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## **RELATIVE RESISTANCE OF ESCHERICHIA COLI AND EBER-THELLA TYPHOSA TO CHLORINE AND CHLORAMINES**<sup>1</sup>

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In the course of studies on the influence of pH and temperature on the bactericidal properties of chlorine for coliforms and enteric pathogens (1), it was noted that the relative resistance, or susceptibility, of *Esch. coli* and *Eber. typhosa* appeared to shift as the pH of the suspending water was changed. This phenomenon has been investigated further by making additional observations at other hydrogen ion concentrations in the zone of the apparent shift in resistance and by repeating the tests with other bacterial strains. In addition, the study has been repeated, using chloramine as the disinfecting agent instead of free chlorine.

The methods used in carrying on these studies, such as the preparation of (1) chlorine-free, chlorine-demand-free water, (2) glassware, (3) stock chlorine solution, (4) bacterial suspensions, (5) the determination of residual chlorine and of hydrogen ion concentrations, and (6) test procedures have been described fully in the reference (1) given.

In the portion of the study in which chloramine was used as the killing agent, the required amount of a standard chloride solution to produce 0.3 p. p. m. of nitrogen as N, was added to the sterile chlorine-free, chlorine-demand-free water, mixed thoroughly, and distributed in 500-ml. portions to a series of sterile containers. At appropriate time intervals varying amounts of standardized chlorine solution were added to produce chlorine/nitrogen ratios of 0.0 to 1.0, 0.5 to 1.0, 1.0 to 1.0, 2.0 to 1.0, 3.0 to 1.0, 4.0 to 1.0, 5.0 to 1.0, and 6.0 to 1.0 p. p. m. "Appropriate time intervals" mean that additions of chlorine were

<sup>&</sup>lt;sup>1</sup> From Water and Sanitation Investigations, East Third and Kilgour, Cincinnati 2, Ohio. Presented before the annual meeting of the Society of American Bacteriologists, May 5, 1944.

made at such intervals that no conflicts would occur in the times for subsequent examinations of the various test portions. Examinations were made at 1-, 3-, 5-, 10-, 20-, 40-, 60-, 90-, 120-, 150-, 180-, and 240-minute intervals, with tests stopped when previous results indicated that 100-percent kills had been obtained for at least 2 of the preceding test periods. Various periods of contact (from a few minutes to 68 hours) between the chlorine and nitrogen before the addition of the suspension of test organisms were tried out. A 1-hour contact period was found most satisfactory and was adopted as a standard for the results reported at this time. With free chlorine, 17 series of tests have been completed with *Esch. coli* and 16 with *Eber. typhosa*. With chloramine, 25 series of tests have been completed with *Esch. coli* and 26 with *Eber. typhosa*. In each series, tests were made at pH 6.5, 7.0, 7.8, 8.5, 9.5, and 10.5.

The results obtained are presented in table 1 for *Esch. coli* strains exposed to free chlorine, in table 2 for *Esch. coli* exposed to chloramine, in table 3 for *Eber. typhosa* exposed to free chlorine, and in table 4, for *Eber. typhosa* exposed to chloramine. Consideration of the significance of these results will be covered in the discussion which follows.

A visual presentation of the results in figures portraving the full scope of the three variables concerned, namely, (1) percentage of bacterial survival, (2) time of exposure, and (3) variations in concentration of killing agent, has not appeared possible without confusion. Consequently, in the figures shown the percentage of bacterial survival and the variations in concentration of killing agent have been contrasted with the time factor limited to one period only, the 5-minute period having been selected for this purpose, as it appeared to be representative of the observed phenomena. In reaching this decision to use the 5-minute exposure time, study charts were prepared for the 3-, 5-, 10and 20-minute exposure periods at pH 7.0, 7.8, and 8.5. Careful study of the lines of these charts indicated very close agreement in the general trends of the curves for the four exposure periods. The three pH values used were selected because the "change-over" of sensitivity of Esch. coli and Eber. typhosa occurred within this range with free chlorine as the bactericidal agent.

In figures 1, 2, 3, 4, 5, and 6 are presented the data obtained on the relative survival of *Esch. coli* and *Eber. typhosa* when exposed to free chlorine and to chloramine in various concentrations at 20° to 25° C. for 5 minutes at pH 6.5, 7.0, 7.8, 8.5, 9.5, and 10.5, respectively. It should be noted that the residual chlorine scale for chloramine had to be increased greatly over that used for free chlorine, due to the pronounced delay in the killing rate with chloramine.

**TABLE 1.**—Average survival of Esch. coli, expressed in percent of initial number, when exposed to free chlorine in various concentrations at pH 6.5, 7.0, 7.8, 8.5, 9.5, and 10.7 when held at 20° to 25° C.

Number of	Number of	Ave	rage perc	centage s	urviving	after exp	osure	Residual Cl <sub>3</sub> p. p. m.		
strains	tests	1 min- ute	3 min- utes	5 min- utes	10 min- utes	20 min- utes	60 min- utes	0 min- ute	60 min- utes	
			pН	6.5						
1 1 1 1 1 1 1	2 2 2 2 2 2 2	100. 0 92. 8 85. 1 37. 3 4. 6 0 0	34.4 2.2 0 0 0 0	14.4 .1 0 - 0 0	100. 0 2. 8 0 0 0 0 0	94.3 .2 0 0 0 0 0	94.6 .2 0 0 0 0	0.0 .01 .02 .03 .04 .05 .085	0.0 .005 .015 .03 .04 .05 .085	
		•	pH	7.0	•	<u>.</u>		•	·	
2 2 1 2 2 2 2 2	3 4 2 3 2	98.6 29.1 16.1 0 0 0 0	16. 2 . 8 0 0 0 0	19.4 .8 0 0 0 0	<sup>1</sup> 18.0 <sup>1</sup> 6 <sup>1</sup> 0		94.8 19.4 .8 0 0 0 0	0.00 .02 .03 .04 .05 .07 .10	0.01 .02 .03 .04 .06 .10	
			pH	7.8						
2 2 2 2 2 2	2 2 2 2 2	100. 0 97. 3 63. 1 30. 2 12. 4 1. 4	58.0 41.0 1.0 0 0	53.0 37.3 0 0 0	96. 1 50. 0 32. 4 0 0 0	98.4 41.1 35.7 0 0 0	97. 8 40. 0 27. 3 0 0 0	0.00 .02 .04 .08 .10 .15	0.00 .02 .04 .07 .09 .14	
			pН	8.5						
1 1 1 1	2 2 2 8	100. 0 90. 0 87. 0 29. 5	64.1 5.9 .1	29.6 .2 .1	94.6 1.2 0 0	92.4 .2 0 0	95.4 0 0 0	0.00 .05 .07 .14	0.00 .05 .07 .14	
			pH 9	).8						
	4 3 2 9 2 1 1	100. 0 83. 2 93. 4 80. 0 85. 4 65. 7 58. 3 48. 3 59. 4 5. 8 0	99.1 88.5 67.6 43.0 30.4 3.1 .4 0 0 0	76. 1 70. 7 33. 5 7. 8 13. 7 0 0 0 0 0 0 0	97.0 81.4 56.8 2.0 .2 2.8 0 0 0 0 0	91. 9 56. 2 44. 7 0 0 0 0 0 0 0 0 0 0 0	69.0 5.8 9.5 0 0 0 0 0 0 0 0 0 0	$\begin{array}{c} 0.\ 00\\ .\ 02\\ .\ 04\\ .\ 06\\ .\ 08\\ .\ 14\\ .\ 30\\ .\ 40\\ .\ 50\\ .\ 75\\ 1.\ 00\\ \end{array}$	$\begin{array}{c} 0.\ 00\\ .\ 02\\ .\ 04\\ .\ 06\\ .\ 08\\ .\ 13\\ .\ 26\\ .\ 38\\ .\ 46\\ .\ 75\\ 1.\ 00 \end{array}$	
			pH 1(	).7						
1 1	4 1 1 2 6 3 3 1 1 1	100. 0 97. 8 92. 2 72. 4 85. 3 85. 8 86. 6 87. 9 81. 4 74. 8 37. 7 31. 8	95.7 65.5 74.1 82.8 74.5 75.7 33.2 18.0 9.6 2.6 .7	90. 5 79. 3 64. 6 64. 6 67. 2 39. 5 8. 3 3. 0 . 6 0 0	93. 4 73. 9 45. 7 31. 2 16. 2 35. 2 7. 9 .3 0 0 0 0	78. 2 44. 6 9. 0 2. 8 . 2 9. 0 . 4 0 0 0 0 0 0	44.4 6.4 0 0 0 0 0 0 0 0 0 0 0 0 0	0.00 .02 .03 .04 .05 .06 .16 .30 .40 .53 .75 1.00	0.00 .02 .03 .04 .05 .06 .16 .29 .40 .52 .75 1.00	

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TABLE 2.—Average survival of Esch. coli, expressed	in percent	of initial	number,
when exposed to chloramine in various concentrati	ions at pH	6.5, 7.0,	7.8, 8.5,
9.5, and 10.5 at 20° to 25° C., with nitrogen conter	nt constant	(0.3 p. p.	m.) and
contact of Cl <sub>2</sub> and N, 1 hour before addition of bacte	ria	• • •	•

