0	0	27	47
District of Columbia	8	0	6	2	0	0	6	1
Virginia	1	1	33	----	0	3	38	----
West Virginia	4	3	23	11	0	2	87	46
North Carolina [3]	1	5	45	55	1	0	36	74
South Carolina [3]	2	1	7	5	0	0	41	57
Georgia [3]	0	0	12	6	0	0	72	43
Florida [3]	0	0	3	5	0	0	6	1
East South Central States:								
Kentucky	0	1	34	43	0	2	96	51
Tennessee	4	0	40	25	0	0	74	69
Alabama [3]	5	4	32	34	1	0	33	32
Mississippi	0	1	10	17	0	5	23	21

See footnotes at end of table.

Cases of certain communicable diseases reported by telegraph by State health officers for weeks ended September 3, 1932, and September 5, 1931—Continued

Division and State	Poliomyelitis		Scarlet fever		Smallpox		Typhoid fever	
	Week ended Sept. 3, 1932	Week ended Sept. 5, 1931	Week ended Sept. 3, 1932	Week ended Sept. 5, 1931	Week ended Sept. 3, 1932	Week ended Sept. 5, 1931	Week ended Sept. 3, 1932	Week ended Sept. 5, 1931
West South Central States:								
Arkansas	2	1	7	5	0	0	23	18
Louisiana [3]	2	2	9	11	0	1	39	39
Oklahoma [5]	2	0	11	16	0	3	49	32
Texas [3]	0	1	19	19	0	0	82	58
Mountain States:								
Montana	0	2	7	22	3	5	6	0
Idaho	0	0	1	3	0	1	0	0
Wyoming [4]	0	1	7	4	1	0	1	1
Colorado	0	0	10	3	0	1	13	7
New Mexico	1	0	13	0	0	0	4	3
Arizona	0	1	3	2	0	0	1	5
Utah [2]	0	0	5	1	0	0	1	4
Pacific States:								
Washington	0	4	25	11	6	15	8	4
Oregon	0	1	3	5	1	6	8	11
California	9	8	40	61	4	3	6	15
Total	262	1,370	1,125	1,012	32	82	1,209	953

[1] New York City only.
[2] Week ended Friday.
[3] Typhus fever, week ended Sept. 3, 1932, 43 cases: 3 cases in Maryland, 1 case in North Carolina, 1 case in South Carolina, 8 cases in Georgia, 4 cases in Florida, 13 cases in Alabama, 1 case in Louisiana, and 12 cases in Texas.
[4] Rocky Mountain Spotted fever, week ended Sept. 3, 1932, 2 cases: 1 case in Maryland and 1 case in Wyoming.
[5] Figures for 1932 are 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
July, 1932										
Arkansas	-------	10	5	160	4	160	2	5	5	128
Nevada	1	2	3	-------	5	-------	1	-------	0	0
South Carolina	-------	36	497	1,685	218	704	9	12	0	273
South Dakota	2	8	-------	-------	10	-------	0	21	4	7
Texas	2	168	125	953	-------	-------	21	118	-------	251
Virginia	5	53	-------	54	215	127	6	84	2	254
August, 1932										
Nebraska	5	20	-------	1	10	-------	3	40	3	12

July, 1932

Anthrax:	Cases
Arkansas	1
Chicken pox:	
Arkansas	17
Nevada	2
South Carolina	37
South Dakota	16
Virginia	83
Diarrhea:	
South Carolina	1,161
Diarrhea and dysentery:	
Virginia	1,921
German measles:	
South Carolina	1
Hookworm disease:	
Arkansas	3
South Carolina	79

	Cases
Lethargic encephalitis:	
South Carolina	5
Virginia	3
Mumps:	
Arkansas	17
South Carolina	55
South Dakota	1
Ophthalmia neonatorum:	
South Carolina	12
Virginia	1
Paratyphoid fever:	
South Carolina	21
Texas	12
Virginia	14
Rocky Mountain spotted or tick fever:	
Nevada	1
Virginia	5
Scabies:	
South Carolina	4
Tetanus:	
South Dakota	2
Virginia	3
Trachoma:	
Arkansas	2
South Carolina	1
South Dakota	8
Virginia	3
Trichinosis:	
South Dakota	1
Tularæmia:	
Nevada	5
Virginia	4
Typhus fever:	
South Carolina	4
Virginia	6
Undulant fever:	
South Carolina	1
South Dakota	1
Virginia	6
Whooping cough:	
Arkansas	28
Nevada	45
South Carolina	139
South Dakota	29
Virginia	897

