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EXPERIMENTAL TRANSMISSION OF TULARÆMIA BY MOSQUITOES

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Few pathogenic organisms show the ready adaptability of *Bacterium tularense* to varying host and environmental conditions. This is indicated by the diverse and unusual means by which tularæmia infection can be acquired by man, and by the several vectors of wide taxonomic distribution which are capable of natural or experimental transmission of the disease. Of the several groups of arthropods known or suspected to be concerned in the transmission of tularæmia, present evidence indicates that ticks are the most important both from the standpoint of the maintenance of infection in nature and its transfer to man. Among biting insects, however, one species is a proved mechanical carrier, several more having suitable host relationships have been shown experimentally to be potential transmitters, while still others are suspected agents because of circumstantial data. Mosquitoes are among the last group, and experiments planned to determine their possible rôle in the transmission of this infection are reported in this paper.

Several cases of human infection are on record in which mosquitoes have been suggested as possible vectors. Brown and Brown (1925) report the case of a man at El Paso, Tex., who was bitten on the cheek by what he presumed to be "a large mosquito." The time of day, 8 p. m., rather precludes deer-fly activity and strengthens his presumption. Geiger and Meyer (1929) list a case from Pine Valley, Nev., which was "attributed to mosquito bite." Two cases in which mosquitoes are mentioned, but other biting flies are not excluded, are tabulated in the Weekly Bulletin of the California State Department of Public Health (vol. 8, No. 43, 1929). In addition, a case which was associated with mosquito bite was reported near Ismay, Mont., by a physician well acquainted with the disease. All the above cases, excepting the last case, were confirmed as tularæmia by laboratory tests. All were of the ulcero-glandular type, and in all but the Pine Valley case, in which the location of the ulcer is not mentioned, the primary lesion occurred on the face.

[1] Contribution from the Rocky Mountain Spotted Fever Laboratory, Hamilton, Mont.

METHODS

In all but one of the following experiments the B. C. strain of *Bact. tularense* was used. This strain was recovered from a snowshoe rabbit in British Columbia (Parker, Hearle, and Bruce, 1931), and has been maintained by guinea pig passage since May, 1930. In guinea pigs it has been invariably fatal.

All species of mosquitoes used, excepting *Aëdes aegypti* Linn., were collected in the Bitterroot Valley. Some of them are rather widespread in the United States and Canada. Eggs of *A. aegypti* were obtained through the courtesy of Dr. Henry Beeuwkes, of the International Health Division, Rockefeller Foundation. This species was obtained for two reasons: First, it bites and breeds readily in captivity and is easily handled under cage conditions; and, second, it is a known vector of disease and might possibly prove a better host for the etiologic agent than local species.

All adult mosquitoes were reared from larvæ and pupæ taken in the field or, in the case of *A. aegypti*, from eggs laid in the laboratory. The technique of handling and sorting experimental lots was the same as that used by one of us (Philip, 1930, 1931) in experiments on yellow-fever transmission. Each lot was fed on an infected animal in a moribund condition and the blood-gorged specimens were segregated for subsequent testing. All injections of mosquito suspensions in salt solution were made intraperitoneally.

Guinea pigs surviving the experiments were routinely proved susceptible by testing with known infectious materials after varying periods of observation. Crucial tests involving positive transmission of *Bact. tularense*, as noted below, were checked by isolation of pure cultures which were agglutinated to titer by antitularense rabbit serum.

The period of survival in those test animals which became infected varied between a minimum of 2 and a maximum of 28 days, but was most frequently 4 to 7 days. Those dying on the second and twenty-eighth days exhibited just as typical lesions as did those dying after the usual course. Of the two animals which died on the second day, one had received 3 *A. nearcticus*, lot 1, and the other 1 *A. stimulans*, lot 13b, 1 and 7 days, respectively, after original infection of the mosquitoes involved. One animal, exhibiting the maximum period, died 28 days after injection of 1 *A. aegypti* 14 days after its infecting blood meal (see control, lot 9b, Table 2).

The few animals which died following unusually long periods after incubation were all associated with tests of relatively old mosquitoes of lots in which recoverable infection was just disappearing. This suggests some qualitative change of the organism resulting in decrease of virulence with continued residence in certain species.

EXPERIMENTAL

The following local species of mosquitoes were tested under various experimental conditions: *Aëdes canadensis*, 5 lots; *A. dorsalis*, 1 lot; *A. nearcticus*, 2 lots; *A. stimulans*, 5 lots; and *A. vexans*, 4 lots; *Theobaldia incidens*, 1 lot; *Culex tarsalis*, 1 lot. In addition 17 lots of *A. aegypti* were used.

Answers were desired to the following five questions: (1) Does *Bact. tularense* remain viable when ingested with the blood meal of mosquitoes feeding upon infected animals, and what is the duration of such viability? If the infection does persist after ingestion: (2) Can it be transferred to normal hosts by biting or by the crushing of the mosquitoes on the skin, or both? If by biting, is a period of incubation in the insect necessary? (3) Can *Bact. tularense* be transmitted by infected females to their offspring? (4) Is the excrement of such females infective and for how long after original infection? (5) Can males become infected by copulation with infected females?

(1) VIABILITY OF TULARÆMIA ORGANISMS IN MOSQUITOES

It was soon determined that various species of mosquitoes fed on infected guinea pigs retained the infection. In establishing the longevity of *Bact. tularense* in an infected lot, a few of the mosquitoes were removed from the cage at certain intervals after feeding, stupefied with tobacco smoke, macerated in physiological salt solution, and injected intraperitoneally into normal guinea pigs.

TABLE 1.—*The observed duration of Bact. tularense in mosquitoes as determined by injection into guinea pigs* [1]

Lot No.	Species of mosquito	Days after infective feed	Number of mosquitoes injected	Number of pigs injected	Result in test animals	Remarks
1	*A. nearcticus*	11	1	1	No reaction, 16 days	Longevity of lot too short for later test.
		11	1	1	Died, tularæmia	
8	*A. vexans*	15	4	1	do	
		16	3	1	No reaction, 12 days	
		27	8	8	7, no reaction, 17 days	1 animal died of intercurrent infection, eleventh day.
13	*A. stimulans*	3	7	7	5 died, tularæmia; 2, no reaction, 23 days.	
		7	5	5	3 died, tularæmia; 2, no reaction, 83 days.	
		14	3	3	No reaction, 76 days	
14	do	7	4	4	1 died, tularæmia; 3, no reaction, 83 days.	
13c	*A. canadensis*	3	1	1	Died, tularæmia	
		14	1	1	No reaction, 76 days	
8	*A. aegypti*	2	4	1	Died, tularæmia	
		5	3	1	No reaction, 35 days	
		12	5	5	No reaction, 24 days	

[1] *Aëdes dorsalis* and *Culex tarsalis* were not available in sufficient numbers to produce significant tests, although 3 of the latter were fed simultaneously with *T. incidens* (lot 17). Injection of 1 *C. tarsalis* at 11 days was negative.

TABLE 1.—*The observed duration of Bact. tularense in mosquitoes as determined by injection into guinea pigs*—Continued

Lot No.	Species of mosquito	Days after infective feed	Number of mosquitoes injected	Number of pigs injected	Result in test animals	Remarks
9b	*A. aegypti*	14	1	1	Died, tularæmia	No mosquitoes available for further tests.
15b	do	18	1	1	No reaction, 64 days	
		18	1	1	Died, tularæmia	Do.
21	do	1	1	1	do	Rubbed on clipped skin.
		6	4	4	No reaction, 35 days	
22	do	3	4	4	Died, tularæmia	
		7	4	4	No reaction, 23 days	
		13	6	6	No reaction, 16 days	
		16	5	1	No reaction, 13 days	
		16	4	1	No reaction, 13 days	
17	*T. incidens*	5	3	3	Died, tularæmia	
		11	1	1	do	
		11	1	1	No reaction, 22 days	
		18	3	3	2 died, tularæmia; 1, no reaction, 17 days.	
		23	3	3	No reaction, 54 days	
		35	6	6	2 died, tularæmia; 4, no reaction, 44 days.	

The duration of the infection in the bodies of infected mosquitoes as determined by such periodic injection is indicated by the results shown in Table 1. Since, as previously mentioned, death of test animals has occurred infrequently after a protracted period, the number of days of observation of those guinea pigs listed with "no reaction" has been included.

It will be noted in the table that some individuals of *A. nearcticus* and *T. incidens* retained viable organisms for the length of life of each lot, 11 and 35 days, respectively. The maximum periods for which infection was demonstrated in the other species were as follows: *A. vexans*, 15 days; *A. stimulans*, 7 days; and *A. canadensis*, 3 days.

