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CURRENT PREVALENCE OF COMMUNICABLE DISEASES IN THE UNITED STATES [a]

October 6–November 2, 1935

Poliomyelitis.—A decrease in poliomyelitis of approximately 1,500 cases occurred during the 4 weeks ended November 2 as compared with the preceding 4 weeks. The number of cases (1,039) for the country as a whole was approximately 50 percent in excess of that for the corresponding periods in 1934 and 1933, but it was only about half of the number reported for this period in each of the years 1931 and 1930. The incidence was still considerably above that of recent years in regions along the Atlantic coast where the disease has been most prevalent, but all other sections reported fewer cases than last year.

Table 1 shows for each State the number of cases reported during the 28 weeks since the increased incidence began, with comparative figures for the corresponding period in the 3 preceding years. The table also includes data for recent weeks of 1935.

TABLE 1.—*Poliomyelitis cases reported in each State during recent weeks [1] of 1935*

State	28 weeks ended—				Cases reported in 1935 for week ended—						
	Nov. 12, 1932	Nov. 11, 1933	Nov. 10, 1934	Nov. 9, 1935	Sept. 28	Oct. 5	Oct. 12	Oct. 19	Oct. 26	Nov. 2	Nov. 9
All States [2]	3,192	4,340	6,461	9,742	569	445	339	324	223	153	155
New England:											
Maine	54	53	15	137	14	7	13	8	6	1	6
New Hampshire	3	7	6	54	4	3	3	2	0	0	0
Vermont	2	32	6	41	7	3	6	2	4	1	1
Massachusetts	40	350	69	1,368	88	99	52	47	35	28	26
Rhode Island	8	17	1	324	32	25	13	9	7	2	3
Connecticut	24	72	13	388	33	22	18	17	9	7	7
Middle Atlantic:											
New York	276	1,320	202	2,778	150	106	71	84	45	23	25
New Jersey	340	232	58	476	51	31	24	26	22	12	12
Pennsylvania	1,211	363	114	180	15	12	1	13	1	19	3
East North Central:											
Ohio	63	330	242	76	7	3	5	3	0	1	2
Indiana	12	32	53	40	1	1	4	3	4	2	3
Illinois	145	191	190	219	14	23	16	7	12	5	6
Michigan	90	78	200	595	30	25	29	16	14	12	8
Wisconsin	40	45	121	53	4	2	0	1	1	1	1

[1] See Public Health Reports for Oct. 25, p. 1486, Sept. 27, p. 1330; Aug. 30, p. 1166, and Aug. 2, p. 986 for preceding weekly data.
[2] Nevada excluded; no data.

[a] From the Office of Statistical Investigations, U. S. Public Health Service. These summaries include only the 8 important communicable diseases for which the Public Health Service receives weekly telegraphic reports from the State health officers. The numbers of States included for the various diseases are as follows: Typhoid fever, 48; poliomyelitis, 48; meningococcus meningitis, 48; smallpox, 48; measles, 47; diphtheria, 48; scarlet fever, 48; influenza, 44 States and New York City. The District of Columbia is counted as a State in these reports.

TABLE 1.—*Poliomyelitis cases reported in each State during recent weeks of 1935*—Continued

State	28 weeks ended—				Cases reported in 1935 for week ended—						
	Nov. 12, 1932	Nov. 11, 1933	Nov. 10, 1934	Nov. 9, 1935	Sept. 28	Oct. 5	Oct. 12	Oct. 19	Oct. 26	Nov. 2	Nov. 9
West North Central:											
Minnesota	99	307	78	52	2	4	3	3	0	1	0
Iowa	36	41	29	49	3	3	2	7	1	0	2
Missouri	7	33	25	31	2	2	1	1	1	2	2
North Dakota	26	77	9	15	0	1	0	1	1	1	3
South Dakota	8	29	34	9	0	0	2	0	2	1	0
Nebraska	24	14	11	6	1	1	1	0	0	0	0
Kansas	33	44	70	25	4	0	2	0	1	2	4
South Atlantic:											
Delaware	9	14	2	4	0	0	0	0	0	0	0
Maryland	31	40	21	93	13	4	6	3	1	2	4
District of Columbia	31	6	7	80	7	5	4	1	3	1	1
Virginia	41	33	66	672	10	7	1	7	4	2	2
West Virginia	38	80	73	36	0	1	0	1	0	0	2
North Carolina	33	20	31	634	15	9	9	8	3	2	1
South Carolina	32	11	7	29	1	1	0	1	1	0	0
Georgia	8	6	19	18	0	0	0	0	0	3	1
Florida	2	5	10	13	1	0	0	0	1	0	0
East South Central:											
Kentucky	26	32	105	300	19	11	11	13	7	4	8
Tennessee	38	100	51	73	3	1	1	0	1	2	1
Alabama	22	14	41	44	1	0	1	1	1	1	0
Mississippi	18	6	16	11	0	0	2	1	0	0	0
West South Central:											
Arkansas	13	8	8	25	4	0	0	2	0	1	1
Louisiana	27	16	13	82	1	0	4	3	3	0	4
Oklahoma	21	16	14	9	0	0	0	0	0	0	1
Texas	63	33	65	54	1	1	2	3	3	2	4
Mountain:[1]											
Montana	2	6	314	4	0	0	0	1	0	0	0
Idaho	1	2	118	1	0	0	0	0	0	0	0
Wyoming	4	11	7	1	0	0	0	0	0	0	0
Colorado	4	6	14	6	1	0	1	0	0	0	0
New Mexico	5	4	11	4	0	0	0	0	0	0	0
Arizona	5	4	98	15	1	0	0	1	0	1	0
Utah	1	10	13	9	0	0	1	1	1	1	0
Pacific:											
Washington	54	71	676	24	0	2	0	2	5	0	3
Oregon	16	26	72	20	3	1	1	5	2	2	0
California	107	93	3,043	565	26	29	26	20	21	11	8

Meningococcus meningitis.—The number of cases of meningococcus meningitis rose from 240 for the preceding period to 273 for the current 4-week period. This disease is usually at or near its lowest level at this season of the year and the increase is somewhat unexpected. The sharpest rise occurred in the South Atlantic region, where practically every State reported an increase over the preceding 4 weeks and the number of cases (59) was the highest for this period in the 7 years for which data are available. Other sections reported increases, but individual States seemed to be mostly responsible for them. In the East North Central region, Ohio reported 21 cases for the current period as against 7 for the preceding 4 weeks and Illinois 19 as against 9; in the West North Central area, Missouri reported 13 as against 7; and in the Mountain region, Wyoming reported 5 cases as against none. In the New England and Middle Atlantic and South Central regions the incidence of the disease continued to decline.

Compared with recent years the incidence of meningococcus meningitis was the highest for this period since 1930, thus continuing the high level which has prevailed since the first of the year. All parts of the country show an incidence above that for preceding years.

Smallpox.—The number of cases of smallpox reported for the current period was 244. Washington reported 56; Wisconsin, 25; Iowa, South Dakota, and Nebraska, 23 each; Montana, 15; and Illinois 10; about three-fourths of the total cases were in these 7 States. The rather high incidence of smallpox that has prevailed throughout the current year has been due mostly to excesses in certain States rather than to a general increase in the whole reporting area. States in the West North Central and Mountain and Pacific regions were the most affected; in other sections the incidence has generally been below that of recent years.

Typhoid fever.—The incidence of typhoid fever continued to decline in all sections of the country. For the 4 weeks ended November 2 the number of cases totaled 1,600, which was the lowest figure for this period in recent years. In the Mountain and Pacific section the incidence was practically on a level with that of last year, but all other regions reported very significant decreases from last year's figures.

Diphtheria.—The usual seasonal increase of diphtheria continued. For the 4 weeks ended November 2, 5,416 cases were reported. Compared with recent years the current incidence was slightly below the level of last year (5,699 cases) and only about 65 percent of the average incidence for the 5 preceding years. The Mountain and Pacific regions reported about a 50 percent increase over last year's figure for the same period, and the South Atlantic States reported a 20 percent decrease; all other areas closely approximated last year's incidence.

Scarlet fever.—The number of cases of scarlet fever rose from 8,277 for the preceding 4-week period to 15,142 for the current period. For the country as a whole, the incidence compared very favorably with that for the corresponding period in preceding years. In the West North Central and Mountain and Pacific regions the number of cases was somewhat above the seasonal expectancy, but other sections reported about the normal incidence for this season of the year.

Measles.—The incidence of measles apparently reached its low level for the current year during the 4 weeks ended October 5 and the expected seasonal increase was reported from all sections of the country during the 4 weeks ended November 2. The seasonal increase was about the same as in recent years, except in 1934, when the increase at this time was considerably above the expectancy. For the current 4-week period 4,513 cases were reported, as compared with 4,005, 4,537, and 4,280 for the corresponding period in the years

1933, 1932, and 1931, respectively. Last year approximately 9,200 cases were reported for this period.

Influenza.—The influenza incidence was very favorable for the current period. For the entire reporting area the number of cases totaled 2,544, as compared with 2,334, 3,303, and 4,651 for the corresponding period in the years 1934, 1933, and 1932, respectively. The East North Central section reported a 50 percent increase over last year's figure, and the Mountain and Pacific section reported a 40 percent increase, but in all other areas the incidence closely approximated that of last year.

Mortality, all causes.—The average mortality rate in large cities for the 4 weeks ended November 2, as reported by the Bureau of the Census, was 10.7 per 1,000 inhabitants (annual basis). For the corresponding period in the years 1934, 1933, and 1932 the average rate was 10.6, 10.6, and 10.3 respectively.

FURTHER STUDIES OF THE EFFECT OF RADIUM UPON BACTERIA

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Numerous investigators have demonstrated the bactericidal effect of radium emanations. References to many of the papers dealing with this subject have been given in a previous communication (Spencer, 1934).

We have now been able to demonstrate the differential bactericidal effect of the beta and gamma rays of radium far more graphically than heretofore, by permitting the organisms (seeded upon the surface of solid media rather than planted, as formerly, in liquid broth) to grow in the presence of radium enclosed in two separate needles, the metal casings of which possess different densities.

Figure 1 shows a growth of *Eberthella typhi* which has developed around 3 needles after 24 hours' incubation at 37.5° C. All 3 needles were first boiled in 5 percent carbolic acid, then washed in sterile broth and subsequently dipped in a 24-hour broth suspension of *E. typhi* and finally placed on the surface of a sterile agar plate.

Needle (A) is simply a capillary glass tube which served as a control.