August, 1932

Nebraska:	
Chicken pox	10
Mumps	27
Whooping cough	108

GENERAL CURRENT SUMMARY AND WEEKLY REPORTS FROM CITIES

The 94 cities reporting cases used in the following table are situated in all parts of the country and have an estimated aggregate population of more than 33,755,000. The estimated population of the 88 cities reporting deaths is more than 32,275,000. The estimated expectancy is based on the experience of the last nine years, excluding epidemics.

Weeks ended August 27, 1932, and August 29, 1931

	1932	1931	Estimated expectancy
Cases reported			
Diphtheria:			
46 States	665	695	
94 cities	153	193	334
Measles:			
45 States	725	545	
94 cities	157	140	
Meningococcus meningitis:			
46 States	38	65	
94 cities	17	21	
Poliomyelitis:			
46 States	251	1,319	
Scarlet fever:			
46 States	933	935	
94 cities	288	262	224
Smallpox:			
46 States	45	137	
94 cities	6	6	7
Typhoid fever:			
46 States	1,043	961	
94 cities	163	141	143
Deaths reported			
Influenza and pneumonia:			
88 cities	305	302	
Smallpox:			
88 cities	0	0	

City reports for week ended August 27, 1932

The "estimated expectancy" given for diphtheria, poliomyelitis, scarlet fever, smallpox, and typhoid fever is the result of an attempt to ascertain from previous occurrence the number of cases of the disease under consideration that may be expected to occur during a certain week in the absence of epidemics. It is based on reports to the Public Health Service during the past nine years. It is in most instances the median number of cases reported in the corresponding weeks of the preceding years. When the reports include several epidemics, or when for other reasons the median is unsatisfactory, the epidemic periods are excluded, and the estimated expectancy is the mean number of cases reported for the week during non-epidemic years.

If the reports have not been received for the full nine years, data are used for as many years as possible, but no year earlier than 1923 is included. In obtaining the estimated expectancy the figures are smoothed when necessary to avoid abrupt deviation from the usual trend. For some of the diseases given in the table the available data were not sufficient to make it practicable to compute the estimated expectancy.

Division, State, and city	Chicken pox, cases reported	Diphtheria		Influenza		Measles, cases reported	Mumps, cases reported	Pneumonia, deaths reported
		Cases, estimated expectancy	Cases reported	Cases reported	Deaths reported			
NEW ENGLAND								
Maine:								
Portland	0	0	0	---	0	0	0	0
New Hampshire:								
Concord	0	0	0	---	0	0	0	0
Vermont:								
Barre	0	0	0	---	0	1	1	0
Burlington	0	0	0	---	0	0	1	0
Massachusetts:								
Boston	4	12	0	1	0	5	11	8
Fall River	1	1	1	---	0	1	0	0
Springfield	0	1	1	---	0	1	0	0
Worcester	1	2	0	---	0	1	0	2
Rhode Island:								
Pawtucket	0	0	0	---	0	0	0	0
Providence	0	2	0	---	0	0	0	4
Connecticut:								
Bridgeport	0	2	0	1	1	1	2	1
Hartford	0	1	0	---	0	1	0	0
New Haven	0	1	1	---	0	0	1	0
MIDDLE ATLANTIC								
New York:								
Buffalo	3	5	0	---	0	4	0	0
New York	18	71	34	3	1	38	28	6
Rochester	0	2	0	---	0	4	0	1
Syracuse	0	1	0	---	0	0	0	2
New Jersey:								
Camden	0	1	0	2	2	0	0	0
Newark	2	6	1	---	0	7	10	1
Trenton	0	0	0	---	0	3	0	2
Pennsylvania:								
Philadelphia	4	21	5	2	1	4	7	13
Pittsburgh	1	8	3	---	0	0	3	16
Reading	0	0	0	---	0	3	2	2
EAST NORTH CENTRAL								
Ohio:								
Cincinnati	0	2	0	---	0	1	0	3
Cleveland	7	13	1	3	0	3	6	9
Columbus	1	2	1	---	0	0	0	1
Toledo	0	3	0	---	0	3	0	4
Indiana:								
Fort Wayne	0	1	1	---	0	0	0	2
Indianapolis	0	1	2	---	0	0	3	4
South Bend	0	0	0	---	1	0	0	1
Terre Haute	0	0	0	---	0	0	0	0
Illinois:								
Chicago	9	44	13	2	2	17	3	23
Springfield	0	1	2	1	0	0	0	1
Michigan:								
Detroit	4	20	6	---	0	22	1	9
Flint	0	1	0	6	0	0	0	2
Grand Rapids	1	1	0	---	0	0	6	1

