PUBLIC HEALTH REPORTS

VOL. 38 JUNE 29, 1923 No. 26

STUDIES ON THE PERMEABILITY OF LIVING AND DEAD CELLS.

I. NEW QUANTITATIVE OBSERVATIONS ON THE PENETRATION OF ACIDS INTO LIVING AND DEAD CELLS.

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The effect of acids upon the permeability of tissues has attracted the interest of investigators for many years. From the qualitative determinations of such men as Pfeffer (1) and Ruhland (2) were born the efforts of later investigators, who have attempted to place the study of acid penetration upon a quantitative basis. The excellent work of these men has opened the way for further observations.

The first to use quantitative methods was Harvey (3), who made direct observations upon the pigmented gonidial filaments of a holothurian, *Stichopus ananas*, the "prickly fish." This animal contains a pigment which is sensitive to changes in H-ion concentrations within a certain range. Harvey placed animals in equal molecular concentrations (0.01N) of a large number of acids, and measured the time required to produce color change in the pigment. He concluded that there was no relation between degree of dissociation of an acid and its toxicity, but that there is a general relation, though not exact and quantitative, between penetrating power on the one hand and lipoid solubility and capillary activity on the other hand.

Crozier (4), noting that Harvey studied only one concentration of acid, made observations at a number of concentrations in a series of acids similar to the concentration employed by Harvey. Although using a totally unrelated animal, he nevertheless obtained results concordant with those obtained by Harvey using 0.01N solutions. Crozier (5) used the mantle tissue of a nudibranch mollusk, *Chromodoris zebra,* which also contains a natural pigment sensitive to acids and changing from blue to pink at a pH of about 5.6. In further studies Crozier (6) found that in most of the lower concentrations butyric acid penetrates more readily than acetic acid, and that the effect of the relative H-ion concentration on the speed of penetration increases with increasing concentration of acid. In this investigation the same writer made observations on the chloroacetic acids, and from the consistent behavior of the members of this series he was led to conclude that ionization determines the relative penetrating ability. He concludes that the actual speed of penetration through the tissues observed with any acid is dependent upon two influences: namely, preliminary chemical combination with the outer protoplasm followed by diffusion.

Osterhout (7) has shown that the resistance of the marine alga, *Laminaria agardhii*, when it is immersed in different concentrations of HCl, is that which would be expected if this tissue behaved like the mantle tissue of *Chromodoris*.

Haas (8) used acids in such concentrations as to give the same external pH (2.0), and found that acetic acid penetrates into various plant cells more quickly than HCl at the same pH.

Recent work by Loeb (9) has shown that the rate of diffusion of acids into the egg of the marine teleost fish, *Fundulus*, is greatly influenced by the cations present in the surrounding solution.

In this paper the penetration of acids into a living cell has been studied under conditions in which the surrounding solution always consisted of sea water to which had been added traces of acid. The same cations were therefore always present in the same proportions.

Furthermore, the same concentration of hydrogen ions was maintained throughout the whole series of experiments. The recent researches of Loeb (10) on the chemical and physical behavior of proteins have demonstrated the importance of maintaining equal H-ion concentrations when the behavior of ampholytes is involved, and have led the writer to maintain equal external H-ion concentrations throughout the present investigations of the penetrating power of a series of acids. These acids were used in such concentrations as to give a pH of 3.6, because the observations of Loeb show that near this pH the salts of many native proteins have their maximum osmotic pressure, viscosity, and swelling. At this pH adventitious changes in the reaction have relatively little influence on these physical properties, thus minimizing the possible error produced by such changes. At lower H-ion concentrations, such as pH 5.0, it was also found that the time elapsing before there was an appreciable change in the pH of the cell sap was very great, particularly in the case of sulphuric and the weak acids, and the results could not be depended upon for accuracy.

The marine alga, *Valonia ventricosa* (J. Aghard [1]) was used because of its exceptional suitability for studying the penetration of sub-

[1] Dr. M. A. Howe, of the New York Botanical Garden, so identified the species used. (Personal communication.)

stances through living protoplasm. It is a single coenocytic cell with a large vacuole which contains cell sap in quantities sufficient for making accurate analyses. Outside of this vacuole is a delicate layer of protoplasm containing many nuclei, chloroplasts, etc., and this in turn is inclosed in a thin, very tough external wall. The size of this organism varies from very small plants to those containing 25 to 50 c. c. of sap. Thus by noting the H-ion concentration of the sap at various intervals after immersing the cell in an acid solution, one can readily detect the entrance of the acid in question.

Valonia ventricosa was obtained by dredging about 3 meters below low tide level along the Florida Keys. The plants usually had adhering to them pieces of coral, sand, sponges, other seaweeds, or débris, and these were all carefully removed before the plants were used for experiments. The plants were collected three times a week. After collection there were always some which were injured, and these cytolyzed usually by the next morning, so that the plants were seldom used immediately after collection. In this way most of the plants not in good condition were eliminated. The ones in good condition were used one day and sometimes two days after collection.

For testing the sap, each cell was thoroughly wiped on filter paper until dry, a small hole punctured through the wall by means of a pointed glass rod, and the sap forced through the opening. As the sap is under considerable pressure it comes out readily. In all of these investigations, hard glass test tubes and tubing were used. The pH determinations were made by means of indicators. Under no conditions was the sap allowed to spray through the air, because CO_2[1] is quickly dissipated, thereby causing a change in the pH of the sap and giving rise to erroneous data. Distilled water was not used for rinsing because of the pronounced influence exerted by it on the hydrostatic pressure within the cell. It was found that when cells were left in distilled water for 10 minutes or even less, they ruptured. It was also found that by wiping a cell thoroughly on filter paper, all particles which might contaminate the sap were effectively removed. It was very important to make certain of this, because the sap at certain H-ion concentrations was almost devoid of buffer properties, and traces of alkali or acid would seriously affect the results.

It was found that the pH of the sap of healthy plants was almost invariably between 6.2 and 6.4 when the free CO_2 was not removed, and between 6.6 and 6.8 when the free CO_2 had been eliminated. One would expect the pH of the CO_2-free sap of *Valonia ventricosa* to be very close to 7.0, according to the analysis of the sap of *V. macrophysa* (12), most of the salts of which are in the form of chlorides.

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[1] This was also noted by Crozier (11).

Crozier (11) found the sap of *V. macrophysa* to have an average pH value of 6.9. This measurement was evidently made without eliminating the CO_2, as no mention is made of removing it. The slight differences between the results obtained by Crozier and the writer may be due to difference in species or to local conditions. It may be of interest to add that the cell reaction of most plants has been found to be acid. The writer (13) has also had occasion to note the reaction of the sap of a fresh-water alga, *Nitella* sp., which grows at Woods Hole, and found it to have a pH value of 5.7. No account was taken of the CO_2 content of this alga, except the usual care in preventing its escape. In the light of these experiments it would be of interest to find out the pH of the sap of *Nitella* after removing the CO_2. Some of the larger cells of *Valonia* were more alkaline (pH 7.0 to 7.6). This may be due to the fact that as the cells age they become more permeable to the salts of sea water, and therefore the composition of their sap more nearly approaches that of sea water, the pH of which is 8.6. Only occasionally are small plants found the cell sap of which has a pH of 7.0 and more. These have perhaps been injured at some time. The readings obtained from these were always discarded. Some plants are also incrusted with a growth of some kind of sea weed, which can not be scraped off without injuring the plant. It was found that the readings in which these plants were used could not be relied upon to give accurate results, and they were therefore never used.

Dead cells have the same reaction as sea water, which, in this locality, is pH 8.6. In all of the experiments only those cells which were obviously healthy or in good condition were used. These were dark olive green in color, glossy and very firm and hard. As the plants die they become light green in color and finally soft and dull. The protoplasm then disintegrates and leaves the cells transparent, and the small particles of the disorganized protoplasm can be seen as small dark green or black bits floating loosely in the sap. Not all plants become soft immediately. Some retain their turgor for a long time.

The temperature at which these experiments were done was 24° C. This is the temperature of the sea water at Miami and of the running sea water at the laboratory. It remains constant throughout the year.

It was found that *Valonia* is very sensitive to any slight changes in osmotic pressure, and care was therefore necessary to interfere with this as little as possible. The acids were added to sea water in traces until pH 3.6 was obtained. They were kept constant at this pH by addition of traces or by replacing the liquid, depending on the rapidity with which the pH changed from 3.6.

In all of this work two sets of readings were made; one set, including all the free CO_2 found in the sap and the other set when the free CO_2 had been removed. In all the figures the curves marked "A" indicate the pH of the sap when CO_2 was included in the readings, or, in other words, just as it was inside the cell. Those curves marked "B" indicate the pH of the sap after the CO_2 had been expelled. The CO_2 was blown out by placing the sap in Pyrex tubes and bubbling through it compressed air washed through a solution of NaOH. The outlet tube of the NaOH wash bottle was thoroughly protected by a "hood" of filter paper to keep out any spray from NaOH. No ammonia was detected in the compressed air. By this method it was found that in many cases an acid, upon penetrating, combined immediately with the basic ions previously present in combination with CO_2. The latter was liberated as carbonic acid, which was the acid directly responsible for the observed increase of acidity, and which could be removed by aeration. Any change of pH still remaining after aeration would then be due to acid penetrating from the exterior solution in excess over the amount needed to displace the carbonic acid.

It was thought that perhaps some of the acids entering the cells were volatile enough to be bubbled off by this method, thereby giving wrong values for the H-ion concentration of the sap; but in no case could any change of pH be produced by aeration of sap from cells previously in solutions of such acids.

In all figures each curve represents one typical experiment. In every case a number of experiments have been performed, varying from 6 in cases which gave concordant results to 10 or more in those which were less certain. For each experiment the number of plants used is shown by the points on the curve. Each point represents one observation made upon the sap of one plant.

The probable error was determined for a few cases and found to be about 1 per cent.

RELATION OF SIZE OF PLANT TO RATE OF PENETRATION OF ACID.

It was soon discovered that cells of the same size had to be chosen for all the experiments in order to obtain consistent results. Crozier (6) also had made this observation in the case of *Chromodoris*. He assumes that the distance to which acid must have penetrated in order to occasion the indicative color change is essentially a constant quantity in the case of *Chromodoris*, quoting Conklin (14) to the effect that "in mollusks the cell size is not a function of body size but is constant during by far the greater part of the life duration." In *Valonia* the size of the cell and vacuole changes with the age of the plant; and when acids appear to penetrate more slowly, this may be due to the greater distance through which substances must diffuse in order to pass from the periphery to the center of the vacuole, or vice versa. That simple diffusion controls, to a considerable extent, the rate of change of the pH of the sap of *Valonia* is illustrated by the following experiment: If the sap from a single cell which had been previously placed in certain of the acids was forced out continuously, without releasing the pressure, into several successive tubes, each containing indicator, it was found that the acidity changed in the successive tubes. For this reason, when making a single determination of the acidity of the cell sap, all of the sap was used and only the average acidity was recorded. This precaution was found to be unnecessary in the case of those acids which penetrate so rapidly that diffusion is a negligible factor. One can readily understand that cells having a diameter of 10 mm. might be expected to give different results from those the diameter of which is 25 mm. For all the experiments here described, only those cells having a diameter of 13 mm. were used, unless otherwise specified, as it was found that these were most convenient to handle and gave reliable and consistent data. In order to obtain the proper grading, a piece of cardboard with an opening of 13 mm. in diameter was used for measuring the cells (on the principle used in grading fruit). The relation of size of plant to rate of penetration of acid is illustrated in Figure 1.

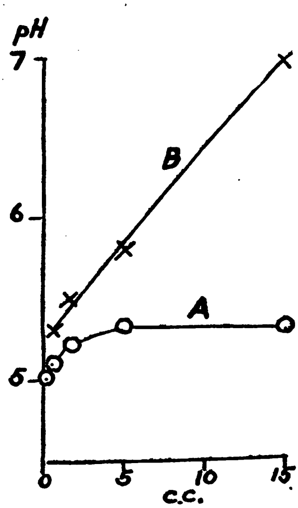

FIG. 1.—Relation of size of plant to rate of penetration of HCl into the cell sap of *Valonia* in one hour. The ordinates represent pH, and the abscissæ show the number of cubic centimeters of sap contained by the plant.

Figure 1 shows the relation of the size of *Valonia* to the rate of penetration of HCl when the plant was left in a solution consisting of sea water in which enough HCl had been dissolved to produce a pH of 3.6. The abscissæ represent the number of cubic centimeters of sap which the cell contained and the ordinates represent the pH of the sap after the cell had been in HCl for one hour.

Curve "B" shows that the H-ion concentration of the sap when the free CO_2 was removed was considerably less than that in its presence. Thus, the first point shows that when the CO_2 was eliminated from the sap of a cell containing 0.5 c. c. of solution the residual pH was 5.3. In the same way points 3 and 4 show that when the plants contained 5 c. c. and 15 c. c., respectively, of cell sap, the residual pH was 5.8 and 7.0.

In the first two cells, which are the smallest, there is not so much bicarbonate to be acted upon and, therefore, less CO_2 to be liberated. In other words, the greater the diameter the smaller the ratio of the area of the cell surface to the volume of the cell, and therefore the less acid will enter in any given time per gram ion of HCO_3 to be decomposed, and the slower the apparent penetration. That diffusion plays a rôle in some cases of slower penetration is very probable. That larger plants have a higher concentration of bicarbonates to decompose is also probable, inasmuch as the pH of the sap of large plants is normally considerably higher than that of smaller plants. The initial pH of the plant represented by point "4" in Figure 1 was probably about 7.4 (as indicated by controls which had been previously observed).

THE EFFECT OF ACIDS UPON LIVING PLANTS.

The chracteristic difference between the action upon protoplasm of mineral acids and that of organic acids is the subject of much discussion. It is hoped that the observations here recorded may throw some light upon this problem.

It was found that the acids used in these experiments could be grouped into two broad classes. The behavior of carbonic acid was found to be sufficiently characteristic to make it seem desirable to devote a separate paper to its discussion.

The first class comprises those acids which, in penetrating, displace all or most of the bicarbonates, producing a great deal of free CO_2, which persists for a considerable length of time. These acids are hydrochloric, nitric, sulphuric, arsenic, phosphoric, oxalic, citric, tartaric, trichloracetic. To this list must be added mono- and dichloracetic acids, which appear to penetrate more rapidly and maintain free CO_2 for a much shorter time.

To the second class belong benzoic, butyric, and acetic acids, which give no evidence of CO_2 liberation; and salicylic acid liberated so slight an amount that it has also been included.

The acids of the first class are more strongly dissociated than those of the second class, which, with the exception of salicylic acid, are very slightly dissociated (see Table I). The acids of the second class are also distinguished by the fact that they belong to the class of substances which Hantsch terms "pseudo-acids." The significance of this fact has been discussed by Loeb in a recent paper (9). They are more toxic than acids of the first class (except mono- and dichloracetic acids). It will also be evident that a quite different set of reactions is induced in the cell by acids of the second class.

Figure 2 shows the effect upon the cell sap of *Valonia* of immersing the plant in sea water in which enough acid was dissolved to give a pH of 3.6. The three mineral acids used are represented by the following symbols: hydrochloric, open and closed circles; nitric, open triangles and underlined circles; sulphuric, closed triangles and crosses.

The ordinates show the pH of the sap. An initial pH of 6.6 is always indicated for curve "B," as that was the average normal pH of the cell sap from which CO_2 had been removed, and an initial pH of 6.2 was always indicated for curve "A," indicating the usual pH of the sap with CO_2 present. The abscissæ show the time in minutes, beginning at the moment the cells are placed in the acid solution.

Curve "A" shows the reaction of the sap when CO_2 is allowed to remain. These curves are identical in the first part of the reaction but vary in the latter part on account of varying rates of penetration of these three acids. Sulphuric acid is the slowest of any studied; the dotted lines show that an interval of five hours elapsed without a change in pH. It seems as if the SO_4 has an effect upon the penetration of the H-ion. Since SO_4 is absent from normal sap (15), it seems probable that the same mechanism acts here as acts to prevent the penetration of sulphuric acid.

Curves "B" show the pH value of the sap when CO_2 has been removed. These curves are all more or less identical in shape

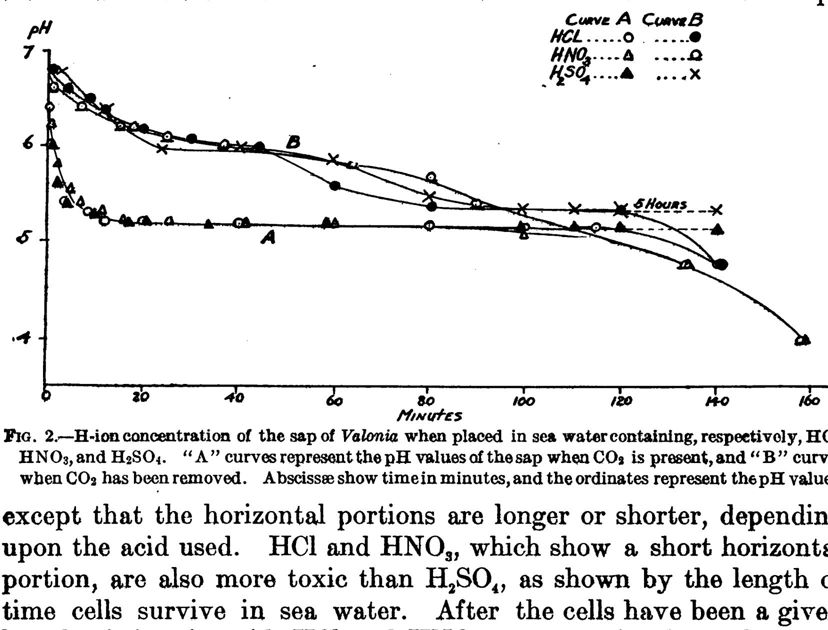

FIG. 2.—H-ion concentration of the sap of *Valonia* when placed in sea water containing, respectively, HCl, HNO_3, and H_2SO_4. "A" curves represent the pH values of the sap when CO_2 is present, and "B" curves when CO_2 has been removed. Abscissæ show time in minutes, and the ordinates represent the pH values.

except that the horizontal portions are longer or shorter, depending upon the acid used. HCl and HNO_3, which show a short horizontal portion, are also more toxic than H_2SO_4, as shown by the length of time cells survive in sea water. After the cells have been a given length of time in acid, HCl and HNO_3 penetrate in about the same time and are about equally toxic. In the experiments on survival, summarized in Table I, all plants were returned to sea water after having been in acid the indicated length of time. Only cells of the same size as were used for the other data were included. The time they survived was reckoned from the time they were returned to sea water until they cytolyzed. Thus, after 90 minutes in HCl, the cells cytolyzed in five days; after three hours, in two days. After 45 minutes in HNO_3 they cytolyzed in four days; after five hours, in one day. Normal cells live under laboratory conditions in sea water from 10 days to one month.