Needle (B) is a platinum-iridium needle with a density of 21.5 and screens off approximately 99 percent of the primary beta radiation. The radium encased in this needle emits a gamma radiation equivalent to that from 10 mg of radium element according to tests and certification of the United States Bureau of Standards.

Needle (C) is made of monel metal (an alloy) and has a density of 8.7. It screens off 85 percent of the primary beta radiation and, therefore, permits the passage of about 15 percent of these rays. Its wall thickness is only 0.25 mm, as compared with 0.5 mm wall thick-

ness of the platinum-iridium needle. According to the Bureau of Standards certificate it has a gamma radiation equivalent to that from 5 mg of radium element. Since needle (C) contains 5 mg of radium and (B) is 4 times as long as (C), then (C) contains twice as much radium per unit length.

It can be seen clearly that needle (B), containing 10 mg of radium, did not inhibit growth, while needle (C), containing 5 mg, did inhibit growth on each side of the hollow shank of the needle but not around the ends where the needle is solid. The hollow shank contains the radium salt (bromide).

The two small colonies seen just to one side of needles (A) and (B) are not contaminations, but arose from points on the agar surface where the end of the forceps had touched, accidentally, in making the transfer of the needles to the plate.

Figure 2 shows the same plate after 7 days' incubation. The heavier growth noted at the ends of needles (A) and (B) as compared with the less dense growth along the shanks of these needles may be due simply to the fact that those organisms at the end of the needles are able to draw nourishment from a larger area of agar, or it may be due, in part, to a larger amount of inoculum at the end of the needles.

If stained smears are made of the organisms very close to the middle portion of the shank of needle (B) after only 24 hours' growth, one will find numerous filamentous and thread-like forms. When transferred to fresh media they tend to revert rapidly to the original rod form.

If smears are prepared again after 7 days' incubation, one will find the filamentous forms still more numerous and transfers will not be viable, provided care is taken to remove only those organisms lying close to the needle.

In order to obtain the picture seen in figures 1 and 2, it is necessary to have the surface of the agar plate quite dry before applying the inoculated needles. When the surface contains sufficient moisture to form and retain for several hours a liquid meniscus between the needles and the agar surface, a growth will occur on all sides of even needle (C). This is because the beta rays are not highly penetrating and the liquid will absorb a sufficient number of these particles to permit growth and multiplication to proceed faster than the killing. It does not absorb them all. Although growth does appear, those organisms lying close to the needle will not remain viable after 3 or 4 days.

Figure 3 presents additional evidence as to the bactericidal effect of the beta rays. The entire surface of this plate was first seeded with *E. typhi* and then the 10-mg platinum-iridium needle (B) and the 5-mg monel-metal needle (C) were placed upon the seeded sur-

face. After 24 hours there was a definite zone of inhibition around the needle (C).

In figure 4 the needles were placed on the bottom of a sterile petri dish and melted agar was poured over them until they were completely submerged, having a thin film of agar above the needle. After the agar had solidified, the entire surface was seeded with *E. typhi*. Inhibition of growth was observed only along a narrow oblong area immediately above the 5-mg monel-metal needle (C).

This experiment indicates that the killing rays (beta) are able to penetrate the agar for a short distance. None of these tests yielded evidence that the gamma rays (known to be highly penetrating) from either needle (B) or (C) are bactericidal. Perhaps all results can be accounted for by the action of the beta rays alone.

DO GAMMA RAYS STIMULATE GROWTH OF BACTERIA?

The bacillary strains that we have irradiated (*Proteus vulgaris* X 19 and *E. typhi*) have shown the formation of giant forms and long filaments. After the irradiation has taken place over many generations, there is a tendency for these forms to persist in subsequent transplants which are not irradiated.

Either cell division is retarded by an irradiation effect which is sublethal, while the organisms continue to grow at a normal rate, or growth is stimulated and the normal rate of cell division is unable to keep up with the accelerated growth, thus resulting in filaments. At any rate, we invariably obtain very large forms after irradiation.

In figure 5 we see the effect of continuous irradiation of a yeast (*Saccharomyces elipsoideus*) for 22 daily transplants. The control strain, which was not irradiated, shows the normal size of the yeast. It will be noted that there are a few cells of normal size in the irradiated culture, and this is always the case.

The result of the irradiation of *E. typhi* is shown in figure 6. Here we also see many normal-sized organisms, but the predominance of the filamentous variety is apparent.

Since the beta rays are generally regarded as highly bactericidal, we might reasonably assume that the change here noted is due to the gamma radiation; however, there is no proof of it in this test. But since the large forms in the irradiated strain are viable and transferable and remain in the cultures after several transplants, we regard this as proof that some portion of the radium emanation does produce nonlethal effects.

On the other hand, Wyckoff and Rivers (1930) state that "for the two motile bacilli, *Escherichia coli* and *Salmonella aertrycke*, the absorption of a single 155 kv electron is sufficient to cause death. Furthermore, all, or nearly all, the electrons absorbed are lethal. The same is undoubtedly true of *Staphylococcus aureus*." These investi-

gators consider the radiation not suitable for altering the inheritable characteristics of bacteria.

Later, Wyckoff (1930), in speaking of the effects of X-rays, says: "Although on the average the absorption of one quantum of these radiations is sufficient to kill a bacterium of either *E. coli* or *S. aertrycke* relatively few of the absorbed quanta are lethal * * * The fact that so many quanta can be absorbed by a bacterium without causing death apparently means that the vital elements within the cell which can be destroyed by a direct quantum hit are much smaller than the cell itself."

In view of these observations of Wyckoff and Rivers and the well known fact that the gamma rays of radium are practically identical with the X-rays of short wave length, we were inclined to regard the effect of radium emanations shown in figures 5 and 6 as suggestive that heritable changes might be induced by irradiating bacterial cultures in series over many generations, and that the absorbed quanta which were nonlethal might modify the germ plasm.

EFFORTS TO INDUCE BACTERIAL MUTATIONS BY MEANS OF IRRADIATION

Prior to 1927 the numerous attempts to modify the germ plasm of various species resulted in failure. In that year Müller (1927) succeeded in producing mutations in flies by the use of X-rays, and in the following year Hanson (1928) and Stadler (1928) produced mutations with radium. The question was then raised as to whether or not all mutations were due to natural radiation, since it is well known that radiations are constantly emanating from the earth's surface.

In support of this view the experiments of Babcock and Collins (1929), who conducted their work in a street car tunnel in San Francisco, and those of Hanson and Heys (1930), who used a carnotite mine in Colorado, have shown that the occurrence of mutations in *Drosophila* was much greater in these locations than mutations occurring in corresponding flies in the laboratories where the natural radiation was far less.

This suggests that radio-activity of the earth's surface may play an important role in the evolution of species by furnishing heritable variations for the action of natural selection. As Hanson (1928) says, "Heritable variations are facts of nature, else there could have been no evolution." Müller and Mott-Smith (1930), on the other hand, have shown that mutation frequency in *Drosophila melanogaster* is at least 1,300 times as high as it would be if caused solely by the radiation which the flies receive from their outer environment. This observation suggests that most mutations must come about as a result of other causes than the natural radio-activity arising from the outer environment. While these other causes are, as yet, unknown,

all geneticists agree that gene mutations resulting from radium and X-ray are indistinguishable from those occurring naturally, and that radiation is the only satisfactory method known at present by which the problems of the mechanism of mutations may be studied.

Hanson and Heys (1928) and Oliver (1930) have shown for radium and X-rays, respectively, that the rate of mutation in *Drosophila* is determined by the strength of dosage applied. The rate seemed to be directly proportional to the dosage. Doubling the time of exposure also doubled the number of mutations.

In view of these observations and of our own results with radium, we came to the conclusion that geneticists who wish to study the causes of mutations can find no better group of organisms upon which to experiment than bacteria, or other single-cell forms, because a bacterial generation is so short, permitting the race to be observed over a relatively long period. It was thought also that we could reasonably expect the germ plasm of single-cell forms to yield more readily and to a greater degree to the environmental influences than the germ plasm of multicellular forms. The somatic cells of the latter serve to protect the germ cells from purely external influences, while in the former the somatic component and the germinal component are contained in one and the same cell at all times. However, our own efforts in this field have been somewhat disappointing, since we have found bacteria, in general, to be highly resistant to irradiation (so far as the production of mutations is concerned) when compared with the reported results following the irradiation of flies and other species. According to Oliver (1934) also, bacteria in general are less sensitive to irradiation than other forms.

In all previous studies of the effect of radio-active substances upon bacteria, so far as we are aware, only individual cultures were irradiated and no effort has been made to study the effect following a continuous application of the rays to a rapidly multiplying bacterial species throughout many thousands of generations.

Technique of irradiation.—The same radium needles used in our previous work, referred to above, were employed in the following experiment. One or more needles are threaded with a small loop of platinum wire to facilitate removal from the broth tubes. Removal is then easily accomplished by the use of a platinum wire hook. The needles are first sterilized by boiling in 5-percent carbolic acid and then are tested for sterility by washing in sterile salt solution to remove excess of phenol and planting in sterile broth tubes for several days. The first tube in a series of sterile broth tubes is then inoculated with a pure culture, preferably a single-cell culture of the organism to be studied, and at the same time the needles of radium are placed in the same tube. When a good growth has appeared after 24 hours' incubation, the needles are transferred to the next

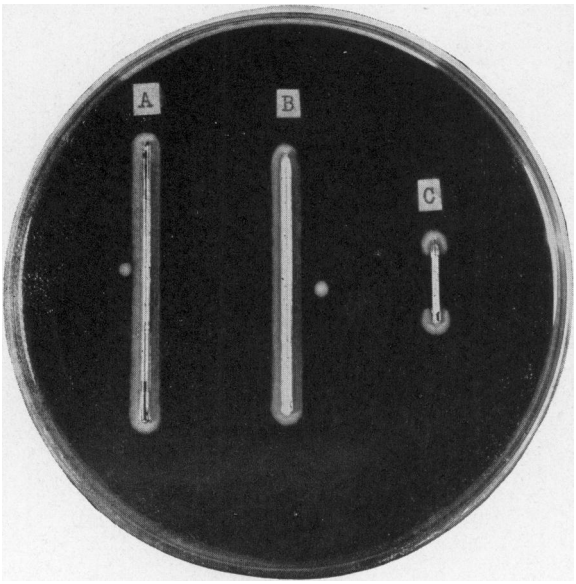


FIGURE 1.—Needles dipped in broth culture of *E. typhi* and placed on sterile agar surface. 24-hour growth.

