Public Health Reports

Vol. 55 • JUNE 14, 1940 • *No. 24*

TRAPPING RATS ON SHIPS

The secret of keeping a vessel free of rats lies in the continuous, energetic application of the principles of good housekeeping to ships. A number of steamship companies find it easy and comparatively inexpensive to apply these principles and thus keep their vessels in faultless sanitary condition. For these, freedom from rats and the consequent avoidance of fumigation is merely one of the advantages to be derived from keeping ships clean.

On the other hand, there are some vessels, especially those in coast-wise service, the operators of which have failed to grasp the significance of rat infestation and are not aware of the many benefits which result from rat control. This article has been prepared for the purpose of stimulating the interest of these operators, their agents, and the personnel of their vessels, and to provide practical suggestions for keeping ships free of rats.

Why a Ship Should Be Kept Free of Rats.

1. Because the rat is a reservoir of a number of dangerous diseases, among them plague and typhus fever. Infected rats may bring these diseases to us from foreign ports or may spread the infections from one to another of our own ports.

2. Because rats eat and soil large quantities of food, deface and destroy portions of a ship's structure, and damage cargo and the containers in which it is packed.

Methods of Controlling Rats on Ships.

1. Ratproof construction of new ships.
2. Eliminating harborages and nesting places on all ships.
3. Starving rats by making food scarce. This measure includes the removal of spilled grain and foodstuffs from holds, the protection of ship's stores, and the prompt disposal of garbage and waste food. Whatever is done to perfect these measures will supplement all other measures of rat control.
4. Trapping, by means of snap traps of the dead-fall or guillotine type.
5. Poisoning.
6. Fumigation with a deadly gas such as hydrocyanic acid gas.

229382°—40——1

Choice of Control Methods.

Rats may be killed with certainty in any enclosed structure by using a deadly fumigant such as hydrocyanic acid gas, provided all harboring places have been opened up to permit free access of the gas to rats wherever they may seek harborage. When a vessel is heavily infested with rats, fumigation is the measure of choice to secure immediate results; but unless it is repeated at relatively short intervals, fumigation cannot be depended on to prevent the building up of a ship's rat population. Because of the danger to human life and the expense incident to the use of hydrocyanic acid gas, other measures for rat control should be given a thorough trial before resort is made to the gas routinely.

Many structural defects which make rat harboring easy and safe may be overcome at the time a vessel is built by applying the principles of ratproof design and construction. The same principles may with advantage be applied to vessels already in operation, but under no circumstances should entire dependence be placed on ratproofing. If rat life is to be controlled, even the theoretically ratproof ship must at all times be kept in a clean and orderly condition.

The systematic removal of debris remaining after the discharge of cargo confers a twofold benefit: (1) The removal of waste that might provide food for rats, and (2) the elimination of potential harborages. Accumulations of seldom-used dunnage, surplus gear, and other equipment furnish ideal harborages. All such material as is not needed should be removed from the vessel, and that which remains on board should frequently be disturbed and rearranged or, preferably, should be stowed on racks elevated above decks.

Methods of extermination, such as starving, trapping, and poisoning, are essentially related in that they supplement each other. Trapping and poisoning, of course, are more effective when sources of food supply, other than bait, are cut off. Separating the rat from its customary food supply is closely linked to the system of ship sanitation, previously referred to as good housekeeping. Poisoning is of doubtful value on two counts: First, there is the danger of accidental harm to human beings and lower animals; and, second, it is often impossible to secure visible evidence of the results obtained with this measure.

Trapping is recommended as being the most effective method of exterminating rats on ships, especially clean ships on which measures are energetically applied to prevent ready access of rats to food supplies. Trapping is also to be recommended on the grounds that it is inexpensive, comparatively easy of application by the ship's regular personnel, and causes no loss of time during the routine operation of the vessel, either at dock or at sea.

Requirements for Success in Trapping.

The trapping of rats is most successfully undertaken by men with well-developed hunting instincts. After all, the rat is a wild animal, able to live near man because of superior cunning. The survival of the rat in this close but antagonistic association is proof of its resourcefulness, adaptability, persistence, agility, and hardihood.

To cope with the rat, one must know its habits and learn to outwit the animal. Careful study and persistent effort are required, because the rat will make the most of every opportunity. If turned back at one point, it will appear at another.

Rats Found on Ships.

The two varieties of rats most frequently encountered on shipboard are the Alexandrine (gray) and Indian (black). The Norway (brown) is found to a lesser extent, but is not averse to shipboard conditions.

Characteristics of Rats Which Make Control Difficult.

Rats are able to—

1. Climb with ease and rapidity surfaces affording slight footholds, such as rough seams, wall angles, and perpendicular pipes.
2. Jump a distance several times their own length.
3. Run along pipes, wires, and narrow beams, even though partially blocked by structural elements running at right angles.
4. Squeeze through small openings.
5. Survive in small spaces with restricted air supply.
6. Subsist on small quantities of food.
7. Secure sufficient water from food or from condensation on metallic surfaces.

Factors Governing Rat Control on Shipboard.

Knowledge of the habits of rats is essential to satisfactory control. The following points may be emphasized in this connection:

1. The female rat requires a sheltered place in which to nest and rear the young. Therefore, such locations should be sought by inspectors and trappers.
2. In order to nourish large and frequent litters, the female must have sufficient food.
3. Rats seek safe and inconspicuous harborages, even for temporary sojourns.
4. Repeatedly used runways disclose evidence of a rat's presence and the routes to hiding places.
5. Rat signs include droppings (excreta), marks of gnawing, and trails made by feet, tails, and bodies.

Inspection Hints.

With some attention to the foregoing details, inspectors and trappers can locate freshly marked runways leading to probable hiding

and nesting places. Taking into consideration the various signs, an inspector should be able to estimate, with comparative accuracy, the approximate number and whereabouts of rats on a ship.

Traps: Their Care and Use.

Although numerous devices are available, it has been found that the most effective trap for ship use is the so-called snap trap. Of convenient size for placing in small spaces and on narrow runways, this trap is nevertheless sufficiently powerful to kill a full-grown rat.

In this type of trap the dead-fall, operated by a coiled spring stapled to a small, flat board, is released when the rat attempts to seize the bait which is affixed to the trigger. Such a trap, baited and set, is illustrated in figure 1.

In order to be effective, traps must be kept clean. Frequent wiping with an oiled cloth aids in keeping the metal parts of the trap rust-free, which is essential to fast spring and dead-fall action. Because rats are suspicious of the human odor, traps should preferably be handled by hands encased in frequently-washed cotton gloves. Occasionally the traps may be brushed lightly with oil of anise to cover the odor of human contact and to increase their attractiveness to rats.

Much of the success of trapping depends upon the kind of bait used and upon the ingenuity with which the experienced trapper applies his knowledge of the habits and food preferences of rats. For example, in initiating trapping, the rat's natural suspicion may be overcome by placing attractively baited but unset traps around for a day or two, during which time the animal is misled into believing that the trap is a safe source of food. A hungry rat will be attracted by many kinds of food, such as stale bread, raw meat, bacon, fresh and smoked fish, cheese, fruit, and vegetables; but when food is plentiful outside of traps, rats are extremely "choosey," and the trapper must experiment with a variety of baits to determine what food is in demand. When sources of water supply are scarce or inaccessible on a vessel, a moist bait is likely to be most attractive.

Freshly baited traps should be set in runways and other places late in the day after work on a ship has stopped, the locations of the settings being carefully recorded. On the following morning the traps should be examined, dead rats removed, and the traps cleaned and repaired pending resetting with fresh bait. After a ship's hold has been loaded, and before the hatches are replaced, traps should be set on top of the cargo in anticipation of a further catch. A trapper should constantly seek new and more advantageous locations for his traps. By keeping a written record of locations in which rats are caught, later trapping efforts will be simplified and systematized. The trapper who studies the habits of rats, pursuing his quarry diligently and persistently, will be able to maintain satisfactory control, especially if the vessel is kept

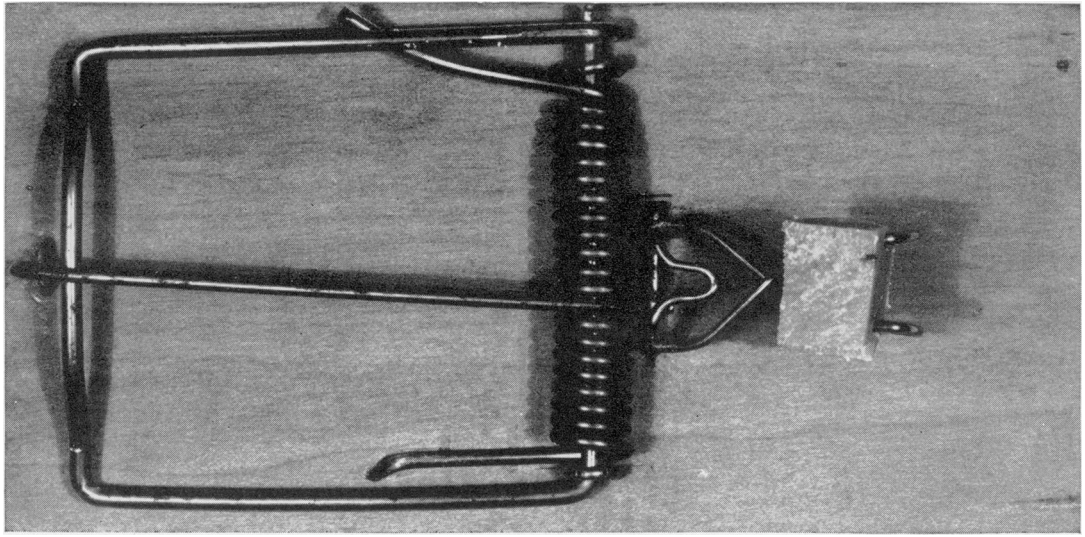

FIGURE 1.—Approved type of trap, baited and set. The trap is 7 inches in length.

clean. However, rats may invade clean ships or be brought aboard in cargo even when reasonable precautions are observed. Fortunately, an alert trapper can destroy such rodents before harborages are established and the species propagated.

Disposal of Dead Rats.

Dead rats should be removed from traps with gloved hands. They should then be placed in paper or finely meshed cloth bags and burned.

References.

It is not practicable in the present article to cover completely the subject of rat control on vessels. However, those interested in the details of ship ratproofing, infestation inspections, and sanitary maintenance of vessels, will find much of practical value in the following publications of the United States Public Health Service. Copies of these publications may be obtained, at the prices quoted, from the Superintendent of Documents, Government Printing Office, Washington, D. C.

The Ratproofing of New Ships. Supplement No. 151 to the Public Health Reports. (15 cents).

Rat Infestation Inspection of Vessels. (Reprint No. 1529 from the Public Health Reports.) (10 cents).

Some Experiments with Rats and Rat Guards. (Reprint No. 1827 from the Public Health Reports.) (10 cents).

Sanitary Units on Ships; Organization and Operation. Public Health Reports, vol. 55, No. 11, March 15, 1940 (5 cents).

IMMUNITY TO THE LANSING STRAIN OF POLIOMYELITIS AS REVEALED BY THE PROTECTION TEST IN WHITE MICE [1]

By V. H. Haas, *Passed Assistant Surgeon*, and Charles Armstrong, *Senior Surgeon, United States Public Health Service*

In a previous communication (*1*) it was pointed out that the Lansing strain of poliomyelitis could be employed with the cotton rat to determine the protective properties of sera. It was also shown that white mice could be similarly employed (*2*) and that the results were in marked agreement in the two species when the same sera were employed, and that the results were repeatable.

In table 1 are presented the results of neutralization tests in both cotton rats and white mice employing the same virus suspension and the same sera. The virus utilized in these tests was the cotton rat strain of Lansing virus which had been carried through 23 successive passages in mice. The cotton rat strain of virus prior to passage in the white mouse, while utilizable, was inferior to the mouse adapted strain since the former often failed to produce paralysis and death with

[1] From the Division of Infectious Diseases, National Institute of Health.

all mice when known negative sera were employed and the incubation period in mice with the unadapted strain tended to be quite variable and often prolonged.

TABLE 1.—*Serum-virus neutralization test in cotton rats and white mice*

Source of serum	Cotton rats [1]					Mice [2]				
	Serum dilution	Number of rats	Day of death following inoculation	Survived	Immunity	Serum dilution	Number of mice	Day of death following inoculation	Survived	Immunity
Monkey 609, negative control.	1/40	1	6	0	−	1/10	4	5 [3], 6, 8, 10	0	−
	1/40	1	5	0		1/20	4	6, 8, 13, 21	0	
	1/40	1	5	0		1/40	4	2 [3], 6, 7, 12	0	
Human serum, D. D.	1/40	1		1	+	1/10	4		4	+
	1/40	1		1		1/20	4		4	
	1/40	1		1		1/40	4		4	
Human serum, T. C.	1/40	1	9	0	−	1/10	4	4 [3], 6, 6, 8	0	−
	1/40	1	3 [4]	1		1/20	4	3 [3], 3 [3], 5, 6	0	
	1/40	1	6	0		1/40	4	7, 7, 21	1	
Human serum, M. F.	1/40	1	7	0	−	1 10	4	5, 7, 8, 10	0	−
	1/40	1	12	0		1/20	4	5, 7 [3], 9, 14	0	
	1/40	1	9	0		1/40	4	3, 5, 6, 6	0	
Human serum, J. V.	1/40	1		1	+	1/10	4		4	+
	1/40	1		1		1/20	4		4	
	1/40	1		1		1/40	4	10 [3]	3	
Pooled serum from monkeys recovered from poliomyelitis.	1/40	1		1	+	1/10	4		4	+
	1/40	1		1		1/20	4		4	
	1/40	1		1		1/40	4		4	

[1] Tests made Mar. 8, 1940.
[2] Tests made Mar. 7, 1940.
[3] Died; no previous paralysis noted.
[4] Paralysis with recovery.

The tests reported in table 1 were performed on mice and cotton rats on successive days by the same worker (C. A.). The same sera and virus suspension were employed in each test, virus for the second test being held overnight at 3° to 5° C.

In view of the high degree of agreement found on several comparative trials with the two species and because of economy, availability, and ease of handling, white mice were selected as the animals of choice for the following serum-virus neutralization studies.

Tests on human sera.—A total of 83 human sera have been investigated, the actual tests in most instances being performed by V. H. H.

METHOD OF TESTING SERA

The virus used was the Lansing strain established in white mice by Armstrong (*1*). The spinal cord and base of the brain of mice, taken on the first day of paralysis, were the sources of the virus. Mice showing paralysis within a week of inoculation were usually selected and the virus was used on the day it was collected, without glycerinization. The base of the brain and the cord from two or three mice

were thoroughly triturated in a mortar and suspended in sufficient saline to make dilutions of approximately 1:10, 1:20, and 1:40 by volume (not centrifuged).

Each serum in 0.15 cc. amounts was mixed with 0.10 cc. of each virus dilution and allowed to stand for 1 hour at room temperature, being shaken at intervals.[2] Each serum-virus mixture was next inoculated intracerebrally into 4 mice (0.03 cc.), a total of 12 mice thus being utilized for each serum tested.

Sera were tested in groups of 4 to 10, and with each group a known positive serum and a known negative serum were employed as controls.