It is probable that the data presented in Table 1 do not represent the longest possible duration of infection in these species, but they do indicate the variability in individual mosquitoes and lots that was encountered in the laboratory, as shown particularly in *A. aegypti*.

On these data alone, *T. incidens* appears to be the most favorable of the species tested for retention of the infection. In this connection it is possible that the greater amount of blood ingested by this large species was a contributory factor; but there also appears to be other variables which can not be excluded, as will be mentioned later.

A number of tests made on other lots, particularly of *A. aegypti*, have not been tabulated, because of complete failure to show infection at any stage, although the mosquitoes were fed on guinea pigs which showed characteristic lesions at necropsy.

Infection in dead, disintegrating mosquitoes.—The last, living *T. incidens*, lot 17, Table 1, was removed for testing 35 days after the

original infecting blood meal. A moisture pad in the cage was removed with several dead insects upon it and set aside for subsequent experiments. After four days, six of these disintegrating insects were macerated in salt solution and injected into a normal animal, which died of typical tularæmia five days later. *Bact. tularense* therefore remained viable not only during the life of the mosquitoes but also for four days after death, a total of 39 days after their initial infecting blood meal.

(2) TRANSMISSION TESTS WITH ADULT FEMALE MOSQUITOES

Transfer of the infection to healthy guinea pigs by mosquito feeding was first attempted after varying periods of "incubation" such as are known to be necessary in the essential arthropod vectors of certain diseases. Table 2 presents results of such test feedings at varying intervals following the infecting blood meal.

TABLE 2.—*Test feeds of "incubated" mosquitoes infected with Bact. tularense*

Lot No.	Species of mosquito	Days after infective meal	Number of mosquitoes feeding	Result in test animals	Controls by injection of mosquitoes previously fed		
					Number of mosquitoes injected	Number of guinea pigs injected	Result in test animals
1	*A. nearcticus*...	11	2	No reaction, 16 days...	1	1	Died seventeenth day, intercurrent infection.
					1	1	Died, tularæmia, 3 days.
3	*A. vexans*.....	15	11	No reaction; killed for transfer eleventh day; no reaction in transfer.	4	1	Do.
13b	*A. stimulans*..	7	8	No reaction, 83 days.....	5	5	5 pigs received 1 mosquito each; 3 of 5 died of tularæmia.
6	*A. aegypti*.....	4	3	No reaction, 26 days.....	2	1	Died, tularæmia, 9 days.
9b	.....do.....	14	1	No reaction, 108 days...	1	1	Died, tularæmia, 28 days.

Difficulties were encountered in obtaining the necessary longevity of certain species of mosquitoes to make possible periodic removal of a few for test purposes. Test feedings on normal animals after varying periods of "incubation" were also a matter of tedious work with individual specimens in all lots excepting those of *A. aegypti*. *T. incidens* was never induced to accept a second or testing blood meal.

According to these data, "incubation" of infected mosquitoes does not appear to influence transmission to healthy guinea pigs.

Mechanical transmission.—To obtain tests by interrupted feeding, a modification of the mosquito catcher described by Philip (1931) was used to transfer mosquitoes which had commenced feeding on a donor animal in moribund condition to a normal, immobilized guinea pig in another cage. The insects were excited as little as possible,

and many settled down to resume feeding almost immediately; the majority would not feed until released from the tube of the catcher. In every test recounted in Table 3 at least one or two of the attempts to effect mechanical transmission to the normal animals were immediate, and none occurred over 15 minutes from the time the interrupted mosquito was liberated in the test cage. Other tests are not listed owing to failure of the control injections.

TABLE 3.—*Experiments on mechanical transmission by mosquitoes interrupted in feeding*

Lot No.	Species of mosquito	Number of mosquitoes completing interrupted feed [1]	Result in test animals	Controls by injection of mosquitoes previously fed	
				Number of mosquitoes injected	Result in test animals
5a	*A. vexans*	6	No reaction. Killed for transfer 12th day; no reaction in transfer.	5	Died of tularæmia.
8a	*A. aegypti*	19	Died 18th day; unknown cause; transfer twice without results.	4	Do.
9a	do	8	Died, tularæmia, in 7 days	4	Do.
10a	*A. stimulans*	3	No reaction, 102 days	2	Do.
				1	Do.
				2	Do.
10c	*A. canadensis*	5	No reaction, 102 days	2	Do.
				1	Do.
11a	*A. aegypti*	2	do	1	Do.
				1	Do.
13a	*A. stimulans*	7	No reaction, 88 days	7	7 animals received 1 mosquito each; 5 died of tularæmia; 2 showed no reaction during 23 days.
13c	*A. canadensis*	2	do	1	Died of tularæmia.

[1] One normal guinea pig used in each instance.

Of eight experiments using four species of mosquitoes (*vexans*, *stimulans*, *canadensis*, and *aegypti*), only one test, with eight *A. aegypti*, was positive. The animal died atypically, but characteristic infection was obtained by transfer to a second guinea pig. Heart blood of the latter yielded a pure culture of *Bact. tularense*.

Tests were also conducted to determine the possibility of producing infection by crushing infected insects on the skin of healthy guinea pigs. Two methods were used to simulate natural reactions to biting mosquitoes, especially on the part of human beings: One method involved crushing by simple slapping of stupefied single insects with a flexible, sterile instrument, on the carefully clipped skin of test animals; the other consisted of a similar procedure followed by rubbing the crushed tissues against the skin. Since the hair of the guinea pig had been closely clipped in such manner as to avoid abrasions, and no puncture had been made by the mosquito previous to crushing, there was obviously less chance for penetration of the organisms than

would be encountered naturally when crushing would likely occur over the site of bite on the smooth skin of a person.

The results of three experiments using *A. aegypti* are presented in Table 4. Similar attempts with 4-, 6-, and 7-day-old lots are not listed, owing again to absence of infection in controls. It will be noticed that the controls for lot 25b also failed, although one test by crushing of the insect on the skin of a guinea pig was positive. Only 2 of 16 tests produced infection, both animals exhibiting typical lesions at necropsy. Pure cultures were obtained from both test guinea pigs.

TABLE 4.—*Experiments on mechanical transmission by crushing of infected A. aegypti on skin of guinea pigs*

Lot No.	Number of mosquitoes used	Days after infective feed	Method of exposure	Result in test animals
21	1	1	Crushed by slapping	Died twelfth day of intercurrent infection.
	1	1	do	No reaction, 35 days.
	1	1	do	Do.
	1	1	Crushed and rubbed	Do.
	1	1	do	Died of tularæmia, 7 days; culture and agglutination positive.
	1	1	do	No reaction, 35 days.
22	1	3	Crushed by slapping	No reaction, 27 days.
	1	3	do	Do.
	1	3	Crushed and rubbed	Do.
	1	3	do	Do.
	1	3	Injected intraperitoneally	Died of tularæmia (control).
	1	3	do	Do.
	1	3	do	Do.
	1	3	do	Do.
25b	1	9	Crushed by slapping	No reaction.
	1	9	do	Do.
	1	9	do	Died of tularæmia, 7 days; culture and agglutination positive.
	1	9	Crushed and rubbed	No reaction, 35 days.
	1	9	do	Do.
	1	9	do	Do.
	1	9	Injected intraperitoneally	No reaction (control).
	1	9	do	Do.
	2	9	do	Do.
	3	9	do	Do.

Greater success with this type of experiment might have been secured had the larger specimens of *T. incidens* been available.

(3) INFECTIVITY OF EGGS LAID BY INFECTED A. AEGYPTI

Tests of eggs of local, reared species were not possible, owing to their refusal to mate or oviposit in confinement. Three batches of eggs laid by different lots of *A. aegypti* 5 days, 7 days, and 12 days, respectively, after their original infection were washed in distilled water several times to remove as much external contamination as possible, suspended in salt solution, and injected intraperitoneally into 5 test pigs with negative results. The parent lots of mosquitoes were each proved to be infected by injection of a few insects into normal animals.

(4) INFECTIVITY OF MOSQUITO EXCREMENT

Fed female mosquitoes generally pass droplets of whitish feces after an initial period of varying duration following their first blood meal. Droplets of dark, altered blood are then excreted for a time. The chances are good that the latter contains viable organisms when freshly deposited. Transfer of infection from this source could conceivably take place by the deposition, on the skin of a healthy person or animal, of excrement by a mosquito seeking to complete an interrupted blood meal begun on an infected host. Persons bitten are prone to scratch or rub the irritated area and deposited feces could thus be introduced into the puncture or other skin abrasion, or infection might even take place through the unbroken skin. Chances for infection from this source are better with only partially fed mosquitoes, as *completely* blood-gorged specimens will not usually imbibe blood for several days until deposition of the resultant, developing batch of eggs is accomplished.