N	Norm	Average percentage surviving after exposure											Re-	
ber of strains	ber of tests	1 min- ute	3 min- utes	5 min- utes	10 min- utes	20 min- utes	40 min- utes	60 min- utes	90 min- utes	120 min- utes	180 min- utes	240 min- utes	Cl <sub>2</sub> p.p.m. 0 min- utes	Cl <sub>2</sub> /N ratio
						pE	E 6.5							
2 2 2 2 2 2 2	55 55 55 55 55 55 35	100. 0 88. 6 94. 1 81. 7 72. 5 67. 5 56. 2 60. 5	88.5 57.5 47.7 17.2 .1	179.3 49.0 36.8 22.2 .9 0	60. 8 20. 7 2. 4 . 8 0 0	54.4 27.2 .1 0 0 0 0	15.6 .2 0 0 0 0 0	91.3 .5 0 0 0	0	98.3		93. 7	0.01 .15 .30 .90 1.20 1.50 1.80	0-1 0. 5-1 1-1 2-1 3-1 4-1 5-1 6-1
	;					pB	[ 7.0							
2 2 2 2 2 2 1	4 4 4 4 4 4 2	100. 0 97. 3 99. 0 92. 4 96. 2 78. 4 72. 1 86. 6	85. 9 61. 0 52. 5 15. 4	76.6 81.7 72.8 58.2 41.2 17.8 0	82.6 76.4 60.2 23.5 3.2 .2 0	97.6 69.8 59.6 4.2 .4 0 0	100. 0 54. 4 4. 4 0 0 0 0 0	100. 0 25. 2 . 1 0 0 0 0 0	0 0 0 	86.6 .1 0 	100. 0	77.4	0.01 .15 .30 .60 .90 1.20 1.50 1.80	0-1 0.5-1 1-1 2-1 3-1 4-1 5-1 6-1
	· · · · · · · · · · · · · · · · · · ·					pB	7.8	•					·	
2 2 2 2 2 2 2 1 Intern	2 2 2 2 2 2 2 2	100. 0 100. 0 98. 8 91. 1 81. 8 76. 0 67. 4	67.9	81. 7 74. 0 59. 7 36. 6	87. 0 79. 3 55. 8 19. 6 3. 8 6. 0	81.8 35.0 2.3 .1 0 0	39.8 1.4 .1 0 0	8.7 .1 0 0 0 0		0.3 0 0	0	100. 0 0 	0.00 .30 .60 .90 1.20 1.50 1.80	0-1 1-1 2-1 3-1 4-1 5-1 6-1
						pН	8.5							
2 2 2 2 2 2 2 2 2	5 5 5 5 5 5 5 3	100. 0 100. 0 99. 1 97. 9 95. 3 89. 7 87. 1 43. 1	95. 3 198. 3 193. 0 80. 7 75. 8 77. 1 19. 1	<sup>1</sup> 98. 5 <sup>1</sup> 97. 0 <sup>1</sup> 89. 1 75. 0 74. 0 65. 7 10. 1	93. 6 79. 7 75. 1 63. 6 46. 9 . 1	<sup>1</sup> 90. 5 72. 9 61. 0 30. 5 9. 0 0	92.6 78.9 42.4 22.7 1.4 0 0	98.8 94.2 62.9 12.8 1.6 0 0	83.4 32.0 1.8 0 0 0	100. 0 67. 5 14. 6 0 0 0	28.8 4.1 0 0	93. 7 6. 5 . 10 0	0. 01 . 15 . 30 . 60 . 90 1. 20 1. 50 1. 80	0-1 0.5-1 1-1 2-1 3-1 4-1 5-1 6-1
						pН	9.5						······	
2 1 2 2 2 2 2 2 2	5 5 5 5 5 5 5 3	100. 0 100. 0 99. 1 100. 0 95. 8 97. 3 82. 3 52. 9	94. 0 55. 1 6. 9	98. 1 194. 5 84. 4 41. 9 0	88. 2 87. 1 73. 4 34. 4 0	94. 0 96. 2 92. 5 79. 1 55. 6 24. 4 0	98. 6 93. 4 82. 3 50. 3 18. 3 3. 8 0	98. 9 99. 2 88. 5 52. 6 18. 0 1. 2 0 0	21.5 2.2 0 0	97.6 83.4 59.7 4.2 .2 0 0	24.1 .8 0	92.8 17.1 6.8 0 0	0.015 .15 .30 .60 .90 1.20 1.50 1.80	0-1 0. 5-1 1-1 2-1 3-1 4-1 5-1 6-1
						pH	10.5							
2 1 2 2 2 2 1	5 3 5 5 5 2	100. 0 96. 1 98. 9 97. 2 98. 5 96. 4 91. 2 100. 0	86. 9 83. 2	96. 5 74. 7 86. 0	100. 0 92. 4 81. 5 70. 4	100. 0 93. 5 91. 2 76. 4 27. 9	100. 0 84. 7 77. 2 50. 6 5. 1	87.6 100.0 94.7 90.0 82.0 63.6 27.9 0	70.8 64.7 24.4 7.9 0	74. 2 93. 7 85. 7 73. 2 39. 0 30. 3 2. 7 0	67. 8 84. 2 74. 8 39. 7 22. 8 5. 4 0	74.4 65.6 56.6 20.7 7.3 .2 0	0. 01 . 15 . 30 . 60 . 90 1. 20 1. 50 1. 80	0-1 0.5-1 1-1 2-1 3-1 4-1 5-1 6-1

# **TABLE 3.**—Average survival of Eber. typhosa, expressed in percent of initial number, when exposed to free chlorine in various concentrations at pH 6.5, 7.0, 7.8, 8.5, 9.8, and 10.7 when held at 20° to 25° C.

Number of	Number of		Ave	rage pe	rcentag	e survi	ving aft	er expo	sure		Residual Cl <sub>2</sub> p. p. m.		
strains	tests	1 min- ute	3 min- utes	5 min- utes	10 min- utes	15 min- utes	20 min- utes	30 min- utes	40 min- utes	60 min- utes	0 min- utes	60 min- utes	
					р <b>Н 6.5</b>		·						
1 1 1 1 1 1 1	2 2 2 2 2 2 2	100. 0 91. 0 74. 3 36. 6 8. 6 1. 6 0	84.2 36.6 16.4 0 .4 0	76. 2 20. 7 7. 2 0 1. 3 0	92.9 70.0 18.2 2.8 0 .1 0	88.7	63. 4 12. 8 2. 1 0 0			89.8 63.0 3.0 0.2 0 0 0	0.00 .01 .02 .03 .04 .05 .09	0.00 0.00 .02 .03 .04 .05	
pH 7.0													
2 2 2 2 2 2 2 2 2 2 2	5 6 5 4 5 5 1	100. 0 82. 7 71. 0 16. 8 8. 9 6. 0 1. 0 0	77.6 33.8 1.3 6.9 0 0 0	72.3 27.2 0.1 4.8 0 0 0	$ \begin{array}{r} 1 68.5 \\ 1 25.4 \\ 1.1 \\ 1 2.9 \\ 1 0 \\ 1 0 \\ 0 \\ \end{array} $	96. 2 64. 7 23. 6 0 1. 1 0 0 0	<sup>1</sup> 63.5 <sup>1</sup> 24.0 <sup>1</sup> 0 <sup>1</sup> .8 0	98.4 61.0 25.0 0 .1 0 0 0		99.0 48.4 22.0 0 0 0 0 0	0.00 .02 .03 .04 .05 .06 .08 .15	0.00 	
	•	· · · · · ·		1	pH 7.8								
1 2 2 2 2 2 2	1 2 2 2 2 2	97.4 58.6 21.0 2.0 0 0	93.4 21.6 4.4 0 0	74.3 18.9 1.7 0 0	67.1 14.6 1.0 0 0		50.3 14.0 .5 0 0 0			26.3 13.2 .4 0 0 0	0.02 .04 .06 .09 .11 .15	0.02 .04 .06 .08 .10 .14	
				]	pH 8.5								
1 1 1 1	2 1 2 2 7	100. 0 81. 6 70. 2 42. 8 3. 9	47.7 2.4 .1 0	13.2 0 0 0	95.7 .4 0 0 0		93.1 .3 0 0 0			87.5 6.0 0 0 0	0.00 .03 .06 .08 .15	0.00 .02 .04 .06 .14	
				p	H 9.8								
1 1 1 1 1 1 1 1	2 1 2 2 1 1	100. 0 93. 1 62. 2 26. 0 17. 0 6. 0 . 3 0	85.6 11.4 0 0 0 0 0 0	<sup>1</sup> 87.7 55.2 .6 0 0 0 0 0	72.5 7.7 0 0 0 0 0		61.2 .7 0 0 0 0 0 0			28.0 0 0 0 0 0 0 0	0.00 .05 .16 .30 .40 .50 .75 1.00	0.00 .05 .16 .26 .36 .46 .65 .90	
					pH 10.7								
1 1 1 1 1 1 1 1 1 1 1	3 2 2 4 2 4 2 1 1	100. 0 92. 8 97. 8 85. 4 88. 8 92. 0 72. 6 65. 4 47. 8 31. 8 8. 2	82.8 69.3 62.9 65.6 38.5 6.3 1.9 .7 0 0	78.6 61.4 35.9 21.2 11.5 .1 0 0 0	47.1 48.8 20.7 5.6 .9 .8 0 0 0 0 0		27.3 18.0 1.3 .1 0 0 0 0 0 0			10.5 .4 0 0 0 0 0 0 0 0 0 0 0	0.00 .01 .03 .04 .06 .18 .30 .40 .50 .75 1.00	0.00 .01 .02 .04 .06 .15 .26 .38 .50 .75 1.00	

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#### **TABLE 4.**—Average survival of Eber. typhosa, expressed in percent of initial number, when exposed to chloramine in various concentrations at pH 6.5, 7.0, 7.8, 8.5, 9.5, and 10.5 at 20° to 25° C., with nitrogen content constant (0.3 p. p. m.) and contact of CL and N, 1 hour before addition of bacteria