TABLE I.—*Viability of Valonia in sea water after exposure to acid solutions having a pH of 3.6.*

Acid.	Approximate dissociation constant.	Length of life, in days, after exposure to acid solutions for the indicated time in minutes.																					
		0.5	2	4	5	6	7	10	11	14	22	27	30	35	42	60	90	120	150	180	240	300	360
Carbonic	3.4×10^{-7}								10														
Butyric	1.6×10^{-5}	1	1	1					1														
Acetic	1.8×10^{-5}						3																
Benzoic	6.0×10^{-5}				1		1																
Citric	8.2×10^{-4}															9							
Salicylic	1.0×10^{-3}						4					3											
Monochloracetic	1.6×10^{-3}						5	2			1		1										
Arsenic	5.0×10^{-3}							9								5				3			
Phosphoric	1.0×10^{-2}																				4		1
Dichloracetic	$5-6 \times 10^{-2}$							2		2													
Trichloracetic	$3-12 \times 10^{-1}$					10							6										
Nitric	Ill-defined									6					4				2			1	
Hydrochloric	Ill-defined																5		3	2	1		
Sulphuric	Ill-defined															7		6		3			

The data in Table I do not purport to be complete. They give a comparative idea of the length of life and amount of injury in some of the acids used. It is readily seen here that those acids which decompose bicarbonates are not so toxic as those acids which enter without acting on the bicarbonate. It might be possible to determine what proportion of the bicarbonates may be decomposed

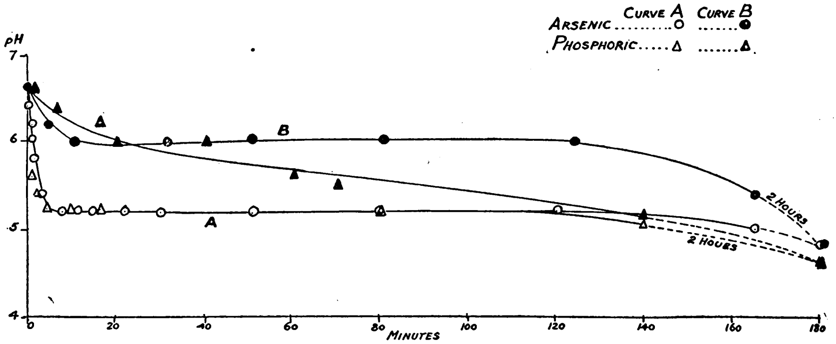

FIG. 3.—Changes in the H-ion concentration of the sap of *Valonia* when placed in solutions of arsenic and phosphoric acids. Curves "A" show the pH values when CO_2 has not been removed, and curves "B" show the pH values when CO_2 has been removed. The ordinates represent the pH of the sap, the abscissæ the time in minutes.

without causing irreversible injury. Those acids which penetrate without acting upon the bicarbonates produce irreversible injury almost immediately. Stated in other words, it seems that the

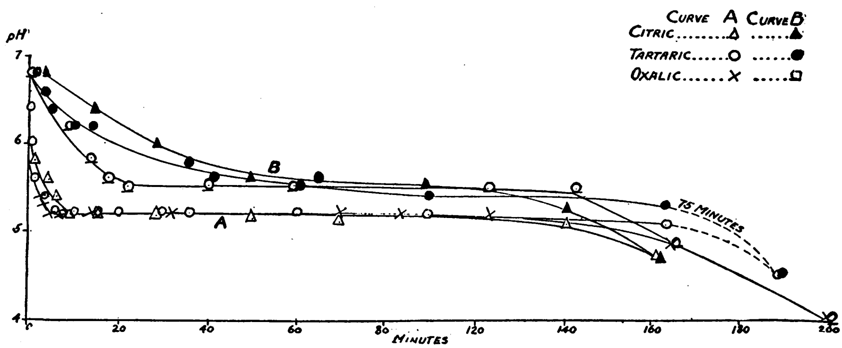

FIG. 4.—Changes in the H-ion concentration of the sap of *Valonia* when placed in solutions of citric, tartaric, and oxalic acids. Curves "A" show the pH when CO_2 is present, and curves "B" show the pH when the CO_2 has been removed. The ordinates represent the pH of the sap, and the abscissæ show the time in minutes. The dotted lines indicate 75 minutes.

presence of bicarbonates affords a protection against injury by highly dissociated acids.

The descriptions for the following figures are identical with the explanation of Figure 2 and will not be repeated. The only differences are in the kind of acid used.

Figure 3 shows results obtained with arsenic acid ($2AsO(HO)_3 \cdot H_2O$) and phosphoric acid (H_3PO_4). The dotted lines show an interval of two hours elapsing before the A and B curves coincide. Curves A are almost identical for these two acids and resemble those of Figure 2 also. Curves B are also much like those of Figure 2.

These acids are slightly less toxic than HCl. Cells allowed to remain in arsenic acid for three hours cytolyzed in three days; for one hour, five days. In the case of phosphoric acid they cytolyzed in one day after six hours in the solution, and in four days after four hours in the solution.

Figure 4 gives the results with citric ($(CH_2 \cdot CHOH \cdot CH \cdot_2 COOH)_3$), tartaric ($CHOH \cdot CHOH \cdot (COOH)_2$), and oxalic $(COOH)_2$ acids. These curves are similar in form to those of the preceding figures. Penetration seems to be somewhat more rapid. Survival data were obtained for citric acid alone. After one hour in this acid, the plant

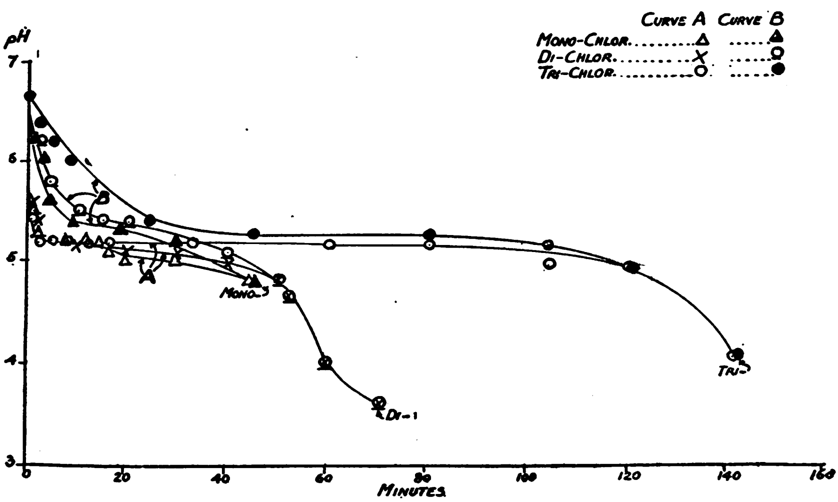

FIG. 5.—Changes in the pH value of the sap of *Valonia* when placed in solutions of mono-, di-, and trichloracetic acids. Curves "A" show the pH when CO_2 is present, and curves "B" show the pH when CO_2 has been removed. The ordinates represent the pH values of the sap, and the abscissæ show the time in minutes.

lived nine days. Citric acid is therefore considerably less toxic than the other acids mentioned above.

Figure 3 represents the results with mono- di- and tri- chloracetic acids ($CH_2ClCOOH$, $CHCl_2COOH$, and CCl_3COOH). These acids are much more toxic than those noted in the preceding paragraph. After 12 minutes in monochloracetic acid the cells cytolyzed in two days, and after 22 minutes, in one day. After 14 minutes in dichloracetic acid they cytolyzed in two days when transferred to sea water, and after 35 minutes they cytolyzed in one day. Trichloracetic acid was less toxic than the other two chloracetic acids. After 6 minutes in this acid, the plants lived 10 days in sea water, and after 30 minutes they lived 6 days.

Contrary to expectation it was found that trichloracetic acid was less toxic and less rapid in bringing the sap to the ultimate pH of 3.6 than the other two acids of the series. These results do not agree with those of Harvey (16) and Crozier (6). Harvey states that all three acids penetrate tissue within the same time approximately from 0.01 N solutions; and Crozier states that ionization determines the relative penetrating ability within groups of acids having chemical relationship. It is noteworthy that trichloracetic acid, which is a strongly dissociated acid, produced results approximating those of

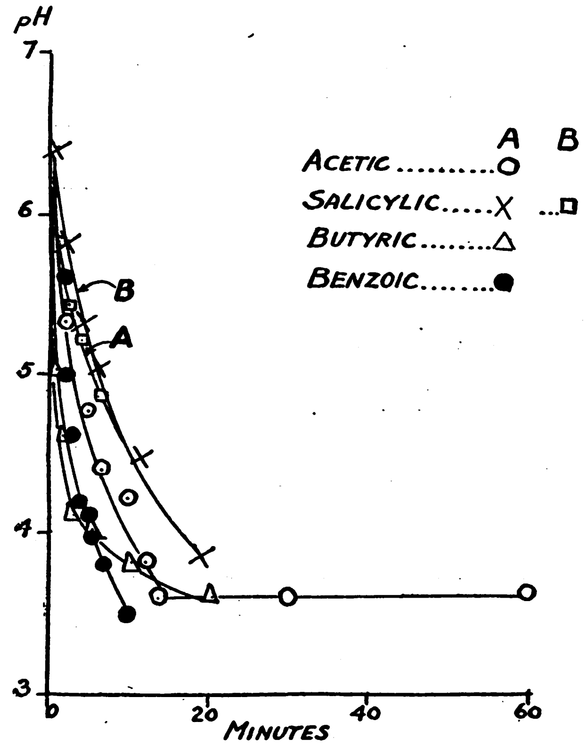

FIG. 6.—H-ion concentration of the sap of *Valonia* when placed in solutions of acetic, salicylic, butyric, and benzoic acids. (Salicylic acid is the only one of this group having two curves, as there was a slight amount of CO_2 liberated.) The ordinates represent the pH values of the sap, and the abscissæ show the time in minutes.

the mineral acid, HCl, whereas mono- and di- chloracetic, which are less strongly dissociated, penetrate more quickly than the other acid of this series.

If the curves "A" in the following figures alone were considered, the writer might also have concluded that the penetration of the three acids is almost identical. However, curves "B" show a decidedly different set of conditions. The "A" and "B" curves of tri- chloracetic acid coincide much later than those of mono- and di- chloracetic acids. This suggests that a great deal more bicarbonate is decomposed by the more strongly dissociated acid.

Figure 6 shows the rate of penetration of the following acids: acetic, butyric, salicylic, and benzoic (CH_3COOH, $CH_3CH_2CH_2COOH$, $C_6H_4OHCOOH$, C_6H_5COOH). These acids were grouped together because of the rapid entrance of the acid and the absence of CO_2 liberation, except in the case of salicylic acid, which liberated a very slight amount.

These acids are all very toxic, except salicylic, which is the least toxic of this class. Table I shows that when the plants were allowed to remain in acetic acid for 42 minutes, they cytolyzed the next day; after 7 minutes they cytolyzed in three days. When they remained in butyric acid for either 30 seconds, 2, 4, or 11 minutes, they cytolyzed in one day; after 31 minutes they cytolyzed the same day. In the case of benzoic acid they survived one day after having been in a solution of this acid for only 5 minutes. In salicylic acid, which is not so toxic, they survived three days after having been in this solution for 27 minutes Since salicylic acid liberated some of the bicarbonates, its effect on the viability of the cell agrees with the concept that those acids which act on the bicarbonates of the cell are less toxic than those which penetrate without this reaction.

If a penetrating acid of the first class liberates the CO_2 of the cell by decomposing the bicarbonates, it would be expected that those cells which had been in this acid long enough would have lost the whole of their bicarbonates, and after having been transferred to sea water long enough for all the free acid to diffuse from the cell, would show rapid penetration of this acid. This was proved to be the case by the following experiment: Cells had been kept in the usual solutions of HCl long enough to have a pH below 5.0 and then transferred to sea water till their pH became 8.6. When, after this, they were returned to HCl solution, the sap became acid very rapidly. Cells which had been kept in an acetic acid solution (acid of the second class) for a few minutes until the required pH of the solution was attained and then transferred to sea water until the pH of their sap became 8.6, were likewise placed in HCl solution, but the penetration of HCl took place in the usual manner, i. e., very slowly, thereby showing that in the latter case there is no alteration in the manner of penetration of HCl whereas in the former case the absence of bicarbonate hastens the penetration of HCl. Crozier (17) also found that to be the case, although he has attributed another reason for this increased rate of penetration.

These cells in both cases are dead, but the experiments with the cells killed by other methods show that this rapid increase of H ion concentration is not due to the fact that the cell is dead.

EXPERIMENTS WITH DEAD CELLS.

It is a matter of general opinion that when tissues are dead, substances penetrate "instantly." It was therefore thought of interest to make some quantitative observations upon the penetration into dead cells of some of the acids studied in the preceding pages.

Two sets of dead plants were used—those which were killed by boiling in sea water for 10 minutes and those which were found dead. Those which had been boiled and cooled to 24° C. before use became bright green in color, soft and dull, but the protoplasm remained intact. It was thought that this control would show the rate of penetration through dead protoplasm. Other cells which were

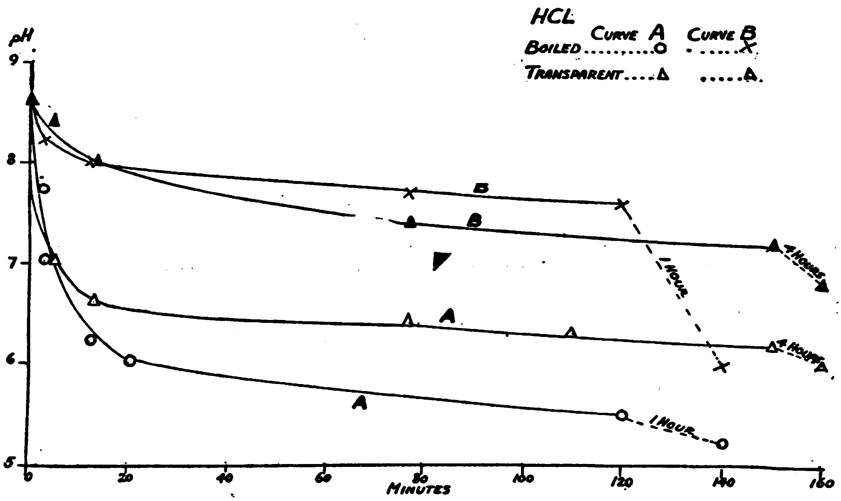

FIG. 7.—Effects on the pH of the sap of dead plants when placed in solutions of HCl. Curves "A" show the pH when CO_2 has been allowed to remain, and curves "B" show the effects when CO_2 has been removed. Ordinates represent pH values, and abscissæ time in minutes.

found dead in their natural habitat, sea water, were transparent, and the protoplasm could be seen through the wall in small dark green or black disintegrated particles floating loosely in the sap. The cell sap of all of the dead plants, boiled or not boiled, was of the same pH as the sea water of this locality (8.6) with free CO_2, and pH 9.0 without free CO_2. Therefore in all of the figures concerning dead plants the initial pH is shown as 8.6.[1] In some cases the results obtained with these two sets of dead plants were identical, and therefore only one set of symbols was used; in those cases in which there was a difference in the action of the acids upon dead plants, the two sets of curves were included.

[1] In the figures illustrating the effects on dead plants the initial pH of all of the curves was 8.6; but where a great many symbols were used, it was impossible to designate their origin at one point, and hence most of them were omitted at zero minutes.

Figures 7 to 9 include the rate of penetration of solutions of HCl, HNO_3, and H_2SO_4. Here again the buffer effect of the sap of dead

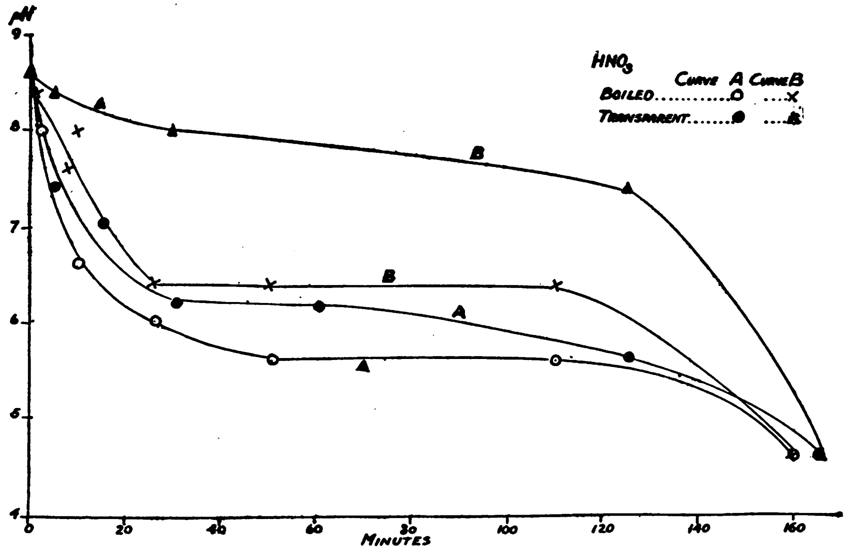

FIG. 8.—Rate of penetration of nitric acid into dead cells. Curves "A" show the pH when CO_2 is present, curves "B" when it is removed. Ordinates represent pH values of the sap, abscissæ the time in minutes.

cells is seen, with free CO_2 (Curve "A") and without CO_2 (Curve "B"). The pH of living cells is 6.4, whereas that of dead cells is

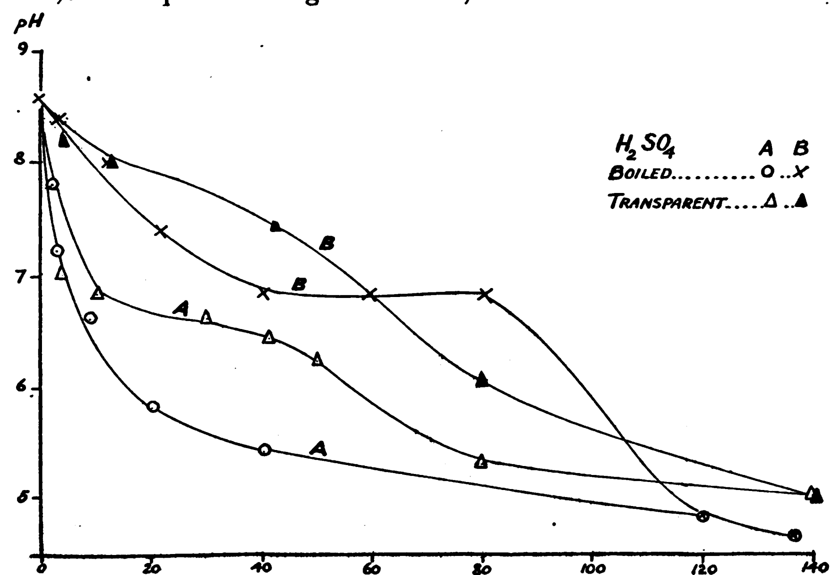

FIG. 9.—Rate of penetration of sulphuric acid into dead cells. Curves "A" show the pH when CO_2 is present, curves "B" when CO_2 is removed. The ordinates represent the pH values, the abscissæ the time in minutes.

