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The Occurrence in the Sera of Man and Monkeys of Protective Antibodies Against the Virus of Lymphocytic Choriomeningitis as Determined by the Serum-Virus Protection Test in Mice*

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Armstrong and Lillie (*1*) in 1934, described a previously unidentified virus encountered during studies of brain material from an individual who died in St. Louis, Mo., during the 1933 epidemic of encephalitis. Two additional similar strains of virus were described by Armstrong and Wooley (*2*) in 1935, one of which was isolated during studies of the brain of an individual who died in Maine and the other from a monkey that had died following inoculation with the virus of poliomyelitis.

Traub (*3*) and Lépine and Sautter (*13*) recovered a virus from white mice which resembled the virus of Armstrong, and Rivers and Scott (*4*) reported the isolation of similar strains from two human cases of meningitis. These strains were shown by Armstrong and Dickens (*8*), by Rivers and Scott (*4*), and by Traub (*3*) to be serologically identical with the Armstrong strain.

Findlay, Alcock, and Stern (*5*), in England, also isolated a virus from the cerebrospinal fluid of two human cases with nervous symptoms and a similar virus from a strain of apparently healthy laboratory mice. These strains affected animals in the same way and were immunologically similar to the virus described by Armstrong. Serum from a patient in Ireland, whose symptoms were described by Collis (*6*) was shown by Findlay et al. (*5*) to contain antibodies against both the American and the English strains of virus. Dickens (*7*), in 1932, reported two cases of aseptic meningitis, and in 1935 Armstrong and Dickens (*8*) showed that the sera from these two cases, and also the serum from a patient of Bloedorn (*9*), protected animals from the virus of lymphocytic choriomeningitis described by Armstrong and Lillie (*1*).

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Thus it appears that the virus of lymphocytic choriomeningitis, first described less than 3 years ago, has been isolated in several places in the United States and in Europe, and that recovery from infection with the virus is followed by the production of demonstrable antibodies.

The studies here reported were undertaken, therefore, to determine the distribution of protective antibodies in the sera of persons from various localities of the United States.

Source and treatment of the virus.—The virus first isolated by Armstrong was employed throughout these experiments (Green strain).

The strain was maintained by serial intracerebral passages in mice, with an occasional passage through guinea pigs whenever the virus appeared to be losing potency.

The stock virus was stored in equal parts of neutral glycerin and 0.85 percent NaCl solution at about +5° C. until used.

Technique of neutralization test.—Virus for the test was prepared by finely grinding halves of three infected mouse brains in a mortar, without sand. The ground brain was then suspended in 10 cc of 0.85 percent NaCl solution of pH 7.6. After thorough mixing, the suspension was diluted to approximately 1:300, 1:2,000 and 1:10,000. To one part of each of these suspensions (0.1 cc) were added two parts of the serum (0.2 cc) to be tested. The mixtures were agitated thoroughly, then kept at a room temperature of 37° C. for 4 hours, following which 0.03 cc of each mixture was inoculated intracerebrally into each of 4 white mice by means of a 0.25-cc syringe and a 26-gage needle. Thus 12 white mice were utilized for each serum investigated.

This technique was carried out in testing all sera, except that it was occasionally necessary to make minor adjustments in the dilutions of virus to compensate for changes in pathogenicity for mice. It was found that it required a lower dilution of virus to kill mice during the cooler months than in the warmer periods of the year.

A serum known to possess strong protective properties and one without protective antibodies were included in each test.

The mice were observed for 14 days following inoculation and the date of death of those dying was recorded. Mice ill from the virus usually remained apart from the group, the hair was ruffled, and they exhibited fine tremors when lifted by the tail and often went into tetanic contractions with the rear legs completely extended. This position was usually maintained in death, which tended to occur on from the seventh to the tenth day following inoculation. Mice dying without this period or with symptoms other than those mentioned were found by pathological studies usually to have died from other causes than choriomeningitis. The histopathological studies were made by Surgeon R. D. Lillie and Passed Assistant Surgeon J. G. Pasternack.

Reading the results.—The symptoms exhibited by ill mice, the number dying, the position of the animals in death, the time of death, and the pathology of representative brain samples were considered when reading the results of the test.

If no characteristic symptoms with death occurred during the seventh to tenth days of the test while many mice with normal serum virus mixtures died, the serum was recorded as having strong protection. When only a few deaths occurred in the group inoculated with the higher concentrations of virus, the serum was recorded as possessing moderate protection. When more mice survived than with the negative control serum, though several died within the proper period, the serum was recorded as having questionable protection. When the number of deaths approximated the number dying with the negative control serum, the test serum was recorded as being devoid of antibodies. (For sample protocol see table 1.)

TABLE 1.—*Protocol of a sample test*

EXPERIMENT EX. 143, FEB. 13, 1936

Serum	Cage no.	Virus dilution in serum-virus mixture	Day of death of mice	Number of mice surviving	Interpretation
Positive control	1	1:300		4	Strong protection.
	2	1:2,000		4	
	3	1:10,000		4	
Negative control	4	1:300	6, 7, 7, 8	0	No protection.
	5	1:2,000	7, 8, 9, 11	0	
	6	1:10,000	8, 11	2	
H. A. H. 2/10/36	7	1:300	9, 9, 10, 11	0	Questionable protection.
	8	1:2,000	6, 8	2	
	9	1:10,000	14	3	
W. L. B. 2/10/36	10	1:300	7, 7, 8, 9	0	No protection.
	11	1:2,000	6, 9, 9, 14	0	
	12	1:10,000		4	
B. L. L. 2/10/36	13	1:300	8	3	Strong protection.
	14	1:2,000		4	
	15	1:10,000	14	3	
J. L. E. 2/10/36	16	1:300	8, 8, 10	1	Moderate protection.
	17	1:2,000		4	
	18	1:10,000		4	

Protection tests with the sera of monkeys.—Sera were collected from 17 monkeys that had been experimentally inoculated with the virus of lymphocytic choriomeningitis 2 or more weeks previous to bleeding. One serum collected 3 weeks after inoculation was negative; the other 16 gave protection. The sera of 8 uninoculated monkeys, 11 monkeys that had received the virus of encephalitis, St. Louis type, and 16 that had been given poliomyelitis virus (monkey strain), were also tested. All were negative except two. One of these had been housed in the same room in which monkeys with lymphocytic choriomeningitis were caged. The other was housed in a distant room, but had been caught frequently in a net employed for catching the choriomeningitis monkeys. Moreover, a spontaneously infected monkey was actually found by Armstrong and Wooley (*2*). Therefore, the

mouse-protection test appears to be a specific test for the presence in monkeys of antibodies against the virus of lymphocytic choriomeningitis. (See table 2.)

Symptoms of lymphocytic choriomeningitis in experimentally inoculated monkeys, as described by Armstrong (*1*), were frequently noted. But in our series of 16 inoculated monkeys, whose sera gave protection, 6 had had no fever nor recognizable symptoms. However, the virus was recovered from the blood of one of these monkeys on the 15th and again on the 19th day following inoculation. These observations indicate that subclinical infections in monkeys inoculated with the virus of lymphocytic choriomeningitis occur and that subsequent development of specific antibodies against the virus may take place.

TABLE 2.—*Results of the protection tests employing sera of monkeys*

Source of sera	Total number of sera	Protection test results			
		Strong protection	Moderate protection	Questionable protection	No protection
Monkeys, convalescent choriomeningitis	17	13	3	----------	1
Monkeys, convalescent St. Louis type encephalitis	11	1	----------	1	9
Monkeys, survived poliomyelitis inoculation	16	1	----------	----------	15
Noninoculated monkeys	8	----------	----------	----------	8

Protection studies with human sera.—Blood sera from 1,248 persons from various localities of the United States were tested for protective antibodies against the virus of lymphocytic choriomeningitis, of which 138, or 11 percent, gave definite protection. The two clinical histories here given are representative for those cases showing central nervous system symptoms followed by immunity.

Case 1.—P. H., aged 29, a white male, railroad employee (patient of Dr. Paul Stookey, of Kansas City, Mo.) was seen to stumble on November 11, 1936. When approached by his foreman, he complained of headache and blurred vision. On November 12, he was admitted to a hospital in coma with a temperature of 103.6° F. Examination revealed a stiff neck, dilated pupils, and a positive Gordon on the right side. The spinal fluid was under increased pressure and contained 35 cells, mostly lymphocytes. November 13: Stiffness of neck had increased, knee jerks were absent, Babinski suggestive, Oppenheim and Gordon were positive. White blood cell count was 12,000 with 85 percent polymorphonuclear leucocytes. Spinal fluid contained 75 cells with 95 percent lymphocytes. The patient was restless, requiring restraint and artificial feeding during the first 4 days in the hospital. There was gradual improvement and the temperature was normal on November 17. Blood serum, collected December 2, gave strong protection.

Case 2.—S. M., white female, aged 30 (patient of Dr. Joseph L. Abramson, Brooklyn, N. Y.). Sudden onset on March 19, 1935, with severe occipital headache, vomiting, and a stiff neck, which followed a head cold of one week's duration. Physical examination revealed a stiff neck, horizontal nystagmus, and a temperature of 100.2° F. On March 20, spinal fluid contained 1,200 cells with 75 percent

lymphocytes; March 21, 360 cells; March 26; 60 cells; and March 30, 35 cells. The cells in each of the last three counts were all lymphocytes. The patient was discharged on March 31, apparently recovered. The blood serum collected in September 1935 gave strong protection.