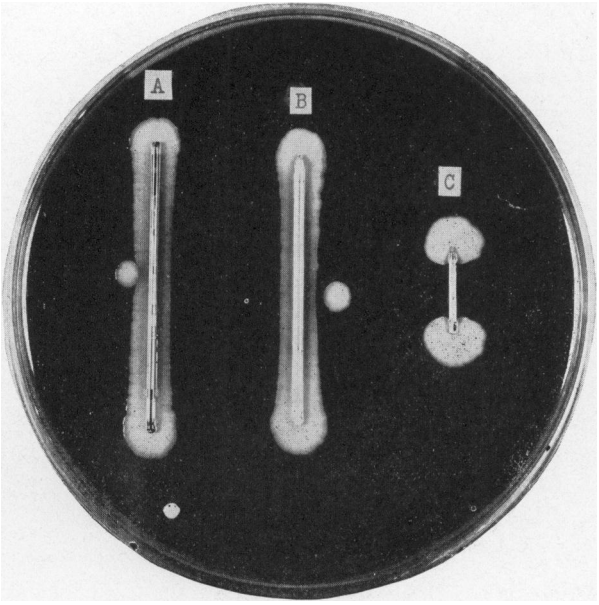


FIGURE 2.—Same as fig. 1—7 days' growth.

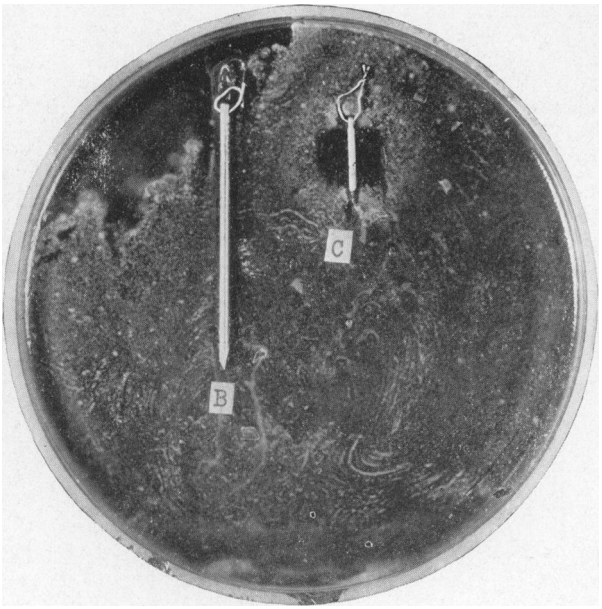


FIGURE 3.—Dry surface of agar seeded with *E. typhi* and sterile needles immediately superimposed. 24-hour growth.

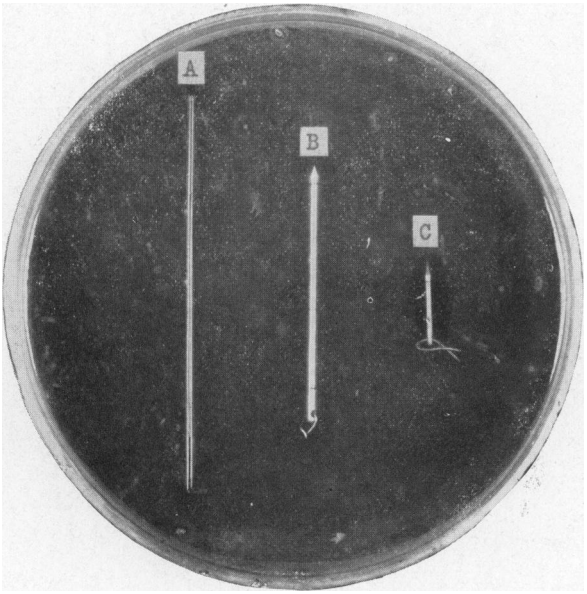
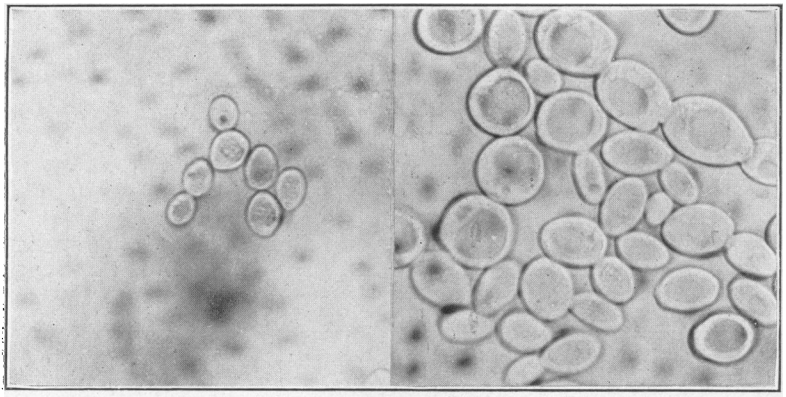


FIGURE 4.—Needles buried in agar and dry surface seeded with *E. typhi*. 24-hour growth.



Strain not irradiated. Strain irradiated during 22 days' continuous growth.

FIGURE 5.—*Saccharomyces elipsoideus.*

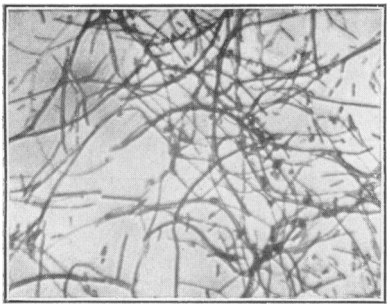


FIGURE 6.—*E. typhi*—24-hour growth of 94th irradiated transfer.

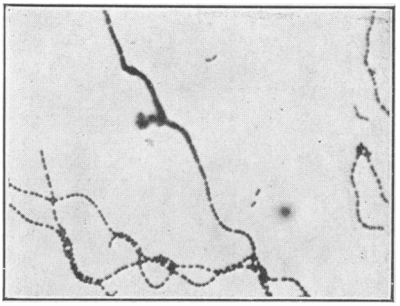


FIGURE 7.—*S. scarlatinae*, series I, 12th tube. Apparent fusion of streptococcal elements. Irradiated.

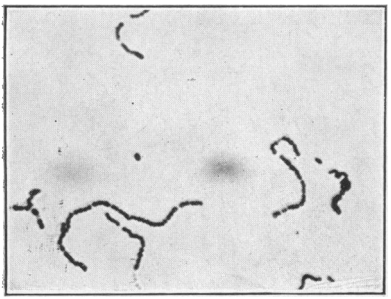


FIGURE 8.—Strep. series XIX-G 16. Original irradiated tube.

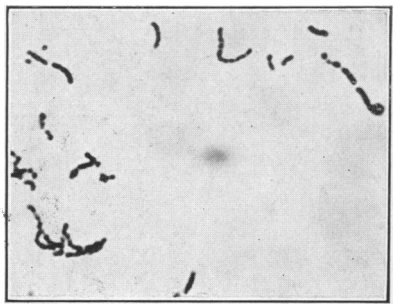


FIGURE 9.—Strep. series XIX-G 16. Original irradiated tube.

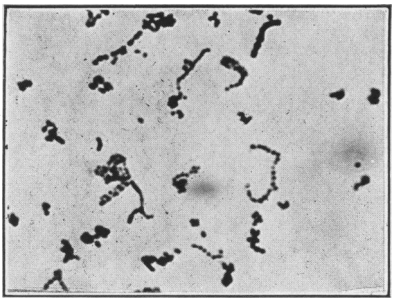


FIGURE 10.—Strep. series XIX-G 19. Original irradiated tube.

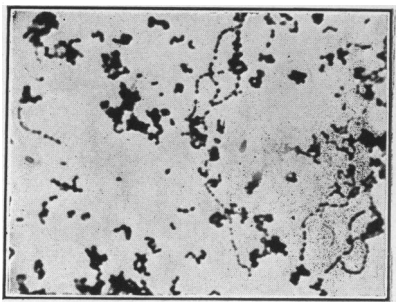


FIGURE 11.—Strep. series XIX-G 22. Original irradiated tube.

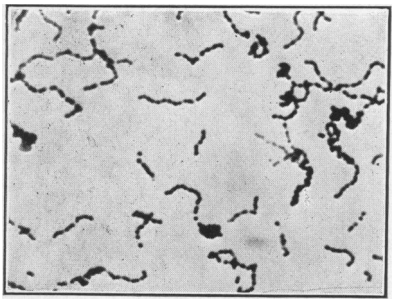


FIGURE 12.—Strep. series XIX-G 22. First broth transfer.

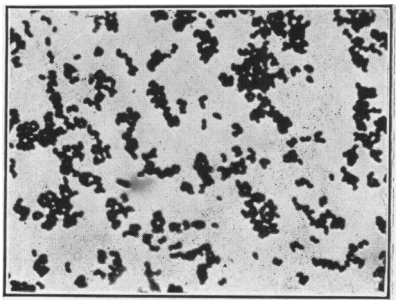


FIGURE 13.—Strep. series XIX-G 22. First agar transfer.

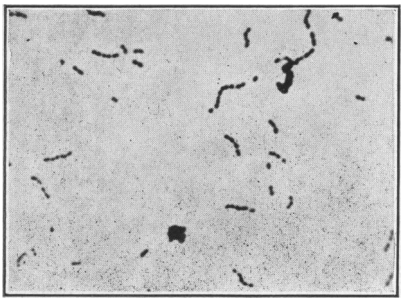


FIGURE 14.—Strep. series XIX-G 23. Third transfer in broth.

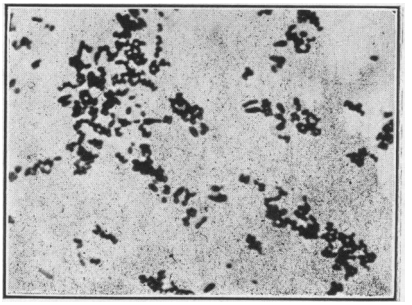


FIGURE 15.—Strep. series XIX-G 23. Third transfer on agar.

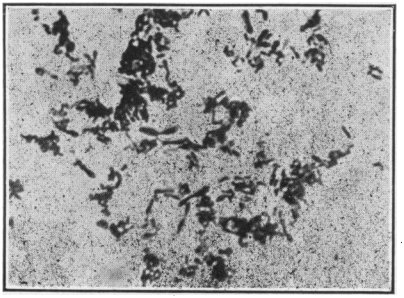


FIGURE 16.—Strep. series XIX. Bact. var. J 16, 19th transfer on agar.

sterile broth tube in the series and transferred daily in the same manner for as many days as seen fit. The needles thus carry over their own inoculum to each tube in succession. We have always carried as control one or more series employing identical technique, using a plain platinum or nicrome wire with the same strain of organisms. Furthermore, as a control against air contaminations, a sterile wire is similarly transferred in series daily from tube to tube of sterile broth.