City reports for week ended August 27, 1932—Continued

Division, State, and city	Chicken pox, cases reported	Diphtheria		Influenza		Measles, cases reported	Mumps, cases reported	Pneumonia, deaths reported
		Cases, estimated expectancy	Cases reported	Cases reported	Deaths reported			
EAST NORTH CENTRAL—continued								
Wisconsin:								
Kenosha	2	0	0		0	2	3	0
Madison	0	0	0			0	0	
Milwaukee	5	5	1		0	2	1	2
Racine	1	0	0		0	0	0	0
Superior	1	0	0		0	0	0	0
WEST NORTH CENTRAL								
Minnesota:								
Duluth	2	0	0		0	0	1	1
Minneapolis	3	6	0		0	0	1	3
St. Paul	2	3	0		0	0	0	4
Iowa:								
Des Moines	0	1	2			0	0	
Sioux City		0						
Waterloo	0	0	0			0	0	
Missouri:								
Kansas City	1	1	1		0	3	0	5
St. Joseph	0	0	1		0	0	0	1
St. Louis	1	12	4			1	2	2
North Dakota:								
Fargo	0	0	0		0	0	0	0
Grand Forks	0	0	0			0	0	
South Dakota:								
Sioux Falls	0	0	0			0	0	
Nebraska:								
Omaha	0	3	1		0	0	0	1
Kansas:								
Topeka	0	0	0		0	3	0	3
Wichita	0	0	1		0	0	0	0
SOUTH ATLANTIC								
Delaware:								
Wilmington	0	1	0		0	0	0	2
Maryland:								
Baltimore	2	9	2	1	0	1	5	10
Cumberland	0	0	0		0	0	0	0
Frederick	0	0	0		0	0	0	1
District of Columbia:								
Washington	2	6	1		0	2	0	3
Virginia:								
Lynchburg	0	0	0		0	0	0	0
Norfolk	0	1	0		0	2	0	1
Richmond	0	4	0		0	1	0	1
Roanoke	0	1	0		0	0	0	0
West Virginia:								
Charleston	0	0	0		0	0	0	2
Huntington	0	1	1		0	0	0	
Wheeling	1	1	1		0	0	0	1
North Carolina:								
Raleigh	0	1	0		0	0	0	1
Wilmington	0	0	1		0	0	0	0
Winston-Salem	0	1	1		0	13	0	1
South Carolina:								
Charleston	0	0	1	2	0	0	0	1
Columbia	0	0	0		0	0	0	2
Georgia:								
Atlanta	0	4	1	9	0	0	0	2
Brunswick	0	0	0		0	0	0	0
Savannah	0	0	0		0	0	0	3
Florida:								
Miami	0	0	1		0	1	0	0
Tampa	0	1	5		0	0	0	1