Specificity of the test in man.—The origin of the sera and the results of the test, as shown in table 3, indicate the wide geographical distribution of antichoriomeningitis immune bodies in the sera of certain groups of our population. The highest incidence of protection, 32 percent, was noted among 53 sera submitted from various parts of the United States from clinically diagnosed cases of "aseptic meningitis." These findings, together with the isolation of the virus of choriomeningitis from several cases by Rivers and Scott (*4*), and by Findlay, Alcock, and Stern (*5*), indicate that this virus is the etiologic agent of a portion of the cases diagnosed as aseptic meningitis. The low incidence of protection found in the sera from other central nervous ailments, such as encephalitis in the Windber (Pa.) outbreak of 1935 (0.0 percent); encephalitis, St. Louis type, from Kentucky and Illinois, 1935 (1.4 percent); the Virginia outbreak of poliomyelitis during 1935 (3.1 percent); and mental cases from St. Elizabeths Hospital, Washington, D. C. (3.9 percent) (table 4), evidences the specificity of the test insofar as central nervous system conditions are concerned.

While recovery from choriomeningitis has been shown to lead to the development of specific antivirus substances in the serum of the individual, such antibodies were far more frequently found in certain groups tested than was a history of meningeal or central nervous system involvement. This fact might be explained either by the assumption that the test is not specific, or that the antibodies are the result of a nonidentified infection with the virus. The latter explanation appears to be the most probable, because in infected monkeys the virus is polytropic, being found (*10*), together with pathological evidence of its activity (*12*), in all the organs so far tested. It is, moreover, quite unusual for meningeal symptoms to develop in animals inoculated by routes other than directly into the central nervous system; and, as above noted, an asymptomatic type of infection, with virus circulating in the blood and with subsequent development of immunity, actually occurred in monkeys inoculated by routes other than into the central nervous system.

TABLE 3.—*Results of the protection tests on human sera from various sources*

Source of sera and clinical diagnosis	Total number of sera	Protection test results				
		Strong protection	Moderate protection	Questionable protection	No protection	Percentage of definite protection
Various localities (aseptic meningitis)	53	7	10	6	30	32.1
Various localities (miscellaneous diagnoses)	17	1	1	2	13	11.7
Illinois and Kentucky in 1934 (encephalitis—St. Louis type)	70	1	----------	6	63	1.4
Virginia in 1935 (poliomyelitis)	98	----------	3	25	70	3.1
Windber, Pa. epidemic in 1935 (encephalitis—type?)	25	----------	----------	3	22	0
St. Elizabeths Hospital, Washington, D. C. (mental cases)	51	1	1	9	40	3.9
U. S. Marine Hospital, Baltimore, Md. (various diagnoses)	314	31	31	36	216	19.7
Wassermann test sera:						
U. S. Northeastern Penitentiary, Lewisburg, Pa	113	10	17	10	76	23.8
U. S. Industrial Reformatory, Chillicothe, Ohio	59	5	1	----------	53	10.1
U. S. Penitentiary, Atlanta, Ga	42	1	2	7	32	7.1
Federal Industrial Institute for Women, Alderson, W. Va	39	3	1	2	33	10.2
U. S. Penitentiary Annex, Fort Leavenworth, Kans	12	3	1	1	7	----------
Alexandria Health Department, Alexandria, Va	6	2	----------	1	3	----------
U. S. National Training School for Boys, Washington, D. C	4	----------	1	----------	3	----------
Total (submitted for Wassermann test)	275	24	23	21	207	17.0
Normal children:						
Rosewood State Training School, Owens Mill, Md	81	----------	----------	6	75	0
State Colony for Epileptics and Feeble Minded, Colony, Va	47	----------	----------	5	42	0
Epworth Orphan Home, Columbia, S. C	119	----------	1	4	114	.8
Carolina Orphan Home, Columbia, S. C	22	----------	----------	1	21	0
Connie Maxwell Orphan Home, Greenwood, S. C	40	----------	3	4	33	7.5
Thornwell Orphan Home, Clinton, S. C	36	----------	----------	3	33	0
Total (normal children under 12 years of age)	345	----------	4	23	318	1.1
Children (under 17)	396	0	5	30	361	1.2
Adults (over 16)	481	42	46	56	337	18.3
Age unknown	371	23	22	45	281	12.1
Total	1,248	65	73	131	979	11.0

TABLE 4.—*Protection with sera taken during or following variously diagnosed ailments*

Clinical diagnosis	Number of sera tested	Results of serum virus protection test				
		Strong protection	Moderate protection	Questionable protection	No protection	Percentage of definite protection
Aseptic meningitis	53	7	10	6	30	32.1
Encephalitis (St. Louis type)	75	1	----------	8	66	1.3
Poliomyelitis (Virginia, 1935)	98	0	3	25	70	3.1
Windber epidemic (encephalitis, 1935)	25	0	0	3	22	0
Syphilis (positive Wassermann)	62	4	4	3	51	12.9
Gonorrheal infection	136	16	17	20	83	24.2
Lymphogranuloma inguinale	4	1	0	0	3	----------
Respiratory infections	106	14	16	10	66	28.3
Various neuropsychiatric conditions	51	1	1	9	40	3.9
Miscellaneous infections	167	13	19	23	112	19.1
Noninfectious conditions	126	10	14	13	89	19.0

The variability in severity of proved cases in man and the often observed presence of a "cold" or "grippe" a few days prior to the occurrence of meningeal symptoms suggests that these early signs may represent a systemic invasion in which the meningeal involvement is a later and possibly exceptional occurrence. The high incidence of protection found in the group giving a history of upper respiratory infection but no meningeal involvement tends to support this view (table 4). The results of the protection test with sera from various sources and conditions are shown in tables 3 and 4, respectively, and are consistent with the above-expressed concept. There is, however, an unexplained relatively infrequent occurrence of antibodies in the sera of children as compared with adults.

Protective antibodies in the sera of children.—Sera from 345 normal children, 16 years of age or under, living in orphans' homes and training schools in Maryland, Virginia, or South Carolina, and from 51 additional ill children from various localities were tested for antibodies against the virus of choriomeningitis (table 3). Not a single instance giving strong protection was encountered and moderate protection was found in only five sera or 1.2 percent of the group, while among 481 adults 17 years and over, there were 90, or 18.3 percent, that gave positive results. This relative infrequency of serological evidence of infection among the children as compared with the adults in our series is not explained, but may possibly be due to our groups not being representative samples of the general population or possibly to the virus having been prevalent in epidemic form some years ago, following which it may have tended to disappear until recently. The latter explanation would be tenable only in case the neutralizing antibodies tended to persist following the attack. Evidence on this point is meager, but Armstrong and Dickens (*8*) have reported the presence of potent neutralizing antibodies as long as 3 years and 11 months following the attack. The low incidence in children might, however, be explained by natural resistance to the infection, by a lack of exposure, or both.

Method of spread of the virus.—It is interesting to note that we have found it possible to transmit occasional infection by instilling the virus into the urethra or vagina of monkeys. These observations combined with the fact that we have demonstrated the presence of virus in the urine, where it tends to persist, and in the seminal vesicle fluid and testicular tissue of infected animals, together with the above-mentioned higher incidence after puberty, at least suggests a venereal route as one of the possible explanations for the peculiar age distribution.

If a portion of the cases are venereally transmitted, it seems probable that criminals and perhaps merchant seamen might represent highly exposed classes, with an incidence higher than might be expected in other adult groups. In this connection it may be noted (table 3) that sera from 51 adults from St. Elizabeths Hospital, and from 70 patients with the St. Louis type of encephalitis, many of whom were adults, gave protection in only 3.9 percent and 1.3 percent, respectively, of cases, as compared with a protection incidence of 17.0 percent and 19.7 percent, respectively, for 275 sera from Federal Penitentiary and 314 from marine hospital patients. A study of the results of the Wassermann and of the serum-virus protection tests as carried out on 275 sera, however, shows no increased incidence of protection among those with positive Wassermann findings as compared with those showing a negative test. In fact the reverse is the case, since positive Wassermann readings were present in 62 of the 275 cases, or 22.5 percent,[1] of which number 8, or 12.9 percent, had definitely demonstrable protective antibodies against the virus of choriomeningitis, while among 213 negative Wassermann sera there were 39, or 18.3 percent, that gave definite protection. This series is small, however, and it is known that many of the negative sera had been rendered so by vigorous antisyphilitic treatment.

The evidence set forth as suggesting a venereal route of infection is not considered to be in any sense conclusive, but is mentioned merely as one possible route of infection to be kept in mind by those who may investigate cases of the disease.

Protection test results according to nationality, color, and occupation.—Information as to nativity, color, and occupation of the serum donors was available only for inmates of the Baltimore Marine Hospital and the Northeastern Penitentiary, Lewisburg, Pa. By reference to table 5 it may be noted that these factors apparently exerted very little influence upon the incidence of protective antibodies in sera from these two groups of patients. Too few sera from females were tested to permit of a comparison of the occurrence of antibodies in the two sexes.

[1] The Wassermann tests were performed by Miss Rose Parrott, serologist, at the National Institute of Health.

TABLE 5.—*Protection tests on sera of patients from the U. S. Marine Hospital, Baltimore, Md., and from Northeastern Penitentiary, Lewisburg, Pa., by various groups*

Classification of patients	Number of sera tested	Results of protection test				Percentage of definite protection
		Strong	Moderate	Questionable	Negative	
Foreign born	87	9	8	14	56	19.3
Native born	313	28	34	29	222	19.8
Unknown	2				2	
White	385	34	47	43	261	21.0
Colored	42	7	1	3	31	19.0
Merchant seamen	177	17	19	21	120	20.3
Office workers	26	2	3	1	20	19.2
Miscellaneous	199	18	20	22	136	19.1
Age (in years):						
17–20	22	2	1	2	17	13.6
21–30	120	11	12	12	85	19.1
31–40	143	8	17	16	102	17.4
41–50	74	9	8	4	53	22.9
51 plus	43	7	4	9	23	25.5

SUMMARY

1. The technique of the serum-choriomeningitis virus protection test in mice is described.

2. The protection test appears to be a practicable test for the presence of specific neutralizing antibodies in the sera of monkeys and man.