8.6. The buffer effect in dead cells is in the carbonic acid-bicarbonate range (approximately 8.0), and continues until, as the bicarbonate-carbonic acid transformation approaches completion, the acidity of the sap increases more rapidly.

The rate of penetration into those plants which had been boiled is, in some cases, faster than that into transparent plants, and these acids cause an immediate liberation of CO_2 in large quantities.

Taking into consideration the differences in the initial amount of combined CO_2, and the ratio, $\frac{\text{carbonic acid}}{\text{bicarbonate}}$ of living and dead cells, it is difficult to draw exact conclusions as to the rate of penetration of acids. But in general it appears that HCl penetrates more slowly

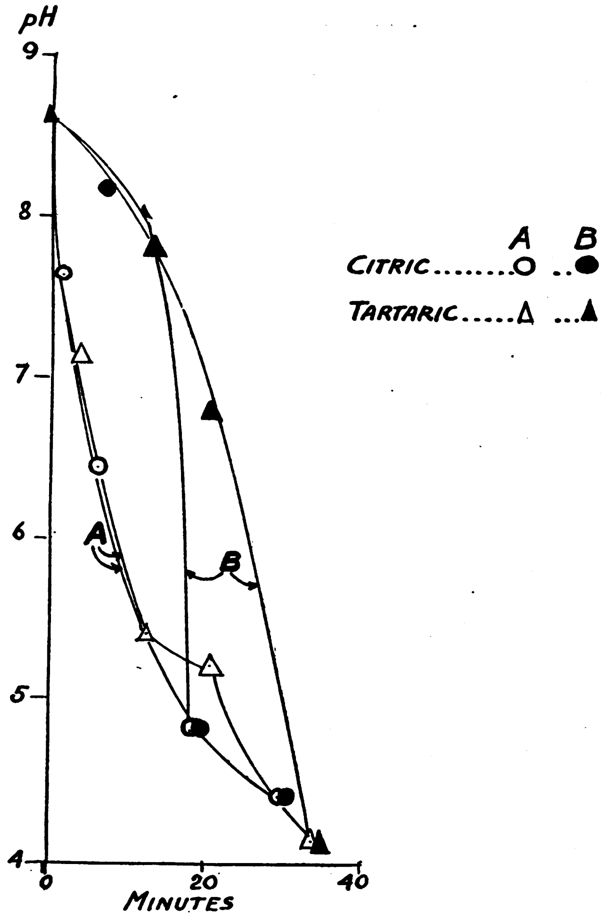

FIG. 10.—Rate of penetration of citric and tartaric acids into dead cells. Curves "A" represent pH values when CO_2 is present, curves "B" when CO_2 has been removed. Ordinates represent pH values, abscissæ the time in minutes.

into dead than into living plants, and still slower into transparent (i.e., naturally dead) plants. In the case of nitric acid, penetration is about as rapid in dead as in living plants. In the case of sulphuric acid, on the other hand, penetration is more rapid in both kinds of dead plants than in living plants. As some of the curves were too long to be included in the graphs, dotted lines indicate the time interval elapsing.

Penetration of these three acids is of interest on account of the relative concentration of their anions in the sap of living *Valonia*. Here most of the salts are in the form of chlorides (12); the concen-

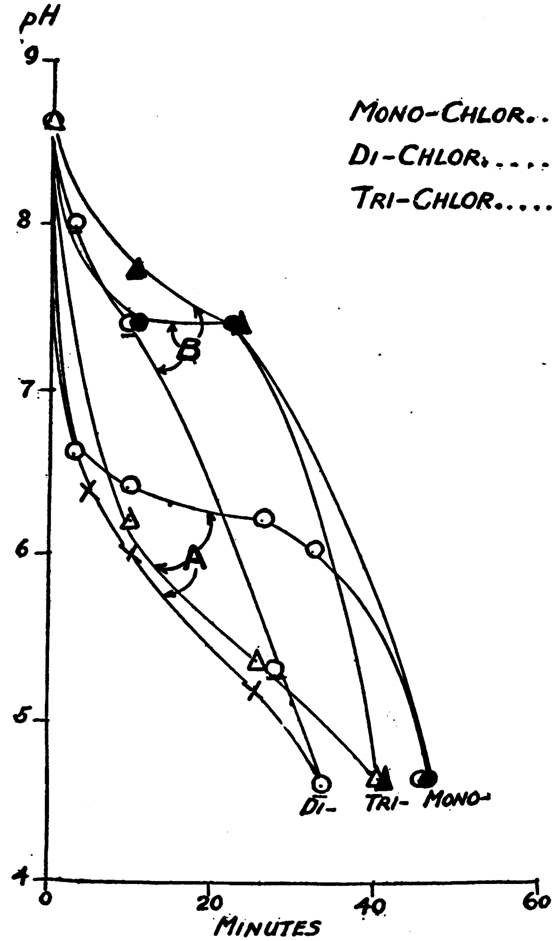

FIG. 11.—Rate of penetration of chloracetic acids into dead cells. Curves "A" show the pH values when CO_2 is present, curves "B" when CO_2 has been removed. Ordinates represent the pH values of the sap, abscissæ indicate the time in minutes.

tration of nitrates is greater than in sea water, but there is no sulphate in living plants (15). When plants die, SO_4 enters readily. It seems as if the same mechanism which regulates the presence or absence of these anions in living cells also regulates the penetration of the anions of these acids. Thus, in living plants HCl and HNO_3 enter at about the same rate, whereas the rate of penetration of H_2SO_4 is much slower. In dead plants HNO_3 enters at the same rate as in living plants; HCl is slower than in living plants, and H_2SO_4 is much more rapid than in living plants. The importance of diffusion con-

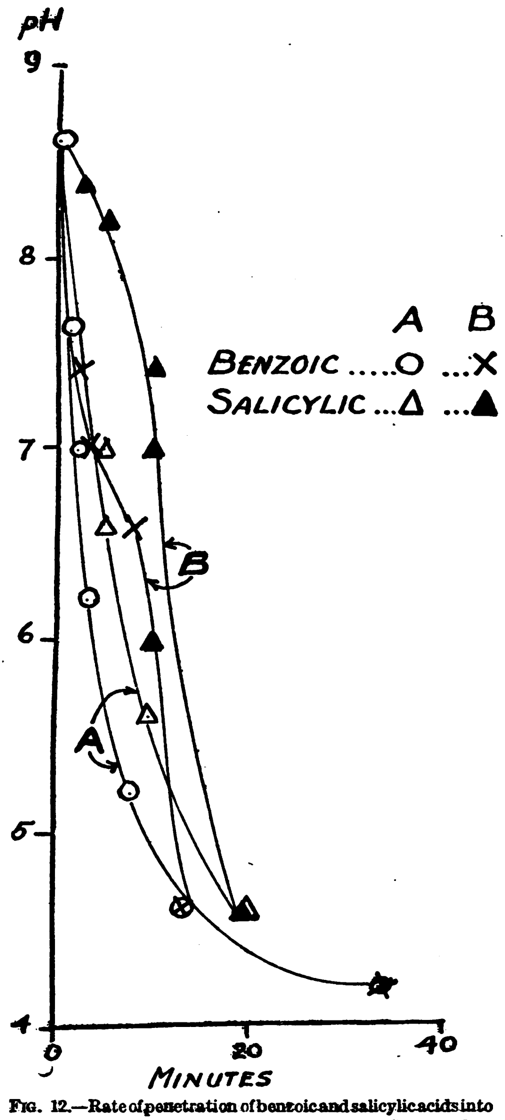

FIG. 12.—Rate of penetration of benzoic and salicylic acids into dead cells. Curves "A" show the pH values of the sap when CO_2 is present, curves "B" the values when CO_2 has been removed. Ordinates represent the pH values of the sap, abscissæ the time in minutes.

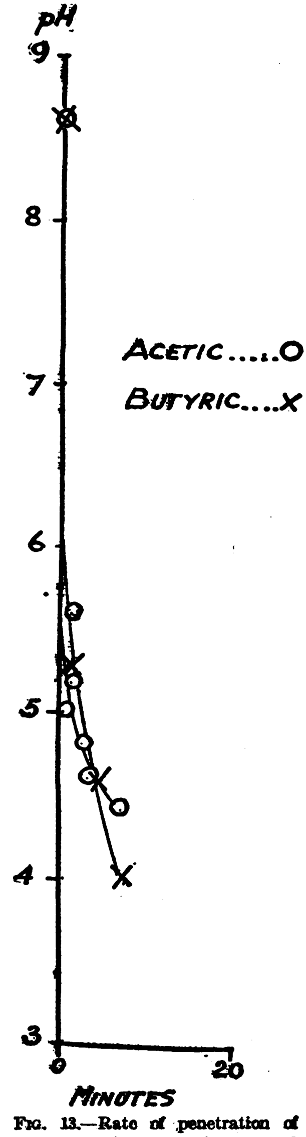

FIG. 13.—Rate of penetration of acetic and butyric acids into dead cells. The ordinates represent the pH values of the sap, and the abscissæ show the time in minutes.

stants of acids and of salt effect is explained by Loeb (18), and must of necessity have considerable bearing upon the explanation of these results.

Citric and tartaric acids enter much more rapidly into dead than into living plants. The curves for transparent and for boiled plants were the same, and, hence, only one set is indicated in the figures. (Fig. 10.)

The rates of penetration of the chloracetic acids into dead cells differ from those observed for living cells. In the case of tri-chloracetic acid the rate of penetration into dead plants greatly exceeds that into living plants; di-chloracetic acid penetrates somewhat more rapidly; and mono-chloracetic differs little in rate. The three acids which penetrate living plants at widely different rates, besides differing in the amount of CO_2 liberated (Fig. 5), now penetrate at comparable rates and differ only moderately in the amount of CO_2 liberated (Fig. 11). There is no difference in the rate of penetration of any of these acids into boiled and transparent plants.

Figure 12 shows the results with salicylic and benzoic acids. The results for boiled and for transparent plants were identical. A small amount of CO_2 is liberated by both these acids; and in this respect the behavior of benzoic acid differs in its effects on living and dead plants, no CO_2 being liberated in the former case. This difference prevents exact comparison of the permeability of the cells to benzoic acid in the two cases, but it appears to be much greater in the case of living cells. Salicylic acid seems to penetrate living and dead cells at about the same rate.

In the case of acetic and butyric acids (Fig. 13) no liberation of CO_2 was noted. This is true for both boiled and transparent plants, the curves of which are identical. The rate of penetration of these two acids seems to be about the same in living and in dead plants.

DISCUSSION.

The methods here recorded have enabled the writer to determine the rate of penetration of various acids from moment to moment during the entire process, and to show that this is not a simple or orderly process. The data show that it is not sufficient to adopt an arbitrary pH interval by which to measure the rate of penetration, as previous writers have done. In studying the penetration of acids into plants the reactions produced within the cell by each acid must be considered. It is evident that the liberation of CO_2 from the bicarbonates is a process which plays an important part in the case of some acids. After the bicarbonates are used up, the acidity immediately increases, showing that the presence of bicarbonates is very efficient in maintaining the pH above 5.0. The value of this device as a protection against destruction is apparent. This process occurs in the case of certain acids only and is absent in others.

The significance of the rate of production of CO_2 is as follows: Where a great amount of CO_2 accumulates slowly, it may be supposed that the bicarbonates are being decomposed in the same way that they are decomposed by mineral acids when they are mixed *in vitro;* where a smaller amount of CO_2 is indicated, it may be surmised that there is some effect acting secondarily to retard or prevent the liberation of CO_2, or to prevent the decomposition of bicarbonates by the entering acid. While acids producing the last type of action are able to decompose bicarbonates *in vitro*, they apparently do not do so in the living cell. They must therefore so alter the nature of the cell as to produce this phenomenon, or they may suffer some displacement of the equilibrium between the dissociated, normal, and "aci-forms" of the pseudo acid, such as might be produced through the agency of the protoplasm; or they may accumulate in a phase in which bicarbonate is absent. Thus they are seen to produce in the cell, effects not produced by acids of the first class; they are also far more toxic, as evidenced by tests of subsequent viability. The decomposition of a considerable portion of the bicarbonates does not appear to be excessively injurious. Only when, for some reason, this reaction is absent, does the extreme toxicity of the acid exhibit itself.

In these studies it is assumed that changes of the pH of the sap are due to penetration of both ions of the acid rather than to exosmosis of ions from the interior. It would undoubtedly be very desirable to verify this assumption by chemical analysis of the sap; but, unfortunately, it is seldom possible to do this, especially in the case of strong acids, because these are applied in concentrations which are below the limits for successful quantitative analysis. In the case of chlorides the results would be masked by overwhelming amounts of chlorides already present in the sap.

However, in two cases which have been observed by the writer, there is direct evidence of the penetration of the acid used. In the case of cells which have been in butyric acid solution, there is an unmistakable odor of butyric acid in the sap when it is expressed. The butyrate ion has therefore penetrated through the protoplasm and cell wall into the sap.

The penetration of arsenic from solutions of arsenic acid may be proved by analysis. There is normally almost no arsenic in the cell sap, and the Gutzeit method of arsenic analysis is delicate enough to detect the minute quantities (a few micromilligrams) of arsenic entering. Rough calculations show a surprising agreement between the change of pH calculated from the observed arsenic content (by assuming that it is in the form of arsenic acid) and the change of pH observed.

It is therefore to be presumed that the other acids used produce their effects upon the pH of the cell sap by penetration of both ions of the acid, and not by inducing any exosmosis of basic substances.

These considerations can not be applied to cells which have become moribund under the influence of the acid.

The acids studied could be separated into two distinct groups—those which caused a liberation of CO_2 from bicarbonates and those which did not.

The first class included hydrochloric, nitric, sulphuric, arsenic, phosphoric, oxalic, citric, tartaric, and mono-, di-, and tri- chloracetic acids. Neither rate of penetration nor toxicity of these acids can be correlated with their percentage dissociation, partition coefficients, or surface tension effects as has been pointed out by Harvey (3). However, they all reacted upon the bicarbonates of the cell. That living protoplasm is not the only factor controlling the rate of penetration of these acids is seen by reference to the experiments on dead plants.

The acids of the first class are all more or less strongly dissociated. In strong contrast with these acids are those of the second class. They include the very weak acids—acetic, butyric, and benzoic, besides salicylic, which is the strongest of this group. Failure to show liberation of CO_2 in living plants characterizes all except salicylic, which produces only a very small amount. In dead plants both salicylic and benzoic acids liberate small amounts of CO_2.

Decomposition of bicarbonates may be said to be at least partly dependent upon percentage dissociation of the acid. (It is supposed that dissociation of acids is approximately the same when they are dissolved in sea water as in distilled water, but figures are not available.) This is illustrated broadly by the action of the strong acids as compared with that of the weak ones. The behavior of the chloracetic acids show that this is not the only factor determining the rate of penetration. Neither is the pseudo-acid character of acids of the second class alone able to explain all the facts. Chemical union with protoplasm, salt effects, lipoid solubility, partition coefficients, and so on must be considered before the nature of penetration of acids is entirely understood.

SUMMARY.

The penetration of several acids of different types through the cell wall and protoplasm into the cell sap of *Valonia ventricosa* has been studied.

1. Combined carbon dioxide (bicarbonate) present in the cell sap before exposure of the cells to the acid solution was found to exert a marked effect on the apparent rate of change of pH of the cell sap, which does not fall below pH 5.2 until the bicarbonate has all been displaced by the entering acid.

This factor, which probably affects protoplasm itself, has heretofore been entirely neglected.

2. The acids studied may be divided into two groups, the acids of one of which liberated CO_2 and appeared to penetrate more slowly than they actually do. This group includes hydrochloric, nitric, sulphuric, arsenic, phosphoric, oxalic, citric, tartaric, and mono-, di-, and trichloracetic acids.

The second group of acids includes acetic, salicylic, butyric, and benzoic acids, which are unable to replace CO_2 (except very slightly in the case of salicylic acid) and penetrate with great rapidity.

3. Evidence is submitted to show that living protoplasm is not the only agency regulating the rate of penetration of acids, since dead cells behave somewhat like those which are alive.

Acknowledgments.—The writer takes pleasure in acknowledging the courtesies afforded by the Miami Aquarium Association, where this work was done, and in expressing much gratitude to the authorities of the Carnegie Institution of Washington, D. C., who made arrangements for collecting plants.

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STUDIES ON THE PERMEABILITY OF LIVING AND DEAD CELLS.

II. OBSERVATIONS ON THE PENETRATION OF ALKALI BICARBONATES INTO LIVING AND DEAD CELLS.

By Matilda Moldenhauer Brooks, Assistant Biologist, Division of Pharmacology, Hygienic Laboratory United States Public Health Service.

In the previous paper, dealing with the effects of acids upon the protoplasm of living and dead cells, carbonic acid was not included because of the characteristic changes which it produces in the cell-sap of *Valonia*. In the case of other acids there is a progressive increase in the acidity of the sap until its pH is equal to that of the solution in which the plants are immersed, whereas in the case of carbonic acid the increase in acidity is only temporary and is followed by a progressive increase of alkalinity. It was thought of interest to study the pH of the cell sap of *Valonia* when it is immersed in a solution containing carbonic acid or its salts.