City reports for week ended August 27, 1932—Continued

Division, State, and city	Chicken pox, cases reported	Diphtheria		Influenza		Measles, cases reported	Mumps, cases reported	Pneumonia, deaths reported
		Cases, estimated expectancy	Cases reported	Cases reported	Deaths reported			
EAST SOUTH CENTRAL								
Kentucky:								
Covington		0						
Lexington	0		0		0	0	0	
Louisville	0		3	1	0	0	1	7
Tennessee:								
Memphis	0	1	1		0	0	0	1
Nashville	0	1	0		1	1	0	1
Alabama:								
Birmingham	0	2	3		3	0	2	5
Mobile	0	0	0		0	0	0	0
Montgomery	0	1	0			0	0	
WEST SOUTH CENTRAL								
Arkansas:								
Fort Smith	0	0	0			0	0	
Little Rock		0						
Louisiana:								
New Orleans	0	6	3	2	2	0	0	7
Shreveport	0	0	1		0	0	0	0
Oklahoma:								
Muskogee	0		2		0	0	0	0
Texas:								
Dallas	0	4	26		0	0	0	1
Fort Worth	0	1	2		1	0	0	1
Galveston	0	0	0		0	0	0	2
Houston	0	3	1		0	0	0	3
San Antonio	0	2	2		2	0	0	5
MOUNTAIN								
Montana:								
Billings	0	0	0		0	0	0	0
Great Falls	0	1	0		0	0	0	0
Helena	0	0	0		0	0	0	0
Missoula	0	0	0		0	1	0	0
Idaho:								
Boise	0	0	0		0	0	0	0
Colorado:								
Denver	3	6	5		0	3	3	0
Pueblo	1	1	0		0	0	0	0
New Mexico:								
Albuquerque	0	0	0		0	0	0	0
Utah:								
Salt Lake City	3	1	0	1	0	1	3	3
Nevada:								
Reno	0	0	0		0	0	0	0
PACIFIC								
Washington:								
Seattle	4	2	1			0	1	
Spokane	3	1	0			0	0	
Tacoma	1	0	0		0	1	0	0
Oregon:								
Portland	0	2	3		0	3	0	0
California:								
Los Angeles	3	16	15	74	2	3	7	10
Sacramento	0	0	0		0	0	2	5
San Francisco	6	4	1	15	0	2	4	6

City reports for week ended August 27, 1932—Continued

Division, State, and city	Scarlet fever		Smallpox			Tuberculosis, deaths reported	Typhoid fever			Whooping cough, cases reported	Deaths, all causes
	Cases, estimated expectancy	Cases reported	Cases, estimated expectancy	Cases reported	Deaths reported		Cases, estimated expectancy	Cases reported	Deaths reported		
NEW ENGLAND											
Maine:											
Portland	0	5	0	0	0	0	0	2	1	5	19
New Hampshire:											
Concord	0	0	0	0	0	0	0	0	0	0	7
Vermont:											
Barre	0	0	0	0	0	1	0	0	0	0	4
Burlington	0	1	0	0	0	0	0	0	0	0	7
Massachusetts:											
Boston	14	24	0	0	0	14	2	3	0	30	171
Fall River	1	3	0	0	0	0	0	1	0	0	21
Springfield	1	3	0	0	0	1	1	0	0	1	33
Worcester	2	6	0	0	0	2	1	0	0	6	42
Rhode Island:											
Pawtucket	0	0	0	0	0	0	0	0	0	0	13
Providence	2	7	0	0	0	5	1	0	0	49	58
Connecticut:											
Bridgeport	1	5	0	0	0	3	1	0	0	2	5
Hartford	1	0	0	0	0	2	0	0	0	0	26
New Haven	1	0	0	0	0	1	1	0	0	8	33
MIDDLE ATLANTIC											
New York:											
Buffalo	5	6	0	0	0	6	1	0	0	20	101
New York	19	20	0	0	0	91	34	43	2	134	1,175
Rochester	2	3	0	0	0	1	0	0	0	4	65
Syracuse	1	5	0	0	0	0	0	0	0	32	37
New Jersey:											
Camden	0	1	0	0	0	1	1	0	0	1	28
Newark	3	5	0	0	0	8	1	0	1	23	71
Trenton	1	0	0	0	0	2	1	0	0	3	27
Pennsylvania:											
Philadelphia	14	15	1	0	0	32	6	10	4	20	366
Pittsburgh	6	10	0	0	0	4	2	0	1	10	156
Reading	0	0	0	0	0	2	1	0	0	3	27
EAST NORTH CENTRAL											
Ohio:											
Cincinnati	4	3	0	0	0	2	2	1	0	1	98
Cleveland	9	17	0	0	0	12	3	3	0	55	154
Columbus	2	2	0	0	0	4	0	2	0	4	66
Toledo	2	4	0	0	0	6	3	0	0	9	57
Indiana:											
Fort Wayne	0	1	0	0	0	0	2	0	0	0	19
Indianapolis	2	1	0	0	0	3	0	2	1	5	
South Bend	1	1	0	0	0	0	0	0	0	0	17
Terre Haute	0	0	0	0	0	1	0	0	0	0	15
Illinois:											
Chicago	24	34	0	0	0	34	5	6	0	67	560
Springfield	0	2	0	0	0	0	0	5	0	0	18
Michigan:											
Detroit	17	19	0	0	0	20	4	3	0	106	243
Flint	3	3	0	0	0	1	0	0	0	16	22
Grand Rapids	3	1	0	0	0	0	1	0	0	18	20
Wisconsin:											
Kenosha	0	0	0	0	0	0	0	0	0	11	4
Madison	1	1	0	0			0	0		3	
Milwaukee	5	8	0	0	0	3	0	0	0	53	93
Racine	0	0	0	0	0	0	0	0	0	5	9
Superior	0	0		0	0	0	0	1	0	0	9
WEST NORTH CENTRAL											
Minnesota:											
Duluth	4	2	0	0	0	0	0	0	0	1	20
Minneapolis	8	1	0	0	0	3	1	2	0	6	67
St. Paul	5	1	0	0	0	4	0	2	0	20	51
Iowa:											
Des Moines	2	2	1	0			0	0		2	40
Sioux City	0		0				0				
Waterloo	0	0	0	0			0	0		4	