3. Antibodies were demonstrated by the protection test in 138 (11 percent) of 1,248 sera tested, questionable protection was noted in 131 (10.4 percent), while 979 (78.6 percent) gave negative results. Sera from Federal penal institutions and from beneficiaries of the United States marine hospitals gave a higher incidence of protection than did those of comparable age from other groups and probably are not representative of our general population.

4. Antibodies were demonstrated by the protection test in 90 sera from 481 adults (over 17 years), or 18.3 percent, while only 5 sera from 396 persons under 17 years of age, or 1.2 percent, showed protection. The reason for the difference in age incidence is not established.

5. Antibodies were demonstrated by the protection test in 17 of 53 sera (32.1 percent) from individuals on whom a clinical diagnosis of "aseptic meningitis" was made.

6. A positive protection test is believed to indicate that the serum donor has been in contact with virus of choriomeningitis.

7. The occurrence of demonstrable antibodies in 117 sera from 997 individuals without history of central nervous system or meningeal involvement suggests that immunity may result not only from a frank meningeal attack but also from either a subclinical infection or

a clinical condition, possibly an upper respiratory symptom complex, not yet recognized as due to choriomeningitis virus.

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NOTE ON COMPARATIVE TESTS MADE WITH THE HATCH AND THE GREENBURG-SMITH IMPINGERS[1]

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Since the introduction of the Greenburg-Smith impinger in 1923 several modifications of this important dust-sampling device have been made (*1*) (*2*). In general, it may be said that these modifications have not affected the basic impingement principle. Such changes as have been made have been concerned chiefly with alterations in the design of the flask used. However, in 1932, Hatch, Warren, and Drinker described a modification of the impinger apparatus which has since been widely used (*3*). In the impinger developed by these

[1] From the Laboratory of Industrial Hygiene, National Institute of Health.

investigators, the fixed disk was discarded and a distinct improvement in design was made by combining the suction connection and the inlet tube into a single piece. The impingement principle was retained by setting the nozzle approximately 5 mm from the bottom of a 325-cc flat-bottom flask. This flask was 50 mm in diameter, with volumetric graduations in steps of 50 cc starting at the 75-cc line, which represented the amount of impingement fluid used. A line 50 mm from the bottom of the flask indicated the nozzle setting.

Although Hatch and his coworkers showed that the characteristics of the modified impinger compared favorably with the Greenburg-Smith designs discussed in Public Health Bulletin 144, a comparative test of the two instruments under field conditions was never made. This omission, coupled with the modifications incorporated in the Hatch impinger, has resulted in numerous requests to the Public Health Service for information regarding the similarity of the two instruments for dust quantification.

In order to make comparative tests of these two instruments, dust samples were taken in a steel foundry and in a ceramic mill with both impingers strapped together and operated simultaneously at a sampling rate of one cubic foot per minute. The nozzle of the Hatch impinger was kept adjusted at the 5-mm mark, although it has been shown that the impingement distance might be varied from 2 to 7 mm without affecting the efficiency of the device. The impingement distances of both instruments were therefore the same.

Comparison of the Hatch and Greenburg-Smith impingers

Sample no.	Sample diluted to—	Dust concentration—millions of particles per cubic foot		Difference (b—a)	Percent difference in terms of Greenburg-Smith impinger
		G.-S. (a)	Hatch (b)		
	cc				
CORE-MAKERS' EXPOSURE—FOUNDRY					
1	250	6.5	5.9	−0.6	−9.2
2	250	7.4	7.1	−0.3	−4.1
3	250	4.7	5.5	+0.8	+17.0
4	250	4.8	5.0	+0.2	+4.2
5	250	7.4	7.0	−0.4	−5.4
6	500	2.3	2.2	−0.1	−4.3
KNOCKOUT-MEN'S EXPOSURE—FOUNDRY					
7	5,000	81.2	87.2	+6.0	+7.4
8	5,000	308.0	288.0	−20.0	−6.5
9	5,000	324.0	316.0	−8.0	−2.5
10	10,000	872.0	860.0	−12.0	−1.4
11	10,000	832.0	868.0	+36.0	+4.3
12	5,000	336.0	328.0	−8.0	−2.4
SCREENERS' EXPOSURE—CERAMIC DUST					
13	20,000	456.0	500.0	+44.0	+9.7
14	20,000	824.0	784.0	−40.0	−4.9
15	5,000	202.0	207.0	+5.0	+2.2
16	5,000	204.0	186.0	−18.0	−8.8
17	2,500	205.0	204.0	−1.0	−0.49
18	2,500	57.0	59.7	+2.7	+4.7

One hundred cubic centimeters of impinging fluid were used in the Greenburg-Smith impinger and 75 cc in the Hatch impinger. The samples were counted by the light field technique described by Greenburg and Bloomfield (*2*).

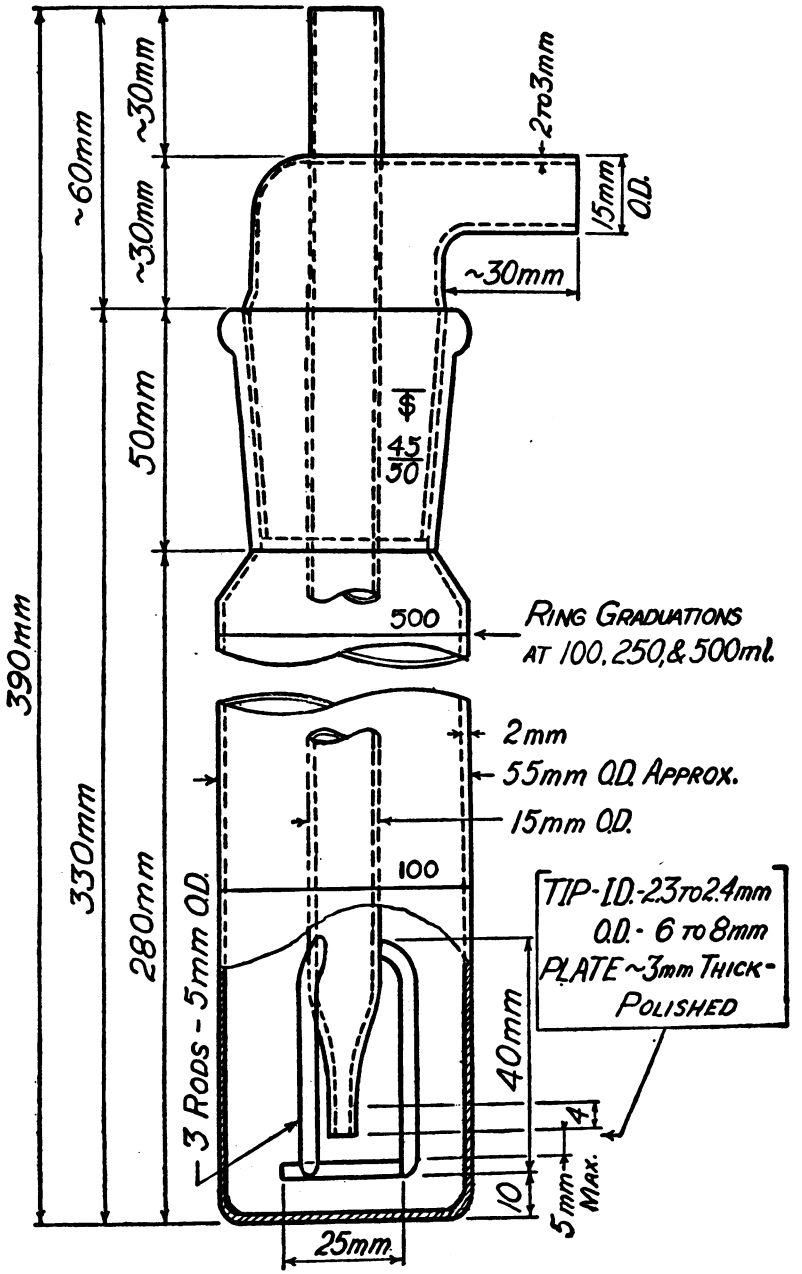
The results of the tests made are shown in the accompanying table. In all, 18 samples were taken, with dust concentrations ranging from approximately 2 million to more than 800 million particles per cubic foot of air. The corresponding determinations give very similar results. The differences, except for one pair of samples, lie within ± 10 percent of the counts obtained by the Greenburg-Smith impinger, a range within that of the experimental and personal errors. Hence, it may be concluded that the Hatch impinger gives the same results as would be obtained with the Greenburg-Smith type.

The Public Health Service has used both the Hatch and Greenburg-Smith types of impingers in its field studies. However, it has generally favored the latter type inasmuch as it has been believed that a fixed impingement disk tends to eliminate possible sampling errors which might occur through fluctuations in the impingement distance. Such variations have been thought to be significant in the Hatch-type impinger, especially since some flasks and nozzles have been found to be noninterchangeable without a certain amount of readjustment to stoppers. Readjustment of some stoppers frequently entails many difficulties, because of their tendency to adhere to the glass surfaces.

Recently it has been possible to construct an all-glass (Pyrex) impinger which embodies what is believed to be the best features of both types of impingers described above.[2] This new type of impinger is shown in the accompanying illustration. It consists of a flat-bottom cylindrical flask, with three graduations, 100 cc, 250 cc, and 500 cc. These graduations permit dilutions of samples to be made easily in the flask itself without the necessity of transferring to larger containers as is usually the case. The tops of all flasks are ground uniformly for $\overline{\text{T}}$45/50 glass stoppers. The nozzles are equipped with fixed disks, but with much shorter supporting arms. This tends to cut down breakage, which formerly was a serious drawback to the all-glass Greenburg-Smith type of nozzle. The combination suction connection and inlet tube used on the Hatch impinger is retained, but the former now has been carefully ground so as to be interchangeable with all flasks.

