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STUDIES ON OXIDATION-REDUCTION.

III. ELECTRODE POTENTIALS OF MIXTURES OF 1-NAPHTHOL-2-SULPHONIC ACID INDOPHENOL AND THE REDUCTION PRODUCT.

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The introductory papers of this series (Clark, 1923, and Clark and Cohen, 1923) outlined the general principles of that theory of oxidation-reduction which has guided our experimental work. We may now elevate to their proper rank the experimental data, letting the mathematical treatment given in the second paper formulate these data as best it can.

The experimental equipment will first be described. Its application will then be illustrated by studies on 1-naphthol-2-sulphonic acid indophenol.

EQUIPMENT.

The measurements to be described are not unlike those made with the hydrogen electrode. Since these have been described frequently, there is no need to repeat the elementary principles.¹

For the measurement of potential differences there was used a Leeds and Northrup type K potentiometer calibrated by the Bureau of Standards. The null-point instrument was a Leeds and Northrup type R galvanometer having a megohm sensitivity of 2,245, a period of six seconds, and a coil resistance of 530 ohms. The sensitivity was sufficient to permit the use of an additional resistance of 2,000 ohms in series with the chain under measurement. This was placed in series with the first key of the potentiometer to lower polarization effects during adjustment, and it was seldom necessary to use the other keys.

Several Weston standard cells certified by the Bureau of Standards and maintained at constant temperature were intercompared during the measurements and found not to drift apart to any significant extent.

¹ For a detailed description see Clark: The Determination of Hydrogen Ions.

was therefore adapted to the same type of support employed in the earlier experiments. The rubber stopper is supported by means of an iron lock nut, H, soldered to the brass bar, D. D serves to support the saturated KCl calomel half-cell, C, and a bar not shown, upon which the support, G, pivots.

In using the vessel, the siphon, S, was flushed with KCl solution by opening cocks 1 and 2. Some of the buffer solution to be used was then gently drawn into S, until the sharply defined junction of buffer and saturated KCl solutions lay at the widest part of the 7-mm. bulb. With care to prevent entrance of an air bubble at the tip of S, the vessel, A, containing 50 c. c. of buffer solution, was then forced into place so that the junction with the rubber stopper was tight, and it was then kept in place by the strong spring, G. A stirrer, P, running through a mercury seal, T, was spun by the air motor, M.

For filling and cleaning, the apparatus was raised out of the oil bath during short periods. At other times it was kept immersed up to the shoulder of C.

During a measurement, cock 2 was closed and 1 was open.

The solution was swept free of oxygen by means of a stream of nitrogen running for 30 minutes at about 600 c. c. per minute, entering at I and escaping at T and O. The nitrogen was furnished in tanks by the Linde Air Products Co. The small amount of oxygen it contained was removed by passing it through an electrically heated tube 4 cm. in diameter, 60 cm. long, filled with 5-mm. lengths of reduced copper wire. The copper column seldom became oxidized for over one-third its length during a 12-hour run, and there is no evidence that the issuing nitrogen was over contaminated enough to oxidize appreciably the highly diluted reduced solutions used. However, there is evidence to be given later that there can be diffusion of oxygen through rubber tubing; and for this reason, rubber tubing was reduced to a minimum and the nitrogen within kept flowing and under pressure.

In Figure 1 there is but one electrode shown, but in every case two electrodes were used. Platinum wire, platinum foil, gold-plated foil and wire, rhotanium alloy, burnt-on platinum, gold-plated and amalgamated burnt-on platinum, and mercury have been employed as electrodes. They seldom differed more than 0.1 millivolt, and generally agreed.

Electrodes of wire and foil need no description. The burnt-on platinum electrodes illustrated in Figure 2, D, were made as follows: A No. 36 platinum wire was fused into the end of a glass tube and was broken off flush with the surface of the glass. After a thorough cleaning, the tube was dipped into Westhaver's (1905) platinum solution and whipped in the air till no liquid could thus be thrown off. With slow heating over an alcohol lamp, there developed a thin, mirror deposit of platinum. This was reinforced by a second coating

and then heated almost to incipient fusion of the underlying glass surface. In some cases the butt of the exposed wire was covered by a bead of glass. Electrical contact was made by filling the tube with mercury. Sometimes this burnt-on platinum was lightly coated with gold by electrolysis. At other times a mercury deposit was flashed upon the gold plate by momentary electrolysis in a mercurous nitrate solution. This last procedure often furnished a rapidly adjusting electrode.

Mercury electrodes were also made as illustrated in Figure 2. The mercury was highly purified by several distillations according to Hulett's method, and a final distillation *in vacuo*. Contact is made at C. Reserve mercury is stored in A, from which the exposed

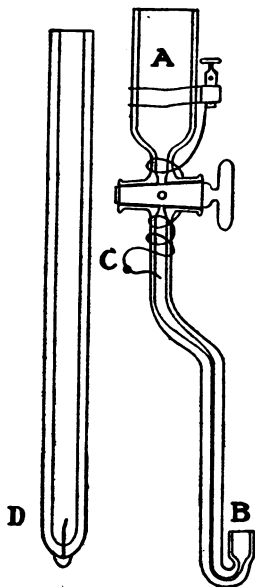


FIG. 2.—Electrodes of burnt-on platinum and of mercury.

mercury at B may be renewed. These electrodes are sometimes erratic, but usually agree well with other types. A renewal of the exposed surface at B seldom fails to bring one of these electrodes into agreement with others, provided the mercury column is clean and intact.

If the substance to be studied was already in the oxidized state, it was usually placed in the electrode vessel with the buffer solution before the nitrogen was turned in. A reduced or partially reduced solution was added from a protected burette.

Such a burette is shown at B in Figure 3. If a fully reduced solution was to be prepared, A was at first left empty. Nitrogen was then passed in at F and different branches of the apparatus were flushed. Meanwhile filter D was prepared. A firm pad of asbestos

was formed against the perforated platinum disk and sucked free from excess water in order to open its texture for the passage of nitrogen. The filter was then attached to H while nitrogen was escaping. With nitrogen running through the filter, vessel C was put in place with its content of dye solution and platinized asbestos.²

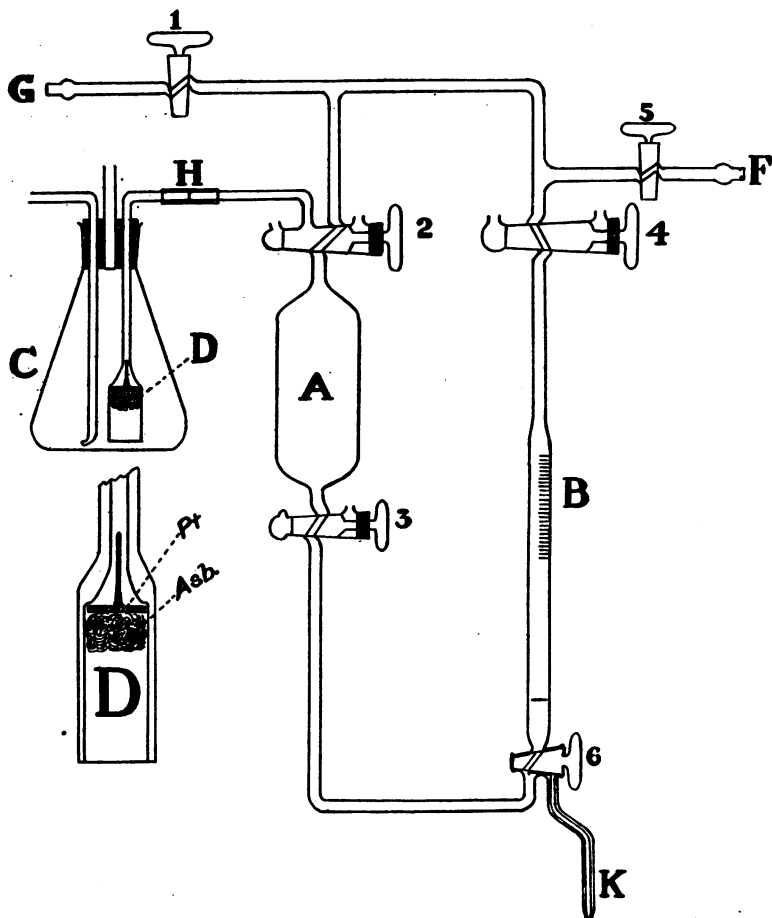


FIG. 3.—Apparatus for reduction, storage, and delivery of solution.

The dye was then reduced in C by means of a stream of hydrogen. When reduction was complete, a Cenco pump was attached at G, cock 5 was closed, and the apparatus was evacuated. Cock 1 was opened only when an outward flow of gas was insured. Otherwise an appreciable back-diffusion of air occurred. Cock 2 was now

² This platinized asbestos was prepared by the hot reduction of platinum chloride by means of dextrose and alkali in the presence of washed asbestos. After the reduction the asbestos was repeatedly filtered, washed, reboiled with water, filtered, etc., during several hours. It was then repeatedly and for several days washed by decantation. Before a portion of this stock was placed in C, it was washed with a portion of the solution to be reduced.

turned so that the reduced solution would be forced from C to A. When A was to contain a fully reduced solution, the first 20 c. c. or so of solution were wasted through 3, although with proper precautions there appeared no sign of reoxidation.

When A, of about 200 c. c. capacity, was nearly full, nitrogen was admitted and was bubbled through the solution by way of 5, 4, 6, and 3, escaping through 2 and 1 and a mercury trap attached to G. C was now disconnected at H, and the tube between H and cock 2 was left full of reduced solution.

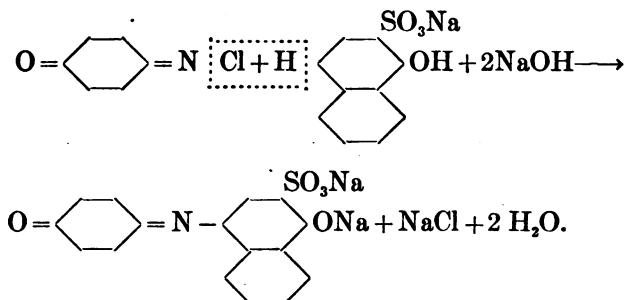
If a partially reduced solution was to be prepared, a solution of oxidant was placed in A and mixed with reductant from C.

We have already mentioned the fact that we have found no evidence that the nitrogen, purified by the method described, had any oxidizing effect. In the use of the apparatus shown in Figure 3 it was necessary to attach a long rubber tube at F in order to permit the apparatus to be carried from one electrode vessel to another for delivery of solution. Under these circumstances a slight but distinct oxidation was made apparent, in the case of indigo, by the re-coloration of the solution. The material in A, when held between closed cocks, showed no such signs. We therefore believe that oxygen in detectable amounts may diffuse through the rubber tubing. To render its effect negligible, reserve material in A was stored between closed cocks. Cocks 1 and 5 were kept closed except during transfer of solution; and before such a transfer, nitrogen was passed in a vigorous stream from F to G.

In stating results, we shall reduce observed single potential differences to the hydrogen standard, designating by E_h reduction electrode potentials, and by π_h hydrogen electrode potentials. In this treatment there are involved the following assumptions: The ultimate working standard, with which the saturated KCl calomel half-cells were compared, was the hydrogen electrode potential difference of M/20 acid potassium phthalate solution to which was assigned the value -0.2386 at 30°C . Liquid junctions in all cases were made with saturated KCl solution upon one side, and the potential differences at such junctions were ignored.

PREPARATION OF 1-NAPHTHOL-2-SULPHONATE INDOPHENOL.

Fourteen and two-tenths grams quinone chlorimide were placed in a mortar with a handful of chopped ice and 25 c. c. water. With constant grinding, there was added to this a solution of 24.6 grams, 1-naphthol-2-sodium sulphonate in 75 c. c. 4N NaOH. The reaction supposed to take place may be represented as follows:



The solution became so deeply colored that it was impossible to observe when the chlorimide had disappeared. The solution was allowed to stand for about an hour. Cold saturated salt solution was then added, and the thick precipitate which formed was filtered with suction and washed with cold, saturated salt solution. The material was then extracted with water. The filtrate was cooled with an ice-salt mixture and precipitated with CO_2 . This precipitate was filtered and dried on a porous plate. It was then extracted with hot, absolute alcohol. From the alcoholic solution there crystallized very fine bars of the red mono-sodium salt.

Although a search of the literature has not been completed, we have reason to believe that this is a new compound.

ANALYSIS.

A sample slowly dried at low temperature first and gradually brought up to 105°C . with a loss of 5.99 per cent "moisture" remained constant in weight on further heating at 110°C .

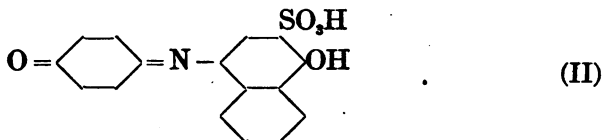
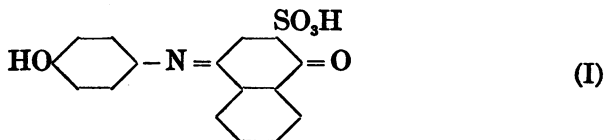
Nitrogen was determined by the Kjeldahl method. Sulphur was determined as BaSO_4 after fusion with sodium carbonate-potassium nitrate mixture. Ashing was done in an electrically controlled electric furnace. After charring, a drop of nitric acid and a drop of concentrated sulphuric were added, and the temperature was raised to 760°C . The white ash was assumed to be Na_2SO_4 .

With correction for "moisture" the following percentages were found:

	Found.		Average.	Calculated for $\text{C}_{16}\text{H}_{10}\text{O}_3$ N S Na.
	1	2		
N.....	4.02	3.98	4.00	3.99
S.....	9.08	8.94	9.01	9.13
Na.....	6.57	6.57	6.57	6.55

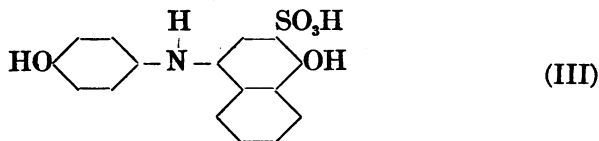
PROPERTIES.

Arguing from the mode of its formation and the analogy with similar syntheses, 1-naphthol-2-sulphonic acid indophenol should have either structure (I) or (II):



We shall postpone a discussion of these and regard them as possible tautomers in equilibrium with one another.

It will presently be shown that, on reduction, two electrons are concerned. The hydrogenated reduction product of (I) or (II) can then be represented by (III):



The crystals of 1-naphthol-2-sodium sulphonate indophenol, which were obtained from alcoholic solutions, are dark red bars. They are soluble in water, ethanol, methanol, and acetone. They are practically insoluble in benzene, toluene, xylene, ether, and chloroform. The clear aqueous solution, on exposure to the air, slowly forms a precipitate and an iridescent film. At high acidities the solution is very unstable. (Walter C. Holmes, of the color laboratory, Bureau of Chemistry, is studying the absorption spectra of this compound under various conditions. His results will be published later.)

On reduction, the aqueous solution becomes almost colorless, having only a faint tinge of yellow in 0.006 M solution.

The aqueous solution is bright red. Upon addition of alkali, this changes to a most beautiful rich blue of remarkable tinctorial power. This color change is doubtless associated with the neutralization of the phenolic group. The apparent dissociation constant characterizing this color change, was determined by the method of Salm.* Proper concentrations of the red, acid solution, and of the blue, alkaline solution, were superposed and compared with buffer solutions

* For details of the method see Clark (1920).

containing proper concentrations of the dye. The following tabulation shows, in pH units, the observed deviation of each set from that of the 5:5 combination. The agreement with the theoretical deviation is within the limits of experimental error.

	Drops.						
	2	3	4	5	6	7	8
Acid solution.....							
Alkaline solution.....	8	7	6	5	4	3	2
Deviation in pH from 5:5 combination.....	0.55	0.40	0.15	0	0.20	0.35	0.55
Theoretical deviation.....	0.60	0.37	0.18	0	0.18	0.37	0.60

The buffer which matched most closely the 5 : 5 combination was found by electrometric measurement to have a pH value of 8.63, and was estimated to be about 0.05 pH lower than it should have been to make the color match perfect. Hence 8.68 is the estimated midpoint at the laboratory temperature of about 20° C., and the dissociation constant, which we shall designate by K_o , is 2.09×10^{-9} .

OUTLINE OF POTENTIAL MEASUREMENTS.

It was shown in the second paper of this series (Clark and Cohen, 1923) that if pH is maintained constant the electrode equation reduces to the form

$$E_h = E'_o - \frac{RT}{nF} \ln \frac{[S_r]}{[S_o]} \quad (1)$$

We shall first describe experiments in which pH was maintained constant by means of buffer solutions with the maintenance of relatively low concentrations of reactants, and in which the ratio $\frac{[S_r]}{[S_o]}$ was varied—

1. By reducing the oxidant with Ti^{+++} ;
2. By reducing the oxidant with sulphide;
3. By reducing the oxidant with hydrosulphite;
4. By oxidizing the reductant with oxygenated water;
5. By mixing in different proportions equimolecular solutions of oxidant and of reductant.

These experiments permit the determination of n , and furnish values for E'_o characteristic of a given pH value.

Such experiments might be repeated at various pH values in order to find the variation of E'_o with pH. There are fewer sources of error if the ratio of reductant to oxidant is fixed and the same mixture is measured at different pH values. This is the procedure we shall depend upon to furnish the data necessary for placing the case in the proper classification outlined in the previous paper.

DETERMINATION OF "n."

Equation (1) in its numerical form for 30° C. may be written—

$$n = \frac{0.0601 \log \frac{[S_r]}{[S_o]}}{E'_o - E_h} \quad (2)$$

For the determination of n, we shall choose, from experiments made with equimolecular mixtures of oxidant and reductant, a case where the drifts of potential to be discussed later were notably absent, and where pH was known, with considerable precision, to have been constant.

In Table I are given in the first column the ratio of $\frac{[S_r]}{[S_o]}$, in the second column the observed E_h , in the third column E_h corrected to a dilution of common pH, in the fourth column E'_o (the value of E_h when $\frac{[S_r]}{[S_o]} = 1$). In the last columns are the values of n calculated by means of equation (2), first by using the value of E'_o given, and second by the solution of simultaneous equations and elimination of E'_o .

Similar values taken from the central portion of a titration curve made with titanium, ranged from 1.88 to 2.05, with an average of 1.95, the largest discrepancy being attributable to an error of only 0.00015 volt.

Since n must be a whole number, it is obviously 2.

TABLE I.—Determination of n.

$\frac{[S_r]}{[S_o]}$	E_h	$E_h \text{ cor.}$	E'_o	n	n (second method).
3/3.....	0.1675	0.1670	0.1670	.....	1.997
3/2.....	0.1624	0.1617	.....	1.996	2.009
3/4.....	0.1711	0.1707	.....	2.028	1.944
3/5.....	0.1740	0.1737	.....	1.989	
Average.....				2.004	1.983

In this result there is considerable significance. Among inorganic systems there occur cases where the reduction can take place in distinct steps involving but one electron to each step. In all the recent and more exact electrode measurements of the reduction of *organic* compounds, the value of n is apparently 2. Other values have yet to be revealed, experimentally.

One is tempted to dwell upon the contrast between this situation and that of acidic and basic dissociation, although there is danger

in forcing the analogy between oxidation-reduction systems and acid-base systems. Among acid-base systems we recall no instance in which two acidic or basic dissociations are exactly equal as measured by the dissociation constants. Not infrequently the constants are very nearly the same, yet even in extreme cases they are sufficiently unlike for their divergence to be revealed.

In subsequent papers we shall encounter instances in which the slopes of our reduction titration curves diverge slightly from the slope of an $n=2$ curve, and this may indicate stepwise reduction, with the steps closely overlapping. The preponderance of evidence is against this view and in favor of other reasons for the apparent divergence.

The fact that in many instances n is unequivocally 2 with no evidence of stepwise reduction, will have to be taken into consideration by those seeking the mechanism involved in the oxidation-reduction process. It is probable that the cause is associated with the quinoid structure of the oxidants rather than with any particular substance used as transference agent.

REDUCTION WITH Ti^{++} .

For the determination of the constant, E'_0 (equation (1)) occurring at a fixed value of $[\text{H}^+]$, it is required that $[\text{H}^+]$ shall be kept rigidly constant. This may be accomplished by keeping the reactants at low concentrations in *heavily buffered solution*. We believe that Clark (1920) was the first to practice this extensively. He employed titanous chloride as a reducing agent, kept the titanium from precipitating by means of a citrate solution, buffered the titanium citrate complex with the same buffer employed with the substance to be reduced, compensated for the acidity of the titanous chloride by adding alkali, and thus conducted the titration under approximately constant hydron concentration.

Obviously this is a complex procedure. The chief difficulty is in compensating for the "acidity" of the titanous chloride solution. An analytical determination of "free" acid and of total chloride is of no use, because the solution is often to be brought into a range of pH^4 where a buffer action by the titanous hydroxide is exerted. Moreover an examination of this effect in simple mixtures is of dubious value because so little is known of the effect of the citrate. The best we can do is to place dependence on the principle of isohydric solutions.

The titanous chloride solutions on the market have such very high concentrations of hydrochloric acid that it is out of the question to

⁴Conant, Hahn, Fieser, and Kurtz (1922) claim that they were the first to measure the potential of an organic reduction process over a wide range of pH . But compare Clark's studies on indigo sulphamate and methylene blue, *J. Wash. Acad. Sci.*, 10, 255, 1920.

employ them. To reduce the acid content, solid titanous chloride was prepared by the method of Polidori (1899). Into commercial "20 per cent" titanous chloride solution was passed a stream of dry HCl gas. The solution was meanwhile cooled. After some hours a crystalline deposit of the chloride formed. This was filtered on a platinum cone with a strong stream of CO_2 impinging. It was quickly transferred to a porous plate and placed in a desiccator over sticks of KOH.⁵ After several days it was quickly transferred to small vials, flooded with CO_2 and stoppered with paraffined corks.

In Tables II, III, and IV are data obtained in the titration of 0.002 M 1-naphthol-2-sulphonate indophenol with titanium solution.

In the first two cases, approximately 3.5 gram $\text{TiCl}_3 \cdot 6\text{H}_2\text{O}$ crystals were added to 200 c. c. O_2 -free M/5 citric acid. An endpoint titration against a known weight of 1-naphthol-2-sodium sulphonate indophenol showed that the titanium solution was about 0.06 normal. Five c. c. of the M/5 citric acid took 8.70 c. c. standard alkali, and 5 c. c. citric acid-titanium solution after oxidation with H_2O_2 , took 12.89 c. c. standard alkali to match (colorimetrically) the buffer to which the dye was to be added. Hence 4.19 c. c. standard alkali were required to balance the effect of the titanium salt. With these data at hand the following mixture was made: 500 c. c. M/5 Na_2HPO_4 + 83.8 c. c. standard NaOH + 317 c. c. water. To this mixture, after removal of oxygen, was added 100 c. c. of the titanium-citric acid mixture.

Since such titanium solutions are unstable, they were made fresh before each set of measurements.

For solution of the dye, there was prepared a buffer solution identical with that of the titanium solution, with the exception of the titanium and compensation alkali.

It was assumed that by this procedure the pH could be considered constant throughout the titration and that the correct pH could be estimated from a hydrogen electrode measurement of the buffer containing neither oxidant nor reductant. Within certain limits this procedure is legitimate, but several minor sources of error remain.

La Mer and Baker (1922), who used the method of titanium reduction, made corrections for changes in hydrion concentration due to oxidation of the titanium. In our work we have considered this from the first, but have not applied any such correction because it appears to us uncertain in the regions of pH where a great deal of our work has been done. Furthermore, it is but one of several

⁵ An attempt to wash off adherent HCl solution by means of acetic anhydrid led to an action of explosive violence and the formation of a green powder. This was very deliquescent and rapidly oxidized in the air. Small quantities were transferred dry to tubes and sealed in an atmosphere of CO_2 . These samples gave very good reducing solutions. The substance was not studied in detail, but it is believed to be the anhydride of titanium trichloride

corrections which will have to be made if extremely exact measurements are to be reduced to a common standard of comparison.