Following this technique a strain of *Streptococcus scarlatinae* (N Y 5) has been irradiated in series 19 times and continued for at least 12 transfers (12 days), but usually many more. In some series we employed only one needle (5 mg). In others as many as seven (35 mg).

In 6 of the 19 series we obtained forms from the irradiated tubes that were morphologically, serologically, and culturally distinct from the original streptococcus. In every instance they were bacillary forms. In only 2 tubes of the entire 19 series did we obtain growth other than streptococcus in the nonirradiated controls. These were molds and developed many days after the tests had been completed and the tubes had been opened many times.

On the other hand, the irradiated tubes that produced variants could be recognized by a peculiar discoloration of the bacterial sediment in the bottom of the tube. The sediment turned a brown or dark brown color, and even the supernatant broth was considerably darker than the broth in the control tubes and in the other tubes of the irradiated series. The sediment appeared as if it had been scorched by the irradiation. The discoloration was observed to some extent in other tubes of the irradiated series, but it was never as distinct as in those tubes that produced a variant. It was not observed at the time of irradiation or even the following day, but always after several days, or in some cases as long as 10 days after irradiation.

When transplants were diluted out upon agar slants (rather than plated out) from these tubes, two distinct types of colonies were observed; one was the original streptococcus, while the other was a more vigorously growing variant.

No such changes took place in any of the nonirradiated control series, each of which was plated out to test for purity.

Additional evidence that these forms were genuine variants or mutants was obtained by observing in smears what seemed to be actual transitions of the streptococcal chains to the bacillary forms (figs. 7, 8, 9, 10, and 11).

In contrasting the corresponding tubes of the irradiated with the nonirradiated series one almost invariably noticed that the growth in the radium tubes was retarded for several hours; yet, after the needles

had been passed on to the next tube in the series, the growth frequently became more luxuriant and the organisms, as a rule, took a deeper stain than those in the corresponding control tubes.

STREPTOCOCCUS IRRADIATION, SERIES XIX (MARCH 31, 1933)

In the following are given the detailed results of one of the irradiated series in which a bacillary variant was observed. This series is selected for record because proof of the genuineness of the variant was furnished when certain sub-cultures reverted to the typical parent strain of streptococcus.

Material.—(*a*) Agglutination tubes 3-inches by ⅜-inch containing 1 cc of plain broth at a pH 7.4; (*b*) monel-metal needles containing 5 mg of radium each; (*c*) aluminum needles of approximately same size used as controls.

Technique.—After having been tested for sterility by boiling in 5 percent phenol and then incubating several days in broth, 4 of the radium needles were placed in the first tube of the series to be irradiated and at the same time the same tube was inoculated with one drop of a 24-hour broth culture of *S. scarlatinae*.

In order to exclude as nearly as possible the probability of contaminating organisms from the air, we set up, in addition to the irradiated series, six control series. The first three control series consisted simply of sterile broth tubes. One sterile aluminum needle was transferred each day from tube to tube, beginning with tube no. 1 and continuing to the next tube in each of the three series. The second of the three control series consisted of the transfer of *S. scarlatinae* daily by means of similar aluminum needles. Thus, we had 6 control series to 1 irradiated series, the technique of transfer being identical in all 7 (table 1).

TABLE 1.—*Irradiation of streptococcus scarlatinae—Serial daily transfers with plain and radium needles from tube to tube for 23 days*

Mar. 31, 1933.

Series no.	Method and material transferred	1 cc plain broth in agglutination tubes 3″×⅝″. Daily transfers																						
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1	Transfer of sterile plain needle	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
2	do	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
3	do	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
4	Transfer of Strep. with plain needle	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
5	do	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
6	do	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
7	Transfer of Strep. with radium needle	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	V	V	V	V	V	V	V	V

O=No growth.
+=Typical streptococcus growth.
V=Bacillary variant.

In the first tube of the 3 control series inoculated with the streptococcus, a good growth appeared in 6 hours. In the first tube of the irradiated series, some retardation of growth was observed in 4 hours when compared with the nonirradiated tubes, but after 24 hours no difference could be detected. All needles were transferred to the next succeeding tube daily for 23 days, the needles thus carrying over their own inoculum.

On the 11th day there were added to the 11th tube of the irradiated series 3 additional sterile radium needles, making a total of 35 mg of radium.

At the end of 23 days, all tubes of the three control series in which the streptococcus was transferred daily without irradiation showed grossly no unusual growths, and smears of all yielded only typical streptococci.

Visible changes occurred only in certain of the 23 tubes of the irradiated series. Previous experience had taught us that it would not be necessary to open and examine any of the irradiated series until visible gross changes occurred. The appearance of the first 15 tubes revealed nothing unusual.

From the 16th to the 23d tube, inclusive, however, the sediment turned a distinct brown to dark brown color several days after inoculation, and the supernatant fluid became distinctly more turbid than that in any of the other tubes.

Smears and transfers were then made of all 23 tubes of the irradiated series. From the first 15 only pure streptococci were seen and recovered. Tubes 16 to 23, however, yielded distinct bacillary forms, and when diluted out on agar slant tubes 2 distinct types of colony were visible. One was the typical fine, translucent colony of the normal streptococcus and the other was a much larger, decidedly more opaque, colony and grew more vigorously. These colonies yielded deeply pycnotic cocco-bacillary forms. They certainly appeared to be in no way related to the streptococcus and would easily be considered an entirely different species. However, when one of these isolated colonies was transplanted to both broth and agar slants, the growth in broth yielded a large number of streptococcus chains as well as scattered clumps of bacillary forms (figs. 12, 13, 14, and 15), while on agar the bacillary forms predominated, a few being coccoidal but none in chains. After a few transfers on agar, the chain formation could not be obtained even in broth.

The variant strain from the 16th tube in the irradiated series was transferred daily to both broth and agar for 6 days and thereafter has been transferred every 2 or 3 weeks for 6 months. In broth it grows very slowly, forming a heavy sediment at the bottom after a few days and a pellicle at the top. This pellicle formation has

gradually increased as transfers were continued. On agar the colonies are large, whitish, and opaque. The organisms themselves have always been deeply Gram-positive, and in our latter transfers the bacillary forms have become even larger and many unusual shapes are seen. At the present time it is distinctly pleomorphic (see fig. 16), but yields only one type of colony.

Transfers had been made from the original irradiated tubes nos. 16 to 23, inclusive, to broth daily for 6 days, and then these 48 tubes were left at room temperature for several months. The bacillary variant in all these tubes appeared to be the same, but only the one from tube no. 16 has been transferred regularly every 2 weeks on both broth and agar. Its sugar reactions are given in table 2.

TABLE 2.—*Sugar reactions of streptococcus variant J. 16*

	1 week	6 weeks
Adonital	O	alk.
Amagdylin	O	O.
Arabinose	O	alk.
Dextrine	O	alk.
Dulcitol	O	O.
Erythritol	O	O.
Galactose	O	O.
Glucose	a	a.
Glycerin	O	alk.
Inisitol	a	a.
Inulin	O	alk.
Lactose	O	alk.
Levulose	a	a.
Maltose	O	alk.
Mannitol	O	O.
Mannose	a	a.
Raffinose	O	alk.
Saccharose	O	alk.
Salacin	O	alk.
Sorbitol	O	O.
Starch	O	alk.
Trehalose	O	a (slight).
Xylose	O	a (trace).
Litmus milk	alk.	alk. and reduction.

O=No change in reaction.
a=Acid.
alk.=Alkaline.
Indole test was negative. Nitrates were markedly reduced. No hemolysis on blood agar. Gelatine was not liquefied. Gas was not produced in any sugar.

A pure culture of the bacillary variant from each of the original irradiated tubes nos. 16 to 23, inclusive, had been transferred to plain broth tubes for 6 successive days and all 48 tubes left at room temperature for several weeks. Transplants were then made from all these tubes to agar slants, using the same loops of culture upon several successive tubes in order to obtain single colonies. It was very surprising to find that only the 5th and 6th transfers from tubes nos. 19, 22, and 23 now yielded fine pinpoint colonies, the organisms of which possessed the typical streptococcus morphology. These organisms grew as fine hemolytic colonies on blood agar and agglutinated promptly in the specific immune serum prepared from the original NY 5 streptococcus strain. On the other hand, the transfers from all other tubes which had originally come from tubes nos. 16, 17, 18, 20, and 21 of the irradiated series yielded only the luxuriantly

growing bacillary variant which is nonhemolytic and is not related morphologically or serologically to the parent streptococcus strain. Furthermore, it should be emphasized that *only the 5th and 6th transfers* from nos. 19, 22, and 23 yielded the streptococcus. The 1st, 2d, 3d, and 4th transfers still yielded only the bacillary variant. Therefore, the streptococcus in the 5th and 6th tubes was derived from the bacillary variant in the first four transfers coming from the irradiated tubes 19, 22, and 23.

The original irradiated tubes had now dried up, so we returned to the first broth transfers from each of the 7 original irradiated tubes nos. 16 to 23, inclusive, which had remained at room temperature for 4 months. Again transfers to both broth and agar slants were made in series daily from all 7 and continued for 10 days. Only the bacillary variant was recovered, although it is recalled that similar transfers made earlier from the same tubes had yielded a pure streptococcus in the 5th and 6th transplants of tubes 19, 22, and 23. This means that cultures of a variant at one time capable of reverting to the parent strain by continued transfer are at another time incapable of reversion even when employing, as far as possible, the same technique.

In early transfer series of nos. 19, 22, and 23, even the 4th transfer could not be made to revert to the streptococcal type, although these 4th transfers were the same tubes just preceding those in the series which formerly did yield a streptococcus.

DISCUSSION OF STREPTOCOCCUS SCARLATINAE SERIES XIX

These results suggest that variability and constancy of bacterial strains are influenced by factors of which we have, as yet, little knowledge and control. It should be emphasized that the results here recorded could not be repeated regularly by employing, as far as possible, the identical technique. Since the irradiation of the streptococcus in series XIX, we have now completed a 20th series, in which the organisms were irradiated for 60 days without obtaining any changes whatever, and we have no explanation for the fact that the variation occurred in 6 series and failed to occur in 14. The same technique was employed in all, except for the fact that the amount of radium used was not always the same.