The animals were observed for 21 days, paralyses and deaths being recorded daily. Most of the paralyses occurred within 1 week after inoculation, but some developed even during the last few days of observation.

METHOD OF INTERPRETING RESULTS

The results were read in relation to the findings in the controls for each test. Where the controls were satisfactory [3] the following classifications were observed:

1. If 9 or more of the 12 mice survived without symptoms the serum was regarded as giving definite protection against the virus.

2. If 5 to 8 mice survived without symptoms while not more than 2 or 3 survived in the negative controls, the serum was regarded as showing moderate to questionable protection.

3. If less than 5 mice survived without symptoms, the serum was regarded as giving no protection.

CONSISTENCY OF RESULTS

Twenty sera were tested two or more times. In only two instances was there any tendency for results to fall into different categories, and even these discrepancies were slight. The sera used as controls also gave consistent results on repetition, as may be seen from table 2.

TABLE 2.—*Consistency of results given by sera used as controls for protection test*

Sera used as controls	Number of tests	Number of tests showing—			
		Definite protection	Moderate protection	Questionable protection	No protection
1. Pooled monkey serum, positive	14	[1] 13	----------	----------	----------
2. Human serum (Charleston), positive	3	3	----------	----------	----------
3. Uninoculated monkey serum, negative	6	----------	----------	----------	[1] 5
4. Uninoculated monkey serum, positive	7	----------	----------	----------	7
5. Human serum (Charleston), negative	4	----------	----------	----------	4
6. Human serum (Charleston), negative	3	----------	----------	----------	3

[1] One test excluded on account of the number of mice dying of unknown causes.

[2] Overnight icebox fixation was investigated and the results were identical.

[3] In a satisfactory negative serum not more than 3 mice should survive without paralysis. In a satisfactory positive control 9 to 12 mice should survive without paralysis.

ORIGIN OF SERA TESTED

There were 83 human sera tested; 69 were obtained in Charleston, S. C., and 14 from Detroit, Mich. Outbreaks of poliomyelitis occurred in both localities in 1939, and all poliomyelitis cases from which sera were obtained had been affected during these outbreaks, with the single exception of a case occurring in 1933.

The blood from the Detroit cases was sent to us by Dr. J. G. Molner, to whom we acknowledge our gratitude.

The origin of the sera is shown in table 3.

TABLE 3.—*Origin of sera tested*

Source of sera	Detroit, Mich.	Charleston, S. C.
Poliomyelitis cases	14	19
Family contacts of poliomyelitis cases		26
Children in orphanages where no cases occurred		20
Suspected cases, not reported as poliomyelitis		4
Total	14	69

The sera used as controls were obtained from the following sources:

Positive controls:

1. Pooled sera of monkeys surviving inoculation with poliomyelitis virus (PCMS XII) sent to us by Dr. E. H. Lenette.

2. A human serum from Charleston, S. C., which was found to give positive results comparable with the pooled monkey sera.

Negative controls:

Nos. 3 and 4. Sera from 2 uninoculated monkeys.

Nos. 5 and 6. Sera from 2 Charleston cases, giving negative results comparable to those given by the sera of the uninoculated monkeys.

RESULTS OBTAINED WITH CHARLESTON SERA

As shown in table 4, the sera of 12 of the 19 Charleston, S. C., poliomyelitis cases protected mice against the Lansing strain of virus. There is no evidence to indicate that ability of sera to neutralize this strain of virus was influenced by either the extent of involvement during the acute stage or the presence of residual involvement at the time the blood was taken.

When sera of the different groups of donors are compared, as shown in table 5, it is apparent that sera from the poliomyelitis cases gave less protection than from the other groups of persons tested. This fact is somewhat clarified, however, by consideration of the age groups into which the donors fall; 47 percent of the poliomyelitis cases tested were under 10 years of age whereas only 13 percent of the other donors were in this age group.

TABLE 4.—*Poliomyelitis cases, Charleston, S. C., whose sera were tested for neutralizing antibodies against the Lansing strain of poliomyelitis virus*

Patient	Race	Sex	Age (years)	Onset date, 1939	Date bled, 1940	Extent of involvement during acute stage	Condition at time blood was taken	Reaction of sera in neutralization tests
J. H.	C	F	5	Apr. 10	Jan. 31	Both legs	Residuals present	No protection.
T. W.	W	M	5	May 15	Feb. 1	No paralysis	No residuals	Protection.
L. A.	C	M	6	Feb. 5	Feb. 2	Left arm and hand; left abdominal.	Residuals present	Do.
A. P.	C	M	6	June 5	Jan. 31	Both legs	do	No protection.
M. M.	C	F	6	July 14	Jan. 30	Right arm; abdominals.	No residuals	Do.
Z. G.	C	F	6	[1]	Jan. 31	[1]	Residuals present	Do.
T. C.	C	F	7	Feb. 7	Jan. 29	Both arms, both legs	do	Do.
N. N.	C	M	9	May 19	Jan. 31	Weakness left leg	No residuals	Protection.
J. M.	W	M	9	July 23	do	Both legs; abdominals	Residuals present	No protection.
E. B.	C	F	11	May 4	Jan. 30	Both legs; left abdominal.	do	Protection.
M. G.	W	F	12	May 2	do	Both legs; abdominals	Slight residuals	Do.
P. E.	W	M	12	May 31	Feb. 1	No paralysis	No residuals	Do.
H. C.	W	M	17	May 3	Jan. 30	do	do	Questionable
V. L.	W	F	18	May 15	do	Right arm; both legs	do	Protection.
L. M.	W	F	21	July 3	Feb. 1	Both legs; left arm	Residuals present	Do.
B. S.	W	F	21	Aug. 7	Feb. 3	No paralysis	No residuals	Do.
D. D.	C	F	24	June 10	Jan. 30	Both legs; right arm	Residuals present	Do.
R. Z.	W	M	27	Aug. 9	Jan. 31	No paralysis	No residuals	Do.
J. N.	C	M	11	1933	Jan. 29	Both legs	Residuals present	Do.

[1] No data.

TABLE 5.—*Protection shown by sera of poliomyelitis cases and others, Charleston, S. C.*

Classification of donors	Number of sera tested	Degree of protection			
		Definite protection		Moderate to questionable	No protection
		Number	Percent		
Poliomyelitis cases	19	12	63	1	6
Family contacts of cases	26	21	81	2	3
Children in orphanages	20	18	90	1	1
Suspected cases	4	1	25		3
Total	69	52	75	4	13

The results of the neutralization tests according to age groups are shown in table 6.

TABLE 6.—*Protection shown by sera of different donors, according to age,*[1] *Charleston, S. C.*

Age group	Cases			Contacts			Orphanages			Total		
	Number tested	Number protected	Percent protected	Number tested	Number protected	Percent protected	Number tested	Number protected	Percent protected	Number tested	Number protected	Percent protected
Under 10	9	3	33	6	3	50	None			15	6	40
10 to 19	6	5	83	10	8	80	20	18	90	36	31	86
20 and over	4	4	100	10	10	100	None			14	14	100

[1] 4 suspected cases of which 1 gave positive protection are omitted from table.

In each category, the percentage of sera giving protection rises with the age of the donors, and while the figures in each separate group are too small to be significant, those for all categories combined are large enough to give definite indication of this rise in protective ability with increasing age. Whereas only 6 of the 15 sera from all donors under 10 gave protection, 31 of the 36 in the age group 10 to 19 gave protection. All of 14 sera from persons 20 or more years old protected.

When adequate allowance is thus made for age of the donors, it appears that in this series of tests the factor which influenced the presence or absence of protective antibodies in the sera was the age of the donors, rather than their experience with clinical poliomyelitis.

This relative unimportance of experience with the recognized disease is shown when the different categories of sera falling in a single age group are compared. In table 7 this comparison is made for the age group 10 to 19, this being the only group with enough sera in each category to give reliable comparative results. From this table it may be seen that no significant differences as to protective power were found among persons who had or had not had clinically recognized poliomyelitis.

TABLE 7.—*Protection shown by sera from various donors in the age group 10 to 19 years* [1]

Classification of donors, age group 10-19 years	Number tested	Sera giving protection	
		Number	Percent
Poliomyelitis cases	6	5	83
Family contacts of cases	10	8	80
Orphanage children	20	18	90

[1] Suspected cases omitted.

TABLE 8.—*Protection shown by sera of persons in private urban dwellings and of persons in orphanages, age group 10 to 19 years*

Classification of donors, age group 10-19 years	Number tested	Sera giving protection	
		Number	Percent
Children in private urban dwellings [1]	17	11	65
Children in orphanages [2]	20	18	90

[1] 12 white, 5 colored. [2] 10 white, 10 colored.

In addition to age, it appears that another factor, related to frequency of contact among individuals, may have had an influence on the degree of protection shown by the sera tested. In table 8 persons of the age group 10 to 19 years are separated into two classes, those living in private dwellings in the city of Charleston, and those living in two orphanages, one for white and one for colored children. The number of sera tested is small and does not warrant making

generalizations, but it is interesting to note that the orphanage group showed appreciably more protection than the persons living in private homes.

RESULTS OBTAINED WITH DETROIT SERA

All the Detroit sera tested were obtained from cases of poliomyelitis. Of the 14 sera, 5 gave protection. Data were complete for only 10 of these sera, 3 being from persons under 10 years of age and 7 from persons in the age group 10 to 19 years. These figures are too small to permit analysis, and about the only statement to be made regarding this group of sera is that a minority of the specimens tested was capable of protecting mice against the Lansing strain of virus.

Table 9 shows the results obtained with the Detroit sera.

TABLE 9.—*Poliomyelitis cases from Detroit, Mich., whose sera were tested for neutralizing antibodies against the Lansing strain of poliomyelitis in mice*

Patient	Race	Sex	Age	Onset date, 1939	Date of bleeding	Extent of involvement during acute stage [1]	Reaction of sera in neutralization tests
D. G.	C	F	6	Sept. 15	April 1940	Legs and abdominals	Protection.
N. P.	W	F	7	July 27	do	do	No protection.
P. R.	W	F	8	Aug. 13	do	Right leg	Do.
A. H.	C	F	10	July 13	do	Leg, abdominals, back	Questionable.
P. B.	W	M	10	Sept. 15	do	Right leg	No protection.
J. M.	W	M	11	do	do	Both arms, leg, back	Do.
R. M.	W	M	11	Sept. 11	do	Both arms	Do.
H. E.	W	M	14	Aug. 20	do	Both arms, abdominals	Do.
J. P.	W	M	14	August	do	Left leg	Protection.
M. R.	C	M	16	do	do	Right arm	No protection.
J. J.	[2]	[2]	[2]	[2]	do	[2]	Protection
H. J.	[2]	[2]	[2]	[2]	do	[2]	No protection.
J. K.	[2]	[2]	[2]	[2]	do	[2]	Protection.
A. V.	[2]	[2]	[2]	[2]	do	[2]	Do.

[1] Extent of residual involvement at time of bleeding not known.
[2] No data.

COMPARISON OF RESULTS WITH CHARLESTON AND DETROIT SERA

The sera from the Charleston cases gave protection in a higher proportion of instances than those from Detroit. This appears from the following comparison:

	Number tested	*Number giving protection*	*Percent giving protection*
Sera tested from Charleston cases	19	12	63
Sera tested from Detroit cases	14	5	36

The ages of all the Detroit cases are not known, but at least 7 of the 14 are known to be 10 or more years old; 53 percent of the Charleston cases were aged 10 or more.

DISCUSSION

Results of the serum-virus protection test on 83 human sera indicate that serum antibodies capable of neutralizing the Lansing strain of

poliomyelitis virus are widely prevalent, especially among older individuals. The results secured with mice appear to be more trustworthy than those usually secured with monkeys, since mice are more uniformly susceptible than monkeys besides being inexpensive and available in large numbers. The test is easily performed, the results consistent and usually clear-cut, and, insofar as results are available, they are in general agreement with neutralization results secured with human sera in monkeys. These considerations, together with the small amount of serum required for the test (0.45 cc.) should render it possible to follow serum immunity in groups of population from different localities and from infancy to adulthood and thus probably to clarify many epidemiological questions still awaiting solution, at least insofar as one strain of poliomyelitis is concerned.

SUMMARY

1. The mouse protection test, using human sera and the Lansing strain of poliomyelitis virus adapted to mice, gives results that are clear-cut and consistent.

2. An appreciable percentage (68.7+) of the human sera tested protected mice against this virus.

3. The individual's experience with clinically recognized poliomyelitis, or lack of it, did not determine the presence or absence in his blood serum of protective antibodies against the virus employed.

4. The percentage of sera giving protection increased with the age of the donors.

5. There was more protection shown by the sera of persons living in orphanages than by those of the same age group living in private urban dwellings.

6. A higher percentage of poliomyelitis sera tested from Charleston, S. C., gave protection than did those tested from Detroit, Mich.

ACKNOWLEDGMENT

We are indebted to Dr. Leon Banov, Miss Margaret S. Arey, and Mrs. Holmes Hazelton of Charleston, S. C., for invaluable personal assistance in the collection of blood in that city, to Dr. J. G. Molner for sending us the specimens from Detroit, Mich., and to Passed Assistant Surgeon A. G. Gillian for providing data relative to the Charleston cases.

REFERENCES

(*1*) Armstrong, Charles: Successful transfer of the Lansing strain of poliomyelitis virus from the cotton rat to the white mouse. Pub. Health Rep., **54**: 2302–2305 (1939).

(*2*) Armstrong, Charles: Unpublished data.

STUDIES ON TRICHINOSIS

XIV. A SURVEY OF MUNICIPAL GARBAGE DISPOSAL METHODS AS RELATED TO THE SPREAD OF TRICHINOSIS[1]

By WILLARD H. WRIGHT, *Chief, Division of Zoology, National Institute of Health, United States Public Health Service*

The relatively high incidences of the trichina parasite, *Trichinella spiralis*, in various population groups in the United States, as indicated by studies at the National Institute of Health and elsewhere, warrant the expenditure of some effort to determine the factors responsible for such a widespread distribution of this parasite. Some time ago, the writer (*1*) reported an incidence of trichinae of 16.3 percent in 3,000 diaphragm examinations in the National Institute of Health and summarized the findings in other post-mortem surveys in the United States which indicated an incidence of trichinae of 18 percent in 3,494 examinations when due allowance is made for differences in the techniques employed. Since that time Walker and Breckenridge (*2*) have reported finding the parasite in 33 of 100 persons coming to necropsy in Birmingham and Tuscaloosa, Ala.; Evans (*3*) has reported an incidence of 36 percent in 100 cases at Cleveland, Ohio; Hood and Olson (*4*) in Chicago found trichinae in 5.77 percent of 208 diaphragms examined by the digestion method and in 13.6 percent of 220 diaphragms examined by both the digestion and microscopic methods; while Sawitz (*5*) has reported a finding of trichina infection in 7 percent of 200 additional diaphragms examined at New Orleans. These findings, together with those from later examinations in the National Institute of Health, add confirmation to the results of previous surveys which showed that approximately 1 in every 6 persons examined was infected with the parasite.