Fecal infectivity tests have resulted in 3 infections in test animals. These were made with the whitish droplets of *A. aegypti* (lot 24) at 3 days, and dark excrement of the same lot at 4 days and of *A. vexans* (lot 5a) at 24 hours, respectively, after the original blood meal. Thirteen negative results followed similar attempts 2 to 9 days after infection (*A. vexans*, *A. stimulans*, *A. canadensis*, and *A. aegypti*). The second positive test of *A. aegypti* was confirmed by isolation of a pure culture of *Bact. tularense* from the test guinea pig.

Freshly deposited feces collected from the sides of glass flasks in which known infected insects were temporarily segregated were employed in the above experiments. All tests were made by wiping the droplets onto saline-moistened cotton wisps which were in turn rubbed on the abraded skin of normal guinea pigs.

(5) INFECTIVITY OF MALE A. AEGYPTI AFTER COPULATION WITH INFECTED FEMALES

It has been noted by several investigators that yellow-fever virus can be passed from infected females to males of *A. aegypti* during copulation. This is suggested as one factor in maintaining endemic foci. This species of mosquito was used for similar tests in the present tularæmia studies, because the local species refuse to mate in confinement. Tests with 4 and 8 male mosquitoes from lot 8b, 5 and 7 days, respectively, after original infection of the females, and 4 from lot 9b at 4 days, were negative. On the other hand, the injection of 6 males, removed from lot 24 five days after the infected blood-meal of the females, caused the death of the test animals with typical lesions in 5 days.

As in routine injections of female mosquitoes, the above males were all stupefied with tobacco smoke, macerated in salt solution, and injected intraperitoneally. To remove possible external contamination

before maceration, they had been thoroughly washed in distilled water by vigorous shaking (so vigorous, in fact, that many of the appendages were broken loose from the insects).

DISCUSSION

It is evident that certain mosquitoes, like several other blood-sucking insects, are capable of ingesting and retaining *Bact. tularense* for variable periods of time. It appears equally evident, however, that no essential host relationship is indicated by the experimental results.

On the other hand, the several positive transmission experiments suggest that human infection might occur mechanically (1) through interrupted feeding between infected and healthy hosts, (2) by excrement deposited during feeding, or (3) by the crushing of infected mosquitoes on the skin, particularly if either of the last two conditions are followed by rubbing or scratching. Mechanical infection by these means, under natural conditions, involves two considerations, viz (1) the frequency with which mosquitoes of suitable host habits would have opportunity to feed on infected rodents or other animals,[1] and (2) even after becoming infected, the infrequency with which transfer could be affected judged by the small proportion of positive experiments reported above (1 out of 8 tests by interrupted feeding, 2 of 16 by crushing of the insect on the skin, and 3 of 13 using mosquito excrement).

As regards interrupted feeding, these experiments further suggest that the transfer of infection is unlikely to occur unless the interval is very short. Transfer could be accomplished either on the contaminated mouth parts or by regurgitation. Theoretical considerations practically eliminate regurgitation as a factor on the basis of observations by several investigators, including MacGregor (1931), who says, among other pertinent statements, "Although strong aspiratory effort is possible it appears that the mosquito is incapable of any expulsive effort directed to the discharge of fluid from the buccal cavity, or even the lumen of the proboscis itself. Any remnant of liquid in the

[1] Since there is little authentic information concerning the extent to which mosquitoes feed on rodents, it is of interest to call attention to an article by W. B. Grange, which has but recently come to hand ("Observations on the snowshoe hare, *Lepus americanus phaeonatus* Allen." Journal of Mammalology, vol. 13, No. 1, pp. 1–19, February, 1932). The author reports having confined a number of snowshoe hares in an outdoor pen under natural habitat conditions. All but one (which was killed by a cat) were dead within a month. The cause of death was not determined, but the author observed that they were "harrassed by great clouds of mosquitoes" which, he suggests, might have been concerned. A letter to the author requesting more detailed information as to the extent to which mosquitoes were actually observed to feed on the hares elicited the following additional information.

"In reply to your inquiry whether I have ever observed mosquitoes in the actual act of feeding on rabbits, will say that the clouds of mosquitoes mentioned in the article as harassing the snowshoe hares did very definitely feed on the animals. I meant to convey this by implication, but should have stated it definitely. The mosquitoes, engorged with blood, were noted especially on the ears, on the eyelids and eye region generally, and about the nose. The hares shook their heads repeatedly in the effort to dislodge the mosquitoes, and they also scratched. I can certainly vouch for this very definite instance of mosquitoes feeding on hares, and I recall a few years ago watching a wild hare (pursued by a dog) which stopped close to me, I believe it was in June, and which shook its head in a similar way in attempting to dislodge mosquitoes."

proboscis is always cleared by aspiration." Strong presumptive evidence that regurgitation does not take place is also afforded in the study of yellow fever in which lethal doses of 0.0000001 c c of blood virus have frequently been observed in tests with monkeys; and yet Philip (1930b) has reported negative results after interrupted feeding of 39 to 100 *A. aegypti* in three tests. The least regurgitation by any one insect after resumption of feeding on a normal animal should have produced infection.

The one positive transmission of tularæmia by interrupted feeding of *A. aegypti* (Table 3) therefore probably involved direct transfer on contaminated mouth parts rather than regurgitation.

So many variables enter into mosquito experiments in the laboratory that it is difficult to say that any one of the species of mosquitoes used is more favorable to persistence of the infection (notwithstanding the results shown in Table 1).

That the difference noted in the longer persistence of *Bact. tularense* in *T. incidens* than in other species is not necessarily specific is shown by the variable results of the more numerous tests of *A. aegypti.* Different lots of the latter species were tested continuously over a period of approximately 1½ years and failures to recover infection in later experiments were much more frequent than in earlier tests under apparently the same donor conditions, and when using the same strain of tularæmia. Variations in this respect might be accounted for by changes in some intrinsic quality of the strain over a period of time, or by variations of infectivity of the blood of donor guinea pigs at the time of exposure.

We have found that the degree of bacteremia varies at different stages of infection in the same guinea pig and also at corresponding periods in different guinea pigs. This would obviously affect the number of organisms in the small amounts of blood ingested at any particular time by mosquitoes.

So far as a possible difference of blood infectivity is concerned, it was the practice to expose infected animals only when they were near death, at which time experiments (unpublished) have indicated that the bacteremia is most marked. However, if the syndromes of passage animals and necropsy findings are criteria, no qualitative change in the strain has been perceptible.

Lack of infectivity of eggs from infected *A. aegypti* and the failure of secondary feedings of "incubated" mosquitoes to infect suggest that *Bact. tularense* is confined to the alimentary tract, where it is eventually lost by excretion or gradually dies out. In this connection the isolated instance of recovered infection using male *A. aegypti* after copulation with infected females can hardly be explained on the basis of tissue invasion by *Bact. tularense* without more extended data.

SUMMARY AND CONCLUSIONS

The rôle played by mosquitoes in transmission of tularæmia was investigated, using *Aëdes nearcticus*, *A. vexans*, *A. dorsalis*, *A. stimulans*, *A. canadensis*, *Theobaldia incidens*, and *Culex tarsalis* reared from local collections in the Bitterroot Valley, Mont., and *A. aegypti* from imported stock.

Mechanical transmission was shown to be occasionally possible, infection being transferred from infected to healthy guinea pigs by interrupted feeding of *A. aegypti* in one instance, and twice by crushing single specimens on the unbroken skin of guinea pigs, 24 hours and 9 days, respectively, after original infecting feed of the mosquitoes.

Viable organisms were recovered for varying periods (up to death of the lot, 35 days, in *T. incidens*) following injection of killed, emulsified mosquitoes into healthy guinea pigs, and in dead specimens of the above lot 4 days later (39 days after original infecting blood meal). Duration of recoverable infection was variable in different lots of the same species. Transmission by "incubated" mosquitoes similar to that which occurs in the case of ticks was not accomplished.

Excrement of *A. vexans* passed 24 hours after infecting bloodmeals and of *A. aegypti* 3 and 4 days after such meals was found to be infectious, although other tests at 2 to 9 days proved to be negative. Injections of eggs from lots of infected *A. aegypti* were also negative.

One of four attempts to recover the infection by injection into guinea pigs of male *A. aegypti* previously confined with infected females was successful. The males were thoroughly and vigorously washed before injection. This is of but theoretical interest in view of the other results obtained.