Although our results have been irregular, we believe them to be genuine because of the following observations:

1. There were six times as many control as irradiated tubes, none of which yielded any unusual forms.

2. Some of the bacillary variants did revert to the original streptococcus.

3. The first transfers from an isolated colony of the bacillary variant yielded a predominance of streptococcic forms *in broth* and

only bacillary forms *on agar*, even when the same inoculum was used. (Compare fig. 12 with fig. 13 and fig. 14 with fig. 15.)

Despite these convincing reasons for the genuineness of our observations, we have not been able to obtain similar results in 5 tests averaging about 40 transfers each and in which each experiment was carried out in the contamination-proof pyrex glass box described in the following paper. We have no explanation, as yet, for this disparity in results.

WHAT IS THE DIFFERENCE BETWEEN BACTERIAL VARIANTS AND MUTANTS?

Our knowledge of bacterial variation is, at present, so meager and inexact that we frequently employ the terms "variant" and "mutant" somewhat loosely. If we define a bacterial variant as "any strain that displays morphological, serological, or cultural characters different from its parent strain, but under suitable conditions can be made to reassume the characters of the parent strain", and a mutant as "any strain that will not under any conditions revert to the original type", then the bacillary form described in our "Streptococcus XIX" experiment was potentially both a variant and a mutant, since some of the transplants reverted and others have remained as bacillary forms for 2 years and still show no cultural, serological, or morphological relationship to a streptococcus.

Our tests seem to suggest, therefore, that genuine mutations, although extremely rare, do occur.

EFFECT OF CONTINUOUS IRRADIATION OF THE SAME CULTURE FOR 30 DAYS

The following tests suggest that continuous irradiation of the same culture over a very long period does not necessarily induce either variations or mutations.

Technique.—An apparatus was set up as shown in figure 17. It consisted of a collodion sack attached by means of rubber bands to one end of a large glass tube prepared by cutting off the butt of an ordinary test tube. The tube with the attached sack was plugged with cotton at the open end and made fast in the neck of a 1,000-cc Ehrlenmeyer flask by means of tightly fitting cotton wadding, permitting the sack to hang down in the flask. Two 5-mg radium needles were placed in the bottom of the sack. The flask and sack were then nearly filed with plain broth to the same level and the apparatus was sterilized for ½ hour at 15 pounds pressure.

Two such flasks were prepared and the fluid on the inside of the collodion sacks was inoculated with *S. scarlatinae* and *E. typhi*, respectively, and incubated for 30 days.

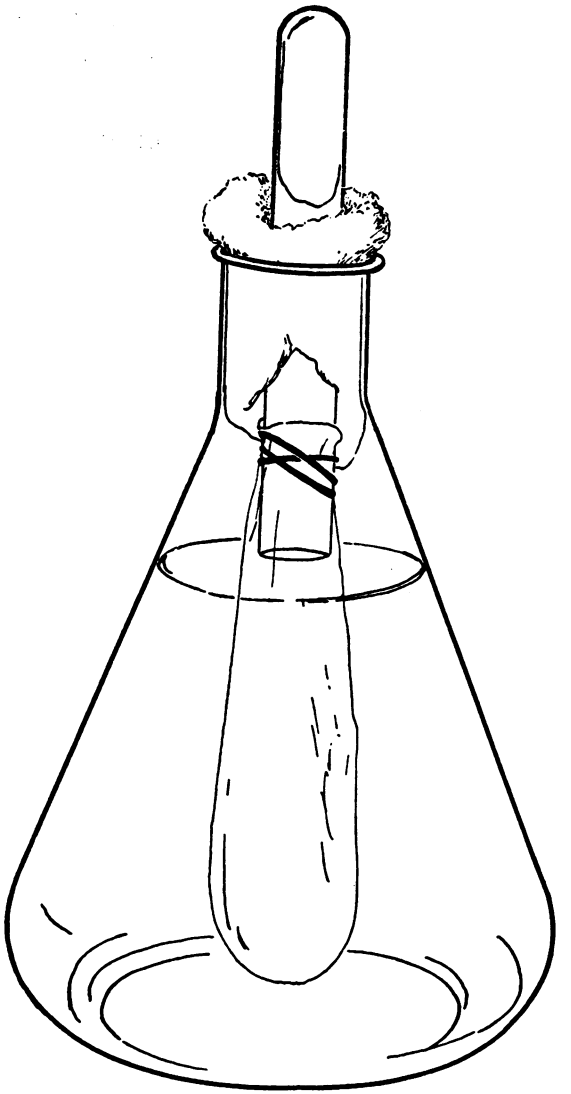


FIG. 17.—Apparatus for irradiation of bacterial culture in collodion sac surrounded by nutrient broth.

At the end of this period there was a heavy growth of organisms (pea soup in consistency) on the inside of each sack. The broth in the flasks surrounding the sacks remained clear and proved to be sterile on subsequent tests.

Repeated transplants were made from the organisms at the bottom of each sack and were diluted sufficiently to yield single isolated colonies on agar. In no instance was any growth obtained other than the pure *S. scarlatinae* and *E. typhi*.

This test demonstrates the extreme resistance of these bacterial strains to continuous irradiation for a period of 30 days and is interesting when compared with the statements of geneticists (Hanson and Hays, 1928) and (Oliver, 1930) that, in the irradiation of *Drosophila*, a doubling of the time of exposure doubled the number of mutations.

DISCUSSION

Our results would seem, at first, to suggest that bacteria are more insensitive to radium emanations than higher forms, in which there has been found a definite correlation between frequency of mutation and intensity and time of irradiation. However, we must remember that bacteria have apparently no morphologically definite chromosomes and the nucleus is assumed to be in the disperse form. In the absence of chromosomes there is no reason to assume any definite fixed order of the genic units such as occurs in the chromosomes of higher forms. These structural differences between bacterial cells and the cells of higher forms may account, in part, for the apparent random distribution of mutations which was actually observed. Furthermore, bacteria have no mechanism comparable to mitosis, which serves to insure both quantitative and qualitative equal distribution of the nuclear material to the daughter cells.

It should be emphasized that (*a*) the mutations observed in this research are not necessarily criteria of the actual number of mutations which occur nor of the ratio in which these mutations occur. (*b*) In bacterial cells with a disperse nucleus and no sexual reproduction it is impossible to be certain as to whether a given "mutation" is such in the sense ordinarily used, since it may be cytoplasmic and not a nuclear change. That cytoplasmic changes may be heritable until sexual reproduction intervenes has been shown by Jollos (Jollos, 1914). (*c*) In the higher organisms, e. g., *Drosophila*, by far the greater number of mutations are lethal. They may be demonstrated through breeding, but such a demonstration is probably impracticable if not impossible with bacteria.

At the present stage of our work we refrain from drawing any definite conclusions or making any generalizations. Much more work is needed. The data, however, have encouraged us to attempt

to employ a similar technique in the study of various organisms higher than bacteria in the biological scale which possess different types of nuclear structure in order to ascertain whether the type of result is, in fact, correlated with the nuclear morphology as here suggested.

SUMMARY

1. A graphic representation of the killing effect of the beta as compared with the gamma rays of radium is presented.

2. Evidence is also presented that irradiation of bacteria over many generations may induce at times (6 out of 20 tests), but not regularly, profound cultural and morphological changes.

3. Continuous irradiation of the same culture for 30 days produced no genetic changes. Five tests in contamination-proof boxes yielded no changes.

4. Irradiation of bacteria does not induce genetic changes as frequently as does irradiation of certain higher forms.

5. The probable reasons for this disparity are discussed.

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23192°—35——2

A TECHNIQUE WHICH COMPLETELY EXCLUDES AIR CONTAMINATION OF BACTERIAL CULTURES

By R. R. SPENCER, *Senior Surgeon, United States Public Health Service*

Even in specially equipped rooms with filtered air, one can never be absolutely sure that an occasional organism does not get into cultures when transfers are made in the open. A dust particle or spore may lodge on the wet wire loop during the process of transferring, or there is the possibility that organisms may reach the culture from the skin of the hands, from the hair, or from droplets in the expired air of the operator while talking, sneezing, or coughing.

Whenever a cotton plug is removed from any tube of bacterial culture media one runs the risk of contaminating the tube with air organisms.

For this reason, and because it was desired to carry out certain types of experiments in which it was necessary to exclude completely all possibility of air contaminations, we have developed the simple glass box apparatus described below. It has proved very satisfactory. Indeed we have succeeded in transferring pure cultures daily for several months (twice as long as 6 months) in this box, in which there were just as many sterile control broth tubes with stoppers off exposed to the air of the box as there were experimental tubes. Never have we had any contaminations develop in the control tubes unless the apparatus was improperly set up.

Figure 1 shows a diagram of the box, with dimensions, and figure 2 is a photograph of the box in use.

DESCRIPTION OF APPARATUS AND TECHNIQUE

Heat-resistant obstetrical gloves, with long gauntlets are placed over the 5-inch flanges at each end after the necessary media, forceps, and transfer needles have been placed in the box. Experience soon taught us that it was necessary to place a small amount of cotton between the outer edge of the flanges and the rubber gloves, the gauntlet ends of which are stretched over the flanges and secured by elastic rubber bands. The elasticity of the gloves alone is not sufficient to hold them in place when the hands are thrust in. The chimney at the top of the box is plugged with cotton and the apparatus is ready for autoclaving at 15 pounds pressure as long as necessary.

After the box has been sterilized and permitted to cool, one tube of the media can be inoculated through the chimney. In doing this, care should be taken to bring the tube very close up to the chimney before its cotton or rubber stopper is removed, and then the gloved hand which holds the tube to be inoculated should not be moved until after the cotton stopper of the chimney is again in place. Thus is prevented the suction of outside air into the box. After this first

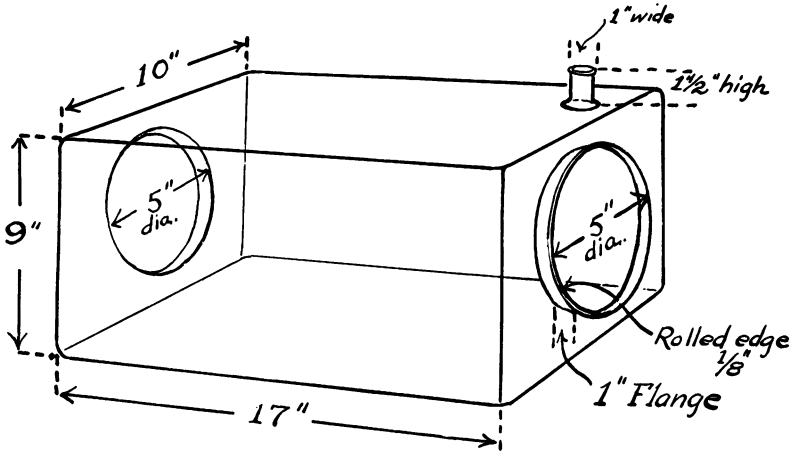

FIGURE 1.—Diagram showing dimensions of box.