Average percentage surviving after exposure										p. p.					
Num- ber of strains	Number of tests	1 minute	3 minutes	5 minutes	10 minutes	20 minutes	40 minutes	60 minutes	90 minutes	120 minutes	150 minutes	180 minutes	240 minutes	Residual Cla m. 0 minut	Cla/N ratio
						pВ	[ 6.5								-
2 2 2 2 2 2 2 2 2	4 4 4 4 4 4 4 4 4 4 4	100. 0 94. 3 89. 5 77. 8 67. 6 54. 2 43. 4 15. 1	59. 6 50. 0 29. 7 6. 3 0	<sup>1</sup> 82.0 68.2 52.7 28.8 3.7 0 0	67.4 55.2 21.4 0 0 0	58.5 20.8 0 0 0 0 0	23. 8 0 0 0 0 0 0	8 4. 0 0 0 0	9 0. 0 0 0 			94. 8 0 		0.01 .15 .30 .61 .90 1.20 1.55 1.80	0-1 . 5-1 1-1 2-1 3-1 4-1 5-1 6-1
						нg	7.0								
2 2 2 2 2 2 2 2 2	4 4 4 4 4 4 4 4 4	100. 0 95. 6 95. 4 88. 6 75. 5 63. 6 46. 4 20. 6	66. 8 43. 3 22. 0 . 2	<sup>1</sup> 94. 9 <sup>•</sup> 83. 1 79. 1 53. 9 23. 2 1. 4 0	77.4 58.0 9.0 .3 0 0	93. 7 62. 6 5. 7 0 0 0 0	67.3 13.4 0 0 0 0	49. 1. 0 0 0 0 0	27. 0 0 	4 30. 6 0 0		97. 8 3. 4 0	0.6	Trace 0.15 .31 .60 .90 1.10 1.45 1.60	0-1 .5-1 1-1 2-1 3-1 4-1 5-1 6-1
						рH	7.8								
2 2 2 2 2 2 2	4 4 4 4 4 4 4 4	100. 0 94. 6 87. 8 83. 8 75. 1 59. 4 24. 5	73. 7 54. 7 43. 0 2. 0	76. 8 55. 3 48. 0 25. 4 0	96. 6 60. 7 38. 4 12. 1 5. 2 0	70. 4 20. 1 3. 2 0 0 0	29.4 .2 0 0 0 0	4.9 0 0 0 0	0.5 0 0 0 0	2 0.0 0 0		96.7 0 0 	92. 2 0	0.00 .32 .63 .94 1.26 1.48 1.56	0-1 1-1 2-1 3-1 4-1 5-1 6-1
						pН	8.5			<u>.</u>					
2 2 2 2 2 2	4 4 4 4 5 3	100. 0 93. 4 92. 7 90. 8 85. 6 86. 1 8. 1	98.6 100.0 74.0 0	<sup>1</sup> 97. 0 90. 3 82. 8 80. 7 55. 1 0	100. 0 81. 2 75. 4 45. 2 22. 3 0	83.7 53.6 29.4 5.4 .6 0	58.4 15.8 1.5 0 0 0	24.9 6.7 0 0 0	6.1 0 0 0	0.7 0 0		96. 2 0 0	98.0 0	0.00 .30 .61 .92 1.20 1.28 1.55	0-1 1-1 2-1 3-1 4-1 5-1 6-1
						р <b>Н 9</b> .	5								
2 2 2 2 2 2 2	4 4 4 4 4 4 4	100. 0 - 94. 5 - 92. 8 - 91. 5 - 84. 8 - 84. 0 43. 8	 78. 2 0	96. 0 100. 0 77. 9 75. 2 0	100. 0 92. 4 79. 2 71. 6 64. 5 0	93. 2 86. 2 73. 9 54. 6 38. 4 0	89. 1 67. 9 52. 4 29. 0 3. 8 0	73. 6 55. 6 33. 7 6. 3 0 0	66. 1 35. 8 4. 1 0 0	89.0 51.0 8.4 .1 0	21.5 .8 0	11. 9 0	86.6 .4 0	0.00 .31 .61 1.05 1.20 1.50 1.80	0-1 1-1 2-1 3-1 4-1 5-1 6-1
						pH 1	0.5								
	4 4 4 4 4 4	100. 0 - 89. 0 - 93. 2 - 90. 1 - 97. 2 - 89. 7 - 76. 2	70. 0	86. 8 15. 7	 76. 2 1. 5	86. 6 89. 1 85. 3 68. 8 0	85. 4 78. 2 69. 5 54. 5 27. 4 0	73. 3 75. 6 71. 2 44. 8 30. 3 6. 6 0	55. 2 40. 9 21. 3 7. 8 . 2	59.6 54.9 36.8 7.0 1.9 0	52.0	37.5 30.0 4.9 .3 0	40. 1 17. 4 .5 0 0	0.00 .31 .95 1.20 1.45 1.75	0-1 1-1 2-1 3-1 4-1 5-1 6-1

In figure 1, showing the relative survival of *Esch. coli* and *Eber.* typhosa at pH 6.5, it is noted that the strains of *Eber.* typhosa tested were definitely more resistant to free chlorine. With chloramine, both genera displayed approximately the same sensitivity until a residual chlorine concentration, as chloramine, of about 0.75 p. p. m. was reached. With increasing amounts of chloramine *Esch. coli* strains were more resistant, requiring 1.8 p. p. m. residual for a 100-percent kill in 5 minutes, whereas with *Eber.* typhosa, only about 1.5 p. p. m. were required.

Similar data are presented in figure 2 for tests carried on at pH 7.0. Again it is observed the strains of *Eber. typhosa* tested were more resistant to free chlorine than *Esch. coli* with all residuals tried. With concentrations of chloramine of less than about 0.75 p. p. m., *Eber. typhosa* was slightly more resistant than *Esch. coli*, while with greater concentration, *Eber. typhosa* was slightly more sensitive. With free chlorine a higher residual was required to obtain a 100-percent kill in 5 minutes at pH 7.0 than at pH 6.5 with both coli and typhosa.

In figure 3, presenting results obtained at pH 7.8, *Eber. typhosa* is not more resistant than *Esch. coli* throughout the range of concentrations tested, as was the case at pH 6.5 and 7.0. With concentrations of free chlorine of about 0.03 p. p. m. or less, typhosa was more resistant, while at greater concentrations of chlorine, typhosa became more sensitive than coli. With chloramine at pH 7.8, *Esch. coli* was found slightly more resistant than *Eber. typhosa* throughout the range of concentrations tested. Thus, a residual of more than 1.8 p. p. m. was required to produce a 100-percent kill, while all typhosa were killed in 5 minutes with this concentration.

In figure 4, the results obtained at pH 8.5 are shown. At this pH, *Eber. typhosa* was much more sensitive to free chlorine than *Esch. coli*, the latter requiring about twice as high a concentration as the former to produce a 100-percent kill in 5 minutes. When chloramine was used, only a very slight difference was noted in the death rates of these two genera, the same general curve being followed throughout the range of residuals tested. It is noted also that the free chlorine residual required to produce a 100-percent kill of *Eber. typhosa* at pH 8.5 was the same as that required at pH 7.0, while to produce the same result for *Esch. coli*, approximately three times as much chlorine was needed.

Similar data, obtained at pH 9.5, are presented in figure 5. At this pH, the difference in sensitivity of *Esch. coli* and *Eber. typhosa* was reduced greatly with both free chlorine and chloramine, with practically no variation in the rate of kill of either. It should be noted that at this pH 9.5, the concentrations of chlorine used had to be greatly

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increased to produce reasonable rates of kill. Apparently differences in sensitivity may be overcome by higher concentrations of chlorine.

Figure 6 shows the relative sensitivity of *Eber. typhosa* and *Esch.* coli to free chlorine and chloramine in waters of pH 10.5. Here the trends with both free chlorine and chloramine are similar to those observed at pH 8.5 and 9.5. Here also, with increasing pH, greater residuals of both free chlorine and chloramine were required to produce equivalent kills. For instance, at pH 10.5, for *Eber. typhosa* a residual of 0.4 p. p. m. and for *Esch. coli* more than 0.7 p. p. m. of free chlorine was required to produce 100-percent kills in 5 minutes, while with chloramine *Eber. typhosa* required a residual of 1.8 p. p. m. for a 20-minute period, or 0.9 p. p. m. for 4 hours, and *Esch. coli* an exposure of 1.8 p. p. m. for 60 minutes, or 1.5 p. p. m. for 4 hours to produce similar results.

#### DISCUSSION AND SUMMARY

Data have been presented showing the relative resistance of *Eber*. typhosa and Esch. coli strains to free chlorine and to chloramine in waters held at 20° to 25° C. and buffered at pH 6.5, 7.0, 7.8, 8.5, 9.5, and 10.5. Each figure in the tables and each point plotted on the charts represents the average of from two to eight determinations under the conditions given. Although a statistical analysis of the results is not within the scope of this report, a study has been made of the differences between individual observations, with particular reference to (1) variations in resistance of the same strains in different tests, (2) variations in resistance between different strains, and (3) routine observational errors. The results with free chlorine indicated that (1) at pH 6.5 and 7.0 typhosa strains were consistently more resistant than coli strains, (2) at pH 7.8 coli strains were more resistant with concentrations of free chlorine in excess of about 0.03 p.p.m., and (3) at pH 8.5 or above all strains of Esch. coli tested were consistently as resistant, and usually much more resistant, to free chlorine than any Eber. typhosa strains. Consequently, while the range of probable error does not permit a definite allocation of the pH, between 7.0 and 8.5, where the "change-over" in sensitivity occurs, the consistency of the results at pH 6.5 and 7.0, and at pH 8.5 or above, leaves no doubt as to the existence of the "change-over." This "change-over" in sensitivity with increasing pH was marked by the condition that Esch. coli required greater increases in chlorine concentration than Eber. typhosa to produce equivalent kills. Although factual information is not available to support the theory, it would seem that the cells of Eber. typhosa might become more sensitive to free chlorine with increasing pH, due to some function of their capsular substance. Perhaps the capsular substance is less permeable to chlorine at lower



pH values. If this were true then the more heavily encapsulated *Eber. typhosa* would be more resistant under such conditions.

When chloramine was used as the bactericidal agent, only slight differences were observed in the sensitivity of the two genera studied. In a few instances *Esch. coli* was more resistant to chloramine than *Eber. typhosa*, particularly at pH 7.8 and 10.5, but in general they were about equally sensitive.

The pronounced difference in the bactericidal properties of chlorine and chloramine should also be noted. At normal pH values approximately 40 times more residual chlorine as chloramine was required to produce a 100-percent kill of *Esch. coli* in the same time interval. For *Eber. typhosa* this ratio was about 25 to 1.

On the basis of the time required to produce a 100-percent kill with equivalent amounts of residual chlorine, as free chlorine, and as chloramine, results were not readily obtainable for the lower pH zones. In this range the lethal amounts of free chlorine are much less than the amount of chloramine required to produce a 100-percent kill in any reasonable period (4 to 6 hours). At pH 9.5, where such comparisons were possible, chloramine required approximately 100-fold the period for free chlorine.

#### REFERENCES

(1) Butterfield, C. T., Wattie, Elsie, Megregian, Stephen, and Chambers, C. W.: Influence of pH and temperature on the survival of coliforms and enteric pathogens when exposed to free chlorine. Pub. Health Rep., 58:1837 (1943). Reprint No. 2530.

# STUDIES OF ANTIGENS IN INFECTED YOLK SACS<sup>1</sup>

By NORMAN H. TOPPING, Surgeon, and M. J. SHEAR, Principal Biochemist, United States Public Health Service

The material for these studies was derived from yolk sacs infected with the Breinl strain of epidemic typhus fever after the method described by Cox. This strain has been carried in developing eggs for some time and is well adapted. It has become less virulent for guinea pigs but does produce, on occasion, large numbers of rickettsiae in the yolk sacs.

Clark, Rasmussen, and White have reported the use of ether in the separation of poliomyelitis virus from extraneous material, and Craigie has applied the use of ether to rickettsiae<sup>2</sup>. Craigie's technique gives a clean vaccine containing relatively large numbers of rickettsiae and is perhaps an improvement on the technique as described by Cox.

<sup>&</sup>lt;sup>1</sup> This manuscript, Section III of Studies of Typhus Fever (National Institute of Health Bulletin No. 183 (in press)), was approved for publication March 18, 1942, and scheduled for publication in Public Health Reports in the issue of March 27, 1942. Because of the subject matter the paper was withheld from publication at that time.

<sup>&</sup>lt;sup>3</sup> Personal communication from Dr. Craigie.

We have employed certain modifications of the ether technique and have found an additional antigenic material in the developing yolk sac which is being discarded in the technique as described by Craigie. This substance can be found in the supernatant fluid after the first centrifugation. This immunizing substance has many of the characteristics usually found in "soluble antigens" in that some of it passes a Berkefeld N filter and the major portion remains in solution after centrifugation for 15 minutes at about 15,000 r. p. m. It has not been determined whether this substance is a true "soluble antigen" or whether it consists of minute rickettsiae or other bodies so small as to pass a filter and not be precipitated by centrifugation as described. Other academic questions regarding its chemical nature and properties are being pursued; however, some of its immunological properties have been briefly studied to date.