The buffered dye solution in vessel A, Figure 1, was freed from oxygen and then titrated with the titanium solution. The amounts of titanium added up to each stage are shown in the first column of Table II. Under E_h are given the observed electrode potentials corrected to the hydrogen standard. The percentages reduction (second column) are calculated from the data of column 1, and the estimated end-point obtained with 32.8 c. c. The calculated values of $0.03006 \log \frac{[S_r]}{[S_o]}$ are next shown. From these and the corresponding E_h values are calculated E'_h .

Selecting the average E'_h value of +0.1218 as true, the deviations in each instance are shown. Also with this value as a point of

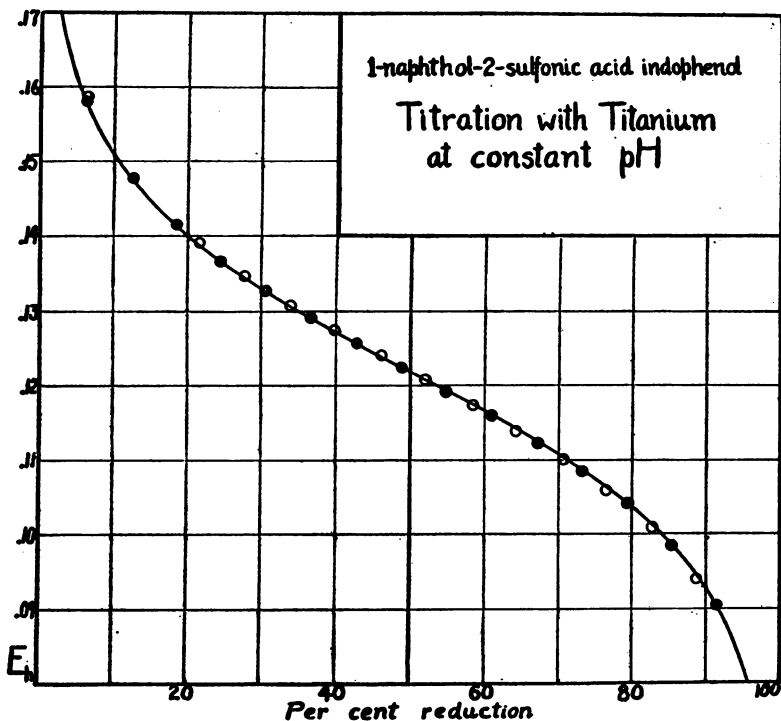


FIG. 4.—Relation between electrode potential and percentage reduction when pH is constant at 6.98.

reference, there can be calculated the "ideal" E_h values shown in the last column. These last values are plotted against percentage reduction and determine the curve shown in Figure 4. In this figure the E_h values of Table II are shown by the centers of the dots. The centers of the circles in the figure are the E_h values taken from the duplicate experiment for which the data are given in Table III.

It will be perceived that slight errors in estimating the end-point of a titration, or the presence of a titratable impurity which will give an asymmetry to the experimental curve, will have the greatest effect near one or the other extreme of the curve. E'_0 values obtained with data taken near the mid point are therefore safest. La Mer and Baker (1922) have well illustrated this by their Figure 1.

In Table IV are given the data obtained in an alkaline region.

TABLE II.—Reduction of buffered 1-naphthol-2-sulphonate indophenol with buffered titanium solution.

[pH=6.98.]

Ti ⁺⁺⁺ c. c.	Reduction.	$\frac{RT}{2F} \log \frac{[S_1]}{[S_0]}$	E_h (observed).	E'_0	Deviation.	E_h ideal.
	<i>Per cent.</i>					
0.....	0		+0.287			
2.....	6.10	-0.0357	+0.1581	(0.1224)	+0.0008	0.1575
4.....	12.20	-0.0258	+0.1479	.1221	+0.0003	.1476
6.....	18.29	-0.0195	+0.1415	.1220	+0.0002	.1413
8.....	24.39	-0.0143	+0.1368	.1220	+0.0002	.1366
10.....	30.49	-0.0107	+0.1327	.1220	+0.0002	.1325
12.....	36.57	-0.0072	+0.1292	.1220	+0.0002	.1290
14.....	42.67	-0.0038	+0.1256	.1218	.0000	.1256
16.....	48.78	-0.0005	+0.1224	.1218	.0000	.1224
18.....	54.88	+0.0025	+0.1192	.1218	.0000	.1192
20.....	60.98	+0.0058	+0.1159	.1217	-0.0001	.1160
22.....	67.08	+0.0093	+0.1124	.1217	-0.0001	.1125
24.....	73.17	+0.0131	+0.1085	.1216	-0.0002	.1087
26.....	79.27	+0.0175	+0.1041	.1216	-0.0002	.1043
28.....	85.36	+0.0230	+0.0985	.1215	-0.0003	.0988
30.....	91.46	+0.0310	+0.0905	.1215	-0.0003	.0908
32.8.....	100.00		+0.036			
Average E'_0				+0.1218		
Hydrogen electrode π_h				-0.4196		
Difference.....				0.5414		

TABLE III.—Reduction of buffered 1-naphthol-2-sulphonate indophenol with buffered titanium solution.

[pH=6.98.]

Ti ⁺⁺⁺ c. c.	Reduction.	$\frac{RT}{2F} \log \frac{[S_1]}{[S_0]}$	E_h (observed).	E'_0	Deviation.	E_h ideal.
	<i>Per cent.</i>					
0.....			+0.396			
2.....	6.14	-0.0356	+0.1587	+(0.1231)	+0.0015	0.1574
7.....	21.47	-0.0169	+0.1393	+(0.1224)	+0.0008	.1387
9.....	27.62	-0.0126	+0.1343	+0.1222	+0.0004	.1344
11.....	33.74	-0.0088	+0.1308	+0.1220	+0.0002	.1306
13.....	39.88	-0.0054	+0.1274	+0.1220	+0.0001	.1272
15.....	46.03	-0.0021	+0.1240	+0.1219	+0.0001	.1239
17.....	52.15	+0.0011	+0.1206	+0.1217	-0.0001	.1207
19.....	58.28	+0.0044	+0.1174	+0.1218	.0000	.1174
21.....	64.42	+0.0077	+0.1133	+0.1215	-0.0003	.1141
23.....	70.56	+0.0114	+0.1101	+0.1215	-0.0003	.1104
25.....	76.69	+0.0155	+0.1059	+0.1214	-0.0004	.1063
27.....	82.82	+0.0205	+0.1009	+0.1214	-0.0004	.1013
29.....	88.96	+0.0272	+0.0940	+0.1212	-0.0006	.0946
32.6.....			+0.0531			
Average E'_0				+0.1218		
Hydrogen electrode π_h				-0.4196		
Difference.....				0.5414		

TABLE IV.—*Titration of buffered 1-naphthol-2-sulphonate indophenol with buffered titanium solution.*

[pH=8.90.]

Ti ⁺⁺⁺ c. c.	Reduction.	$\frac{RT}{2F} \log \frac{[S_2]}{[S_0]}$	E_h (observed).	E' .
	<i>Per cent.</i>			
0.....	0		+0.193	
2.5.....	8.47	-0.0311	+0.0367	(0.0056)
4.5.....	15.25	-0.0224	+0.0260	.0036
9.5.....	32.20	-0.0097	+0.0133	.0034
14.5.....	49.16	-0.0004	+0.0047	.0043
19.5.....	66.10	+0.0087	-0.0044	.0043
23.5.....	79.68	+0.0178	-0.0132	.0046
27.5.....	93.22	+0.0342	-0.0304	(0.0038)
29.5.....	100.00		-0.096	
Average E'				+0.0040
Hydrogen electrode π_h				-0.5351
Difference.....				0.5391

REDUCTION WITH SULPHIDE AND HYDROSULPHITE.

Neither of these reagents was found to be satisfactory at the pH value tried. Marked drifts of potential occurred, which, in the case of hydrosulphite, was traced to slow action of sulphite persisting after the first rapid action of the hydrosulphite. The values given in Tables V and VI are those found by rapid titration, and are probably somewhat more positive than the equilibrium values of the estimated stages of reduction.

TABLE V.—*Reduction of 1-naphthol-2-sulphonic acid indophenol with sulphide in borax buffer solution.*

[End point 14.1 c. c. pH about 9.15.]

Sulphide c. c.	Reduction.	$\frac{RT}{2F} \log \frac{[S_2]}{[S_0]}$	E_h (observed).	E' .
	<i>Per cent.</i>			
2.....	14.3	-0.023	+0.017	-0.006
4.....	28.4	-0.012	+0.005	-0.007
6.....	42.8	-0.004	-0.004	-0.008
8.....	57.1	+0.004	-0.013	-0.009
9.....	64.3	+0.008	-0.014	-0.006
10.....	71.4	+0.012	-0.019	-0.007
12.....	85.7	+0.023	-0.032	-0.009
Average E'				-0.007
Estimated hydrogen electrode π_h				-0.550
Difference.....				0.543

TABLE VI.—*Reduction of 1-naphthol-2-sulphonic acid indophenol with $Na_2S_2O_4$ in borax buffer solution.*

[End point 37.2 c. c. pH about 9.15.]

$Na_2S_2O_4$ c. c.	Reduction.	$\frac{RT}{2F} \log \frac{[S_2]}{[S_0]}$	E_h (observed).	E' .
	<i>Per cent.</i>			
5.....	13.4	-0.024	+0.020	-0.001
10.....	26.9	-0.013	+0.009	-0.004
15.....	40.3	-0.005	-0.001	-0.006
20.....	53.8	+0.002	-0.009	-0.007
25.....	67.2	+0.009	-0.013	-0.003
Average E'				-0.006
Estimated hydrogen electrode π_h				-0.553
Difference.....				0.544

OXIDATION WITH AERATED WATER.

To 50 c. c. oxygen-free buffer solution of pH 8.90 were added 5 c. c. of a 0.006 M solution of the dye which had been reduced with hydrogen in the presence of platinized asbestos, and had then been filtered clear.

The flow of nitrogen in the titration vessel was stopped. The tip of a burette was then brought below the surface of the solution, and while the solution was vigorously stirred, measured quantities of distilled water were added. This water had stood for several days in a wash bottle and was probably well aerated. Its temperature was approximately 22° C. Up to the addition of 42 c. c. of aerated water the potentials became constant fairly rapidly after each addition. From then on the attainment of constant potentials was very slow, and only an approximate end point was observed. The data are summarized in Table VII.

TABLE VII.—Oxidation of reduced 1-naphthol-2-sulphonate indophenol by aerated water.

[pH 9.30.]

Aerated water c. c.	Reduction.	$\frac{RT}{2F} \log \frac{[S_1]}{[S_2]}$	E_h (observed).	E'_{\circ}
	<i>Per cent.</i>			
0.....	0	.....	-0.120	.....
4.....	7.14	-0.0335	-0.0613	-0.0278
6.....	10.71	-0.0277	-0.0558	-0.0281
8.....	14.29	-0.0234	-0.0516	-0.0282
11.....	19.64	-0.0184	-0.0466	-0.0282
14.....	25.00	-0.0143	-0.0426	-0.0283
17.....	30.36	-0.0106	-0.0390	-0.0282
22.....	39.29	-0.0067	-0.0336	-0.0279
27.....	48.21	-0.0009	-0.0288	-0.0279
32.....	57.14	+0.0037	-0.0242	-0.0279
37.....	66.08	+0.0087	-0.0192	-0.0279
42.....	75.00	+0.0143	-0.0138	-0.0281
56.....	100	.....	.....	.....

Average E'_{\circ}	-0.0280
Hydrogen electrode π_h	-0.5590
Difference.....	0.5310

POTENTIALS OF MIXTURES OF REDUCTANT AND OXIDANT AT CONSTANT pH.

A 0.006 molecular solution of the dye was divided into two parts. One part was placed in an apparatus similar to that shown in Figure 3, and nitrogen was blown through the solution. This will be known as solution O. The other part was placed in C, Figure 3, completely reduced with hydrogen in the presence of platinized asbestos, and then transferred through the filter, D, to the previously exhausted reservoir, A. This solution will be known as solution R.

When 50 c. c. of buffer in vessel, A, Figure 1, had been freed from oxygen, measured quantities of solutions O and R were separately added.

In Table VIII are shown the results obtained when the buffer had the following composition:

250 c. c. M/5 KH_2PO_4 + 20 c. c. M/5 KOH + 230 c. c. M/5 KCl + 500 c. c. water.

The hydrogen electrode potentials of the dilutions were—

	Π_h	pH
50 c. c. buffer + 0 c. c. water—	0.3763	6.262
50 c. c. buffer + 5 c. c. water—	0.3774	6.279
50 c. c. buffer + 10 c. c. water—	0.3781	6.291

TABLE VIII.—Potentials of mixtures of oxidant and reductant added to 50 c. c. phosphate buffer pH of mixture=6.291.

Reductant c. c.	Oxidant c. c.	Time (minutes).	E_h .	E_h corrected to 50 per cent reduction= E'_{50} .	E'_{50} corrected to 10+50 dilution.
2.5.....	2.5	1 50	+0.1672 +0.1664	+0.1672 +0.1664	0.1657
2.5.....	2.5	2 52	+0.1675 +0.1661	+0.1675 +0.1661	0.1654
1.....	3	1 108	+0.1811 +0.1805	+0.1668 +0.1662	0.1653
3.....	3	108+21	+0.1658	+0.1658	.1653
2.5.....	1.5	1 204	+0.1599 +0.1596	+0.1666 +0.1663	0.1654
5.....	5	1 79	+0.1673 +0.1659	+0.1673 +0.1659	0.1659
5.....	5	1	+0.1675	+0.1675	
4.....	4	1 85	+0.1674 +0.1660	+0.1674 +0.1660	0.1657
4.....	5	85+3	+0.1687	+0.1658	0.1657
3.....	5	1 38	+0.1742 +0.1733	+0.1675 +0.1666	(0.1663)
Averages.....				+0.1672 0.1662	0.1656

It is uncertain what correction should be made for the effect of dilution. The hydrogen electrode potentials of the buffer-water mixtures can not be strictly compared with the buffer-dye mixtures. However, the corrections applied to bring the data to the basis of a 50 + 10 dilution are shown in the last column.

In almost every case there was a very puzzling drift, the characteristics of which are illustrated in Table IX.

TABLE IX.—Drift of potential of 2.5 c. c. R+2.5 c. c. O added to 50 c. c. buffer.

Time (minutes).	Potential.	Time (minutes).	Potential.
2.....	+0.1675	36.....	+0.1661
2.5.....	+0.1672	44.....	+0.1661
4.....	+0.1669	52.....	+0.1661
7.....	+0.1666	61.....	+0.16605
14.....	+0.1663	84.....	+0.1660
20.....	+0.1662	97.....	+0.16595
30.....	+0.16615	116.....	+0.16595

In almost every instance the curve relating time and potential fell slowly to a plateau; but in no instance did the drift to more negative potentials cease, even though it was not apparent for an hour or so. In two instances, the data of which we have arbitrarily rejected, the drift never paused upon a plateau, and in several instances there were two periods of apparent pause at levels somewhat farther apart than in the case given in Table IX. Under these circumstances it is difficult to judge what values to use. We have taken those of the most pronounced period of apparent constancy.

We have no conclusive proof of the cause of the drift. It can hardly be ascribed to an electrode phenomenon. Except for variations attributable to incomplete mixing and incomplete adjustment of electrodes during the first moments, there is a remarkable agreement among the potentials measured within the first minute of observation. Thereafter the mercury, gold-plated platinum, and burnt-on platinum electrodes, which were intercompared in this particular series of measurements, agreed almost perfectly. Since the direction of drift was always toward more negative values, it can not be accounted for by the leakage of air. If the reduction of R had been carried too far, or if R had retained active hydrogen, there might have been a slow adjustment to potentials more negative than those expected from the estimated ratios of R/O when R and O were mixed. But then there should not have been so good an agreement between calculated and observed potentials for different ratios of R and O; there should have been found a kink in the titration curve of the reductant, and there should have been no drift in the experiments described in the next section where O and R were mixed sometime previous to the introduction of the mixture to the electrode vessel.

We have not thoroughly investigated the liquid junction potential difference.

It will be recalled that the junction

Buffer | Sat. KCl

was formed some time before the introduction of the dye, and that the highest rate of drift occurs immediately after the introduction of the dye. Are we justified in neglecting the junction

Buffer | Buffer,
Dye-Mixture |

or is there a new problem involved in cases where reductant and oxidant were added at periods sufficiently far apart for the junction

Buffer | Buffer
Oxidant | Reductant

to be formed? No improvement was obtained in a single experiment where the junction

Buffer | Sat. KCl
Dye-Mixture |

was formed in an ungreased cock.

At the extremes of alkalinity and acidity used the drifts were of considerable magnitude, their extent in the course of one hour and one-half hour in the two cases being indicated by the spread of the connected dots shown in Figure 5. In the other instances no very definite correlation between rate or extent of drift and pH was found. However, it is known that acid solutions of 1-naphthol-2-sulphonate indophenol, like other indophenols, decompose rapidly and in all cases the direction of drift could be accounted for by the disappearance of oxidant. If this be the explanation, there could not have been extensive decomposition in the aqueous stock solutions preserved under nitrogen, because fairly good checks were obtained between measurements made 24 hours apart. Furthermore, the greatest rate of change appears directly after mixing the dye with the salt-rich buffer solutions. It therefore appears that salts accelerate whatever change is occurring, and that the cause of the drift is either an actual destruction of the oxidant or a slow alteration of its degree of activity or state of association when changed from plain aqueous solution to salt-rich buffer solutions. The data on absorption spectra being obtained by Walter C. Holmes are expected to reveal valuable information on this point.

In Table VIII eight experiments are listed, and initial as well as "plateau" values are given. In the last column are the values corrected both to a 50 per cent reduction standard, and to a dilution of 10 c. c. dye solution to 50 c. c. buffer. This last is for the purpose of establishing the E'_0 value at the same measured pH, the assumption being that dilution does not change the relative activities of oxidant and reductant.

A different lot of buffer solution gave the following data:

5 c. c. O + 5 c. c. R in 50 c. c. buffer, $E_h = +0.1693$

4 c. c. O + 6 c. c. R in 50 c. c. buffer, $E_h = +0.1642$

The last value corrected to 50 per cent reduction is $+0.1695$; average, $+0.1694$. The hydrogen electrode potential of 50 c. c. buffer + 10 c. c. water was -0.3743 (pH = 6.228).

In Table X are assembled the data obtained with different methods. Comment must be deferred until the influence of pH is more clearly established by the experiments described in the next section.

TABLE X.— E'_0 values at different constant pH values.

Method.	pH	E'_0	π_h	$E'_0 - \pi_h$
Titration of oxidant with Ti^{+++}	6.98	+0.1218	-0.4196	0.5414
Do.....	8.90	+0.0040	-0.5351	0.5391
Titration of oxidant with sulphide.....	9.15	-0.007	-0.550	0.543
Titration of oxidant with hydrosulphite.....	9.15	-0.006	-0.550	0.544
Titration of reductant with aerated water.....	9.30	-0.0280	-0.5590	0.5310
Mixtures of oxidant and reductant.....	6.291	+0.1656	-0.3781	0.5437
Do.....	6.228	+0.1694	-0.3743	0.5437

VARIATION OF POTENTIAL AT FIXED RATIO OF $\frac{[S_r]}{[S_o]}$ WITH ALTERATION
OF $[H^+]$

In this series of experiments no attempt was made to determine the percentage reduction. A fixed mixture of oxidant and reductant was added to buffer solutions of different pH, and in this manner the curve relating E_h to pH at a fixed value of $\frac{[S_r]}{[S_o]}$ was determined. The mixture contained approximately 50 per cent reductant and 50 per cent oxidant, and the total concentration was 0.006 molecular. This will be called solution A. Ten c. c. of A was added to 50 c. c. buffer and the potentials were measured. The pH in each case was considered to be identical with that of a mixture of 10 c. c. water and 50 c. c. buffer. As in the case of mixtures formed by separate addition of oxidant and reductant, drifts of potentials occurred. The values chosen are those of a period of apparent constancy.

TABLE XI.

Buffer solution.	τ_h	pH	E_h	E' .
250 c. c. M/5 KH Phthalate+150 c. c. M/5 KOH+100 c. c. M/5 KCl+500 c. c. H ₂ O.....	-0.3096	5.151	+0.2354	+0.2343
250 c. c. M/5 KH Phthalate+225 c. c. M/5 KOH+25 c. c. M/5 KCl+500 c. c. H ₂ O.....	-3603	5.995	+1842	+1.1831
250 c. c. M/5 KH ₂ PO ₄ +60 c. c. M/5 KOH+190 c. c. M/5 KCl+500 c. c. H ₂ O.....	-3743	6.228	+1705	+1.1694
250 c. c. M/5 KH ₂ PO ₄ +210 c. c. M/5 KOH+40 c. c. M/5 KCl+500 c. c. H ₂ O.....	-4520	7.520	+0.922	+0.0911
125 c. c. M/5 H ₃ BO ₃ +15 c. c. M/5 KOH+110 c. c. M/5 KCl+250 c. c. H ₂ O.....	-4856	8.080	+0.655	+0.0544
125 c. c. M/5 H ₃ BO ₃ +40 c. c. M/5 KOH+85 c. c. M/5 KCl+250 c. c. H ₂ O.....	-5223	8.690	+0.0181	+0.0170
125 c. c. M/5 H ₃ BO ₃ +80 c. c. M/5 KOH+45 c. c. M/5 KCl+250 c. c. H ₂ O.....	-5589	9.300	-0.0228	-0.0239
125 c. c. M/5 H ₃ BO ₃ +120 c. c. M/5 KOH+5 c. c. M/5 KCl+250 c. c. H ₂ O.....	-6125	10.191	-0.0754	-0.0765
125 c. c. M/5 KOH+100 c. c. M/5 KH ₂ PO ₄ +25 c. c. M/5 KCl+250 c. c. H ₂ O.....	-6605	10.990	-1.110	-1.1121
125 c. c. M/5 KOH+60 c. c. M/5 KH ₂ PO ₄ +65 c. c. M/5 KCl+250 c. c. H ₂ O.....	-7081	11.699	-1.392	-1.3933
125 c. c. M/5 KOH+0 c. c. M/5 KH ₂ PO ₄ +125 c. c. M/5 KCl+250 c. c. H ₂ O.....	-7270	12.096	-1.558	-1.569

TABLE XII.

Buffer solution.	τ_h	pH	E_h	E' .
250 c. c. M/5 KH Phthalate+250 c. c. M/5 KCl+500 c. c. H ₂ O.....	-0.2355	3.918	$\left\{ \begin{array}{l} +0.308 \\ +.300 \end{array} \right\}$	$\left\{ \begin{array}{l} (+0.310) \\ (+.302) \end{array} \right\}$
250 c. c. M/5 KH Phthalate+225 c. c. M/5 KOH+25 c. c. M/5 KCl+500 c. c. H ₂ O.....	-3603	5.995	+1819	+1.1836
250 c. c. M/5 KH ₂ PO ₄ +60 c. c. M/5 KOH+190 c. c. M/5 KCl+500 c. c. H ₂ O.....	-3743	6.228	+1677	+1.1694
250 c. c. M/5 KH ₂ PO ₄ +210 c. c. M/5 KOH+40 c. c. M/5 KCl+500 c. c. H ₂ O.....	-4188	6.919	+1.263	+1.280
125 c. c. M/5 H ₃ BO ₃ +40 c. c. M/5 KOH+85 c. c. M/5 KCl+250 c. c. H ₂ O.....	-5223	8.690	+0.0152	+0.0166
125 c. c. M/5 KOH+125 c. c. M/5 KCl+250 c. c. H ₂ O.....	-7270	12.096	$\left\{ \begin{array}{l} -.157 \\ -.162 \end{array} \right\}$	$\left\{ \begin{array}{l} (-.155) \\ (-.160) \end{array} \right\}$
125 c. c. M/5 KOH+125 c. c. H ₂ O.....	-7550	12.562	$\left\{ \begin{array}{l} -.166 \\ -.174 \end{array} \right\}$	$\left\{ \begin{array}{l} (-.164) \\ (-.172) \end{array} \right\}$

¹ Initial and half-hour values.

² Initial and 1 hour values.