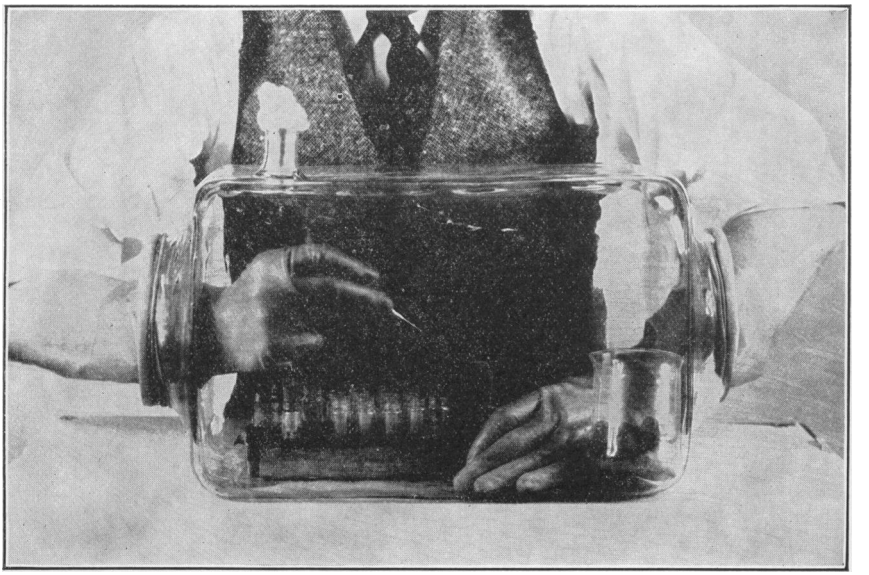

FIGURE 2.—Photograph showing box in use.

inoculation the box is never opened again until the experiment is completed.

Metal racks holding 40 to 60 homeopathic vials containing plain broth media have been employed. The apparatus does not lend itself readily to the use of solid media or plates if the experiment is long in duration, since solid media dries very rapidly and plates are not as easily manipulated as vials placed in racks. The vials may be left open or kept closed with rubber stoppers as desired. An equal number of sterile control tubes should be kept open throughout the experiment. Occasionally one of these uninoculated control tubes have shown a growth which subsequently proved to be the organism under test and was due to carelessness in making transfers. In no instance have we found extraneous organisms in any tubes.

We have found it impossible to use spore-bearing molds on solid media. The bellows action of the gloves when the hands are thrust into them sets up air currents which distribute the spores to every plate. Thus, liquid media is always to be preferred.

Because of its rather limited usefulness, this pyrex glass box is not on the market. It was manufactured on special order.[1]

Prior to the use of the glass boxes we had tried copper boxes with glass windows but found them unsatisfactory, because frequent sterilization soon produced air leaks in the aquarium cement used to seal the glass to the copper.

DEATHS DURING WEEK ENDED NOV. 2, 1935

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

	Week ended Nov. 2, 1935	Corresponding week, 1934
Data from 86 large cities of the United States:		
Total deaths	7,842	7,590
Deaths per 1,000 population, annual basis	10.9	10.6
Deaths under 1 year of age	510	597
Deaths under 1 year of age per 1,000 estimated live births	47	56
Deaths per 1,000 population, annual basis, first 44 weeks of year	11.3	11.3
Data from industrial insurance companies:		
Policies in force	67,661,227	67,051,927
Number of death claims	11,473	11,460
Death claims per 1,000 policies in force, annual rate	8.8	8.9
Death claims per 1,000 policies, first 44 weeks of year, annual rate	9.6	9.9

[1] The name of the manufacturer will be supplied on request.

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 Nov. 9, 1935, and Nov. 10, 1934

Cases of certain communicable diseases reported by telegraph by State health officers for weeks ended Nov. 9, 1935, and Nov. 10, 1934

Division and State	Diphtheria		Influenza		Measles		Meningococcus meningitis	
	Week ended Nov. 9, 1935	Week ended Nov. 10, 1934	Week ended Nov. 9, 1935	Week ended Nov. 10, 1934	Week ended Nov. 9, 1935	Week ended Nov. 10, 1934	Week ended Nov. 9, 1935	Week ended Nov. 10, 1934
New England States:								
Maine	2	2	----	----	106	20	0	0
New Hampshire	----	----	----	----	----	----	0	0
Vermont	1	----	----	----	21	----	0	0
Massachusetts	8	19	----	----	82	65	0	1
Rhode Island	----	1	----	----	4	----	0	0
Connecticut	2	8	1	----	32	145	0	0
Middle Atlantic States:								
New York	39	41	[1]5	[1]18	411	544	9	2
New Jersey	10	17	6	5	12	26	0	1
Pennsylvania	39	69	----	----	73	347	5	3
East North Central States:								
Ohio	69	54	2	5	56	130	1	1
Indiana	105	69	31	19	9	85	3	0
Illinois	103	98	12	8	13	180	9	2
Michigan	7	25	1	4	26	60	1	0
Wisconsin	6	6	42	4	52	144	1	0
West North Central States:								
Minnesota	20	8	----	1	39	59	0	0
Iowa	16	13	2	2	6	46	2	1
Missouri	82	57	64	30	9	74	4	0
North Dakota	1	8	----	----	13	68	0	0
South Dakota	1	1	----	----	----	10	2	0
Nebraska	6	1	----	4	13	2	0	1
Kansas	12	16	----	2	4	45	4	0
South Atlantic States:								
Delaware	1	2	----	----	29	----	0	0
Maryland [2]	13	29	6	7	2	37	2	0
District of Columbia	18	11	1	1	2	1	2	1
Virginia	86	99	----	----	18	124	1	4
West Virginia	48	58	10	51	3	48	1	0
North Carolina [3]	105	96	8	4	1	38	2	1
South Carolina [3]	13	16	114	221	----	5	0	0
Georgia [3]	50	49	----	----	----	----	0	2
Florida	17	11	2	----	----	2	1	0
East South Central States:								
Kentucky	68	86	6	12	44	120	0	4
Tennessee [3]	54	36	22	24	----	9	2	0
Alabama [3]	37	43	35	41	----	12	2	0
Mississippi [3]	24	27	----	----	----	----	1	0

Cases of certain communicable diseases reported by telegraph by State health officers for weeks ended Nov. 9, 1935, and Nov. 10, 1934—Continued

Division and State	Diphtheria		Influenza		Measles		Meningococcus meningitis	
	Week ended Nov. 9, 1935	Week ended Nov. 10, 1934	Week ended Nov. 9, 1935	Week ended Nov. 10, 1934	Week ended Nov. 9, 1935	Week ended Nov. 10, 1934	Week ended Nov. 9, 1935	Week ended Nov. 10, 1934
West South Central States:								
Arkansas	20	33	2	31	3	1	0	1
Louisiana	23	31	13	7	13	2	3	1
Oklahoma [4]	18	14	15	37	4	2	5	0
Texas [3]	178	73	137	179	12	44	0	1
Mountain States:								
Montana	3	9	5	8	15	72	1	0
Idaho					8		0	0
Wyoming	2	2			13	2	0	0
Colorado	11	3		1	2	134	1	0
New Mexico	8	9	3			31	0	0
Arizona		3	15	4			1	0
Utah [2]					4	14	0	0
Pacific States:								
Washington	3	1		1	49	99	0	0
Oregon	1		24	17	97	4	0	0
California	54	49	32	18	154	152	5	0
Total	1,384	1,303	616	766	1,454	3,003	71	27
First 45 weeks of year	30,393	32,567	110,137	55,499	705,615	683,515	4,938	1,991

Division and State	Poliomyelitis		Scarlet fever		Smallpox		Typhoid fever	
	Week ended Nov. 9, 1935	Week ended Nov. 10, 1934	Week ended Nov. 9, 1935	Week ended Nov. 10, 1934	Week ended Nov. 9, 1935	Week ended Nov. 10, 1934	Week ended Nov. 9, 1935	Week ended Nov. 10, 1934
New England States:								
Maine	6	0	14	30	0	0	1	4
New Hampshire	0	0	4	8	0	0	0	0
Vermont	1	0	4	14	0	0	0	2
Massachusetts	26	3	191	132	0	0	3	3
Rhode Island	3	0	7	7	0	0	0	0
Connecticut	7	0	32	37	0	0	1	0
Middle Atlantic States:								
New York	25	2	330	294	0	0	13	9
New Jersey	12	0	67	74	0	0	1	2
Pennsylvania	3	6	354	408	0	0	13	26
East North Central States:								
Ohio	2	3	242	373	0	0	10	16
Indiana	3	2	162	148	1	5	5	8
Illinois	6	4	451	516	1	0	17	29
Michigan	8	3	155	206	0	0	6	10
Wisconsin	1	1	315	382	15	20	2	2
West North Central States:								
Minnesota	0	6	233	77	0	11	1	0
Iowa	2	2	97	76	3	2	3	3
Missouri	2	2	100	77	2	2	9	12
North Dakota	3	0	40	18	1	0	0	1
South Dakota	0	0	34	11	11	0	0	0
Nebraska	0	1	31	23	9	9	0	2
Kansas	4	4	90	65	6	1	7	8
South Atlantic States:								
Delaware	0	0	19	5	0	0	1	0
Maryland [2]	4	1	93	86	0	0	22	7
District of Columbia	1	0	10	31	0	0	1	1
Virginia	2	1	56	144	0	0	25	9
West Virginia	2	0	146	149	0	0	10	14
North Carolina [3]	1	2	90	97	2	0	19	2
South Carolina [3]	0	2	5	10	0	0	8	8
Georgia [3]	1	0	22	20	0	0	4	7
Florida	0	1	8	9	0	0	0	1
East South Central States:								
Kentucky	8	7	84	121	0	1	12	52
Tennessee [3]	1	1	71	85	0	0	8	9
Alabama [3]	0	1	23	18	0	0	5	3
Mississippi [3]	0	0	19	27	0	0	5	10

See footnotes at end of table.