Most of these surveys comprise samplings of the urban population, and persons residing in rural areas are very inadequately represented. In order to offset this great preponderance of urban material, we are now engaged in a survey designed to determine the incidence of the parasite in persons residing on farms or in villages of 1,000 population or less. To date, only 5, or 4.1 percent, of 122 such persons have been found positive for trichinae. While this represents a relatively small number of examinations, the incidence figure is lower than that obtained by us in any group of 100 individuals examined from the urban population and would seem to indicate that persons residing in rural areas are not as frequently exposed to trichinosis as are persons residing in urban areas. If future examinations bear out this conclusion, we would have the rather anomalous situation in which persons in rural areas raising their own pork supply would be less

[1] Presented in abridged form before the 37th Annual Conference of State and Territorial Health Officers with the United States Public Health Service, Washington, D. C., April 24, 1939.

exposed to trichinosis than persons dependent on commercial sources for the pork which they consume. While any discussion of the reasons for such a situation would at this time be premature, it is not out of order to hazard an opinion that the relatively large number of garbage-fed hogs going on the market in cities may represent the answer to the increased exposure to trichinosis faced by the city dweller.

Hall (*6*) has aptly pointed out the role of the hog fed on raw garbage as a source of human trichinosis. Since the appearance of Hall's paper Schwartz (*7*) has reported further on the examination for trichinae of swine maintained on different types of feed. Of 2,847 diaphragms from hogs that had been fed garbage as collected, 286, or 10 percent, were infected with trichinae, the number of larvae in individual diaphragms ranging from 1 to 77,100. Of 3,799 diaphragms from so-called grain-fed hogs, 40, or 1 percent, were infected with trichinae, the number of larvae in the individual diaphragms ranging from 1 to 1,033. Schwartz (*8*) had previously reported on the examination of 1,860 swine fed on cooked garbage, of which only 0.59 percent were infected with trichinae. At the present time the evidence is overwhelmingly in support of the view that the hog fed on uncooked garbage is the chief source of human trichinosis.

For the reason that most of the garbage fed to swine originates in towns and cities, it seemed pertinent to inquire into the extent to which present practices in the disposal of municipal garbage are concerned in the dissemination of the trichina parasite.

RESULTS OF PREVIOUS SURVEYS

We were led to make this survey because of the difficulty of obtaining reliable information concerning the extent of the hog-feeding method of disposal of municipal garbage. The Municipal Index for 1930 (*9*) gave data on garbage collection and disposal in 557 cities of over 4,500 population, of which 216, or 38.8 percent, disposed of their garbage by feeding it to swine. Eddy (*10*) has recently stated that this method is the one practiced in the largest number of cases and Toquet (*11*) has estimated that 50 percent of cities with a population of 15,000 utilize the hog-feeding method of garbage disposal. Gillespie and Reinke (*12*) reported that in 1930, 162 of 242 cities in California were disposing of garbage by feeding it to swine. Conti (*13*) in 1930 stated that for 5 years previously none of the 44 cities in Los Angeles County, Calif., had used any method other than hog feeding for the disposal of their garbage. The magazine, Public Works (*14*), noted that for the year 1930, 49 percent of the cities reporting to it fed all or part of the garbage to hogs. The 1931 report of the United States Chamber of Commerce on refuse disposal in American cities (*15*) gave

data on the results of three surveys, including the Municipal Index survey mentioned above. A survey made in 1917 indicated that 35 percent of 610 reporting cities used the hog-feeding method of garbage disposal, while another survey made in 1925 indicated that 44 percent of 967 cities disposed of municipal garbage in this way.

NATURE AND EXTENT OF THE SURVEY

During the months of November and December 1938 and January 1939, letters were addressed to health officers in all cities of 10,000 population and over according to the 1930 census. The health officer was requested to indicate on a form supplied for that purpose the method of garbage disposal employed in his city and, in event that the garbage was fed to swine, whether it was fed on a municipally owned hog farm or by contractor, whether the garbage was fed raw or was cooked, and the number of garbage-fed hogs marketed during the calendar year 1937. As some cities employing sanitary methods of disposal give or sell municipally collected garbage to farmers for hog feed, effort was made to ascertain the number of tons of garbage disposed of in these ways. The questionnaire was designed to cover the disposal of municipally collected garbage only and did not refer to the disposal of hotel and restaurant garbage for the reason that in most cities and towns this refuse is collected by individuals who usually feed it to swine.

RESULTS OF THE SURVEY

Letters were addressed to health officers in 964 cities and replies were received from 764, or 79.3 percent, of these cities. Table 1 summarizes the results from the standpoint of the frequency of the methods employed, both as regards the use of single methods and as regards the use of multiple methods of disposal. Impending changes in methods of disposal were indicated in the replies from some cities. Three were changing from the fill and cover method to incineration, one from fill and cover to hog feeding, one from fill and cover to grinding and discharge into sewers, one from hog feeding to grinding and discharge into sewers, and one from hog feeding and fill and cover to incineration.

It will be noted that the hog-feeding method of disposal was used in the greatest number of cases followed in order by incineration, fill and cover, reduction, and by certain miscellaneous methods of disposal. A total of 296 cities disposed of municipal garbage entirely by feeding it to swine, while an additional 107 cities disposed of part of the garbage by feeding it to swine. Thus a total of 403, or 52.7 percent, of the 764 cities replying to the questionnaire disposed of municipally-collected garbage in whole or in part by feeding it to swine. Twenty-two of these cities maintained a municipal hog farm.

TABLE 1.—*Results of survey of garbage disposal methods in 764 of 964 cities with a population of 10,000 and over, showing number of cities using various single and multiple methods of disposal*

Methods of disposal	Number of cities
Single methods of disposal:	
Incineration	197
Reduction	7
Fill and cover (including dump)	135
Hog feeding	296
Dumping at sea	2
Dumping in lake	1
Dumping in river	1
Multiple methods of disposal:	
Incineration and reduction	1
Incineration and fill and cover	16
Reduction and fill and cover	1
Hog feeding and incineration	38
Hog feeding, incineration, and fill and cover	4
Hog feeding and reduction	8
Hog feeding and fill and cover	57
Hog feeding and dumping at sea	2
Hog feeding and dumping in river	1
Hog feeding and grinding and discharge into sewers	2
Total	764

Replies to the questionnaire indicated that municipal garbage from only 24 of the 403 cities was cooked before its consumption by swine but even in some of these cities only a portion of the garbage was cooked.

Inasmuch as health officers seldom have direct supervision over refuse disposal, it was not expected that complete returns would be made in connection with the question asking for the number of garbage-fed hogs marketed during the calendar year 1937. However, 232 cities reported the marketing in that year of a total of 302,796 hogs fed on municipally-collected garbage; of these hogs, only 32,028 were fed on cooked garbage. Even if the former figure is approximately accurate, which it probably is not, it would in no way be indicative of the number of garbage-fed hogs marketed yearly in the United States, for the reason that it does not take into account estimates from cities not represented in this survey or the vast number of swine fed on hotel, restaurant, and privately-collected garbage.

In the majority of cities using the hog-feeding method of disposal, it is the practice usually to feed the garbage on a municipally-owned hog farm or to dispose of it through contractors who in turn feed it to swine. However, returns from the questionnaire indicated that a few cities having available sanitary methods of disposal indulged in the practice of giving or selling to numerous individual hog feeders a portion of the garbage collected by the municipality. Among these cities, Washington, D. C., having a reduction plant, gave away approximately three-fourths of the garbage to hog feeders and sent only one-fourth to the reduction plant. Boston, Mass., also having a reduction plant, furnished gratis to farmers approximately 15,000 tons, or about one-fourth of the amount of garbage collected by the

municipality. St. Louis, Mo., which discharges ground garbage into sewers, sold 26,150 tons to farmers for hog feed. Lastly, Philadelphia, Pa., using the reduction method of disposal, presented gratis to hog feeders 119,416 tons, over 70 percent of the total amount collected. While these cities have available methods of garbage disposal other than hog feeding, actually a varying percent of the garbage was fed to hogs during the calendar year 1937. Consequently, these cities have been included in the group of municipalities employing in part the hog-feeding method of disposal.

DISCUSSION

These results show that a surprisingly large percentage of cities included in the survey dispose of garbage by feeding it to swine and that this method is employed more frequently than is any other single method of disposal. While no reliable figures are available, it seems probable that this method is used as frequently, or even more frequently, by smaller communities in which revenue from taxation is not sufficient to provide for more sanitary methods of disposal. In the aggregate, American municipalities either directly or indirectly are probably the largest feeders of raw garbage to swine and would therefore appear to be chiefly responsible for the dissemination of trichinosis. Many hogs maintained on municipal garbage are slaughtered locally, and many cities are thus contributing indirectly to the ill health of their own citizens. We have been informed that many garbage feeders avoid marketing their hogs in federally inspected packing plants in order to obviate price differentials resulting from condemnations under Federal inspection for disease conditions, other than trichinosis, which are common in garbage-fed hogs. In uninspected plants, trichinous pork may go into products customarily eaten raw by the consumer, thus providing very dangerous avenues of infection.

It has been pointed out in a previous paper (*1*) that geographical areas in which many hogs are raised on garbage are the areas having the most clinical trichinosis. There is even some further correlation between the percentage of cities feeding garbage to hogs and the trichinosis morbidity rate. For instance, the Pacific Coast States, in which 82.8 percent of the cities concerned dispose of garbage by feeding it to swine, have the highest morbidity rate of any section. The New England States, with the next highest morbidity rate, lead all other geographical areas in the number of cities using the hog-feeding method of disposal. Table 2 presents the results of the present survey by States and geographical areas and shows the number and percentage of cities which use the hog-feeding method of garbage disposal.

TABLE 2.—*Results by States and geographical divisions of survey of garbage disposal methods in 764 of 964 cities of 10,000 population and over, showing distribution of cities using the hog-feeding method of disposal*

Division and State	Total cities with population of 10,000 and over	Number of replies received	Percent of cities replying	Number of cities in which municipal garbage is fed to swine	Percent of cities in which municipal garbage is fed to swine
NEW ENGLAND					
Maine	11	9		8	
New Hampshire	10	8		5	
Vermont	4	4		4	
Massachusetts	73	56		54	
Rhode Island	12	11		9	
Connecticut	31	20		12	
Total	141	108	76.6	92	85.2
MIDDLE ATLANTIC					
New York	69	52		12	
New Jersey	55	44		7	
Pennsylvania	92	66		13	
Total	216	162	75.0	32	19.8
EAST NORTH CENTRAL					
Ohio	59	51		29	
Indiana	34	28		20	
Illinois	58	46		20	
Michigan	40	34		22	
Wisconsin	27	19		8	
Total	218	178	81.7	99	55.6
WEST NORTH CENTRAL					
Minnesota	14	10		4	
Iowa	21	16		13	
Missouri	16	14		11	
North Dakota	4	3		2	
South Dakota	6	6		1	
Nebraska	8	6		3	
Kansas	20	14		14	
Total	89	69	77.5	48	69.6
SOUTH ATLANTIC					
Delaware	1	1		0	
Maryland	6	6		1	
District of Columbia	1	1		1	
Virginia	14	13		5	
West Virginia	10	8		1	
North Carolina	21	14		6	
South Carolina	9	8		1	
Georgia	15	13		3	
Florida	14	12		4	
Total	91	76	83.5	22	28.9
EAST SOUTH CENTRAL					
Kentucky	12	11		4	
Tennessee	8	7		2	
Alabama	14	12		1	
Mississippi	12	11		7	
Total	46	41	89.1	14	34.1
WEST SOUTH CENTRAL					
Arkansas	9	5		4	
Louisiana	8	6		2	
Oklahoma	15	12		9	
Texas	36	30		18	
Total	68	53	77.9	33	62.3

TABLE 2.—*Results by States and geographical divisions of survey of garbage disposal methods in 764 of 964 cities of 10,000 population and over, showing distribution of cities using the hog-feeding method of disposal*—Continued

Division and State	Total cities with population of 10,000 and over	Number of replies received	Percent of cities replying	Number of cities in which municipal garbage is fed to swine	Percent of cities in which municipal garbage is fed to swine
MOUNTAIN					
Montana	6	5		2	
Idaho	2	2		2	
Wyoming	2	1		0	
Colorado	8	6		6	
New Mexico	3	2		2	
Arizona	2	2		2	
Utah	3	1		1	
Nevada	1	0		0	
Total	27	19	70.4	15	78.9
PACIFIC					
Washington	15	12		6	
Oregon	6	5		4	
California	47	41		38	
Total	68	58	85.3	48	82.8
Grand total	964	764	79.3	403	52.7

The situation today plainly indicates that methods of garbage disposal have not kept pace with the marked improvements effected during recent years in other municipal sanitary services. While no effort has been made to obtain such information, it seems safe to assume that nearly all, if not all, of the cities utilizing the hog-feeding method of garbage disposal have sewage and water systems sufficiently adequate for the prevention of fecal-borne diseases. Many of them have food-inspection services and probably most of them have milk ordinances based on the standard ordinance of the United States Public Health Service or ordinances equivalent to that ordinance. Thus, most of these municipalities have probably provided adequate protection against most of the diseases spread through food or water; however, in the case of trichinosis they are not only failing to provide adequate safeguards but are contributing to the spread of infection.

The persistence of such an outmoded method of garbage disposal is accounted for in part by the revenue which many cities derive from such refuse. Some municipalities receive a sizable amount of income from the sale of garbage. Others, which merely furnish the garbage gratis to hog feeders, while not profiting directly, are relieved of the expense of disposal. With the present burden of taxation, any method of refuse disposal which represents a saving to the municipality appeals alike to the city official and the taxpayer. The general application of any suitable method or methods for the sterilization and processing of garbage so that its value as an animal food might be safely conserved would help solve the present problem. However,

the economic factor is not the factor of prime importance. With such things as the use of night soil as fertilizer, we have long since disregarded the economic factor in favor of benefits to community health.

The vociferous pressure brought to bear by the organized garbage feeder, who frequently is merely a proprietor of a piggery and in no sense a swine raiser or an agriculturist even though producing pork in competition with farmers who raise swine in a clean and sanitary manner, has probably helped to perpetuate the noxious practice of disposing of garbage by feeding it to swine. Recent attempts in at least two States to secure legislation looking to the control of trichinosis by restricting the practice of feeding uncooked garbage to swine have been blocked largely by organizations of persons engaged in this practice. There is no doubt that similar influences have been brought to bear on many city officials in the matter of the disposal of municipal garbage.

State and local health officials may well assume the leadership in remedying the present anomalous situation. State surveys would be desirable in ascertaining those cities, incorporated towns, and villages disposing of collected garbage by feeding it to swine. Effort should be made to encourage disposal by methods which are accordant with accepted public health standards. Until facilities are available for sanitary methods of disposal, it would be desirable for cities to include in contracts for garbage removal and disposal provisions for the adequate cooking of garbage before its consumption by swine. In those cities already employing sanitary methods of disposal but benefiting from garbage sold or furnished gratis to farmers and hog feeders, the public health aspects of the matter should be considered and effort made to curb such practices.

It is apparent from the present survey that archaic methods of garbage disposal are still widely employed and that improvements in this essential municipal function have lagged far behind those effected in other municipal sanitary services. Under present conditions, it would appear that little can be accomplished in the way of controlling trichinosis so long as our cities and towns continue their substantial contributions to the spread of this disease and serve as flagrant examples for others to do likewise.

ACKNOWLEDGMENTS

We are greatly indebted to those city health officials who responded so generously to our request for information. This summary would not have been possible without their splendid cooperation.