The impinger just described is a rigid unit. There is little opportunity for the fixed disk or supporting rods to break. The all-glass feature also makes it possible to use, for sampling certain gases, liquids which ordinarily attack rubber. In addition, the fact that the complete nozzle can be immersed in caustic solutions for cleaning is a feature which has long been desired.

[2] The writer is indebted to Mr. W. J. D. Walker, of the Corning Glass Works, Corning, N. Y., for many suggestions incorporated in this design.



New type all-glass impinger.

REFERENCES

(1) Katz, S. H., Smith, G. W., Myers, W. M., Trostel, L. J., Ingels, M., and Greenburg, L.: Comparative tests of instruments for determining atmospheric dusts. Pub. Health Bull. No. 144 (January 1925).
(2) Greenburg, Leonard, and Bloomfield, J. J.: The impinger dust sampling apparatus as used by the United States Public Health Service. Pub. Health Rep., vol. 47, no. 12 (Mar. 18, 1932).
(3) Hatch, T., Warren, H., and Drinker, P.: Modified form of the Greenburg-Smith impinger for field use, with a study of its operating characteristics. J. Ind. Hyg., vol. 14, no. 8 (October 1932).

SIMPLE EQUIPMENT FOR REMOVING CHANNEL OBSTRUCTIONS

By R. E. Dorer, *Assistant State Director of Malaria Control, Virginia*

The success of any malaria-control drainage enterprise depends upon adequate drainage outlet. Often it is impossible to drain pools and ponds which breed countless mosquito larvae, because the clogging of a natural channel does not allow sufficient run-off or wastes valuable grade. The filling of a stream bed with logs and debris may cause the stream to overflow its banks and leave pockets of water to produce successive crops of mosquitoes. It can readily be seen that in such cases it is as essential to clean the main channel as it is to install lateral ditching.

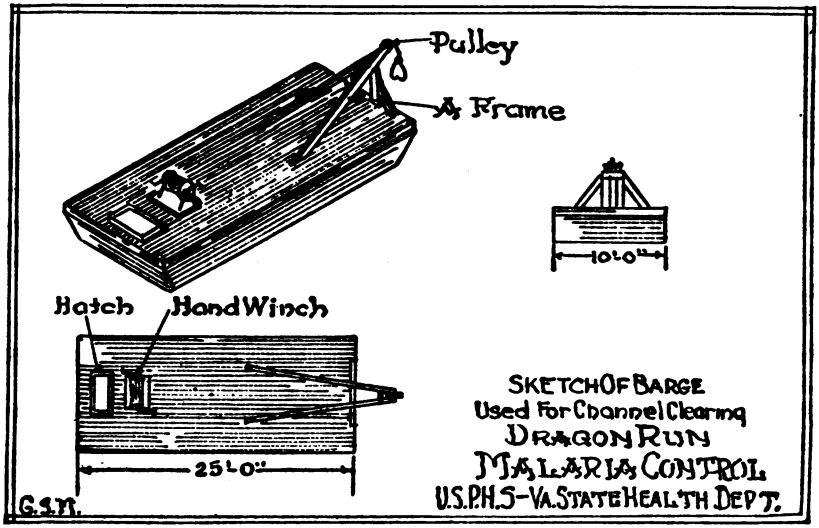
The development of stream blockage is simple. A tree blows over, a log from some sawmill operation "catches up" in a bend, a coon hunter fells a tree to get across the stream, or some other similar incident initiates the process. In times of flood, branches, leaves, and debris become lodged behind the main obstruction, creating the nucleus of a dam. Erosion of surrounding hillsides causes sand and soil to be washed into the stream and, in turn, deposited behind the dam, thus completing the obstruction. The result may be a change in stream location or the formation of an island, but in all cases a loss of grade. Many times trees take root in this newly made land; the change is then made permanent in nature.

The problem of removing obstructions and returning a stream to its original condition involves more or less heavy operations. A land pull from either bank is not practicable when used alone. Dynamite can not always be used, because of the destruction of fish life. Timbers submerged for years become water-logged and embedded in the bottom of streams and are very difficult to remove. To meet this particular need in malaria control drainage in Virginia, a barge has been constructed, together with a small bateau or flat-bottomed skiff. The barge is 10 feet by 25 feet by 32 inches. On the forward deck and extending over the end, an A frame was built, equipped with a sheave. A hand winch was mounted near the stern. A cable from the winch, carrying timber hooks on the free end, extends over the

Tree trunk brought to surface and ready to be hauled to shore.

sheave in the A frame. Logs and other debris to be removed are grappled and, by means of the hand winch, are broken loose from the bed of the stream. In the case of resistant loads, effective additional lifting power can be secured by having several men move to the stern of the barge. Heavy obstructions are usually lifted endwise from the channel above water level and are then conveyed to the bank by a second winch mounted on a slide and anchored at some advantageous point on the shore. By this method logs are hauled to the shore and up on the bank. Entire trees, 5 feet in diameter at the stump, have been thus removed. As much as 8 tons have been lifted in a single operation.

Lines from the shore, attached to cleats on the four corners of the barge, hold the barge in any desired position. The barge will float in 4 to 5 inches of water, and can be moved over land by skidding,



with the hand winch used for power. The bateau is used for probing and for other general purposes. The barge and bateau, fully equipped, including labor, cost only $210.

To March 1, 1937, the barge had been in use for 1,012 hours (including time taken for moving and break-downs), during which time it has removed from the stream 1,057 logs, 335 stumps, and 521 trees. It is not uncommon to move major obstructions at the rate of 4 or 5 per hour.

The location of the project for which this barge was designed is inaccessible to land machinery. Block and falls or other simple machines working from the bank would be of little value, because it is necessary to lift an obstruction before it can be pulled to and upon the shore. This simple barge rig has solved this problem. It has

done the work of heavy expensive machinery without difficulty. It is accomplishing the most important operation of the work of the drainage project—providing an adequate outlet—for a drainage system is no better than its outlet.

PUBLIC HEALTH SERVICE PUBLICATIONS

A List of Publications Issued During the Period January–June 1937

There is printed herewith a list of publications of the United States Public Health Service issued during the period January–June 1937.

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

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

Periodicals

*Public Health Reports (weekly), January–June, vol. 52, nos. 1–26, pages 1 to 871. 5 cents a copy.

*Venereal Disease Information (monthly), January–June, vol. 18, nos. 1–6, pages 1 to 222. 5 cents a copy.

Reprints from the Public Health Reports

1791. Report on market-milk supplies of urban communities. Compliance of the market-milk supplies of urban communities with the grade A pasteurized and grade A raw milk requirements of the Public Health Service Milk Ordinance and Code (as shown by ratings of 90 percent or more reported by the State milk-sanitation authorities during the period Jan. 1, 1935, to Dec. 31, 1936). January 29, 1937. 4 pages.

1792. Disabling illness among industrial employees in 1935 as compared with earlier years. By Dean K. Brundage. January 1, 1937. 8 pages.

1793. Toxicity of fruit sprays. A study of lead spray residues in Iowa-grown fruit, with reference to manifestations in consumers. By Ralph H. Heeren and Helen B. Funk. January 1, 1937. 9 pages.

1794. Six years' intensive observation on the seasonal prevalence of a tick population in western Montana. A preliminary summary. By Cornelius B. Philip. January 1, 1937. 6 pages.

1795. Further study of the duration and cost of Federal compensation cases with disease as a complicating factor. Cases classified into accidental injuries, occupational diseases, and hernias. By William M. Gafafer. January 8, 1937. 16 pages.

1796. Studies in chemotherapy. II. Chemotherapy of experimental pneumococcus infections. By Sanford M. Rosenthal. January 8, 1937. 6 pages.
1797. Distribution of tuberculosis mortality in the white population of the United States. By C. C. Dauer. January 15, 1937. 6 pages.
1798. Rat harborage and ratproofing. By B. E. Holsendorf. January 15, 1937. 7 pages.
1799. Sources of infection and seasonal incidence of tularaemia in man. By Edward Francis. January 22, 1937. 10 pages.
1800. Salient public health features of rheumatic heart disease. By O. F. Hedley. February 5, 1937. 8 pages.
1801. Control of chromic acid mists from plating tanks. By Edward C. Riley and F. H. Goldman. February 5, 1937. 3 pages.
1802. Studies in chemotherapy. III. The effect of p-aminobenzene sulphonamide on pneumococci in vitro. By Sanford M. Rosenthal. February 12, 1937. 5 pages.
1803. Pulmonary tumors in mice. I. The susceptibility of the lungs of albino mice to the carcinogenic action of 1, 2, 5, 6-dibenzanthracene. By H. B. Andervont. February 19, 1937. 9 pages.
1804. The determination of mercury in carroted fur. By F. H. Goldman. February 19, 1937. 3 pages.
1805. Lactoflavin in the treatment of canine blacktongue. By W. H. Sebrell, D. J. Hunt, and R. H. Onstott. February 26, 1937. 5 pages.
1806. Age of gainful workers of the United States, 1920 and 1930. Studies on the age of gainful workers no. 1. By William M. Gafafer. March 5, 1937. 13 pages.
1807. The distribution of *Brucella melitensis* variety *melitensis* in the United States. By Alice C. Evans. March 12, 1937. 9 pages.
1808. Pulmonary tumors in mice. II. The influence of heredity upon lung tumors induced by the subcutaneous injection of a lard-dibenzanthracene solution. By H. B. Andervont. March 12, 1937. 12 pages.
1809. Some aspects of blanket coverage of occupational diseases in the United States. March 19, 1937. 6 pages.
1810. Pulmonary tumors in mice. III. The serial transmission of induced lung tumors. By H. B. Andervont. March 26, 1937. 9 pages.
1811. Public Health Service publications. A list of publications issued during the period July–December 1936. March 26, 1937. 4 pages.
1812. Studies of sewage purification. VI. Biochemical oxidation by sludges developed by pure cultures of bacteria isolated from activated sludge. By C. T. Butterfield, C. C. Ruchhoft, and P. D. McNamee. April 2, 1937. 26 pages.
1813. The treatment of blacktongue with a preparation containing the "filtrate factor", and evidence of riboflavin deficiency in dogs. By W. H. Sebrell, R. H. Onstott, and D. J. Hunt. April 9, 1937. 7 pages.
1814. Labile bacterial antigens and methods of preparing and preserving them. By Stuart Mudd, E. J. Czarnetzky, Horace Pettit, and David Lackman. April 9, 1937. 3 pages.
1815. Age of gainful male workers in different geographic regions of the United States, 1920 and 1930. Studies on the age of gainful workers no. 2. By William M. Gafafer. April 9, 1937. 17 pages.
1816. Studies on trichinosis. I. The incidence of trichinosis as indicated by postmortem examinations of 300 diaphragms. By Maurice C. Hall and Benjamin J. Collins. April 16, 1937. 22 pages.