Among the acids used, carbonic acid is peculiar in yielding alkali metal salts capable of hydrolytic dissociation which thus furnish an opportunity for studying the penetration of their two ions separately, and for determining whether either of them affects the permeability of protoplasm to other ions. Carbonic acid is also normally present in the cell.

A description of the method used for determining the pH of the sap of *Valonia* was given in the preceding paper and will not be repeated here. Suffice it to say that two sets of pH determinations were made—one set upon freshly extracted sap containing all its free CO_2, and the other set upon the same samples of sap after the CO_2 had been removed by aeration with CO_2-free air.

Immersion of normal cells in acids such as HCl and HNO_3 lowers the pH of the sap to about 5.2, at which point the acidity remains fixed for a considerable time, only ultimately going on to a higher acidity and death. The curves representing as a function of time the pH of the sap of cells placed in these acids, show a general tendency to "flatten out" at a pH of 5.2. This is probably due to a steady decomposition of bicarbonates with liberation of CO_2, but other substances which have a buffer action at pH 5.2 may play a part. The buffer effect of the bicarbonate-carbonic acid system lies at a pH between 7.0 and 8.0 when the system is in equilibrium with ordinary air, but increased CO_2 tension would cause this range to lie at a lower pH. If the intracellular CO_2 tension were raised to that of air containing about 3 to 5 per cent of CO_2, the pH of the buffer range would be about that actually observed (5.2). At this pH an accumulation of acid would therefore be needed before further change in reaction occurred. Even when sea water is saturated at atmospheric pressure with CO_2 so that its pH becomes 5.4, the pH of cell sap of plants placed in this solution does not exceed 5.2.

There is undoubtedly a balance between the production of respiratory CO_2 and its escape from the cell; and under ordinary conditions this mobile equilibrium keeps the H-ion concentration of the sap approximately constant. There seems to be an intracellular CO_2 tension normal for *Valonia* and responsible for the observed differences between the pH of sap with and without free CO_2. These differences are normally about 0.6 of a pH unit (6.2 to 6.8). When the balance is upset, changes in the permeability of the protoplasm or alterations in the distribution of ions between the sap and protoplasm take place. This is nicely illustrated in the following simple experiment: By allowing cells to remain in sea water containing enough CO_2 to produce a pH of 6.8 to 7.0, an abnormally large amount of CO_2 was made to accumulate in the sap, which became acid, attaining a pH of 5.2 to 5.3. After a time the pH of the sap when free CO_2 was removed began to increase in spite of the fact that the cells were in a solution the pH of which was 7.0 until the alkalinity approached pH 8.0 in three hours.

Observations on the effects of sodium and potassium bicarbonates dissolved in sea water, upon the pH of the cell sap show that, as in the case of sea water containing free CO_2, there is at first a rapid increase of acidity and of free CO_2 in the sap. After a time the acidity decreases gradually and the pH finally approaches or even exceeds

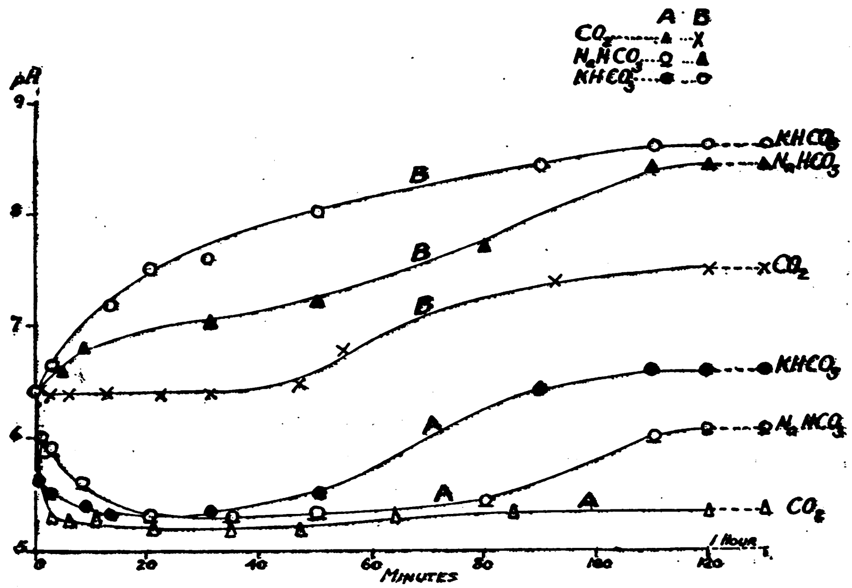

FIG. 1.—Rate of penetration of free CO_2 into the cell sap of *Valonia* from solutions of sea water containing either free CO_2 alone or $KHCO_3$ or $NaHCO_3$ (0.03 M) (curves "A"). Curves "B" show the changes in alkalinity of the sap. The ordinates represent the pH values, the abscissæ the time in minutes.

that at the beginning of the experiment. This is connected with an increased alkalinity of the CO_2-free sap, which begins immediately and proceeds until the pH approaches that of the external solution when the latter is freed from CO_2 (9.0 to 9.2). The curves in Figure 1 show the effects of placing *Valonia* in solutions consisting of 200 c. c. of sea water containing $KHCO_3$, 0.03 M, $NaHCO_3$ in the same molecular concentration, or enough free CO_2 to produce a pH of 6.8 to 7.0. The pH of the potassium and sodium solutions was about 7.9 in sea water. When freed from CO_2 their pH was 9.0 to 9.2. Curves "A" show the pH of the sap before and curves "B" after the free CO_2 has been removed. The concentration of the CO_2 in the cell sap is increased most rapidly when the cells are placed in solutions containing CO_2 only, but the data representing penetration of CO_2 and other ions from such a solution are not quantitatively comparable to those of the other curves ($KHCO_3$ and $NaHCO_3$), inasmuch as CO_2 was present in a much higher concentration. The curves for sodium and potassium bicarbonate solutions are comparable, and show that CO_2 penetrated more rapidly from the latter. Curves "B" also show differences in the rate of the changes producing alkalinity. Here again the change is more rapid when $KHCO_3$ has been used than when $NaHCO_3$ is present. Increased alkalinity might be due to substances given off by the protoplasm, but is more probably due to entrance of ions from the external solution.

The objection might be raised that this increase of alkalinity was due not to entrance of bases but to exosmosis of acids presumably other than carbonic. However, it is very improbable that carbonic acid should displace any stronger acid, and anions of weaker acids have not yet been found in the sap of *Valonia.*

In order to find direct evidence for the penetration of Li, $LiCO_3$ (0.03 M) was added to sea water and enough CO_2 added to produce a pH of 7.0; the sap of *Valonia* became pH 5.3 in a few minutes, and the CO_2-free sap became alkaline gradually as in the case of Na and K bicarbonates. When cells of *Valonia* were allowed to remain in this solution for four hours, and their sap then collected and evaporated nearly to dryness, it was not possible to demonstrate the presence of Li by spectroscopic analysis. This is of interest because in the case of *Nitella* (*1*), a fresh-water alga, the writer found Li in the sap of plants which had been in a 0.05 M solution for 24 hours. The time element may account for this difference, but the penetration of Li in the case of *Nitella* was much slower from a balanced solution than from an unbalanced one. As the salts of balanced solutions affect the penetration of other salts into living cells, it is possible that the concentration of the salts of sea water in the case of *Valonia* prevented the entrance of more than a trace of Li; whereas in the case of *Nitella* the Li penetrated readily because of the low salt concentration of the surrounding medium.

Then, too, the change in the pH of the CO_2-free sap of *Valonia* was from 6.6 to 8.0. If this increase in alkalinity were due entirely to the penetration of Li compounds, its concentration could not be more than about 1×10^{-6} N. Since it was possible to detect solutions of LiCl of 1×10^{-3} but not 1×10^{-4} N, it is quite probable that Li entered the cell of *Valonia,* but in amounts too slight to be detected by the spectroscope.

The length of survival of plants treated with the above solutions was also determined. It was found that normal cells lived under laboratory conditions in running sea water from 10 days to 1 month, whereas most of the plants which had been obviously injured during the process of experimentation cytolyzed before 10 days. Therefore, cells which remained in good condition 10 days in sea water after having been in the test solutions were considered not to have been irreversibly injured. In all of the experiments represented in Figure 1, the plants apparently suffered no permanent injury when allowed to remain in the solutions one hour before being transferred to sea water. All the cells survived at least 10 days and some almost 1 month.

Some of the plants which had been in the bicarbonate solutions for one hour and were then transferred to sea water, were tested after six days to determine whether the sap still had the same pH that it had when the cells were replaced in sea water. It was found that the pH had returned to normal. This appears to have been due to an exosmosis of ions, but a study of this point has been left for future investigation.

It was thought that perhaps the pH 8.0 was responsible for the rapid entrance of basic ions in the case of K and Na bicarbonates rather

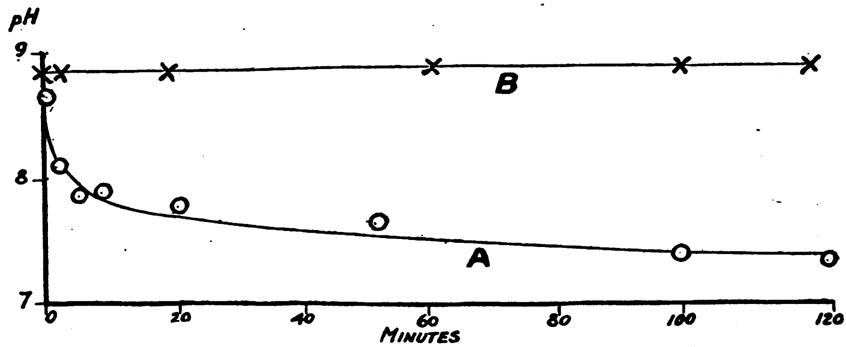

FIG. 2.—Rate of penetration of free CO_2 into the sap of dead cells (curve "A") and the basicity of the sap when the free CO_2 has been removed (curve "B").

than pH 7.0, that of sea water containing CO_2. For this reason, to the solutions containing K and Na-bicarbonates CO_2 was added until pH 7.0 was obtained. The results were as follows: Cell-sap of plants attained a pH of 5.2 (with CO_2) and a gradual alkalinity of the CO_2-free sap which was slower in rate of attaining a higher alkalinity than when pH 8.0 was used. It would seem from these data that much CO_2 present hinders the entrance of basic ions into the interior of the cell, or that a more alkaline reaction of the surrounding medium is more favorable to the entrance of certain basic ions.

Figure 2 shows the effects of placing dead cells in sea water containing CO_2 and having a pH of 6.8 to 7.0. The pH of the sap, which was originally 8.6, drops to 7.4 in 30 minutes (curve "A"). When the CO_2 is removed, it is found that the sap has a pH of 8.8 (which is the same as that of the surrounding medium without CO_2). Its basicity is unaltered (curve "B"). Therefore, the initial increase in the acidity of the cell sap of living plants above that of the surrounding medium, observed under the same conditions, is due to some property inherent in the living condition.

When dead cells are placed in a solution of $KHCO_3$ or $NaHCO_3$ of the same concentration used for living cells, the pH of the sap (containing free CO_2) becomes that of the surrounding solution (7.8). When the CO_2 has been removed, the pH of the sap is 8.8 to 9.0 (that of the surrounding medium without CO_2). This process is similar to that which occurs in the case of dead cells placed in sea water containing CO_2 (Fig. 2).

When living cells are placed in any of the sea-water solutions containing CO_2 or bicarbonates, there is apparently a membrane hydrolysis which results in the penetration of H_2CO_3, to which protoplasm is easily permeable, in advance of KOH or NaOH, which are retarded presumably by the cation. Subsequent slow penetration of these alkalies brings the pH of the cell sap to that which it would have become had the salt itself penetrated as such.

In the case of dead cells, the fact that the H-ion concentration of the sap never exceeds that of the surrounding solution may be due to the fact that basic ions can penetrate freely into dead cells, so that no membrane hydrolysis occurs; or it might possibly be due in part to the fact that there is more available base present in the sap of dead cells than in that of living cells; since the amounts of acid which must be added to sap from living and dead cells to produce a given change of the pH is less in the case of the former than in the latter.

Jacobs (2) noted the increased acidity produced in cells exposed to solutions containing CO_2, but failed to detect such a change in cells placed in solutions not enriched with free CO_2. He used three solutions, one containing free CO_2 in distilled water, one containing free CO_2 in a 0.5 M solution of $NaHCO_3$, and one a 0.5 M solution of $NaHCO_3$. The cells used were the petals of *Symphytum peregrinum*, which are blue when alkaline and pink when acid. When they were placed in either of the first two solutions they became pink, but in the third they turned gradually greenish. This latter reaction was interpreted as being due to the action of alkali. In the experiments of the writer, CO_2 penetrates from a solution of $NaHCO_3$ in sea water.

No free CO_2 had been added to this solution, but owing to the presence of bicarbonates, a certain amount of this was present. Evidently the indicator of the plant used by Jacobs was not sensitive to changes in pH over the whole necessary range and, therefore, under the conditions just described, it gave no evidence of the penetration of the acid. It would be of interest to know the pH range over which this indicator is sensitive. In the experiments of the writer, the increased acidity due to penetration of CO_2 is followed by an increase of alkalinity. Perhaps the green coloration of the petals of *Symphytum* observed by Jacobs was also due to increased alkalinity following a stage of increased acidity which was due to penetration of CO_2, but which was too slight to affect the color of the natural indicator.

It will be noted that the pH of CO_2-free sap of living cells increased in all the solutions in the above experiments. The question arises as to whether the alkaline ions which are presumably responsible for this effect are normally able to penetrate the cell or whether the existence of abnormally high H or HCO_3 concentration in the cell sap is capable of increasing the permeability of the cell to alkalies.

TABLE I.—*The effects of several anions upon the rate of change in pH of the CO_2-free sap of Valonia when K and Na are used.*

[The pH of each solution is 6.8 to 7.0. All cells lived more than 10 days when transferred from these solutions to sea water.]

	pH of CO_2-free sap after having been in solution indicated length of time.					
Substance (.03 M) in sea water	10 minutes.	20 minutes.	40 minutes.	80 minutes.	120 minutes.	3 hours.
$NaHCO_3$	7.0	7.4	7.5	7.6	....	8.4
$KHCO_3$	7.2	7.5	7.7	8.0	....	8.8
Li carbonate	....	....	7.4	7.7	8.0	....
Na citrate	6.8	6.8	7.2	7.2	....	7.4
K citrate	6.8	7.4	7.4	7.4	....	7.5
Na acetate	6.8	6.8	6.8	6.6	....	6.6
K acetate	6.8	6.8	6.8	7.2	....	7.5
Na chloride	6.8	....	....	....	7.0	7.0
K chloride	6.8	....	....	....	7.2	7.2

To obtain more light on this subject, plants were placed in equimolecular solutions (0.03) of K and Na as follows: citrate, acetate and chloride. Table I shows the results. In every case there is a more rapid increase in the degree of alkalinity in the CO_2-free sap in the case of K than of Na; but none of the substances studied produces so great a degree of alkalinity as do the bicarbonates. It seems, therefore, that the free CO_2 has some influence upon the rate of penetration of these two substances. The fact that CO_2 penetrates the cell more rapidly from $KHCO_3$ containing solutions than from those containing $NaHCO_3$ shows that under these conditions the cation affects the permeability of the protoplasm to either itself or to other ions. The same considerations show that the increase in alkalinity of the CO_2-free sap may be due either to a selective permeability of the protoplasm, to potassium ions, or to an effect of the increased proportion of potassium upon the permeability of the cell to incoming basic or outgoing acidic ions.

Further experiments on cells placed in solutions of NaOH, KOH, or NH_4OH in sea water do show that only the last is capable of penetrating in an appreciable time. The pH of the solutions was in each case 10.0 to 11.5.

These studies may be significant as clues to an explanation of the excessive proportion of K over Na in the sap of *Valonia*. Further experiments are in progress which may throw more light upon the relative importance of the different ions affecting the permeability of *Valonia*.

SUMMARY.

Living cells of *Valonia ventricosa* are exceedingly permeable to carbonic acid. When they are placed in sea water containing alkali bicarbonates, a membrane hydrolysis occurs, carbonic acid entering the cell rapidly. At the same time there is an increase in the alkalinity of sap freed from CO_2, presumably due to the penetration of alkali ions. The addition of $KHCO_3$ to sea water makes both the entrance of carbonic acid and the increase in alkalinity more rapid than does the addition of $NaHCO_3$. The potassium ion therefore affects the permeability of the protoplasm to the potassium ion or to other ions. These processes do not occur in dead plants.

Other anions studied, citrate, acetate, and chloride, do not produce so great an increase in the alkalinity of the CO_2-free sap, but also show the greater influence of the K-ion over Na in producing this alkalinity.

Acknowledgments.—The writer takes pleasure in acknowledging the courtesies afforded by the Miami Aquarium Association, where this work was done, and in expressing much gratitude to the authorities of the Carnegie Institution of Washington, D. C., who made arrangements for collecting the plants.

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INCIDENCE OF VENEREAL DISEASES AMONG AMERICAN SEAMEN IN THE ORIENT.

By M. R. King, Assistant Surgeon, United States Public Health Service.

Opportunity for the study of health conditions among American seamen in the Orient is especially favorable in the port of Manila, P. I., since this is the only station which furnishes both out-patient and hospital relief in this region. The out-patient relief station is maintained as an integral part of the quarantine office, whereas patients needing hospital care are sent to St. Paul's Hospital in Manila, which is under contract to care for beneficiaries of the Public Health Service.

Of all disabilities encountered in the station of Manila, P. I., venereal diseases predominate. Approximately one patient out of every three who reports for treatment, is afflicted with venereal disease.[1] The out-patient record cards on file show a total of 1,246 patients treated for various disabilities during the period October 23, 1920, to February 12, 1923, 36 per cent of whom were treated for venereal diseases. The in-patient cards show a total of 526 patients sent to the hospital during the above period, 30.4 per cent of whom were hospitalized for venereal diseases.

The number of days spent in the hospital for various disabilities was found to be greater for venereal diseases than for any other class of disability. All patients sent to the hospital during the period considered above consumed a total of 9,306 hospital days, 41.28 per cent of which were spent for venereal diseases. The accompanying table and graph, illustrating the relation of the above figures, are self-explanatory.

Percentage of total cases admitted to hospital and of hospital days on account of various classified disabilities.