Senior Sanitary Engineer R. E. Tarbett, U. S. Public Health Service, aided in the collection of certain data and offered valuable suggestions.

REFERENCES

(1) Wright, Willard H.: Studies on trichinosis. XI. The epidemiology of *Trichinella spiralis* infestation and measures indicated for the control of trichinosis. Am. J. Pub. Health, **29**: 119–127 (February 1939).
(2) Walker, J. Henry, and Breckenridge, C. G.: Preliminary report on the incidence of trichinosis in Alabama. J. Parasitol., **24**: (Supplement) 10 (December 1938).
(3) Evans, C. H., Jr.: Trichinosis in Cleveland. Post-mortem examination of diaphragm and skeletal muscle from 100 consecutive autopsies. J. Infect. Dis., **63**: 337–339 (Nov.–Dec. 1938).
(4) Hood, Marion, and Olson, S. W.: Trichinosis in the Chicago area. Am. J. Hyg., **29**: Sec. D., 51–56 (March 1939).
(5) Sawitz, Willi: *Trichinella spiralis*. 1. Incidence of infection in man, dogs, and cats in the New Orleans area as determined in post-mortem examinations. Arch. Path., **28**: 11–21 (July 1939).
(6) Hall, Maurice C.: Studies on trichinosis. IV. The role of the garbage-fed hog in the production of human trichinosis. Pub. Health Rep., **52**: 873–886 (July 2, 1937).
(7) [Schwartz, Benjamin.] *In* Annual Report of the Bureau of Animal Industry, 1938, pp. 75–85.
(8) [Schwartz, Benjamin.] *In* Annual Report of the Bureau of Animal Industry, 1937, pp. 57–64.
(9) Municipal Index, 7th Ed., Section 11, pp. 617–635. American City Mag. Corp., New York (1930).
(10) Eddy, Harrison P., Jr.: Refuse disposal—a review. Municipal San., **8**: 77–78, 81, 86 (January 1937).
(11) Toquet, Frederick E.: A comparison of methods for garbage disposal without odor nuisance, from the viewpoint of a municipal engineer. Municipal Index, 10th Ed., pp. 349–354. American City Mag. Corp., New York (1933).
(12) Gillespie, C. G., and Reinke, E. A.: Municipal refuse problems and procedures. Weekly Bull., California State Dept. Pub. Health, **8**: 153–155, 157–159 (October 27, November 3, 1934).
(13) Conti, L. F.: A survey of municipal garbage disposal. [Mimeographed.] The Los Angeles County Live Stock Department (1930).
(14) Refuse disposal data. Public Works, **62**: 34 (December 1931).
(15) Refuse disposal in American cities. [Mimeographed.] Chamber of Commerce of the United States. Washington (April 1931).

PATHOLOGIC HISTOLOGY OF EXPERIMENTAL VIRUS INFLUENZA IN FERRETS [1]

By T. L. Perrin and J. W. Oliphant, *Passed Assistant Surgeons, United States Public Health Service*

In 1933 Smith, Andrewes, and Laidlaw (*1*) reported on an acute respiratory infection experimentally produced in ferrets by the intranasal inoculation of influenza virus from human sources. Since that time ferrets have been used extensively for the study of influenza virus from both human and swine sources. However, reports in the literature on the pathologic alterations produced in ferrets by the inoculation of influenza virus are few in number and are limited to the study of changes in the respiratory system. The reports describing these pathologic changes are by Smith, Andrewes, and Laidlaw (*1*, *2*), Shope (*3*), Francis (*4*), Francis and Stuart-Harris (*5*), Brightman (*6*),

[1] From the Divisions of Pathology and Infectious Diseases, National Institute of Health.

and Dujarric de la Riviere and Cheve (*7*). Only two of these reports, (*3*) and (*5*), give much histopathologic detail.

The purpose of this experiment was to observe the histopathologic changes in the respiratory system of ferrets inoculated with human influenza virus, and to observe certain other organs for possible effects.

MATERIALS AND METHODS

Twenty-one young male ferrets, about 4 months old, with normal temperatures were inoculated on September 14, 1939, with 5 percent suspension of ferret lung and turbinates in 50-percent beef broth-normal saline. The virus used was the P.R. 8 strain which was supplied by Dr. Thomas Francis, Jr., and has been maintained in this laboratory by mouse passage for about 2 years. Before use, two ferret passages of the virus were made. The animal used in making the suspension for inoculation had been inoculated 3 days previously, had been febrile for 2 days, and had a temperature of 39.9° C. when killed with ether. Small to moderate-sized pneumonic areas were present in all lobes of both lungs. Portions of the lungs and turbinates were ground with an abrasive, suspended in broth-saline and centrifuged at 1,000 r. p. m. for 10 minutes. One and five-tenths cubic centimeters of the supernatant were dropped into the nostrils of each animal under ether anesthesia. All animals were febrile within 36 hours after inoculation.

Two uninoculated ferrets and one which had been inoculated intranasally with plain broth were used as controls.

Animals were killed for study by first anesthetizing deeply with ether, then allowing them to inhale Orth's solution dropped into both nostrils until respiration ceased. The thorax was opened, a ligature was placed around the upper border of the larynx, and about 30 cc. of Orth's solution was injected into the trachea so that the lungs were moderately distended. All organs to be used for study were then placed in Orth's solution.

Routine sections for study in all animals were made from the nose, larynx, trachea, lungs, heart, liver, spleen, kidneys, and adrenals. The sections from the nose were usually three in number and were cross sections cut in a transverse vertical plane from the anterior, mid, and posterior portions of the nose. Both upper and both lower lobes of the lungs were sectioned in each animal, and usually a section was taken from the right middle lobe. A portion of mediastinum was included in sections from the upper lobes, usually showing one or more mediastinal lymph nodes. Tissues were routinely stained with modified Romanowsky (*8*) and Van Gieson stains.

ANATOMIC NOTE

As a detailed description of the normal anatomy of the ferret nose has been given by Francis and Stuart-Harris, only a few further notes seem necessary in following a description of the pathologic changes found in the nose.

Only the respiratory type of mucosa is seen in the anterior portion of the nose. In the midportion the olfactory type of mucosa is seen in small to moderate areas on the roof and turbinates, while the remainder is respiratory. The posterior portion of the nose is divided into three compartments, two major upper compartments separated by the nasal septum, and a lower smaller compartment. The latter is nasopharynx and is lined by respiratory mucosa. The upper compartments, containing the posterior laminae of the turbinates, are covered almost completely by olfactory mucosa.

In our animals the supporting framework of the turbinates was entirely bony and calcified. This contrasts with Francis and Stewart-Harris' finding of a cartilaginous framework.

HISTOPATHOLOGY

Nasal lesions.—In general the inflammatory reaction was more marked and extensive in respiratory than in olfactory mucosa. In the anterior and midportions of the nose where respiratory mucosa is predominant, the inflammation was more severe on the turbinates and floor than on the roof and walls.

Bacteria were usually absent. Clumps of cocci were seen around a foreign body in only one section.

The exudate covering the mucosa varied in amount from animal to animal and was either muco-purulent or purulent. It was first seen in small amounts 24 hours after inoculation and was not present in animals killed after the fourteenth day.

One day after inoculation, changes in the nasal mucosa were confined to areas covered by respiratory epithelium and consisted of congestion and focal infiltration by small numbers of polymorphonuclears and lymphocytes.

By the end of the second day the inflammatory reaction was accentuated but was still confined to respiratory mucosa. There was a diffuse but irregular infiltration by moderate numbers of polymorphonuclears and fewer lymphocytes, the cells focally being more numerous in the epithelium than in the lamina propria. The epithelium over the floor, roof, and walls was largely intact, but in foci the cells were swollen, showed cytoplasmic oxyphilia and vacuolization, karyopyknosis and, rarely, desquamation. Over the turbinates, columnar ciliated epithelium was almost completely replaced by a single layer of flattened, deeply basophilic cells with small patches devoid of

epithelium. The lamina propria was congested, edematous, and focally there was extravasation of blood.

Ferrets killed on the third and fourth days showed involvement of both respiratory and olfactory mucosa. The cellular infiltration noted previously was increased, being dense in some areas. In portions of the nose where respiratory mucosa is usually found, intact columnar epithelium was seen only in small irregular patches on the lateral walls and roof. In other areas degenerative changes similar to those noted on the second day were seen, and, in addition, cytoplasmic or intercellular vacuoles often contained fragmenting leucocytes or small hyaline oxyphil globules. Where a single layer of flattened cells had covered most of the turbinates in the anterior and midportions of the nose on the second day, there was now a single or double layer of swollen fusiform to polyhedral cells. The inflammatory reaction in the olfactory mucosa varied considerably in amount from animal to animal. At least half of this type of mucosa was normal in every ferret, and in some over three-fourths was intact. In the patchy, small to moderate-sized areas of involvement there were necrosis and desquamation of the superficial epithelial cells, and the deeper cells were swollen, irregularly polyhedral and without polarity. Infiltrating polymorphonuclears were sometimes clumped in intercellular vacuoles and in the lumina of mucosal glands, some of which were dilated. Leucocyte infiltration was rarely as dense in the involved portions of the olfactory lamina propria as it was in the edematous and focally hemorrhagic lamina propria of the respiratory mucosa. The osseous laminae of the turbinates showed moderate periosteal proliferation, and focally polymorphonuclears were seen between the proliferating cells; this periosteal reaction was noted especially under respiratory mucosa.

During the fifth and sixth days the cellular infiltration of the mucosa was unchanged, but in the respiratory mucosa definite stratification of the polyhedral epithelial cells was taking place. In the lamina propria of both respiratory and olfactory mucosa a little fibroblast proliferation was seen focally, and small groups of subperiosteal osteoblasts and occasional osteoclasts were found adjacent to the osseous laminae of the turbinates.

In the animals killed from the seventh through the eleventh days, the cellular infiltration of the mucosa was decreased in amount, and while polymorphonuclears predominated in the epithelium, lymphocytes and plasma cells were slightly more numerous in the lamina propria. Most of the respiratory mucosa was covered by stratified epithelium of transitional type, and focally the superficial cells were cuboidal. In the olfactory mucosa the basal layer of cells was almost entirely intact and arranged normally, but in patchy areas the superficial cells were loose, polyhedral, and irregularly arranged, and in an

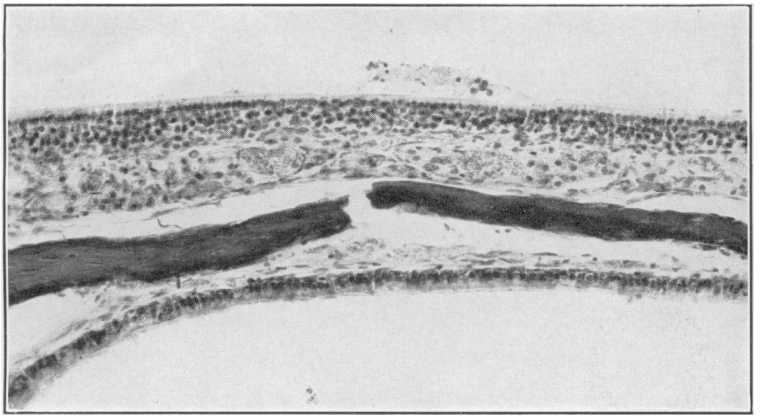

FIGURE 1.—Portion of nasal turbinate, showing normal olfactory (above) and respiratory mucosa (× 250).

FIGURE 2.—Nasal turbinate, third day after inoculation. Inflammatory reaction in respiratory mucosa. Note the loss of epithelium (× 260).

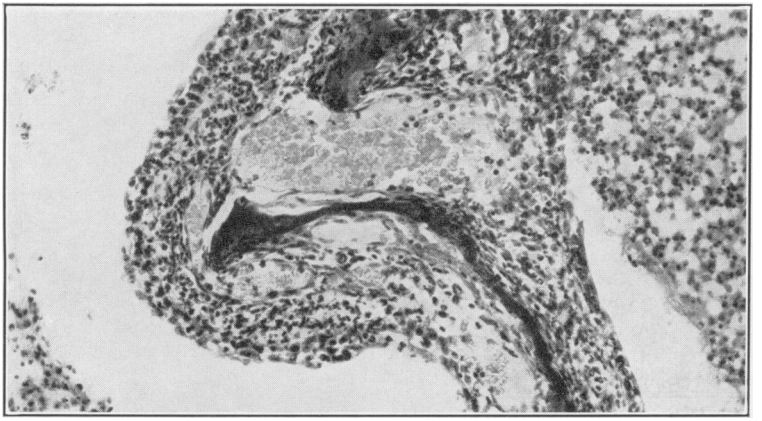

FIGURE 3.—Nasal turbinate, fifth day, respiratory mucosa. Note more marked cell infiltration and beginning stratification of epithelium (× 260).

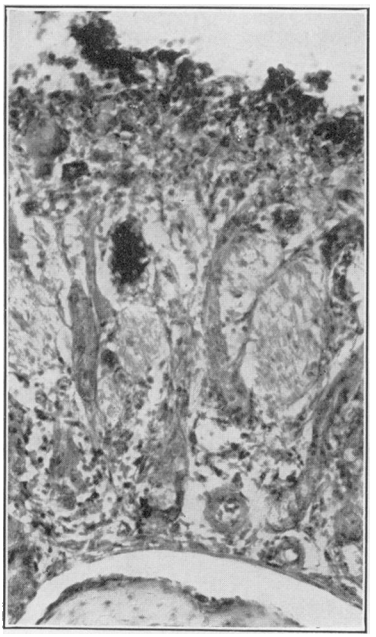

FIGURE 4.—Nasal turbinate, fourth day. Inflammatory reaction in olfactory mucosa (× 260).

FIGURE 5.—Lung, one day after inoculation. Bronchiole in center shows partial loss of epithelium. Polymorphonuclears predominate in alveolar exudate (× 260).

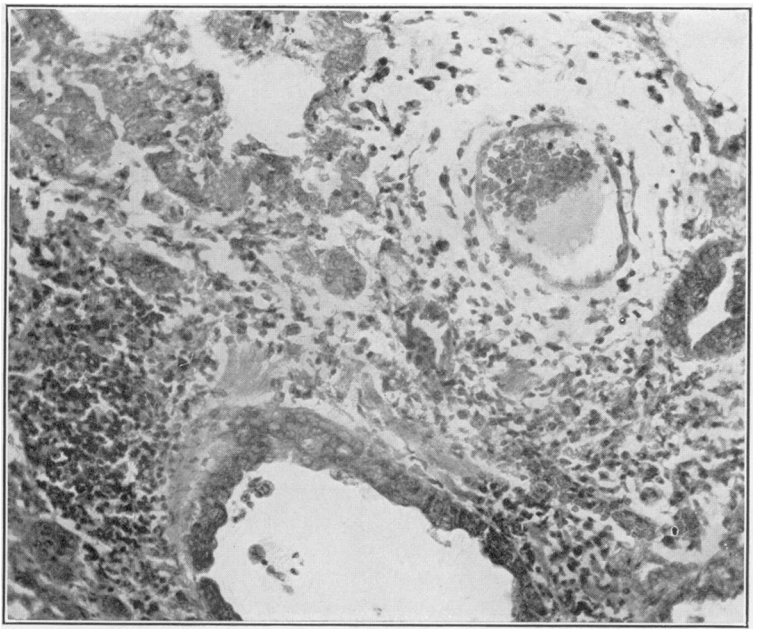

FIGURE 6.—Lung, sixth day. Marked proliferation of bronchial epithelium (below), and of mononuclear cells lining alveoli (above). Note the loose cellular zone around the vessel (× 340).

occasional focus grouped into imperfect acini. The turbinate laminae were focally thickened beneath groups of osteoblasts, and occasional osteoclasts were seen in irregular surface depressions or within the laminae. A little fibrosis was seen in the lamina propria of the mucosa, particularly on the floor of the nose.