In Tables XI and XII are two series of measurements. In each case the compositions of the stock buffer solutions are given in the first column and are followed by the hydrogen electrode potentials and corresponding pH values of a 50 c. c. buffer+10 c. c. water mixture. No attempt was made to prepare the buffers with exact reproducibility of pH, since dependence was placed upon hydrogen electrode measurements. Under E_h are the electrode potentials of

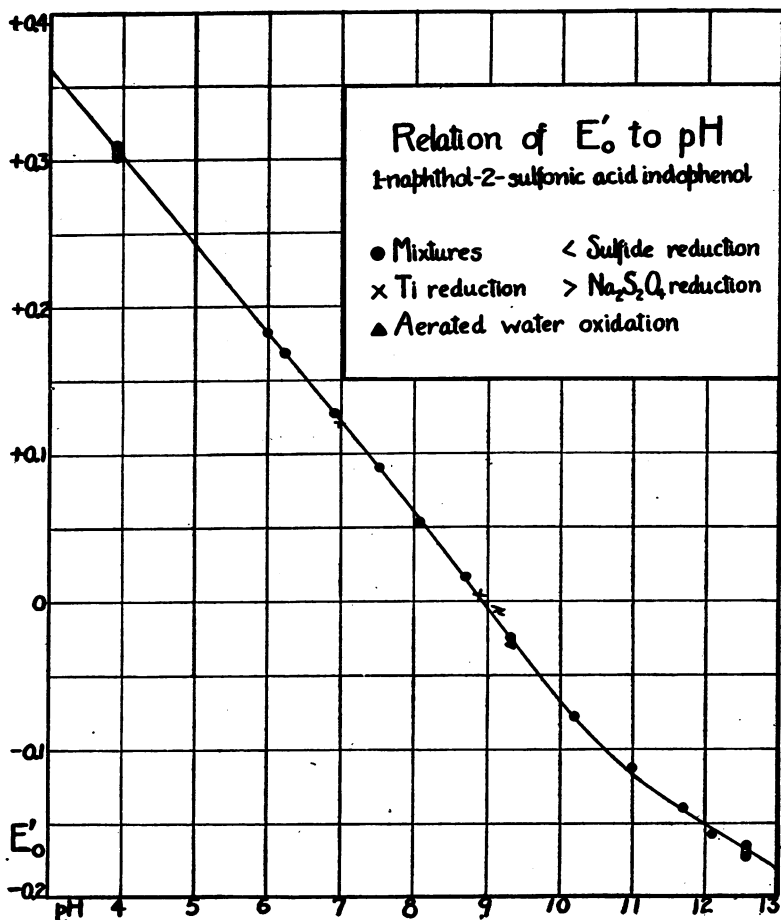


FIG. 5.—Relation between electrode potential and pH when total oxidant and total reductant are equimolecular.

50 c. c. buffer+10 c. c. partially reduced dye solution. These potentials can be corrected to the potentials of an equimolecular mixture of oxidant and reductant by the use of comparable data in Table X. The corrected values are given under E'_o . These E'_o values are assembled in the second column of Table XIII and are plotted in Figure 5 as dots. In the same figure, the data obtained by titanium, by sulphide, by hydrosulphite reductions and by aerated

water oxidation are indicated as described in the figure. Of these the data obtained with aerated water are not corrected to a known end point nor for the effect of dilution on pH. The sulphide and hydro-sulphite reductions are approximate only, and for reasons previously stated undoubtedly give too positive potentials. The data obtained with titanium suffer from difficulties in determining pH. In spite of these obvious errors all the data harmonize to the extent revealed in Figure 5.

TABLE XIII.—*Variation of E' with pH.*

pH.	E'_o (observed).	E'_o (calculated).	E'_o (calc.) — E'_o (obs).
3.918.....	(+0.306)	+0.308	—0.002
5.995.....	+ .1834	+ .1835	+ .0001
6.228.....	+ .1694	+ .1694	.0000
6.291.....	+ .1656	+ .1657	+ .0001
6.919.....	+ .1280	+ .1279	— .0001
7.52.....	+ .0911	+ .0914	+ .0003
8.080.....	+ .0544	+ .0564	+ .0020
8.690.....	+ .0170	+ .0162	— .0008
9.300.....	— .0239	— .0239	.0000
10.191.....	— .0765	— .0773	— .0008
10.990.....	— .1121	— .1151	— .0030
11.699.....	— .1393	— .1406	— .0013
12.095.....	— .1569	— .1531	+ .0038
12.56.....	(— .168)	— .168	.000

The continuous curve in Figure 5 was plotted by the aid of the electrode equation, which will now be developed.

ELECTRODE EQUATION.

So far as can be seen from the alignment of the experimental data as shown in Figure 5, the oxidation-reduction system under consideration might be placed under any one of several classifications.⁶ However, we may draw certain inferences from the chemistry of the compounds and shall apply them in the formulation of the electrode equation.

If it be granted that the structures shown on page 940 represent the oxidant and reductant, the case is clearly one falling under group D, class 2, of our classification. The equation for this case is

$$E_h = E_o - 0.03006 \log \frac{[S_r]}{[S_o]} + 0.03006 \log \left[K_{a_1} K_{a_2} K_w + K_{a_1} K_w [H^+] + K_w [H^+]^2 + K_b [H^+]^3 \right] \quad (3)$$

But in the experimental curve no value of $-\frac{dE_h}{dpH}$ greater than 0.06 and no zero values are observed. Consequently the basic dissociation constant and the acidic constant for the nitrogen are

⁶ See studies on oxidation-reduction. II. An analysis of the theoretical relation between reduction potentials and pH. Public Health Reports, 38, 666. (Reprint No. 826.)

negligible. By eliminating the terms where these occur, combining $0.03006 \log K_w$ with E_o and retaining this symbol for the assembled constants, we find equation (3) simplified to (4)

$$E_h = E_o - 0.03006 \log \frac{[S_r]}{[S_o]} + 0.03006 \log [K_{a1}[H^+] + [H^+]^2] \quad (4)$$

This would apply to the case at hand were there no distinct evidences of a displacement in the region pH 8 to pH 10. We may assume that the sulphonic-acid group is so strong that it is completely dissociated in the regions with which we are concerned. We already know from colorimetric measurements that the apparent acid dissociation constant of the phenolic group of the oxidant is 2.09×10^{-9} . Since the displacement of the curve in Figure 5 occurs in this region, it is reasonable to suppose that it is due to an alteration of the phenolic dissociation constant by the reduction at other points, and that we have here a specific instance of the possibility discussed in the second paper of this series, illustrated by Figure 8 of that paper. The maximum displacement along the pH coordinate is ordinarily determined by the difference between $\log 1/K_o$ and $\log 1/K_r$, K_o referring to the same group in the oxidant to which K_r refers in the reductant.

We shall let K_2 designate the dissociation constant of the second phenolic group created by reduction. Ordinarily this would be determined by the intersection of extensions of the curves, the $-\frac{dE_h}{dpH}$ values of which are 0.03 and 0.06; but in this case K_r and K_2 are so close that the displacement of the 0.06 curve cannot reach its maximum. This affects the graphic estimation of both K_r and K_2 , however, only in its refinement. An approach by "trial and error" was used. We estimate tentative values to be—

$K_o = 2.09 \times 10^{-9}$ by colorimetric measurement;

$K_r = 9.01 \times 10^{-10}$ by correction of displacement value;

$K_2 = 2.00 \times 10^{-11}$ by correction of intersection value.

Following the development outlined in the second paper, eliminating constants of negligible magnitude and retaining the three constants discussed, we reach the following equation:

$$E_h = 0.5440 - 0.03006 \log \frac{[S_r]}{[S_o]} + 0.03006 \log$$

$$[K_r K_2 [H^+] + K_r [H^+]^2 + [H^+]^3] - 0.03006 \log [K_o + [H^+]] \quad (5)$$

With equation (5) and the values of K_o , K_r , and K_2 , given above, we derive the calculated values given in the column headed "E' (calculated)," of Table XIII.

E_o is then +0.5440.

Realizing the uncertainties of measurements at the extremes of acidity and alkalinity, and the somewhat arbitrary manner in which we selected values from a very slow drift, we were surprised to find the calculated and observed values to agree as well as they do.

By means of equations given in the last paper, it can be calculated that the *hypothetical* hydrogen and oxygen pressures in equilibrium with a solution of the dye which has been 50 per cent reduced, are $10^{-17.99}$ and $10^{-45.64}$, respectively,

Within the ordinary physiological range of pH there may be used the proximate equation for 30° C.:

$$E_h = 0.544 - 0.03 \log \frac{[S_r]}{[S_o]} - 0.0601 \text{ pH} \quad (6)$$

When $\frac{[S_r]}{[S_o]} = 1$, $E_h = 0.544 - 0.0601 \text{ pH}$.

In colorimetric measurements it is easier to judge an 80 to 90 per cent reduction than a 50 per cent reduction. It is then convenient to remember that a solution between about pH 4 and pH 8, which has induced an 80 per cent to 90 per cent reduction of the dye, should furnish a reduction potential about 0.52 volt more positive than a hydrogen electrode in a solution of the same pH.

If the present data be compared with Clark's (1920) data on indigotine sulphonate and methylene blue, it will be found that 1-naphthol-2-sulphonate indophenol changes color with very much less reduction intensity than either of the other oxidation-reduction indicators. It will doubtless be found that in the majority of cases the slightest physiological reduction in the absence of oxygen-restoration will completely reduce 1-naphthol-2-sulphonate indophenol.

SUMMARY.

What is believed to be a new indophenol, namely, 1-naphthol-2-sodium sulphonate indophenol, has been synthesized.

Methods of studying the reduction potentials of this compound in equilibrium with its reduction product at different pH values of the solutions are described.

It has been found that the measurements at 30° C. conform fairly well with the equation

$$E_h = 0.5440 - 0.03006 \log \frac{[S_r]}{[S_o]} + 0.03006 \log \left[K_r K_2 [H^+] + K_r [H^+]^2 + \dots + [H^+]^3 \right] - 0.03006 \log \left[K_o + [H^+] \right]$$

Where $[S_r]$ is the concentration of total reductant, $[S_o]$ is the concentration of total oxidant, K_r is the dissociation constant of that

phenolic group in the reductant which is possessed by the oxidant, K_o is the dissociation constant of this same group in the oxidant, and K_r is the dissociation constant of the phenolic group created by the reduction. It is estimated that—

$$K_o = 2.09 \times 10^{-9}$$

$$K_r = 8.01 \times 10^{-10}$$

$$K_s = 2.00 \times 10^{-11}$$

The hypothetical "normal potential" is +0.5440.

It is shown that an 80 to 90 per cent reduction of 1-naphthol-2-sulphonate indophenol within the ordinary physiological range of pH indicates a reduction potential about 0.52 volt more positive than the hypothetical hydrogen electrode potential of the solution, and it is suggested that the reduction of this dye should indicate minute degrees of physiological reduction.

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POPULATION CHANGES IN THE UNITED STATES, 1910-1920.

Bureau of the Census Analyzes Changes in the Composition and Residence of the Population.

The Bureau of the Census, Department of Commerce, is beginning a new series of publications, *Census Monographs*, designed to interpret adequately in somewhat popular form, some of the important subjects covered by the census inquiries. The first of these publications (*Census Monograph No. 1*, "Increase in the Population

of the United States, 1910-1920"), which has just been issued, is a study of the changes in the population of divisions, States, counties, and rural and urban areas, and in sex, color, and nativity, at the Fourteenth Census (1920). The following excerpts are taken from this monograph.

REPLACEMENT AND INCREASE.

The purpose of this monograph is primarily to describe the location and group characteristics of men, women, and children who composed the increase which took place from 1910 to 1920 in the population of the United States. This increase was 13,738,354 and represented the excess of inhabitants in the Nation enumerated by the Fourteenth Census, 1920, over the number enumerated at the Thirteenth Census, 1910. Clearly enough, these persons were not in existence or not in the United States April 15, 1910, the enumeration date of the Thirteenth Census. This increment, however, represented but approximately one-half of the actual change which took place in the American people. The population of the United States at the Thirteenth Census was 91,972,266. How many of these persons were again enumerated at the Fourteenth Census, 1920? The answer to this question proves exceedingly interesting, since "increase of population" is commonly considered to represent merely the excess shown at a given enumeration over the last preceding enumeration.

Between the taking of the Thirteenth Census and that of the Fourteenth, a scant 10 years (April 15, 1910, to January 1, 1920) elapsed. During that period the estimated number of deaths of persons enumerated in 1910 was 11,240,000, hence the survivors of the Thirteenth Census available for enumeration at the Fourteenth Census, if in the United States, numbered only 80,730,000 on January 1, 1920. Not all these persons, however, were in this country on that date.

The decade was unusual for the great number of departures of aliens and foreign-born and native-born citizens to take part in the World War or to participate in hospital or other activities connected with it. The number of survivors in 1920 of the emigrants who left the United States between 1910 and 1920 has been estimated at 2,280,000. Hence, the survivors in this country of the Thirteenth Census, as previously specified, were further reduced by that number, leaving 78,450,000. Therefore, instead of there being some 90,000,000 persons to enumerate again, together with the normal decennial increase, as might be supposed, the number of persons to be counted at the Fourteenth Census who had been counted before at least once did not greatly exceed the population enumerated 20 years before, 76,000,000.

It remained for the Nation, when the count was made in 1920, to have made good by births and by immigration, first, the shrinkage noted from the population returned at the previous census, and second, having replaced the losses, to supply additional numbers to represent a normal increase over the total shown 10 years before.

The replacement and increase were accomplished about as follows:

Natives under 5 years of age, 1920.....	11,528,000
Natives from 5 to 9 years of age, inclusive, 1920.....	11,228,000
Total natives under 10 years of age.....	22,756,000
Survivors of natives born between Jan. 1 and Apr. 15, 1910.....	630,000
Surviving natives born since Apr. 15, 1910.....	22,126,000
Surviving immigrants.....	5,345,000
Total additions (stated as a multiple of 10,000).....	27,470,000
Survivors of the Thirteenth Census.....	78,450,000
Estimated population, 1920.....	105,920,000

The close similarity between the total thus estimated and the number actually enumerated at the Fourteenth Census (105,710,620) constitutes credible evidence of the substantial completeness of the Fourteenth Census enumeration.

INCREASE IN URBAN POPULATION.

Until 1900 the flow of population was mainly westward. From that census it appeared that the current had slackened, and changes of population became more dependent upon isolated developments in different sections of the country, such as irrigation, the settlement of Oklahoma, orcharding in the far Northwest, and the mining and oil discoveries of the Southwest. The Central States and the South grew in industrial importance. The eddies and currents of population tended increasingly to follow changing industrial development. This naturally led to an accelerated increase in urban population. It remained for the decade under consideration to record an aggregate population in the 68 cities of 100,000 inhabitants and over, so great that they comprised more than one-quarter of the entire population of the United States. This tendency has, as suggested, kept pace with the industrial development—in fact, has been guided largely by it. But the tendency of the American people to concentrate in cities was stimulated by the war, and economically is probably the most important development indicated by the Fourteenth Census.

ONE-THIRD OF ALL COUNTIES DECLINED IN POPULATION.

At the census of 1920 the 2,000 counties which increased in population for the most part included either large cities, industrial areas, active mining developments, or rich agricultural regions, the products

of which continued to prove profitable or lent themselves to organized marketing or specialization.

On the other hand, more than 1,000 counties declined in population. They either were distinctly rural or had not natural resources capable of affording the particular profits encouraged by war operations. So it came about that from 900,000 square miles many thousands of citizens departed and flocked into the remaining 2,000,000 square miles to contribute their numbers and initiative toward further increasing the prosperity of already prosperous areas.

REVOLUTIONARY STOCK INCREASING.

The 47,330,000 estimated as representing the amount of native white stock in 1920 may be considered as the number of white persons who would have been enumerated in that year had there been no immigration nor emigration since 1790 and if, nevertheless, the rate of natural increase had been what, historically, it appears to have been. The total number descended, in whole or in part, from white persons enumerated in 1790 was, of course, considerably larger because of the intermingling of native and foreign stock.

* * *

The importance of this computation as to the present theoretical strength of the descendants of the original stock is found in the fact that it appears to be evident that this blood strain in the population is not disappearing, but is increasing at a reasonable and rather normal rate, ranging somewhere between 10 and 12 per cent, an increase contributed by different parts of the country in widely varying percentages.

PROPORTIONATELY MORE SINGLE WOMEN NOW THAN IN COLONIAL TIMES.

A century or more ago practically no women were employed in gainful callings outside of domestic service. Marriage and maternity commonly were accepted as the woman's natural sphere of responsibility and activity in life. Clearly the possession, were they obtainable, of reasonably reliable statistics showing, for some early period, the proportions married and widowed among adult women would prove of great value, because it would permit comparison of our own exceptional period with one reflecting those social conditions which prevailed prior to the so-called industrial revolution. Is such a comparison impossible? Are the exact proportions, during the colonial period of American history, of women single, married, and widowed among adult females of that period past finding out in our time? Fortunately there exists one colonial enumeration which throws some light upon this subject.

The royal governors of the British North American colonies, from 1635 to 1775, made, in all, 30 counts, or more ambitious enumerations, of population. A variety of statistical information, in addition to the mere count of inhabitants, was recorded at many of these enumerations. In but three, however, do any facts relating to marriage appear—in the colonial censuses of New Hampshire taken in 1767 and 1773 and in the Connecticut census of 1774. The Connecticut census gives the number of each sex married "under 20," "from 20 to 70," and "over 70," but ignores widows. Fortunately, the New Hampshire colonial enumerations furnish practically all the information desired to set up what appears to be a reasonably accurate marriage rate for females as it existed a century and a half ago. * * *

* * * A direct comparison between the New Hampshire census and the 1920 figures is perhaps best obtained, however, by using the native white group for 1920, since the total population includes the negro and the foreign-born elements, both of which groups introduce new factors into the problem. Making the comparison in this manner, if the proportion had been the same for the United States in 1920 as for New Hampshire in 1773, the number of unmarried native white women in the country would have been a million less than that shown by the census returns. This increase in the proportion single is presumably due to the increased opportunities for self-support, as suggested before, and to the change in the social status of the unmarried woman.

NEGRO INCREASE.

In 1920 the Negro population of the United States numbered 10,463,131. This represented a 10-year increase of 635,000, or 6.5 per cent, the lowest thus far recorded. In consequence of this slow numerical progress, the proportion formed by Negroes in the total population declined from 10.7 per cent in 1910 to 9.9 per cent in 1920. The highest proportion, 19.3 per cent, was recorded in 1790. One hundred and thirty years later, at the census of 1920, the proportion had shrunk to slightly more than half its original size. At the census of 1810, Negroes showed the greatest percentage of increase, 37.5, derived from a numerical increase of 375,000, or more than one-half that recorded 110 years later. The decennial increases from 1850 to 1910 ranged from 765,000 to double that number, and thus the increase for 1910 to 1920 was lower than for any previous decade since 1840. The Negro increase was greater at each of the last two censuses before emancipation than at a census taken more than half a century after that event. * * *

In his analysis of the census returns for 1920, in so far as they relate to the Negro population, Prof. Walter F. Wilcox, of Cornell University reaches the following conclusions:

In every one of the Northern States Negro deaths outnumber births; in the Southern States, in general, the conditions are reversed.

The difference between city and country is at least as influential upon race increase as the difference between South and North, which in this case closely parallels it. Throughout the North and in the cities of the South, Negro deaths are more numerous than Negro births; in fact, southern cities are even more unfavorable than those of the North to natural increase.

INDIAN STOCK MERGING INTO NATIONAL POPULATION AND DECLINING IN NUMBERS.

The North American Indian seems to be slowly merging into the national population, or, where this is not occurring, to be declining in numbers.

The inference from the changes here noted is that the extinction of the North American Indian at no distant date, which so long has been confidently predicted, has been averted by increasing intermarriage; and that while possibly Indian tribal relations and customs may disappear, a considerable strain of Indian blood will remain, especially in the 13 States having an appreciable Indian population in 1920, where the reservation system continues to make segregation possible.

JAPANESE IN CONTINENTAL UNITED STATES AND HAWAII.

Immigration from Japan is restricted, but the influx of persons of this nationality has not suffered an absolute check; so that, as the number in the country is small, the percentage of growth has been high.

The Japanese in the United States in 1880 numbered only 148, but in 1920, had increased to more than 100,000. The increase from 1910 to 1920 was 54 per cent, which was the lowest rate for any decade during which the Japanese have been coming to the United States, the lowest rate for any previous decade (1900-1910) having been about 200 per cent. It should be observed, however, that if Japanese women alone were considered, the increase during the 10 years from 1910 to 1920 would be over 300 per cent. In 1910, 57.3 per cent of the Japanese in the United States resided in California, but in 1920 this proportion had increased to 64.8 per cent.

Obviously the Japanese were not attracted either to Hawaii, then an independent kingdom, or to the United States as early as 1880. But by 1890 Hawaii had apparently been discovered as a desirable country to which to emigrate, and in that year also the first suggestion of emigration to the United States appeared. During the following decade occurred the heaviest movement of Japanese to Hawaii,

together with a marked increase in the number coming to the United States.

Thereafter appears a rather interesting equalization of numbers. Immigration of Japanese to Hawaii slackened from 1900 to 1910, the increase in Japanese population for the 10 years amounting to less than 20,000, as against nearly 50,000 for the preceding decade; but the number coming to this country was so great that the total Japanese population of continental United States in 1910 tended to approach the number in the territory of Hawaii. In 1920 the increase shown for continental United States was considerably greater than that for Hawaii, and for the first time the number of Japanese in continental United States slightly exceeded that in the island Territory.

Increase in number of Japanese in Continental United States and Hawaii, 1880 1920.¹

Year.	Continental United States.	Hawaii.
1880.....	148	86
1890.....	2,039	12,360
1900.....	24,326	61,111
1910.....	72,157	79,675
1920.....	111,010	109,274

¹ Figures include the American-born (or Hawaiian-born) descendants of Japanese immigrants. The figures for Hawaii for 1880 and 1890 are taken from reports published by the (then) Hawaiian Government.

SCHOOL DENTAL CLINIC AT TRONDHJEM, NORWAY.

The results of an interesting and successful experiment in dental hygiene, as demonstrated by the dental clinic of the public schools at Trondhjem, Norway, are set forth in a recent report by Dr. Otto Ottesen, who states that this clinic has been in operation for 13 years, having begun with the entering first-grade class in 1910. Each year since that date, the new first-grade class was examined and treated, and the treatment begun with the first grades in earlier years was continued. At the time of the report all of the eight grades of the public schools were under treatment.

The school children are called in for examination and treatment once each year; and unless a child brings a certificate from a private dentist stating that dental treatment has been completed, examination and treatment at the public-school dental clinic are obligatory.

The total population of Trondhjem in 1922 was 55,500. There were 7,326 children between the ages of 8 and 15 in the public schools, and 1,169 children of this same age group in other schools. The report states that all of these children appeared at the clinic; 98 per cent came for treatment, only 2 per cent having taken private treatment.

Doctor Ottesen states that after 13 years of operation of the clinic very definite and tangible results of this work are apparent. Not only has there been an improvement in dental conditions, but reports from the public health officer and the school physicians show that the general health of the children has been improved.

The school authorities are taking an active interest in the clinic, for they have discovered that it is one means of greatly reducing absenteeism. During 1922 the improvement was marked; only 65 per cent of the 98 per cent of the school children presenting themselves for treatment were actually in need of treatment.

The clinic is open every forenoon during the school year. The services performed by the clinic are gratis. The cost per child has ranged from 2 to 7 kroner (shillings) a year. This increase in the per capita cost, it was stated, has been brought about by the general rise in prices.

POLITICS AND PUBLIC HEALTH.

The following extract is taken from the Health News Service of April 21, 1923, issued by the State Department of Health of New York:

"The city of Savannah, Ga., wants a new health officer. The position carries a salary of \$4,800 a year. An automobile is furnished for official business. Like other city officers, Savannah's health commissioner is entitled to retire on a pension after a certain term of service. * * * But most notable of all, to our way of thinking, in Savannah's straightforward advertisement of its needs, is the ringing declaration, '*The city of Savannah guarantees the position of health officer free from political interference.*'"

"Here is a heartening symptom of a notable advance in the interests of public health in America. When the spacious and lovable city of Savannah feels moved, perhaps even obliged, to put a guaranty of that kind into its call for a health officer, something has happened in this country and we are now at a point where recently we were not. The incident must be symptomatic. If this spirit exists in one of our cities, it must exist in others. Perhaps it is not too much to hope that we are entering an era in which enlightened communities are already beginning to realize that the cost of political muddling in public health is paid, not merely with the dollars of the taxpayers, but with their lives."