Cases of certain communicable diseases reported by telegraph by State health officers for weeks ended Nov. 9, 1935, and Nov. 10, 1934—Continued

Division and State	Poliomyelitis		Scarlet fever		Smallpox		Typhoid fever	
	Week ended Nov. 9, 1935	Week ended Nov. 10, 1934	Week ended Nov. 9, 1935	Week ended Nov. 10, 1934	Week ended Nov. 9, 1935	Week ended Nov. 10, 1934	Week ended Nov. 9, 1935	Week ended Nov. 10, 1934
West South Central States:								
Arkansas	1	0	10	23	1	1	4	13
Louisiana	4	1	17	25	0	0	14	12
Oklahoma [4]	1	0	14	20	0	4	15	10
Texas [3]	4	4	78	44	0	0	25	47
Mountain States:								
Montana	0	5	161	12	34	0	0	4
Idaho	0	1	54	9	0	1	7	2
Wyoming	0	0	16	25	1	1	2	0
Colorado	0	0	106	123	4	3	1	2
New Mexico	0	0	15	29	0	0	22	29
Arizona	0	0	28	21	0	0	0	12
Utah [3]	0	0	69	29	0	0	0	1
Pacific States:								
Washington	3	16	72	43	25	22	0	3
Oregon	0	4	45	57	0	0	2	1
California	8	26	235	163	0	1	14	13
Total	155	112	4,519	4,401	116	84	318	409
First 45 weeks of year	10,147	6,871	211,969	178,988	5,874	4,332	15,996	18,920

[1] New York City only.
[2] Week ended earlier than Saturday.
[3] Typhus fever: North Carolina, 1; South Carolina, 2; Georgia, 13; Tennessee, 1; Alabama, 9; Texas, 1.
[4] 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
October 1935										
Connecticut	1	26	6	1	225	-------	67	138	0	11
Delaware	1	2	-------	1	158	-------	0	29	0	14
Georgia	7	147	54	415	5	8	3	111	-------	62
Indiana	8	470	103	2	50	-------	13	622	6	26
Iowa	4	75	7	-------	7	-------	13	353	24	33
Missouri	15	307	198	89	76	1	8	506	8	54
New Mexico	1	35	5	7	28	2	0	57	0	112
North Carolina	11	448	31	-------	8	53	28	386	1	53
Vermont	-------	8	-------	-------	138	-------	17	40	0	2
Wyoming	3	8	-------	-------	64	-------	0	82	-------	0

October 1935

Chicken pox:	Cases
Connecticut	183
Delaware	85
Georgia	5
Indiana	226
Iowa	149
Missouri	124
New Mexico	53
North Carolina	90
Vermont	194
Wyoming	40
Conjunctivitis, Infectious:	
Connecticut	3
Georgia	9
New Mexico	1

Dengue:	Cases
Georgia	4
Dysentery:	
Connecticut (amoebic)	1
Connecticut (bacillary)	8
Georgia (amoebic)	7
Georgia (bacillary)	4
Missouri	21
New Mexico (amoebic)	2
New Mexico (bacillary)	4
New Mexico (unspecified)	4
Epidemic encephalitis:	
Indiana	1
Iowa	1
New Mexico	1

Favus:	Cases
Connecticut	1
Food poisoning:	
New Mexico	1
German measles:	
Connecticut	25
Iowa	1
New Mexico	1
North Carolina	9
Vermont	20
Hookworm disease:	
Georgia	404
Ipetigo contagiosa:	
Iowa	11

October 1935—Continued

Mumps:	Cases
Connecticut	82
Deleware	4
Georgia	27
Indiana	76
Iowa	219
Missouri	83
New Mexico	55
Wyoming	13
Ophthalmia neonatorum:	
Connecticut	1
North Carolina	3
Paratyphoid fever:	
Georgia	1
North Carolina	4
Puerperal septicemia:	
New Mexico	3
Rabies in animals:	
Missouri	1
Rabies in man:	
North Carolina	1
Screw worm infection:	
Georgia	1

Rocky Mountain spotted fever:	Cases
North Carolina	1
Septic sore throat:	
Connecticut	7
Georgia	19
Iowa	1
Missouri	43
New Mexico	6
North Carolina	13
Wyoming	1
Tetanus:	
Connecticut	1
Georgia	1
Missouri	1
New Mexico	1
Trachoma:	
Missouri	25
North Carolina	1
Trichinosis:	
Connecticut	4
Tularaemia:	
Georgia	2
Iowa	1
Missouri	1

Typhus fever:	Cases
Georgia	46
North Carolina	2
Undulant fever:	
Connecticut	6
Delaware	1
Georgia	2
Indiana	1
Iowa	11
Missouri	3
New Mexico	1
North Carolina	1
Vermont	3
Whooping cough:	
Connecticut	199
Delaware	5
Georgia	21
Indiana	109
Iowa	85
Missouri	76
New Mexico	36
North Carolina	133
Vermont	130
Wyoming	21

WEEKLY REPORT FROM CITIES

City reports for week ended Nov. 2, 1935

This table summarizes the reports received weekly from a selected list of 140 cities for the purpose of showing a cross section of the current urban incidence of the communicable diseases listed in the table. Weekly reports are received from about 700 cities, from which the data are tabulated and filed for reference.

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Maine:											
Portland	0	------	0	0	4	1	0	1	1	3	21
New Hampshire:											
Concord	0	------	0	0	1	0	0	0	0	0	5
Nashua	0	------	--------	0	-------	1	0	-------	0	0	--------
Vermont:											
Barre	0	------	0	0	0	0	0	0	0	0	2
Burlington	0	------	0	0	0	0	0	0	0	0	9
Rutland	0	------	0	0	0	3	0	0	1	0	11
Massachusetts:											
Boston	2	------	2	1	17	31	0	8	0	5	193
Fall River	2	------	0	0	3	4	0	2	1	0	31
Springfield	0	------	0	0	1	0	0	3	0	11	30
Worcester	0	------	0	0	3	20	0	0	0	0	35
Rhode Island:											
Pawtucket	0	------	0	0	0	0	0	0	0	0	13
Providence	2	------	0	0	4	10	0	2	0	3	65
Connecticut:											
Bridgeport	1	1	0	0	2	0	0	0	1	0	22
Hartford	1	------	0	0	4	1	0	0	0	11	53
New Haven	0	------	1	0	0	0	0	1	0	10	38
New York:											
Buffalo	1	------	0	15	12	33	0	6	0	3	144
New York	28	8	1	48	92	71	0	76	8	108	1,332
Rochester	0	------	0	3	8	3	0	0	0	5	76
Syracuse	0	------	0	1	5	8	0	1	1	15	53
New Jersey:											
Camden	1	1	0	0	1	3	0	1	0	2	23
Newark	0	------	0	0	6	21	0	10	0	16	87
Trenton	1	------	0	0	1	2	0	0	0	3	38
Pennsylvania:											
Philadelphia	3	2	1	27	32	86	0	19	1	82	426
Pittsburgh	1	2	0	4	11	58	0	6	0	25	150
Reading	0	------	0	1	2	4	0	1	0	2	35
Scranton	0	------	--------	0	-------	1	0	-------	0	0	--------
Ohio:											
Cincinnati	11	0	2	4	13	16	0	5	0	17	129
Cleveland	7	19	1	2	11	21	0	9	1	25	176
Columbus	12	2	2	1	1	17	0	4	0	2	90
Toledo	0	------	0	0	4	6	0	1	0	14	61

City reports for week ended Nov. 2, 1935—Continued

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Indiana:											
Anderson	0	------	0	0	1	7	0	0	0	0	10
Fort Wayne	13	------	0	0	3	9	0	0	0	0	32
Indianapolis	9	------	0	1	10	21	0	5	0	13	93
Muncie	0	------	0	4	2	0	0	0	0	0	15
South Bend	0	------	0	0	2	2	0	0	0	1	23
Terre Haute	0	------	0	0	0	3	0	0	0	0	22
Illinois:											
Alton	8	------	0	0	1	7	0	0	0	0	12
Chicago	9	4	1	10	31	130	0	31	1	72	644
Elgin	0	------	0	0	1	5	0	0	0	0	13
Moline	0	------	0	0	0	0	0	0	0	0	9
Springfield	0	------	0	0	4	1	0	0	0	2	25
Michigan:											
Detroit	11	------	2	2	20	34	0	15	3	129	254
Flint	0	------	0	2	0	9	0	0	0	4	20
Grand Rapids	0	------	1	1	0	5	0	0	0	9	29
Wisconsin:											
Kenosha	0	------	0	0	0	8	0	0	0	15	8
Milwaukee	0	1	1	0	1	41	0	6	0	53	101
Racine	0	------	0	1	0	28	0	0	0	8	11
Superior	1	------	0	0	0	4	0	0	0	2	8
Minnesota:											
Duluth	0	------	0	0	0	1	0	0	0	1	21
Minneapolis	5	------	0	2	7	83	0	0	0	5	84
St. Paul	0	------	0	0	4	28	0	1	0	1	52
Iowa:											
Cedar Rapids	0	------	0	0	0	3	0	0	0	1	--------
Davenport	0	------	--------	2	--------	5	0	--------	0	0	--------
Des Moines	0	------	--------	0	--------	13	0	--------	0	1	21
Sioux City	0	------	--------	1	--------	3	0	--------	0	0	--------
Waterloo	5	------	--------	0	--------	7	0	--------	0	0	--------
Missouri:											
Kansas City	3	------	0	1	11	12	0	7	0	0	118
St. Joseph	13	------	0	0	1	1	0	0	0	0	33
St. Louis	19	------	--------	2	4	30	0	5	1	3	214
North Dakota:											
Fargo	0	------	0	2	1	7	0	0	0	0	5
Grand Forks	0	------	--------	2	--------	0	0	--------	0	0	--------
Minot	0	------	0	3	0	0	0	0	0	0	4
South Dakota:											
Aberdeen	0	------	--------	0	--------	0	0	--------	0	0	--------
Nebraska:											
Omaha	9	0	--------	0	3	18	1	2	0	0	61
Kansas:											
Lawrence	0	------	0	0	0	0	0	0	0	0	6
Topeka	0	------	0	0	6	1	0	0	0	1	37
Wichita	0	------	0	0	4	3	0	2	0	0	23
Delaware:											
Wilmington	0	------	0	0	5	3	0	0	0	1	24
Maryland:											
Baltimore	1	1	1	4	17	32	0	7	1	19	197
Cumberland	2	------	0	0	0	1	0	0	0	0	15
Frederick	0	------	0	0	1	0	0	0	0	0	4
District of Col.:											
Washington	24	2	0	0	12	6	0	11	0	3	145
Virginia:											
Lynchburg	1	------	--------	--------	1	2	0	1	0	2	16
Norfolk	3	------	0	0	3	2	0	1	0	0	24
Richmond	2	------	0	0	6	4	0	0	0	0	58
Roanoke	2	------	0	0	2	3	0	0	0	0	19
West Virginia:											
Charleston	2	------	0	1	2	4	0	0	0	5	26
Huntington	3	------	--------	0	--------	13	0	--------	0	0	--------
Wheeling	1	------	1	0	2	5	0	0	1	0	16
North Carolina:											
Gastonia	1	------	0	0	0	1	0	0	0	0	2
Raleigh	0	------	0	0	0	1	0	1	0	0	9
Wilmington	1	------	1	0	1	0	0	3	0	3	14
Winston-Salem	3	------	0	1	1	9	0	1	0	0	14
South Carolina:											
Charleston	0	3	0	0	3	1	0	0	0	0	25
Columbia	--------	------	--------	--------	--------	--------	--------	--------	--------	--------	--------
Florence	0	------	0	0	2	0	0	0	0	0	12
Greenville	1	------	0	1	1	1	0	0	0	2	16