For purposes of discussion, we shall designate the substance present in the supernatant fluid after centrifugation as the "soluble antigen," while the antigen present in the precipitate will be designated as "rickettsiae" because they are demonstrable there in large numbers. Three separate immunological procedures have been studied in comparing these two antigens. The first of these techniques was complement fixation as described previously by Bengtson; the second was the ability of these two antigens to produce the Weil-Felix reaction in rabbits; and the third was a comparison of these two antigens in immunizing guinea pigs against a challenging dose of a passage strain of epidemic typhus fever virus.

Our technique for the preparation of the antigens is briefly as follows: (1) infected yolk sacs are harvested; (2) ground with alundum; (3) diluted to a 10-percent suspension with saline containing 0.5-percent formalin; (4) shaken with one volume of ether, and sufficient time allowed to elapse for the phases to separate well (about 1 to  $1\frac{1}{2}$  hours); (5) repeated extraction of the aqueous phase (either once or twice) until the excess ether is colorless; (6) removal of the ether at room temperature under reduced pressure.

After centrifugation, the sediment containing large numbers of demonstrable rickettsiae was resuspended in saline to the original volume; this suspension and the clear supernatant containing the "soluble antigen" were tested for their ability to fix complement in the presence of specific immune guinea pig serums. Two of these titrations are presented in table 6.

-
9
53
3
2
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	Complement terial fixation reaction		ent Negative.	ent Pos. 1:32.	te Pos. 1:16.
tion	Mai		Super	Sedim	Filtra
manipul	Desig- nation		ू द	ę ,	• •
Secondary	Manipulation		Centrifuged 15,000 r. p. m. 15 min	Washed and recentrifuged at 4,000	Filtered Berkefeld N.
	Complement fixation reaction	Poe 1-8.2	Pos. 1:128	Pos. 1:32	Pos. 1:64
ıary manipulation	Material	Sodiment (contains ricketteise)	Supernatant (soluble antigen)	Sediment (contains rickettsise)	Supernatant (soluble antigen)
Prim	Desig- nation		م . 	8	۹ ا
	Manipulation		Centrifuged 4,000 r. p. m. 1 hour.		Centraugeu 4,000 f. p. 111. 1 hour.
	per Num		ET34		013

<sup>1</sup> Tables 1 to 5 will be found in Studies of Typhus Fever Vaccine, Sections I and II, National Institute of Health Bulletin No. 183 (in press). \* Only 3+ and 4+ reactions were considered positive.

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It will be noted in table 6 that there were two separate lots, ET-34 and ET-5; these lots were composed of three pooled yolk sacs each. It is known that there is usually a considerable variation in the numbers of rickettsiae to be found in the harvested yolk sacs and that the amount of antigen present is roughly proportionate to the numbers of rickettsiae present in the preliminary smear preparation direct from the yolk sac. In both lots in table 6 the supernatant fluid fixed complement to a higher dilution than did the sediment, and further, this antigen in the supernatant was not sedimented at 15,000 r. p. m. for 15 minutes, nor was it completely removed by filtration through a Berkefeld N. It will also be seen that one washing of the rickettsiae of the sediment No. 5a did not remove the complement-fixing antibody.

A control experiment was done using a supernatant solution and a sediment prepared in an identical manner but from eggs not inoculated with epidemic typhus virus. The results were entirely negative with both fractions. Further, these two fractions were each inoculated into four guinea pigs; two inoculations of 1 cc. each were given at weekly intervals. Both fractions failed to produce complement-fixing antibodies in their serums.

Several of the fractions containing antigenic properties, as tested by the complement fixation test, have been injected intravenously into rabbits and observation made of the Weil-Felix reaction. Two of these are presented in table 7.

	w	)rigir eil-F	al elix			Weil-Felix								
bit num- ber 1:10				Inoculated with	Date	Date								
ber 1	1:10	1:20	1:40			Feb. 18	Feb. 20	Feb. 23	Feb. 26	Mar. 2	Mar. 5	Mar. 10		
29304	12	1	0	ET-5d (sediment table 6).	Feb. 11, 1942	Pos. <sup>1</sup> 1:40	Pos. 1:320	Pos. 1:160	Pos. 1:320	Pos. 1:80	Pos. 1:40	Pos. 1:40		
29305	3	0	0	ET-5b (supernatant table 6).	do	Pos. 1:160	Pos. 1:320	Pos. 1:160	Pos. 1:80	Pos. 1:40	Pos. 1:40	Pos. 1:20		

TABLE 7

<sup>1</sup> Only 3+ and 4+ reactions were considered positive.

Table 7 shows that both the sediment ET-5d and the supernatant solution, ET-5b, are about equally effective in producing the Weil-Felix reaction in rabbits.

These fractions have been inoculated into guinea pigs for the purpose of observing their ability to produce complement-fixing antibodies, as well as to immunize them against a challenge inoculation of living epidemic typhus virus. The results of these tests are presented in table 8.

Guinea pig number	Immunizing material 1 cc. each of—	Dates	Date bled	Comple- ment fixation	Date of chal- lenge with 10 percent Breini strain	Days of fever	Comment
29314	ET5b, ET34b (Su- pernatants) <sup>1</sup> .	Feb.11, 19	Feb. 26	1:64	Feb. 28, 1942	2	Abscess palpable in abdomen.
29315	do	do	do	1:256	do	0	Immune.
29316	do	do	do	1:512	do	Ō	Do.
29317	do	do	do	1:512	do	Ō	Do.
29318	ET5d, ET34a (Sedi- ments) <sup>1</sup> .	do	do	1:16	do	3	Abscess palpable in abdomen.
29319	do	do	do	1:512	do	0	Immune.
29320	do	do	do	1:128	do	ŏ	Do.
29321	do	do	do	1:256	do	Ō	Do.
29468 29469 29470	Controls					8+ 6+ 8+	No immunity. Do. Do.
29471		•• <i>;</i>				8+	Do.

TABLE 8

<sup>1</sup>See Table 6.

In table 8 it will be noted that the four guinea pigs vaccinated with the soluble fraction produced complement-fixing antibodies in their serums at least as well as did the four guinea pigs vaccinated with the sediment containing the rickettsiae. This same statement can be made concerning their immunity. It is interesting further to note that in each group of four guinea pigs there was one (29314 and 29318) that did not produce as high a titer in the complement fixation test as the others, and that each of these guinea pigs developed fever during the immunity test. In both of these male guinea pigs a large abdominal abscess could be palpated easily, perhaps due to a perforation of the rectum while temperatures were being taken. Any attempted explanation of these results would only be conjecture.

From the foregoing evidence it would appear that there is a "soluble" substance present in the supernatant fluid after ether extraction and centrifugation that has the same immunological properties (as far as we have gone) as does the sediment containing the rickettsiae. This substance is antigenic in the complement fixation test, produces a Weil-Felix reaction when inoculated into rabbits, produces complement-fixing antibodies in the serums of vaccinated guinea pigs, and finally immunizes those guinea pigs against a subsequent inoculation of virulent epidemic typhus virus.

# PREVALENCE OF COMMUNICABLE DISEASES IN THE UNITED STATES

#### November 5-December 2, 1944

The accompanying table summarizes the prevalence of nine important communicable diseases, based on weekly telegraphic reports from State health departments. The reports from each State for each week are published in the PUBLIC HEALTH REPORTS under the section "Prevalence of disease." The table gives the number of cases of these diseases for the 4 weeks ended December 2, 1944, the number reported for the corresponding period in 1943, and the median number for the years 1939-43.

#### DISEASES ABOVE MEDIAN PREVALENCE

Meningococcus meningitis.—The total of 670 cases of meningococcus meningitis reported for the 4 weeks ended December 2 was lower than the 1943 figure (957 cases) for this period, but it was 4.5 times the 1939–43 median. The number of cases was higher than in 1943 in only the West South Central section, but all sections reported excesses over the seasonal expectancy. Since there were 3 low years of this disease, preceding the current high wave, the 1939–43 median falls within that period. Compared with the median for earlier years the current incidence, however, is still high; the median for the corresponding period in 1934–38 and 1929–33 was 279 cases for each period.

Poliomyelitis.—The number of cases of poliomyelitis dropped from 8,464 during the preceding 4 weeks to 997 for the 4 weeks ended December 2. While the cases of poliomyelitis have declined gradually since the peak was reached during the week ended August 2, the incidence has continued at a relatively high level as compared with prior years. The number of cases reported for the current 4 weeks was about 30 percent above the number (755) reported for the corresponding period in 1943, and almost 60 percent greater than the 1939-43 median. All sections except the West South Central and Mountain and Pacific reported an excess of cases over 1943, and all except the Mountain region reported an excess over the preceding 5-year median. The Atlantic Coast region continued to report the largest increases over the normal seasonal expectancy. In the first 48 weeks of 1944 there have been 18,885 cases reported, as compared with 12.134 and 8.899 in the years 1943 and 1941, respectively. In 1942 there was no particular outbreak of poliomyelitis and the number of cases for the same weeks totaled approximately 4,000.

Scarlet fever.—The usual seasonal rise of scarlet fever was apparent in all sections of the country during the 4 weeks ended December 2. The number of cases (12,577) was slightly above the 1943 figure for the same weeks, and about 20 percent above the 1939–43 median. Fewer cases than normally occur were reported from the West North Central and East South Central regions, but in all other regions the incidence was above the normal seasonal expectancy, the excesses ranging from 10 percent in the East North Central region to 65 percent in the Mountain region.

#### DISEASES BELOW MEDIAN PREVALENCE

Diphtheria.—During the 4 weeks ended December 2 the incidence of diphtheria (1,826 cases) was about 20 percent above that recorded for the corresponding period in 1943. The 1939-43 median was approximately 1,900 cases. The largest increase over the expected seasonal incidence was reported from the West South Central section. Minor increases occurred in the East South Central and Pacific sections, and in other sections the number of cases either closely approximated the 5-year median or fell considerably below.

Influenza.—For the current 4-week period there were 7,127 cases of influenza reported, as compared with 10,243 for the same weeks in 1943 and a 5-year median of 7,581 cases. The West South Central section reported a 40-percent increase in the number of cases over the 1939–43 median and, while the number of cases (99) in the New England section was not large, it was more than 6 times the normal seasonal expectancy. In all other sections the incidence was comparatively low. Seventy-five percent of the total cases were reported from 4 States, viz, Texas (3,530 cases), South Carolina (1,245), Virginia (652), and Arizona (262).

Measles.—The incidence of measles during the current 4 weeks was comparatively low, the number of cases (2,715) being about 25 percent of the 1939–43 median figure for this period. For the country as a whole and for each geographic section except the New England, West South Central, and Pacific, the current incidence was the lowest for this period in the 16 years for which these data are available.