One ferret was killed on the fourteenth day, and the only changes from previous days were seen in the respiratory mucosa, where in a few areas the epithelium was stratified columnar in type and some of the superficial cells were distended with mucus.

By the nineteenth day most of the respiratory epithelium covering the turbinates and floor was stratified columnar, while that on the roof and walls was almost entirely normal. Goblet cells were numerous, and scattered polymorphonuclears were seen in the epithelium where they were occasionally clumped in vacuoles between cells or in occasional small acini. Olfactory epithelium was normal in appearance except for a few small areas where superficial cells were flattened. Focally, small to moderate numbers of lymphocytes and plasma cells were seen in the lamina propria, especially on the floor of the nose. In small areas periosteal proliferation was noted on the turbinate laminae, the latter showing irregular thickening beneath groups of osteoblasts. This thickening was especially prominent in the tips of the laminae where bulbous swellings were produced. In these thickened areas some of the osteoid cells within the laminae were round and swollen and were surrounded by small clear spaces.

Two ferrets were killed on the twenty-ninth day following inoculation. In these the respiratory epithelium on the walls and roof was normal except for occasional intercellular vacuoles containing a very few polymorphonuclears. The epithelium over the turbinates was a little irregular owing to focal stratification. The olfactory mucosa was normal. Irregular thickening of the turbinate laminae was similar to that described above.

Larynx and trachea.—Sections were taken from the larynx and from the midportion and lower end of the trachea of all animals. No lesions were seen in the larynx or midtrachea. In the lower end of the trachea small numbers of polymorphonuclears were seen in the mucosa in animals killed between the first and ninth days. Three of these ferrets also showed polymorphonuclear and lymphocyte infiltration around groups of tracheal glands, some of which contained pus.

Lungs.—The pathologic alterations in the lungs consisted of patchy pneumonic areas of small to moderate size occurring around inflamed medium-sized and small bronchi and bronchioles. The lesions were most numerous and extensive in the bases of the lower lobes, decreasing progressively upwards. Bacteria were not seen.

The lesions appeared early, and in ferrets killed 1 day after inoculation small numbers of polymorphonuclears were seen in mucoid

exudate in the main bronchi, and all lobes were congested. A small to moderate number of the medium and small bronchi and bronchioles contained a variable amount of purulent exudate; some contained only a few polymorphonuclears, while in others the lumina were filled with exudate. The walls of these bronchi and bronchioles were irregularly infiltrated by a small number of polymorphonuclears and lymphocytes, and focally the lining epithelial cells were swollen, vacuolated, and occasionally desquamated. Around these involved bronchi and bronchioles small to moderate-sized patches of alveoli contained small to moderate numbers of polymorphonuclears and fewer red blood cells, macrophages, and large mononuclear cells. Septal cells in these alveoli were swollen and polymorphonuclears were accumulated in the capillaries. A moderate number of medium-sized vessels and fewer medium-sized and small bronchi showed compact, thin to moderately thick collars of cells, chiefly lymphocytes. These peribronchial and perivascular collars were seen in apparently normal areas as well as in areas of inflammation.

By the second and third days the pneumonic process was more extensive, although the amount of involvement varied in different ferrets. Some of the pneumonic areas were larger than those seen on the first day, but many remained small. A moderate number of medium and small bronchi and bronchioles showed inflammatory reaction and contained more abundant purulent exudate than on the first day. In a few of these bronchi and bronchioles patchy areas of the mucosa were devoid of lining epithelium, and there was focal hyaline necrosis in the subjacent connective tissue. In others, groups of lining cells were degenerating and necrotic, while in other areas the cells were swollen and heaped. Slight to moderate polymorphonuclear and lymphocyte infiltration was seen in the bronchial walls and peribronchial connective tissue. In the pneumonic areas moderate numbers of polymorphonuclears and large mononuclear cells, together with a little fibrin, made up the exudate within alveoli; about half of the mononuclear cells showed phagocytic activity while the remainder had relatively large nuclei, prominent nucleoli, and scanty cytoplasm. In some alveoli large mononuclear cells lined the septa. A little edema fluid was seen in alveoli in a few pneumonic areas and beneath the pleura in some lung sections. Instead of compact perivascular and peribronchial collars made up of lymphoid cells as were seen on the first day, a moderate number of vessels and fewer bronchi were surrounded by a fairly wide zone in which lymphocytes, large mononuclear cells, and polymorphonuclears were loosely arranged in a meshwork of fibrillar basophilic material. In a moderate number of large bronchi, purulent exudate was present in small groups of mucous glands and moderate numbers of polymorphonuclears and lymphocytes were infiltrating the adjacent connective tissue.

In ferrets killed on the fourth, fifth, and sixth days the pneumonic process was slightly more extensive than that seen on previous days. In addition to changes previously seen in the medium and small bronchi and bronchioles, focal heaping of lining epithelium was prominent. The heaped-up cells were swollen, deeply stained, chiefly polyhedral, and at times showed cytoplasmic vacuolization; scattered mitoses were present. In the pneumonic areas macrophages and large mononuclear cells were slightly more numerous than polymorphonuclears. Large, deeply stained mononuclear cells lined some of the alveolar walls, particularly those walls adjacent to bronchi and vessels. Loose cellular zones around many vessels and a few bronchi were similar to those seen on previous days, and the inflammatory reaction around groups of mucous glands in large bronchi was also similar.

During the seventh, eighth, and ninth days the inflammatory changes in the lung became more prominently proliferative and less exudative. Purulent exudate in the bronchi and bronchioles was less in amount and showed a considerable admixture of large mononuclear cells. In most of the medium and small bronchi and bronchioles showing inflammatory change, focal heaping of the lining epithelial cells was marked. In a few of these bronchi and bronchioles a single layer of flattened epithelium covered areas of mucosa which had apparently been previously denuded of lining cells. In pneumonic areas mononuclear cells definitely predominated in most alveoli, and proliferating large mononuclear cells were prominent in the adventitial portions of vessels and bronchi, in interalveolar septae, and lining alveolar walls. In some alveoli syncytial groups of large mononuclear cells almost filled the lumina. In large bronchi some of the mucous glands were dilated and lined by swollen cells; others contained fragmenting polymorphonuclears and cellular debris. Lymphocytes predominated in a moderate cellular infiltration seen around these glands.

Ferrets killed on the eleventh and fourteenth days showed a definite shrinkage in the size of the pneumonic areas, and the lesions were less exudative than those noted previously. Proliferative changes were similar in type to those noted above, but they were less marked. Cuboidal and goblet lining epithelial cells were seen in small to moderate numbers in bronchi and bronchioles showing inflammatory reaction, and the goblet cells were numerous in all other bronchi.

By the nineteenth day goblet cells were numerous in the large and medium bronchi. In small bronchi and bronchioles there was still a little focal heaping of lining epithelial cells and small numbers of polymorphonuclears and lymphocytes were scattered between the epithelial cells and in the walls. A small number of alveoli contained occasional macrophages and polymorphonuclears, and in a very few, mononuclear

cells lined the septae. Cellular zones around a moderate number of vessels and fewer bronchi were compact, thin to moderately thick, and again composed chiefly of lymphocytes. A slight lymphocyte and polymorphonuclear infiltration was seen around groups of dilated mucous glands in a moderate number of large bronchi.

Of two ferrets killed on the twenty-ninth day, one showed focal foreign body reaction in the base of one lung. Occasional accumulations of lymphocytes were seen in peribronchial connective tissue in both animals and compact, thin to moderately thick lymphocyte zones were seen around some vessels and small bronchi.

Mediastinal lymph nodes.—Mediastinal lymph nodes were seen in sections from 15 of the 21 ferrets inoculated with influenza virus. In 7, small to moderate numbers of macrophages in dilated central sinuses showed marked erythrophagia. As a similar process was noted in one uninoculated ferret, no significance can be attached to this finding.

Spleen.—In 8 of the 21 ferrets inoculated with influenza virus and in the control ferret inoculated with plain broth, small circumscribed hemorrhagic lesions were noted focally in the spleen. These lesions were approximately of the same size and distribution as ellipsoids, and some were seen definitely involving portions of these structures. The lesions consisted of a central hyaline or fibrillar zone in which fragmented red blood cells and occasional elongated pyknotic nuclei were seen, and a peripheral zone where red blood cells were mingled with small to moderate numbers of polymorphonuclears. These lesions were inconstant, they occurred also in a control animal, and their appearance bore no relation to the lapse of time following inoculation; hence they were considered to be of no definite significance.

Kidneys.—In 12 of the inoculated animals and 1 of the controls, a variable amount of amorphous calcareous material was present in the lumina of loop and collecting tubules. It is probable that this finding, which is fairly common in some laboratory animals under various conditions, has no relation to the present experiment.

Heart, liver, and adrenals.—These organs were normal in all ferrets.

DISCUSSION

An acute inflammatory reaction in the nasal mucosa was produced in ferrets by the inoculation of human influenza virus. A ferret inoculated with plain broth and two uninoculated controls showed no nasal lesions. The pathologic changes described by Francis and Stuart-Harris (*5*) were essentially the same as those seen in this experiment, with only one exception. They found involvement of olfactory mucosa in a ferret inoculated with the W.S. strain of human influenza virus, but not in ferrets inoculated with the P.R. 8 strain. In this

experiment, lesions were regularly produced in the olfactory mucosa by the P.R. 8 strain. No explanation is offered for this difference.

The pathologic alterations in the lungs produced by influenza virus in this study consisted of acute bronchitis and bronchiolitis with an associated bronchopneumonia. The control ferret which was inoculated with plain broth showed a focal foreign body reaction in the lungs. The reaction occurred around fragments of vegetable tissue and did not resemble lesions produced by the virus. Two uninoculated ferrets showed no lesions. The type of lung lesions seen in this experiment differed from that described by Shope (*3*) in ferrets inoculated in a similar manner with swine influenza virus, and from that described by Francis (*4*) who used a human strain of virus. Both of these authors described a pneumonic process which was lobar in character and in which edema was a prominent feature. Shope apparently obtained the pulmonary lesions from the outset with the swine virus, while Francis was able to produce the lesions only after serial passage through ferrets. The human virus used in this experiment had been mouse adapted; it was then passed twice through ferrets before the experiment was begun. It is probable that lesions of the type described by Shope and by Francis would have been produced had our virus been adapted by preliminary serial passage through several more generations in ferrets.

The incomplete descriptions by other authors of lung lesions produced in ferrets by the inoculation of influenza virus do not permit close comparison with the results of this study. However, the pathologic alterations described appear to be of the same general nature.

SUMMARY

The intranasal inoculation of influenza virus in ferrets while under ether anesthesia produced definite pathologic alterations in the nose and lungs; these alterations have been described. No lesions which could be definitely attributed to the influenza virus were seen in mediastinal lymph nodes, heart, liver, spleen, kidneys, or adrenals.

REFERENCES

(*1*) Smith, W., Andrewes, C. H., and Laidlaw, P. P.: A virus obtained from influenza patients. Lancet, **225**: 66–68 (1933).

(*2*) Smith, W., Andrewes, C. H., and Laidlaw, P. P.: Influenza: Experiments on the immunization of ferrets and mice. Brit. J. Exp. Path., **16**: 291–302 (1935).

(*3*) Shope, R. E.: The infection of ferrets with swine influenza virus. J. Exp. Med., **60**: 49–61 (1934).

(*4*) Francis, T., Jr.: Transmission of influenza by a filterable virus. Science, **80**: 457–459 (1934).

(*5*) Francis, T., Jr., and Stuart-Harris, C. H.: Studies on the nasal histology of epidemic influenza virus infection in the ferret. J. Exp. Med., **68**: 789–800 (1938).

(*6*) Brightman, I. J.: Streptococcus infection occurring in ferrets inoculated with human influenza virus. Yale J. Biol. and Med., **8**: 127–135 (1935).

(7) Dujarric de la Riviere, R., and Cheve, J.: Transmission au furet du virus de la grippe humaine. Bull. Acad. Med., Paris, **116**: 408 (1936).
(8) Lillie, R. D., and Pasternack, J. G.: Romanowsky staining with buffered solutions; current modification. J. Tech. Meth., **15**: 65–70 (1936).

PROVISIONAL MORTALITY STATISTICS, BY STATES, FOR 1939

A continuation of favorable health conditions in the United States in 1939, as interpreted by the crude mortality rate, is evidenced by provisional mortality figures recently issued by the Bureau of the Census, Department of Commerce.[1]

According to provisional tabulations, there were 1,387,797 reported deaths in continental United States in 1939, an increase of 6,406 over the number reported in 1938. This figure gives a provisional crude death rate of 10.7 for 1939, as compared with a rate of 10.6 for 1938. This apparent increase, however, may be entirely due to the use of the 1938 estimate of population in computing the 1939 rate. It is quite probable that, when the current census of population is available and more nearly accurate estimates can be made for the late precensal years, the difference may entirely disappear, or even be reversed. In any case, mortality in the United States in 1939 may be said to be equally as favorable as that in 1938, which year recorded the lowest crude death rate in the history of the country.

The rates for the individual States for 1939 are based on population estimates for 1937, the last year for which State estimates have been made by the Census Bureau; and, therefore, they are probably higher, at least for some of the States, than they would be if computed on 1939 population estimates.

Twenty States show lower crude death rates in 1939 than in 1938, 21 States and the District of Columbia show higher rates, and 7 States show no change in rates from 1938 to 1939. On the basis of rates computed on the 1937 population estimates the greatest decreases are reported for Rhode Island, South Carolina, Georgia, North Carolina, Alabama, and Arizona, and the largest increases are recorded for the District of Columbia, Idaho, Iowa, and Montana. In a comparison of the 1938 and 1939 rates for individual States the lack of recent and more nearly accurate population estimates must be taken into consideration.

The highest crude death rates in 1939 are for Arizona (14.2 per 1,000 population), New Mexico (14.1), District of Columbia (13.2), and Florida (12.8). The lowest rates are for North Dakota (7.7), Oklahoma and South Dakota (8.0), and Arkansas (8.1). It must be remembered, however, that differences in crude death rates do not

[1] Vital Statistics—Special Reports, vol. 9, No. 45 (May 20, 1940), pp. 533-536.

necessarily indicate corresponding differences in health conditions. The age, sex, and racial distributions of the population are factors, among others, which affect the crude rate, and these distributions differ in the various States.

The accompanying tables present the number of deaths and crude death rates, by States, for the years 1935 to 1939, inclusive, and a summary of rates for the expanding death registration area, by years, from 1930 to 1939, inclusive. The death registration area did not include all of the States until 1933.