City reports for week ended Nov. 2, 1935—Continued

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Georgia:											
Atlanta	1	1	0	0	8	12	0	4	3	0	87
Brunswick	0	------	0	0	1	0	0	1	0	0	2
Savannah	2	3	0	0	2	5	0	0	1	1	33
Florida:											
Miami	1	------	0	0	1	0	0	1	0	0	31
Tampa	8	------	0	0	0	1	0	0	0	0	25
Kentucky:											
Ashland	3	------	--------	0	-------	2	0	-------	0	0	--------
Covington	0	------	0	1	1	2	0	0	0	0	13
Lexington	0	------	0	0	1	1	0	1	1	0	21
Louisville	4	------	0	2	4	14	0	6	3	1	69
Tennessee:											
Knoxville	5	------	0	0	2	1	0	1	0	0	29
Memphis	4	------	2	0	5	7	0	5	0	3	67
Nashville	0	------	1	0	3	5	0	0	1	0	65
Alabama:											
Birmingham	3	1	1	0	1	5	0	4	2	0	57
Mobile	3	------	0	0	1	1	0	2	0	0	25
Montgomery	1	------	--------	0	-------	1	0	-------	0	1	--------
Arkansas:											
Fort Smith	2	------	--------	0	-------	1	0	-------	0	0	--------
Little Rock	0	------	0	0	4	1	0	1	0	0	6
Louisiana:											
Lake Charles	0	------	0	0	1	0	0	0	0	0	7
New Orleans	6	------	0	0	7	6	0	9	0	10	143
Shreveport	0	------	0	0	3	1	0	0	0	0	24
Oklahoma:											
Oklahoma City	2	------	0	0	1	5	0	0	0	2	52
Texas:											
Dallas	11	------	0	0	4	8	0	3	0	1	62
Fort Worth	12	------	--------	0	-------	6	0	3	-------	0	26
Galveston	3	------	0	0	0	0	0	2	0	0	14
Houston	11	------	0	0	9	3	0	5	0	0	67
San Antonio	2	------	2	0	1	2	0	10	0	0	61
Montana:											
Billings	0	------	0	1	0	3	0	0	0	9	7
Great Falls	0	------	0	0	1	1	0	0	0	6	5
Helena	0	------	0	0	0	0	0	0	0	0	1
Missoula	0	------	0	0	1	22	1	0	0	0	5
Idaho:											
Boise	0	------	0	0	1	3	0	0	0	0	8
Colorado:											
Colorado Springs	0	------	0	0	3	7	0	1	0	9	15
Denver	6	------	0	3	6	18	0	11	0	3	97
Pueblo	0	------	0	0	1	16	0	0	0	0	15
New Mexico:											
Albuquerque	0	------	0	0	2	2	0	1	1	0	14
Utah:											
Salt Lake City	0	------	0	0	2	24	0	0	0	10	20
Nevada:											
Reno	-------	------	--------	-------	-------	-------	-------	-------	-------	--------	--------
Washington:											
Seattle	0	------	--------	1	6	10	0	1	0	3	90
Spokane	2	------	--------	7	4	0	2	-------	0	1	46
Tacoma	0	------	0	1	0	6	0	1	0	0	27
Oregon:											
Portland	0	------	2	2	2	9	0	1	1	2	72
Salem	0	------	--------	0	-------	2	0	-------	0	0	--------
California:											
Los Angeles	12	12	0	24	23	33	0	0	0	11	314
Sacramento	12	------	0	0	1	21	0	1	0	5	25
San Francisco	2	1	0	27	7	15	0	8	1	24	151

City Reports for week ended Nov. 2, 1935—Continued

State and city	Meningococcus meningitis		Poliomyelitis cases
	Cases	Deaths	
Vermont:			
Burlington	1	1	0
Massachusetts:			
Boston	1	0	12
Fall River	0	0	2
Springfield	0	0	1
Worcester	0	0	3
Rhode Island:			
Providence	0	1	0
Connecticut:			
New Haven	0	0	1
New York:			
New York	4	6	10
Syracuse	0	0	2
New Jersey:			
Newark	0	0	1
Pennsylvania:			
Philadelphia	2	1	1
Ohio:			
Cincinnati	0	0	0
Indiana:			
Muncie	1	1	0
Illinois:			
Alton	0	2	0
Chicago	1	0	0
Springfield	1	0	0
Michigan:			
Detroit	0	0	3
Flint	1	0	0
Iowa:			
Sioux City	1	0	0
Missouri:			
Kansas City	0	0	1
St. Louis	2	0	1
Nebraska:			
Omaha	1	0	0
Maryland:			
Baltimore	3	0	0
District of Columbia:			
Washington	2	0	1
Virginia:			
Richmond	0	1	0
South Carolina:			
Charleston	0	1	0
Georgia:			
Atlanta	1	0	0
Kentucky:			
Louisville	0	0	1
Alabama:			
Birmingham	1	0	0
Louisiana:			
New Orleans	1	1	0
Oklahoma:			
Oklahoma City	0	1	0
Montana:			
Missoula	1	0	0
Colorado:			
Colorado Springs	0	0	1
Utah:			
Salt Lake City	0	0	1
Washington:			
Seattle	2	2	0
Spokane	1	0	0
California:			
Los Angeles	2	1	3
San Francisco	1	0	0

Epidemic encephalitis.—Cases: Chicago, 1; Sacramento, 1.
Pellagra.—Cases: Winston-Salem, 2; Charleston, S. C., 1; Atlanta, 1; Savannah, 1; Louisville, 1; Los Angeles, 1.
Typhus fever.—Cases: Atlanta, 1; Tampa, 1.

FOREIGN AND INSULAR

BRITISH WEST INDIES

Barbados—Vital statistics—1934.—Following are vital statistics for Barbados, British West Indies, for 1934:

Number of marriages	1,011	Number of deaths	4,176
Marriages per 1,000 population	11.2	Deaths per 1,000 population	23.04
Number of births	5,380	Deaths under 1 year of age	1,376
Births per 1,000 population	29.44		

CUBA

Habana—Communicable diseases—4 weeks ended October 26, 1935.—During the 4 weeks ended October 26, 1935, certain communicable diseases were reported in Habana, Cuba, as follows:

Disease	Cases	Deaths	Disease	Cases	Deaths
Diphtheria	7	3	Tuberculosis	47	4
Malaria	[1] 126		Typhoid fever	[1] 36	10
Measles	4				

[1] Includes imported cases.

Provinces—Notifiable diseases—4 weeks ended October 19, 1935.—During the 4 weeks ended October 19, 1935, cases of certain notifiable diseases were reported in the provinces of Cuba as follows:

Disease	Pinar del Rio	Habana	Matanzas	Santa Clara	Camaguey	Oriente	Total
Cancer		2		2	1		5
Diphtheria		2	1	1			4
Hookworm disease						1	1
Leprosy						7	7
Malaria	876	86	48	555	565	449	2,579
Measles		1		4	2		7
Poliomyelitis				2	1	1	4
Scarlet fever	1						1
Tuberculosis	5	12	19	26	24	20	106
Typhoid fever	1	35	6	52	58	10	162

HAWAII TERRITORY

Honolulu—Influenza.—A report dated November 14, 1935, stated that there were on that day about 5,000 cases of influenza in Honolulu, 3,000 of them among school children. The outbreak began about November 1. The disease was of the respiratory type, mild, and no death had been reported.

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

NOTE.—A table giving current information of the world prevalence of quarantinable diseases appeared in the PUBLIC HEALTH REPORTS for October 25, 1935, pages 1512-1526. A similar cumulative table will appear in the PUBLIC HEALTH REPORTS to be issued November 29, 1935, and thereafter, at least for the time being, in the issue published on the last Friday of each month.

Cholera

India (French)—Karikal.—During the week ended November 2, 1935, 1 case of cholera was reported at Karikal, French India.

Plague

Hawaii Territory—Hawaii Island—Hamakua District.—Plague-infected rats have been reported in Hamakua District, Hawaii Island, Hawaii Territory, as follows: 1 plague-infected rat at Kukaiau, on October 29 and 1 on October 31, 1935, and 1 plague-infected rat at Paauhau on October 26, 1935.

Smallpox

Iraq—Baghdad.—During the week ended November 2, 1935, 1 case of smallpox was reported at Baghdad, Iraq.

Mexico.—During the month of August 1935, smallpox was reported in Mexico, as follows: Guanajuato State, Leon, 2 cases, 2 deaths; Jalisco State, Guadalajara, 1 case, 1 death; Mexico, D. F., 4 cases, 2 deaths; Mexico City, 31 cases, 12 deaths; Oaxaca State, 23 cases; Puebla State, Puebla, 1 case; San Luis Potosi State, San Luis Potosi, 5 cases, 2 deaths; Vera Cruz State, 2 cases; Vera Cruz, 1 case.

Typhus fever

Mexico.—During the month of August 1935, typhus fever was reported in Mexico, as follows: Coahuila State, 1 case; Guanajuato State, 1 case, 1 death; Leon, 6 cases, 2 deaths; Jalisco State, 7 cases, 1 death; Guadalajara, 1 case, 1 death; Mexico State, 15 cases, 1 death; Mexico, D. F., 4 cases, 2 deaths; Mexico City, 155 cases, 60 deaths; Nayarit State, 2 cases, 6 deaths; Oaxaca State, 6 cases; Puebla State, Puebla, 9 cases, 1 death; Queretaro State, 5 cases, 5 deaths; San Luis Potosi State, 2 cases; San Luis Potosi, 1 case; Sonora State, 4 cases; Vera Cruz State, 5 cases; Vera Cruz, 2 cases, 1 death.

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