1817. Studies on trichinosis. II. Some correlations and implications in connection with the incidence of trichinae found in 300 diaphragms. By Maurice C. Hall and Benjamin J. Collins. April 23, 1937. 16 pages.
1818. Sickness among male industrial employees during the final quarter of 1936 and the year as a whole. By Dean K. Brundage. April 30, 1937. 3 pages.
1819. Studies on trichinosis. III. The complex clinical picture of trichinosis, and the diagnosis of the disease. By Maurice C. Hall. April 30, 1937. 12 pages.
1820. Radio pratique. Pratique by wireless in lieu of quarantine inspection for passenger vessels. By C. V. Akin. April 23, 1937. 5 pages.
1821. Mortality in certain States during 1936, with comparative data for recent years. May 7, 1937. 11 pages.
1822. Tuberculosis control by a small county health department. Brunswick-Greensville health administration studies no. 8. By J. O. Dean. May 7, 1937. 12 pages.
1823. Seasonal patterns and trends of communicable diseases. By Robert Olesen and Brock C. Hampton. May 7, 1937. 8 pages.
1824. Dibenzanthracene tumors in mice. The production of subcutaneous, pulmonary, and liver tumors by serum dispersions and lard solutions. By H. B. Andervont and Egon Lorenz. May 14, 1937. 11 pages; 2 plates.
1825. Studies in chemotherapy. IV. Comparative studies of sulphonamide compounds in experimental pneumococcus, streptococcus, and meningococcus infections. By Sanford M. Rosenthal, Hugo Bauer, and Sara E. Branham. May 21, 1937. 10 pages.
1826. Studies in chemotherapy. V. Sulphanilamide, serum, and combined drug and serum therapy in experimental meningococcus and pneumococcus infections in mice. By Sara E. Branham and Sanford M. Rosenthal. May 28, 1937. 11 pages.
1827. Some experiments with rats and rat guards. By O. E. Denney June 4, 1937. 4 pages; 8 plates.
1828. A new species of Thrassis (*Siphonaptera*). By William L. Jellison. June 4, 1937. 3 pages.
1829. Age of gainful female workers in different geographic regions of the United States, 1920 and 1930. Studies on the age of gainful workers no. 3. By William M. Gafafer. June 4, 1937. 19 pages.
1830. Report on two outbreaks of food poisoning. By J. C. Geiger. June 11, 1937. 8 pages.
1831. Incidence of spontaneous tumors in a colony of strain C_3H mice. By H. B. Andervont and W. J. McEleney. June 11, 1937. 9 pages.
1832. Geographical distributions of mortality from tuberculosis, cancer, appendicitis, and typhoid fever in the white population of the United States. By L. L. Lumsden and C. C. Dauer. June 18, 1937. 8 pages.
1833. The need for industrial hygiene courses in public health curricula. By J. J. Bloomfield and R. R. Sayers. June 18, 1937. 4 pages.
1834. Purification and precipitation of the erythrogenic factor of scarlet fever streptococcus toxin and its antigenic value. By M. V. Veldee. June 25, 1937. 11 pages.
1835. Typhoid vaccine: The technique of its preparation at the Army Medical School. By Rufus L. Holt and Arthur P. Hitchens. June 25, 1937. 16 pages; 4 plates.

Supplements to the Public Health Reports

122. Clinical studies of drug addiction. I. The absence of addiction liability in "perparin." By C. K. Himmelsbach. 1937. 4 pages.

123. The scientific exhibit "The Story of Life", at the Texas Centennial Exposition, Dallas, Tex., June 6–November 29, 1936. By Paul T. Erickson. 1937. 28 pages; 10 plates.
124. Ground-water supplies. Progress report of the Committee on Ground-water Supplies, Conference of State Sanitary Engineers, 1936. 1937. 24 pages.
125. Clinical studies of drug addiction. II. "Rossium" treatment of drug addiction. By C. K. Himmelsbach. With a report on the chemistry of "rossium." By Lyndon F. Small. 1937. 18 pages.
126. The public health program under title VI of the Social Security Act. 1937. 23 pages.

Public Health Bulletins

233. Measurements of ultraviolet radiation and illumination in American cities during the years 1931 to 1933. By James E. Ives and W. A. Gill. March 1937. 36 pages.
234. A study of chronic mercurialism in the hatters' fur-cutting industry. Medical studies by Paul A. Neal and Roy R. Jones. Engineering studies by J. J. Bloomfield and J. M. DallaValle. Statistical analysis by Thomas I. Edwards. May 1937. 70 pages; 21 plates.
235. Mortality among Southern Negroes since 1920. With comparative data for Southern whites and Northern Negroes. By Mary Gover. June 1937. 52 pages.
236. Evaluation of the industrial hygiene problems of a State. By J. J. Bloomfield and Mary F. Peyton. June 1937. 126 pages.

National Institute of Health Bulletins

167. The pathology of tularaemia. I. The pathology of tularaemia in man. By R. D. Lillie and E. Francis. II. The pathology of tularaemia in the Belgian Hare (*Oryctolagus cuniculus*). By R. D. Lillie and E. Francis. III. The pathology of tularaemia in the black-tailed jack rabbit (*Lepus* sp.). By R. D. Lillie and E. Francis. IV. The pathology of tularaemia in the cottontail rabbit (*Sylvilagus floridanus*). By R. D. Lillie and E. Francis. V. The pathology of tularaemia in the cotton rat (*Sigmodon hispidus*). By R. D. Lillie and E. Francis. VI. The pathology of tularaemia in the California ground squirrel (*Citellus beecheyi beecheyi*). By R. D. Lillie and E. Francis. VII. The pathology of tularaemia in the mouse (*Mus musculus* and *M. musculus albinus*). By R. D. Lillie and E. Francis. VIII. The pathology of tularaemia in the white rat (*Rattus norvegicus albinus*). By R. D. Lillie and E. Francis. IX. The pathology of tularaemia in the guinea pig (*Cavia cobaya*). By R. D. Lillie and E. Francis. X. The pathology of tularaemia in the sheep (*Ovis aries*). By R. D. Lillie, E. Francis, and R. R. Parker. XI. The pathology of tularaemia in the opossum (*Didelphis virginiana*). By R. D. Lillie and E. Francis. XII. The pathology of tularaemia in other mammals. By R. D. Lillie and E. Francis. XIII. The pathology of tularaemia in the quail (*Colinus virginianus*). By R. D. Lillie and E. Francis. XIV. The pathology of tularaemia in other birds. By R. D. Lillie, E. Francis, and R. R. Parker. February 1937. 217 pages; 88 plates.
169. Standardization of antipneumococcus horse sera and concentrates. By Lloyd D. Felton and H. J. Stahl. February 1937. 58 pages.

Annual Report

Annual Report of the Surgeon General of the United States Public Health Service for the fiscal year 1936. 158 pages.

Unnumbered Publications

Index to Public Health Reports, vol. 51, part 2 (July–December 1936). 1937. 24 pages.

Treatment of malaria. Reprinted from Public Health Reports. May 28, 1937. 1 page.

*National Negro Health Week program. This pamphlet is published annually, usually about the middle of March, for community leaders in an effort to suggest ways and means by which interested individuals and organizations may be organized for a concerted and effective attack upon the community's disease problems. Twenty-third annual observance. 1937. 8 page folder. Out of print.

*National Negro Health Week poster. Twenty-third annual observance. 1937. Out of print.

*National Negro Health Week leaflet. Twenty-third annual observance. 1937. 2 pages. Out of print.

Reprints from Venereal Disease Information

61. The efficiency of State and local laboratories in the performance of serodiagnostic tests for syphilis. By Thomas Parran, H. H. Hazen, Arthur H. Sanford, F. E. Senear, Walter M. Simpson, and R. A. Vonderlehr. Vol. 18, no. 1. 8 pages.

62. Asymptomatic neurosyphilis. Cooperative clinical studies in the treatment of syphilis. By Paul A. O'Leary, Harold N. Cole, Joseph Earle Moore, John H. Stokes, Udo J. Wile, Thomas Parran, R. A. Vonderlehr, and Lida J. Usilton. Vol. 18, no. 3. 21 pages.

63. Continuous and intermittent treatment for early syphilis. By John H. Stokes and Lida J. Usilton. Vol. 18, no. 3. 18 pages.

64. Late prenatal syphilis with special reference to interstitial keratitis, its prevention and treatment. By Harold N. Cole, Lida J. Usilton, Joseph Earle Moore, Paul A. O'Leary, John H. Stokes, Udo J. Wile, Thomas Parran, and R. A. Vonderlehr. Vol. 18, no. 4. 15 pages.