Smallpox.—The incidence of smallpox was the lowest on record for this period. The number of cases (17) was less than 40 percent of the comparatively low incidence reported in 1943, and less than 15 percent of the 1939–43 median.

Typhoid and paratyphoid fever.—This disease also remained at a relatively low level, the number of cases (297) being the lowest on record for this period. The 1939–43 median was 578 cases. A slight increase over the normal seasonal incidence was reported from the Pacific section; in the Middle Atlantic and Mountain regions the numbers of cases were about normal, and in all other sections the number of cases was below the preceding 5-year median.

Whooping cough.—The number of cases of whooping cough was below normal for this season. For the 4 weeks ended December 2

#### December 29, 1944

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Number of reported cases of 9 communicable diseases in the United States during the 4-week period November 5-December 2, 1944, the number for the corresponding period in 1943, and the median number of cases reported for the corresponding period, 1939-43

Division	Current period	1943	5-year median	Current period	1943	5-year median	Current period	1943	5-year median
	I	Diphther	ia	1	Influenza	<b>3</b> 1		Measles	2
United States. New England. Middle Atlantic. East North Central. West North Central. South Atlantic. East South Oentral. West South Central. Mountain Pacific.	1, 828 30 119 181 158 365 276 450 54 195	1, 528 44 89 175 159 334 201 274 70 182	1, 904 27 144 277 152 591 222 347 70 122	7, 127 99 19 127 70 2, 097 200 3, 933 454 128	10, 243 90 78 362 893 2, 829 695 4, 037 1, 119 140	7, 581 16 74 285 77 2, 681 399 2, 845 715 229	2, 715 500 398 261 142 150 65 130 92 977	18, 239 1, 457 3, 136 6, 211 3, 308 2, 055 411 327 738 596	10, 851 1, 481 2, 743 1, 064 620 641 310 173 738 1, 438
	Mening	gitis	menin-	Po	liomyeli	tis	Sc	arlet fev	er
United States New England Middle Atlantic East North Central West North Central South Atlantic East South Central West South Central Mountain Pacific	670 54 179 152 37 68 64 39 12 65	957 95 250 178 61 152 64 34 19 104	145 19 47 22 8 26 19 17 9 10	997 52 435 147 73 114 40 35 15 86	755 50 65 120 60 9 20 76 63 292	635 10 65 120 60 75 35 33 27 82	12, 577 1, 172 2, 016 3, 249 1, 185 1, 655 707 622 669 1, 302	11, 836 977 2, 078 2, 970 1, 275 1, 446 563 526 642 1, 359	10, 464 946 1, 814 2, 970 1, 223 1, 223 1, 426 828 413 405 580
	8	mallpox		Typh typ	oid and boid fev	para- 'er	Whoo	ping cou	1gh 3
United States. New England Middle Atlantic. East North Central West North Central South Atlantic. East South Central West South Central Mountain Pacific.	17 0 6 6 2 0 1 2 0	46 0 29 7 1 1 6 1 1	128 0 0 45 26 1 4 19 4 8	297 15 38 31 9 45 32 70 32 25	312 16 64 32 14 32 31 76 34 13	578 14 103 55 31 108 50 105 32 17	7, 410 1, 090 1, 797 1, 305 433 983 250 717 308 527	9, 973 778 2, 112 2, 466 665 1, 695 527 526 467 737	13, 366 1, 342 3, 711 2, 863 665 1, 420 531 495 467 1, 018

Mississippi and New York excluded; New York City included.
 Mississippi excluded.

there were 7,410 cases reported, as compared with 9,973 for the corresponding period in 1943 and a 5-year median of 13,336 cases. The incidence was slightly above the seasonal expectancy in the West South Central section, but in all other regions the cases reported were considerably below the 1939-43 median.

#### MORTALITY, ALL CAUSES

For the 4 weeks ended December 2 there were 35,633 deaths from all causes reported to the Bureau of the Census by 93 large cities. The average number reported for the corresponding period in 1941-43 was 35,608 deaths. The number of deaths was above the 3-year average in each of the first 2 weeks of the current period, and below during the third and fourth weeks.

# **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 DECEMBER 9, 1944**

#### Summary

Continuing the upward trend, the incidence of meningococcus meningitis increased during the current week. A total of 190 cases was reported for the week, as compared with 172 last week, 287 for the corresponding week last year, and a 5-year (1939–43) median of 35 cases. States reporting 9 or more cases are New York (26), Pennsylvania (17), California (14), Illinois (12), Massachusetts (10), and Ohio, Texas, and Washington (9 each). Since the week ended March 4 the weekly incidence of the disease for the country as a whole has been continuously below that of last year; but to date, with the exception of one week, it has been above that for any other year for which comparable weekly records are available (since 1927). The cumulative figure since the week ended March 4 is 10,451, as compared with 13,293 for the same period last year. The largest number of cases reported for any other entire year was 10,551, in 1929.

The incidence of poliomyelitis continues to decline. A total of 133 cases was reported, as compared with 174 last week and 96 for the corresponding week last year, which is also the 5-year median. Of the current total, 82 cases were reported in 4 States—New York (46), California (16), Washington (11), and Ohio (9). The cumulative total to date is 19,019 as compared with 12,230 for the same period last year and a 5-year median of 8,904.

The current figures for influenza, measles, smallpox, typhoid fever, and whooping cough are below the corresponding figures for last year and the 5-year medians, while the current totals for diphtheria and scarlet fever are slightly above the 5-year medians and the corresponding figures for last year.

Deaths recorded in 92 large cities in the United States for the current week total 9,313, as compared with 9,373 last week, 10,442 for the corresponding week last year, and a 3-year (1941-43) average of 9,449. The cumulative total to date is 438,941, as compared with 447,984 for the corresponding period last year.

# Telegraphic morbidity reports from State health officers for the week ended December 9, 1944, and comparison with corresponding week of 1943 and 5-year median

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

	Díphtheria				Influen	Z8		Measle	8	Meningitis, meningocoocus		
Division and State	W end	eek ed—	Me-	W end	eek ed	Me-	Wend	'eek led—	Me-	W end	eek ed—	Me- dian
	Dec. 9, 1944	Dec. 11, 1943	dian 1939- 43	Dec. 9, 1944	Dec. 11, 1943	dian 1939- 43	Dec. 9, 1944	Dec. 11, 1943	1939- 43	Dec. 9, 1944	Dec. 11, 1943	1939- 43
NEW ENGLAND Maine	0	3	1		2	2 2		2 98	5	1	0	0
New Hampshire	0	0	0					2 34	24	0		0
Massachusetts	- 1	9	3	25	1		50		5 324 20	10	16	5
Connecticut	0	2	1	1	98	8 2	16	5 8	<b>4</b> 0	3	5	1
MIDDLE ATLANTIC	6	16	16	12	1 70	1 12	56	600	509	26	41	3
New York New Jersey Pennsylvania	3	4 11	4 11	2 3	50 13	9	17 27	405 410	25 495	7 17	11 34	1 5
EAST NORTH												
CENTRAL Ohio	17	14	14	9	4	14	20	2, 035	36	9	16	1
Indiana Illinois	18	13 5	13 21	10	280 447	12	41	80 174	20 69	3 12	3 22	12
Michigan <sup>3</sup> Wisconsin	14	9 1	7 1	1 16	63 130	6 34	24 17	673 482	271 140	8 5	11 8	02
WEST NORTH CENTRAL												
Minnesota	10	9 1	52	2	396 2.337	23	4	437	33	1	1	0
Missouri	10	6	6	3 10	137	2	1	22	7	5	12	Ŏ
South Dakota	1	ĩ	ĩ				ğ	71	1	ŏ	Ŏ	ŏ
Kansas	2	11	4	2	197	14	. 8	11	32	Ő	0 3	Ő
SOUTH ATLANTIC		·										
Delaware Maryland <sup>3</sup> District of Colum-	0 10	0 5	0 5	3	62	8	5 4	18 36	2 6	0 4	1 6	0 4
bia Virginia	0 5	0 11	2 26	1 287	245 1,649	2 250	3 6	28 550	3 69	2 4	1	0
West Virginia North Carolina	· 6 20	5 28	7 28	12	629 3	16 6	8 11	60 166	11 139	1	45	2 2
South Carolina	3 17	57	15 19	222 53	755 676	517 133	32	45 55	20 27	2	3	1
Florida	5	4	7		16	10	3	23	2	5	ĭ	ĭ
EAST SOUTH CENTRAL												
Tennessee	14	3 9	11	20	5, 416 285	6 30	3 29	6 20	22 21	24	63	0
Alabama Mississippi <sup>3</sup>	19 12	11 9	17 9	58	306	80	1	163	14	3 2	2 0	1
WEST SOUTH CENTRAL			-								•	
Arkansas	5 15	9	15	59 1	427 84	99 13	3	23 1	22 1	3	12	0
Oklahoma	6	3	17	130	201	185	6	11	6	ĩ	3	i
MOUNTAIN	Ĩ		10	1, 002	2, 021	102	20	10	202	Ĩ	°	•
Montana	2	0	1	21	34	12	3	103	52	0	1	0
Wyoming	Ō	1	1	11	11	11	0	19	8 6	Ő	1	ŏ
New Mexico	3 9	3 1	10 2	11	322 18	49	2 1	165 0	28 2	1	1	1 0
Arizona Utah <sup>3</sup>	1	9	1	61 3	950 56	127 56	1	12 12	12 29	0	12	0
Nevada	Ō	Ō	Õ.				ĭ	1	1	ŏ	ī	ŏ
PACIFIC Washington	8	7	1	1	2	2	34	42	43	0		1
Oregon California	5	3	2 23	14 31	25 60	25 60	30 240	50 105	40 105	2	8	2 2
Total	415	317	393	2, 449	23, 746	4, 325	777	8, 161	4, 285	190	287	35
49 weeks	12, 995 1	2, 960 1	4, 739 3	58, 761	26, 643	169, 793	300, 050	580, 588	491, 288	5, 488 1	6. 817	1, 915

<sup>1</sup> New York City only.

<sup>2</sup> Period ended earlier than Saturday.

# Telegraphic morbidity reports from State health officers for the week ended December 9, 1944, and comparison with corresponding week of 1943 and 5-year median—Con.