City reports for week ended August 27, 1932—Continued

Division, State, and city	Scarlet fever		Smallpox			Tuberculosis, deaths reported	Typhoid fever			Whooping cough, cases reported	Deaths, all causes
	Cases, estimated expectancy	Cases reported	Cases, estimated expectancy	Cases reported	Deaths reported		Cases, estimated expectancy	Cases reported	Deaths reported		
WEST NORTH CENTRAL—contd.											
Missouri:											
Kansas City	2	3	0	0	0	8	2	1	0	13	76
St. Joseph	0	0	0	0	0	0	0	0	0	0	28
St. Louis	9	4	0	0	0	6	6	2	2	13	187
North Dakota:											
Fargo	0	0	0	0	0	0	0	1	0	2	5
Grand Forks	0	0	0	0	-------	-------	0	0	-------	0	-------
South Dakota:											
Sioux Falls	0	0	0	0	-------	-------	0	0	-------	0	7
Nebraska:											
Omaha	1	6	1	0	0	1	0	1	0	2	48
Kansas:											
Topeka	1	1	0	0	0	0	1	0	0	3	3
Wichita	1	0	0	0	0	3	0	3	0	6	21
SOUTH ATLANTIC											
Delaware:											
Wilmington	0	3	0	0	0	1	0	0	0	1	2
Maryland:											
Baltimore	4	9	0	0	0	13	8	5	1	19	165
Cumberland	0	0	0	0	0	1	0	0	0	1	11
Frederick	0	2	0	0	0	0	0	0	0	0	4
District of Col.:											
Washington	4	6	0	0	0	12	3	2	0	4	111
Virginia:											
Lynchburg	0	1	0	0	0	1	2	2	0	20	14
Norfolk	1	2	0	0	0	1	1	0	0	2	28
Richmond	2	6	0	0	0	2	1	0	0	1	35
Roanoke	0	1	0	0	0	1	0	1	0	1	22
West Virginia:											
Charleston	0	1	0	0	0	1	3	[1]4	0	0	11
Huntington	-------	3	-------	0	0	0	-------	1	0	0	-------
Wheeling	0	0	0	0	0	0	1	0	0	13	19
North Carolina:											
Raleigh	0	0	0	0	0	0	1	0	0	0	15
Wilmington	0	0	0	0	0	1	0	0	0	0	9
Winston-Salem	1	0	0	0	0	1	1	0	0	2	9
South Carolina:											
Charleston	0	2	0	0	0	0	2	3	0	0	20
Columbia	0	0	0	0	0	3	0	0	0	0	12
Georgia:											
Atlanta	3	4	0	0	0	3	4	10	1	6	69
Brunswick	0	0	0	0	0	1	0	1	0	0	3
Savannah	0	0	0	0	0	4	1	0	0	0	28
Florida:											
Miami	0	0	0	0	0	1	1	0	0	0	17
Tampa	0	0	0	0	0	2	0	1	0	0	16
EAST SOUTH CENTRAL											
Kentucky:											
Covington	0	-------	0	-------	-------	-------	1	-------	-------	-------	-------
Lexington	-------	0	-------	0	0	0	-------	7	0	0	14
Louisville	-------	1	-------	0	0	3	-------	0	0	0	-------
Tennessee:											
Memphis	2	1	0	0	0	3	9	4	0	0	63
Nashville	0	1	0	0	0	1	6	0	0	3	35
Alabama:											
Birmingham	3	1	0	0	0	3	4	5	0	7	54
Mobile	0	0	0	0	0	0	0	1	0	0	19
Montgomery	0	1	0	0	0	-------	0	0	-------	0	-------
WEST SOUTH CENTRAL											
Arkansas:											
Fort Smith	1	1	0	0	-------	-------	0	0	-------	1	-------
Little Rock	0	-------	0	-------	-------	-------	1	-------	-------	-------	-------