It may be added that the United States Public Health Service has been asked to conduct the examinations for the candidates. The selection will be made by the city health officials.

DEATHS DURING WEEK ENDED APRIL 21, 1923.

Summary of information received by telegraph from industrial insurance companies for week ended April 21, 1923, and corresponding week of 1922. (From the Weekly Health Index, April 24, 1923, issued by the Bureau of the Census, Department of Commerce.)

	Week ended Apr. 21, 1923.	Corresponding week, 1922.
Policies in force.....	52, 209, 548	49, 049, 781
Number of death claims.....	11, 263	9, 872
Death claims per 1,000 policies in force, annual rate.....	11.2	10.5

Deaths from all causes in certain large cities of the United States during the week ended April 21, 1923, infant mortality, annual death rate, and comparison with corresponding week of 1922. (From the Weekly Health Index, Apr. 24, 1923, issued by the Bureau of the Census, Department of Commerce.)

City.	Week ended Apr. 21, 1923.		Annual death rate per 1,000, corre- sponding week, 1922.	Deaths under 1 year.		Infant mor- tality rate, week ended Apr. 21, 1923. ²
	Total deaths.	Death rate. ¹		Week ended Apr. 21, 1923.	Corre- sponding week, 1922.	
Total.....	7,800	14.0	12.9	981	990	.....
Akron, Ohio.....	37	9.3	7.0	7	5	83
Albany, N. Y.....	40	17.8	14.8	3	4	66
Atlanta, Ga.....	81	18.9	14.0	5	8	.....
Baltimore, Md.....	243	16.4	13.8	34	24	100
Birmingham, Ala.....	54	14.4	10.1	9	6	.....
Boston, Mass.....	244	16.5	15.2	43	32	123
Bridgeport, Conn.....	37	13.4	11.6	8	5	111
Buffalo, N. Y.....	153	14.9	13.1	23	22	96
Cambridge, Mass.....	34	15.9	13.2	4	4	71
Camden, N. J.....	31	13.0	13.7	4	3	66
Chicago, Ill.....	719	13.0	12.7	90	119	.....
Cincinnati, Ohio.....	132	16.9	18.3	11	11	72
Cleveland, Ohio.....	193	11.3	10.0	24	34	66
Columbus, Ohio.....	84	16.8	12.3	9	3	94
Dallas, Tex.....	42	12.4	12.7	3	4	.....
Dayton, Ohio.....	44	13.9	12.9	4	3	66
Denver, Colo.....	69	13.2	13.6	4	6	.....
Detroit, Mich.....	294	15.4	11.2	52	41	104
Duluth, Minn.....	34	16.7	.....	3	.....	68
Erie, Pa.....	21	9.7	10.9	2	2	41
Fall River, Mass.....	26	11.2	15.5	6	5	85
Flint, Mich.....	20	8.8	.....	4	.....	79
Fort Worth, Tex.....	19	6.9	10.5	0	1	.....
Grand Rapids, Mich.....	47	16.8	11.6	7	3	110
Houston, Tex.....	32	10.8	13.9	6	5	.....
Indianapolis, Ind.....	114	17.3	13.4	10	11	77
Jacksonville, Fla.....	24	12.5	11.2	0	5	.....
Jersey City, N. J.....	71	12.0	14.7	11	12	74
Kansas City, Kans.....	37	16.7	12.4	6	6	137
Kansas City, Mo.....	111	16.5	16.7	9	18	.....
Los Angeles, Calif.....	195	15.2	15.7	23	24	86
Louisville, Ky.....	101	20.4	12.4	12	15	129
Lowell, Mass.....	40	18.1	13.7	9	8	156
Lynn, Mass.....	28	14.2	.....	2	.....	63
Memphis, Tenn.....	63	19.3	17.7	7	6	.....
Milwaukee, Wis.....	114	12.3	10.4	19	18	94
Minneapolis, Minn.....	99	12.6	10.3	13	7	71
Nashville, Tenn.....	58	25.0	14.3	3	6	.....
New Bedford, Mass.....	31	12.4	17.2	9	11	134
New Haven, Conn.....	44	13.3	14.4	7	6	91
New Orleans, La.....	121	15.6	15.8	12	19	.....
New York, N. Y.....	1,380	12.1	12.9	175	224	70
Bronx Borough.....	157	9.7	9.5	23	20	81
Brooklyn Borough.....	473	11.4	12.0	65	74	69
Manhattan Borough.....	417	14.2	15.6	73	120	71
Queens Borough.....	93	9.0	9.5	9	6	48
Richmond Borough.....	40	16.4	15.5	5	4	91

¹ Annual rate per 1,000 population.

² Deaths under 1 year per 1,000 births—an annual rate based on deaths under 1 year for the week and estimated births for 1922. Cities left blank are not in the registration area for births.

Deaths from all causes in certain large cities of the United States during the week ended April 21, 1923, infant mortality, annual death rate, and comparison with corresponding week of 1922—Continued.

City.	Week ended Apr. 21, 1923.		Annual death rate per 1,000, corre- sponding week, 1922.	Deaths under 1 year.		Infant mor- tality rate, week ended Apr. 21, 1923.
	Total deaths.	Death rate.		Week ended Apr. 21, 1923.	Corre- sponding week, 1922.	
Newark, N. J.	118	14.0	13.4	17	14	80
Norfolk, Va.	32	10.5	8.3	4	4	71
Oakland, Calif.	38	8.3	8.3	2	4	26
Omaha, Nebr.	55	14.0	18.2	4	5	43
Paterson, N. J.	36	13.4	15.1	6	3	96
Philadelphia, Pa.	563	15.3	12.2	65	63	84
Pittsburgh, Pa.	194	16.5	11.7	25	27	87
Portland, Oreg.	60	11.4	11.2	3	5	30
Providence, R. I.	70	15.1	12.8	4	5	33
Richmond, Va.	67	19.3	14.3	13	3	159
Rochester, N. Y.	97	15.9	10.9	11	9	87
St. Louis, Mo.	234	15.2	13.1	27	22	.....
St. Paul, Minn.	58	12.5	12.6	5	4	46
Salt Lake City, Utah.	35	14.5	6.3	3	2	49
San Antonio, Tex.	52	14.7	.....	8	.....	.....
San Francisco, Calif.	139	13.4	14.3	7	7	42
Seattle, Wash.	58	9.6	9.4	6	1	53
Spokane, Wash.	28	14.0	12.0	3	4	66
Springfield, Mass.	30	10.8	14.9	4	5	57
Syracuse, N. Y.	67	18.9	13.8	12	6	156
Tacoma, Wash.	21	10.8	.....	4	.....	100
Toledo, Ohio.	69	13.4	8.8	6	5	60
Trenton, N. J.	40	16.4	20.0	2	11	34
Washington, D. C.	163	19.4	16.7	26	14	149
Wilmington, Del.	33	14.6	11.7	8	6	163
Worcester, Mass.	52	14.1	11.9	11	8	124
Yonkers, N. Y.	30	14.5	11.9	3	7	65

Conference of State Health Officers with the Public Health Service for Considering Means of Protecting Water Supplies from Phenol Wastes.

A conference of State health officers and other State representatives from States in which the contamination of water supplies with phenol wastes is a public health problem, has been arranged for May 18, 1923, at Washington, D. C., at which time the subject will be discussed with representatives of the United States Public Health Service.

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 STATE SUMMARIES.

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

Reports for Week Ended April 28, 1923.

ALABAMA.		CALIFORNIA.	
	Cases.		Cases.
Chicken pox.....	24	Anthrax—Humboldt County.....	1
Diphtheria.....	15	Cerebrospinal meningitis—San Francisco....	1
Influenza.....	244	Diphtheria.....	133
Malaria.....	80	Influenza.....	73
Measles.....	1,113	Lethargic encephalitis—San Francisco.....	1
Mumps.....	7	Measles.....	1,022
Pellagra.....	15	Scarlet fever.....	147
Pneumonia.....	106	Smallpox.....	18
Rabies.....	1	Typhoid fever.....	5
Scarlet fever.....	10		
Smallpox.....	10	COLORADO.	
Tuberculosis.....	26	(Exclusive of Denver.)	
Typhoid fever.....	17	Chicken pox.....	17
Whooping cough.....	57	Diphtheria.....	23
		Impetigo contagiosa.....	1
		Influenza.....	8
		Measles.....	20
		Mumps.....	50
		Pneumonia.....	15
		Scarlet fever.....	39
		Smallpox.....	2
		Tuberculosis.....	15
		Typhoid fever.....	1
		Whooping cough.....	26
ARIZONA.		CONNECTICUT.	
	Cases.		Cases.
Chicken pox.....	3	Cerebrospinal meningitis.....	1
Diphtheria.....	2	Chicken pox.....	45
Measles.....	74	Diphtheria.....	48
Mumps.....	1	German measles.....	7
Pneumonia.....	1	Influenza.....	3
Scarlet fever.....	3	Lethargic encephalitis.....	2
Typhoid fever.....	2	Measles.....	249
Whooping cough.....	9	Mumps.....	45
		Paratyphoid fever.....	2
		Pneumonia (lobar).....	45
		Scarlet fever.....	76
		Smallpox.....	4
		Trachoma.....	1
		Tuberculosis (all forms).....	35
		Typhoid fever.....	6
		Whooping cough.....	72
ARKANSAS.			
	Cases.		
Cerebrospinal meningitis.....	1		
Chicken pox.....	24		
Diphtheria.....	5		
Influenza.....	58		
Malaria.....	24		
Measles.....	233		
Mumps.....	6		
Paratyphoid fever.....	1		
Pellagra.....	1		
Scarlet fever.....	1		
Smallpox.....	6		
Trachoma.....	1		
Tuberculosis.....	18		
Typhoid fever.....	4		
Whooping cough.....	54		

FLORIDA.		KANSAS.	
	Cases.		Cases.
Diphtheria.....	9	Chicken pox.....	56
Influenza.....	7	Diphtheria.....	43
Malaria.....	5	Influenza.....	5
Pneumonia.....	7	Lethargic encephalitis.....	2
Scarlet fever.....	2	Measles.....	587
Typhoid fever.....	22	Mumps.....	64
		Pneumonia.....	43
GEORGIA.		Scarlet fever.....	60
Chicken pox.....	12	Smallpox.....	23
Conjunctivitis (infectious).....	3	Tuberculosis.....	28
Dengue.....	10	Typhoid fever.....	4
Diphtheria.....	6	Whooping cough.....	60
Hookworm disease.....	3		
Influenza.....	59	LOUISIANA.	
Malaria.....	25	Cerebrospinal meningitis.....	2
Measles.....	187	Diphtheria.....	16
Mumps.....	20	Influenza.....	41
Pellagra.....	1	Poliomyelitis.....	1
Pneumonia.....	19	Scarlet fever.....	4
Scarlet fever.....	15	Smallpox.....	78
Smallpox.....	11	Typhoid fever.....	22
Tuberculosis (pulmonary).....	17		
Typhoid fever.....	2	MARYLAND. ¹	
Whooping cough.....	12	Chicken pox.....	86
		Diphtheria.....	41
ILLINOIS.		German measles.....	4
Cerebrospinal meningitis:		Influenza.....	36
Chicago.....	1	Malaria.....	4
Gallatin County.....	1	Measles.....	939
Diphtheria:		Mumps.....	60
Cook County (including Chicago).....	129	Pneumonia (all forms).....	137
Chicago.....	108	Scarlet fever.....	91
Scattering.....	41	Septic sore throat.....	2
Influenza.....	78	Smallpox.....	1
Lethargic encephalitis:		Tuberculosis.....	64
Cook County.....	1	Typhoid fever.....	8
Pneumonia.....	528	Whooping cough.....	150
Poliomyelitis:			
Cook County.....	1	MASSACHUSETTS. ¹	
Montgomery County.....	1	Cerebrospinal meningitis.....	2
Perry County.....	1	Chicken pox.....	169
Scarlet fever:		Conjunctivitis (suppurative).....	4
Cook County (including Chicago).....	104	Diphtheria.....	159
Chicago.....	83	German measles.....	32
Scattering.....	93	Influenza.....	16
Smallpox:		Lethargic encephalitis.....	4
Tazewell County.....	8	Malaria.....	1
Scattering.....	13	Measles.....	1,249
Typhoid fever.....	17	Mumps.....	244
Whooping cough.....	203	Ophthalmia neonatorum.....	15
		Pneumonia (lobar).....	103
INDIANA.		Poliomyelitis.....	4
Diphtheria.....	47	Scarlet fever.....	348
Influenza.....	6	Septic sore throat.....	3
Measles.....	1,345	Tetanus.....	1
Pneumonia.....	5	Trachoma.....	1
Scarlet fever.....	69	Trichinosis.....	1
Smallpox.....	83	Tuberculosis (all forms).....	146
Typhoid fever.....	2	Typhoid fever.....	12
		Whooping cough.....	381
IOWA.			
Diphtheria.....	19	MICHIGAN.	
Scarlet fever.....	109	Diphtheria.....	115
Smallpox.....	52	Measles.....	897
		Pneumonia.....	136

¹ Week ended Friday.

MICHIGAN—continued.		Cases.	NEW JERSEY—continued.		Cases.
Scarlet fever.....	262		Pneumonia.....	124	
Smallpox.....	27		Scarlet fever.....	166	
Tuberculosis.....	63		Typhoid fever.....	4	
Typhoid fever.....	6		Whooping cough.....	105	
Whooping cough.....	195				
MINNESOTA.			NEW MEXICO.		
Cerebrospinal meningitis.....	1		Chicken pox.....	20	
Chicken pox.....	10		Diphtheria.....	17	
Diphtheria.....	29		Influenza.....	2	
Influenza.....	3		Measles.....	15	
Lethargic encephallitis.....	2		Mumps.....	4	
Measles.....	851		Pneumonia.....	8	
Pneumonia.....	15		Scarlet fever.....	4	
Scarlet fever.....	115		Smallpox.....	12	
Smallpox.....	20		Tuberculosis.....	11	
Tuberculosis.....	112		Typhoid fever.....	5	
Typhoid fever.....	13		Whooping cough.....	8	
Whooping cough.....	22				
MISSISSIPPI.			NEW YORK.		
Diphtheria.....	7		(Exclusive of New York City and Buffalo.)		
Influenza.....	90		Diphtheria.....	67	
Scarlet fever.....	2		Influenza.....	27	
Smallpox.....	2		Lethargic encephalitis.....	3	
Typhoid fever.....	5		Measles.....	1,481	
			Pneumonia.....	230	
			Scarlet fever.....	261	
			Smallpox.....	2	
			Typhoid fever.....	14	
			Whooping cough.....	190	
MISSOURI.			NORTH CAROLINA.		
Chicken pox.....	69		Chicken pox.....	109	
Diphtheria.....	63		Diphtheria.....	24	
Epidemic sore throat.....	8		German measles.....	8	
Influenza.....	409		Measles.....	2,885	
Measles.....	1,926		Scarlet fever.....	24	
Mumps.....	35		Septic sore throat.....	1	
Pneumonia.....	11		Smallpox.....	113	
Scarlet fever.....	75		Typhoid fever.....	10	
Smallpox.....	7		Whooping cough.....	459	
Trachoma.....	8				
Tuberculosis.....	85				
Typhoid fever.....	13				
Whooping cough.....	83				
MONTANA.			OREGON.		
Diphtheria.....	18		Chicken pox.....	14	
Rocky Mountain spotted or tick fever:			Diphtheria.....	11	
Maudlin.....	1		Lethargic encephalitis—Wallowa County....	1	
Scarlet fever.....	11		Measles.....	3	
Smallpox.....	12		Mumps.....	3	
Typhoid fever.....	1		Pneumonia.....	18	
			Scarlet fever.....	13	
NEBRASKA.			Smallpox:		
Chicken pox.....	19		Baker.....	12	
Diphtheria.....	12		Portland.....	11	
Measles.....	33		Scattering.....	16	
Mumps.....	54		Tuberculosis.....	8	
Pneumonia.....	7		Typhoid fever.....	1	
Scarlet fever.....	31		Whooping cough.....	12	
Septic sore throat.....	1				
Typhoid fever.....	4				
Whooping cough.....	63				
NEW JERSEY.			SOUTH DAKOTA.		
Cerebrospinal meningitis.....	4		Chicken pox.....	4	
Chicken pox.....	169		Diphtheria.....	3	
Diphtheria.....	112		Mumps.....	4	
Influenza.....	15		Measles.....	11	
Measles.....	944		Pneumonia.....	13	
			Scarlet fever.....	23	
			Tuberculosis.....	1	
			Whooping cough.....	1	

Reports for Week Ended April 21, 1923.

DISTRICT OF COLUMBIA.		NORTH DAKOTA.	
	Cases.		Cases.
Chicken pox.....	23	Chicken pox.....	2
Diphtheria.....	10	Diphtheria.....	3
Influenza.....	4	Influenza.....	5
Measles.....	672	Measles.....	11
Scarlet fever.....	42	Pneumonia.....	6
Tuberculosis.....	28	Scarlet fever.....	20
Whooping cough.....	48	Smallpox.....	14
		Tuberculosis.....	3
		Typhoid fever.....	2
		Whooping cough.....	20

SUMMARY OF CASES REPORTED MONTHLY BY STATES.

The following summary of monthly State reports is published weekly and covers only those States from which reports are received during the current week.

State.	Cerebrospinal meningitis.	Diphtheria.	Influenza.	Malaria.	Measles.	Pellagra.	Polomyelitis.	Scarlet fever.	Smallpox.	Typhoid fever.
<i>January, 1923.</i>										
Wyoming.....	3	3	109	-----	2	-----	-----	35	6	-----
<i>February, 1923.</i>										
Wyoming.....	-----	5	49	-----	6	-----	-----	41	4	-----
<i>March, 1923</i>										
Arizona.....	1	8	-----	-----	7	-----	-----	28	22	1
California.....	11	629	1,651	6	2,867	3	1	803	84	27
Colorado.....	2	166	124	-----	200	-----	-----	236	12	5
District of Columbia.....	2	47	55	-----	1,398	-----	-----	125	1	3
Hawaii.....	3	14	27	-----	288	-----	1	3	-----	19
Illinois.....	25	1,032	1,737	26	6,604	-----	8	1,006	63	89
Indiana.....	-----	270	731	-----	1,543	-----	-----	344	149	13
Iowa.....	2	116	-----	-----	325	-----	1	500	69	2
Kansas.....	2	140	425	4	805	1	2	317	56	3
Mississippi.....	-----	80	8,133	3,230	4,893	209	2	13	6	58
North Dakota.....	-----	90	108	-----	49	-----	2	128	98	1
Oregon.....	-----	41	106	-----	9	-----	2	74	89	4
Pennsylvania.....	11	1,327	-----	-----	17,667	-----	5	1,674	12	72
South Carolina.....	5	63	605	2	170	1	-----	35	51	6
South Dakota.....	4	57	102	-----	87	-----	-----	204	26	2
Virginia.....	7	173	9,479	123	5,682	14	2	183	36	29
Washington.....	5	72	20	-----	38	-----	1	215	196	20
Wyoming.....	-----	3	25	-----	53	-----	-----	24	4	-----

CITY REPORTS FOR WEEK ENDED APRIL 14, 1923.

ANTHRAX.

City.	Cases.	Deaths.
California:		
Eureka.....	-----	1

CEREBROSPINAL MENINGITIS.

The column headed "Median for previous years" gives the median number of cases reported during the corresponding week of the years 1915 to 1922, inclusive. In instances in which data for the full eight years are incomplete, the median is that for the number of years for which information is available.

City.	Median for previous years.	Week ended Apr. 14, 1923.		City.	Median for previous years.	Week ended Apr. 14, 1923.	
		Cases.	Deaths.			Cases.	Deaths.
California:				Minnesota:			
Los Angeles.....	0	6	-----	Duluth.....	0	1	-----
San Bernardino.....	0	-----	1	Missouri:			
Connecticut:				St. Louis.....	2	1	1
Derby.....	0	-----	1	New Jersey:			
Illinois:				Newark.....	2	2	1
Chicago.....	3	4	2	New York:			
Rock Island.....	0	1	1	New York.....	7	3	2
Indiana:				Ohio:			
Indianapolis.....	0	1	1	Cincinnati.....	0	-----	1
Laporte.....	-----	1	1	Rhode Island:			
Maryland:				Providence.....	1	-----	1
Cumberland.....	0	1	1				
Massachusetts:							
Boston.....	1	-----	1				
Dedham.....	0	-----	1				
Southbridge.....	0	-----	1				

CITY REPORTS FOR WEEK ENDED APRIL 14, 1923—Continued.

DENGUE.

City.	Cases.	Deaths.
Alabama:		
Anniston.....	1	

DIPHTHERIA.

See p. 979; also Current State summaries, p. 968, and Monthly summaries by States, p. 972.

INFLUENZA.

City.	Cases.		Deaths, week ended Apr. 14, 1923.	City.	Cases.		Deaths, week ended Apr. 14, 1923.
	Week ended Apr. 15, 1922.	Week ended Apr. 14, 1923.			Week ended Apr. 15, 1922.	Week ended Apr. 14, 1923.	
Alabama:				Maine:			
Anniston.....		14		Bangor.....		2	
Birmingham.....		31	3	Biddeford.....			1
Mobile.....		5	1	Portland.....			1
Montgomery.....		1		Maryland:			
Tuscaloosa.....		1		Baltimore.....	21	22	6
Arkansas:				Cumberland.....	1	1	
Little Rock.....		5		Massachusetts:			
North Little Rock.....		1		Boston.....	7	5	1
California:				Braintree.....	1		
Bakersfield.....	1			Cambridge.....	1	1	
Los Angeles.....	16	22	1	Fall River.....	5	1	
Oakland.....	1	2	2	Lowell.....		1	
Riverside.....	1			Lynn.....	1	2	1
Sacramento.....		2		Malden.....			1
San Diego.....		8	2	North Adams.....			1
San Francisco.....	11	2	1	Pittsfield.....		1	1
Santa Barbara.....	2			Quincy.....	2	1	1
Stockton.....		5		Saugus.....	1		
Colorado:				Somerville.....	1	1	
Denver.....			2	Worcester.....			1
Connecticut:				Michigan:			
Bridgeport.....	2	3	2	Detroit.....	8	8	1
Hartford.....		3		Grand Rapids.....	1		
New Britain.....	3	2		Hamtramck.....		1	
New Haven.....	1			Highland Park.....	1		
Waterbury.....	1			Kalamazoo.....		3	2
District of Columbia:				Port Huron.....	1		
Washington.....	5	3	3	Sault Ste. Marie.....	4		
Florida:				Minnesota:			
Tampa.....	1		1	Hibbing.....	2		
Georgia:				Minneapolis.....			4
Atlanta.....	4	5		Rochester.....		1	1
Augusta.....	11			Virginia.....		1	
Rome.....	1	1		Missouri:			
Savannah.....			2	Kansas City.....	3	8	6
Illinois:				St. Joseph.....			1
Aurora.....		1		St. Louis.....	1		
Chicago.....	37	42	9	Montana:			
Decatur.....	2			Great Falls.....			1
East St. Louis.....			1	Helena.....			1
Springfield.....	1	2	2	Nevada:			
Indiana:				Reno.....	1		
Anderson.....			1	New Jersey:			
East Chicago.....			1	Bayonne.....		2	
Fort Wayne.....			1	Kearny.....	2	4	
Indianapolis.....			3	Long Branch.....		1	
La Fayette.....			1	Newark.....	14	7	
Terre Haute.....			2	Orange.....	1		
Kentucky:				Passaic.....			1
Louisville.....		1	2	Trenton.....			3
Louisiana:				West Orange.....		1	
Baton Rouge.....	4			New York:			
New Orleans.....	5	5	7	Albany.....	5		
				Buffalo.....	6		

CITY REPORTS FOR WEEK ENDED APRIL 14, 1923—Continued.

INFLUENZA—Continued.