It appears that mosquitoes which had fed on an animal infected with tularæmia might infect persons mechanically (1) by biting, after having been interrupted during their meal on the infected animal (2) by being crushed on the skin with or without subsequent rubbing, and (3) by deposition of excrement on the skin. However, it is likely that suitable conditions to effect such transfers in nature are rare, and it is probable that at most only infrequent infection of man would occur in this manner.

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PUBLIC HEALTH SERVICE PUBLICATIONS

A List of Publications Issued During the Period January–June, 1932

There is printed herewith a list of publications of the United States Public Health Service issued during the period January–June, 1932.

The most important articles that appear each week in the PUBLIC HEALTH REPORTS are reprinted in pamphlet form, making possible a wider and more economical distribution of information that is of especial value and interest to public-health workers and the general public.

All of the publications listed below except those marked with an asterisk (*) are available for free distribution and as long as the supply lasts may be obtained by addressing the Surgeon General, United States Public Health Service, Washington, D. C. Those publications marked with an asterisk are not available for free distribution but may be purchased from the Superintendent of Documents, Government Printing Office, Washington, D. C., *at the prices noted.* (No remittances should be sent to the Public Health Service.)

Periodicals

Public Health Reports (weekly), January-June, Vol. 47, Nos. 1–26, pages 1 to 1418.

Venereal Disease Information (monthly), January–June, Vol. XIII, Nos. 1–6, pages 1 to 252. (Index included in June issue.)

Reprints from the Public Health Reports

1525. Typhus fever. Transmission of endemic typhus by rubbing either crushed infected fleas or infected flea feces into wounds. By R. E. Dyer, E. T. Ceder, W. G. Workman, A. Rumreich, and L. F. Badger. January 15, 1932. 3 pages.

1526. Public Health Service publications. A list of publications issued during the period July–December, 1931. January 29, 1932. 4 pages.

1527. The health officer's viewpoint of child hygiene. By Taliaferro Clark. February 26, 1932. 12 pages.

1528. The impinger dust sampling apparatus as used by the United States Public Health Service. By Leonard Greenburg and J. J. Bloomfield. March 18, 1932. 22 pages.

1529. Rat infestation inspection of vessels. By C. L. Williams. April 1, 1932. 35 pages.

1530. Relative incidence of typhoid fever in urban and rural areas of Tennessee. By D. F. Milam and Elbridge Sibley. April 8, 1932. 6 pages.

1531. Typhus fever. The experimental transmission of endemic typhus fever of the United States by the rat flea Ceratophyllus fasciatus. By R. E. Dyer, W. G. Workman, L. F. Badger, and A. Rumreich. April 22, 1932. 2 pages.

1532. Typhus fever. The multiplication of the virus of endemic typhus in the rat flea Xenopsylla cheopis. By R. E. Dyer, W. G. Workman, E. T. Ceder, L. F. Badger, and A. Rumreich. April 29, 1932. 8 pages.

1533. The standardization of scarlet fever streptococcus antitoxin. A method employing the ear of the white rabbit. By M. V. Veldee. May 6, 1932. 14 pages.

1534. The action of colloidal Paris green on the larvae of Culex apicalis. A preliminary report. By H. G. Grant, Barclay M. Newman, and Pierce D. Wood. June 3, 1932. 9 pages.

1535. Duration of viability and virulence of Bacillus pestis. By Edward Francis. June 10, 1932. 8 pages.

1536. The preparation of a vaccine from fleas infected with endemic typhus. By R. E. Dyer, W. G. Workman, A. Rumreich, and L. F. Badger. June 17, 1932. 3 pages.

1537. Some instances of rapid rat infestation of vessels. By C. L. Williams. June 17, 1932. 5 pages.

1538. Acute respiratory disease in University of Michigan students, 1917–1931. Incidence of cases attended by university physicians among students at the university health service. By Warren E. Forsythe. June 24, 1932. 11 pages.

Public Health Bulletins

*184. Health departments of States and Provinces of the United States and Canada. By John A. Ferrell, Wilson G. Smillie, Platt W. Covington, and Pauline A. Mead. Revised April, 1932. 785 pages. 75 cents.

*201. Transactions of the Twenty-Eighth Annual Conference of State and Territorial Health Officers with the United States Public Health Service, held at Washington, D. C., June 18, 19, and 20, 1930. April, 1932. 113 pages. 10 cents.

National Institute of Health Bulletins

*159. Key-catalogue of parasites reported for insectivora (moles, shrews, etc.), with their possible public health importance. By C. W. Stiles and Samuel F. Stanley. June, 1931. 121 pages. 15 cents.

Unnumbered Publications

*National negro health week program. This pamphlet is published annually, usually about the middle of March, for community leaders in an effort to suggest ways and means by which interested individuals and organizations may be organized for a concerted and effective attack upon the community's disease problems. Eighteenth annual observance. 1932. 16 pages. 5 cents.

*National negro health week poster. Eighteenth annual observance. 1932. (Out of print.)

*Index to Public Health Reports Vol. 47, Part 2 (July–December, 1931). 27 pages. 5 cents.

Reprints from Venereal Disease Information

38. Survey of the venereal diseases in the city of Baltimore, Baltimore County, and the four contiguous counties. By Taliaferro Clark and Lida Usilton. From Venereal Disease Information, Vol. XII, No. 10. 20 pages.

39. A second study of the prevalence of syphilis and gonorrhea in upstate New York. By Albert Pfeiffer and Herbert W. Cummings. From Venereal Disease Information, Vol. XII, No. 11. 18 pages.

COURT DECISION RELATING TO PUBLIC HEALTH

County ordinance, imposing license fee in connection with sale, etc., of butter substitutes, held invalid.—(California District Court of Appeal, First District; Ex parte Bock, 13 P. (2d) 836; decided Aug. 18, 1932.) Marin County passed an ordinance making it unlawful for any person, firm, or corporation outside of the limits of incorporated cities "to manufacture, buy, sell, deal in, or furnish to his, its, or their patrons, or to have in possession for any purpose whatsoever, other than for consumption in his own family or for transportation in case of a common carrier, any oleomargarine or other substitute for butter" without having a license issued by the county tax collector. The fee for such license was $200 a year.

There was in effect at the same time a State statute regulating the manufacture and sale of oleomargarine and providing, among other things, for the payment of license taxes. In the case of retailers, the county tax imposed by the ordinance was 40 times as large as the tax required under the State law.

A person who was engaged in the business of selling oleomargarine and who had some of the product in his possession for the purpose of sale failed to obtain a county license and was arrested. In a habeas corpus proceeding he assailed the ordinance as being invalid. It was conceded that the ordinance had to stand or fall as a regulatory measure because a county could impose a license tax for the purpose of regulation only and could not impose such a tax for the purpose of revenue. It was also conceded that an ordinance purporting to prohibit the manufacture or sale of oleomargarine would be unconstitutional and that an ordinance indirectly accomplishing that result by means of imposing a tax in such amount as to be prohibitory would also be unconstitutional. The petitioner's main contention was that the ordinance was invalid because the tax prescribed was prohibitory in amount.

The district court of appeal stated that it had no hesitancy in declaring the ordinance invalid. "The only semblance of a regulatory provision," said the court, "is the one requiring that the county license, as well as the State license, be conspicuously displayed. In view of the provisions of section 12½ of the general dairy law, we can not but conclude that this purported added regulation was but a pretense, inserted in an attempt to justify the imposition of a tax. It was, in effect, no regulation at all * * *." The $200 tax imposed upon every retailer, irrespective of the amount of sales, was

declared by the court to be clearly excessive and prohibitory, and it was stated that the conclusion was inescapable that the tax was imposed either for the purpose of revenue or of indirectly prohibiting the sale of oleomargarine.