65. The philosophy of case holding. By Louise B. Ingraham and John H. Stokes. Vol. 18, no. 5. 5 pages.

DEATHS DURING WEEK ENDED JULY 24, 1937

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

	Week ended July 24, 1937	Corresponding week, 1936
Data from 86 large cities of the United States:		
Total deaths	7,384	7,841
Average for 3 prior years	8,984	
Total deaths, first 29 weeks of year	265,473	266,876
Deaths under 1 year of age	588	557
Average for 3 prior years	561	
Deaths under 1 year of age, first 29 weeks of year	16,751	16,646
Data from industrial insurance companies:		
Policies in force	70,056,862	68,651,544
Number of death claims	11,684	13,710
Death claims per 1,000 policies in force, annual rate	8.7	10.4
Death claims per 1,000 policies, first 29 weeks of year, annual rate	10.4	10.4

PREVALENCE OF DISEASE

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

UNITED STATES

CURRENT WEEKLY STATE REPORTS

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

Cases of certain communicable diseases reported by telegraph by State health officers for weeks ended July 31, 1937, and Aug. 1, 1936

Division and State	Diphtheria		Influenza		Measles		Meningococcus meningitis	
	Week ended July 31, 1937	Week ended Aug. 1, 1936	Week ended July 31, 1937	Week ended Aug. 1, 1936	Week ended July 31, 1937	Week ended Aug. 1, 1936	Week ended July 31, 1937	Week ended Aug. 1, 1936
New England States:								
Maine	---	1	---	---	5	40	0	0
New Hampshire	---	---	---	---	4	12	0	0
Vermont	1	---	---	---	5	7	0	0
Massachusetts	6	9	---	---	66	118	0	3
Rhode Island	---	---	---	---	6	7	1	0
Connecticut	3	1	1	---	10	14	0	0
Middle Atlantic States:								
New York	29	29	[1]4	[1]1	314	261	4	10
New Jersey	4	3	2	2	125	74	3	3
Pennsylvania	9	10	---	---	249	89	4	3
East North Central States:								
Ohio	22	25	10	11	534	121	5	9
Indiana	9	11	---	5	31	2	3	1
Illinois [2]	20	22	5	7	169	12	4	5
Michigan	10	12	---	---	128	22	1	1
Wisconsin	---	1	9	1	21	32	0	0
West North Central States:								
Minnesota	3	3	---	2	---	20	1	2
Iowa	4	---	1	---	8	4	3	1
Missouri	6	6	44	18	14	5	0	1
North Dakota	---	4	---	2	1	3	0	0
South Dakota	1	1	---	---	1	---	0	0
Nebraska	---	5	---	---	5	2	0	1
Kansas	3	4	2	---	9	3	1	0
South Atlantic States:								
Delaware	---	---	---	---	1	---	0	0
Maryland [2 3]	9	4	---	---	6	33	3	1
District of Columbia	1	5	---	---	6	20	0	1
Virginia [2]	5	---	---	---	55	16	2	6
West Virginia	3	3	9	4	30	4	5	0
North Carolina [2 4]	12	9	---	---	62	2	0	2
South Carolina [4]	5	3	40	29	6	6	0	1
Georgia [4]	5	11	---	---	---	---	0	3
Florida [4]	6	7	---	1	---	2	2	1
East South Central States:								
Kentucky	8	3	1	1	51	2	3	1
Tennessee [2]	4	6	3	2	21	10	1	2
Alabama [4]	12	9	12	1	8	3	11	1
Mississippi [2]	9	5	---	---	---	---	0	0

See footnotes at end of table.

Cases of certain communicable diseases reported by telegraph by State health officers for weeks ended July 31, 1937, and Aug. 1, 1936—Continued

Division and State	Diphtheria		Influenza		Measles		Meningococcus meningitis	
	Week ended July 31, 1937	Week ended Aug. 1, 1936	Week ended July 31, 1937	Week ended Aug. 1, 1936	Week ended July 31, 1937	Week ended Aug. 1, 1936	Week ended July 31, 1937	Week ended Aug. 1, 1936
West South Central States:								
Arkansas	11	1	7	4	2	----	0	0
Louisiana	7	11	16	13	----	4	0	0
Oklahoma [5]	4	6	5	5	3	3	2	0
Texas [4]	22	16	55	24	66	18	2	1
Mountain States:								
Montana	----	1	----	----	10	1	0	0
Idaho [2]	1	----	6	1	4	7	0	0
Wyoming [2]	----	----	----	----	1	3	0	0
Colorado [2]	6	4	----	----	32	5	2	1
New Mexico	3	3	1	1	22	6	0	0
Arizona	----	2	15	5	1	21	0	0
Utah [3]	----	----	----	----	22	12	0	0
Pacific States:								
Washington	1	1	----	----	16	22	2	0
Oregon [3]	----	----	8	2	4	5	0	0
California [4]	22	12	10	11	36	91	5	5
Total	286	269	266	153	2,170	1,144	70	66
First 30 weeks of year	12,811	13,842	273,800	139,497	238,001	265,377	3,991	5,702

Division and State	Poliomyelitis		Scarlet fever		Smallpox		Typhoid fever	
	Week ended July 31, 1937	Week ended Aug. 1, 1936	Week ended July 31, 1937	Week ended Aug. 1, 1936	Week ended July 31, 1937	Week ended Aug. 1, 1936	Week ended July 31, 1937	Week ended Aug. 1, 1936
New England States:								
Maine	3	2	1	17	0	0	5	3
New Hampshire	2	1	4	----	0	0	0	0
Vermont	0	1	1	2	0	0	0	1
Massachusetts	13	1	32	55	0	0	5	4
Rhode Island	0	0	2	2	0	0	0	0
Connecticut	2	0	10	9	0	0	4	0
Middle Atlantic States:								
New York	11	6	93	101	0	0	12	19
New Jersey	5	0	15	26	0	0	2	9
Pennsylvania	6	1	62	72	0	0	28	25
East North Central States:								
Ohio	48	1	117	75	3	1	25	13
Indiana	15	0	21	19	6	0	8	6
Illinois [2]	26	12	91	117	4	12	18	19
Michigan	10	3	138	79	1	0	11	11
Wisconsin	2	0	54	78	3	11	1	3
West North Central States:								
Minnesota	1	4	19	28	12	2	0	0
Iowa	3	0	25	29	20	0	8	1
Missouri	16	2	34	23	0	1	30	20
North Dakota	0	3	6	2	1	9	1	0
South Dakota	0	1	3	4	0	4	4	1
Nebraska	11	3	10	16	0	2	1	0
Kansas	7	0	17	36	1	0	7	8
South Atlantic States:								
Delaware	0	0	----	----	0	0	0	0
Maryland [2 3]	7	0	10	15	0	0	18	11
District of Columbia	1	0	6	1	0	0	6	1
Virginia [2]	5	3	11	4	0	0	37	10
West Virginia	4	0	15	12	3	1	12	10
North Carolina [2 4]	6	2	19	7	0	0	21	23
South Carolina [4]	1	0	2	2	0	0	15	13
Georgia [4]	2	6	10	8	0	0	35	46
Florida [4]	1	0	1	3	0	0	1	2
East South Central States:								
Kentucky	33	3	6	5	0	0	45	32
Tennessee [2]	6	26	16	13	0	0	38	32
Alabama [4]	1	29	6	4	0	0	5	15
Mississippi [3]	13	5	5	2	2	0	25	19

See footnotes at end of table.

Cases of certain communicable diseases reported by telegraph by State health officers for weeks ended July 31, 1937, and Aug. 1, 1936—Continued

Division and State	Poliomyelitis		Scarlet fever		Smallpox		Typhoid fever	
	Week ended July 31, 1937	Week ended Aug. 1, 1936	Week ended July 31, 1937	Week ended Aug. 1, 1936	Week ended July 31, 1937	Week ended Aug. 1, 1936	Week ended July 31, 1937	Week ended Aug. 1, 1936
West South Central States:								
Arkansas	26	0	4	4	0	0	38	18
Louisiana	5	0	5	2	0	0	32	27
Oklahoma [5]	28	0	13	5	0	0	32	14
Texas [4]	42	1	21	21	0	0	72	34
Mountain States:								
Montana	0	1	15	4	25	20	1	3
Idaho [3]	0	1	8	1	2	1	1	1
Wyoming [3]	1	0	----	9	0	2	0	1
Colorado [3]	2	6	6	7	0	1	5	4
New Mexico	0	0	3	8	0	0	5	7
Arizona	1	0	4	5	0	0	3	5
Utah [3]	0	0	5	8	0	0	0	2
Pacific States:								
Washington	0	1	14	8	4	0	5	1
Oregon [3]	1	1	4	6	6	1	2	4
California [4]	34	16	56	84	9	3	16	16
Total	401	142	1,020	1,038	102	71	640	494
First 30 weeks of year	2,071	1,036	162,236	175,916	7,795	5,838	6,126	5,512

[1] New York City only.
[2] Rocky Mountain spotted fever, week ended July 31, 1937, 12 cases, as follows: Illinois, 2; Maryland, 1; Virginia, 2; North Carolina, 2; Tennessee, 1; Idaho, 1; Wyoming, 1; Colorado, 1; Oregon, 1.
[3] Week ended earlier than Saturday.
[4] Typhus fever, week ended July 31, 1937, 60 cases, as follows: North Carolina, 5; South Carolina, 3; Georgia, 29; Florida, 2; Alabama, 8; Texas, 12; California, 1.
[5] Figures for 1936 are exclusive of Oklahoma City and Tulsa.