Number of deaths (exclusive of stillbirths) from all causes and death rates per 1,000 estimated population, by States, 1935–39

Area	1939[1]	1938	1937	1936	1935	1939[1]	1938	1937	1936	1935
United States	1,387,797	1,381,391	1,450,427	1,479,228	1,392,752	10.7	10.6	11.2	11.5	10.9
Alabama	28,305	29,536	30,843	31,153	28,585	9.8	10.2	10.7	10.9	10.1
Arizona	5,839	6,002	6,919	6,551	6,077	14.2	14.6	16.8	16.1	15.0
Arkansas	16,521	16,971	18,364	18,465	16,176	8.1	8.3	9.0	9.1	8.1
California	77,115	76,187	80,256	76,094	72,456	12.5	12.4	13.0	12.6	12.1
Colorado	12,552	12,615	13,833	13,674	13,134	11.7	11.8	12.9	12.8	12.4
Connecticut	17,695	17,582	17,892	17,858	17,659	10.2	10.1	10.3	10.3	10.3
Delaware	3,170	3,199	3,290	3,317	3,208	12.1	12.3	12.6	12.8	12.5
District of Columbia	8,290	7,962	8,727	9,094	8,483	13.2	12.7	13.9	14.7	14.3
Florida	21,305	21,024	20,960	20,953	20,046	12.8	12.6	12.6	12.8	12.4
Georgia	31,843	33,783	34,446	37,263	34,288	10.3	11.0	11.2	12.2	11.3
Idaho	4,755	4,545	4,752	5,014	4,531	9.6	9.2	9.6	10.3	9.5
Illinois	86,993	84,769	87,739	92,806	85,518	11.0	10.8	11.1	11.8	10.9
Indiana	39,511	38,573	40,929	42,470	39,515	11.4	11.1	11.8	12.3	11.5
Iowa	26,460	25,623	26,485	28,432	26,364	10.4	10.0	10.4	11.2	10.4
Kansas	18,470	18,583	19,204	21,674	20,334	9.9	10.0	10.3	11.5	10.8
Kentucky	29,509	29,310	30,899	32,378	29,370	10.1	10.0	10.6	11.2	10.3
Louisiana	24,534	24,767	25,010	25,974	23,711	11.5	11.6	11.7	12.2	11.2
Maine	10,803	10,507	11,465	11,325	11,024	12.6	12.3	13.4	13.3	13.0
Maryland	20,830	20,847	22,083	21,960	21,182	12.4	12.4	13.2	13.1	12.7
Massachusetts	50,917	49,606	52,248	52,052	50,237	11.5	11.2	11.8	11.8	11.5
Michigan	52,023	50,687	53,472	54,781	51,050	10.8	10.5	11.1	11.5	10.8
Minnesota	26,784	26,179	26,905	28,630	26,247	10.1	9.9	10.1	10.9	10.0
Mississippi	22,647	22,800	23,856	24,128	21,339	11.2	11.3	11.8	12.0	10.6
Missouri	42,591	42,558	44,974	48,767	43,201	10.7	10.7	11.3	12.3	11.0
Montana	5,805	5,684	6,128	6,255	6,291	10.9	10.5	11.4	11.8	11.8
Nebraska	12,189	11,964	13,199	13,752	13,181	8.9	8.8	9.7	10.1	9.7
Nevada	1,256	1,272	1,322	1,439	1,324	12.4	12.6	13.1	14.4	13.4
New Hampshire	6,301	6,400	6,528	6,438	6,532	12.4	12.5	12.8	12.7	13.0
New Jersey	43,960	43,831	45,003	44,959	43,284	10.1	10.1	10.4	10.4	10.1
New Mexico	5,937	5,962	6,422	6,248	6,272	14.1	14.1	15.2	14.8	14.9
New York	149,507	147,106	153,772	153,545	148,462	11.5	11.4	11.9	11.9	11.5
North Carolina	31,644	33,599	33,981	35,630	33,485	9.1	9.6	9.7	10.3	9.8
North Dakota	5,427	5,208	5,440	5,654	5,860	7.7	7.4	7.7	8.0	8.4
Ohio	76,933	74,899	80,189	80,941	77,356	11.4	11.1	11.9	12.1	11.5
Oklahoma	20,378	19,957	21,313	23,250	21,091	8.0	7.8	8.4	9.2	8.4
Oregon	11,788	11,784	12,341	12,367	11,430	11.5	11.5	12.0	12.2	11.3
Pennsylvania	108,027	107,282	114,949	112,711	108,555	10.6	10.5	11.3	11.1	10.8
Rhode Island	7,775	8,276	8,334	8,126	7,838	11.4	12.2	12.2	11.9	11.5
South Carolina	19,274	20,718	20,540	21,426	20,353	10.3	11.0	11.0	11.5	11.1
South Dakota	5,549	5,482	5,959	6,157	6,316	8.0	7.9	8.6	8.9	9.1
Tennessee	28,726	29,288	30,232	32,522	30,002	9.9	10.1	10.5	11.4	10.6
Texas	60,225	60,208	65,448	65,803	61,663	9.8	9.8	10.6	10.8	10.1
Utah	4,713	4,853	4,989	5,126	5,066	9.1	9.4	9.6	9.9	9.8
Vermont	4,546	4,591	4,981	4,957	4,777	11.9	12.0	13.0	13.0	12.7
Virginia	28,641	29,579	31,119	32,202	30,358	10.6	10.9	11.5	12.1	11.5
Washington	18,514	18,528	19,094	19,356	18,203	11.2	11.2	11.5	11.8	11.1
West Virginia	17,494	17,766	19,190	19,908	18,340	9.4	9.5	10.3	10.9	10.1
Wisconsin	31,425	30,704	31,973	33,242	30,694	10.7	10.5	10.9	11.4	10.6
Wyoming	2,211	2,235	2,430	2,401	2,284	9.4	9.5	10.3	10.3	9.8

[1] 1939 figures are provisional.

NOTE.—United States rates for 1938 and 1939 are based on the 1938 estimated population; each State rate for 1938 and 1939 is based on the 1937 estimated population.

All data for the years prior to 1939 are final tabulations. The figures for 1939 are based on hand counts of death transcripts received by the Census Bureau from State offices of vital statistics. For the States from which the transmission of copies is complete, the provisional figures will agree closely with final tabulations. In the other States it may be expected that a few delayed certificates will be received before final tabulations are completed.

Death rate (number per 1,000 population) for registration area,[1] by years, 1900–1939

Year	Rate	Year	Rate	Year	Rate	Year	Rate	Year	Rate	Year	Rate	Year	Rate	Year	Rate
1939	[2] 10.7	1934	11.0	1929	11.9	1924	11.7	1919	12.9	1914	13.6	1909	14.4	1904	16.5
1938	10.6	1933	10.7	1928	12.1	1923	12.2	1918	18.1	1913	14.1	1908	14.8	1903	16.0
1937	11.2	1932	10.9	1927	11.4	1922	11.7	1917	14.3	1912	13.9	1907	16.0	1902	15.9
1936	11.5	1931	11.1	1926	12.3	1921	11.6	1916	14.0	1911	14.2	1906	15.7	1901	16.5
1935	10.9	1930	11.3	1925	11.8	1920	13.0	1915	13.6	1910	15.0	1905	16.0	1900	17.6

[1] In continental United States.
[2] Provisional.

COURT DECISION ON PUBLIC HEALTH

Death certificate as evidence of facts stated therein.—(New Jersey Court of Errors and Appeals; *Aitken* v. *John Hancock Mut. Life Ins. Co.*, 10 A.2d 745; decided January 25, 1940.) The statutes of New Jersey provided that in the execution of a death certificate the death and last sickness particulars should be supplied by the attending physician or, if there was no attending physician, by the county physician or coroner. It was also provided that, where a certificate or return of death was made by any person according to law, the original certificate, or a certified copy of such certificate or record thereof, should be received as prima facie evidence of the facts therein stated in all courts and places.

In an action on life insurance policies providing for extra indemnity for death by accident it appeared that there was an attending physician but that the death certificate was not made by him but by the acting county physician. Such certificate recited accidental injuries as the cause of death, but the court of errors and appeals stated that if it could disturb the finding on the weight of evidence it would do so because the proofs from the attending physician clearly demonstrated that death was from disease. The said court, in reversing the judgment of the lower courts in favor of the plaintiff, took the view that it was only a death certificate made in accordance with law that was prima facie evidence of the facts stated. It held that, as there was an attending physician able and competent to state the cause of death, the instant report was not made in accordance with the law and should not be given an effect to defeat the proper determination of the case.

DEATHS DURING WEEK ENDED JUNE 1, 1940

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

	Week ended June 1, 1940	Corresponding week, 1939
Data from 88 large cities of the United States:		
Total deaths	7,682	7,950
Average for 3 prior years	7,989	
Total deaths, first 22 weeks of year	199,673	199,346
Deaths under 1 year of age	461	490
Average for 3 prior years	508	
Deaths under 1 year of age, first 22 weeks of year	11,169	11,696
Data from industrial insurance companies:		
Policies in force	65,415,160	67,305,304
Number of death claims	9,899	10,089
Death claims per 1,000 policies in force, annual rate	7.9	7.8
Death claims per 1,000 policies, first 22 weeks of year, annual rate	10.4	11.5

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

REPORTS FROM STATES FOR WEEK ENDED JUNE 8, 1940

Summary

Slight increases were reported for the current week for each of the 9 communicable diseases included in the following weekly table, with the exception of scarlet fever and typhoid; but both the current incidence and the cumulative totals were below the 5-year (1935–39) median expectancy for all of these diseases except influenza and poliomyelitis.

The number of cases of poliomyelitis increased from 47 for the preceding week to 58 for the current week, as compared with a 5-year median expectancy of 38 cases. Of the 58 cases reported currently, 40 occurred in 2 Pacific States—25 in Washington State (the same as last week), of which 23 occurred in Pierce County, 8 in Tacoma, and 15 cases in California (9 last week), of which 7 occurred in Los Angeles. The other cases were scattered, with not more than 3 cases reported by any one State.

The number of smallpox cases increased from 47 to 62, Wisconsin (11) and Minnesota (8) reporting the largest numbers. For the country as a whole the current incidence is less than one-third of the median expectancy.

Rocky Mountain spotted fever recorded a seasonal rise, with 25 cases reported as compared with 18 last week. Of these, 10 cases occurred in the eastern States (5 in Maryland), 1 case in Illinois, and 14 cases in the northwestern States (7 in Wyoming). Seven cases of Colorado tick fever were reported in Colorado and 2 cases in Utah. Of 25 cases of endemic typhus fever, 8 cases each were reported in Georgia and Texas and 1 case was reported in California.

For the current week the Bureau of the Census reports 8,579 deaths in 88 large cities, as compared with 7,682 for the preceding week and with a 3-year average of 7,773 for the corresponding week. The cause of the sharp increase in mortality in these cities for the current week—nearly 900 deaths, or approximately 12 percent—is not revealed.

Telegraphic morbidity reports from State health officers for the week ended June 8, 1940, and comparison with corresponding week of 1939 and 5-year median

In these tables a zero indicates a definite report, while leaders imply that, although none were reported cases may have occurred.

Division and State	Diphtheria			Influenza			Measles			Meningitis, meningococcus		
	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39
	June 8, 1940	June 10, 1939		June 8, 1940	June 10, 1939		June 8, 1940	June 10, 1939		June 8, 1940	June 10, 1939	
NEW ENG.												
Maine	0	0	1	2	------	------	307	147	147	1	0	0
New Hampshire	0	0	0	------	------	------	3	13	30	0	0	0
Vermont	0	0	0	------	------	------	19	105	96	0	0	0
Massachusetts	5	3	3	------	------	------	1,341	1,120	634	1	2	2
Rhode Island	1	0	1	------	------	------	255	106	69	0	0	0
Connecticut	0	0	3	1	3	3	35	738	218	0	0	0
MID. ATL.												
New York	17	22	35	[1] 9	[1] 7	[1] 5	953	1,856	2,746	3	1	7
New Jersey [2]	10	13	14	4	------	5	1,256	51	605	0	1	2
Pennsylvania [2]	8	30	30	------	------	------	455	165	1,727	6	7	7
E. NO. CEN.												
Ohio	13	8	13	24	7	7	29	24	997	2	0	3
Indiana	4	7	7	11	11	11	13	8	155	2	1	2
Illinois [2]	28	27	39	11	18	18	188	40	457	0	0	5
Michigan [3]	4	10	10	2	1	1	832	283	283	2	1	1
Wisconsin	3	0	1	16	37	19	1,219	686	686	0	0	1
W. NO. CEN.												
Minnesota	1	1	3	2	1	1	88	166	311	0	0	1
Iowa	3	4	2	------	------	------	177	167	167	1	0	1
Missouri	3	9	14	------	1	10	6	8	56	0	0	1
North Dakota	0	0	1	14	18	7	2	17	11	0	0	0
South Dakota	3	0	1	1	2	------	3	117	8	0	0	0
Nebraska	1	2	4	------	------	------	16	132	132	0	0	0
Kansas	2	0	4	2	2	2	357	57	57	0	0	1
SO. ATL.												
Delaware [3]	0	0	1	------	------	------	2	20	22	0	0	0
Maryland [2 3]	1	1	5	2	2	2	18	225	195	1	0	3
Dist. of Col. [2]	3	0	7	1	------	------	2	181	93	0	1	1
Virginia	6	9	6	47	173	------	336	437	339	1	0	7
West Virginia [3]	6	7	7	6	7	17	26	6	46	2	0	3
North Carolina	9	7	8	1	2	1	111	296	196	0	0	1
South Carolina [4]	2	4	4	166	200	67	8	30	30	1	1	1
Georgia [4]	3	8	8	8	26	------	187	21	0	0	0	0
Florida [4]	0	7	3	------	5	2	62	73	19	0	0	2
E. SO. CEN.												
Kentucky	2	7	6	29	8	5	154	18	144	0	1	4
Tennessee	2	6	6	10	18	18	116	45	45	1	0	2
Alabama [4]	8	5	7	9	54	15	52	80	80	0	2	4
Mississippi [3]	6	8	6	------	------	------	------	------	------	0	0	0
W. SO. CEN.												
Arkansas	5	2	3	15	11	9	45	11	11	0	1	0
Louisiana [4]	3	11	11	14	7	7	5	74	13	1	0	1
Oklahoma [4]	4	5	5	10	28	28	8	159	63	1	1	1
Texas [4]	20	25	26	153	143	135	946	437	241	3	1	1
MOUNTAIN												
Montana [3]	0	0	1	------	4	2	86	154	97	0	0	0
Idaho [2]	2	1	0	------	------	1	16	23	11	0	0	0
Wyoming [2]	2	0	0	1	------	------	8	53	19	0	0	0
Colorado [2 5]	5	8	4	2	4	------	37	145	143	0	1	0
New Mexico [6]	1	0	5	------	2	2	38	11	47	0	2	0
Arizona	3	1	2	45	43	22	39	1	18	0	0	0
Utah [2 3 5]	0	1	0	------	4	------	363	105	50	0	1	0
PACIFIC												
Washington	1	4	2	------	------	------	263	1,053	299	0	0	0
Oregon [3]	10	1	1	3	13	13	236	69	69	0	0	0
California [4]	12	25	31	110	15	31	491	1,936	1,451	0	0	3
Total	222	289	335	731	877	512	11,209	11,669	11,669	29	25	88
23 weeks	7,254	9,556	11,359	165,405	147,990	137,512	183,643	312,854	312,854	[6] 879	1,077	3,206

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended June 8, 1940, and comparison with corresponding week of 1939 and 5-year median—Con.