DEATHS DURING WEEK ENDED OCTOBER 1, 1932

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

	Week ended Oct. 1, 1932	Corresponding week, 1931
Data from 85 large cities of the United States:		
Total deaths	6,593	6,641
Deaths per 1,000 population, annual basis	9.4	9.6
Deaths under 1 year of age	562	576
Deaths under 1 year of age per 1,000 estimated live births [1]	47	46
Deaths per 1,000 population, annual basis, first 39 weeks of year	11.2	12.0
Data from industrial insurance companies:		
Policies in force	70,415,889	74,736,758
Number of death claims	11,909	13,557
Death claims per 1,000 policies in force, annual rate	8.8	9.5
Death claims per 1,000 policies, first 39 weeks of year, annual rate	9.6	9.9

[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 October 8, 1932, and October 10, 1931

Cases of certain communicable diseases reported by telegraph by State health officers for weeks ended October 8, 1932, and October 10, 1931

Division and State	Diphtheria		Influenza		Measles		Meningococcus meningitis	
	Week ended Oct. 8, 1932	Week ended Oct. 10, 1931	Week ended Oct. 8, 1932	Week ended Oct. 10, 1931	Week ended Oct. 8, 1932	Week ended Oct. 10, 1931	Week ended Oct. 8, 1932	Week ended Oct. 10, 1931
New England States:								
Maine	2	4	5	1	2	46	0	0
New Hampshire	2	1			1	1	0	0
Vermont	1				1	1	0	0
Massachusetts	29	56	4	4	22	22	3	1
Rhode Island	5	2				53	0	0
Connecticut	5	6	5	1	5	11	0	1
Middle Atlantic States:								
New York	63	80	[1] 9	[1] 2	125	58	4	5
New Jersey	26	15	13	4	58	2	1	4
Pennsylvania	76	81			41	118	2	7
East North Central States:								
Ohio	82	111	5	7	19	2	0	1
Indiana	42	36	23		22	7	12	1
Illinois	138	79	12	62	21	8	6	4
Michigan	12	29	3	2	38	25	2	4
Wisconsin	19	16	23	14	39	12	1	2
West North Central States:								
Minnesota	16	15			60	2	0	3
Iowa	11	6			1	1	1	1
Missouri	54	73	2	1	8	1	4	2
North Dakota		5			6	18	0	1
South Dakota	2	17	1			9	0	1
Nebraska	32	17	3		14		0	0
Kansas	35	19	2	3	2	10	0	1
South Atlantic States:								
Delaware	1	4					0	0
Maryland [2] [3]	26	68	8	6		3	0	0
District of Columbia [3]	8	10			1	1	0	2
Virginia	65				45		2	
West Virginia	67	55	4	19	7	9	0	3
North Carolina [3]	84	199	17	2	22	14	1	2
South Carolina [3]	24	32	285	154	28	4	0	1
Georgia [3]	73	32	19	11	2		1	0
Florida	17	18	2	1	1	16	0	0
East South Central States:								
Kentucky	81	175					1	2
Tennessee	112	171	15	5	1	1	2	2
Alabama [3]	119	101	14		1	11	0	4
Mississippi	40	138					1	0

See footnotes at end of table.

Cases of certain communicable diseases reported by telegraph by State health officers for weeks ended October 8, 1932, and October 10, 1931—Continued

Division and State	Diphtheria		Influenza		Measles		Meningococcus meningitis	
	Week ended Oct. 8, 1932	Week ended Oct. 10, 1931	Week ended Oct. 8, 1932	Week ended Oct. 10, 1931	Week ended Oct. 8, 1932	Week ended Oct. 10, 1931	Week ended Oct. 8, 1932	Week ended Oct. 10, 1931
West South Central States:								
Arkansas	42	44	10	----	4	3	0	0
Louisiana [3]	37	22	14	3	2	2	0	0
Oklahoma [4]	95	107	26	8	1	----	1	0
Texas [3]	151	35	59	12	----	2	0	0
Mountain States:								
Montana	----	1	2	----	93	10	0	0
Idaho	1	3	----	----	----	2	1	0
Wyoming	----	----	----	----	----	1	0	0
Colorado	10	11	----	----	2	3	0	1
New Mexico	8	9	9	----	----	----	0	0
Arizona	3	6	1	7	1	1	0	2
Utah [3]	1	1	1	----	4	1	0	0
Pacific States:								
Washington	11	6	----	----	2	7	0	0
Oregon	2	1	141	22	28	6	0	1
California	58	61	166	73	29	71	1	3
Total	1,788	1,978	903	424	759	575	47	62

Division and State	Poliomyelitis		Scarlet fever		Smallpox		Typhoid fever	
	Week ended Oct. 8, 1932	Week ended Oct. 10, 1931	Week ended Oct. 8, 1932	Week ended Oct. 10, 1931	Week ended Oct. 8, 1932	Week ended Oct. 10, 1931	Week ended Oct. 8, 1932	Week ended Oct. 10, 1931
New England States:								
Maine	12	8	17	9	0	0	3	3
New Hampshire	0	3	7	5	0	0	0	1
Vermont	0	6	8	4	0	1	0	2
Massachusetts	3	72	158	151	0	0	5	12
Rhode Island	0	5	31	7	0	0	2	0
Connecticut	0	45	38	9	0	0	3	5
Middle Atlantic States:								
New York	17	239	210	184	0	0	55	35
New Jersey	23	50	99	54	0	0	18	12
Pennsylvania	61	40	161	187	0	0	71	69
East North Central States:								
Ohio	2	8	276	178	1	0	69	57
Indiana	3	5	78	48	0	3	30	12
Illinois	7	61	201	178	3	16	44	51
Michigan	3	74	146	102	1	2	22	20
Wisconsin	2	49	32	22	3	1	6	3
West North Central States:								
Minnesota	5	58	48	36	1	0	6	3
Iowa	3	13	34	31	1	5	13	5
Missouri	0	7	102	107	0	8	39	15
North Dakota	2	1	1	19	2	5	6	5
South Dakota	0	0	14	7	0	2	0	8
Nebraska	1	1	34	18	3	1	1	1
Kansas	2	1	63	46	1	2	7	13
South Atlantic States:								
Delaware	0	1	6	5	0	0	4	2
Maryland [2 3]	1	5	50	61	0	0	36	33
District of Columbia [3]	3	3	4	15	0	0	2	9
Virginia	1	1	62	----	0	----	21	----
West Virginia	1	3	72	43	0	0	74	79
North Carolina [3]	2	7	71	111	1	3	8	23
South Carolina [3]	0	0	4	9	0	0	20	22
Georgia [3]	0	0	37	34	0	2	22	28
Florida	0	0	7	0	0	0	2	3
East South Central States:								
Kentucky	3	1	81	68	0	0	29	68
Tennessee	5	3	75	63	1	1	31	30
Alabama [3]	2	0	66	66	0	0	22	33
Mississippi	5	0	30	40	0	1	6	27

See footnotes at end of table.

Cases of certain communicable diseases reported by telegraph by State health officers for weeks ended October 8, 1932, and October 10, 1931—Continued

Division and State	Poliomyelitis		Scarlet fever		Smallpox		Typhoid fever	
	Week ended Oct. 8, 1932	Week ended Oct. 10, 1931	Week ended Oct. 8, 1932	Week ended Oct. 10, 1931	Week ended Oct. 8, 1932	Week ended Oct. 10, 1931	Week ended Oct. 8, 1932	Week ended Oct. 10, 1931
West South Central States:								
Arkansas	0	0	22	23	0	1	21	19
Louisiana [3]	6	1	10	17	2	2	9	40
Oklahoma [4]	0	0	36	38	2	1	30	60
Texas [3]	4	0	46	39	3	5	29	36
Mountain States:								
Montana	0	7	4	10	0	0	1	9
Idaho	0	0	1	10	0	8	10	4
Wyoming	0	0	6	5	0	0	1	1
Colorado	0	1	26	12	0	0	12	1
New Mexico	1	4	13	7	0	0	15	14
Arizona	0	1	7	1	0	0	2	2
Utah [2]	0	0	1	6	0	1	2	4
Pacific States:								
Washington	3	10	33	26	7	5	8	4
Oregon	0	0	18	8	2	1	9	3
California	5	6	88	67	4	9	13	15
Total	188	800	2,634	2,186	38	86	839	901

[1] New York City only.
[2] Week ended Friday.
[3] Typhus fever, week ended Oct. 8, 1932, 51 cases: 2 cases in Maryland, 1 case in District of Columbia, 3 cases in North Carolina, 2 cases in South Carolina, 17 cases in Georgia, 19 cases in Alabama, 1 case in Louisiana, and 6 cases in Texas.
[4] Figures for 1932 are exclusive of Oklahoma City and Tulsa, and for 1931 are exclusive of Tulsa only.