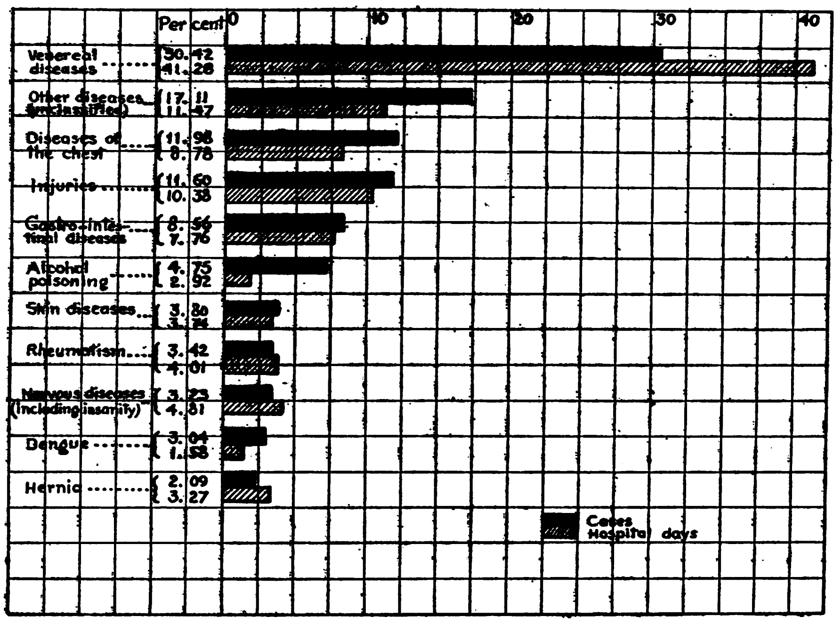
Disability.	Number of cases admitted to hospital.	Number of days in hospital.	Percentage of total cases.	Percentage of total days.
Hernia	11	304	2.09	3.27
Dengue	16	147	3.04	1.58
Nervous diseases (including insanity)	17	448	3.23	4.81
Rheumatism	18	373	3.42	4.01
Skin diseases	20	348	3.80	3.74
Alcohol poisoning	25	272	4.75	2.92
Gastro-intestinal diseases	45	722	8.56	7.76
Injuries	61	966	11.60	10.38
Diseases of the chest	63	817	11.98	8.78
Other diseases (unclassified)	90	1,067	17.11	11.47
Venereal diseases	160	3,842	30.42	41.28
Total	526	9,306	100.00	100.00

One noteworthy factor is the greater percentage of chancroidal disease at this station as compared with this type of venereal disease reported in continental United States. Although the majority of cases of venereal ulcers were subjected to a Wassermann reaction, undoubtedly some errors in diagnosis have been made, owing to the early stage of most of the cases. However, even if considerable allowance is made for mistakes in diagnosis between syphilis and chancroid, the greater prevalence of the latter is marked. The annual report of the Surgeon General of the United States Public

[1] Venereal diseases constitute one-third of all cases of disease among sailors in the port of Hamburg, Germany, according to the returns of the Hamburg port medical officer (PUBLIC HEALTH REPORTS, May 25, 1923, p. 1141).—Editor.

Health Service for the fiscal year 1922 shows that the reports of cases of venereal diseases received from the State boards of health totaled 333,718 for the year ended June 30, 1922, of which number 2.68 per cent were chancroid, 51.18 per cent syphilis, and 45.80 per cent gonorrhea. Out of the total of 606 venereal cases considered here, 30.37 per cent were chancroid, 12.38 per cent syphilis, and 57.27 per cent gonorrhea. A comparison of these figures shows 27.69 per hundred more cases of chancroid and 38.80 per hundred fewer cases of syphilis in this district.

One of the main causes of the increase in the number of venereal disease cases among American seamen is the unrestricted and marked prevalence of prostitution in many of the seaport cities of the Orient.



Graphic representation of percentage of total cases and hospital days due to various classified disabilities.

The majority of our patients have acquired their infection in Japanese and Chinese seaports, and by the time Manila is reached the disease has secured a firm foothold and is acute and virulent in nature, with frequent complications. By direct inquiry it was learned that solicitation is practiced on the streets in the cities of the Orient; also that it is not an unusual thing for a rickshaw man, on his own initiative, to carry a stranger to a house of ill repute when out sightseeing. Many of the seamen confessed to being intoxicated at time of infection. The prevalence of chancroidal disease may be associated with greater personal filthiness in oriental ports. Chancroid is more easily prevented by simple cleanliness than gonorrhea or syphilis. The fact that many of the cases run a very severe course may be due not only to the lack of care at the onset of the disease, but also to the increase in virulence that the organisms acquire by transmission from one host to another of different races.

No specific remedy for the above situation seems to be at hand. Education of seamen as to the danger present in this region and to the value of proper and early prophylactic measures are essential. Many of our cases give a history of having been infected on one or more previous occasions, and so the lesson learned from the first infection seems to be of little value.

DEATH RATES IN A GROUP OF INSURED PERSONS.

COMPARISON OF DEATH RATES FOR PRINCIPAL CAUSES, MARCH AND APRIL, 1923, AND APRIL AND YEAR, 1922.

The accompanying table is taken from the Statistical Bulletin of the Metropolitan Life Insurance Co. for May, 1923, and presents the mortality experience of the industrial department of the company for the months of March and April, 1923, and April and year, 1922. The rates are based on a strength of approximately 14,500,000 insured persons.

The gross death rate for April (10.1 per 1,000) in this group of persons shows a seasonal decline from the rate for March (12 per 1,000), but was slightly higher than the rate for April of 1922 (9.7 per 1,000). The largest declines from rates for the previous month are shown for influenza, tuberculosis, pneumonia and other respiratory diseases, and organic diseases of the heart. High death rates still obtained for measles and whooping cough. The widespread prevalence of measles gives that disease a prominent place in the morbidity record so far this year.

Death rates (annual basis) for principal causes of death per 100,000 lives exposed, March and April, 1923, and April and year, 1922.

Cause of death.	Death rate per 100,000 lives exposed.			
	April, 1923.	March, 1923.	April, 1922.	Year 1922.[1]
Total, all causes	1,008.4	1,199.4	969.4	877.2
Typhoid fever	3.9	3.3	3.6	5.6
Measles	12.5	13.6	7.6	4.3
Scarlet fever	6.5	6.9	5.9	4.8
Whooping cough	6.8	7.3	2.1	2.6
Diphtheria	12.3	18.2	12.7	17.8
Influenza	47.7	100.4	41.1	21.5
Tuberculosis (all forms)	119.0	124.2	124.8	113.4
Tuberculosis of respiratory system	109.0	114.8	113.9	102.9
Cancer	74.6	74.2	66.8	71.5
Diabetes mellitus	21.3	22.0	(2)	17.0
Cerebral hemorrhage	65.9	72.9	66.8	62.4
Organic diseases of heart	139.3	174.6	142.3	126.0
Pneumonia (all forms)	108.2	164.3	102.4	73.3
Other respiratory diseases	15.7	23.8	15.0	13.6
Diarrhea and enteritis	8.7	5.2	5.5	10.7
Bright's disease (chronic nephritis)	78.3	88.2	74.8	69.9
Puerperal state	18.0	19.1	18.3	18.9
Suicides	7.0	7.0	9.0	7.4
Homicides	6.6	5.9	4.2	6.2
Other external causes (excluding suicides and homicides)	55.1	54.6	45.0	57.7
Traumatism by automobile	11.0	7.8	8.8	13.5
All other causes	201.1	213.7	221.8	172.6

[1] Based on provisional estimate of lives exposed to risk in 1922. [2] Not available.

DEATHS DURING WEEK ENDED JUNE 16, 1923.

Summary of information received by telegraph from industrial insurance companies for week ended June 16, 1923, and corresponding week of 1922. (From the Weekly Health Index, June 19, 1923, issued by the Bureau of the Census, Department of Commerce.)

	Week ended June 16, 1923.	Corresponding week, 1922.
Policies in force	49, 178, 986	50, 058, 107
Number of death claims	9, 632	8, 289
Death claims per 1,000 policies in force, annual rate	10. 2	8. 6

Deaths from all causes in certain large cities of the United States during the week ended June 16, 1923, infant mortality, annual death rate, and comparison with corresponding week of 1922. (From the Weekly Health Index, June 19, 1923, issued by the Bureau of the Census, Department of Commerce.)

City.	Week ended June 16, 1923.		Annual death rate per 1,000, corresponding week, 1922.	Deaths under 1 year.		Infant mortality rate, week ended June 16, 1923.[2]
	Total deaths.	Death rate.[1]		Week ended June 16, 1923.	Corresponding week, 1922.	
Total	6, 298	11. 3	11. 4	805	762	....
Akron, Ohio	27	6. 8	7. 5	3	5	36
Albany, N. Y.[3]	22	9. 8	12. 6	2	4	44
Atlanta, Ga	82	19. 2	13. 7	14	11	....
Baltimore, Md.[3]	193	13. 0	13. 5	27	26	79
Birmingham, Ala	68	18. 1	16. 4	7	9	....
Boston, Mass	187	12. 7	14. 0	27	19	77
Bridgeport, Conn	26	9. 4	11. 3	2	4	28
Buffalo, N. Y	113	11. 0	10. 7	24	19	101
Cambridge, Mass	29	13. 6	13. 6	5	4	89
Camden, N. J.[3]	21	8. 8	13. 7	1	2	17
Chicago, Ill	582	10. 5	10. 3	69	85	....
Cincinnati, Ohio	115	14. 8	12. 5	15	12	99
Cleveland, Ohio[3]	148	8. 7	10. 2	21	25	58
Columbus, Ohio	57	11. 4	13. 0	5	4	52
Dallas, Tex	39	11. 5	11. 2	10	4	....
Dayton, Ohio	34	10. 7	10. 3	5	1	82
Denver, Colo	76	14. 6	13. 8	8	6	....
Des Moines, Iowa	33	12. 2	....	2	....	....
Detroit, Mich	233	12. 2	9. 4	43	30	86
Duluth, Minn	17	8. 3	....	0	....	0
Erie, Pa	22	10. 2	5. 7	2	4	41
Fall River, Mass	30	12. 9	10. 8	9	3	128
Flint, Mich	24	10. 6	....	6	....	119
Fort Worth, Tex	31	11. 2	11. 4	8	3	....
Grand Rapids, Mich	27	9. 6	8. 0	3	3	47
Houston, Tex	29	9. 8	15. 3	4	1	....
Indianapolis, Ind	87	13. 2	10. 7	13	10	100
Jacksonville, Fla	36	18. 8	18. 7	3	1	....
Kansas City, Kans	24	10. 8	8. 7	2	2	46
Kansas City, Mo	81	12. 0	15. 0	9	10	....
Los Angeles, Calif	180	14. 1	15. 8	25	20	94
Louisville, Ky	63	12. 7	11. 0	9	6	97
Lowell, Mass	33	15. 0	6. 4	2	5	35
Memphis, Tenn	38	11. 7	22. 4	5	5	....
Milwaukee, Wis	104	11. 2	8. 3	13	12	65
Minneapolis, Minn	68	8. 7	9. 8	6	7	33
Nashville, Tenn.[3]	29	12. 5	11. 7	7	7	....
New Bedford, Mass	26	10. 4	11. 0	3	8	47
New Haven, Conn	29	8. 7	8. 3	5	2	65
New Orleans, La	126	16. 2	17. 9	16	9	....
New York, N. Y	1, 166	10. 3	11. 2	138	164	55
Bronx Borough	126	7. 8	10. 1	4	13	14
Brooklyn Borough	391	9. 5	9. 5	48	58	51
Manhattan Borough	537	12. 4	13. 4	76	78	74
Queens Borough	74	7. 2	9. 1	5	14	27
Richmond Borough	38	15. 5	16. 3	5	1	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.
[3] Deaths for week ended Friday, June 15, 1923.

Deaths from all causes in certain large cities of the United States during the week ended June 16, 1923, infant mortality, annual death rate, and comparison with corresponding week of 1922. (From the Weekly Health Index, June 19, 1923, issued by the Bureau of the Census, Department of Commerce.)—Continued.

City.	Week ended June 16, 1923.		Annual death rate per 1,000, corresponding week, 1922.	Deaths under 1 year.		Infant mortality rate, week ended June 16, 1923.
	Total deaths.	Death rate.		Week ended June 16, 1923.	Corresponding week, 1922.	
Newark, N. J.	83	9.9	10.5	17	16	80
Norfolk, Va.	25	8.2	9.2	7	5	123
Oakland, Calif.	44	9.6	8.9	4	1	51
Omaha, Neb.	32	8.2	15.3	0	7	0
Paterson, N. J.	34	12.7	13.2	4	4	64
Philadelphia, Pa.	430	11.7	11.6	37	49	48
Pittsburgh, Pa.	139	13.5	11.3	27	16	94
Portland, Oreg.	56	10.7	9.5	5	3	51
Providence, R. I.	63	13.6	10.8	5	10	41
Richmond, Va.	61	17.6	12.3	13	6	159
Rochester, N. Y.	66	10.8	9.4	8	6	63
St. Louis, Mo.	170	11.0	11.8	12	11	....
St. Paul, Minn.	49	10.6	9.6	5	10	46
Salt Lake City, Utah [1]	35	14.5	10.5	6	4	98
San Antonio, Texas.	40	11.3	....	9	....	....
San Francisco, Calif.	112	10.8	11.5	6	14	36
Seattle, Wash.	55	9.1	9.3	3	3	27
Spokane, Wash.	24	12.0	12.0	1	1	22
Springfield, Mass.	36	13.0	7.1	3	1	43
Syracuse, N. Y.	41	11.6	13.0	5	7	65
Tacoma, Wash.	23	11.8	....	2	....	50
Toledo, Ohio.	55	10.7	9.6	18	9	131
Trenton, N. J.	32	13.5	13.3	6	1	102
Utica, N. Y.	17	8.6	....	2	....	42
Washington, D. C.	92	11.0	12.2	11	12	63
Wilmington, Del.	23	10.2	10.4	2	3	41
Worcester, Mass.	33	9.0	9.4	5	8	57
Yonkers, N. Y.	15	7.2	10.4	5	2	108
Youngston, Ohio.	37	14.6	9.5	4	1	54

[1] Deaths for week ended Friday June 15, 1923.

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 June 23, 1923.

ALABAMA.

	Cases.
Chicken pox	8
Diphtheria	5
Dysentery	207
Influenza	20
Malaria	74
Measles	585
Mumps	11
Pellagra	17
Pneumonia	12
Scarlet fever	8
Tuberculosis	47
Typhoid fever	55
Whooping cough	64

ARIZONA.

	Cases.
Chicken pox	6
Diphtheria	5
Measles	10
Pneumonia	1
Scarlet fever	7
Typhoid fever	4

ARKANSAS.

	Cases.
Chicken pox	4
Diphtheria	5
Hookworm disease	1
Influenza	12
Malaria	150
Measles	83
Mumps	5
Pellagra	20
Smallpox	5
Tuberculosis	9
Typhoid fever	8
Whooping cough	30

CALIFORNIA.

	Cases.
Cerebrospinal meningitis—Redding	1
Diphtheria	121
Influenza	15
Lethargic encephalitis:	
Grass Valley	1
San Francisco	2
Measles	490
Rabies in man—Los Angeles	1
Scarlet fever	108
Smallpox	20
Typhoid fever	9

COLORADO.

(Exclusive of Denver.)

	Cases.
Chicken pox	5
Diphtheria	13
Measles	80
Mumps	7
Scarlet fever	4
Tuberculosis	110
Typhoid fever	6
Whooping cough	5

CONNECTICUT.

	Cases.
Chicken pox	22
Diphtheria	32
Dysentery (bacillary)	1
German measles	10
Lethargic encephalitis	2
Malaria	2
Measles	99
Mumps	9
Pneumonia (lobar)	6
Scarlet fever	64
Tetanus	1

CONNECTICUT—continued.

	Cases.
Tuberculosis (all forms)	36
Whooping cough	46

DELAWARE.

Chicken pox	2
Diphtheria	6
Measles	6
Pneumonia	4
Scarlet fever	5
Tuberculosis	3
Typhoid fever	1
Whooping cough	4

DISTRICT OF COLUMBIA.

Chicken pox	18
Diphtheria	6
Measles	63
Scarlet fever	14
Tuberculosis	19
Typhoid fever	4
Whooping cough	23

FLORIDA.

Cerebrospinal meningitis	2
Dengue	1
Diphtheria	8
Influenza	20
Leprosy	1
Malaria	32
Ophthalmia neonatorum	1
Pneumonia	66
Scarlet fever	1
Smallpox	7
Typhoid fever	21

GEORGIA.

Chicken pox	7
Diphtheria	3
Dysentery (amebic)	1
Dysentery (bacillary)	7
Hookworm disease	20
Influenza	7
Malaria	23
Measles	124
Mumps	5
Pneumonia	11
Scarlet fever	7
Septic sore throat	1
Smallpox	9
Trachoma	1
Tuberculosis (pulmonary)	9
Typhoid fever	22
Whooping cough	16

ILLINOIS.

Cerebrospinal meningitis—Cook County	2
Diphtheria:	
Cook County (including Chicago)	96
Chicago	80
Scattering	26
Influenza	4
Lethargic encephalitis:	
Grundy County	1
La Salle County	1
Pneumonia	116

ILLINOIS—continued.

	Cases.
Poliomyelitis:	
Cumberland County	1
Fulton County	1
Scarlet fever:	
Cook County (including Chicago)	69
Chicago	61
Scattering	36
Smallpox:	
Cook County (including Chicago)	6
Chicago	5
Kane County	18
Scattering	29
Typhoid fever	24
Whooping cough	198

INDIANA.

Diphtheria	20
Measles	462
Scarlet fever	25
Smallpox	40
Tuberculosis	42
Typhoid fever	17

IOWA.

Diphtheria	8
Scarlet fever	21
Smallpox	17
Typhoid fever	2

KANSAS.

Chicken pox	20
Diphtheria	19
German measles	3
Measles	371
Mumps	20
Pneumonia	4
Scarlet fever	29
Smallpox	8
Tuberculosis	53
Typhoid fever	8
Whooping cough	45

LOUISIANA.

Diphtheria	13
Influenza	1
Measles	90
Scarlet fever	1
Smallpox	3
Typhoid fever	35
Whooping cough	12

MAINE.

Chicken pox	14
Diphtheria	8
German measles	12
Measles	130
Pneumonia	4
Scarlet fever	17
Tuberculosis	7
Typhoid fever	4
Whooping cough	10

MARYLAND.[1]

Cerebrospinal meningitis	1
Chicken pox	51
Diphtheria	24

[1] Week ended Friday.