City.	Cases.		Deaths, week ended Apr. 14, 1923.	City.	Cases.		Deaths, week ended Apr. 14, 1923.
	Week ended Apr. 15, 1922.	Week ended Apr. 14, 1923.			Week ended Apr. 15, 1922.	Week ended Apr. 14, 1923.	
New York—Continued.				South Carolina:			
Dunkirk.....		28	1	Charleston.....			1
Middletown.....		2		Greenville.....	6		
New York.....	42	69	20	Tennessee:			
Poughkeepsie.....	4			Memphis.....			5
Rochester.....			1	Nashville.....			6
Saratoga Springs.....	3			Texas:			
Schenectady.....		2	1	Dallas.....			4
North Carolina:				Fort Worth.....		2	2
Winston-Salem.....			1	Houston.....			1
Ohio:				San Antonio.....			1
Cambridge.....	1			Utah:			
Cincinnati.....			3	Salt Lake City.....			2
Cleveland.....	2		1	Vermont:			
Mansfield.....	2			Rutland.....			1
Newark.....			1	Virginia:			
Norwood.....	1			Charlottesville.....			1
Piqua.....	2			Lynchburg.....			1
Sandusky.....			1	Petersburg.....	1		
Springfield.....			1	Richmond.....			2
Toledo.....			1	West Virginia:			
Oregon:				Parkersburg.....			1
Portland.....	1	1	4	Wisconsin:			
Pennsylvania:				Eau Claire.....	3		
Philadelphia.....	9	19	21	Marinette.....			2
Rhode Island:				Milwaukee.....	2		
Providence.....			1				

LEPROSY.

City.	Cases.	Deaths.	City.	Cases.	Deaths.
California:			Illinois:		
Los Angeles.....	1		Chicago.....	1	
Florida:					
Key West.....		1			

LETHARGIC ENCEPHALITIS.

California:			Nebraska:		
San Francisco.....	1		Omaha.....	1	1
Kansas:			New York:		
Topeka.....	2	1	Little Falls.....	1	1

MALARIA.

Alabama:			New York:		
Birmingham.....	2		New York.....	4	
Mobile.....	2		North Carolina:		
Tuscaloosa.....	1		Rocky Mount.....		1
California:			Tennessee:		
Sacramento.....	1		Memphis.....	6	
Maryland:			Texas:		
Baltimore.....	1		Dallas.....		1

MEASLES.

See p. 979; also Current State summaries, p. 968, and Monthly summaries by States, p. 972.

CITY REPORTS FOR WEEK ENDED APRIL 14, 1923—Continued.

PELLAGRA.

City.	Cases.	Deaths.	City.	Cases.	Deaths.
Arkansas:			Massachusetts:		
North Little Rock.....	1	.....	Arlington.....	1	.....
Florida:			South Carolina:		
Tampa.....	.....	1	Charleston.....	.....	1
Georgia:			Columbia.....	.....	1
Atlanta.....	.....	1	Tennessee:		
Louisiana:			Memphis.....	.....	1
New Orleans.....	1	1			

PNEUMONIA (ALL FORMS).

Alabama:			Indiana:		
Anniston.....	12	.....	East Chicago.....	.....	5
Birmingham.....	.....	13	Fort Wayne.....	.....	1
Mobile.....	.....	1	Gary.....	.....	5
Montgomery.....	.....	4	Hammond.....	.....	3
Arkansas:			Indianapolis.....	.....	13
Little Rock.....	13	.....	Kokomo.....	.....	1
California:			La Fayette.....	.....	1
Alameda.....	1	.....	Mishawaka.....	.....	2
Bakersfield.....	.....	1	Muncie.....	.....	5
Eureka.....	1	.....	South Bend.....	.....	2
Long Beach.....	.....	4	Terre Haute.....	.....	1
Los Angeles.....	31	16	Iowa:		
Oakland.....	.....	4	Burlington.....	2	1
Pasadena.....	.....	1	Council Bluffs.....	.....	3
Riverside.....	.....	4	Muscatine.....	.....	1
Sacramento.....	3	2	Kansas:		
San Bernardino.....	.....	3	Coffeyville.....	1	.....
San Diego.....	.....	7	Kansas City.....	3	.....
San Francisco.....	14	7	Lawrence.....	.....	1
San Jose.....	1	.....	Parsons.....	.....	1
Santa Barbara.....	.....	1	Topeka.....	2	1
Stockton.....	3	1	Wichita.....	.....	2
Colorado:			Kentucky:		
Denver.....	.....	12	Covington.....	.....	2
Pueblo.....	.....	1	Louisville.....	.....	18
Connecticut:			Louisiana:		
Bridgeport.....	4	3	New Orleans.....	.....	13
Bristol.....	3	.....	Maine:		
Derby.....	.....	1	Bangor.....	1	.....
Fairfield.....	.....	1	Biddeford.....	.....	1
Hartford.....	.....	3	Lewiston.....	2	.....
New Britain.....	.....	2	Portland.....	.....	1
New Haven.....	.....	5	Sanford.....	.....	1
Stonington.....	1	.....	Maryland:		
District of Columbia:			Baltimore.....	91	38
Washington.....	.....	27	Cumberland.....	5	3
Florida:			Frederick.....	1	.....
St. Petersburg.....	.....	1	Massachusetts:		
Tampa.....	.....	1	Amesbury.....	.....	1
Georgia:			Attlebury.....	5	3
Albany.....	1	.....	Boston.....	38	27
Atlanta.....	14	13	Braintree.....	1	.....
Brunswick.....	1	.....	Brockton.....	2	.....
Rome.....	2	.....	Cambridge.....	.....	8
Savannah.....	.....	7	Chelsea.....	.....	4
Illinois:			Chicopee.....	.....	3
Alton.....	.....	1	Easthampton.....	2	.....
Aurora.....	5	1	Everett.....	2	.....
Bloomington.....	.....	2	Fall River.....	.....	7
Champaign.....	2	.....	Frammingham.....	.....	2
Chicago.....	388	127	Haverhill.....	.....	1
Cicero.....	5	2	Holyoke.....	4	2
Decatur.....	5	1	Leominster.....	.....	6
East St. Louis.....	.....	4	Lynn.....	.....	3
Elgin.....	4	.....	Malden.....	6	.....
Evanston.....	2	.....	Medford.....	.....	5
Forest Park.....	1	.....	Methuen.....	.....	1
Fresport.....	2	.....	Milford.....	.....	2
Galesburg.....	6	.....	New Bedford.....	.....	7
Kewanee.....	7	.....	Newton.....	.....	3
Oak Park.....	6	4	Northbridge.....	.....	1
Peoria.....	.....	5	Plymouth.....	.....	1
Quincy.....	2	.....	Quincy.....	.....	4
Rockford.....	.....	1	Salem.....	1	.....
Rock Island.....	.....	1	Somerville.....	6	1
Springfield.....	4	2	Springfield.....	6	2

CITY REPORTS FOR WEEK ENDED APRIL 14, 1923—Continued.

PNEUMONIA (ALL FORMS)—Continued.

City.	Cases.	Deaths.	City.	Cases.	Deaths.
Massachusetts—Continued.			New York—Continued.		
Taunton.....		1	Lackawanna.....	3	.....
Webster.....	1	.....	Lockport.....	3	1
West Springfield.....		1	Middletown.....	4	1
Westfield.....		1	Mount Vernon.....	1	.....
Woburn.....		1	New York.....	384	211
Worcester.....		1	Newburgh.....	7	2
Michigan:			Niagara Falls.....		5
Alpena.....		1	Port Chester.....	3	1
Ann Arbor.....	7	.....	Poughkeepsie.....	3	2
Battle Creek.....	2	.....	Rochester.....	21	9
Detroit.....	96	60	Rome.....	1	.....
Flint.....	6	5	Schenectady.....	6	2
Grand Rapids.....	8	2	Syracuse.....	27	8
Hamtramck.....		3	Troy.....	5	2
Highland Park.....	8	3	Watertown.....	5	3
Jackson.....		3	White Plains.....	3	.....
Kalamazoo.....		2	Yonkers.....		2
Muskegon.....	4	3	North Carolina:		
Pontiac.....	4	1	Durham.....		2
Port Huron.....		1	Greensboro.....		2
Minnesota:			Rocky Mount.....		1
Duluth.....	12	1	Wilmington.....		1
Hibbing.....	3	3	Winston-Salem.....		1
Minneapolis.....		3	Ohio:		
Rochester.....	1	.....	Akron.....	6	.....
St. Paul.....		13	Cincinnati.....		18
Missouri:			Cleveland.....	47	34
Kansas City.....	27	14	Cleveland Heights.....	1	.....
St. Joseph.....		2	Columbus.....		8
Springfield.....		1	Dayton.....	1	.....
Montana:			East Cleveland.....		1
Anaconda.....		1	East Youngstown.....		1
Great Falls.....		2	Fremont.....	1	.....
Helena.....		1	Mansfield.....	2	1
Missoula.....	2	.....	Martins Ferry.....		2
Nebraska:			Middletown.....	4	2
Lincoln.....	2	1	Newark.....		2
Omaha.....		11	Piqua.....	3	1
New Hampshire:			Sandusky.....		3
Concord.....		1	Springfield.....		6
Dover.....		1	Toledo.....		6
New Jersey:			Youngstown.....		7
Atlantic City.....		1	Zanesville.....		3
Bayonne.....	1	.....	Oklahoma:		
Belleville.....	1	.....	Oklahoma.....		1
Bloomfield.....	6	.....	Oregon:		
Clifton.....	1	.....	Portland.....		9
East Orange.....	4	2	Pennsylvania:		
Englewood.....		1	Philadelphia.....	119	91
Garfield.....	2	.....	Rhode Island:		
Harrison.....	3	.....	Cranston.....		1
Hoboken.....		1	Cumberland.....	1	.....
Jersey City.....	6	.....	Newport.....		1
Kearny.....	6	2	Pawtucket.....		4
Long Branch.....	2	1	Providence.....		12
Montclair.....	1	.....	South Carolina:		
Newark.....	52	9	Charleston.....		6
Orange.....	8	1	Columbia.....		2
Passaic.....	2	.....	South Dakota:		
Phillipsburg.....		2	Sioux Falls.....		1
Summit.....	1	.....	Tennessee:		
Trenton.....		12	Memphis.....		12
West Hoboken.....		1	Nashville.....		8
West New York.....		1	Texas:		
West Orange.....	1	.....	Amarillo.....	1	.....
New Mexico:			Austin.....		1
Albuquerque.....		1	Beaumont.....		2
New York:			Dallas.....		5
Albany.....	15	.....	Fort Worth.....		5
Amsterdam.....	1	.....	Houston.....		5
Buffalo.....	54	14	San Angelo.....		1
Dunkirk.....	1	.....	San Antonio.....		3
Elmira.....	8	2	Waco.....		3
Geneva.....		2	Utah:		
Glens Falls.....	1	.....	Salt Lake City.....		6
Hornell.....	1	.....	Virginia:		
Hudson.....		1	Lynchburg.....		2
Ithaca.....	6	1	Norfolk.....		5
Jamestown.....	4	1	Petersburg.....	3	1

CITY REPORTS FOR WEEK ENDED APRIL 14, 1923—Continued.

PNEUMONIA (ALL FORMS)—Continued.

City.	Cases.	Deaths.	City.	Cases.	Deaths.
Virginia—Continued.			Wisconsin:		
Portsmouth.....		3	Beloit.....	4	2
Richmond.....		9	Fond du Lac.....		2
West Virginia:			Kenosha.....		2
Fairmont.....	1		Madison.....		1
Huntington.....		3	Milwaukee.....	10	
Parkersburg.....		2	Oshkosh.....		4
Wheeling.....		3	Racine.....		3
			Superior.....		3

POLIOMYELITIS (INFANTILE PARALYSIS).

The column headed "Median for previous years" gives the median number of cases reported during the corresponding week of the years 1915 to 1922, inclusive. In instances in which data for the full eight years are incomplete, the median is that for the number of years for which information is available.

City.	Median for pre- vious years.	Week ended Apr. 14, 1923.		City.	Median for pre- vious years.	Week ended Apr. 14, 1923.	
		Cases.	Deaths.			Cases.	Deaths.
Georgia:				Michigan:			
Atlanta.....	0	1		Grand Rapids.....	0	1	1
Illinois:				Ohio:			
Chicago.....	0	1		Canton.....	0		1
Springfield.....	0	1		Youngstown.....	0	1	
Maryland:							
Baltimore.....	0	2					

RABIES IN ANIMALS.

City.	Cases.	City.	Cases.
California:		New Jersey:	
Los Angeles.....	12	Montclair.....	1
Pasadena.....	3	Tennessee:	
Kentucky:		Memphis.....	1
Louisville.....	1		
Missouri:			
Kansas City.....	3		

ROCKY MOUNTAIN SPOTTED OR TICK FEVER.

City.	Cases.	Deaths.
Montana:		
Helena.....	1	

SCARLET FEVER.

See p. 979; also Current State summaries, p. 968, and Monthly summaries by States, p. 972.

CITY REPORTS FOR WEEK ENDED APRIL 14, 1923—Continued.

SMALLPOX.

The column headed "Median for previous years" gives the median number of cases reported during the corresponding week of the years 1915 to 1922, inclusive. In instances in which data for the full eight years are incomplete, the median is that for the number of years for which information is available.

City.	Median for pre- vious years.	Week ended Apr. 14, 1923.		City.	Median for pre- vious years.	Week ended Apr. 14, 1923.	
		Cases.	Deaths.			Cases.	Deaths.
Alabama:				Nebraska:			
Mobile.....	3	1	.....	Omaha.....	11	1	.....
California:				New York:			
Bakersfield.....	0	1	.....	Niagara Falls.....	0	2	.....
Los Angeles.....	2	5	.....	North Carolina:			
Stockton.....	0	2	.....	Greensboro.....	0	15	.....
Florida:				Winston-Salem.....	2	35	.....
Key West.....	0	1	.....	Ohio:			
Georgia:				Columbus.....	0	4	.....
Rome.....	0	2	.....	Dayton.....	0	2	.....
Illinois:				Sandusky.....	0	1	.....
Aurora.....	0	1	.....	Toledo.....	0	12	.....
Chicago.....	1	3	.....	Oklahoma:			
Indiana:				Oklahoma.....	7	3	.....
Fort Wayne.....	1	4	.....	Tulsa.....	5	3	.....
Gary.....	1	9	.....	Oregon:			
Indianapolis.....	3	5	.....	Portland.....	5	17	.....
Iowa:				Pennsylvania:			
Council Bluffs.....	2	1	.....	Braddock.....	0	1	.....
Davenport.....	7	9	.....	Johnstown.....	0	1	.....
Des Moines.....	9	2	.....	Steelton.....	0	1	.....
Kansas:				Tennessee:			
Kansas City.....	5	1	.....	Knoxville.....	0	23	.....
Parsons.....	1	1	.....	Memphis.....	5	6	.....
Louisiana:				Texas:			
New Orleans.....	4	1	.....	Amarillo.....	.....	1	.....
Maine:				Houston.....	0	1	.....
Biddeford.....	.....	2	.....	Virginia:			
Michigan:				Richmond.....	0	1	.....
Detroit.....	13	1	.....	West Virginia:			
Flint.....	1	.....	1	Bluefield.....	3	1	.....
Grand Rapids.....	0	2	.....	Wisconsin:			
Minnesota:				Beloit.....	1	1	.....
Duluth.....	3	7	.....	Eau Claire.....	0	2	.....
Minneapolis.....	24	3	.....	Konosha.....	0	5	.....
St. Cloud.....	2	2	.....	Oshkosh.....	1	2	.....
St. Paul.....	8	11	.....	Racine.....	0	3	.....
Montana:				Sheboygan.....	0	1	.....
Great Falls.....	0	2	.....	Superior.....	0	6	.....
Helena.....	.....	2	.....			

TETANUS.

City.	Cases.	Deaths.	City.	Cases.	Deaths.
Alabama:			Oklahoma:		
Birmingham.....	1	1	Oklahoma.....	.....	1
Missouri:			Pennsylvania:		
St. Louis.....	1	.....	Philadelphia.....	2	.....
New York:			Tennessee:		
New York.....	1	.....	Nashville.....	.....	1
North Carolina:					
Raleigh.....	.....	1			

TUBERCULOSIS.

See p. 979; also Current State summaries, p. 968.

CITY REPORTS FOR WEEK ENDED APRIL 14, 1923—Continued.

TYPHOID FEVER.

The column headed "Median for previous years" gives the median number of cases reported during the corresponding week of the years 1915 to 1922, inclusive. In instances in which data for the full eight years are incomplete, the median is that for the number of years for which information is available.

City.	Median for previous years.	Week ended Apr. 14, 1923.		City.	Median for previous years.	Week ended Apr. 14, 1923.	
		Cases.	Deaths.			Cases.	Deaths.
California:				New Hampshire:			
Los Angeles.....	1	1	1	Dover.....	0	1	.....
Riverside.....	0	1	.....	New Jersey:			
San Francisco.....	3	2	.....	Hoboken.....	0	1	.....
District of Columbia:				Newark.....	1	1	.....
Washington.....	1	1	.....	Trenton.....	0	2	1
Florida:				New York:			
St. Petersburg.....	.....	1	.....	Buffalo.....	1	1	.....
Illinois:				New York.....	9	12	.....
Decatur.....	0	1	.....	Ohio:			
Indiana:				Cincinnati.....	1	1	.....
Hammond.....	1	2	1	Cleveland.....	3	2	.....
Kentucky:				East Cleveland.....	0	1	.....
Covington.....	0	8	1	Mansfield.....	0	2	.....
Lexington.....	0	1	.....	Pennsylvania:			
Louisville.....	1	1	.....	Du Bois.....	0	1	.....
Maine:				Erle.....	0	1	.....
Lewiston.....	0	1	1	New Kensington.....	0	2	.....
Maryland:				Philadelphia.....	5	2	.....
Baltimore.....	2	4	.....	Pittsburgh.....	1	2	.....
Massachusetts:				Tennessee:			
Boston.....	2	4	2	Nashville.....	1	1	.....
Brockton.....	0	1	.....	Texas:			
Everett.....	0	1	.....	Fort Worth.....	0	1	.....
Fall River.....	0	1	1	Virginia:			
Southbridge.....	0	1	.....	Norfolk.....	0	1	.....
Michigan:				West Virginia:			
Detroit.....	4	.....	1	Charleston.....	0	.....	2
Grand Rapids.....	0	1	.....	Huntington.....	0	.....	1
Muskegon.....	0	1	1				
Missouri:							
St. Louis.....	2	2	.....			

DIPHTHERIA, MEASLES, SCARLET FEVER, AND TUBERCULOSIS.

City.	Population Jan. 1, 1920.	Total deaths from all causes.	Diphtheria.		Measles.		Scarlet fever.		Tuberculosis.	
			Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
Alabama:										
Anniston.....	17,734	.....	1	.....	8	.....	.....	.....	1	.....
Birmingham.....	178,806	75	2	.....	142	.....	.....	.....	15	4
Mobile.....	60,777	20	4	.....	.....	.....	.....	.....	4	1
Montgomery.....	43,464	13	2	.....	1	.....	.....	.....	1	2
Tuscaloosa.....	11,996	.....	.....	.....	15	.....	.....	.....	.....	.....
Arkansas:										
Little Rock.....	65,142	.....	.....	.....	113	.....	.....	.....	0	.....
North Little Rock.....	14,048	.....	.....	.....	27	.....	.....	.....	.....	.....
California:										
Alameda.....	28,806	6	2	1	6	.....	.....	.....	1	.....
Bakersfield.....	18,638	8	.....	.....	4	.....	.....	.....	1	2
Eureka.....	12,923	6	1	.....	.....	.....	1	.....	1	2
Glendale.....	13,536	7	.....	.....	.....	.....	.....	.....	.....	.....
Long Beach.....	55,593	20	3	.....	20	.....	.....	.....	2	1
Los Angeles.....	576,673	205	56	4	162	.....	34	1	50	26
Oakland.....	216,261	56	12	.....	113	.....	10	.....	2	6
Pasadena.....	45,354	9	2	.....	8	.....	10	.....	.....	2
Richmond.....	16,943	1	1	.....	1	.....	.....	.....	.....	.....
Riverside.....	19,341	9	2	.....	4	.....	1	.....	2	1
Sacramento.....	65,908	20	2	.....	.....	.....	4	.....	3	.....
San Bernardino.....	18,721	14	2	.....	11	1	2	.....	.....	2
San Diego.....	74,683	45	.....	.....	110	.....	4	.....	1	1

CITY REPORTS FOR WEEK ENDED APRIL 14, 1923—Continued.

DIPHtheria, MEASLES, SCARLET FEVER, AND TUBERCULOSIS—Continued.

City.	Popula- tion Jan. 1, 1920.	Total deaths from all causes.	Diphtheria.		Measles.		Scarlet fever.		Tuber- culosis.		
			Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	
California—Continued.											
San Francisco.....	506,676	147	23	6	23		16		29	16	
San Jose.....	39,642	7			10		2		1		
Santa Ana.....	15,485	6			10		1	1	1		
Santa Barbara.....	19,441	7									
Stockton.....	40,296	10	3		164	1	3		7		
Colorado:											
Denver.....	256,491	92	20	2	132	1	18			18	
Pueblo.....	43,050	5	4				5				
Trinidad.....	10,906		5	1			1				
Connecticut:											
Bridgeport.....	143,555	52	8		7	3	21		6	3	
Bristol.....	20,620	2							2		
Derby.....	11,238	6									
Fairfield (town).....	11,475	3			37		5				
Hartford.....	138,036	47	8		1		4		7	2	
Manchester (town).....	18,370	4	1								
Milford (town).....	10,193	2			4		1				
New Britain.....	59,316	14	1		1		1	1			
New Haven.....	162,537	36	2		36		6		11		
New London.....	25,688	7			42				1		
Norwich (city).....	22,304	6	1		3				3		
Stonington (town).....	10,236	3			4						
District of Columbia:											
Washington.....	437,571	128	10		887		21		22	11	
Florida:											
Key West.....	18,749	10								1	
St. Petersburg.....	14,237	5			1				1	1	
Tampa.....	51,608	15	2		4				1	1	
Georgia:											
Albany.....	11,555				64						
Atlanta.....	200,616	68	2	1	8		3		6	8	
Brunswick.....	14,413	3							1		
Macon.....	52,985				39						
Rome.....	13,252						1				
Savannah.....	83,252	40			5				2	3	
Valdosta.....	10,783	1							1		
Idaho:											
Boise.....	21,393	4	1								
Pocatello.....	15,001	7									
Illinois:											
Alton.....	24,632	5			69		1		1		
Aurora.....	36,397	7	2		4		5		1	1	
Bloomington.....	28,725	9			11		1			1	
Centralia.....	12,491	3			4		1			1	
Champaign.....	15,673	5	2		8						
Chicago.....	2,701,705	802	109	6	953	7	95	3	196	59	
Cicero.....	44,995	15	3		44		4		3	1	
Decatur.....	43,818	11			2				8		
East St. Louis.....	66,767	22	1		8		1		4	1	
Elgin.....	27,454	8		1	12		1				
Evanston.....	37,234	12			45		3				
Forest Park.....	10,763				3						
Freeport.....	19,669	2			13		1				
Galesburg.....	23,834	7	1		9		1				
Jacksonville.....	15,713	3	1				2		1	1	
Kewanee.....	16,026	3							1		
La Salle.....	13,050	3									
Mattoon.....	13,552	4			24				1		
Oak Park.....	39,858	15			14		2			2	
Peoria.....	76,121	28			47	1	3				
Quincy.....	35,978	16	3		5		3				
Rock Island.....	35,177	6	4		2		1		1	1	
Rockford.....	65,651	15	1		4		2				
Springfield.....	59,183	19	3		38		6		3	1	
Indiana:											
Anderson.....	29,767	8								1	
Bloomington.....	11,595	4								2	
Crawfordsville.....	10,139	2			2		1				
East Chicago.....	35,967	20	2		13					2	
Elwood.....	10,790	2	1	1							
Fort Wayne.....	86,549	16	2				6				
Frankfort.....	11,585	4			1		1				
Gary.....	55,378	26			73	1	5			1	

CITY REPORTS FOR WEEK ENDED APRIL 14, 1923—Continued.

DIPHTHERIA, MEASLES, SCARLET FEVER, AND TUBERCULOSIS—Continued.