[1] 3 nonresidents.

City reports for week ended August 27, 1932—Continued

Division, State, and city	Scarlet fever		Smallpox			Tuberculosis, deaths reported	Typhoid fever			Whooping cough, cases reported	Deaths, all causes
	Cases, estimated expectancy	Cases reported	Cases, estimated expectancy	Cases reported	Deaths reported		Cases, estimated expectancy	Cases reported	Deaths reported		
WEST SOUTH CENTRAL—CON.											
Louisiana:											
New Orleans	2	0	0	0	0	5	4	15	3	0	126
Shreveport	0	1	0	0	0	1	0	0	1	1	36
Oklahoma:											
Muskogee	0	0	----	0	0	0	----	4	0	0	----
Texas:											
Dallas	2	0	1	0	0	2	2	2	0	2	40
Fort Worth	1	3	0	0	0	0	0	1	1	0	34
Galveston	0	0	0	0	0	0	0	1	0	0	18
Houston	1	0	0	0	0	4	1	1	0	0	67
San Antonio	1	0	0	0	0	2	1	0	0	0	52
MOUNTAIN											
Montana:											
Billings	0	0	0	0	0	0	0	0	0	0	----
Great Falls	0	0	0	0	0	0	0	0	0	1	11
Helena	0	0	0	0	0	0	0	1	0	0	7
Missoula	0	0	0	0	0	0	0	0	0	0	6
Idaho:											-
Boise	0	1	0	2	0	0	0	0	0	0	5
Colorado:											
Denver	2	7	0	0	0	7	1	2	0	15	66
Pueblo	0	0	0	0	0	1	0	2	0	6	12
New Mexico:											
Albuquerque	0	0	0	0	0	2	1	0	0	2	9
Utah:											
Salt Lake City	2	0	0	0	0	2	1	0	0	13	29
Nevada:											
Reno	0	0	0	0	0	0	0	0	0	0	4
PACIFIC											
Washington:											
Seattle	4	2	1	2	----	----	2	1	----	0	----
Spokane	2	0	1	0	----	----	1	2	----	3	----
Tacoma	1	4	1	0	0	1	0	0	0	1	29
Oregon:											
Portland	2	1	3	1	0	3	0	1	0	3	54
California:											
Los Angeles	7	4	1	2	0	13	1	1	0	73	247
Sacramento	1	0	0	0	0	2	1	2	1	0	31
San Francisco	4	1	0	0	0	10	1	0	0	14	153

Division, State, and city	Meningococcus meningitis		Lethargic encephalitis		Pellagra		Poliomyelitis (infantile paralysis)		
	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases, estimated expectancy	Cases	Deaths
NEW ENGLAND									
Massachusetts:									
Boston	1	0	0	0	0	0	4	0	0
Worcester	0	0	0	1	0	1	0	0	0
MIDDLE ATLANTIC									
New York:									
New York	4	2	0	0	0	0	16	11	3
New Jersey:									
Camden	0	0	0	0	0	0	0	5	0
Pennsylvania:									
Philadelphia	3	0	1	0	0	0	1	118	4
Reading	0	0	0	0	0	0	0	3	1