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										
Puerto Rico	----	51	1,200	2,290	139	2	0	----	0	21
August, 1932										
Massachusetts	2	121	5	----	254	1	10	317	0	29
Mississippi	4	133	610	6,711	15	505	5	42	6	136
September, 1932										
Alabama	5	285	19	445	3	31	7	191	2	95
Arizona	----	5	14	1	5	----	2	22	0	17
Connecticut	1	25	7	1	24	----	5	73	0	12
District of Columbia	1	8	1	----	6	1	8	24	0	8
Iowa	2	31	----	----	8	1	18	84	11	69
Michigan	6	64	3	16	170	----	32	298	1	100
Nebraska	----	56	13	----	23	----	8	69	0	4
North Dakota	----	4	10	----	14	----	4	12	1	27
Vermont	----	3	----	----	8	----	1	17	0	0

July, 1932

Puerto Rico:	Cases
Chicken pox	27
Colibacillosis	3
Dengue	2
Dysentery	34
Erysipelas	5
Filariasis	1
Leprosy	1

Puerto Rico—Continued.	Cases
Mumps	9
Ophthalmia neonatorum	4
Puerperal septicemia	11
Tetanus	1
Tetanus, infantile	22
Trachoma	2
Whooping cough	129
Yaws	5

August, 1932

Chicken pox:	Cases
Massachusetts	123
Mississippi	166
Dengue:	
Mississippi	4
Dysentery:	
Mississippi (ambic)	46
German measles:	
Massachusetts	26

	Cases
Lead poisoning:	
Massachusetts	1
Lethargic encephalitis:	
Massachusetts	3
Mumps:	
Massachusetts	176
Mississippi	56
Ophthalmia neonatorum:	
Massachusetts	160
Mississippi	6
Paratyphoid fever:	
Massachusetts	5
Puerperal septicemia:	
Mississippi	23
Septic sore throat:	
Massachusetts	7
Tetanus:	
Massachusetts	1
Trachoma:	
Massachusetts	4
Mississippi	2
Trichinosis:	
Massachusetts	8
Undulant fever:	
Massachusetts	2
Mississippi	2
Whooping cough:	
Massachusetts	454
Mississippi	395
September, 1932	
Anthrax:	
Connecticut	1
Chicken pox:	
Alabama	8
Arizona	3
Connecticut	16
District of Columbia	5
Iowa	17
Michigan	109
Chicken pox—Continued.	
Nebraska	15
North Dakota	10
Vermont	18
Conjunctivitis, infectious:	
Connecticut	1
Dysentery:	
Arizona	2
Connecticut (amebic)	1
Connecticut (bacillary)	2
Michigan	1
North Dakota (bacillary)	4
German measles:	
Arizona	1
Connecticut	4
Iowa	1
Impetigo contagiosa:	
Iowa	8
Lead poisoning:	
Connecticut	4
Lethargic encephalitis:	
Alabama	2
Iowa	2
Michigan	8
Mumps:	
Alabama	27
Arizona	25
Connecticut	41
Iowa	11
Michigan	108
Nebraska	19
North Dakota	3
Vermont	68
Ophthalmia neonatorum:	
North Dakota	3
Paratyphoid fever:	
Arizona	3
Connecticut	1
Iowa	2
Rabies in animals:	
Connecticut	2
Rocky Mountain spotted fever:	
Arizona	1
District of Columbia	1
Septic sore throat:	
Iowa	2
Michigan	30
Tetanus:	
Connecticut	2
Iowa	1
Trachoma:	
Arizona	31
North Dakota	1
Tularaemia:	
Arizona	1
Iowa	1
Typhus fever:	
Alabama	51
Undulant fever:	
Alabama	2
Arizona	5
Iowa	13
Michigan	3
Vincent's angina:	
Iowa	3
Vincent's infection:	
North Dakota	22
Whooping cough:	
Alabama	36
Arizona	5
Connecticut	173
District of Columbia	32
Iowa	28
Michigan	868
Nebraska	69
North Dakota	47
Vermont	22

WEEKLY REPORTS FROM CITIES

City reports for week ended October 1, 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 nonepidemic 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	2	0	2		0	1	0	1
New Hampshire:								
Concord	0	0	0		0	0	0	0
Nashua	1	0	0		0	0	0	0
Vermont:								
Barre	1	0	0		0	0	0	0
Burlington	0	0	0		0	0	0	0
Massachusetts:								
Boston	7	15	3	1	0	2	13	11
Fall River	0	2	1		0	0	0	0
Springfield	2	2	1		0	0	0	0
Worcester	1	4	1		0	1	2	1

City reports for week ended October 1, 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			
NEW ENGLAND—con.								
Rhode Island:								
Pawtucket	0	1	0		0	0	0	0
Providence	2	3	1		0	0	1	2
Connecticut:								
Bridgeport	1	2	1		0	2	0	0
Hartford		1						
New Haven	0	0	0		0	0	3	2
MIDDLE ATLANTIC								
New York:								
Buffalo	3	7	13		0	1	0	6
New York	20	78	24	13	1	23	30	80
Rochester	1	2	0	1	0	0	1	6
Syracuse	2	1	0		0	0	0	3
New Jersey:								
Camden	0	3	1		0	0	0	0
Newark	5	9	1	1	0	2	11	3
Trenton	0	1	0		0	1	0	2
Pennsylvania:								
Philadelphia	1	21	5	33	2	1	5	10
Pittsburgh	3	11	7		0	0	1	15
Reading	0	0	2		0	8	0	3
EAST NORTH CENTRAL								
Ohio:								
Cincinnati	1	7	8		0	0	1	4
Cleveland	9	18	6	6	0	3	1	7
Columbus	2	4	6	1	1	12	0	0
Toledo	3	4	1		0	2	0	4
Indiana:								
Fort Wayne	1	1	3		0	0	0	0
Indianapolis	2	6	0		1	0	12	10
South Bend	0	1	0		0	1	0	0
Terre Haute	0	0	0		0	0	0	0
Illinois:								
Chicago	25	56	20	3	1	11	1	21
Springfield	5	0	1	1	0	0	0	0
Michigan:								
Detroit	15	33	8		0	2	6	8
Flint	1	2	1	1	0	1	1	1
Grand Rapids	0	1	0		0	0	4	1
Wisconsin:								
Kenosha	0	0	0		0	1	1	0
Madison	0	1	0			0	0	
Milwaukee		4						
Racine	0	0	0		0	0	0	0
Superior	0	0	0		0	0	0	0
WEST NORTH CENTRAL								
Minnesota:								
Duluth	0	0	0		0	0	1	3
Minneapolis	7	16	3		0	5	7	4
St. Paul	0	4	1		0	0	1	3
Iowa:								
Des Moines	0	0	1			0	0	
Sioux City	1	1	2			0	0	
Waterloo	1	0	0			0	0	
Missouri:								
Kansas City	2	3	3		0	1	3	7
St. Joseph	0	0	7		0	0	0	3
St. Louis	3	22	8			1	3	3
North Dakota:								
Fargo	4	1	0		0	0	0	0
Grand Forks	0	0	0			1	0	
Nebraska:								
Omaha	2	7	15		0	0	0	2
Kansas:								
Topeka	4	1	0		1	0	4	1
Wichita	0	1	1		0	0	0	5

City reports for week ended October 1, 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			
SOUTH ATLANTIC								
Delaware:								
Wilmington	0	1	0		0	0	0	1
Maryland:								
Baltimore	3	12	2		0	1	11	2
Cumberland	0	0	0		0	0	0	2
Frederick	0	0	0		0	0	0	0
District of Columbia:								
Washington	1	10	3		0	2	0	4
Virginia:								
Lynchburg	1	3	2		0	0	0	0
Norfolk	0	2	2		0	1	0	2
Richmond	0	15	5		0	0	0	2
Roanoke	0	3	2		0	0	0	1
West Virginia:								
Charleston	0	1	1		0	1	0	1
Huntington	0		2		0	0	0	0
Wheeling	6	0	0		0	5	0	1
North Carolina:								
Raleigh	0	3	0		0	0	0	0
Wilmington	0	1	1		0	0	0	2
Winston-Salem	1	4	1	1	0	0	0	0
South Carolina:								
Charleston	0	1	0	7	0	0	0	0
Columbia	0	1	2		0	0	0	1
Greenville	0	2	0		0	0	0	0
Georgia:								
Atlanta	0	5	6	6	0	1	0	3
Brunswick	0	0	0		0	0	0	0
Savannah	1	1	3		0	0	0	2
Florida:								
Miami	0	1	0		0	0	0	1
Tampa	0	1	3		0	0	0	0
EAST SOUTH CENTRAL								
Kentucky:								
Covington		1						
Lexington	0		6		0	0	0	1
Louisville	2		5		0	1	2	4
Tennessee:								
Memphis	1	5	1		0	0	1	5
Nashville	0	1	1		0	0	0	2
Alabama:								
Birmingham	0	5	10	4	1	1	0	5
Mobile	0	1	4		0	0	0	0
Montgomery	0	3	2			0	4	
WEST SOUTH CENTRAL								
Arkansas:								
Fort Smith	1	0	1			0	0	
Little Rock	0	0	3		0	0	0	0
Louisiana:								
New Orleans	0	7	8	1	2	1	0	4
Shreveport	0	1	0		0	0	2	1
Oklahoma:								
Muskogee	0		2		0	0	0	0
Texas:								
Dallas	0	8	33		0	0	0	3
Fort Worth	0	3	5		0	0	0	1
Galveston	0	0	0		0	0	0	1
Houston	0	6	6		1	0	0	1
San Antonio	0	2	1		2	0	0	0
MOUNTAIN								
Montana.								
Billings	0	0	0		0	0	0	0
Great Falls	0	0	0		0	0	0	2
Helena	0	0	0		0	0	0	0
Missoula	1	1	0		0	0	0	0
Idaho:								
Boise	0	1	0		0	1	0	0