	Poliomyelitis		8	carlet fe	ver	6	mallp	DX	Typhoid and par typhoid fever			
Division and State	wende	eek d—	Me-	W end	'eek ed	Me-	Week ended—		Me-	W end	eek led—	Me
	Dec. 9, 1944	Dec. 11, 1943	1939- 43	Dec. 9, 1944	Dec. 11, 1943	1939- 43	Dec. 9, 1944	Dec. 11, 1943	1939- 43	Dec. 9, 1944	Dec. 11, 1943	1939- 43
NEW ENGLAND												
Maine New Hampshire Vermont Massachusetts Rhode Island Connecticut				1 44 1 2 1 10 2 23 1 3 1 3 1 3	5 2 1 ( 3 24 3 ( 4 4)	1 19 6 3 7 6 4 244 6 7 7 39						1 0 2 0
MIDDLE ATLANTIC												
New York New Jersey Pennsylvania	40			3 28 2 7( 2 24)	7 353 3 99 7 213	3 278 9 99 3 225			00000			6 2 6
EAST NORTH CENTRAL Ohio Indiana Illinois Michigan <sup>3</sup> Wisconsin				2 34 14 222 3 21 9	5 278 5 57 8 202 2 154 2 148	8 278 7 99 2 202 4 154 8 146	1 4 0 2	0 0 1 0 0	0 3 1 1 1	8 1 1 0 0		6 1 2 1 1
WEST NORTH CENTRAL Minnesota Iowa Missouri North Dakota South Dakota Nebraska Kansas						) 89 7 67 4 64 7 17 8 33 1 20 8 88	0 0 0 0 0 1	0 1 0 0 1 4	1 3 0 0 0 0 0 0	0 1 1 0 0 0 0		0 0 2 0 0 0 1
SOUTH ATLANTIC Delaware	1 1 1 2 1 5 0 1 0	0 0 1 1 1 1 1 0 1	0 1 0 1 1 1 1 1 0	119 24 69 72 96 12 34 14	88 23 40 50 107 8 15 23	7 12 54 15 52 50 105 20 34 7	00000000000000000000000000000000000000	0 0 0 0 0 0 1 0 0	0 0 0 0 0 0 0 0	0 1 0 5 0 1 3 4 0	0 2 0 2 2 2 1 3 0 1	· 0 2 0 2 2 2 3 4 1
KAST SOUTH CENTRAL Kentucky Tennessee Alabama. Mississippi <sup>3</sup>	2 0 1 0	2 0 0 0	2 0 0 1	49 57 31 17	75 78 20 9	75 74 35 20	0 0 0 0	0000	0 0 0	0 2 0 1	1 1 1 3	3 7 0 3
Arkansas Louisiana Oklahoma Texas	2 0 1 2	1 1 5 10	1 1 1 4	15 14 32 102	6 7 26 63	6 8 24 56	0 1 0 0	0 0 0 1	1 0 0 1	0 1 2 4	0 0 5 10	3 5 2 10
Montana. Idaho	0 0 0 0 2 0 0 0	1 0 1 4 1 0 2 0	0 0 2 0 1 0	22 65 8 59 21 9 19 2	32 52 3 36 1 18 88 2	32 10 7 36 12 4 22 0	0 0 0 0 0 0 1	1 0 0 0 2 0 0	1 0 0 0 0 0 0 0	2 0 1 0 0 1 0	0 0 0 4 0 1 1	0 0 0 3 0 0 0
PACIFIC Washington Oregon California	11 2 16	7 9 14	2 1 13	113 37 338	152 99 179	29 20 144	0 0 0	0 0 0	0 0 0	1 3 3	0 0 26	0 0 5
Total	133	96	96	3, 768	3, 557	3, 091	11	12	25	71	84	127
9 weeks	4 19, 019	12, 230	8, 904	179, 335	131, 727	131, 727	4 371	713	1, 323	5, 247	5, 306	8, 239

4

<sup>2</sup> Period ended earlier than Saturday.
<sup>3</sup> Including paratyphoid fever reported separately as follows: Maine, 2; Massachusetts, 2; New Jersey, 1; Ohio, 1; Indiana, 1; Illinois, 1; Iowa, 1; South Carolina, 1; Georgia, 3.
<sup>4</sup> Cumulative totals changed by corrected reports.

#### December 29, 1944

# 1682

	wi	Whooping cough			Week ended December 9, 1944									
Division and State	Wenc	'eek led—	Me- dian	An-	I	ysent	ery	En- ceph-	Lep-	Rocky Mt.	Tula-	Ty-		
	Dec. 9, 1944	Dec 11, 1943	1939- 43	thraz	Ame bic	Bacil lary	Un- speci- fied	tious	rosy	ted fever	remia	fever		
NEW ENGLAND	1													
Maine New Hampshire Vermont Massachusetts Rhode Island Connecticut	- 3 - 3 - 12 - 1 9	5 1 0 9 3 1 9 2 2 0 2	0 53 0 7 0 30 1 218 4 24 2 61				0 0 0 0 1 0 5 0 2 0 0 0	0 0 1 0 0	0 0 0 0 0	0 0 0 0 0 0	0 0 0 0 0	0 0 0 0 0		
MIDDLE ATLANTIC					1									
New York New Jersey Pennsylvania	- 28 - 7 - 15	8 34 2 6 2 9	5 473 2 171 6 303	0000	3 4 0	45	2 0 0 0	2 1 0	0 0 0	0 0 0	0 0 3	0 0 0		
EAST NORTH CENTRAL					ł									
Ohio Indiana Illinois Michigan <sup>3</sup> Wisconsin		9 12 7 2 5 10 9 20 2 13	7 152 0 17 1 140 4 282 5 161	0 0 0 0	0 2 0 0 7	0 0 1 3 0		0 0 0 0	0 0 0 0	0 0 0 0	3 11 6 0 0	0 0 0 0		
WEST NORTH CENTRAL	-													
Minnesota Iowa Missouri North Dakota South Dakota Nebraska Konses			5 52 3 27 9 14 0 17 0 2 7 7 7 37	0 0 0 0 0	3 0 0 0 0	3 0 0 0 0 0	000000000000000000000000000000000000000	0 0 0 0 0	000000000000000000000000000000000000000	000000000000000000000000000000000000000	000000000000000000000000000000000000000	000000000000000000000000000000000000000		
SOUTH ATLANTIC	1	1		v	Ň	, U	Ĭ	Ů	Ĭ	Ĭ	Ĭ	U		
Delaware Maryland <sup>1</sup> District of Columbia. Virginia West Virginia Worth Carolina. South Carolina. Georgia. Florida.	0 76 27 20 85 10 1 13	i 3 10 20 45 21	) 11 7 55 6 14 4 75 7 33 8 142 8 32 5 20 9	000000000000000000000000000000000000000	0 1 0 0 0 1 1 2	0 0 0 0 2 0 1	0 0 110 0 0 0 0 0	0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	0 2 0 2 0 0 0 1 0	0 0 2 0 12 4 50 3		
EAST SOUTH CENTRAL								1						
Kentucky Tennessee Alabama Mississippi <sup>3</sup>	8 7 39	80 229	67 43 13	0 0 0 0	0 0 0 0	0 0 0	0 2 0 0	0 2 1 0	0 0 0	0 0 0 0	6 1 0 0	0 4 20 1		
WEST SOUTH CENTRAL														
Arkansas Louisiana Oklahoma Texas	29 4 13 150	0 2 4 138	14 4 4 120	. 0 . 0 0	0 0 15	5 0 8 405	0 0 33	0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	2 7 0 27		
MOUNTAIN		-												
Montana Idaho. Wyoming Colorado New Mexico Arizona Utah <sup>3</sup> Nevada	24 6 5 0 7 53 0	6 32 31 0 14 26 0	6 3 4 31 16 14 26 4	0 0 0 0 0 0 0 0	1 0 0 0 0 0 0	0 0 0 10 0 0	0 0 0 1 12 0 0	0 0 0 0 0 0 0	0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	0 0 0 0 0 0 1 0	0 0 0 0 0 0 0		
PACIFIC														
Washington Oregon California	25 12 126	61 26 101	61 26 192	0 0 0	0 0 6	0 0 5	1 0 0	0 1 2	0 0 0	0 0 0	0 0 0	0 0 2		
Total	1, 966	2, 675	3, 572	0	46	493	159	10	0	0	36	134		
Same week, 1943 Same week, 1942 49 weeks, 1944 49 weeks, 1943 49 weeks, 1943	2, 675 3, 572 90, 576 171, 855 169, 469		4 169, 469	1 1 40 63 76	79 20 1, 767 2 2, 050 1 1, 157 1	722 116 3, 351 7, 099 1, 758	107 64 8, 650 7, 293 6, 324	13 2 616 660 542	1 1 32 29 44	0 0 453 433 433 451	18 24 578 753 830	117 90 5, 019 4, 304 2, 803		

Telegraphic morbidity reports from State health officers for the week ended December 9, 1944, and comparison with corresponding week of 1943 and 5-year median—Con.

<sup>2</sup> Period ended earlier than Saturday.

4 5-year median, 1939-43.

#### WEEKLY REPORTS FROM CITIES

# City reports for week ended December 2, 1944

This table lists the reports from 89 cities of more than 10,000 population distributed throughout the United States, and represents a cross section of the current urban incidence of the diseases included in the table.

	808	-i 88	Influ	ienza		nen- us,	eaths	cases	ases		para- Byer	qĝn
	Diphtheria c	Encephalitis, fectious, or	Cases	Deaths	Measles cases	Meningitis, 1 ingococo cases	Pneumonía d	Poliomyelitis	Scarlet fever o	Smallpox case	Typhold and typhold fo cases	Whooping or cases
NEW ENGLAND												
Maine: Portland	0	0	0	0	1	0	2	0	5	0	0	0
Concord	. 0	0	0	0	0	0	1	0	1	0	0	0
Vermont: Barre	0	0	0	0	0	0	0	1	1	0	0	3
Massachusetts: Boston	. 2	0	0	2	33	9	5	2	68	0	0	14
Fall River	' 0 0	0	0	0	04			0	2	0	0	75
Worcester	Ō	Ŏ	Ō	Ō	Ō	Ŏ	Ă	Ō	Ĭ	Ŏ	Ŏ	6
Providence	0	0	0	0	0	1	2	0	6	0	0	7
Bridgeport	0	0	1	0	ļ	0	0	0	1	0	0	Ģ
New Haven	ŏ	ŏ	3	Ö	ō	Ó	4	ŏ	5	ŏ	ŏ	8
MIDDLE ATLANTIC												
New York: Buffalo	0	0	0	0	0	0	4	4	3	0	2	0
New York	11	Ŏ	ľ	i	13	13	56	23	142	Ŏ	2	113
Syracuse	ŏ	ŏ	ŏ	ŏ	0	ŏ	1	ŏ	3	ŏ	ŏ	14
Camden	0	0	0	0	0	0	0	0	0	0	0	0
Newark Trenton	0	0	0	0	4 0	0	$\frac{2}{1}$	0	2 4	0	0	6
Pennsylvania: Philadelphia	5	0	2	1	2	2	33	2	76	0	1	34
Pittsburgh Reading	0	0	0	0	0	0	10 1	0	9 2	0	0	5
EAST NORTH CENTRAL										-		
Ohio:												
Cincinnati Cleveland	2 4	0	0 5	1	12	$\frac{1}{3}$	6 0	02	21 38	0	02	17
Columbus Indiana:	. 0	0	1	1	0	1	4	0	7	0	0	11
Fort Wayne	2	0	0	0	02	0	5	0	2	0	0	07
South Bend	ò	ŏ	Ő	õ	õ	ò	Ő	ŏ	6	Ŏ	ŏ	ò
Illinois:							- -			. 0		~
Springfield	ő	ŏ	0	ő	3	2	22	ő	3	ŏ	ŏ	23
Michigan: Detroit	15	0	1	0	3	4	16	2	62	0	0	28
Flint Grand Rapids	1 2	0	0	0	0	0	2 1	0	2 5	0	0	0
Wisconsin: Kenosha	0	0	0	0	0	0	0	0	0	0	0	16
Milwaukee	ŏ	ŏ	2	Ž	3	ľ	2	ŏ	23	ŏ	ŏ	7
Superior	ŏ	ŏ	ŏ	ŏ	- i	1	ŏ	ŏ	í	ŏ	ŏ	ŏ
WEST NORTH CENTRAL												
Minnesota: Duluth	4	0	0	0	0	0	2	0	3			2
Minneapolis St. Paul	4	ŏ	ŏ	ŏ	ŏ	ŏ	õ	ŏ	17	ŏ	ŏ	3
		~ 1	~ •			~ .	~ 1			~ •	~ .	