City.	Popula- tion Jan. 1, 1920.	Total deaths from all causes.	Diphtheria.		Measles.		Scarlet fever.		Tuber- culosis.	
			Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
Indiana—Continued.										
Hammond.....	36,004	10	1		3					
Huntington.....	14,000	4								
Indianapolis.....	314,194	115	5		356		3		2	4
Kokomo.....	30,067	5			1		1			1
La Fayette.....	22,486	5			7					
Laporte.....	15,158	3	1		3					
Logansport.....	21,626	7			21					1
Michigan City.....	19,457	4								
Mishawaka.....	15,195	5					1			
Muncie.....	36,524	24			3		1		1	2
South Bend.....	70,983	18	1		3		4			1
Terre Haute.....	66,083	36	2	2	101	1				
Iowa:										
Burlington.....	24,057	7	2		3		1			
Cedar Rapids.....	45,566		1				2			
Clinton.....	24,151		1							
Council Bluffs.....	36,162	9								
Des Moines.....	126,468		1				34			
Dubuque.....	39,141				22		3			
Iowa City.....	11,267		1				12			
Marshalltown.....	15,731						2			
Muscatine.....	16,068	5			11					
Sioux City.....	71,227	1	2	1			1		1	
Waterloo.....	36,230				61		2			
Kansas:										
Atchison.....	12,630				1					
Coffeyville.....	13,452	4			31					
Fort Scott.....	10,693	5								
Kansas City.....	101,177		4		80		2		10	
Lawrence.....	12,456	4								
Parsons.....	16,023	5			26					
Topeka.....	50,022	20			1		3	1	2	1
Wichita.....	72,217	26	3		8		2		1	
Kentucky:										
Covington.....	57,121	12	4		8		3		1	
Henderson.....	12,169	3			1					
Lexington.....	41,534	14								1
Louisville.....	234,691	86	3		76		2		18	3
Owensboro.....	17,424				1					
Louisiana:										
New Orleans.....	387,219	145	8	2	4		11		26	13
Maine:										
Auburn.....	16,985	4			2		4			1
Bangor.....	25,978						1		1	
Bath.....	14,731	2								
Biddeford.....	18,008	4								
Lewiston.....	31,791	14	1		10		7			1
Portland.....	69,272	25			35		2			
Sanford (town).....	10,691	2								
Waterville.....	13,351						1			
Maryland:										
Baltimore.....	733,826	217	30	1	528		62	1	61	14
Cumberland.....	29,837	17			38					1
Frederick.....	11,066	4			1				1	
Massachusetts:										
Adams (town).....	12,967	2								
Amesbury (town).....	10,036	3			2					1
Arlington (town).....	18,665	7	1	1	38		3			
Attleboro.....	19,731	12							5	2
Belmont (town).....	10,749	4			10					
Beverly.....	22,561	4			1		1		1	
Boston.....	748,060	245	71	1	185	1	93	2	50	21
Braintree (town).....	10,580	3	3		7		2		1	1
Brockton.....	66,254	15	2		42		4		2	1
Brookline.....	37,748	11			8		3			
Cambridge.....	109,694	34	5	1	69		10		3	2
Chelsea.....	43,184	12	2		1		9		1	1
Chicopee.....	36,214	9								
Clinton.....	12,979	4	1							
Dedham.....	10,792	3								
Easthampton.....	11,261						1		6	

CITY REPORTS FOR WEEK ENDED APRIL 14, 1923—Continued.

DIPHTHERIA, MEASLES, SCARLET FEVER, AND TUBERCULOSIS—Continued.

City.	Popula- tion Jan. 1, 1920.	Total deaths from all causes.	Diphtheria.		Measles.		Scarlet fever.		Tuber- culosis.		
			Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	
Massachusetts—Continued.											
Everett.....	40,120	8			16	1	4		1		
Fall River.....	120,485	32	4		6	2	3		3	1	
Framingham.....	17,033	7			2		2		1		
Greenfield.....	15,462	3			2						
Haverhill.....	53,884	10	2		31		10		2		
Holyoke.....	60,203	13	7	1			25	1	1		
Leominster.....	19,744	3			1		1		2		
Lowell.....	112,759	44	2		37	2	8		7	4	
Lynn.....	99,148	18	2		13		9		2		
Malden.....	49,103	13	2		13		12		3		
Medford.....	39,038	14			30		2		1		
Melrose.....	18,204	5					6		1		
Methuen.....	15,189	4			5		2			1	
Milford.....	13,471	4			1		7				
New Bedford.....	121,217	29	2		10				8	5	
Newburyport.....	15,618	0			4						
Newton.....	46,054	17	2		5		7	1	2	1	
North Adams.....	22,282	6							1		
Northampton.....	21,951	7			3		3				
Northbridge.....	10,174	1									
Pittsfield.....	41,763	13	2				13		1	2	
Plymouth.....	13,045	4									
Quincy.....	47,876	21	3	1	6		11		1		
Salem.....	42,529	1	2	1			1		4		
Somerville.....	93,091	26	5		29		8		1	1	
Southbridge.....	14,245	4					1				
Springfield.....	129,614	33	10	3	7		7		2	1	
Taunton.....	37,137	9	3	1	11		6		4		
Wakefield.....	13,025	1	2		29		4		1		
Waltham.....	30,915	9			3		6			1	
Watertown.....	21,457	7			4		4				
Webster.....	13,258	5					5				
West Springfield.....	13,443	2									
Westfield.....	18,604	8			6		1		1		
Winchester.....	10,485	6			28		1		1		
Winthrop.....	15,455	3				1					
Woburn.....	16,574	6				1					
Worcester.....	179,754	48	8				14		3	3	
Michigan:											
Alpena.....	11,101		1				2				
Ann Arbor.....	19,516	15	1							1	
Battle Creek.....	36,164	0	3		9		2		3		
Benton Harbor.....	12,233	1	3		4		1				
Detroit.....	930,678	292	39	3	127		104	2	40	28	
Flint.....	91,599	30	5	1	6		13		2	1	
Grand Rapids.....	137,634	39	4		21		6		3		
Hamtramck.....	48,615	7	2	1	1						
Highland Park.....	46,499	11	5	1	49		5		1		
Holland.....	12,183						4				
Jackson.....	48,374	24			57		4		5	2	
Kalamazoo.....	48,487		3		5		2		8	1	
Marquette.....	12,718	2							1		
Muskegon.....	36,570	13	1	1	1		1				
Pontiac.....	34,273	6	6		17		6				
Port Huron.....	25,944	4			6		4				
Sault Ste. Marie.....	12,096	2									
Minnesota:											
Duluth.....	98,917	15			24		7		3	1	
Fairbault.....	11,089	2	1		2			1			
Hibbing.....	15,089	5			2		3				
Minneapolis.....	380,582	87	4		248		22	1	21	8	
Rochester.....	13,722	13					1				
St. Cloud.....	15,873		1				1				
St. Paul.....	234,698	76	11	1	260	1	36	4	12	5	
Missouri:											
Cape Girardeau.....	10,252	4			30						
Joplin.....	29,902		1		1						
Kansas City.....	324,410	108	6	2	221		18		28	8	
St. Joseph.....	77,939	26	1		1		1		1		
St. Louis.....	772,897	235	33	1	1,279	2	27	1	30	17	
Springfield.....	39,631	13									

CITY REPORTS FOR WEEK ENDED APRIL 14, 1923—Continued.

DIPHTHERIA, MEASLES, SCARLET FEVER, AND TUBERCULOSIS—Continued.

City.	Population Jan. 1, 1920.	Total deaths from all causes.	Diphtheria.		Measles.		Scarlet fever.		Tuberculosis.	
			Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
Montana:										
Anaconda.....	11,668	2								1
Billings.....	15,100	5								
Great Falls.....	24,121	7			3		1			
Helena.....	12,037	8					2			
Missoula.....	12,668	1								
Nebraska:										
Lincoln.....	54,948	15	3	1	2		2			
Omaha.....	191,601	60	3	2	7		3			3
Nevada:										
Reno.....	12,016	6					1			
New Hampshire:										
Berlin.....	16,104	3					1			1
Concord.....	22,167	15			2		10			1
Dover.....	13,029	4								
Keene.....	11,210	0								
New Jersey:										
Asbury Park.....	12,400	1			52				5	1
Atlantic City.....	50,707	10	2		8		2			1
Bayonne.....	76,754		3				1		5	
Belleville.....	15,660		1		3					
Bloomfield.....	22,019	7			3		4			
Clifton.....	26,470	5			6		2			
East Orange.....	50,710	8	1		14		1		1	
Englewood.....	11,627	3			16					
Garfield.....	19,381	4			1					1
Hackensack.....	17,667	8			3		1			
Harrison.....	15,721				1		1			
Hoboken.....	68,166	15	4				1		4	1
Jersey City.....	298,103		10		8		14		15	
Kearny.....	26,724	4			38					
Long Branch.....	13,521	1							3	
Montclair.....	28,810	7	1		20		1		3	
Morristown.....	12,548	7			4		1		1	
Newark.....	414,524	107	15	2	199	1	23		31	9
Orange.....	33,268	6			5		1		4	
Passaic.....	63,841	16	1		16				2	2
Perth Amboy.....	41,707	10	2						1	
Phillipsburg.....	16,923	5								
Summit.....	10,174	1			1		1		1	
Trenton.....	119,289	51	14		5		6		4	3
West Hoboken.....	40,074	5	1				3			
West New York.....	29,926	6	1		4		2			1
West Orange.....	15,573	3			16		2		2	
New Mexico:										
Albuquerque.....	15,157	5	4						2	5
New York:										
Albany.....	113,344		3		21		2		7	
Amsterdam.....	33,524	6	2		5		3			
Auburn.....	36,192	7			30					
Buffalo.....	506,775	171	9	2	313	4	43	3	21	14
Dunkirk.....	19,336	10			1					
Elmira.....	45,393		1		4		3			
Geneva.....	14,648	4								
Glens Falls.....	16,638	7					1			
Hornell.....	15,025	2			2					
Hudson.....	11,745	4	1						1	
Ithaca.....	17,004	14			5		1			
Jamestown.....	38,917	8	1		1		1			
Lackawanna.....	17,918	2			1		1		2	
Little Falls.....	13,029	3							1	1
Lockport.....	21,308	5								
Middletown.....	18,420				35				3	
Mount Vernon.....	42,726	5	4		2					
New York.....	5,620,048	1,500	168	13	366	5	266	3	191	104
Newburgh.....	30,396	14							2	2
Niagara Falls.....	50,790	23					2			
North Tonawanda.....	15,482	5			56		6			
Peekskill.....	15,868	6			48		5		1	
Port Chester.....	16,573	10	1							
Poughkeepsie.....	35,000	16							1	
Rechester.....	295,750	67	4		50		13	1		6

¹ Pulmonary only.

CITY REPORTS FOR WEEK ENDED APRIL 14, 1923—Continued.

DIPHTHERIA, MEASLES, SCARLET FEVER, AND TUBERCULOSIS—Continued.

City.	Popula- tion Jan. 1, 1920.	Total deaths from all causes.	Diphtheria.		Measles.		Scarlet fever.		Tuber- culosis.	
			Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
New York—Continued.										
Rome.....	26,341	11	2				5			1
Saratoga Springs.....	13,181	6	2				2		2	
Schenectady.....	88,723	21	1		16	1	6			
Syracuse.....	171,717	54	10		67	1	25		3	2
Troy.....	72,013	27	2		3		2		4	2
Watertown.....	31,285	10	4				2		2	1
White Plains.....	21,031	9					6			
Yonkers.....	100,176	23	3	1	2		6			1
North Carolina:										
Durham.....	21,719	7	1		101				1	
Greensboro.....	43,525	17	1		21					2
Raleigh.....	24,418	8			98					1
Rocky Mount.....	12,742	7								1
Wilmington.....	33,372	9			3				2	
Winston-Salem.....	48,395	14							3	1
North Dakota:										
Fargo.....	21,961	0					1			
Grand Forks.....	14,010				7					
Ohio:										
Akron.....	208,435	41	1		53		5		41	
Ashtabula.....	22,082	9			3				1	1
Barberton.....	18,811	7			8					
Bucyrus.....	10,425	5			32					
Cambridge.....	13,104	3					1			
Canton.....	87,091	1	2		6		1		1	
Chillicothe.....	15,831	4			6					
Cincinnati.....	401,247	137	14	1	35		14		15	11
Cleveland.....	796,841	198	24	1	306		100	4	52	24
Cleveland Heights.....	15,236				63		5			
Columbus.....	237,031	75	4		126		3		3	5
Dayton.....	152,559	32	1		20		10		1	
East Cleveland.....	27,292	4			48		11	1	2	
East Youngstown.....	11,237	4		1						1
Findlay.....	17,021	7			14					
Freemont.....	12,468	6			1					
Hamilton.....	39,675	8	1		35					
Kenmore.....	12,683				3		1		2	
Lancaster.....	14,706	6			4					1
Lima.....	41,326	9		1	4		3			
Lorain.....	37,295		4		40		8		2	
Mansfield.....	27,824	12	1		35					2
Marion.....	27,891				1		2			
Martins Ferry.....	11,634	6								
Middletown.....	23,594	9			25	3			1	
Newark.....	26,718	14			13					1
Niles.....	13,080	0			17					
Piqua.....	15,044	5	2				1			
Salem.....	10,305	2	2							
Sandusky.....	22,897	9	1		16					
Springfield.....	60,840	22			147				1	
Steubenville.....	28,508	6			3				3	
Tiffin.....	14,375	5			1	1				
Toledo.....	243,164	81	5	1	29		36		1	9
Youngstown.....	132,358	36	20	1	42		12		4	4
Zanesville.....	29,569	11			2		2			1
Oklahoma:										
Oklahoma.....	91,295	20					6			2
Tulsa.....	72,075		1		14		1		7	
Oregon:										
Portland.....	258,288	46	2		1		3		8	4
Pennsylvania:										
Allentown.....	73,502		7		47		10		3	
Altoona.....	60,331		2		25		4			
Ambridge.....	12,730				4		2			
Berwick.....	12,181		1				2			
Bethlehem.....	50,358		2		51		8			
Bradock.....	20,879				1					
Bradford.....	15,525				8		1			
Butler.....	23,778				10		1			
Carlisle.....	10,916				3					
Chambersburg.....	13,171				12		6			
Charleci.....	11,516		2		3					
Chester.....	58,030		1		7					

CITY REPORTS FOR WEEK ENDED APRIL 14, 1923—Continued.

DIPHTHERIA, MEASLES, SCARLET FEVER, AND TUBERCULOSIS—Continued.

City.	Popula- tion Jan. 1, 1920.	Total deaths from all causes.	Diphtheria.		Measles.		Scarlet fever.		Tuber- culosis.	
			Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
Pennsylvania—Continued.										
Coatesville.....	14,515				1				4	
Connellsville.....	13,804				19		1			
Donora.....	14,131		1		7					
Dubois.....	13,681				20					
Duquesne.....	19,011								2	
Easton.....	33,813		2		17					
Erie.....	93,372		5		17		5		3	
Farrell.....	15,586		1		21				1	
Greensburg.....	15,033		1							
Harrisburg.....	75,917				21		6			
Hazleton.....	32,277				2					
Homestead.....	20,452				6					
Jeanette.....	10,627				9					
Johnstown.....	67,327		4		13		10			
Lancaster.....	53,150		3		56		7			
Lebanon.....	24,643				3		4			
McKees Rocks.....	16,713		2		21					
McKeesport.....	46,781				6					
Mahoney City.....	15,599				1					
Meadville.....	14,568				2					
Mount Carmel.....	17,469		1						1	
Nanticoke.....	22,614				6		3			
New Castle.....	44,938				1					
New Kensington.....	11,987				3					
Norristown.....	32,319		1		3				1	
North Braddock.....	14,928				3				2	
Oil City.....	21,274				76					
Philadelphia.....	1,823,779	591	69	12	119	5	53		59	42
Phoenixville.....	10,484				2					
Pittsburgh.....	588,343		19		341		12		9	
Pittston.....	18,497		1		4					
Pottstown.....	17,431				6		1			
Pottsville.....	21,876				2					
Reading.....	107,784				16					
Scranton.....	137,783		3		38		3			
Shamokin.....	21,204				4					
Sharon.....	21,747				18		1			
Shenandoah.....	24,726		1							
Steelton.....	13,428								2	
Sunbury.....	15,721		2		5		1			
Tamaqua.....	12,363		1		7					
Uniontown.....	15,692		1		17		1			
Washington.....	21,480				2					
West Chester.....	11,717		1		4					
Wilkes-Barre.....	73,833		1		8					
Wilkinsburg.....	24,403				37		1			
Williamsport.....	36,198		1							
York.....	47,542		1		99		3		2	
Rhode Island:										
Cranston.....	29,407	9	1		14					
Cumberland (town).....	10,077	3			2		1			
Newport.....	30,255	7	1				1			1
Pawtucket.....	64,248	19	2		6		2			
Providence.....	237,595	91	10		97	4	4			7
South Carolina:										
Charleston.....	67,957	25					2			1
Columbia.....	37,524	18							1	1
Greenville.....	23,127	5								
South Dakota:										
Sioux Falls.....	25,202	12			1		5			2
Tennessee:										
Knoxville.....	77,818				25				2	2
Memphis.....	162,351	61	4		57				17	3
Nashville.....	118,342	57			279	10			2	2
Texas:										
Austin.....	34,876	6	1		8		1		2	1
Beaumont.....	40,422	9	2						1	3
Dallas.....	158,976	46	3	1	2		3		4	3
Fort Worth.....	106,482	29	1		1		3		3	2
Galveston.....	44,255	8					1			2
Houston.....	138,276	45	2							5
San Angelo.....	10,050	3								1
San Antonio.....	161,379	49	3		4					7
Waco.....	38,500	11			11					

CITY REPORTS FOR WEEK ENDED APRIL 14, 1923—Continued.

DIPHTHERIA, MEASLES, SCARLET FEVER, AND TUBERCULOSIS—Continued.

City.	Population Jan. 1, 1920.	Total deaths from all causes.	Diphtheria.		Measles.		Scarlet fever.		Tuberculosis.	
			Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
Utah:										
Salt Lake City	118, 110	31	8	1	13		1		2	2
Vermont:										
Barre	10, 008				1		1			
Burlington	22, 779	2			9		2			1
Rutland	14, 954	6			1		1			
Virginia:										
Alexandria	18, 060	2			6					
Charlottesville	10, 688	4								1
Danville	21, 539	7			13					1
Lynchburg	30, 070	12			103	1			1	1
Norfolk	115, 777		3		124				5	5
Petersburg	31, 012	10			20				1	
Portsmouth	54, 387	13	1		14		2			
Richmond	171, 667	65	2		225		2		10	9
West Virginia:										
Bluefield	15, 282	5			22					
Charleston	39, 608	22			4				1	
Clarksburg	27, 869	2			37		1			
Fairmont	17, 851				8		1			
Huntington	50, 177	22			40	2				2
Martinsburg	12, 515				4		1			
Morgantown	12, 127				16		1			
Moundsville	10, 669	4								
Parkersburg	20, 050	6	1		2		1			
Wheeling	56, 208	15			40		4	1	3	1
Wisconsin:										
Appleton	19, 561	2								
Ashland	11, 334		1				1			
Beloit	21, 284	8	3		18		4			
Eau Claire	20, 906		1						1	
Fond du Lac	23, 427	12					1			
Green Bay	31, 017				2		2			
Janesville	18, 293	3	1		12		3			
Kenosha	40, 472	7			6		4			1
Madison	38, 378	7	2		162		2		1	
Manitowoc	17, 563				3				2	
Marquette	13, 610	11			1		2	1		
Milwaukee	457, 147	126	15	1	42		261		31	5
Oshkosh	33, 162	22					3			2
Racine	58, 593	17	4	1	34		5			1
Sheboygan	30, 955	8	5		16		2			
Stevens Point	11, 371		1		15					
Superior	39, 671	11			21					2
Waukesha	12, 558				40		5		1	
Wausau	18, 661		1		79					
West Allis	13, 745						9			
Wyoming:										
Cheyenne	13, 829	2					1		1	1

FOREIGN AND INSULAR.

AUSTRALIA.

Declared Free from Plague.

On April 1, 1923, Australia was officially declared to be free from plague. (The latest reported occurrence of plague in Australia recorded by the United States Public Health Service was as follows: *Sydney*, June 1-15, 1922—2 cases; *Brisbane*, July 23-November 4, 1922—3 plague rats found.)

CANADA.

Lethargic Encephalitis—Vancouver.

During the six weeks ended March 31, 1923, eight cases of lethargic encephalitis were reported at Vancouver, Canada.¹

EGYPT.

Plague.

During the week ended March 25, 1923, 50 cases of plague were notified in Egypt, of which 29 occurred in the Province of Assiout, 17 in the Province of Girgeh, and 4 in the Province of Fayoum. From January 1 to March 25, 1923, 103 cases of plague were notified in Egypt, as against 48 cases for the corresponding period of the preceding year.

Reports of the occurrence of plague in the Province of Assiout show for the period March 23 to 29, 36 cases of bubonic plague, 4 of septicemic and 2 of pneumonic plague.

GREAT BRITAIN.

Undefined Disease Outbreak—Glasgow.

Information dated March 12, 1923, shows a severe outbreak, with several deaths, of an undefined disease believed to be lethargic encephalitis, at Glasgow, Scotland.

¹ Public Health Reports, Mar. 16, 1923, p. 574.

HONDURAS.**Quarantine Against El Salvador and Guatemala.**

On March 23, 1923, quarantine restrictions on account of smallpox were established by the Honduran Government against the Republics of El Salvador and Guatemala, all persons entering Honduras from the Republics named being required to present certificates of vaccination.

IRAQ (MESOPOTAMIA).**Pneumonic Plague—Sumaichah.**

An outbreak of pneumonic plague, with 30 deaths, was reported, under date of March 14, 1923, among the Beni-Tenim tribes living in the vicinity of Sumaichah, about 30 miles north of Bagdad, Iraq (Mesopotamia).

MADAGASCAR.**Plague.**

During the period February 16 to 28, 1923, 33 cases of plague with 26 deaths were reported in the Island of Madagascar. Of these, 32 cases with 25 deaths occurred in the Province of Tananarive, and one case with one death in the town of Tananarive. Occurrence according to type was reported as follows: Bubonic, 12 cases; pneumonic, 6 cases; septicemic, 15 cases.

MEXICO.**"Acute Meningitis"—Frontera.**

During the three-week period ended April 7, 1923, three deaths from "acute meningitis" were reported at Frontera, State of Tabasco, Mexico.

PANAMA CANAL.**Communicable Diseases—March, 1923.**

Communicable diseases were notified for the Panama Canal, during the month of March, 1923, as follows:

Disease.	Canal Zone.	Colon.	Panama.	Non-resident.	Total.
Chicken pox.....	18	1	26	.....	45
Diphtheria.....	3	1	9	1	14
Dysentery.....	1	.....	1	2	4
Hookworm infection.....	8	4	14	17	43
Malaria.....	59	.....	5	38	102
Measles.....	21	2	5	11	39
Meningitis.....	2	.....	.....	.....	2
Mumps.....	.....	1	.....	1	2
Pneumonia.....	1	1	8	.....	10
Scarlet fever.....	1	.....	.....	.....	1
Trachoma.....	.....	1	.....	.....	1
Tuberculosis.....	2	8	16	8	34

POLAND.**Communicable Diseases—January 21-27, 1923.**

Communicable diseases have been notified in Poland as follows:

January 21-27, 1923.

Disease.	Cases.	Deaths.	Districts and city showing greatest number of deaths.
Cerebrospinal meningitis.....	17	5	Lodz.
Diphtheria.....	67	10	Lodz. Warsaw City.
Measles.....	601	21	Do.
Scarlet fever.....	349	32	Stanislawow.
Smallpox.....	20	1	Do.
Tuberculosis.....	103	216	Lodz. Lwow. Warsaw City.
Typhoid fever.....	267	30	Lodz. Posen.
Typhus fever.....	382	41	Stanislawow. Vilna.
Typhus fever, recurrent.....	115	3	Polesia.
Whooping cough.....	95	10	Lodz. Warsaw City.

RUSSIA.**Tuberculosis—Venereal Disease—Ukraine.**

Information received under date of February 17, 1923, relative to the proceedings of the provincial conference of health workers at Kharkov, Russia, shows epidemic spread of tuberculosis and venereal disease in the Ukraine. The prevalence of tuberculosis was stated to be associated with economic and living conditions. A mass extension of syphilis has been registered in all provinces of the Ukraine; and in several localities 60 per cent of the population were stated to be affected with the disease.