City reports for week ended, August 27, 1932—Continued

Division, State, and city	Meningococcus meningitis		Lethargic encephalitis		Pellagra		Poliomyelitis (infantile paralysis)		
	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases, estimated expectancy	Cases	Deaths
EAST NORTH CENTRAL									
Ohio:									
Cleveland	2	0	0	0	0	0	3	3	0
Indiana:									
Indianapolis	1	0	0	0	0	0	0	0	0
Terre Haute	1	1	0	0	0	0	0	0	0
Illinois:									
Chicago	0	1	0	1	0	0	3	1	0
Michigan:									
Detroit	1	1	0	0	0	0	2	1	0
Grand Rapids	0	0	0	0	0	0	0	1	0
Wisconsin:									
Milwaukee	1	1	0	0	0	0	1	1	0
WEST NORTH CENTRAL									
Minnesota:									
St. Paul	0	0	0	0	0	0	0	1	0
Missouri: [1]									
St. Louis	1	1	0	0	0	0	1	0	0
SOUTH ATLANTIC [1]									
Maryland:									
Baltimore	0	0	0	0	0	0	0	1	0
District of Columbia:									
Washington	0	0	0	0	0	0	1	1	0
North Carolina:									
Raleigh	0	0	0	0	3	0	0	0	0
South Carolina: [1]									
Charleston [1]	0	0	0	0	2	0	0	3	0
Georgia: [1]									
Atlanta	0	0	0	0	2	0	0	0	0
EAST SOUTH CENTRAL [1]									
Kentucky:									
Lexington	1	0	0	0	0	0	----	0	0
Tennessee:									
Memphis	0	0	0	0	0	0	0	1	0
Nashville	0	2	0	0	0	0	0	0	0
WEST SOUTH CENTRAL									
Louisiana:									
New Orleans [1]	0	0	0	0	0	0	0	1	0
Shreveport	0	0	0	0	1	1	0	0	0
Texas:									
Dallas	0	0	0	0	1	1	0	0	0
MOUNTAIN									
Utah:									
Salt Lake City	1	0	0	0	0	0	0	0	0
PACIFIC									
Washington:									
Seattle	0	0	0	0	0	0	0	1	0
Oregon:									
Portland	0	0	0	0	0	0	0	2	0
California:									
Los Angeles	1	0	0	0	1	0	2	0	0
Sacramento	1	1	0	0	0	0	0	0	0
San Francisco	0	0	0	0	0	0	1	1	0

[1] Typhus fever, 10 cases: 1 case at St. Joseph, Mo.; 1 case at Charleston, S. C.; 1 case at Columbia, S. C.; 1 case at Savannah, Ga.; 2 cases at Tampa, Fla.; 2 cases at Birmingham, Ala.; and 2 cases at New Orleans, La.

FOREIGN AND INSULAR

CANADA

Provinces—Communicable diseases—Week ended August 20, 1932.—The Department of Pensions and National Health of Canada reports cases of certain communicable diseases for the week ended August 20, 1932, as shown in the following table. No report was received from Prince Edward Island.

Province	Cerebro-spinal fever	Influenza	Poliomyelitis	Typhoid fever
Nova Scotia				[1] 2
New Brunswick				2
Quebec			29	26
Ontario	1	7	12	1
Manitoba				3
Saskatchewan				[1] 5
Alberta			2	3
British Columbia			1	1
Total	1	7	44	43

[1] Paratyphoid fever.

Quebec Province—Communicable diseases—Week ended August 20, 1932.—The Bureau of Health of the Province of Quebec, Canada, reports cases of certain communicable diseases for the week ended August 20, 1932, as follows:

Disease	Cases	Disease	Cases
Chicken pox	5	Poliomyelitis	29
Diphtheria	15	Puerperal septicemia	2
Erysipelas	2	Scarlet fever	34
German measles	3	Tuberculosis	59
Measles	4	Typhoid fever	26
Ophthalmia neonatorum	2	Whooping cough	48

DENMARK

Communicable diseases—June, 1932.—During the month of June, 1932, cases of certain communicable diseases were reported in Denmark as follows:

Disease	Cases	Disease	Cases
Cerebrospinal meningitis	7	Paratyphoid fever	62
Chicken pox	58	Poliomyelitis	3
Diphtheria and croup	144	Puerperal fever	9
Erysipelas	204	Scabies	538
German measles	7	Scarlet fever	202
Gonorrhea	883	Syphilis	61
Influenza	2,474	Typhoid fever	11
Lethargic encephalitis	19	Undulant fever (Bact. abort. Bang)	45
Measles	3,059	Whooping cough	3,580
Mumps	183		

ITALY

Communicable diseases—Four weeks ended March 6, 1932.—During the four weeks ended March 6, 1932, cases of certain communicable diseases were reported in Italy as follows:

Disease	Feb. 8–14		Feb. 15–21		Feb. 22–28		Feb. 29–Mar. 6	
	Cases	Communes affected	Cases	Communes affected	Cases	Communes affected	Cases	Communes affected
Anthrax	13	12	14	14	10	10	17	12
Cerebrospinal meningitis	16	15	16	14	18	18	6	6
Chicken pox	256	97	433	102	333	110	224	82
Diphtheria and croup	454	269	564	300	450	255	397	236
Dysentery	5	5	5	5	3	3	2	2
Lethargic encephalitis	2	2	2	2			1	1
Measles	1,949	225	3,578	290	2,742	276	2,623	284
Poliomyelitis	9	6	10	6	5	5	7	7
Scarlet fever	303	123	416	136	311	118	311	124
Typhoid fever	236	123	288	161	172	111	217	122

JAMAICA

Communicable diseases—Four weeks ended August 13, 1932.—During the four weeks ended August 13, 1932, cases of certain communicable diseases were reported in Kingston, Jamaica, and in the Island of Jamaica, outside of Kingston, as follows:

Disease	Kingston	Other localities	Disease	Kingston	Other localities
Cerebrospinal meningitis	1		Leprosy		1
Chicken pox	4	5	Puerperal fever	1	1
Dysentery	4	5	Tuberculosis	32	75
Erysipelas		3	Typhoid fever	12	47

PUERTO RICO

San Juan—Communicable diseases—Four weeks ended August 13, 1932.—During the four weeks ended August 13, 1932, cases of certain communicable diseases were reported in San Juan, P. R., as follows:

Disease	Cases	Disease	Cases
Broncho-pneumonia	2	Measles	55
Chicken pox	17	Mumps	6
Diphtheria	6	Pellagra	1
Impetigo contagiosa	1	Syphilis	5
Influenza	359	Tuberculosis	31
Leprosy	1	Whooping cough	8
Malaria	59		

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

(NOTE.—A table giving current information of the world prevalence of the quarantinable diseases appears in the Public Health Reports for August 26, 1932, pp. 1798-1811. A similar cumulative table will appear in the Public Health Reports to be issued September 30, 1932, and thereafter, at least for the time being, in the last issue (published on the last Friday) of each month.)

Cholera

China.—Amoy, two weeks ended August 27, 1932, 133 cases, 35 deaths. Hankow, week ended August 13, 1932, 109 cases, 13 deaths. Macao, two weeks ended August 27, 1932, 24 cases, 24 deaths. Nanking, week ended August 20, 1932, 169 cases, 14 deaths. Shanghai, week ended August 20, 1932, 347 cases, 28 deaths. Swatow, week ended August 20, 1932, 48 cases, 11 deaths. Tientsin, week ended August 13, 1932, 2 cases.

Cholera has been reported from southern Manchuria, with 700 deaths in Tungliao, 136 deaths in Pei-chen, 35 deaths in Chinchow Prefecture (Chinhsien), 41 deaths at Changchun, 22 deaths at Chengchiatun, 14 deaths at Newchwang, 4 deaths at Mukden, 1 death at Antung, and scattered reports from other places. The report did not include deaths which occurred later than August 1, 1932.

Philippine Islands.—From August 22 to September 3, 1932, 10 cases of cholera with 5 deaths were reported in Leyte Province, P. I. From August 30 to September 3, 1932, 21 cases and 11 deaths were reported in Samar Province.

Plague

The steamship *City of Oxford* arrived at Liverpool September 2, 1932, from Alexandria, Egypt. Two dead rats on the vessel were found to be plague infected.