# City reports for week ended December 2, 1944—Continued

											_	
	868	Ę 8	Influ	ienza		nen- us,	esths	CBBCB	AS CS		pere-	dgu
-	Diphtheria ca	Encephalitis, fectious, ca	Casee	Deaths	Measels cases	Meningitis, n ingococc cases	Pneumonía d	Poliomyelitis	Scarlet fever o	Smallpor case	Typhoid and typhoid fo cases	Whooping of
WEST NORTH CENTRAL												
Missouri:			1									
Kansas City	0	0	0	2	0		7	0	17	0		1
St. Louis	ŏ	ŏ	2	ŏ	l i	5	15	ŏ	13	ŏ	ŏ	12
North Dakota:												
Nebraska:	U	U U	U U	U U	l v	U U	· ·	U U	1	l v	U V	U
Omaha	0	0	0	0	4	0	3	1	5	0	0	0
Kansas: Topeka	0	0	0	0	0	1	0	.0	7	0	0	3
Wichita	Ŏ	Ŏ	Ŏ	Ŏ	ĺ	Ō	i	Ő	6	0	Ó	7
SOUTH ATLANTIC												
Delaware:								•				
Wilmington	0	0	0	0	0	0	3	0	2	0	0	0
Baltimore	8	0	1	2	1	2	8	1	36	0	0	46
Cumberland	0	0	0	0	0	0	0	0	0	0	0 0	0
District of Columbia:	U		v	U		U V	v	v	v	U	v	v
Washington	0	0	0	0	1	2	7	2	18	0	0	4
Virginia:	0	0	0	0	0	0	1	0	1	0	0	0
Richmond	Ŏ	Ŏ	Ŏ	Ŏ	Ŏ	Ŏ	1	Ō	13	0	Ó	Q
Roanoke	1	0	0	0	0	0	0	0	0	0	0	1
Charleston	0	0	0	0	0	0	0	0	5	0	0	0
Wheeling	0	0	0	0	1	0	1	0	0	0	0	0
Raleigh	0	0	0	0	0	0	0	0	1	0	0	2
Wilmington	5	0	0	0	1	0	1	0	5	0	0	8
South Carolina:		U	z	U	U	U	۰	۷	°	U	U U	-
Charleston	0	0	14	0	1	1	1	0	1	0	1	0
Georgia:	0	0	9	1	0	0	3	0	4	0	. 0	0
Brunswick	ŏ	ŏ	ŏ	ō	Ŏ	Ŏ	ī	ŏ	ī	Ó	Ō	Ó
Savannah	0	0	3	1	0	0	2	0	0	U	0	U
Татра	1	0	0	0	0	0	1	0	1	0	0	0
EAST SOUTH CENTRAL												
Tennessee						.						
Memphis	1	0	5	2	19	5	5	0	10	0	0	6
Nashville	0	0	0	0	2	0	2	0	1	0	U	U
Birmingham	1	0	5	0	1	2	5	0	4	0	0	0
Mobile	1	, 0	0	0	0	0	2	0	0	0	0	0
WEST SOUTH CENTRAL			.									
Arkansas:												٥
Louisiana:	U U			۰	۷I	۳I		v	•		v I	v
New Orleans	2	0	6	2	2	2	11	0	3	0	1	0
Shreveport	1	0	0	0	0	U I	4	U	0	U U	- 1	U
Dallas	8	0	0	0	0	0	1	0	5	0	0	3
Galveston	0	0	0	0	0	0	27	0	5	0		0
San Antonio	î	ŏ	2	ĭ	ĭ	õ	2	ĭ	4	ŏ	ŏ	2
MOUNTAIN												
Montene:												
Billings	0	0	ot	0	0	0	4	0	2	0	0	0
Helena	0	0	0	0	0	0	0	0	0	0	0	0
WI19900119		U 1	U 1	01			וני	<b>U</b> 1			U 1	

01	•											
	88	ti Ses	Influ	ienza		us,	eaths	cases	ases		oara-	qgn
•	Diphtheria ca	Encephalitis, fectious, ca	Cases	Deaths	Measles cases	Meningitis, n ingococc cases	Pneumonia de	Poliomyelitis e	Scarlet fever c	Smallpox case	Typhoid and I typhoid fe cases	Whooping co cases
MOUNTAIN—continued												
Idaho: Boise	0	0	0	0	1	0	0	0	3	o	0	o
Denver Pueblo	1 0	0	6 0	1 0	6 0	10	8 0	0	14 4	00	3 0	6 0
Salt Lake City	0	0	0	0	0	1	0	1	4	0	0	5
PACIFIC												
Washington: Seattle Spokane Tacoma	2 1 0	0 0 0	0 0 0	0 0 0	4 2 0	4 1 0	3 1 0	0 0 0	9 2 0	0 0 0	0 0 0	3 0 0
Los Angeles Sacramento San Francisco	8 0 1	0 0 0	6 0 2	2 0 0	14 1 15	0 0 1	7 2 10	0 0 0	46 7 15	0 0 0	0 0 0	8 4 9
Total	101	0	82	28	185	81	349	55	939	0	15	513
Corresponding week, 1943. Average, 1939-43	84 96		367 712	42 1 48	1, 569 2 964		483 1 448		917 838	1 2	17 20	609 1,000

City reports for week ended December 2, 1944-Continued

<sup>1</sup> 3-year average, 1941-43. <sup>2</sup> 5-year median, 1939-43.

Dysentery, amedic.—Cases: Boston, 4; Chicago, 1. Dysentery, bacillary.—Cases: Buffalo, 2; New York, 12; Syracuse, 1; Chicago, 1; Detroit, 1; St. Louis, 1; Charleston, 8. C., 2; Los Angeles, 5. Dysentery, unspecified.—Cases: Baltimore, 1; Pichmond, 1; Mobile, 1; Dallas, 1. Typkus fever, endemic.—Cases: Atlanta, 3; Savannah, 4; Tampa, 3; Nashville, 1; Birmingham, 3; Mobile, 1; New Orleans, 3; Houston, 4.

Rates (annual basis) per 100,000 population, by geographic groups, for the 89 cities in the preceding table (estimated population, 1943, 34,365,000)

	e	in- rates	Influ	ienza	ates	ien- us,	ath	BSB	<b>B</b> SO	rates	Dara- Iver	ugh
	Diphtheria cas rates	Encephalitis, fectious, case	Case rates	Death rates	Measles case r	Meningitis, m ingococc case rates	Pneumonia de rates	Poliomyelitis ( rates	Scarlet fever c rates	Smallpox case	Typhoid and I typhoid fe case rates	Whooping co case rates
New England Middle Atlantic. East North Central South Atlantic. East South Central West South Central Mountain. Pacific.	5. 2 7. 4 21. 3 15. 9 24. 5 17. 7 25. 8 8. 3 19. 0	0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	13. 1 1. 4 6. 7 4. 0 47. 4 59. 0 23. 0 49. 9 12. 7	7.8 0.9 4.9 6.0 6.5 11.8 8.6 8.3 3.2	102 19 15 12 8 130 9 58 . 57	28.8 7.4 14.0 13.9 8.2 41.3 11.5 16.6 9.5	49. 7 51. 4 45. 0 67. 6 49. 0 82. 6 77. 5 141. 4 36. 4	10.5 17.6 3.6 4.0 4.9 0.0 2.9 8.3 0.0	254 113 166 169 152 89 72 225 125	0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	0.0 2.3 1.2 2.0 1.6 0.0 8.6 25.0 0.0	133 89 67 99 103 35 14 92 38
Total	15.4	0.0	12.5	4.3	28	12.3	53.1	8.4	143	0.0	2.3	78

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#### **TERRITORIES AND POSSESSIONS**

#### **Puerto Rico**

Notifiable diseases—4 weeks ended December 2, 1944.—During the 4 weeks ended December 2, 1944, cases of certain notifiable diseases were reported in Puerto Rico as follows:

Disease	Cases	Disease	Cases
Bilharziasis. Cerebrospinal meningitis. Chickenpox. Diphtheria. Dysentery (unspecified) Erysipelas. Filariasis. Gonorrhea. Influenza. Malaria.	4 1 2 36 8 1 1 403 80 1,026	Measles. Opthalmia neonatorum. Poliomyelitis. Syphilis. Tretanus. Trachoma. Tuberculosis (all forms). Typhoid fever. Typhus fever (murine). Whooping cough.	209 1 573 14 1 590 21 5 46

#### \* \* \*

### **DEATHS DURING**, WEEK ENDED DECEMBER 2, 1944

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

	Week ended Dec. 2, 1944	Correspond- ing week, 1943
Data for 93 large cities of the United States: Total deaths. Average for 3 prior years. Total deaths, first 48 weeks of year. Deaths under 1 year of age. Average for 3 prior years. Deaths under 1 year of age, first 48 weeks of year. Death from industrial insurance companies: Policies in force. Number of death claims. Death claims per 1,000 policies in force, annual rate. Death claims per 1,000 policies, first 48 weeks of year, annual rate.	9, 406 9, 462 430, 826 604 650 29, 708 66, 918, 568 14, 314 11. 2 10. 0	9, 948 438, 776 706 31, 669 66, 068, 509 12, 132 9. 6 9. 6

# FOREIGN REPORTS

#### CANADA

Provinces—Communicable diseases—Week ended November 18, 1944.—During the week ended November 18, 1944, cases of certain communicable diseases were reported by the Dominion Bureau of Statistics of Canada as follows:

Disease	Prince Edward Island	Nova Scotia	New Bruns- wick	Que- bec	On- tario	Mani- toba	Sas- katch- ewan	Al- berta	British Colum- bia	Total
Chickenpox Diphtheria Dysentery (bacillary)	3	38 10	2	403 76 20	319 8	46 8	34 6	65 1	96	1,001 114 20
German measles		2			5	;-		4	11	22
Measles. Meningitis, meningococ-		3	1	321	165	15	25	5	81	616
cus Mumps Poliomyelitis				473	1 31 15	4 1	70	18 1	39	635 17
Scarlet fever Tuberculosis (all forms) Typhoid and paraty.		19 12	8 1	215 135	174 54	17 4	18 2	30 27	46 57	527 292
phoid fever			1	8 1	1 4		1			11 5
Venereal diseases: Gonorrhea Syphilis Whooping cough	1 2	34 17 22	17 14	97 115 259	201 112 52	47 13 7	25 7 6	34 14 25	51 21 40	507 315 411

<sup>1</sup> Includes 1 case, delayed reports.