MARYLAND—continued.

	Cases.
Dysentery	1
German measles	4
Influenza	6
Malaria	3
Measles	370
Mumps	26
Paratyphoid fever	1
Pneumonia (all forms)	41
Scarlet fever	68
Septic sore throat	5
Tetanus	1
Tuberculosis	61
Typhoid fever	14
Whooping cough	111

MASSACHUSETTS.

Cerebrospinal meningitis	2
Chicken pox	147
Conjunctivitis (suppurative)	13
Diphtheria	130
German measles	7
Influenza	5
Lethargic encephalitis	1
Measles	536
Mumps	125
Ophthalmia neonatorum	14
Pneumonia (lobar)	22
Poliomyelitis	2
Scarlet fever	232
Septic sore throat	1
Tetanus	1
Tuberculosis (all forms)	129
Typhoid fever	9
Whooping cough	105

MICHIGAN.

Diphtheria	98
Measles	1,788
Pneumonia	96
Scarlet fever	192
Smallpox	19
Tuberculosis	65
Typhoid fever	9
Whooping cough	211

MINNESOTA.

Chicken pox	7
Diphtheria	47
Lethargic encephalitis	1
Measles	201
Pneumonia	2
Scarlet fever	82
Smallpox	5
Trachoma	7
Tuberculosis	50
Typhoid fever	12
Whooping cough	15

MISSISSIPPI.

Diphtheria	1
Influenza	7
Poliomyelitis	1
Smallpox	3
Typhoid fever	18

MISSOURI.

(Exclusive of Kansas City.)

	Cases.
Cerebrospinal meningitis	1
Chicken pox	10
Diphtheria	27
Measles	247
Mumps	7
Scarlet fever	25
Smallpox	9
Trachoma	1
Tuberculosis	46
Typhoid fever	12
Whooping cough	160

MONTANA.

Diphtheria	2
Rocky Mountain spotted fever:	
Jordan	1
Fingerbutte	1
Scarlet fever	18
Smallpox	6
Typhoid fever	1

NEBRASKA.

Chicken pox	4
Diphtheria	19
Measles	17
Mumps	5
Poliomyelitis	1
Scarlet fever	8
Tuberculosis	1
Typhoid fever	1
Whooping cough	22

NEW JERSEY.

Cerebrospinal meningitis	1
Chicken pox	151
Diphtheria	76
Dysentery	2
Measles	499
Pneumonia	44
Poliomyelitis	1
Scarlet fever	84
Smallpox	1
Typhoid fever	26
Whooping cough	96

NEW MEXICO.

Diphtheria	23
Measles	21
Pneumonia	2
Scarlet fever	2
Tuberculosis	20
Typhoid fever	2

NEW YORK.

(Exclusive of New York City.)

Cerebrospinal meningitis	4
Diphtheria	103
Influenza	1
Lethargic encephalitis	1
Measles	2,013
Pneumonia	127
Poliomyelitis	3

NEW YORK—continued.

	Cases.
Scarlet fever	198
Smallpox	4
Typhoid fever	15
Whooping cough	166

NORTH CAROLINA.

Cerebrospinal meningitis	3
Chicken pox	41
Diphtheria	13
German measles	2
Measles	1,064
Ophthalmia neonatorum	1
Scarlet fever	11
Septic sore throat	3
Smallpox	50
Trachoma	5
Typhoid fever	37
Whooping cough	371

OREGON.

Chicken pox	19
Diphtheria	13
Measles	5
Mumps	2
Pneumonia	[1] 4
Scarlet fever	17
Smallpox:	
Portland	10
Scattering	4
Tuberculosis	4
Typhoid fever	4
Whooping cough	11

SOUTH DAKOTA.

Chicken pox	13
Diphtheria	9
Measles	106
Scarlet fever	8
Tuberculosis	2
Whooping cough	1

TEXAS.

Anthrax	1
Chicken pox	5
Diphtheria	10
Dysentery	2
Influenza	5
Measles	23
Mumps	1
Pellagra	1
Pneumonia	2
Poliomyelitis	1
Scarlet fever	2
Smallpox	26
Tuberculosis	15
Typhoid fever	12
Whooping cough	69

[1] Deaths.

VERMONT.

	Cases.
Chicken pox	3
Diphtheria	3
Measles	89
Mumps	21
Pneumonia	2
Scarlet fever	4
Smallpox	2
Whooping cough	15

VIRGINIA.

Smallpox—Tazewell County	1

WASHINGTON.

Chicken pox	32
Diphtheria	15
Measles	64
Mumps	9
Scarlet fever	17
Smallpox:	
Clark County	16
Scattering	19
Tuberculosis	51
Typhoid fever	6
Whooping cough	90

WEST VIRGINIA.

Scarlet fever	4
Smallpox	1
Typhoid fever	8

WISCONSIN.

Milwaukee:	
Chicken pox	13
Dipthheria	10
Lethargic encephalitis	1
Measles	28
Pneumonia	4
Scarlet fever	73
Tuberculosis	16
Whooping cough	32
Scattering:	
Chicken pox	44
Diphtheria	29
Influenza	8
Measles	806
Pneumonia	6
Poliomyelitis	1
Scarlet fever	137
Smallpox	34
Tuberculosis	39
Typhoid fever	3
Whooping cough	77

WYOMING.

Chicken pox	2
Measles	27
Rocky Mountain spotted fever	5
Typhoid fever	1

Reports for Week Ended June 16, 1923.

DISTRICT OF COLUMBIA.

	Cases.
Chicken pox	20
Diphtheria	4
Measles	104
Scarlet fever	11
Tuberculosis	10
Typhoid fever	1
Whooping cough	18

NORTH DAKOTA.

	Cases.
Chicken pox	12
Diphtheria	8
Measles	30
Pneumonia	1
Scarlet fever	5
Smallpox	2
Tuberculosis	5
Whooping cough	19

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.	Poliomyelitis.	Scarlet fever.	Smallpox.	Typhoid fever.
May, 1923.										
Arizona		20			163			68	6	8
Illinois	9	678	110	4	12,049		5	739	67	54
Indiana	8	162	19		5,421		1	271	243	14
Louisiana	2	53	66	58	345	36	2	12	80	64
Maryland	1	140	69	22	4,419		1	678		35
Michigan		360		1	8,237			1,130	91	35
Minnesota	5	240	8		3,741		2	707	117	21
New York	27	1,224	188	17	13,646		17	2,308	20	122
Rhode Island	3	56	3		487			96		3
South Carolina	1	74		17	386	2		7	23	26

RECIPROCAL NOTIFICATION.

May, 1923.

Cases of communicable diseases referred during May, 1923, to other State health departments by departments of health of certain States.

State referred by.	Diphtheria.	Dysentery.	Lethargic encephalitis.	Measles.	Poliomyelitis.	Smallpox.	Tuberculosis.	Typhoid fever.
Connecticut	1	1		1				2
Illinois								2
Louisiana	1				1		9	
Massachusetts								3
Minnesota			1				38	3
New Jersey								1
New York				2		1		2
Washington								1

CITY REPORTS FOR WEEK ENDED JUNE 9, 1923.

ANTHRAX.

City.	Cases.	Deaths.
Illinois:		
Chicago	1	1

CITY REPORTS FOR WEEK ENDED JUNE 9, 1923—Continued.

CEREBROSPINAL MENINGITIS.

The column headed "Median for previous years" gives the median number of cases reported during the corresponding week of the years 1915 and 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 June 9, 1923. Cases.	Deaths.	City.	Median for previous years.	Week ended June 9, 1923. Cases.	Deaths.
California:				New York:			
San Bernardino	0		1	New York	7	2	1
Connecticut:				Ohio:			
Bridgeport	0	1	1	Cleveland	1	1	1
Illinois:				Pennsylvania:			
Chicago	2	1		Philadelphia	0	1	1
Freeport	0		1	Pittsburgh	0	1	1
Maine:				Texas:			
Lewiston	0		2	Waco	0		1
Minnesota:				Virginia:			
Minneapolis	0	1	1	Richmond	0	1	
Missouri:							
St. Louis	0	1	2				
New Jersey:							
Harrison	0	1	1				
Passaic	0		1				

DIPHTHERIA.

See p. 1494; also Current State summaries, p. 1483, and Monthly summaries by States, p. 1487.

INFLUENZA.

City.	Cases. Week ended June 10, 1922.	Cases. Week ended June 9, 1923.	Deaths, week ended June 9, 1923.	City.	Cases. Week ended June 10, 1922.	Cases. Week ended June 9, 1923.	Deaths, week ended June 9, 1923.
Alabama:				Minnesota:			
Birmingham			1	Minneapolis			1
Mobile			1	Missouri:			
California:				Kansas City	1		
Los Angeles	1	3		New Jersey:			
Sacramento			1	Newark	6		
San Diego	1	1	1	New York:			
San Francisco	4			Jamestown		1	
Colorado:				New York	13	10	4
Denver			1	Rochester			2
Florida:				Saratoga Springs	1		
Tampa	1			Ohio:			
Illinois:				Akron	1	1	
Chicago	5	2		Lancaster			1
Freeport			1	Newark			1
Louisiana:				Piqua			1
New Orleans		2	3	Pennsylvania:			
Maryland:				Philadelphia	1	1	1
Baltimore		3	2	Pittsburgh			1
Massachusetts:				Rhode Island:			
Attleboro		1		Providence	1		
Cambridge	1			Tennessee:			
Haverhill	1			Memphis		1	
Saugus	2			Nashville			1
Springfield		1		Virginia:			
Michigan:				Roanoke			1
Detroit	1		1				

CITY REPORTS FOR WEEK ENDED JUNE 9, 1923—Continued.

LEPROSY.

City.	Cases.	Deaths.
California:		
San Francisco	[1] 2	

[1] Not local.

LETHARGIC ENCEPHALITIS.

California:		
San Francisco	1	1
Nebraska:		
Omaha		1
Oregon:		
Portland		1

MALARIA.

City.	Cases.	Deaths.	City.	Cases.	Deaths.
Alabama:			New Jersey:		
Birmingham	1		East Orange	1	
Mobile	1		Hackensack	1	
Arkansas:			Newark	1	
Little Rock	1		New York:		
Connecticut:			New York	3	
Bridgeport	1		Ohio:		
Greenwich	1		Akron	1	
Florida:			South Carolina:		
Tampa	1		Columbia		1
Georgia:			Tennessee:		
Savannah	1	1	Memphis	6	
Kentucky:			Texas:		
Louisville	1		Beaumont		1
Louisiana:			Houston		1
New Orleans	2				
Massachusetts:					
Springfield	1				

MEASLES.

See p. 1494; also Current State summaries, p. 1483, and Monthly summaries by States, p. 1487.

PELLAGRA.

City.	Cases.	Deaths.	City.	Cases.	Deaths.
Arkansas:			South Carolina:		
Little Rock	1		Columbia		2
Georgia:			Tennessee:		
Atlanta		1	Memphis	1	1
Louisiana:			Virginia:		
New Orleans	1		Lynchburg		1

PNEUMONIA (ALL FORMS).

Alabama:			California—Continued.		
Anniston	18	7	San Diego	3	3
Montgomery	2	1	San Francisco	13	4
California:			Santa Ana		1
Glendale		1	Vallejo		1
Los Angeles	22	11	Colorado:		
Oakland	3	4	Denver		6
Richmond	1	1	Connecticut:		
Riverside		2	Bridgeport	4	2
Sacramento	3	2	Hartford	3	1
San Bernardino	2	1	New Haven		1

CITY REPORTS FOR WEEK ENDED JUNE 9, 1923—Continued.

PNEUMONIA (ALL FORMS)—Continued.

City.	Cases.	Deaths.
District of Columbia:		
Washington		18
Florida:		
Tampa	1	1
Georgia:		
Atlanta	8	8
Savannah		1
Illinois:		
Alton	1	
Aurora		1
Blue Island	2	2
Chicago	196	72
Evanston	1	
Freeport		1
Galesburg	1	
Oak Park		1
Pekin	1	
Rock Island	1	
Springfield	1	1
Indiana:		
Anderson		2
Gary		1
Hammond		1
Indianapolis		5
Kokomo		1
La Fayette		3
Muncie		1
Iowa:		
Burlington	3	1
Muscatine	1	
Kansas:		
Kansas City	1	
Topeka	2	2
Wichita		1
Kentucky:		
Henderson		1
Lexington		2
Louisville	6	10
Louisiana:		
New Orleans	7	7
Maine:		
Bangor	2	
Bath		1
Biddeford		1
Lewiston		1
Portland		2
Maryland:		
Baltimore	35	26
Massachusetts:		
Boston	14	14
Brockton		1
Brookline		1
Cambridge	1	3
Chicopee	1	1
Easthampton	2	
Everett	1	
Fall River	1	1
Framingham		1
Lowell		2
Lynn	1	1
Malden	2	1
Medford	1	
Milford	2	1
New Bedford	3	1
Newton		1
North Adams		1
Pittsfield		3
Quincy	3	
Salem	1	
Somerville	1	1
Springfield	11	1
Taunton		1
Wakefield		1
Waltham	1	1
Worcester		4
Michigan:		
Ann Arbor	1	
Battle Creek	1	
Benton Harbor		1
Michigan—Continued.		
Detroit	81	32
Flint	6	7
Grand Rapids	6	4
Hamtramck		1
Highland Park	3	
Kalamazoo	2	2
Pontiac	4	1
Saginaw		1
Minnesota:		
Duluth	3	
Minneapolis		1
Missouri:		
Kansas City	9	5
St. Joseph		3
Montana:		
Great Falls		1
Missoula	2	2
Nebraska:		
Omaha		1
New Hampshire:		
Nashua		3
New Jersey:		
Bloomfield	1	
Clifton	2	2
East Orange	3	1
Elizabeth		4
Garfield	1	
Harrison	2	
Hoboken		1
Jersey City	2	
Kearny		1
Newark	20	10
Orange		1
Passaic	2	2
Phillipsburg	1	1
Plainfield	5	
Trenton	2	1
West New York	1	
New Mexico:		
Albuquerque	1	
New York:		
Albany	7	
Amsterdam	2	2
Buffalo	29	10
Cohoes	4	
Geneva		2
Hornell	1	
Jamestown	6	2
Lackawanna	4	
Lockport	1	
Middletown	4	
Mount Vernon	1	1
New York	219	130
Newburgh		1
Niagara Falls	6	2
North Tonawanda		1
Peekskill	1	
Rochester	39	4
Schenectady	1	
Syracuse	9	3
Troy	1	1
White Plains	4	
Yonkers	3	
Ohio:		
Akron	4	
Cincinnati	3	8
Cleveland	39	19
Columbus		5
Dayton	1	
Lima		2
Lorain	1	
Mansfield	1	1
New Philadelphia		1
Piqua		1
Springfield		1
Toledo		7
Youngstown		3
Zanesville		2

CITY REPORTS FOR WEEK ENDED JUNE 9, 1923—Continued.

PNEUMONIA (ALL FORMS)—Continued.

City.	Cases.	Deaths.	City.	Cases.	Deaths.
Oklahoma:			Utah:		
Oklahoma		2	Provo	1	
Oregon:			Salt Lake City		1
Portland		1	Vermont:		
Pennsylvania:			Burlington		2
Philadelphia	44	39	Rutland	1	
Pittsburgh		39	Virginia:		
Rhode Island:			Charlottesville		1
Pawtucket		2	Lynchburg		1
Providence		6	Norfolk	1	2
South Carolina:			Petersburg		2
Charleston		1	Richmond	1	4
Columbia		1	Roanoke	1	2
South Dakota:			West Virginia:		
Sioux Falls		1	Bluefield	1	1
Tennessee:			Fairmont		2
Memphis		4	Huntington		2
Nashville		2	Wheeling		2
Texas:			Wisconsin:		
Beaumont		1	Madison	1	
El Paso		2	Milwaukee	7	
Fort Worth	1	1	Racine	1	
Houston		1			
San Antonio	1	2			
Waco		2			

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 previous years.	Week ended June 9, 1923.		City.	Median for previous years.	Week ended June 9, 1923.	
		Cases.	Deaths.			Cases.	Deaths.
Massachusetts:				Ohio:			
Lynn	0	1		Youngstown	0	1	
New York:				Texas:			
Jamestown	0	1		Houston	0	3	
New York	1	1					

RABIES IN ANIMALS.

City.	Cases.	City.	Cases.
California:		Kentucky:	
Los Angeles	13	Louisville	2
Georgia:		Missouri:	
Savannah	2	Kansas City	1

SCARLET FEVER.

See p. 1494; also Current State summaries, p. 1483, and Monthly summaries by States, p. 1487.

CITY REPORTS FOR WEEK ENDED JUNE 9, 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 previous years.	Week ended June 9, 1923. Cases.	Week ended June 9, 1923. Deaths.
Alabama:			
Mobile	3	1	
California:			
Los Angeles	1	11	
Oakland	0	1	
Georgia:			
Augusta	5	2	
Atlanta	7	4	
Savannah	0	1	
Illinois:			
Chicago	2	3	
Decatur	0	6	
Oak Park	0	3	
Pekin	0	3	
Springfield	1	1	
Indiana:			
Anderson	1	1	
Fort Wayne	2	15	
Gary	0	6	
Huntington	0	6	
Indianapolis	14	8	
Logansport	0	4	
Michigan City		3	
Muncie	0	4	
South Bend	0	4	
Iowa:			
Council Bluffs	1	1	
Davenport	3	21	
Kansas:			
Parsons	2	1	
Wichita	7	1	
Kentucky:			
Owensboro	0	2	
Maine:			
Auburn	0	1	
Michigan:			
Benton Harbor	0	1	
Detroit	14	1	
Highland Park	0	1	
Holland	0	2	
Minnesota:			
Duluth	2	9	
Minneapolis	32	2	
Rochester	0	1	
Missouri:			
St. Louis	4	1	
Montana:			
Great Falls	2	2	
New York:			
Niagara Falls	0	1	
North Carolina:			
Greensboro	0	3	
Raleigh	0	3	
Winston-Salem	0	5	
Ohio:			
Barberton	0	1	
Chillicothe	0	2	
Columbus	1	1	
Dayton	0	4	
Middletown	0	1	
Piqua	0	1	
Sandusky	0	5	
Toledo	0	2	
Oklahoma:			
Oklahoma	5	5	
Tulsa	2	8	
Oregon:			
Portland	6	9	
Pennsylvania:			
Erie	0	1	
Philadelphia	0	1	
Tennessee:			
Knoxville	1	24	
Memphis	0	2	
Texas:			
Fort Worth	3	1	
Waco	0	1	
Vermont:			
Barre	0	1	
Burlington	0	1	
Virginia:			
Roanoke	1	2	
Washington:			
Seattle	3	3	
Spokane	4	2	
Wisconsin:			
Ashland	0	1	
Eau Claire	0	1	
Janesville	0	2	
Kenosha	0	6	
Madison	1	1	
Sheboygan	0	1	
Superior	2	2	

TETANUS.