SUMMARY OF MONTHLY REPORTS FROM STATES

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

State	Meningococcus meningitis	Diphtheria	Influenza	Malaria	Measles	Pellagra	Poliomyelitis	Scarlet fever	Smallpox	Typhoid fever
June 1937										
Alabama	29	35	49	515	120	54	10	18	1	33
North Dakota	----	6	230	----	3	----	0	85	51	2
Oregon	1	4	29	4	18	----	2	91	39	5
Tennessee	10	16	67	75	416	39	18	32	0	44

June 1937

	Cases
Chicken pox:	
Alabama	32
North Dakota	75
Oregon	77
Tennessee	39
Dysentery:	
Alabama (amoebic)	2
Tennessee (amoebic)	2
Tennessee (bacillary)	85
Encephalitis, epidemic or lethargic:	
Alabama	2
German measles:	
Alabama	1
Tennessee	35
Impetigo contagiosa:	
Oregon	18
Jaundice, infectious:	
Oregon	9
Mumps:	
Alabama	72
North Dakota	15
Oregon	31
Tennessee	95

June 1937—Continued

	Cases
Ophthalmia neonatorum:	
Alabama	2
Tennessee	1
Paratyphoid fever:	
Tennessee	10
Puerperal septicemia:	
Tennessee	2
Rabies in animals:	
Alabama	79
Oregon	3
Rocky Mountain spotted fever:	
Oregon	9
Tennessee	1
Scabies:	
Oregon	10
Septic sore throat:	
Oregon	11
Tennessee	2
Tetanus:	
Alabama	2
Tennessee	2

June 1937—Continued

	Cases
Trachoma:	
Alabama	1
Tennessee	6
Tularaemia:	
Oregon	3
Tennessee	1
Typhus fever:	
Alabama	43
Tennessee	1
Undulant fever:	
Alabama	9
North Dakota	1
Tennessee	1
Vincent's infection:	
Oregon	14
Tennessee	10
Whooping cough:	
Alabama	248
North Dakota	69
Oregon	93
Tennessee	313

PLAGUE INFECTION IN SAN BERNARDINO COUNTY, CALIF.

Under date of July 29, 1937, Dr. W. M. Dickie, Director of Public Health of California, reported that plague infection had been proved by animal inoculation in a lot of 44 fleas collected from 11 *beecheyi* squirrels, shot on July 14, 1937, 6 miles south of Camp Angeles, San Bernardino County, Calif. Plague infection was also proved by animal inoculation in a lot of six fleas collected from seven *fisheri* squirrels on July 13, 1937, from the San Berdoo Y Camp, 5 miles southeast of Seven Oaks, San Bernardino County, Calif.

WEEKLY REPORTS FROM CITIES

City reports for week ended July 24, 1937

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

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Data for 90 cities:											
5-year average	129	40	14	1,036	309	410	7	386	84	1,309	----
Current week	82	14	7	819	313	283	3	359	54	1,535	----
Maine:											
Portland	0	----	0	0	1	0	0	0	0	6	17
New Hampshire:											
Concord	1	----	0	0	1	0	0	0	0	0	7
Manchester	0	----	----	0	2	1	0	0	0	0	17
Nashua	0	----	----	0	----	0	0	----	1	0	6
Vermont:											
Barre	0	----	0	1	0	0	0	0	0	0	3
Burlington	0	----	0	0	0	0	0	0	0	0	6
Rutland	0	----	0	0	0	0	0	0	0	0	3
Massachusetts:											
Boston	1	----	0	15	14	9	0	6	1	31	155
Fall River	2	----	0	5	2	1	0	1	1	3	41
Springfield	0	----	0	0	0	2	0	0	0	16	39
Worcester	0	----	0	1	2	2	0	1	3	7	50
Rhode Island:											
Pawtucket	0	----	0	0	0	0	0	0	0	1	15
Providence	0	----	0	18	6	5	0	0	0	33	59
Connecticut:											
Bridgeport	0	----	0	0	0	0	0	1	0	0	20
Hartford	0	----	0	4	0	0	0	3	0	4	39
New Haven	0	----	0	3	2	0	0	2	0	4	47
New York:											
Buffalo	0	----	0	16	8	6	0	8	0	39	123
New York	17	6	2	125	69	16	0	84	6	121	1,313
Rochester	0	----	0	3	1	2	0	1	0	9	49
Syracuse	2	----	0	22	3	2	0	1	0	24	42
New Jersey:											
Camden	0	----	0	1	2	0	0	3	1	0	25
Newark	0	----	0	9	2	2	0	5	0	22	79
Trenton	0	----	0	14	2	1	0	2	0	0	30
Pennsylvania:											
Philadelphia	1	----	0	7	24	17	0	17	2	61	414
Pittsburgh	1	1	0	67	13	4	0	4	1	45	142
Reading	1	----	0	9	1	0	0	0	0	0	12
Scranton	0	----	----	2	----	2	0	----	0	1	----
Ohio:											
Cincinnati	0	1	0	14	0	1	0	4	2	38	105
Cleveland	2	2	1	82	7	19	0	11	0	56	175
Columbus	0	1	1	3	1	2	0	4	0	7	91
Toledo	0	1	1	24	2	4	0	1	3	57	62
Indiana:											
Anderson	0	----	0	11	1	1	0	0	0	33	9
Fort Wayne	0	----	0	1	1	0	0	0	0	2	21
Indianapolis	0	----	0	12	5	2	2	2	0	22	84

City reports for week ended July 24, 1937—Continued

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Indiana—Contd.											
Muncie	0	------	0	1	0	1	0	0	0	0	10
South Bend	0	------	0	0	0	0	0	1	0	0	12
Terre Haute	0	------	0	0	0	0	0	0	0	1	17
Illinois:											
Alton	0	------	0	1	0	0	0	1	0	1	5
Chicago	12	------	0	128	14	53	0	45	7	97	598
Elgin	0	------	0	0	0	0	0	0	0	3	8
Moline	0	------	0	0	0	0	0	0	0	8	10
Springfield	0	------	0	2	2	0	0	0	1	5	24
Michigan:											
Detroit	11	------	0	53	12	46	0	18	2	103	239
Flint	0	------	0	0	5	6	0	0	0	3	22
Grand Rapids	0	------	0	17	0	0	0	1	0	46	23
Wisconsin:											
Kenosha	0	------	0	0	0	1	0	0	0	0	5
Madison	0	------	0	1	0	0	0	0	0	8	12
Milwaukee	0	------	0	8	4	7	0	6	0	36	87
Racine	0	------	0	0	0	3	0	0	0	0	13
Superior	0	------	0	0	0	0	0	0	0	11	6
Minnesota:											
Duluth	0	------	0	1	0	0	0	1	0	5	20
Minneapolis	0	------	0	0	4	6	0	1	0	13	92
St. Paul	0	------	0	1	1	1	0	2	0	69	38
Iowa:											
Cedar Rapids	0	------	--------	1	-------	1	0	-------	0	3	--------
Davenport	0	------	--------	0	-------	1	0	-------	1	1	--------
Des Moines	0	------	--------	0	-------	7	0	-------	0	2	24
Sioux City	0	------	--------	1	-------	3	1	-------	0	2	--------
Waterloo	1	------	--------	2	-------	1	0	-------	1	0	--------
Missouri:											
Kansas City	2	1	0	4	7	1	0	7	1	11	81
St. Joseph	0	------	0	2	2	1	0	0	0	2	13
St. Louis	1	------	0	26	4	11	0	11	4	34	179
North Dakota:											
Fargo	0	------	0	0	0	0	0	0	0	32	3
Grand Forks	0	------	--------	0	-------	0	0	-------	0	4	--------
Minot	0	------	0	0	0	0	0	0	0	0	2
South Dakota:											
Aberdeen	0	------	--------	0	-------	0	0	-------	0	0	--------
Nebraska:											
Omaha	0	------	0	0	1	0	0	2	0	3	40
Kansas:											
Lawrence	0	------	--------	0	-------	0	0	-------	0	2	--------
Topeka	0	------	1	0	1	0	0	0	0	6	40
Wichita	0	------	0	0	1	1	0	1	0	6	15
Delaware:											
Wilmington	0	------	0	0	2	1	0	1	0	10	28
Maryland:											
Baltimore	5	------	0	11	10	4	0	13	2	102	194
Cumberland	0	------	0	0	0	0	0	0	0	3	10
Frederick	0	------	0	0	0	0	0	0	0	0	2
Dist. of Col.:											
Washington	4	------	0	20	5	3	0	8	2	13	150
Virginia:											
Lynchburg	2	------	0	2	1	0	0	0	0	8	16
Norfolk	0	------	0	7	3	0	0	1	0	8	35
Richmond	0	------	0	2	4	0	0	1	0	1	54
Roanoke	2	------	0	3	0	2	0	0	1	1	11
West Virginia:											
Charleston	0	------	0	0	0	0	0	0	0	0	7
Huntington	0	------	--------	0	-------	0	0	-------	0	0	--------
Wheeling	0	------	0	0	0	3	0	1	0	16	10
North Carolina:											
Gastonia	0	------	--------	0	-------	0	0	-------	0	1	--------
Raleigh	0	------	0	0	0	0	0	0	0	13	12
Wilmington	0	------	0	1	0	1	0	0	0	18	7
Winston-Salem	0	------	0	1	1	1	0	0	0	10	15
South Carolina:											
Charleston	0	------	0	0	1	2	0	0	1	0	23
Florence	0	------	0	0	0	0	0	0	0	0	5
Greenville	0	------	0	0	0	0	0	0	0	2	8
Georgia:											
Atlanta	0	------	0	0	11	2	0	3	1	30	93
Brunswick	0	------	0	0	1	0	0	0	0	0	3
Savannah	0	------	0	0	0	0	0	1	2	1	21