#### JAMAICA

Notifiable diseases—4 weeks ended November 18, 1944.—During the 4 weeks ended November 18, 1944, cases of certain notifiable diseases were reported in Kingston, Jamaica, and in the island outside of Kingston, as follows:

Disease	Kings- ton	Other lo- calities	Disease	Kings- ton	Other lo- calities
Cerebrospinal meningitis Chickenpox Diphtheria Dysentery (unspecified) Erysipelas	1 1 6 45 1	2 2 113	Leprosy Tuberculosis (pulmonary) Typhoid fever Typhus fever	21 8	4 60 98 1

#### **NEW ZEALAND**

Notifiable diseases—4 weeks ended November 4, 1944.—During the 4 weeks ended November 4, 1944, certain notifiable diseases were reported in New Zealand as follows:

Disease	Cases	Deaths	Disease	Cases	Deaths
Cerebrospinal meningitis Diphtheria Dysentery (bacillary) Erssipelas. Hookworm disease Malaria Ophthalmia neonatorum	13 55 11 21 3 46 2	2 5 	Puerperal fever	3 745 3 5 182 2 1	22 

#### SWEDEN

Notifiable diseases—September 1944.—During the month of September 1944, cases of certain notifiable diseases were reported in Sweden as follows:

Disease	Cases	Disease	Cases
Cerebrospinal meningitis Diphtheria Dysentery Encephalitis, epidemic Gonorrhea Hepatitis, epidemic Paratyphold fever	7 185 488 1 1, 784 632 11	Poliomyelitis Scarlet fever Syphilis Typhoid fever Undulant fever. Weil's disease	438 2, 255 133 8 2 4

#### WORLD DISTRIBUTION OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER AND YELLOW FEVER

From medical officers of the Public Health Service, American consuls, International Office of Public Health, Pan American Sanitary Bureau, health section of the League of Nations, and other sources. The reports contained in the following tables must not be considered as complete or final as regards either the list of countries included or the figures for the particular countries for which reports are given.

#### **CHOLERA**

#### [C indicates cases]

NOTE.—Since many of the figures in the following tables are from weekly reports, the accumulated totals are for approximate dates.

Place	January- Sep-	October	November 1944-week ended-					
	tember 1944	1944	4	11	18	25		
ASIA CeylonC	2	14 274						
CalcuttaC ChittagongC	3, 253 63	11, 374 117	27	33				
Madras	37 17 269							
•••								

#### PLAGUE

[C indicates cases; D, deaths; P, present]

Place	January- Sep- tember 1944	October 1944	November 1944-week ended-			
			4	11	18	25
AFRICA C BechuanalandC	22	23			1 171	
Belgian CongoC Plague-infected rats Buitish Rest Africa.	12 P	7	2			
Kenya	11 5	1			1	
Egypt C Port SaidC SuesC	645 73 157	4 1 2	22	1 1		
French West Africa: Dakar	460 85 144	54 14 27	10	17	5	
Rhodesia, northern	1 42	1	6	7		
Tunisia	26 39		•••••	2		38
ASIA China:						
Chekiang Province	P P 104	P				
IndiaC IndochinaC PalestineC	8, 138 57 44	938 		8	2	
Plague-infected rats	84	48				
Portugal: Azores	20	8	1			
Bolivia: Chuquisaca Department	5					
Santa Cruz Department C Tarija Department C Brazil	5 12 94					
Ecuador: Chimborazo Province	4	4				
Peru: Ancash DepartmentC Lambayaque Department	57 1	3				
Libertad DepartmentC Lima DepartmentC Piura Department	. 20 . 20	2				
OCEANIA Hawaji Tarritary	-					•••••
Hamakua District	³5 ≜50	3	2			<b>-</b> -

From the beginning of the outbreak in October 1944.
 For the period Nov. 1-20, 1944.
 Includes 1 death from pneumonic plague.
 Plague infection was also proved in a pool of 53 fleas on Mar. 7, 1944.
 Includes 12 plague-infected mice. Plague-infected tissue in a pool of 8 mice was also reported during August 1944.

#### **SMALLPOX**

[C indicates cases; P, present]

	January-	October 1944	November 1944-week ended-			
Place	tember 1944		4	11	18	25
Algeria	808 25	61				
Basutoland C Belgian Congo	201 1, 826	894				
Kenya	3, 052 143	51 1	43			
TanganyikaC UgandaC Cameroon (French)C	2, 636 3, 750 370	1 299 17	69	23		
Dahomey C Egypt C French Equatorial Africa	88 10,831 1,306	9				
French GuineaC French West AfricaC Gambia	1,002 129 13	20 36		56		1 55
Gold CoastC Ivory CoastC	10 7 446	9		6 22		
Moreco (French)C MozambiqueC	680 3					1 59
Niger TerritoryC SenegalC	3,753 582 190	199			1	14
Sierra Leone	393 1 1, 926	90				<sup>1</sup> 18
TogoC TunisiaC Union of South Africa: NatalC	8	<sup>3</sup> 1, 800	 21	78 11		
ASIA Arabia C	<sup>\$</sup> 26					
CeylonC China: Kunming (Yunnan Fu)C IndiaC	8 53 231, 681	6, 048	S 	1		
IndochinaC IranC IragC	1, 557 790 43					
PalestineC Syria and LebanonC	165 179			2		
EUROPE FranceC Gibraltar	1 P					
Great Britain C Greece C	4 18 321 761					
Portugal C Spain C	32 157	2				
NORTH AMERICA	5, 028		32	2	10	-
Dominican RepublicC	1					
HondurasC MexicoC Panama (Republic)C	9 2, 347 1	136				
SOUTH AMERICA Bolivia	908	78				
BrazilC ChileC ColombiaC	7, 812	150 15	15			
EcuadorC PeruC	19 253	3				
Venezuela	368	49				

For the period Nov. 1-20, 1944.
 Approximate number of cases reported from Jan. 1944 to Nov. 9, 1944.
 Includes imported cases.
 Includes 1 case imported from the Middle East.

#### **TYPHUS FEVER\***

[C indicates cases]

	Inner	October 1944	November 1944 work and d			
Place	Sep-		Trovermoet 1935 week ended-			
	tember 1944		4	11	18	25
AFRICA						
Algeria	1, 222	116				
BasutolandC	95	94				
British East Africa: Kenya	12	1	1			
Egypt.	16, 862	121	<b>-</b> -			
French Guines						
Gold Coast	6					
Morocco (French)	2, 382	28				1 116
Morocco (Spanish)	8					
Nigeria	2					
Rhodesia, northern	85	11				
Sierra Leone	30					
Tunisia	708	70				1 1 79
Union of South Africa C	5, 525					
ASIA						
Arabia: Western Aden Protectorate	2 15	1				
CeylonC	1	<u>-</u> -		<u>-</u> -		
China: Kunming (Yunnan Fu) C	102	7	4	5	3	
Indochina	1.004					
Iran	6,427					
IraqC	596	10				<b>-</b> -
Palestine C.	400	10	°		0	
Trans-JordanČ	45					
FIDODE						
BelgiumC	10					
BulgariaC	686					
France	11					
Gibrelter C	215	1				
Greece	294					
Hungary	3, 299	15	·····;·			
Irish Free State	9	1	1			
NetherlandsČ	8					
Norway	1					
Portugal	6003	10	2	1	2	
Slovakia C	336	1				
Spain	463	4				
Turkey	2,334	116	15	35	37	66
	1, 512	110				
NORTH AMERICA	,					
Dominican Republic	10					
Guatemala	1,820	109				
Jamaica	1 422	194		1		
Panama Canal Zone	1,400	124				
Puerto Rico *Č	171					
SalvadorC	7					
virgin islands • C	19					
SOUTH AMERICA	0.50	20				
Bollvis	203	32				
ChileČ	392	9	2	4	3	3
Colombia	303	;-				
Curação	336	109				
Peru	740					
VenezuelaČ	82	36				
OCEANIA						
Australia	157	8				
Hawaii Territory	117	23	6	2		

Reports from some areas are probably murine type, while others probably include both murine and loose-borne types.
 For the period Nov. 1-20, 1944.
 A report dated Mar. 3C, 1944, states that an estimated 800 deaths from typhus fever have been reported in Western Aden Protectorate, Arabia.
 Reported as murine.

#### YELLOW FEVER

[C indicates cases; D, deaths]

Place	January- Sep- tember 1944	October ,1944	November 1944-week ended-			
			4	11	18	25
AFEICA						
Belgian Congo:						
Babeyru	2					
Banzyville	113					
BondoD	1 1					
Leopoldville	1					
Gold Coast:	-			1		
Cane Coast	31					
Ho	1 1					
Kintamno	ī					
Northern Territories	l î					
Sekondi	21					
Tamale	21					
Vandi	11					
Twore Coest.	- 1					
Abidian C						
Dire	-					
Divo						
Nigeria: Bukuru	1					
Portuguese Guines. Fort Dintam	1					
STRANS		•				
EUBURE		•				
Portugal: Lisoon.•						
BUUTH ARESICA						
Bonvia:						
La Paz Department	1					
Santa Cruz Department	3					
Brazu:						
Acre Territory	1					
Matto Grosso State	3					
Para State D	2					
Colombia:					1	
Amazonas Department D	1					
Boyaca Department D	4					
Caldas Department D	1					
Cundinamarca Department	1					
Intendencia of Meta C	1					
Santander Department	4					
Venezuela: Tachira State	4 29	1				
		- 1				

<sup>1</sup> Includes 11 suspected cases of yellow freer. <sup>3</sup> Suspected. <sup>3</sup> According to information dated Jan. 21, 1944, it is reported that a vessel which called at the islands of Sao Tome and Cape Verde arrived at Lisbon, Portugal, with cases of yellow fever on board. <sup>4</sup> Includes 21 cases of suspected yellow fever.

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