City reports for week ended October 1, 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			
MOUNTAIN—con.								
Colorado:								
Denver	1	6	5		2	4	4	5
Pueblo	0	0	0		0	0	1	0
New Mexico:								
Albuquerque	0	0	2		0	1	4	0
Arizona:								
Phoenix	0	1	0		0	0	0	1
Utah:								
Salt Lake City	3	2	0		1	1	3	2
Nevada:								
Reno	0	0	0		0	0	0	0
PACIFIC								
Washington:								
Seattle	7	3	0			1	6	
Spokane	0	2	0			1	0	
Tacoma	0	4	0		0	0	0	0
Oregon:								
Portland	2	4	1		0	3	2	1
Salem	0	0	0	1	0	1	0	0
California:								
Los Angeles	6	18	10	90	0	6	22	5
Sacramento	2	1	0		0	0	3	1
San Francisco	10	7	2		1	3	4	2

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	1	1	0	0	0	0	0	2	0	2	20
New Hampshire:											
Concord	0	0	0	0	0	0	0	0	0	0	7
Nashua	0	0	0	0	0	0	0	0	0	0	
Vermont:											
Barre	0	0	0	0	0	1	0	0	0	0	1
Burlington	0	1	0	0	0	0	0	0	0	0	7
Massachusetts:											
Boston	23	18	0	0	0	3	3	1	0	23	205
Fall River	2	7	0	0	0	0	1	0	0	2	20
Springfield	1	2	0	0	0	1	0	1	1	0	21
Worcester	7	4	0	0	0	1	0	0	0	0	39
Rhode Island:											
Pawtucket	0	0	0	0	0	0	0	0	0	0	24
Providence	3	6	0	0	0	1	1	1	0	2	55
Connecticut:											
Bridgeport	1	3	0	0	0	0	0	0	0	6	14
Hartford	1		0				0				
New Haven	1	1	0	0	0	0	0	0	0	3	35
MIDDLE ATLANTIC											
New York:											
Buffalo	8	19	0	0	0	0	1	1	0	18	114
New York	34	41	0	0	0	90	29	6	0	136	1,156
Rochester	3	7	0	0	0	1	2	1	0	5	73
Syracuse	2	4	0	0	0	0	0	0	0	14	54
New Jersey:											
Camden	1	4	0	0	0	2	1	3	0	0	29
Newark	4	2	0	0	0	5	2	0	0	17	93
Trenton	1	5	0	0	0	1	0	0	0	2	24
Pennsylvania:											
Philadelphia	27	25	0	0	0	21	10	4	3	32	358
Pittsburgh	16	35	0	0	0	5	2	1	0	28	126
Reading	0	0	0	0	0	0	0	0	0	1	29

City reports for week ended October 1, 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		
EAST NORTH CENTRAL											
Ohio:											
Cincinnati	10	13	0	0	0	7	2	28	1	1	110
Cleveland	13	17	0	0	0	13	2	3	0	33	152
Columbus	4	24	0	0	0	6	1	1	0	4	73
Toledo	5	14	0	0	0	2	2	1	0	8	55
Indiana:											
Fort Wayne	1	1	0	0	0	1	1	0	0	0	21
Indianapolis	5	6	0	0	0	4	2	0	0	4	95
South Bend	2	3	0	0	0	1	0	0	0	6	10
Terre Haute	1	1	0	0	0	0	0	0	0	0	22
Illinois:											
Chicago	44	67	0	0	0	34	6	3	0	27	535
Springfield	1	2	0	0	0	0	0	0	0	0	21
Michigan:											
Detroit	34	21	0	0	0	14	4	3	0	68	208
Flint	6	2	0	0	0	1	0	0	0	0	14
Grand Rapids	6	7	0	0	0	0	1	0	0	12	27
Wisconsin:											
Kenosha	0	1	0	0	0	0	0	0	0	4	1
Madison	1	0	0	0	----	----	0	0	----	0	----
Milwaukee	8	----	0	----	----	----	1	----	----	----	----
Racine	2	0	0	0	0	1	0	0	0	2	9
Superior	1	0	0	0	0	0	0	0	0	0	11
WEST NORTH CENTRAL											
Minnesota:											
Duluth	4	2	0	0	0	0	0	0	0	1	16
Minneapolis	13	8	0	0	0	0	2	1	1	10	89
St. Paul	10	8	0	0	0	0	1	0	0	15	38
Iowa:											
Des Moines	3	13	0	0	----	----	0	0	----	0	24
Sioux City	2	0	0	0	----	----	0	0	----	1	----
Waterloo	2	1	0	0	----	----	0	0	----	0	----
Missouri:											
Kansas City	6	17	0	0	0	2	1	2	0	3	85
St. Joseph	1	1	0	0	0	1	0	0	0	0	30
St. Louis	12	8	0	0	0	15	4	4	0	5	194
North Dakota:											
Fargo	2	0	0	0	0	0	0	0	0	0	6
Grand Forks	0	0	0	0	----	----	0	0	----	0	----
Nebraska:											
Omaha	2	5	0	0	0	2	0	0	0	0	43
Kansas:											
Topeka	1	0	0	0	0	0	0	0	0	0	13
Wichita	2	1	0	0	0	0	0	0	0	1	27
SOUTH ATLANTIC											
Delaware:											
Wilmington	1	0	0	0	0	2	0	0	1	0	29
Maryland:											
Baltimore	7	19	0	0	0	14	7	4	0	21	171
Cumberland	0	2	0	0	0	0	1	0	0	2	13
Frederick	0	0	0	0	0	0	0	0	0	0	----
District of Col.:											
Washington	8	8	0	0	0	10	2	1	0	5	110
Virginia:											
Lynchburg	1	4	0	0	0	0	1	1	0	5	5
Norfolk	1	0	0	0	0	1	0	0	0	2	23
Richmond	6	6	0	0	0	3	1	0	0	0	34
Roanoke	2	3	0	0	0	0	1	0	0	0	10
West Virginia:											
Charleston	2	2	0	0	0	0	1	2	0	0	12
Huntington	----	2	----	0	0	0	----	0	0	0	----
Wheeling	1	0	0	0	0	1	0	0	0	0	13
North Carolina:											
Raleigh	0	2	0	0	0	0	0	0	0	5	5
Wilmington	1	0	0	0	0	0	0	0	0	0	11
Winston-Salem	3	1	0	0	0	5	1	0	0	2	13