City.	Cases.	Deaths.
California:		
Los Angeles	1	
Illinois:		
Chicago	1	1
Michigan:		
Muskegon	1	1
Minnesota:		
Minneapolis	1	1
Pennsylvania:		
Philadelphia		1
Texas:		
San Antonio		1

TUBERCULOSIS.

See p. 1491; also Current State summaries, p. 1483.

CITY REPORTS FOR WEEK ENDED JUNE 9, 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 June 9, 1923. Cases.	Week ended June 9, 1923. Deaths.
Alabama:			
Birmingham	3	1	
Mobile	0	1	2
California:			
Los Angeles	1	5	1
Sacramento	0	2	
Connecticut:			
Bridgeport	0	1	
District of Columbia:			
Washington	2	5	2
Florida:			
Key West	4		1
Tampa	1	1	1
Georgia:			
Augusta	3	1	
Brunswick	0	2	
Savannah	4	2	
Illinois:			
Alton	0	1	
Chicago	4	3	1
Kewanee	2	1	
Peoria	0	1	
Quincy	0	1	1
Indiana:			
Indianapolis	0	1	
Mishawaka	0	1	
Kansas:			
Wichita	0	1	
Kentucky:			
Covington	0	1	
Louisville	1	4	2
Louisiana:			
New Orleans	4	1	
Maine:			
Lewiston	0	2	
Maryland:			
Baltimore	4	3	
Cumberland	0	1	
Massachusetts:			
Fall River	3	1	
Melrose	0	1	
North Adams	0	2	
Michigan:			
Detroit	4	3	1
Flint	0	1	
Muskegon	0	1	1
Saginaw	0	2	1
Minnesota:			
Minneapolis	1	1	
Missouri:			
St. Louis	1	1	
New Jersey:			
Elizabeth	0	3	
Newark	1	1	
Passaic	0	1	
Plainfield	0	1	
Trenton	1	1	
New York:			
Albany	1	1	
Hornell	0	1	
New York	13	15	
Newburgh	0	1	
White Plains	0	1	
North Carolina:			
Durham	2	1	
Ohio:			
Cincinnati	1	1	
Cleveland	2	1	
Dayton	0	1	
Newark	0	2	
Sandusky	0	1	
Pennsylvania:			
Allentown	0	1	
Harrisburg	0	1	
Norristown	0	1	
Philadelphia	9	2	
Pittsburgh	2	11	1
Pottsville	0	1	
Scranton	0	1	
Sharon	0	1	
Uniontown	0	1	
South Carolina:			
Columbia	2	1	
Tennessee:			
Nashville	3	2	
Texas:			
Amarillo		1	
El Paso	0	1	1
San Antonio	0	1	1
Virginia:			
Richmond	1	1	
Washington:			
Takoma	0	1	
West Virginia:			
Parkersburg	0		1
Wheeling	1	2	

TYPHUS FEVER.[1]

City.	Cases.	Deaths.
Georgia, Atlanta	1	
Maryland, Baltimore	1	

[1] For week ended June 2, 1923.

CITY REPORTS FOR WEEK ENDED JUNE 9, 1923—Continued.

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:										
Birmingham	178,806	59			95	2	1		13	2
Mobile	60,777	17	1		10				2	
Montgomery	43,464	10	1		11		3		2	
Tuscaloosa	11,996				21					
Arkansas:										
Fort Smith	28,870				7					
Little Rock	65,142				13				4	
North Little Rock	14,048				25				1	
California:										
Alameda	28,806	4			39					
Bakersfield	18,638		2				1			
Eureka	12,923	7	1		10		2			
Glendale	13,536	11								
Long Beach	55,593	17	1		4				2	2
Los Angeles	576,673	224	38	1	129	2	21	1	66	26
Oakland	216,261	42	10		79		11		1	2
Pasadena	45,354	14			29		3		2	2
Richmond	16,843	4	1		2		2			
Riverside	19,341	13	1		1		1		9	2
Sacramento	65,908	16	1		68		6			
San Bernardino	18,721	10			7		6			1
San Diego	74,683	20	1		19		6		7	2
San Francisco	506,676	118	20		178		16		10	7
Santa Ana	15,485	6					3		1	1
Santa Cruz	10,917	7								1
Vallejo	21,107	4								1
Colorado:										
Denver	256,491	64	21	3	206	4	8			5
Pueblo	43,050	8	4		3				7	
Trinidad	10,906	1	1		3	1				
Connecticut:										
Bridgeport	143,555	28	6		13		13		7	
Bristol	20,620	2								
Fairfield (town)	11,475	2	1		2				1	
Greenwich (town)	22,123		2		15		1			
Hartford	138,036	24	6	2			3		4	2
Milford (town)	10,193	3			2					1
New Haven	162,537	38	1		11		1		1	3
District of Columbia:										
Washington	437,571	113	2	1	139	3	17		18	8
Florida:										
Key West	18,749	4								
Tampa	51,608	9	1		3				1	1
Georgia:										
Albany	11,555				6					
Atlanta	200,616	76	2	1	24	1	4		1	8
Augusta	52,548	20	1		78	3				1
Brunswick	14,413	0			1					
Rome	13,252		1		13					
Savannah	83,252	33			37	2	1		2	3
Idaho:										
Boise	21,393	5								
Illinois:										
Alton	24,682	6	1		12				2	
Aurora	36,397	14	5	1	15		1		4	3
Bloomington	28,725	2			9					
Blue Islands	11,424	5			24					1
Centralia	12,491	7	1		15					
Chicago	2,701,705	661	78	3	435	8	72	1	246	58
Cicero	44,995	2	1		22				1	
Decatur	43,818	9			91				1	1
East St. Louis	66,767	10	2		3					1
Elgin	27,454	4			22		1			
Evanston	37,234	11	1		60					
Freeport	19,669	6			39					
Galesburg	23,834	9	1		5		1			2
Jacksonville	15,713	9			1				2	1
Kewanee	16,026	5	1		1		1			
La Salle	13,050	5			2					
Mattoon	13,552				11		1			
Oak Park	39,858	18	1		55		1			
Pekin	12,086		1							
Peoria	76,121	19			6					

CITY REPORTS FOR WEEK ENDED JUNE 9, 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.
Illinois—Continued.										
Quincy	35,978	11	3		19		1			
Rock Island	35,177	7	3		47					1
Springfield	59,183	20	3		4		1		1	1
Urbana	10,244				16					
Indiana:										
Anderson	29,767	7	1		50				1	
Bloomington	11,595	5			9					
Crawfordsville	10,139	4								
Elwood	10,799	1			4					
Fort Wayne	86,549	25	3	1						1
Frankfort	11,585	1			28	1				
Gary	55,378	14			5	1	9			3
Hammond	36,004	13			1		4			1
Huntington	14,000	1			1					
Indianapolis	314,194	95	8		486	2	2		9	9
Kokomo	30,067	7			31					
La Fayette	22,486	15			29				1	1
Logansport	21,626	1			4					
Michigan City	19,457	2					2			
Mishawaka	15,195	2								
Muncie	36,524	8	1		75					2
South Bend	70,983	10			1		7		2	
Terre Haute	66,083	22	2		16		3			
Iowa:										
Burlington	24,057				6		1			
Council Bluffs	36,162	5	1							
Davenport	56,727		1		5					
Dubuque	39,141				1		1			
Iowa City	11,267						1			
Muscatine	16,068	4			1					
Ottumwa	23,003		1							
Sioux City	71,227	0					2			
Waterloo	36,230				42		7			
Kansas:										
Atchison	12,630		1							
Coffeyville	13,452	4			7					
Fort Scott	10,693	3			1					
Kansas City	101,177		2		124		1		10	
Parsons	16,028				3				7	
Topeka	50,022	11	5		63				1	1
Wichita	72,217	10	1		48					
Kentucky:										
Covington	57,121	17			8					4
Henderson	12,169	6								1
Lexington	41,534	16			8					2
Louisville	234,891	82			20		1		17	7
Louisiana:										
New Orleans	387,219	125	2		19	9	2		40	14
Maine:										
Auburn	16,985	7			13		4		1	
Bangor	25,978	2	2	2	41					
Bath	14,731	2								
Biddeford	18,008	3					1			
Lewiston	31,791	13			21	1	5			1
Portland	69,272	23	2		6					
Sanford (town)	10,691	2			2		1			
Waterville	13,351				1					
Maryland:										
Baltimore	733,826	234	27		440	6	69	2	28	22
Cumberland	29,837	7			8				1	
Frederick	11,066	4			2				1	
Massachusetts:										
Adams (town)	12,967	1								
Amesbury (town)	10,036	3								
Arlington (town)	18,665	4	1		1		3			
Attleboro	19,731	6			2				2	1
Beverly	22,561	7					3			
Boston	748,060	233	58	7	203		98	1	52	20
Braintree (town)	10,580	3	2		19		3			1
Brockton	66,254	12			43		4		3	
Brookline	37,748	14			36		1		1	
Cambridge	109,694	27	2		27		15		3	2
Chelsea	43,184	10			1		4		2	

CITY REPORTS FOR WEEK ENDED JUNE 9, 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.
Massachusetts—Continued.										
Chicopee	36,214	8					4		2	
Clinton	12,979	1	1						1	
Danvers	11,108								1	
Dedham	10,792	2								
Easthampton	11,261	1								1
Everett	40,120	5	3		8		1			
Fall River	120,485	25	6		2		6		6	4
Framingham	17,033	7			6		3			
Gardner	16,971	5			1					
Greenfield	15,462	2								
Haverhill	53,884	10	1		91		10		1	1
Lawrence	94,270	22	1		31				3	1
Leominster	19,744	0			2					
Lowell	112,759	29	4		8		5		4	6
Lynn	99,148	18	2		2		3		2	
Malden	49,103	3	4	1	12		2		1	1
Medford	39,038	14			5		2		1	2
Melrose	18,204	3	1		10		2			
Methuen	15,189	6	1		4	1			1	
Milford	13,471	5			2		1			
New Bedford	121,217	24			2		1		8	2
Newburyport	15,618	4	1	1	3		1			
Newton	46,054	7			4		3			
North Adams	22,282	6								
Northampton	21,951	15					2			
Pittsfield	41,763	7	2				2		3	
Plymouth	13,045	4								
Quincy	47,876	7	5		8		4		3	
Salem	42,529		1		1		1			
Somerville	93,091	17	2		5		4		2	2
Southbridge	14,245	3			12		1			
Springfield	129,614	22	3		11		3		4	1
Taunton	37,137	10					6			
Wakefield	13,025	16			17					
Waltham	30,915	11			1				2	3
Watertown	21,457	2			6		6			
Webster	13,258	4					1			
West Springfield	13,443	2								
Westfield	18,604	6					5			
Winthrop	15,455	3	2	1	1		1			
Woburn	16,574	1								
Worcester	179,754	45	1				16			2
Michigan:										
Alpena	11,101				1					
Ann Arbor	19,516	11	1		40		1			
Battle Creek	36,164	0	3		109		2		2	
Benton Harbor	12,233	2			1					
Detroit	993,678	272	27	6	396	10	64	1	53	27
Flint	91,599	28	4	2	81	1	4		2	
Grand Rapids	137,634	35	5	1	423		4		6	2
Hamtramck	48,615	7	2		6					1
Highland Park	46,499		2		42		7			
Kalamazoo	48,487	16	2		18	1	4		3	2
Marquette	12,718	3	3				1			
Muskegon	36,570	9			48					
Pontiac	34,273	9	7		80		11		1	1
Port Huron	25,944	6			36		2			
Saginaw	61,903	25	3		107		9		1	1
Sault Ste-Marie	12,096	2								1
Minnesota:										
Duluth	98,917	19			3		6		3	3
Faribault	11,089	5			11					1
Minneapolis	380,582	93	5	1	129	3	17		19	6
Rochester	13,722	13					1			1
St. Cloud	15,873				1				1	
Winona	19,143				1					
Missouri:										
Cape Girardeau	10,252	4			3					
Joplin	29,902				5					
Kansas City	324,410	90	8	1	137	2	1		9	5
St. Joseph	77,939	24			29					
St. Louis	772,897	211	20	1	67	2	13		44	12

CITY REPORTS FOR WEEK ENDED JUNE 9, 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:										
Billings	15,100	3					2		2	
Great Falls	24,121	7							3	
Helena	12,037	2			8					
Missoula	12,668	9					5		1	1
Nebraska:										
Lincoln	54,948	12	2		2		1			1
Omaha	191,601	32	4		1					2
Nevada:										
Reno	12,016	3			3					
New Hampshire:										
Berlin	16,104	5								1
Dover	13,029	5			2					
Keene	11,210	3								1
Manchester	78,384	23	2	1	4					
Nashua	28,379	13			28					
New Jersey:										
Asbury Park	12,400	2			4		2		1	
Atlantic City	50,707	10	1		2		1		1	
Bayonne	76,754		4						2	
Bloomfield	22,019	1			1		1			
Clifton	26,470	7	2		4				1	1
East Orange	50,710	10			32				1	
Elizabeth	95,783	4	6		19		3		5	
Garfield	19,381	0	1		1					
Hackensack	17,667	4			31				2	1
Harrison	15,721	2	2	1			2			
Hoboken	68,166	17			3		2			3
Jersey City	298,103		10		9		3		10	
Kearny	26,724	4			21					
Long Branch	13,521	2			4				1	1
Montclair	28,810	7			16		1		3	
Morristown	12,548	7					2			
Newark	414,524	91	12		109	1	13		13	7
Orange	33,268	9			5		2		1	2
Passaic	63,841	19	1		2		6		1	3
Paterson	135,875		6		85		3		6	
Phillipsburg	16,923	4	1							
Plainfield	27,700	9			1		2			
Summit	10,174	4			22					
Trenton	119,289	38	4		2		9		5	4
Union (town)	20,651		1		1					
West Hoboken	40,074	7	1		2					
West New York	29,926	2	4		7					
West Orange	15,573	1	1		4		3			
New Mexico:										
Albuquerque	15,157	11	2	1	14		1		2	1
New York:										
Albany	113,344		2		210		5		8	
Amsterdam	33,524	11	4		9		2		1	
Buffalo	506,775	167	13	3	127	2	21		21	9
Cohoes	22,987	6			4					
Dunkirk	19,336	7			9		1			
Geneva	14,648	3								
Hornell	15,025	2			16		1			
Hudson	11,745	1								
Ithaca	17,004	7			30					2
Jamestown	38,917	2			34		1			
Lackawanna	17,918	6	1		5				5	
Little Falls	13,029	2								
Lockport	21,308	6			7		1		1	
Middletown	18,420				17					
Mount Vernon	42,726	5	2				1			
New York	5,620,048	1,413	178	13	773	10	184	2	[1] 225	[1] 81
Newburgh	30,366	11			5		1		1	1
Niagara Falls	50,760	18			29		5	1		
North Tonawanda	15,482	4	1		17		1			
Peekskill	15,868	4			4		4		1	
Plattsburg	10,909	4								
Rochester	295,750	30	9	1	74	1	2		21	1

[1] Pulmonary tuberculosis only.

CITY REPORTS FOR WEEK ENDED JUNE 9, 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.
New York—Continued.										
Saratoga Springs	13,181	4					6		1	
Schenectady	88,723	25	2		116		3		6	2
Syracuse	171,717	52	19		333	1	16		10	1
Troy	72,013	21			4				6	
White Plains	21,031				3		5		1	
Yonkers	100,176	13	9		34		12			1
North Carolina:										
Durham	21,719	7			11				1	
Greensboro	43,525	11			58					2
Raleigh	24,418	15			21					2
Rocky Mount	12,742	4								
Salisbury	13,884	1								
Winston-Salem	48,395	20			138		1		1	3
North Dakota:										
Grand Forks	14,010						1			
Ohio:										
Akron	208,435	29	2		33		2		7	
Ashtabula	22,082	3			4					
Barberton	18,811	3			2		1			1
Bucyrus	10,425	1			1		2		1	
Cambridge	13,104	5	1							
Canton	87,091				10		2			
Chillicothe	15,831	4								
Cincinnati	401,247	121	4		101	3	6		24	6
Cleveland	796,841	201	30	1	381	3	76	1	28	13
Columbus	237,031	66	1		20	1	2		2	5
Coshocton	10,847				1					
Dayton	152,559	28	2		24		5		2	
East Cleveland	27,292	3			20		4		1	
East Youngstown	11,237	1								
Findlay	17,021	4								
Fremont	12,468	3								
Kenmore	12,683				49					
Lancaster	14,706	6	1				1			1
Lima	41,326	8			64		1		1	
Lorain	37,295				2		8			
Mansfield	27,824	6			18					
Marion	27,891		1		6		1			
Martins Ferry	11,634	2			1		1		1	
Middletown	23,594	5			3				1	
New Philadelphia	10,718				14					
Newark	26,718	4			17					
Niles	13,080	2		1	2					
Norwood	24,966	4			3					1
Piqua	15,044	9			1					
Salem	10,305	2			23					
Sandusky	22,897	10			8		4		2	
Springfield	60,840	18	3							2
Toledo	243,164	76	6	1	31		66	1	4	6
Youngstown	132,358	17	10		90	2	3			
Zanesville	29,569	12			1		1			2
Oklahoma:										
Oklahoma	91,295	28			8		4			1
Tulsa	72,075				1				1	
Oregon:										
Portland	258,288	52	10		1		5		13	5
Pennsylvania:										
Allentown	73,502		7		17		2			
Altoona	60,331		2		2					
Ambridge	12,730				2					
Beaver Falls	12,802		1		3					
Berwick	12,181		1						1	
Bethlehem	50,358		2		35		3		2	
Bradford	15,525				10					
Bristol	10,273		1						1	
Canonsburg	10,632		1		1					
Carbondale	18,640		1		1				1	
Carlisle	10,916				1					
Carnegie	11,516						1			
Chambersburg	13,171				4					
Chester	58,030		1		3		1			
Coatesville	14,515				1		2			
Dickson	11,049		1				2			