UNION OF SOUTH AFRICA.**Smallpox—Typhus Fever—February, 1923.**

During the month of February, 1923, 12 cases of smallpox with two deaths and 450 cases of typhus fever with 27 deaths were reported in the Union of South Africa, occurring among the colored population. Among the white population, three cases of typhus fever were reported. For distribution of occurrence according to States, see page 991.

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

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.

Reports Received During Week Ended May 4, 1923.¹**CHOLERA.**

Place.	Date.	Cases.	Deaths.	Remarks.
India:				
Calcutta.....	Mar. 4-17.....	56	42	Feb. 4-10, 1923: Cases, 1,074; deaths, 808.

PLAGUE.

Ceylon:				
Colombo.....	Mar. 4-17.....	4	9	
Egypt:				
Province—				
Assiout.....	Mar. 23-29.....	42	19	Jan. 1-Mar. 29, 1923: Cases, 134; deaths, 69. Mar. 19-25, 1923: Cases, 50—Assiout, 29; Fayoum, 4; Girgeh, 17.
Fayoum.....	Mar. 25-28.....	3	1	Bubonic, 36 cases; pneumonic, 2; septicemic, 4.
Girgeh.....	Mar. 24-27.....	6	4	Bubonic.
India:				
Calcutta.....	Mar. 4-10.....	1	1	Bubonic, cases, 4; septicemic, 2.
Karachi.....	Mar. 18-24.....	13	12	
Rangoon.....	Mar. 4-10.....	82	77	
Iraq (Mesopotamia):				
Bagdad.....	Feb. 1-28.....	8		
Sumaichah.....	Mar. 14.....		30	Among Beni-Tanim tribes in vicinity. Locality about 30 miles from Bagdad.
Java.....				Feb. 1-28, 1923: Cases, 818; deaths, 818.
Madagascar.....				Feb. 16-28, 1923: Cases, 33; deaths, 26. Cases and deaths: Bubonic, 12, 5; pneumonic, 6, 6; septicemic, 15, 15.
Province—				
Tananarive.....	Feb. 16-28.....	32	25	
Tananarive.....	do.....	1	1	Septicemic.
Siam:				
Bangkok.....	Feb. 25-Mar. 10.....	26	23	
Straits Settlements:				
Singapore.....	Mar. 4-10.....	2	2	

SMALLPOX.

Algeria:				
Algiers.....	Mar. 1-31.....	2		
Arabia:				
Aden.....	Mar. 18-24.....	1		
Brazil:				
Para.....	Mar. 19-25.....	1		
Ceylon:				
Colombo.....	Mar. 4-10.....	1		
China:				
Amoy.....	Mar. 18-24.....		1	
Chungking.....	Mar. 4-10.....			Present.
Foochow.....	Feb. 25-Mar. 10.....			Do.
Hongkong.....	Mar. 4-17.....	13	13	
Shanghai.....	Mar. 19-25.....		1	Chinese.
France:				
Paris.....	Mar. 1-10.....	1		
India:				
Calcutta.....	Mar. 4-17.....	31	16	Feb. 4-10, 1923: Cases, 1,129; deaths, 329.
Karachi.....	Mar. 18-24.....	1	3	
Rangoon.....	Mar. 4-10.....	58	21	
Italy:				
Turin.....	Jan. 29-Mar. 18.....	21		
Iraq (Mesopotamia):				
Bagdad.....	Feb. 1-28.....		30	
Japan:				
Yokohama.....	Mar. 19-25.....	1		

¹ From medical officers of the Public Health Service, American consuls, and other sources.

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued.

Reports Received During Week Ended May 4, 1923—Continued.

SMALLPOX—Continued.

Place.	Date.	Cases.	Deaths.	Remarks.
Java:				
East Java—				
Soerabaya.....	Feb. 25-Mar. 3....	1	1	
West Java—				
Batavia.....	Mar. 10-16.....	10	1	Province.
Mexico:				
Chihuahua.....	Apr. 2-15.....	10	2	
Mexico City.....	Mar. 4-10.....	12		Including municipalities in Federal District.
Poland.....				Jan. 21-27, 1923: Cases, 20; deaths, 1.
Portugal:				
Lisbon.....	Feb. 26-Mar. 31....	18	9	
Spain:				
Valencia.....	Apr. 1-7.....	4	1	
Switzerland:				
Berne.....	Mar. 25-31.....	8		
Lucerne.....	Mar. 1-31.....	4		
Zurich.....	.....do.....	6		
Turkey:				
Constantinople.....	Mar. 11-24.....		180	
Union of South Africa.....				Feb. 1-28, 1923: Colored, cases, 12; deaths, 2.
Cape Province.....				Feb. 1-28, 1923: Colored, cases, 8; deaths, 2.
Do.....	Mar. 4-10.....			Outbreaks.
Natal.....				Feb. 1-28, 1923: Colored, cases, 3.
Transvaal.....				Feb. 1-28, 1923: Colored, 1 case.
Do.....	Mar. 4-10.....			Outbreaks.
Uruguay:				
Montevideo.....	Jan. 1-31.....	8		

TYPHUS FEVER.

Algeria:				
Algiers.....	Mar. 1-31.....	34	8	
Egypt:				
Alexandria.....	Mar. 19-25.....	3	2	1 imported.
Cairo.....	Jan. 22-28.....		1	
Port Said.....	Mar. 25-31.....	1		
Finland.....				Mar. 1-15, 1923; 1 case.
Hungary:				
Budapest.....	Mar. 12-18.....	3	1	
Iraq (Mesopotamia):				
Bagdad.....	Feb. 1-28.....	1		
Mexico:				
Mexico City.....	Mar. 4-10.....	8		Including municipalities in Federal district.
Palestine:				
Jaffa.....	Mar. 27-Apr. 2....	1		
Poland.....				Jan. 21-27, 1923: Cases, 382; deaths, 41. Recurrent typhus fever, cases 115; deaths, 3.
Spain:				
Barcelona.....	Mar. 22-28.....		1	
Turkey:				
Constantinople.....	Mar. 11-24.....		76	
Union of South Africa.....				Feb. 1-28, 1923: Colored, cases, 450; deaths, 27; White, cases, 3.
Cape Province.....				Feb. 1-28, 1923: Colored, cases, 340; deaths, 18. White, one case.
Do.....	Mar. 4-10.....			Outbreaks.
Natal.....				Feb. 1-28, 1923: Colored, cases, 19; deaths, 2.
Orange Free State.....				Feb. 1-28, 1923: Colored, cases, 56; deaths, 2. White, two cases.
Transvaal.....				Feb. 1-28, 1923: Colored, cases, 35; deaths, 5.
Johannesburg.....	Feb. 1-28.....	24	1	

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued.

Reports Received from December 30, 1922, to April 27, 1923.¹

CHOLERA.

Place.	Date.	Cases.	Deaths.	Remarks.
China:				
Liutaoku.....	Sept. 22.....	60	20	
Chosen (Korea):				
Yalu River Region.....				Sept. 22, 1922: 30 deaths reported.
India:				Sept. 24-Dec. 30, 1922: Cases, 14,637; deaths, 2,833. Dec. 31, 1922-Feb. 3, 1923: Cases, 3,678; deaths, 2,182.
Bombay.....	Oct. 27-Dec. 23.....	2	1	
Do.....	Feb. 4-10.....	2	2	
Calcutta.....	Nov. 12-Dec. 30.....	102	60	
Do.....	Dec. 31-Mar. 3.....	248	164	
Madras.....	Nov. 19-Dec. 16.....	4	2	
Do.....	Jan. 21-Mar. 17.....	11	5	
Rangoon.....	Nov. 12-Dec. 23.....	17	10	
Do.....	Dec. 31-Mar. 3.....	8	4	
Philippine Islands:				
Province—				
Laguna.....	Oct. 12-18.....	1		
Russia:				Jan. 1-Oct. 7, 1922: Cases, 83,367.
Archangel (Government).....	Oct. 1-7.....	7		
Moscow.....	Jan. 1-31.....	1		
Tashkent.....	Oct. 1-7.....	27		Turkestan Republic: 3 cases reported on waterways.
Ukraine:				Sept. 1-30, 1922: Cases, 119.
Donetz (Government).....	Sept. 1-30.....	29		
Tchernigov (Government).....	do.....	36		
Siam:				
Bangkok.....	Oct. 29-Dec. 23.....	4	1	
Do.....	Dec. 31-Feb. 24.....	5	1	

PLAGUE.

Argentina:				
Rosario.....	Feb. 10-27.....	8	3	
Azores:				
Fayal Island—				
Castelo Branco.....	Dec. 2-31.....		3	Vicinity of Horta. Dec. 30, 1922: Several cases.
Do.....	Mar. 12-18.....	2		Actual occurrence about Mar. 6, 1923:
Horta.....	Mar. 23.....	1		
Pico Island—				
Lages.....	Nov. 27-Dec. 15.....		8	1 case present Dec. 15, 1922.
St. Michael Island.....				Nov. 12-Dec. 30, 1922: Cases, 100; deaths, 35. At localities 3-9 miles from Ponta Delgada.
Ponta Delgada.....	Nov. 26-Dec. 9.....	3		Dec. 31, 1922-Feb. 24, 1923: Cases 126; deaths, 52. From 6 to 20 miles distant from port of Ponta Delgada.
Brazil:				
Bahia.....	Oct. 29-Dec. 30.....	5	5	
Do.....	Jan. 28-Feb. 3.....	1	1	
Pernambuco.....	Jan. 14-20.....	3	2	
Porto Alegre.....	Nov. 19-25.....	1		
British East Africa:				
Kenya Colony—				
Tanganyika Territory.....	Oct. 15-Dec. 16.....	12	7	
Do.....	Jan. 14-Feb. 10.....	11	10	
Uganda.....				
Entebbe.....	Nov. 24-30.....	211	202	Dec. 1-31, 1922: Cases, 141; deaths, 129. Jan. 1-31, 1923: Cases, 73; deaths, 73.
Canary Islands.....				Jan. 15-Mar. 17, 1923: Cases, 8; deaths, 7. Rodent plague present, Feb.-Mar., 1923.
Celebes:				
Macassar.....	Feb. 15.....			Present, bubonic; epidemic, pneumonic.
Ceylon:				
Colombo.....	Nov. 12-Dec. 30.....	46	38	Plague rodents, 16.
Do.....	Dec. 31-Mar. 3.....	67	57	Plague rodents, 18.
Chile:				
Antofagasta.....				Quarantine. Year, 1922. March, 1 case; May, 1 case.

¹ From medical officers of the Public Health Service, American consuls, and other sources.

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued.

Reports Received from December 30, 1922, to April 27, 1923—Continued.

PLAGUE—Continued.

Place.	Date.	Cases.	Deaths.	Remarks.
China:				
Hongkong.....	Nov. 5-Dec. 23.....	14	12	
Do.....	Dec. 31-Mar. 3.....	3	2	
Manchuria—				
Harbin.....	Jan. 29-Feb. 4.....	7	.....
Ecuador:				
Guayaquil.....	Nov. 1-Dec. 31.....	9	3	Rats examined, 16,600; found infected, 72.
Do.....	Jan. 1-Mar. 15.....	24	9	Rats examined, 22,400; found infected, 116.
Sabanilla.....	Mar. 1-15.....	1	.....	Country estate.
Egypt:				
City—				
Alexandria.....	Nov. 19-25.....	2	.....	Jan. 1-Dec. 28, 1922: Cases, 485; deaths, 228. Jan. 1, 1922-Jan. 4, 1923: Cases, 487; deaths, 228.
Do.....	Jan. 8-10.....	1	1	Jan. 1-Mar. 8, 1923: Cases, 27; deaths, 17.
Port Said.....	Nov. 19-27.....	4	2	
Do.....	Jan. 26-Mar. 5.....	2	1	
Suez.....	Nov. 18-Dec. 5.....	3	4	
Do.....	Mar. 2.....	1	1	
Province—				
Assiout.....	Nov. 19-Dec. 29.....	4	1	Septicemic: 1 case, 1 death.
Do.....	Jan. 26-Mar. 8.....	14	9	Pneumonic: 6 cases, 4 deaths; septicemic, 1 case, 1 death.
Dakahlieh.....	Dec. 3.....	1	1	Pneumonic.
Kena.....	Mar. 8.....	1	1	Pneumonic, 1 death.
Minieh.....	Nov. 18-27.....	2	1	
Do.....	Feb. 24.....	.....	1	
Hawaii:				
Honokaa.....				Feb. 8-9, 1923: Plague rats, 3.
Do.....				Mar. 24-25, 1923: Plague rats, 2. In vicinity Pacific Sugar Co., near Honokaa.
India.....				
Bombay.....	Oct. 27-Dec. 30.....	41	32	Oct. 1-Dec. 30, 1922: Cases, 25,007; deaths, 12,803. (Report for Nov. 19-25, 1922, not received.)
Do.....	Dec. 31-Mar. 3.....	146	119	Dec. 31, 1922-Mar. 3, 1923: Cases, 43,298; deaths, 41,775.
Calcutta.....	Feb. 11-24.....	2	2	
Karachi.....	Dec. 10-16.....	1	1	
Do.....	Dec. 31-Mar. 17.....	41	34	
Madras Presidency.....	Nov. 19-Dec. 30.....	2,269	1,448	
Do.....	Dec. 31-Mar. 17.....	4,600	3,383	
Madras.....	Nov. 19-25.....	1	1	
Do.....	Jan. 21-27.....	1	1	
Rangoon.....	Nov. 12-Dec. 30.....	52	49	
Do.....	Dec. 31-Feb. 17.....	122	108	
Iraq (Mesopotamia):				
Bagdad.....	Oct. 1-Nov. 30.....	16	.....
Do.....	Jan. 1-31.....	3	.....
Japan:				
Ossaka.....				July 1-Nov. 30, 1922: Cases, 70.
Java.....				Oct. 1-Nov. 3, 1922: Cases, 900; deaths, 763. Jan. 1-31, 1923: Cases, 490; deaths, 549.
East Java.....				Dec. 1-31, 1922: Deaths, 990.
Residences—				
Pekalongan.....	Dec. 1-31.....	56	.....
Samarang.....	.....do.....	202	.....
Soerabaya.....	Oct. 22-Dec. 31.....	34	14	
Do.....	Jan. 14-20.....	2	2	Jan. 17-23, 1923: Cases, 5; deaths, 3.
Toelong-Agoeng.....	Oct. 29-Dec. 16.....	18	18	Not a seaport.
Soerakarta—				
Klaten.....	Nov. 4.....	.....	.....	Present in epidemic form.
Madagascar.....				Jan. 1-Dec. 10, 1923: Cases, 143.
Province—				Jan. 1-Feb. 15, 1923: Cases, 82; deaths, 51.
Antsirabe.....	Jan. 16-Feb. 15.....	2	2	Bubonic and septicemic.
Diego Suarez.....	Jan. 1-Feb. 15.....	4	2	Bubonic.
Moramanga.....				To Nov. 12, 1922: Cases, 24; deaths, 21. Cases reported to Oct. 30, pneumonic.
Amparafara region.....	Sept. 18-Nov. 5.....	21	.....	Bubonic, 18; septicemic, 3 (doubtful, 2).
Moramanga.....	Dec. 6-9.....	3	.....	Bubonic.
Tamatave.....	Feb. 10-Sept. 12.....	10	.....	Do.
Miarinarivo.....				Dec. 14, 1922-Jan. 1, 1923: 1 case (European).

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued.**Reports Received from December 30, 1922, to April 27, 1923—Continued.****PLAGUE—Continued.**

Place.	Date.	Cases.	Deaths.	Remarks.
Madagascar—Continued. Province—Continued. Tananarive.....				Jan. 1-Dec. 10, 1922: Cases, 73 (bubonic, 37; pneumonic, 8; septicemic, 28). Jan. 1-Feb. 15, 1923: Cases, 56; deaths, 41.
Ambohiman- gakeley.....	Nov. 19-Dec. 9....	9		Bubonic, 3; pneumonic, 3; septicemic, 3.
Anketrina.....	Mar. 27-May 9.....	11		Bubonic, 4; pneumonic, 2; septicemic, 5 (3 doubtful).
Fenoarivo region....	Oct. 7-Nov. 28....	16		Bubonic, 3; pneumonic, 8; septicemic, 5.
Tananarive.....	Oct. 23-Dec. 10....		5	1 septicemic.
Do.....	Dec. 14-Feb. 15....	22	6	Bubonic and septicemic.
Mexico: Tampico.....	Mar. 23.....	2	1	Plague rodent found, Mar. 14, 1923.
Palestine: Jaffa.....	Nov. 27-Dec. 4....	1		
Peru.....				Nov. 1-Dec. 31, 1922: Cases, 199; deaths, 93.
Do.....				Jan. 1-31, 1923: Cases, 151; deaths, 59.
Do.....				Feb. 1-15, 1923: Cases, 52; deaths, 21. (All localities of occurrence not given.) Feb. 16-28, 1923: Cases, 38; deaths, 36.
Localities—				
Barranco.....	Feb. 1-15.....	1		
Canete.....	Nov. 16-Dec. 31....	56	19	Including vicinity.
Do.....	Jan. 1-Feb. 28....	26	12	Do.
Casma.....	Jan. 1-31.....	1		At Campina.
Catacaos.....	do.....	4	1	
Chepen.....	Dec. 16-31.....	2	1	Present, Nov. 9-15, 1922.
Do.....	Jan. 1-31.....	1		
Chiclayo (city and country).....	Nov. 16-Dec. 15....	17	7	
Do.....	Jan. 1-Feb. 28....	25	13	
Cutervo.....	Feb. 16-28.....		8	
Eten.....	Nov. 16-Dec. 15....	4		
Guadeloupe.....	Nov. 1-Dec. 31....	22	12	
Do.....	Jan. 1-31.....	4	1	
Huacho.....	Nov. 16-Dec. 31....	4	2	
Do.....	Jan. 1-Feb. 28....	13	1	
Huara.....	Jan. 1-Feb. 15....	8		Country.
Huaral.....	Nov. 16-30.....	1		
Do.....	Jan. 1-Feb. 28....	4	2	
Huarmey.....	Dec. 1-31.....	2	2	
Do.....	Feb. 1-15.....	9		
Jayanca.....	Nov. 16-Dec. 31....	10	8	
Lambayeque.....	do.....	7	3	
Do.....	Jan. 1-Feb. 15....	10	7	
Lima (city).....	Nov. 1-Dec. 31....	11	8	
Do.....	Jan. 1-Feb. 28....	5	1	
Lima (country).....	Nov. 1-Dec. 31....	14	5	
Do.....	Jan. 1-Feb. 28....	8	3	
Lurin.....	Dec. 1-15.....	1		
Magdalena del Mar....	Nov. 16-30.....	1		
Do.....	Jan. 1-31.....	1	1	
Magdalena Vieja.....	Dec. 16-31.....	1	1	
Mala.....	Dec. 1-31.....	2		
Do.....	Jan. 1-31.....	4		
Miraflores.....	Jan. 1-Feb. 15....	3	2	
Mochumi.....	Dec. 16-31.....	5	3	
Do.....	Feb. 1-28.....	4	1	
Monsefu.....	Feb. 1-15.....	5	3	
Mosche.....	Nov. 16-30.....	2	1	
Paita.....	Dec. 16-31.....	3	2	
Do.....	Jan. 1-Feb. 28....	14	10	
Piura.....	Nov. 16-Dec. 31....	12	7	
Do.....	Jan. 1-Feb. 28....	18	8	
Pueblo Nuevo.....	Dec. 1-31.....	7	4	
Do.....	Jan. 1-31.....	10	6	
San Pedro.....	Nov. 1-Dec. 31....	8	4	
Do.....	Jan. 1-Feb. 28....	7	4	
Santa Cruz (Hualgayoc)	Feb. 16-28.....	9	9	

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued.

Reports Received from December 30, 1922, to April 27, 1923—Continued.

PLAGUE—Continued.

Place.	Date.	Cases.	Deaths.	Remarks.
Peru—Continued.				
Localities—Continued				
Sullana.....	Nov. 16-30.....	3	3	
Do.....	Jan. 1-31.....	1	1	
Trujillo.....	Nov. 1-Dec. 31.....	3	1	
Do.....	Jan. 1-Feb. 28.....	41	15	District
Tuman.....	Nov. 16-30.....	3		
Portugal:				
Lisbon.....	Nov. 10-29.....	4	2	
Oporto.....	Jan. 21-27.....		1	
Portuguese West Africa:				
Angola—				
Loanda.....	Oct. 1-Dec. 30.....		45	Fatal cases among white population.
Do.....	Dec. 31-Jan. 20.....	2		
Russia:				
Kirghiz Republic.....				Dec. 2, 1922-Feb. 16, 1923: Cases, 116 (pneumonic), occurring in 2 out of 6 governments.
Siam:				
Bangkok.....	Nov. 12-Dec. 23.....	5	5	
Do.....	Dec. 31-Feb. 24.....	50	39	
Spain:				
Barcelona.....	Nov. 15-Dec. 18.....	1		Sept. 24-Nov. 14, 1922: Cases, 23; deaths, 9.
Malaga.....	Jan. 27.....	3		17 suspected cases.
Straits Settlements:				
Singapore.....	Dec. 17-23.....	2	2	
Do.....	Jan. 21-Mar. 3.....	4	4	
Syria:				
Beirut.....	Nov. 6-30.....	4	3	
Turkey:				
Constantinople.....	Nov. 22-28.....	2		
Do.....	Jan. 28-Feb. 10.....	2		
Union of South Africa:				
Transvaal—				
Klipfontein Farm.....	Dec. 16.....	2	1	Natives. Jan. 25, 1923: Plague-infected wild rodent found in vicinity.
West Africa:				
Senegal—				
Dakar.....	Feb. 1-28.....	2	2	
On vessels:				
S. S. Helcion.....	Dec. 1.....	1		At Thursday Island Quarantine, Australia, from Singapore, Straits Settlements In Chinese firemen.
S. S. —.....	Dec. 30.....			At port of London: Plague-infected rats and cats found in grain cargo on vessel from South America.

SMALLPOX.