Division and State	Poliomyelitis			Scarlet fever			Smallpox			Typhoid and paratyphoid fever		
	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39
	June 8, 1940	June 10, 1939		June 8, 1940	June 10, 1939		June 8, 1940	June 10, 1939		June 8, 1940	June 10, 1939	
NEW ENG.												
Maine	0	0	0	2	15	15	0	0	0	1	3	2
New Hampshire	0	0	0	1	0	1	0	0	0	0	0	0
Vermont	0	0	0	3	2	2	0	0	0	0	0	0
Massachusetts	1	0	0	130	121	197	0	0	0	0	1	1
Rhode Island	0	0	0	6	2	8	0	0	0	0	0	0
Connecticut	0	0	0	39	31	64	0	0	0	3	2	2
MID. ATL.												
New York	3	2	2	579	286	574	0	2	0	7	9	9
New Jersey [3]	1	0	0	264	102	102	0	0	0	0	1	2
Pennsylvania [3]	0	1	1	267	256	436	0	0	0	7	8	8
E. NO. CEN.												
Ohio	0	0	1	235	155	186	0	19	1	5	8	8
Indiana	0	0	0	30	62	62	2	13	7	9	1	3
Illinois [3]	2	1	1	590	202	392	4	24	15	3	8	6
Michigan [3]	0	0	0	255	342	276	2	18	1	3	5	3
Wisconsin	0	0	0	91	94	189	11	1	2	0	0	2
W. NO. CEN.												
Minnesota	0	1	0	49	43	70	8	3	8	0	0	0
Iowa	1	0	0	37	45	86	0	14	15	0	1	0
Missouri	0	0	0	18	29	67	6	8	8	2	7	7
North Dakota	0	0	0	4	5	29	0	0	6	1	2	0
South Dakota	0	0	0	16	7	12	5	10	8	0	0	0
Nebraska	0	1	0	13	8	28	1	1	4	1	2	2
Kansas	2	2	1	29	29	54	0	15	20	3	1	1
SO. ATL.												
Delaware [3]	0	0	0	3	2	6	0	0	0	0	0	0
Maryland [2 3]	0	0	0	30	16	41	0	0	0	1	3	2
Dist. of Col. [3]	0	0	0	21	6	6	0	0	0	0	0	0
Virginia	0	0	0	39	9	16	0	0	0	5	2	8
West Virginia [3]	1	0	0	21	24	31	0	0	0	3	3	3
North Carolina	1	0	1	14	16	16	0	0	0	0	11	10
South Carolina [4]	0	27	0	4	3	0	0	0	0	2	7	7
Georgia [4]	0	1	0	5	5	5	0	6	0	6	14	14
Florida [4]	1	3	1	3	4	4	1	0	0	1	5	4
E. SO. CEN.												
Kentucky	0	1	0	37	16	20	0	1	1	9	17	10
Tennessee	3	0	0	32	26	17	2	32	0	0	3	11
Alabama [4]	0	0	1	8	6	5	3	0	1	3	4	5
Mississippi [3]	0	2	2	2	2	5	0	0	1	3	1	7
W. SO. CEN.												
Arkansas	0	0	0	2	2	2	2	1	0	9	12	6
Louisiana [4]	1	1	2	10	6	6	0	0	0	6	10	12
Oklahoma [4]	0	0	0	5	4	7	3	22	2	3	9	9
Texas [4]	0	4	3	19	22	41	3	3	3	13	16	26
MOUNTAIN												
Montana [3]	0	0	0	10	11	11	0	2	3	0	0	0
Idaho [3]	0	0	0	0	0	5	0	1	1	0	0	0
Wyoming [3]	0	0	0	2	0	24	0	0	4	2	0	0
Colorado [2 5]	0	0	0	13	22	37	4	9	4	2	1	1
New Mexico [6]	1	0	0	9	7	15	0	1	0	2	0	4
Arizona	0	3	0	0	23	14	0	1	0	1	2	2
Utah [2 3 5]	0	0	0	7	14	15	4	0	0	0	2	0
PACIFIC												
Washington	25	0	0	23	26	26	0	1	4	2	31	1
Oregon [3]	0	0	0	11	14	22	0	4	4	2	0	1
California [4]	15	4	4	111	123	164	1	16	16	10	9	9
Total	58	54	38	3,099	2,245	4,011	62	228	215	130	221	221
23 weeks	602	565	506	107,264	106,053	149,164	1,607	7,876	6,898	2,088	2,941	2,941

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended June 8, 1940, and comparison with corresponding week of 1939 and 5-year median—Con.

Division and State	Whooping cough	
	Week ended	
	June 8, 1940	June 10, 1939
NEW ENG.		
Maine	12	24
New Hampshire	38	0
Vermont	47	34
Massachusetts	162	145
Rhode Island	10	55
Connecticut	49	101
MID. ATL.		
New York	279	398
New Jersey [2]	71	266
Pennsylvania [2]	302	303
E. NO. CEN.		
Ohio	145	113
Indiana	50	70
Illinois [2]	91	248
Michigan [2]	197	218
Wisconsin	62	125
W. NO. CEN.		
Minnesota	29	34
Iowa	19	26
Missouri	15	8
North Dakota	15	18
South Dakota	3	2
Nebraska	22	31
Kansas	54	26
SO. ATL.		
Delaware [2]	4	16
Maryland [2 3]	122	31
Dist. of Col. [2]	5	25
Virginia	59	54
West Virginia [3]	73	27
North Carolina	86	237
South Carolina [4]	10	63
SO. ATL.—continued		
Georgia [4]	11	25
Florida [4]	4	15
E. SO. CEN.		
Kentucky	87	16
Tennessee	50	54
Alabama [4]	14	104
Mississippi [3]	----	----
W. SO. CEN.		
Arkansas	20	10
Louisiana [4]	5	40
Oklahoma [4]	12	10
Texas [4]	407	221
MOUNTAIN		
Montana [2]	0	7
Idaho [2]	8	2
Wyoming [2]	6	0
Colorado [2 5]	21	44
New Mexico [6]	45	9
Arizona	29	14
Utah [2 3 5]	174	68
PACIFIC		
Washington	65	25
Oregon [2]	44	27
California [4]	431	166
Total	3,464	3,555
23 weeks	73,248	90,631

[1] New York City only.

[2] Rocky Mountain spotted fever, week ended June 8, 1940, 25 cases, as follows: New Jersey, 1; Pennsylvania, 1; Illinois, 1; Delaware, 2; Maryland, 5; District of Columbia, 1; Montana, 1; Idaho, 1; Wyoming, 7; Colorado, 2; Utah, 1; Oregon, 2.

[3] Period ended earlier than Saturday.

[4] Typhus fever, week ended June 8, 1940, 25 cases, as follows: South Carolina, 3; Georgia, 8; Florida, 1; Alabama, 2; Louisiana, 2; Texas, 8; California, 1. Information has been received that diagnosis was changed on 1 case reported as typhus fever in Oklahoma for the week ended June 1 and published in the Public Health Reports of June 7, 1940, p. 1049.

[5] Colorado tick fever, week ended June 8, 1940, 9 cases, as follows: Colorado, 7; Utah, 2.

[6] Only 1 case of meningococcus meningitis occurred in New Mexico for the week ended May 18, 1940, instead of 19 cases, as published in the Public Health Reports of May 24, p. 946.

PLAGUE INFECTION IN FLEAS AND GROUND SQUIRRELS IN WASHINGTON

IN FLEAS FROM GROUND SQUIRRELS IN LINCOLN COUNTY

Under dates of May 28 and 29, 1940, Surgeon L. B. Byington reported plague infection proved in a pool of 105 fleas from 21 ground squirrels (*C. washingtoni*), and in a pool of 159 fleas from 29 ground squirrels of the same species, shot May 14 on 2 ranches 12 and 14 miles east of Odessa, Lincoln County, Wash.

IN FLEAS AND GROUND SQUIRREL IN SPOKANE COUNTY

Under dates of May 27 and 29, 1940, Surgeon L. B. Byington reported plague infection proved in tissue and in a pool of 36 fleas from 1 ground squirrel (*C. columbianus*), found dead May 21 in Turnbull Slough Game Refuge, near Cheney, and in a pool of 72 fleas from 21 ground squirrels of the same species shot May 21 on a ranch 5 miles east of Cheney, Spokane County, Wash.

SUMMARY OF MONTHLY REPORTS FROM STATES

Cases reported for the quarter January–March 1940

(Diseases covered by weekly telegraphic reports not included)

Division and State	Chickenpox	Dysentery, amoebic	Dysentery, bacillary	Dysentery, unspecified	Encephalitis, epidemic or lethargic	German measles	Hookworm disease	Malaria	Mumps	Ophthalmia neonatorum	Pellagra	Puerperal septicemia	Rabies in animals	Rabies in man	Septic sore throat	Trachoma	Tularaemia	Undulant fever
NEW ENG.																		
Maine	890					86			55						14			6
New Hampshire	185								117						2			
Vermont	462					11			224						1			8
Massachusetts	5,504	1	111		3	152		1	2,096	203	3		33		82	5		11
Rhode Island	439					11			502				16		72			3
Connecticut	2,605		7		2	20		1	1,283	1					100	1		7
MID. ATL.																		
New York	11,347	14	112		18	402		39		[1] 16			[1] 34		513		1	57
New Jersey	6,087	7			3	134			3,770	43			101		59	1	1	10
Pennsylvania	13,101	1	2		3	156			3,621	10	2					1	32	27
E. NO. CEN.																		
Ohio	5,258				4	51		2	2,002		1	4			70	7	14	20
Indiana	1,014		2		4			2	2,575				68		23	11	37	9
Illinois	6,145	21	18		8	96		31	1,549	8	1		68		38	44	113	26
Michigan	6,835	2	4		1	127		9					2		319	2	1	30
Wisconsin	8,610	1			1	92		2	4,557						64		7	19
W. NO. CEN.																		
Minnesota	2,684	7	1		1					1	1		11		34	1	1	18
Iowa	771	1			8	25		2	1,272		1		2		29		46	61
Missouri	378	1	3					9	380						26	40	43	3
North Dakota	450					1			711						2	6		2
South Dakota	372								44						25	18		1
Nebraska	335								605						1			10
Kansas	1,858	1	1		7	60		3	938		2				138	2	12	25

[1] Exclusive of New York City.

Cases reported for the quarter January–March 1940—Continued

Division and State	Chickenpox	Dysentery, amoebic	Dysentery, bacillary	Dysentery, unspecified	Encephalitis, epidemic or lethargic	German measles	Hookworm disease	Malaria	Mumps	Ophthalmia neonatorum	Pellagra	Puerperal septicemia	Rabies in animals	Rabies in man	Septic sore throat	Trachoma	Tularaemia	Undulant fever
SO. ATL.																		
Delaware	302								10	3								1
Maryland	1,647	1	16	1	2	25			132	1	1				106		16	10
District of Columbia	448	1									1							2
Virginia	971	3	200					6	156		23				542	4	23	4
West Virginia	579		1		1			1	36						39		3	1
North Carolina	1,726					21		16			5				25		4	5
South Carolina	362	1			8	12	548	804	128	7	283		47				8	11
Georgia	559	18	12	1			7,338	123	487		47	2			262	2	40	21
Florida	1,241	4				4	3,775	24	86		38		9		14		5	7
E. SO. CEN.																		
Kentucky	1,122	5	8		5	343			785		2				182	35	28	2
Tennessee	748	4	6			97	23	56	197	7	34	7	1		137		41	9
Alabama	403	1			2	141		204	213	2	45		49	1			3	10
Mississippi	1,402	374	716				1,648	3,026	1,222	26	716	99	22			30	7	6
W. SO. CEN.																		
Arkansas	294	13	5		2	4	26	204	130	3	119	3	52		375	45	14	4
Louisiana	225	7			2		12	15	38	1	6		30		11	3	17	7
Oklahoma	291	3	15		1			97	145		28		14		231	301	27	27
Texas	2,772	21	90		11			663	465	4	253		6			11	10	72
MOUNTAIN																		
Montana	677				14	2			606						24	61	1	2
Idaho	296				1	85			171						26			2
Wyoming	280					36			435						3		1	4
Colorado	636	2	7		5				2,164						53			3
New Mexico	441	4	3			3		2	234		8	3	12		13	18	2	3
Arizona	516			133	2	23		8	791		4					186	1	7
Utah	1,350			1		29			586						56	2	4	1
Nevada	106								3									

PACIFIC																		
Washington	2,089				3	61			532			1	18		10	7		7
Oregon	823	6						1	734				3		7	1		1
California	8,044	43	98		10	338	12	16	4,633	2	11		95	1	29	68	1	49
Total	105,680	568	1,438	136	152	2,648	13,382	5,367	41,420	338	1,635	119	693	2	3,757	913	564	631
Alaska	24											1			46			
Hawaii	204	33				14	46	1	141	2					1	4		
Puerto Rico [2]	36			173					5	10	3	13						

Division and State	Actinomycosis	Anthrax	Botulism	Dengue	Food poisoning	Granuloma, coccidioidal	Leprosy	Psittacosis	Rat bite fever	Relapsing fever	Tetanus	Trichinosis	Vincent's infection	Weil's disease
NEW ENG.														
Maine													16	
New Hampshire														
Vermont													34	
Massachusetts							1				2	6		
Rhode Island												1		
Connecticut											3	8		
MID. ATL.														
New York		2	1								11	98	[1] 70	
New Jersey		2										8		
Pennsylvania		9						1				9		
E. NO. CEN.														
Ohio											2	4		
Indiana							1				1			
Illinois	4						2				8		56	
Michigan											2	4	56	10
Wisconsin														
W. NO. CEN.														
Minnesota	1													
Iowa														
Missouri							1		1			1		
North Dakota													2	
South Dakota														
Nebraska														
Kansas											3		31	

[1] Exclusive of New York City.

[2] Reports for January and February only.

Cases reported for the quarter January–March 1940—Continued

Division and State	Actinomycosis	Anthrax	Botulism	Dengue	Food poisoning	Granuloma, coccidioidal	Leprosy	Psittacosis	Rat bite fever	Relapsing fever	Tetanus	Trichinosis	Vincent's infection	Weil's disease
SO. ATL.														
Delaware														
Maryland													19	
District of Columbia														
Virginia											3			
West Virginia														
North Carolina													31	
South Carolina				8							1			
Georgia											2			
Florida											1		12	
E. SO. CEN.														
Kentucky													54	
Tennessee											3		138	
Alabama											9			
Mississippi				1										
W. SO. CEN.														
Arkansas											2			
Louisiana		1					3				8			
Oklahoma													56	
Texas				3			1			4				
MOUNTAIN														
Montana														
Idaho													2	
Wyoming													1	
Colorado														
New Mexico	1													
Arizona														
Utah		1												
Nevada														
PACIFIC														
Washington			1		9						1		4	
Oregon													14	
California		2	8		158	14	1				10	15		
Total	6	17	10	12	167	14	10	1	1	4	72	154	596	10
Alaska													1	
Hawaii							12				5	1		1
Puerto Rico [1]											[3] 26		2	

[1] Reports for January and February only.