City reports for week ended July 24, 1937—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								
Florida:											
Miami	0	1	0	1	2	0	0	3	0	0	43
Tampa	0	------	0	0	1	0	0	1	0	8	23
Kentucky:											
Ashland	0	------	0	1	1	0	0	1	0	0	16
Covington	0	------	0	0	0	0	0	0	0	17	--------
Lexington	0	------	0	0	1	0	0	1	0	7	--------
Louisville	0	------	0	19	2	6	0	2	0	90	58
Tennessee:											
Knoxville	0	------	0	0	1	0	0	0	2	0	33
Memphis	1	------	0	16	1	2	0	4	0	18	83
Nashville	2	------	0	3	1	0	0	1	0	4	37
Alabama:											
Birmingham	1	------	0	5	3	2	0	2	0	5	66
Mobile	0	------	0	0	2	0	0	1	0	0	26
Montgomery	0	------	--------	0	-------	0	0	-------	0	0	--------
Arkansas:											
Fort Smith	0	------	--------	0	-------	0	0	-------	0	2	--------
Little Rock	0	------	0	0	3	1	0	3	0	0	8
Louisiana:											
Lake Charles	0	------	0	0	1	0	0	0	0	0	3
New Orleans	6	------	0	0	1	3	0	6	4	21	117
Shreveport	0	------	0	0	4	0	0	1	0	0	52
Oklahoma:											
Muskogee	0	------	--------	0	-------	0	0	-------	0	0	--------
Texas:											
Dallas	1	------	0	1	5	0	0	2	2	10	56
Fort Worth	1	------	0	0	2	3	0	1	0	3	40
Galveston	0	------	0	0	1	1	0	1	0	0	17
Houston	0	------	0	4	3	1	0	7	0	2	65
San Antonio	0	------	0	1	5	0	0	5	0	1	72
Montana:											
Billings	0	------	0	0	1	0	0	0	0	0	2
Great Falls	0	------	0	0	0	0	0	0	0	8	4
Helena	0	------	0	0	0	2	0	0	0	0	3
Missoula	0	------	0	0	1	0	1	0	0	0	7
Idaho:											
Boise	0	------	0	0	1	0	0	0	0	2	5
Colorado:											
Colorado Springs	0	------	0	1	0	0	0	1	0	1	12
Denver	2	------	0	16	6	2	0	2	1	34	65
Pueblo	0	------	0	1	1	1	0	1	0	0	7
New Mexico:											
Albuquerque	1	------	0	5	0	2	0	1	0	0	15
Utah:											
Salt Lake City	0	------	1	39	1	4	0	2	0	13	41
Washington:											
Seattle	0	------	0	6	1	1	0	5	2	33	78
Spokane	0	------	0	7	0	0	0	1	1	4	33
Tacoma	0	------	0	0	0	0	0	0	0	3	13
Oregon:											
Portland	0	------	0	1	3	1	1	3	0	1	78
Salem	0	------	--------	0	-------	0	0	-------	0	0	--------
California:											
Los Angeles	2	1	1	5	5	8	0	22	0	59	279
Sacramento	0	------	0	1	3	2	0	2	1	7	23
San Francisco	0	1	0	0	2	4	0	6	2	44	162

City reports for week ended July 24, 1937—Continued

State and city	Meningococcus meningitis		Poliomyelitis cases
	Cases	Deaths	
Massachusetts:			
Boston	2	0	5
Rhode Island:			
Pawtucket	1	0	0
New York:			
New York	5	2	5
New Jersey:			
Trenton	0	0	1
Pennsylvania:			
Philadelphia	1	1	0
Ohio:			
Cincinnati	1	1	11
Toledo	1	0	0
Indiana:			
Muncie	0	0	1
Illinois:			
Chicago	0	0	3
Michigan:			
Detroit	0	0	2
Wisconsin:			
Milwaukee	1	1	0
Minnesota:			
Minneapolis	0	0	1
Missouri:			
Kansas City	0	0	4
St. Louis	0	0	2
Nebraska:			
Omaha	0	0	4
Delaware:			
Wilmington	0	0	1
Maryland:			
Baltimore	2	3	1
Virginia:			
Richmond	2	0	0
West Virginia:			
Charleston	0	0	1
Wheeling	1	1	0
North Carolina:			
Wilmington	0	0	1
Georgia:			
Atlanta	1	0	0
Kentucky:			
Louisville	0	0	1
Tennessee:			
Memphis	0	0	1
Arkansas:			
Fort Smith	0	0	1
Little Rock	0	0	5
Louisiana:			
Shreveport	0	1	0
Texas:			
Dallas	1	1	0
Galveston	0	0	1
Houston	1	0	0
San Antonio	0	0	1
Oregon:			
Portland	1	1	0
California:			
Los Angeles	0	0	2
San Francisco	0	0	2

Pellagra.—Cases: Washington, 1; Savannah, 3; Tampa, 1; Nashville, 1; Montgomery, 1; Fort Smith, 3; Houston, 1.

Typhus fever.—New York, 2; Atlanta, 2; Savannah, 2; Nashville, 1; Birmingham, 1; Mobile, 2; Fort Worth, 1; San Antonio, 1.

FOREIGN AND INSULAR

LATVIA

Communicable diseases—January–May 1937.—During the months of January, February, March, April, and May, 1937, cases of certain communicable diseases were reported in Latvia as follows:

Disease	January	February	March	April	May
Botulism	1	1	1	1	3
Cerebrospinal meningitis	12	11	13	6	1
Diphtheria	75	81	44	36	43
Erysipelas	45	62	59	50	40
Influenza	966	435	300	153	41
Leprosy	1		1	3	
Lethargic encephalitis		1			
Malaria					1
Measles	4	5	14	1	2
Mumps	16	5	65	94	42
Paratyphoid fever	5		3	2	21
Poliomyelitis				1	1
Puerperal septicemia	11		7	8	5
Scarlet fever	297	357	437	371	247
Tetanus		1			2
Trachoma	60	97	45	45	27
Tuberculosis	276	285	310	336	311
Typhoid fever	36	[1] 54	29	28	30
Typhus fever			1	1	
Whooping cough	124	121	96	117	128

[1] Includes paratyphoid fever.

PANAMA CANAL ZONE

Notifiable diseases—April–June 1937.—During the months of April, May, and June, 1937, certain notifiable diseases, including imported cases, were reported in the Panama Canal Zone and terminal cities as follows:

Disease	April		May		June	
	Cases	Deaths	Cases	Deaths	Cases	Deaths
Chicken pox	3		6		5	
Diphtheria	5	2	11		6	
Dysentery (amebic)	10		7		10	
Dysentery (bac.llary)		3			5	2
Leprosy	1	1				
Malaria	54	1	90	1	259	4
Measles	31		15		6	
Meningococcus meningitis			1	1	1	
Mumps	20		23		28	
Pneumonia		16		25		28
Relapsing fever			1		1	
Scarlet fever			1			
Tuberculosis		34		35		28
Typhoid fever	2	2			1	
Typhus fever			2			
Whooping cough	2		9	1	9	1

SWEDEN

Notifiable diseases—March–May 1937.—During the months of March, April, and May, 1937, cases of certain notifiable diseases were reported in Sweden as follows:

Disease	March	April	May	Disease	March	April	May
Cerebrospinal meningitis	6	4	3	Poliomyelitis	28	32	29
Diphtheria	7	20	33	Scarlet fever	1,356	1,202	1,361
Dysentery	6	------	9	Syphilis	32	23	23
Epidemic encephalitis	------	2	11	Typhoid fever	4	6	9
Gonorrhea	778	932	914	Undulant fever	14	19	17
Paratyphoid fever	4	21	34				

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

NOTE.—A table giving current information of the world prevalence of quarantinable diseases appeared in the PUBLIC HEALTH REPORTS for July 30, 1937, pp. 1054-1068. A similar cumulative table will appear in the PUBLIC HEALTH REPORTS to be issued August 27, 1937, and thereafter, at least for the time being, in the issue published on the last Friday of each month.

Cholera

China—Hong Kong.—On July 26, 1937, one case of cholera was reported in Hong Kong, China.

Federated Malay States.—According to a recent report, two deaths from cholera were reported in the Federated Malay States during the week ended July 3, 1937. It was stated that cholera had not been reported in the Federated Malay States since 1927.

Siam.—A report dated July 7, 1937, from the American Consulate General at Bangkok, Siam, states that the cholera epidemic has been suppressed in Bangkok and reduced to negligible proportions throughout Siam.

Cases and deaths for the whole country since the beginning of the epidemic are as follows:

Month	Cases	Deaths
1936		
December	184	126
1937		
January	855	517
February	1,339	863
March	1,803	1,195
April	2,954	1,928
May	1,301	780
June	295	209

For the week ended July 3, there were 36 cases and 26 deaths in the entire country, while no cases or deaths were reported from Bangkok. During the week ended July 10, 1 case was reported in Bangkok, and during the week ended July 17, 1 case with 1 death was reported.

Plague

Peru.—During the month of June 1937, plague was reported in Peru as follows: Lambayeque Department, Chiclayo, 1 case; Libertad Department, Trujillo, 1 case; Salaverry, 1 case, 1 death; Lima Department, San Vicente, 1 case.

Tunisia—Tunis.—According to information dated July 23, 1937, 1 case of bubonic plague was reported in Tunis, Tunisia.

United States—California—San Bernardino County.—A report of plague infection in 2 lots of fleas taken from ground squirrels in San Bernardino County, Calif., appears on page 1128 of this issue of PUBLIC HEALTH REPORTS.

Yellow Fever

Brazil.—On July 9, 1937, 1 death from yellow fever was reported in Santa Izabel, Para State, Brazil.

French Equatorial Africa—Libreville.—On July 28, 1937, 1 fatal case of yellow fever was reported in Libreville, French Equatorial Africa.

Gold Coast.—On July 28, 1937, yellow fever was reported in Gold Coast as follows: Amasaman, 1 case; Bisa, 1 case; Nuaso, 1 case; Ozpom, 1 case. On July 21, 1 case of yellow fever was reported in Mepom, Gold Coast.

Nigeria.—On July 28, 1937, 1 case of yellow fever was reported in Ibadan, Nigeria. A fatal case of yellow fever was reported at Ogbomosho, Òyo Province, on July 22.

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