Algeria:				
Algiers.....	Dec. 1-10.....	1		
Do.....	Jan. 1-Feb. 20.....	2		
Arabia:				
Aden.....	Nov. 19-Dec. 23.....	7	3	
Do.....	Jan. 7-Mar. 10.....	21	2	
Bolivia:				
La Paz.....	Jan. 1-Feb. 28.....	11	11	
Brazil:				
Bahia.....	Nov. 5-11.....	1		
Do.....	Mar. 4-10.....	1		
Para.....	Feb. 12-Mar. 18.....	13		
Pernambuco.....	Jan. 21-27.....	1	1	
Rio de Janeiro.....	Nov. 25-Dec. 30.....	40	15	
Do.....	Dec. 31-Mar. 17.....	48	23	
Sao Paulo.....	Oct. 16-22.....	1	1	
Do.....	Jan. 8-Feb. 18.....	5	1	

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued.**Reports Received from December 30, 1922, to April 27, 1923—Continued.****SMALLPOX—Continued.**

Place.	Date.	Cases.	Deaths.	Remarks.
British East Africa:				
Kenya Colony—				
Tanganyika Territory..	Oct. 8-Dec. 23.....	193	10	
Do.....	Jan. 7-Feb. 24.....	44	2	
Uganda.....	Sept. 1-Dec. 31.....	3	1	Jan. 1-31, 1923: Cases, 3; deaths, 1.
Entebbe.....	Nov. 24-30.....	3	3	
Canada:				
Alberta—				
Calgary.....	Mar. 4-10.....	1		
British Columbia—				
Fernie.....	Mar. 18-24.....	1		
Manitoba—				
Winnipeg.....	Dec. 10-30.....	14		
Do.....	Jan. 21-Apr. 7.....	39		
New Brunswick—				
Northumberland County.....	Jan. 21-Feb. 17.....	8		
Restigouche County.....	Mar. 11-17.....	1	1	
Ontario.....				Dec. 1-31, 1922: Cases, 51; deaths, 1. Jan. 1-Mar. 31, 1923: Cases, 92.
Hamilton.....	Dec. 31-Feb. 24.....	7		
Niagara Falls.....	Dec. 3-30.....	10		
Do.....	Dec. 31-Jan. 12.....	12		
Ottawa.....	Dec. 10-23.....	6		
Do.....	Jan. 7-Mar. 31.....	21	1	
Toronto.....	Dec. 10-30.....	2		
Do.....	Feb. 4-10.....	1		
Quebec—				
Quebec.....	Jan. 14-20.....	3		
Sherbrooke.....	Mar. 1-31.....		2	
Saskatchewan—				
Regina.....	Dec. 3-23.....	2		
Ceylon:				
Colombo.....	Nov. 12-Dec. 24.....	9	4	1 case, 1 death outside city.
Do.....	Feb. 18-Mar. 3.....	2		
Chile:				
Concepcion.....	Oct. 30-Dec. 25.....		7	
Do.....	Feb. 1-Mar. 12.....	3	1	
Valparaiso.....	Oct. 2-Dec. 26.....	4	54	In hospital, 83 cases.
Do.....	Jan. 9-Feb. 10.....		90	Dec. 31, 1922-Jan. 27, 1923: Deaths, 66. Feb. 16, 1923: 80 cases present (estimated).
China:				
Amoy.....	Nov. 5-Dec. 23.....		3	Nov. 26-Dec. 30, 1922: Present.
Do.....	Jan. 7-Mar. 10.....		7	
Antung.....	Nov. 13-Dec. 10.....	2		
Do.....	Feb. 26-Mar. 4.....	1		
Canton.....	Oct. 1-Nov. 30.....			Prevalent.
Do.....	Jan. 21-Feb. 17.....			Present.
Changsha.....	Feb. 11-17.....	1		
Chungking.....	Nov. 5-Dec. 30.....			Do.
Do.....	Dec. 31-Mar. 3.....			Do.
Foochow.....	Nov. 12-Dec. 30.....			Do.
Do.....	Dec. 31-Feb. 24.....			Do.
Hankow.....	Dec. 31-Jan. 20.....	4	1	
Hongkong.....	Nov. 5-11.....		1	
Do.....	Dec. 31-Mar. 3.....	16	6	
Manchuria—				
Harbin.....	Nov. 20-Dec. 31.....	13		
Do.....	Jan. 8-Feb. 11.....	7		
Mukden.....	Nov. 19-Dec. 16.....			Do.
Do.....	Jan. 7-Feb. 3.....			Do.
Nanking.....	Nov. 5-Dec. 23.....			Do.
Do.....	Jan. 7-Mar. 3.....			Do.
Shanghai.....	Jan. 15-Feb. 25.....	3	1	Foreign. Death, Chinese.
Tientsin.....	Feb. 18-24.....	1		Reported from foreign office.
Chosen (Korea):				
Chemulpo.....	Oct. 1-Dec. 31.....	135	92	
Do.....	Jan. 1-Feb. 28.....	36	17	
Fusan.....	Nov. 1-Dec. 31.....	4		
Do.....	Jan. 1-Feb. 28.....	9	1	
Gensan.....	Dec. 1-31.....	6	2	
Seoul.....	Oct. 1-Dec. 31.....	19	1	
Do.....	Jan. 1-Feb. 28.....	65	25	

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued.

Reports Received from December 30, 1922, to April 27, 1923—Continued.

SMALLPOX—Continued.

Place.	Date.	Cases.	Deaths.	Remarks.
Colombia:				
Buenaventura	Jan. 25-Feb. 20....	48		Estimated, 50 cases present; type mild; among colored population. Feb. 16-23, 1923: 6 to 9 cases 2 miles from town limits. Mild outbreak.
Santa Marta	Apr. 18.....			
Cuba:				
Province—				
Camaguey	Nov. 11-Dec. 31....	20		
Matanzas	Jan. 1-31.....	2		
Oriente	Nov. 21-Dec. 31....	22		
Do	Jan. 1-Feb. 10....	10		
Santa Clara	Dec. 21-31.....	1		
Czechoslovakia.				Oct. 1-31, 1922: Cases, 3.
Province—				
Bohemia	Oct. 1-31.....	1		
Moravia	do.....	1		
Slovakia	Oct. 1-Nov. 30....	2		
Dominica (West Indies).				Feb. 26, 1923: Present with several thousand cases (estimated). Reported as alastrim.
Dominican Republic:				
Puerto Plata	Dec. 14-30.....	2		
Santo Domingo	Dec. 3-16.....			Present.
Do	Feb. 28-Mar. 6....	3		
San Pedro de Macoris	Jan. 13-19.....	2		
Ecuador:				
Guayaquil	Dec. 1-31.....	10		
Do	Jan. 1-Feb. 28....	11		
Egypt:				
Alexandria	Feb. 19-25.....	1		
Port Said	Jan. 21-27.....	1		
Estonia				Oct. 1-Dec. 31, 1922: Cases, 61.
Do				Jan. 1-Feb. 28, 1923: Cases, 25.
France:				
Paris	Dec. 1-10.....	1		
Germany:				
Bremen	Dec. 3-9.....	1		
Great Britain:				
Liverpool	Dec. 11-17.....	1		From vessel.
London	Nov. 26-Dec. 23....	3		
Nottingham	Nov. 19-Dec. 13....	4		
Do	Jan. 7-Mar. 10....	16		
Greece:				
Kalamata	Jan. 13-Feb. 13....		1	
Patras	Jan. 21-Feb. 17....		84	
Saloniki	Nov. 6-Dec. 31....	6	5	
Do	Jan. 15-Feb. 18....	9	1	
Zante				Epidemic, Jan. 17, 1923.
Do	Jan. 7-14.....	13	4	
Guadeloupe (West Indies).				Feb. 26, 1923: Present. Reported as alastrim.
Guatemala:				
Guatemala City	Feb. 23.....			Present.
Honduras				Apr. 17, 1923: Outbreak in interior.
India				Nov. 5-Dec. 30, 1922: Cases, 5,783, deaths, 333. Dec. 31, 1922-Jan. 27, 1923: Cases, 7,779; deaths, 1,909.
Bombay	Nov. 5-Dec. 30....	22	10	
Do	Dec. 31-Mar. 3....	126	66	
Calcutta	Nov. 12-Dec. 30....	46	23	
Do	Dec. 31-Mar. 3....	126	70	
Karachi	Nov. 26-Dec. 30....	6		
Do	Dec. 31-Mar. 17....	49	16	
Madras	Nov. 12-Dec. 30....	71	23	
Do	Dec. 31-Mar. 17....	251	71	
Rangoon	Nov. 5-Dec. 30....	27	6	
Do	Jan. 7-Feb. 17....	92	36	
Iraq (Mesopotamia):				
Bagdad	Oct. 1-Nov. 30....	568	361	
Do	Jan. 1-31.....	32	20	
Jamaica				Dec. 31, 1922-Mar. 31, 1923: Cases, 557. Previously reported as alastrim.
Kingston	Mar. 11-17.....	1		

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued.

Reports Received from December 30, 1922, to April 27, 1923—Continued.

SMALLPOX—Continued.

Place.	Date.	Cases.	Deaths.	Remarks.
Japan:				
Kobe.....	Jan. 13-Feb. 16....	6	2	
Taiwan Island.....	Mar. 4-10.....	1	1	
Yokohama.....	Jan. 22-23.....	1	.....
Java:				
East Java—				
Scerabaya.....	Nov. 5-11.....	4	.....
Do.....	Feb. 4-24.....	3	.....
West Java—				
Batavia.....	Nov. 11-Dec. 22....	25	1	City and Province.
Do.....	Jan. 27-Feb. 23....	7	1	Province.
Latvia.....				Oct. 1-Dec. 31, 1922: Cases, 7.
Martinique.....				Mar. 31, 1923: Present. Reported as alastrim.
Mexico:				
Chihuahua.....	Dec. 4-17.....	.....	4	
Do.....	Jan. 1-Apr. 1.....	51	20	
Do.....	Dec. 1-31.....	4	.....
Guadalajara.....	Jan. 1-Feb. 23....	54	.....
Do.....	Nov. 12-Dec. 23....	43	.....
Mexico City.....				Including municipalities in Federal district.
Do.....	Dec. 31-Mar. 3....	168	.....	Do.
Nogales.....	Dec. 10-19.....	.....	1	
Do.....	Dec. 31-Feb. 10....	.....	2	
Saltillo.....	Jan. 23-Feb. 3....	1	.....
San Luis Potosi.....	Jan. 14-20.....	.....	1	
Sonora, State.....				Nov. 1-30, 1922: Present in northern section.
Empalme.....	Nov. 1-30.....	4	1	
Tabasco, State.....				Present in some localities, March 26, 1923.
Torreon.....	Dec. 1-31.....	.....	1	
Vera Cruz.....	Feb. 26-Apr. 8....	12	5	
Palestine.....				Jan. 23-Feb. 19, 1923: Cases, 8; Northern district.
Persia:				
Tabriz.....	Dec. 18-31.....	.....	2	
Do.....	Jan. 15-28.....	.....	2	
Teheran.....	Oct. 24-Dec. 22....	.....	139	
Peru.....				Feb. 1-28, 1923: Cases, 8; deaths, 1.
Callao.....	Nov. 1-15.....	2	.....
Lima (city).....	Dec. 1-15.....	3	1	
Lima (country).....	Nov. 1-15.....	2	.....
Do.....	Feb. 16-28.....	2	.....
Poland.....				City and country.
				Oct. 1-Dec. 23, 1922: Cases, 132; deaths, 26. Jan. 1-31, 1923: Cases, 50; deaths, 6.
Portugal:				
Lisbon.....	Nov. 19-Dec. 30....	143	34	
Do.....	Dec. 31-Mar. 18....	152	74	
Oporto.....	Oct. 15-Dec. 30....	24	12	Dec. 25-31, 1922: Deaths, 12. Feb. 19-Mar. 3, 1923: Cases, 17; deaths, 3.
Do.....	Dec. 31-Mar. 17....	22	11	Jan. 5-20, 1923: Cases, 22; deaths, 6.
Portuguese West Africa:				
Angola—				
Loanda.....	Oct. 27-Nov. 11....	.....	10	
Rumania:				
Bucharest.....	Feb. 1-10.....	1	.....
Chisinau.....	Jan. 1-Feb. 28....	26	.....
Galatz.....	Feb. 1-10.....	2	.....
Russia:				
City—				
Moscow.....				Jan. 1-31, 1923: Cases treated in hospital, 10.
Province—				Jan.-Sept., 1922: Cases, 8,744.
Ukraine.....				
Sierra Leone:				
Freetown.....	Feb. 16-28.....	1	.....
Spain:				
Corunna.....	Nov. 26-Dec. 2....	.....	1	
Huelva.....	Nov. 24-Dec. 31....	.....	4	
Madrid.....	Dec. 1-31.....	.....	1	
Do.....	Jan. 1-31.....	.....	1	
Seville.....	Nov. 27-Dec. 31....	.....	32	
Do.....	Jan. 1-Mar. 11....	.....	16	
Valencia.....	Nov. 26-Dec. 23....	3	.....
Do.....	Dec. 31-Mar. 31....	48	2	

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued.

Reports Received from December 30, 1922, to April, 27, 1923—Continued.

SMALLPOX—Continued.

Place.	Date.	Cases.	Deaths.	Remarks.
Switzerland:				
Bas'l.....	Feb. 23-Mar. 24....	4	.....
Berne.....	Nov. 19-Dec. 30....	85	.....
Do.....	Dec. 31-Mar. 10....	168	.....
Lucerne.....	Jan. 1-Mar. 17....	18	.....
Zurich.....	Nov. 19-Dec. 30....	19	.....
Do.....	Jan. 14-Mar. 24....	38	.....
Syria:				
Aleppo.....	Nov. 19-Dec. 23....	38	20	
Do.....	Dec. 31-Mar. 24....	29	6	
Beirut.....	Dec. 11-20....	1	.....
Damascus.....	Nov. 1-Dec. 31....	97	16	
Do.....	Jan. 1-Feb. 20....	22	.....
Tunis:				
Tunis.....	Dec. 1-22....	2	1	
Do.....	Jan. 22-Feb. 4....	1	1	
Turkey:				
Constantinople.....	Nov. 19-Dec. 16....	122	34	
Do.....	Dec. 31-Feb. 23....	416	144	
Union of South Africa:				
Do.....				Oct. 1-Dec. 31, 1922: Cases—colored, 64; deaths, 1; white, cases, 4.
Cape Province.....				Jan. 1-31, 1923: Cases, 22; colored; 18; white, 4; deaths, 1 (colored).
Do.....				Oct. 1-Dec. 31, 1922: Cases—colored, 48; deaths, 1; white, 4 cases.
Do.....				Jan. 1-31, 1923: Cases, 14 (colored, 10, white, 4).
Do.....	Dec. 31-Mar. 3....	.....	.....	Outbreaks.
East London.....	Jan. 7-13....	2	.....
Natal:				
Do.....				Dec. 1-31, 1922: Cases, 6 (colored)
Do.....				Jan. 1-31, 1923: Cases, 4; deaths, 1 (colored).
Do.....	Feb. 4-10....	.....	.....	Outbreaks.
Orange Free State:				
Do.....				Dec. 1-31, 1922: Cases, 2 (colored)
Do.....	Jan. 14-Feb. 3....	.....	.....	Jan. 1-31, 1923: Cases, 3 (colored).
Do.....				Outbreaks.
Southern Rhodesia:				
Transvaal.....	Nov. 9-15....	3	.....
Do.....				Oct. 1-Dec. 31, 1922: Cases, 10.
Do.....	Dec. 31-Mar. 3....	.....	.....	Jan. 1-31, 1923: Cases, 1 (colored)
Johannesburg.....	Nov. 1-30....	.....	1	Outbreaks.
Do.....	Jan. 1-31....	1	.....
Yugoslavia:				
Serbia.....				Aug. 1-31, 1922: Cases, 30; deaths, 12.
Belgrade.....	Nov. 12-Dec. 31....	10	4	Aug. 1-31, 1922: Cases, 26.
On vessel:				
S. S. Huntress.....	Nov. 11....	1	.....	At Fremantle, Australia; from Cape Town, South Africa.
S. S. Junin.....	Jan. 13....	1	.....	At Antofagasta, Chile. Vessel proceeded to Arica, Chile, with patient on board.
S. S. —.....	Dec. 17-23....	1	.....	At Liverpool.
S. S. Tenyo Maru.....	Mar. 20....	1	.....	At Shanghai, China, from Japan. In steerage passenger.

TYPHUS FEVER.

Algeria:				
Algiers.....	Nov. 11-Dec. 31....	2	1	
Do.....	Jan. 1-31....	7	2	
Oran.....	Jan. 11-20....	1	1	
Austria:				
Vienna.....	Jan. 7-17....	1	.....
Bolivia:				
La Paz.....	Jan. 1-Feb. 28....	26	21	
Brazil:				
Pernambuco.....	Dec. 3-9....	2	2	
Porto Alegre.....	Nov. 19-Dec. 16....	3	.....
Do.....	Feb. 25-Mar. 3....	.....	3	

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued.

Reports Received from December 30, 1922, to April 27, 1923—Continued.

TYPHUS FEVER—Continued.

Place.	Date.	Cases.	Deaths.	Remarks.
Bulgaria:				
Sofia.....	Feb. 4-24.....	2	.....	Paratyphus, 3 cases.
Chile:				
Antofagasta.....	Nov. 12-Dec. 30...	24	5	Nov. 11-Dec. 5, 1922: Cases, 10; deaths, 2. Quarantine station;
Do.....	Dec. 31-Feb. 24...	3	2	October, 1922—1 fatal case.
Concepcion.....	Oct. 17-Dec. 18.....	.....	9	On vessel from Valparaiso;
Do.....	Dec. 26-Feb. 23.....	.....	10	November, 1922—cases, 7; December, 1922—cases, 9; remaining, Dec. 31, 3 cases.
Iquique.....	Jan. 14-20.....	1	1	
Talchuanano.....	Nov. 12-Dec. 23.....	10	6	
Do.....	Jan. 7-Mar. 17.....	7	2	
Valparaiso.....	Dec. 3-30.....	.....	9	
Do.....	Dec. 31-Feb. 10.....	.....	23	Daily hospital average, 25 cases.
China:				
Antung.....	Nov. 13-Dec. 10...	7	.....
Manchuria—				
Harbin.....	Nov. 20-26.....	7	.....
Do.....	Jan. 1-Feb. 18.....	7	.....
Cuba:				
Matsnzas.....	Dec. 25-31.....	1	1	
Czechoslovakia:				
City.....				
Prague.....	Nov. 19-25.....	1	.....
Province.....				
Bohemia.....	Nov. 1-30.....	1	.....
Ruthenia.....	Oct. 1-Dec. 31.....	25	.....
Slovakia.....	Nov. 1-30.....	2	.....
Danzig (Free City).....	Jan. 7-Feb. 24.....	2	.....	Including one from Poland.
Egypt:				
Alexandria.....	Nov. 19-Dec. 31...	2	1	
Do.....	Jan. 22-Mar. 4.....	2	.....
Cairo.....	Oct. 1-Dec. 31.....	19	9	
Do.....	Jan. 1-21.....	7	3	
Esthonia:				
Do.....				Oct. 1-Dec. 31, 1922: Cases, 6. Recurrent typhus: Cases, 10. Year 1922: Cases, 159; recurrent typhus, 91 cases.
Libau.....	Dec. 24-30.....	1	.....	Jan. 1-Feb. 23, 1923: Cases, 9. Recurrent typhus Jan. 1-31, cases, 4.
Narva.....				Year 1922: Cases, 140; recurrent typhus: Cases, 83.
Finland.....				Feb. 16-23, 1923: Cases, 6; recurrent typhus, 1.
Germany:				
Berlin.....	Nov. 26-Dec. 2.....	.....	1	
Coblenz.....	Dec. 10-16.....	1	.....
Do.....	Mar. 25-31.....	1	.....
Dresden.....	do.....	1	.....
Great Britain:				
Glasgow.....	Jan. 7-Feb. 17.....	4	1	
Greece:				
Corfu Island.....	Feb. 8.....	.....	.....	Present
Leucadia.....	Jan. 17.....	.....	.....	Do.
Patras.....	Nov. 19-25.....	.....	1	
Do.....	Jan. 1-17.....	3	5	
Piræus.....	Feb. 8.....	.....	.....	Do.
Prevesa.....	Jan. 17.....	.....	.....	Do.
Saloniki.....	Dec. 18-24.....	3	.....	Among refugees
Do.....	Jan. 7-Feb. 25.....	79	4	Refugees.
Zante.....	Jan. 17.....	.....	.....	Present.
Guatemala:				
Guatemala City.....	Jan. 1-31.....	.....	1	
Hungary:				
Budapest.....	Jan. 14-Mar. 11.....	15	3	
Ireland:				
Belmullet.....	June 15-Dec. 14.....	20	.....	In county Mayo.
Italy:				
Trieste.....	Feb. 23-Mar. 3.....	1	.....
Latvia.....				
Mexico:				
Mexico City.....	Nov. 12-Dec. 30.....	90	.....	Including municipalities in Federal District.
Do.....	Dec. 31-Mar. 3.....	112	.....	Do.
San Luis Potosi.....	Jan. 23-Apr. 7.....	.....	4	

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued.

Reports Received from December 30, 1922, to April 27, 1923—Continued.

TYPHUS FEVER—Continued.

Place.	Date.	Cases.	Deaths.	Remarks.
Palestine.....				Dec. 5-25, 1922: Cases, 3; in northern section. Feb. 27-Mar. 5, 1923—1 case in northern section.
Jaffa.....	Dec. 12-18.....	2		
Do.....	Jan. 16-Feb. 26.....	4		
Jerusalem.....	Dec. 26-Jan. 1.....	1		
Paraguay: Asuncion.....	Jan. 1-27.....		1	
Persia: Tabriz.....	Dec. 18-31.....		3	
Do.....	Jan. 15-28.....		1	
Teheran.....	Sept. 24-Nov. 24.....		3	
Poland.....				Oct. 1-Dec. 23, 1922: Cases, 1,916; deaths, 130. Recurrent typhus: Cases, 2,071; deaths, 56. Jan. 1-21, 1923: Cases, 1,029; deaths, 86. Recurrent typhus: Cases, 386; deaths, 7.
Portugal: Oporto.....	Oct. 15-Dec. 2.....	1	1	
Do.....	Mar. 11-17.....	3		
Rumania: Bucharest.....				To Jan. 31, 1923: Cases, 96; deaths, 13.
Do.....	Feb. 1-10.....	133		
Chisinau.....	Nov. 1-30.....	5		
Do.....	Jan. 1-Feb. 28.....	110		Recurrent typhus: Cases, 33.
Craiova.....	Feb. 1-10.....	1		
Russia.....				July 30-Sept. 23, 1922: Cases, 23,803.
Moscow.....	Jan. 1-31.....	290		Undetermined cases, 38.
Ukraine.....	Jan.-Sept.....	307,329		Provisional figures.
Ukraine, Tartar Republic, and Siberia.....	June 1-30.....	35,926		
Do.....	July 1-31.....	17,262		Do.
Do.....	Aug. 1-31.....	6,864		Do.
Do.....	Sept. 1-30.....	2,388		Do.
Siberia: Vladivostok.....	Nov. 1-Dec. 31.....	5		Remittent, 1 case; indefinite, 6 cases.
Do.....	Jan. 1-Feb. 28.....	130		Remittent, 1 case; indefinite, 33 cases.
Spain: Barcelona.....	Nov. 30-Dec. 27.....		3	
Do.....	Jan. 11-17.....		1	
Madrid.....	Dec. 1-31.....		1	
Do.....	Feb. 1-28.....		1	
Syria: Aleppo.....	Dec. 10-16.....	1	1	
Do.....	Jan. 7-Mar. 24.....	84	19	Generally among refugees.
Beirut.....	Oct. 1-22.....	1		
Turkey: Constantinople.....	Nov. 27-Dec. 2.....	3		
Do.....	Dec. 31-Mar. 10.....	199	33	
Union of South Africa.....				Oct. 1-Dec. 31, 1922: Colored—cases, 3,067; deaths, 298; white—cases, 11; deaths, 2.
Do.....				Jan. 1-31, 1923: Total—cases, 597; deaths, 66. (Colored—cases, 587; deaths, 65; white—cases, 10; 1 death.)
Cape Province.....				Oct. 1-Dec. 31, 1922: Colored—cases, 2,799; deaths, 250; white—cases, 6; deaths, 1.
Do.....				Jan. 1-31, 1923: Colored—cases, 513; deaths, 54; white—6 cases; 1 death.
Do.....	Dec. 31-Feb. 24.....			Outbreaks.
Port Elizabeth.....	Jan. 28-Feb. 10.....	3		
Natal.....				Oct. 1-Dec. 31, 1922: Colored—cases, 143; deaths, 32; white—cases, 2.
Do.....				Jan. 1-31, 1923: Colored—cases, 19; deaths, 1; white—1 case.
Do.....	Feb. 4-17.....			Outbreaks.
Orange Free State.....				Oct. 1-Dec. 31, 1922: Colored—cases, 91; deaths, 8; white—cases, 3; deaths, 1.

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued.**Reports Received from December 30, 1922, to April 27, 1923—Continued.****TYPHUS FEVER—Continued.**

Place.	Date.	Cases.	Deaths.	Remarks.
Union of South Africa—Con. Orange Free State.....				Jan. 1-31, 1923: Colored—cases, 37; deaths, 5; white—1 case. Outbreaks.
Do.....	Jan. 7-Mar. 3.....			Oct. 1-Dec. 31, 1922: Colored—cases, 64; deaths, 8.
Transvaal.....				Jan. 1-31, 1923: Colored—cases, 18; deaths, 6; white—cases, 2. Outbreaks.
Do.....				
Do.....	Jan. 14-Feb. 17.....			
Johannesburg.....	Nov. 1-30.....	3	6	
Do.....	Jan. 1-31.....	4	2	
Venezuela:				
Maracaibo.....	Jan. 21-27.....		1	
Yugoslavia:				
Bosnia-Herzegovina.....	Aug. 1-31.....	1		
Serbia.....				Aug. 1-31, 1922: Recurrent typhus fever: Cases, 4.

YELLOW FEVER.

Brazil:				
Bahia.....	Dec. 31-Mar. 10. . .	46	11	
Mexico:				
Ciudad Victoria.....	Dec. 17-23.....	1		
Tampico.....	Jan. 15.....	1		Reported on bills of health.
West Africa:				
Gold Coast—				
Saltpond.....				Reported present Dec. 21, 1922
Nigeria—				
Warrai.....				Do.