[3] 4 cases of infantile tetanus included.

WEEKLY REPORTS FROM CITIES

City reports for week ended May 25, 1940

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.

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								
Data for 90 cities:											
5-year average	135	67	31	5,584	509	1,828	20	391	29	1,223	----
Current week [1]	70	44	12	3,538	367	1,949	0	357	13	1,055	----
Maine:											
Portland	0	----	0	114	4	0	0	0	0	2	28
New Hampshire:											
Concord	0	----	0	0	1	0	0	1	0	0	16
Manchester	0	----	0	0	0	0	0	0	0	0	14
Nashua	0	----	0	1	2	0	0	0	0	0	7
Vermont:											
Barre	----	----	----	----	----	----	----	----	----	----	----
Burlington	0	----	0	0	0	0	0	0	0	0	10
Rutland	0	----	0	0	0	0	0	0	0	0	6
Massachusetts:											
Boston	0	----	0	209	17	54	0	3	0	78	184
Fall River	0	----	0	63	2	1	0	1	0	5	30
Springfield	0	----	0	1	1	7	0	4	0	5	28
Worcester	4	----	0	75	3	9	0	0	0	0	48
Rhode Island:											
Pawtucket	0	----	0	0	0	0	0	0	0	0	11
Providence	0	1	0	147	1	4	0	1	0	7	63
Connecticut:											
Bridgeport	0	----	0	1	1	4	0	0	0	1	21
Hartford	0	----	0	1	3	9	0	1	0	4	26
New Haven	0	1	0	0	1	8	0	1	0	2	40
New York:											
Buffalo	0	----	0	1	5	20	0	4	0	7	133
New York	19	7	0	337	74	632	0	67	2	81	1,481
Rochester	0	1	0	4	3	13	0	0	0	10	68
Syracuse	0	----	0	0	1	7	0	1	0	14	50
New Jersey:											
Camden	2	----	0	0	1	15	0	1	0	1	24
Newark	0	2	0	508	7	22	0	3	0	20	123
Trenton	0	----	0	0	1	-	0	1	0	3	32
Pennsylvania:											
Philadelphia	1	2	1	171	16	125	0	36	1	34	491
Pittsburgh	4	----	2	3	4	27	0	2	1	10	159
Reading	0	----	0	1	1	0	0	0	0	12	20
Scranton	0	----	----	0	----	1	0	----	0	0	----
Ohio:											
Cincinnati	2	----	0	1	7	17	0	7	1	36	122
Cleveland	0	7	0	5	9	51	0	11	0	42	178
Columbus	1	----	0	0	4	13	0	1	0	5	85
Toledo	0	----	0	3	4	50	0	5	0	5	63
Indiana:											
Anderson	0	----	0	0	0	0	1	0	0	0	8
Fort Wayne	1	----	1	5	4	0	0	2	0	4	33
Indianapolis	0	----	0	1	8	23	0	4	0	13	101
Muncie	0	----	0	0	3	0	0	1	0	0	15
South Bend	0	----	0	0	3	0	0	0	0	1	12
Terre Haute	----	----	----	----	----	----	----	----	----	----	----
Illinois:											
Chicago	7	----	0	98	33	513	0	38	0	32	745
Elgin	0	----	0	1	1	0	0	0	0	1	7
Moline	0	----	0	5	0	2	0	0	0	0	7
Springfield	1	----	0	2	0	3	0	0	0	0	22
Michigan:											
Detroit	----	----	----	----	----	----	----	----	----	----	----
Flint	0	----	0	5	2	15	0	0	0	8	23
Grand Rapids	0	----	0	10	1	8	0	0	0	19	24
Wisconsin:											
Kenosha	0	----	0	39	0	1	0	0	0	1	6
Madison	0	----	0	19	0	0	0	0	0	4	11
Milwaukee	0	----	0	199	3	28	0	5	0	4	116
Racine	0	----	0	1	0	2	0	0	0	1	20
Superior	0	----	0	68	0	1	0	0	0	1	6

[1] Figures for Barre, Terre Haute, and Detroit estimated; reports not received.

City reports for week ended May 25, 1940—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								
Minnesota:											
Duluth	0	------	0	9	1	3	0	0	0	0	23
Minneapolis	0	------	0	2	7	23	0	5	0	13	97
St. Paul	0	------	0	5	4	8	0	1	0	4	65
Iowa:											
Cedar Rapids	0	------	--------	32	-------	1	0	-------	0	0	--------
Davenport	0	------	--------	14	-------	4	0	-------	0	1	--------
Des Moines	1	------	0	31	0	13	4	0	0	0	34
Sioux City	0	------	--------	1	-------	3	0	-------	0	0	--------
Waterloo	1	------	--------	0	-------	2	0	-------	0	1	--------
Missouri:											
Kansas City	1	------	0	5	6	8	0	6	0	1	89
St. Joseph	0	------	0	0	2	1	0	0	0	1	20
St. Louis	2	4	2	7	2	20	0	7	0	11	175
North Dakota:											
Fargo	0	------	0	0	1	0	0	0	1	0	9
Grand Forks	0	------	--------	0	-------	0	0	-------	0	0	--------
Minot	0	------	--------	0	-------	2	0	-------	0	0	--------
South Dakota:											
Aberdeen	0	------	--------	0	-------	0	0	-------	0	1	--------
Nebraska:											
Omaha	0	------	0	6	8	4	0	1	0	6	52
Kansas:											
Lawrence	0	------	0	0	0	0	0	0	0	0	1
Topeka	0	------	0	24	1	2	0	0	0	2	15
Wichita	1	------	0	7	5	3	0	0	0	7	24
Delaware:											
Wilmington	1	------	0	0	2	2	0	1	0	2	24
Maryland:											
Baltimore	2	1	1	8	7	11	0	14	0	92	221
Cumberland	0	------	0	0	0	1	0	0	0	0	14
Frederick	0	------	0	0	0	0	0	0	0	0	4
Dist. of Col.:											
Washington	2	------	0	4	9	26	0	17	0	5	165
Virginia:											
Lynchburg	0	------	0	0	3	0	0	1	0	10	11
Norfolk	0	6	0	53	3	2	0	1	0	1	31
Richmond	0	------	1	4	3	2	0	1	0	0	44
Roanoke	1	------	0	29	0	1	0	0	0	0	12
West Virginia:											
Charleston	0	------	0	1	0	1	0	0	0	1	19
Huntington	0	------	--------	0	-------	2	0	-------	1	0	--------
Wheeling	0	------	--------	1	-------	1	0	-------	0	0	--------
North Carolina:											
Gastonia	0	------	--------	0	-------	0	0	-------	0	0	--------
Raleigh	0	------	0	1	0	0	0	0	0	3	14
Wilmington	0	------	0	0	1	1	0	0	0	0	7
Winston-Salem	0	------	0	2	0	3	0	3	0	0	17
South Carolina:											
Charleston	0	3	0	1	1	0	0	1	0	0	17
Florence	0	------	0	0	1	0	0	0	0	0	7
Greenville	0	------	0	0	1	0	0	0	0	1	4
Georgia:											
Atlanta	0	------	0	4	1	1	0	5	2	0	73
Brunswick	0	1	0	0	1	0	0	0	0	0	9
Savannah	0	1	0	0	3	1	0	0	0	0	29
Florida:											
Miami	0	1	0	0	1	0	0	0	0	0	30
Tampa	0	------	0	69	1	1	0	0	0	2	22
Kentucky:											
Ashland	0	------	0	0	0	0	0	0	0	1	5
Covington	0	------	0	10	1	4	0	3	0	0	11
Lexington	0	------	0	35	2	2	0	0	0	4	16
Tennessee:											
Knoxville	0	1	0	2	1	3	0	2	0	0	33
Memphis	0	1	1	25	1	20	0	4	0	20	59
Nashville	0	------	0	2	5	2	0	1	0	1	52
Alabama:											
Birmingham	0	4	0	4	2	2	0	4	0	4	59
Mobile	0	------	1	2	1	0	0	0	0	2	24
Montgomery	0	1	--------	2	-------	0	0	-------	0	0	--------
Arkansas:											
Fort Smith	0	1	--------	0	-------	1	0	-------	0	0	--------
Little Rock	0	1	0	1	6	1	0	1	0	1	7
Louisiana:											
Lake Charles	0	------	0	0	0	0	0	0	0	0	3
New Orleans	1	------	0	1	12	5	0	13	2	51	116
Shreveport	0	------	0	0	2	0	0	1	0	0	35

City reports for week ended May 25, 1940—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								
Oklahoma:											
Oklahoma City	0	------	0	0	3	3	0	0	1	0	39
Texas:											
Dallas	0	------	0	507	4	3	0	3	0	28	65
Fort Worth	0	------	0	9	0	2	0	1	0	28	50
Galveston	0	------	0	0	2	0	0	0	0	2	18
Houston	2	------	0	9	4	2	0	8	0	2	86
San Antonio	2	------	0	7	6	0	0	5	0	10	70
Montana:											
Billings	0	------	0	0	0	0	0	0	0	0	6
Great Falls	0	------	0	30	1	2	0	0	0	0	7
Helena	0	------	0	0	0	0	0	0	0	0	2
Missoula	0	------	0	0	0	1	0	0	0	0	8
Idaho:											
Boise	0	------	0	2	1	0	0	1	0	0	12
Colorado											
Colorado Springs	1	------	0	2	0	0	0	1	0	0	18
Denver	9	------	0	24	5	9	0	1	0	1	81
Pueblo	0	------	0	4	0	2	0	0	0	0	7
New Mexico:											
Albuquerque	2	------	0	1	0	0	0	1	0	7	7
Utah:											
Salt Lake City	0	------	0	264	1	2	0	1	0	110	26
Washington:											
Seattle	0	------	1	167	2	7	0	6	0	13	109
Spokane	0	------	0	5	0	2	0	1	0	2	32
Tacoma	0	------	0	2	0	6	0	1	0	1	37
Oregon:											
Portland	1	1	0	82	5	1	0	5	1	11	109
Salem	0	------	--------	1	-------	0	0	-------	0	0	--------
California:											
Los Angeles	1	5	0	21	7	19	0	22	1	55	333
Sacramento	1	------	0	9	1	1	0	5	0	17	33
San Francisco	0	1	1	12	3	11	0	5	1	33	169

State and city	Meningitis, meningococcus		Poliomyelitis cases	State and city	Meningitis, meningococcus		Poliomyelitis cases
	Cases	Deaths			Cases	Deaths	
New York:				Oklahoma:			
Buffalo	0	2	0	Oklahoma City	0	0	1
New York	1	0	1	Washington:			
Indiana:				Tacoma	0	0	8
Indianapolis	1	0	0	California:			
Michigan:				Los Angeles	0	0	3
Flint	1	0	0	San Francisco	1	0	0
Louisiana:							
New Orleans	1	0	1				
Shreveport	0	1	0				

Encephalitis, epidemic or lethargic.—Cases: New York, 4; Pueblo, 1; San Francisco, 1.
Pellagra.—Cases: Atlanta, 1; Mobile, 1; Sacramento, 1; San Francisco, 2.
Typhus fever.—Cases: New York, 5.

FOREIGN REPORTS

CANADA

Provinces—Communicable diseases—Week ended May 11, 1940.—During the week ended May 11, 1940, cases of certain communicable diseases were reported by the Department of Pensions and National Health of Canada as follows:

Disease	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	Total
Cerebrospinal meningitis			2	5	5					12
Chickenpox		1	1	254	434	26	35	2	73	826
Diphtheria				12		4	1			17
Influenza	4	2			21	1			9	37
Lethargic encephalitis							1			1
Measles		4	1	135	475	452	283	6	102	1,458
Mumps				24	355	4			12	395
Pneumonia		4			14	4	1		15	38
Poliomyelitis					1	1	1			3
Scarlet fever		3	2	130	137	8	6	17	6	309
Tuberculosis	2	2	13	86	35	25	1			164
Typhoid and paratyphoid fever			3	9	5	1	1			19
Whooping cough		7	2	109	91	36	28	6	28	307

ITALY

Communicable diseases—4 weeks ended February 25, 1940.—During the 4 weeks ended February 25, 1940, cases of certain communicable diseases were reported in Italy as follows:

Disease	Jan. 29–Feb. 4	Feb. 5–11	Feb. 12–18	Feb. 19–25
Anthrax	11	6	8	6
Cerebrospinal meningitis	57	82	71	72
Chickenpox	329	339	398	439
Diphtheria	630	552	668	629
Dysentery (amoebic)	8	13	12	17
Dysentery (bacillary)			1	
Hookworm disease	21	15	29	34
Lethargic encephalitis		1	2	1
Measles	1,116	1,246	1,362	1,522
Mumps	346	411	479	499
Paratyphoid fever	49	45	33	33
Pellagra	2		1	
Poliomyelitis	18	12	17	13
Puerperal fever	21	22	16	25
Scarlet fever	212	187	232	236
Typhoid fever	209	224	193	202
Undulant fever	67	84	73	90
Whooping cough	410	375	341	353

JAMAICA

Communicable diseases—4 weeks ended May 11, 1940.—During the 4 weeks ended May 11, 1940, cases of certain communicable diseases were reported in Kingston, Jamaica, and in the island outside of Kingston, as follows:

Disease	Kingston	Other localities	Disease	Kingston	Other localities
Chickenpox	2	27	Poliomyelitis		1
Diphtheria	4	3	Puerperal sepsis		1
Dysentery	4	13	Tuberculosis	38	93
Erysipelas	1	1	Typhoid fever	5	66
Leprosy		2			

SWEDEN

Notifiable diseases—March 1940.—During the month of March 1940, cases of certain notifiable diseases were reported in Sweden as follows:

Disease	Cases	Disease	Cases
Cerebrospinal meningitis	4	Scarlet fever	3,526
Diphtheria	20	Syphilis	26
Epidemic encephalitis	1	Typhoid fever	11
Gonorrhea	673	Undulant fever	9
Paratyphoid fever	4	Weil's disease	7
Poliomyelitis	13		

YUGOSLAVIA

Communicable diseases—4 weeks ended April 21, 1940.—During the 4 weeks ended April 21, 1940, certain communicable diseases were reported in Yugoslavia as follows:

Disease	Cases	Deaths	Disease	Cases	Deaths
Anthrax	19	3	Paratyphoid fever	7	
Cerebrospinal meningitis	790	198	Poliomyelitis	3	1
Diphtheria and croup	433	52	Scarlet fever	194	6
Dysentery	14	1	Sepsis	5	2
Encephalitis	2	2	Tetanus	27	15
Erysipelas	171	6	Typhoid fever	132	14
Favus	4		Typhus fever	58	2

REPORTS OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER RECEIVED DURING THE CURRENT WEEK

NOTE.—A cumulative table giving current information regarding the world prevalence of quarantinable diseases appeared in the PUBLIC HEALTH REPORTS of May 31, 1940, pages 1000-1002. A similar table will appear in future issues of the PUBLIC HEALTH REPORTS for the last Friday of each month.

Plague

Belgian Congo—Tchemba.—During the week ended May 4, 1940, 4 fatal cases of plague were reported in Tchemba, Belgian Congo.

United States—Washington.—A report of plague infection in Lincoln County and Spokane County, Washington, appears on page 1094 of this issue of PUBLIC HEALTH REPORTS.

×