City reports for week ended October 1, 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		
SOUTH ATLANTIC—continued											
South Carolina:											
Charleston	1	1	0	0	0	2	1	1	1	0	14
Columbia	1	1	0	0	0	0	0	0	0	0	1
Greenville	------	0	------	0	0	0	0	0	0	0	------
Georgia:											
Atlanta	6	2	0	0	0	4	2	3	0	1	71
Brunswick	0	0	0	0	0	1	0	0	0	0	2
Savannah	0	1	0	0	0	2	0	0	0	0	30
Florida:											
Miami	0	2	0	0	0	3	1	0	0	0	24
Tampa	0	0	0	0	0	2	0	0	0	0	22
EAST SOUTH CENTRAL											
Kentucky:											
Covington	1	------	0	------	------	------	0	------	------	------	------
Lexington	------	4	------	0	0	2	------	2	0	0	19
Louisville	------	6	------	0	0	0	------	0	0	0	40
Tennessee:											
Memphis	4	4	0	0	0	4	4	2	0	0	72
Nashville	2	2	0	0	0	2	3	1	0	0	43
Alabama:											
Birmingham	6	9	0	0	0	1	3	5	0	0	45
Mobile	1	0	0	0	0	0	0	0	0	0	11
Montgomery	1	0	0	0	------	------	1	1	------	1	------
WEST SOUTH CENTRAL											
Arkansas:											
Fort Smith	1	3	0	0	------	------	0	0	------	1	------
Little Rock	1	2	0	0	0	4	1	0	0	0	4
Louisiana:											
New Orleans	3	0	0	0	0	10	4	0	0	0	125
Shreveport	1	1	0	0	0	3	0	0	0	0	31
Oklahoma:											
Muskogee	------	1	------	0	0	0	------	2	0	0	------
Texas:											
Dallas	3	9	0	0	0	2	1	4	3	1	51
Fort Worth	1	2	0	0	0	1	2	1	0	3	28
Galveston	0	0	0	0	0	1	0	0	0	0	13
Houston	1	1	0	0	0	2	1	0	0	0	60
San Antonio	0	0	0	0	0	3	1	0	0	0	42
MOUNTAIN											
Montana:											
Billings	0	2	0	0	0	0	0	0	0	0	5
Great Falls	1	1	0	0	0	0	0	0	0	1	11
Helena	0	0	0	0	0	0	0	1	0	0	5
Missoula	1	0	1	0	0	0	0	0	0	0	5
Idaho:											
Boise	0	0	0	3	0	0	1	0	0	0	4
Colorado:											
Denver	6	16	0	0	0	6	1	0	0	3	66
Pueblo	0	0	0	0	0	0	1	1	0	1	9
New Mexico:											
Albuquerque	0	2	0	0	0	3	2	0	0	0	16
Arizona:											
Phoenix	1	0	------	0	0	4	0	0	0	0	------
Utah:											
Salt Lake City	3	2	0	0	0	1	1	1	0	3	32
Nevada:											
Reno	0	0	0	0	0	0	0	0	0	0	3
PACIFIC											
Washington:											
Seattle	8	5	0	5	------	------	2	0	------	0	------
Spokane	3	1	1	0	------	------	1	0	------	0	------
Tacoma	1	4	1	0	0	1	1	0	0	0	22
Oregon:											
Portland	4	4	1	0	0	0	1	0	0	2	48
Salem	0	0	1	0	0	0	------	0	0	0	------
California:											
Los Angeles	13	21	0	10	0	22	2	1	0	48	247
Sacramento	1	1	0	0	0	0	1	0	0	12	18
San Francisco	7	4	0	0	0	5	1	1	0	15	130

City reports for week ended October 1, 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
NEW ENGLAND									
Massachusetts:									
Boston	1	1	0	0	0	0	4	0	0
Rhode Island:									
Providence	1	0	0	0	0	0	0	0	0
MIDDLE ATLANTIC									
New York:									
New York	2	0	2	1	0	0	19	6	0
New Jersey:									
Newark	1	0	0	0	0	0	1	2	0
Pennsylvania:									
Philadelphia	0	0	0	0	0	0	2	45	3
Pittsburgh	0	0	0	0	0	0	0	5	0
Reading	0	0	0	0	0	0	0	2	0
EAST NORTH CENTRAL									
Ohio:									
Cleveland	0	0	0	0	0	0	3	3	1
Indiana:									
Fort Wayne	1	1	0	0	0	0	0	1	0
Indianapolis	4	2	0	0	0	0	0	0	0
Illinois:									
Chicago	3	0	0	1	0	0	5	4	0
Michigan:									
Detroit	1	0	1	0	0	0	5	0	0
WEST NORTH CENTRAL									
Minnesota:									
Duluth	1	0	0	0	0	0	1	0	0
Minneapolis	0	0	0	0	0	0	2	1	0
St. Paul	0	0	0	0	0	0	0	1	0
Iowa:									
Des Moines	0	0	0	0	0	0	0	1	0
Missouri:									
Kansas City	1	1	0	0	1	0	1	0	0
St. Louis	2	0	0	0	0	0	0	0	0
Kansas:									
Wichita	0	0	0	0	0	0	0	1	0
SOUTH ATLANTIC[1]									
Maryland:									
Baltimore[1]	0	1	0	1	0	0	1	0	0
District of Columbia:									
Washington	0	0	0	0	1	1	1	2	0
South Carolina:									
Charleston	0	0	0	0	2	0	0	0	0
Georgia:[1]									
Atlanta	0	0	0	0	3	0	0	0	0
EAST SOUTH CENTRAL									
Tennessee:									
Memphis	0	0	0	0	0	0	1	1	0
Nashville	0	1	0	0	0	0	0	0	0
Alabama:									
Birmingham	1	0	0	0	0	0	0	0	0
WEST SOUTH CENTRAL									
Louisiana:									
New Orleans	0	0	0	0	1	1	0	0	0
Shreveport	0	0	0	0	0	1	0	0	0
MOUNTAIN									
New Mexico:									
Albuquerque	0	0	0	0	2	1	0	0	0
Utah:									
Salt Lake City	1	1	0	0	0	0	0	0	0
PACIFIC									
California:									
Los Angeles	0	0	0	0	0	0	1	1	0
Sacramento	0	0	0	0	0	0	0	1	1
San Francisco	1	1	1	0	1	1	1	0	0

[1] Typhus fever, 5 cases: 1 case at Baltimore, Md.; 3 cases at Savannah, Ga.; and 1 case at Tampa, Fla.

FOREIGN AND INSULAR

CANADA

Provinces—Communicable diseases—Week ended September 24, 1932.—The Department of Pensions and National Health reports cases of certain communicable diseases for the week ended September 24, 1932, as follows:

Disease	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	Total
Cerebrospinal meningitis		1			4				5
Chicken pox			11	26	2	7	1	7	54
Diphtheria	6	1	29	8	6	2			52
Dysentery				3					3
Erysipelas			1		1				2
Influenza	7			1				5	13
Measles	4	1	20	23	3	2	29	3	85
Mumps	3			27				3	33
Paratyphoid fever				3	1		1		5
Pneumonia				3				4	7
Poliomyelitis			76	18	1		2		97
Scarlet fever	2	1	35	18	32	1	4	17	110
Smallpox						6			6
Trachoma				1	26			2	29
Tuberculosis	1		70	21	49	4	1	22	168
Typhoid fever	1	1	30	42	11	4		2	91
Undulant fever				3					3
Whooping cough	4		60	86	25	7	8	11	201

MEXICO

Tampico—Communicable diseases—September, 1932.—During the month of September, 1932, certain communicable diseases were reported in the city of Tampico, Mexico, as follows:

Disease	Cases	Deaths	Disease	Cases	Deaths
Diphtheria	3		Paratyphoid fever	1	
Enteritis (various)	58	40	Tuberculosis		29
Influenza	23		Typhoid fever	2	3
Malaria	517	11	Whooping cough	41	5
Measles	2				

PANAMA CANAL ZONE

Communicable diseases—August, 1932.—During the month of August, 1932, certain communicable diseases, including imported cases, were reported in the Panama Canal Zone and terminal cities as follows:

Disease	Cases	Deaths	Disease	Cases	Deaths
Chicken pox	15		Pneumonia		26
Diphtheria	17	1	Tuberculosis		31
Malaria	109	7	Typhoid fever	2	1
Measles	17	1	Whooping cough	2	
Mumps	1				

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

(NOTE.—A table giving current information of the world prevalence of the quarantinable diseases appeared in the PUBLIC HEALTH REPORTS for September 30, 1932, pp. 1992-2005. A similar cumulative table will appear in the PUBLIC HEALTH REPORTS to be issued October 28, 1932, and thereafter, at least for the time being, in the issue published on the last Friday of each month.)

Cholera

China.—The latest reports indicate that cholera is decreasing in China and Manchuria. In ports cholera cases and deaths were reported as follows: Amoy, week ended September 24, 1932, 17 cases, 5 deaths; Canton, week ended October 1, 8 cases, 3 deaths; Macao, week ended September 24, 1 case, 1 death; Shanghai, week ended September 24, 21 cases, 1 death; Swatow, week ended September 10, 7 cases, 5 deaths; Tsingtao, week ended September 10, 5 cases, 1 death.

In Fengtien Province, Manchuria, 5,914 cases of cholera and 4,085 deaths had been reported to September 5. The reports are incomplete.

The Chinese Eastern Railway reported 1,143 cases of cholera with 645 deaths in its zone up to August 31, 1932, 561 of the cases being in Harbin.

Plague

England—Liverpool—From Vessel.—Under date of September 20, 1932, the medical officer of health of Liverpool, England, stated that, in addition to the plague-infected rats found on the steamship *City of Oxford*, one plague-infected rat had been found in a shed at the Langton Branch Dock. This is the dock where the *City of Oxford* was berthed. (See Public Health Reports September 30, 1932, page 1990.)

Yellow Fever

Brazil.—During the week ended August 6, 1932, two deaths from yellow fever were reported in Ceara State, Brazil. Under date of September 19, 1932, two deaths from yellow fever were reported in the State of Pernambuco, Brazil.

Senegal.—A fatal case of yellow fever was reported at Bakel, Kidira, Senegal, during the week ended October 1, 1932.

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