CITY REPORTS FOR WEEK ENDED JUNE 9, 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.
Pennsylvania—Continued.										
Donora	14,131				1					
Dubois	13,681				11					
Duquesne	19,011				1		2			
Easton	33,813				6					
Erie	93,372		3		177		2		2	
Farrell	15,586		1		2				1	
Greensburg	15,033				4					
Harrisburg	75,917				10		1			
Hazleton	32,277		1		10					
Homestead	20,452		1							
Jeannette	10,627		1		1					
Johnstown	67,327		4		31		8			
Lancaster	53,150		1		9		3			
Lebanon	24,643		4				3		1	
McKees Rocks	16,713		1							
McKeesport	46,781				1					
Meadville	14,568				20					
Monessen	18,179		1							
Mount Carmel	17,469		1		2					
Nanticoke	22,614		1		5		1			
New Castle	44,938						1			
New Kensington	11,987				2				1	
Norristown	32,319		2		9		1			
North Braddock	14,928				1					
Oil City	21,274		1		4					
Philadelphia	1,823,779	484	63	5	44		60		50	42
Phoenixville	10,484		1		1					
Pittsburgh	588,343	187	21	2	73		19	1		10
Plymouth	16,500				3					
Pottstown	17,431				1					
Reading	107,784		1		1		3		1	
Scranton	137,783		3		61					
Shamokin	21,204				3					
Sharon	21,747				2		3			
Shenandoah	24,726		1							
Steelton	13,428		1		4		1		1	
Sunbury	15,721		2							
Swissvale	10,908		1							
Tamaqua	12,363				10					
Uniontown	15,692				1					
Warren	14,272				129		1			
Washington	21,480				14		1			
West Chester	11,717				1					
Wilkes-Barre	73,833		5		39				2	
Wilkinsburg	24,403		1		8					
Williamsport	36,198				9					
Woodlawn	12,495				2				1	
York	47,512				5					
Rhode Island:										
Cranston	29,407	4			3		2			
Cumberland (town)	10,077	1								
East Providence (town)	21,793				1					
Newport	30,255	3	4							
Pawtucket	64,248	16	1							
Providence	237,595	68	6		22	4	7		1	6
South Carolina:										
Charleston	67,957	21			6					1
Columbia	37,524	19			1					2
Greenville	23,127	5			4					1
South Dakota:										
Sioux Falls	25,202	7			3					
Tennessee:										
Knoxville	77,818	2			49		1		2	2
Memphis	162,351	68			18		1		17	10
Nashville	118,342	45	1		8	1			8	6
Texas:										
Amarillo	15,494	6								
Beaumont	40,422	11								3
El Paso	77,560	34	1		5				8	8
Fort Worth	106,482	17	1		1				1	1
Galveston	44,255	13								

CITY REPORTS FOR WEEK ENDED JUNE 9, 1923—Continued.

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

City.	Population Jan. 1, 1920.	Total deaths from all causes.	Diphtheria. Cases.	Diphtheria. Deaths.	Measles. Cases.	Measles. Deaths.	Scarlet fever. Cases.	Scarlet fever. Deaths.	Tuberculosis. Cases.	Tuberculosis. Deaths.
Texas—Continued.										
Houston	138,276	33					2			3
San Antonio	161,379	34			7				1	16
Waco	38,500	17								2
Utah:										
Provo	10,303	2								
Salt Lake City	118,110	22	4	1	9		1			3
Vermont:										
Barre	10,008				18		1			
Burlington	22,779	13			63		1			
Rutland	14,954	10					1			
Virginia:										
Alexandria	18,060	2			4					
Charlottesville	10,688	4			4					
Danville	21,539	9	2		15				1	
Lynchburg	30,070	14			5				1	
Norfolk	115,777	8			68				6	6
Petersburg	31,012	13			97				3	
Richmond	171,667	30	3		268	3	2		5	3
Roanoke	50,842	15			13				4	1
Washington:										
Seattle	315,312		4		64		14		33	
Spokane	104,437		6				5			
Tacoma	96,965		9		1		4			
West Virginia:										
Bluefield	15,282	3	1		4		1			
Clarksburg	27,869	4			83					
Fairmont	17,851				4		1		1	
Huntington	50,177	14				1	12			2
Morgantown	12,127				1				1	
Parkersburg	20,050	7			18					
Wheeling	56,208	19			4		1		2	3
Wisconsin:										
Appleton	19,561	3			7		1		1	
Ashland	11,334				24		1			
Beloit	21,284	11	1		34		6		2	
Eau Claire	20,906				32					
Fond du Lac	23,427	2			3					
Green Bay	31,017				39		3		3	
Janesville	18,293	5			2					
Kenosha	40,472	6	3		1		2		1	
Madison	38,378	5			54	1	3		1	
Manitowoc	17,563		1		44					
Marinette	13,610				8					
Milwaukee	457,147	86	14		24		112	3	14	3
Oshkosh	33,162	21			79		1			
Racine	58,593	13			7		4		5	
Sheboygan	30,955	11	2		11		4			1
Stevens Point	11,371				2		1			
Superior	39,671	9			16					
Waukesha	12,558				29		3			
Wausau	18,661		2		29					
West Allis	13,745		1				4			
Wyoming:										
Cheyenne	13,829	1			1		1			

FOREIGN AND INSULAR.

AUSTRIA.

Births and Deaths, 1910–1922.

The figures given in the table below were furnished by the vital statistics bureau of the city of Vienna. They show very vividly the effect of the World War on the birth and death rates in that city.

In 1915, the second year of the war, the death rate increased considerably, and it continued increasing with each new hardship and privation of war until 1918, in which year it reached its highest point, 51,497 deaths (as compared with 32,314 in 1913). In 1915 the number of births decreased to 31,686, and fell to 21,127 in 1918, the year of the highest death rate.

Improvement of conditions was noted in 1919, the first post-war year, with 40,932 deaths and 27,451 births. In 1921 the number of births again exceeded the deaths, as was also the case in 1922.

Among the causes of death, tuberculosis ranks first, with 11,531 deaths in 1918 (about 22 per cent of the total) and 5,552 deaths in 1922 (about 19 per cent of the total). Influenza, which raged in many parts of the world in 1918, also added heavily to the extraordinary death rate in Vienna in 1918.

In 1910 the population of Vienna was 2,031,498, as compared with 1,841,326 in 1920. In 1916 the population was 2,220,511.

Births and deaths in Vienna from 1910 to 1922.

Year.	Deaths.	Births.	Year.	Deaths.	Births.
1910	33,311	48,669	1917	46,131	22,627
1911	33,684	45,154	1918	51,497	21,127
1912	32,141	44,251	1919	40,932	27,451
1913	32,314	41,690	1920	34,197	30,780
1914	33,2[illegible]8	40,213	1921	28,297	31,7[illegible]7
1915	37,018	31,686	1922	30,068	32,857
1916	37,631	26,077			

CANADA.

Decrease in Mortality from Tuberculosis.

A statement made, May 21, 1923, by the president of the London (Ontario) Health Association shows that, according to the Dominion of Canada census of 1901, the deaths from pulmonary tuberculosis were 9,709 in a population of over 5,000,000, while in 1921, with a population of 8,000,000, the deaths from this disease numbered only about 10,000. During the last two decades the death rate in Canada was stated to have dropped from 130 per 100,000 of population to 83 per 100,000. The death rate at the sanitorium near London, Ontario, was stated for 1922 as 65 per 100,000.

This decrease in tuberculosis death rate was attributed, first, to earlier recognition of the disease and to earlier and better treatment in sanitoriums, and, secondly, to the removal of tuberculous patients from their homes to sanitoriums and the consequent improvement in living conditions on their return home.

ESTHONIA.

Communicable Diseases—April, 1923.

Communicable diseases have been reported in the Republic Esthonia as follows:

APRIL 1-30, 1923.

Disease.	Cases.	Remarks.
Diphtheria	52	
Measles	293	
Scarlet fever	57	
Smallpox	6	
Tuberculosis	149	
Typhoid fever	21	
Typhus fever	8	Paratyphus fever, 4 cases.

FRANCE.

Plague—Vicinity of Paris.

Under date of June 11, 1923, the occurrence of four cases of plague with two deaths, during the period May 20 to 22, 1923, was reported at St. Ouen, a suburb of Paris, France. The dates of occurrence were stated as follows: May 20, one case; May 21, one case with one death; May 22, two cases with one death.

HUNGARY.

Typhus Fever—Budapest—Country Districts.

Information dated April 5, 1923, shows an outbreak of typhus fever at Budapest, Hungary, in February, 1923, with a total of 14 cases, of which nearly all were stated to have been imported from the country. Some spread of the disease was reported for the country districts, 76 cases being reported in the county of Heves, occurring in wandering gypsies, and six cases in the county of Fejer.

PERU.

Mortality—Callao—Lima—1918-1922.

The following tables have been compiled from statistics prepared by the Bureau of Public Health of Peru. The population of the city of Lima was estimated at 168,000 in 1918 and 176,000 in 1921. The population of Callao was estimated at 52,000 in 1920.

Mortality in Callao, Peru, 1919 to 1922, inclusive.

Disease.	1919	1920	1921	1922
Childbirth	6	5	4	12
Diphtheria and croup	1	1	2	3
Enteritis ((0-1 year)	108	135	105	136
Enteritis (1-2 years)	23	38	41	39
Influenza	34	54	26	7
Malaria	23	24	15	12
Measles	7	3	....	7
Plague	7	30	21	24
Smallpox	....	1	1	5
Tuberculosis (pulmonary)	190	182	278	342
Tuberculosis (other forms)	66	47	32	58
Typhoid fever	18	28	17	24
Whooping cough (convulsive)	....	7	3	12
Total	483	555	545	681
Other illnesses	883	939	792	914
Total	1,366	1,491	1,337	1,595

Deaths of infants under 1 year of age in Callao, Peru, 1918 to 1922, inclusive.

Disease.	1918	1919	1920	1921	1922
Bronchitis	6	11	16	7	9
Diarrhea and enteritis	154	108	135	105	136
Diphtheria	1	....	1	1	....
Influenza	3	2	6	5	1
Malaria	1	2	5	3	3
Measles	1	2	1	....	3
Meningitis (ordinary)	19	15	29	24	28
Pneumonia (broncho)	11	16	19	24	19
Pneumonia	1	1	10	3	4
Smallpox	....	....	....	....	1
Syphilis (hereditary)	2	1	....	3	1
Tubercular meningitis	1	2	....	....	3
Tuberculosis (pulmonary)	5	4	5	3	13
Tuberculosis (other forms)	3	....	2	....	5
Typhoid fever	....	....	....	....	1
Whooping cough (convulsive)	....	....	4	2	6
Total	208	164	233	180	233
Other illnesses	34	31	35	37	35
No medical attention	187	151	204	142	162
Total	429	346	472	359	430

Mortality in Lima, Peru, 1918 to 1921, inclusive.

Disease.	1918	1919	1920	1921
Childbirth	26	12	25	36
Diphtheria and croup	7	8	6	13
Enteritis (0-1 year)	551	519	474	500
Enteritis (1-2 years)	175	132	163	128
Influenza	347	171	204	110
Malaria	168	146	160	112
Measles	18	66	20	12
Plague	57	30	30	57
Scarlet fever	1	....	2	1
Smallpox	....	....	....	3
Tuberculosis (pulmonary)	929	880	755	796
Tuberculosis (other forms)	216	282	215	219
Typhoid fever	95	83	105	57
Typhus fever	....	2	2	....
Whooping cough (convulsive)	....	2	17	40
Total	2,590	2,339	2,067	2,121
Other illnesses	3,095	2,859	3,014	2,640
Total	5,685	5,198	5,081	4,701

Deaths of infants under one year of age in Lima, Peru, 1918 to 1921, inclusive.

Disease.	1918	1919	1920	1921
Bronchitis	38	34	42	47
Diarrhea and enteritis	551	519	474	500
Diphtheria	....	3	....	1
Influenza	34	25	27	21
Malaria	35	27	24	25
Measles	4	18	5	3
Meningitis (ordinary)	64	91	101	91
Pneumonia (broncho)	58	64	110	94
Pneumonia	13	4	8	8
Scarlet fever	1	....	....	....
Smallpox	....	....	....	2
Syphilis (hereditary)	14	21	20	32
Tubercular meningitis	4	6	8	5
Tuberculosis (pulmonary)	30	23	24	46
Tuberculosis (other forms)	6	7	6	16
Typhoid fever	....	2	5	....
Whooping cough (convulsive)	....	1	17	20
Total	852	845	871	913
Other illnesses	117	113	89	165
No medical attention	343	251	392	260
Total	1,312	1,209	1,352	1,338

POLAND.

Communicable Diseases—February 25-March 3, 1923.

Communicable diseases have been reported in Poland as follows:

FEBRUARY 25-MARCH 3, 1923.

Disease.	Cases.	Deaths.	Districts and city showing greatest mortality.
Cerebrospinal meningitis	27	6	Kielce.
Diphtheria	68	11	Lodz.
Measles	813	32	Lodz.
Scarlet fever	218	32	Stanislawow.
Smallpox	5	3	Stanislawow.
Tuberculosis	145	234	Warsaw City.
Typhoid fever	238	23	Krakow; Lodz.
Typhus fever	446	25	Lwow.
Typhus fever, recurrent	119	5	Eastern Territories.
Whooping cough	66	5	Lwow; Stanislawow.

Dysentery.

During the period under report, 17 cases of dysentery with 3 deaths were reported in Upper Silesia, Poland.

SYRIA.

Lethargic Encephalitis—Beirut.

During the 10-day period ended April 10, 1923, a case of lethargic encephalitis was reported at Beirut, Syria.

TRINIDAD.

Epidemic Influenza.

Under date of June 5, 1923, epidemic influenza was reported prevalent in the island of Trinidad, West Indies. In Port of Spain, the capital, where the number of reported cases was stated to be large, there were few deaths from the disease reported. In some of the poorer districts the mortality was considerable.

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 June 29, 1923.[1]

CHOLERA.

Place.	Date.	Cases.	Deaths.	Remarks.
India				Apr. 8-14, 1923: Cases, 1,902; deaths, 1,278.
Madras	May 6-12	1		
Rangoon	Apr. 29-May 5	3	2	
Siam:				
Bangkok	Apr. 15-28	3	2	

PLAGUE.

Place.	Date.	Cases.	Deaths.	Remarks.
Ceylon:				
Colombo	Apr. 29-May 5	3	3	Plague rodents, 4.
China:				
Hongkong	Apr. 15-28	7	6	
France:				
St. Ouen	May 20-22	4	2	Vicinity of Paris.
India				Apr. 22-28, 1923: Cases, 6,241; deaths, 4,784.
Madras Presidency	May 6-12	88	58	
Rangoon	Apr. 29-May 5	22	24	
Siam:				
Bangkok	Apr. 15-28	23	19	
Straits Settlements:				
Singapore	Apr. 29-May 5	2	2	

[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 June 29, 1923—Continued.

SMALLPOX.

Place.	Date.	Cases.	Deaths.	Remarks.
Brazil:				
Rio de Janeiro	Apr. 29-May 12	1	1	
Sao Paulo	Feb. 19-25		1	
Canada:				
British Columbia—				
Vancouver	Apr. 1-May 26	86		
Saskatchewan—				
Regina	May 6-19	2		
Ceylon:				
Colombo	Apr. 30-May 5	1		
China:				
Amoy	May 6-12		1	
Chungking	do			Present.
Foochow	do			Do.
Hongkong	Apr. 15-28	27	21	
Manchuria—				
Dairen	Apr. 30-May 6	1		
Esthonia				Apr. 1-30, 1923: Cases, 6.
Greece:				
Patras	Apr. 2-22		9	
India				Apr. 8-14, 1923: Cases, 2,432; deaths, 494.
Madras	May 6-12	6	3	
Rangoon	Apr. 30-May 5	25	12	
Java:				
West Java—				
Batavia	Apr. 28-May 4	10	2	
Mexico:				
Mexico City	May 6-19	67		
Vera Cruz	May 28-June 3		1	
Poland				Feb. 25-Mar. 3, 1923: Cases, 5; deaths, 3.
Portugal:				
Oporto	May 27-June 2	2		
Siam:				
Bangkok	Apr. 22-28	5	1	
Society Islands:				
Tahiti	May 13-26	1	1	
Switzerland:				
Basel	May 13-19	3		
Zurich	do	2		
Syria:				
Beirut	Apr. 11-20	1		
Turkey:				
Constantinople	May 6-12		10	

TYPHUS FEVER.

Place.	Date.	Cases.	Deaths.	Remarks.
Chile:				
Talcahuano	Mar. 26-May 12	3	1	
China:				
Hankow	May 13-19	1		
Egypt:				
Port Said	May 20-26	1		
Esthonia				Apr. 1-30, 1923: Cases, 8. Paratyphus, cases, 6.
Greece:				
Athens	Apr. 1-30		5	
Patras	Apr. 2-22		16	
Hungary:				
Budapest	May 6-12	3	1	
Italy:				
Catania	May 7-13	1		
Mexico:				
Mexico City	May 6-19	32		Including municipalities in Federal District.
Poland				Feb. 25-Mar. 3, 1923: Cases, 446; deaths, 25. Recurrent typhus: Cases, 119; deaths, 5.
Rumania:				
Kishineff District	Apr. 1-30	16		
Syria:				
Aleppo	May 13-19	4		Refugees.
Beirut	Apr. 11-20	2		
Turkey:				
Constantinople	May 6-12		15	
Union of South Africa:				
Orange Free State	Apr. 23-28			Outbreaks.

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

Reports Received from December 30, 1922, to June 29, 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, 8,833. Dec. 31, 1922-Apr. 14, 1923: Cases, 20,303; deaths, 13,094.
Bombay	Oct. 27-Dec. 23	2	1	
Do	Feb. 4-Apr. 21	7	7	
Calcutta	Nov. 12-Dec. 30	102	60	
Do	Dec. 31-May 5	453	335	
Madras	Nov. 19-Dec. 16	4	2	
Do	Jan. 21-May 12	14	6	
Rangoon	Nov. 12-Dec. 23	17	10	
Do	Dec. 31-May 5	29	20	
Philippine Islands:				
Province—				
Laguna	Oct. 12-18	1		
Zamboanga	Feb. 11-17	1	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	26		
Siam:				
Bangkok	Oct. 29-Dec. 23	4	1	
Do	Dec. 31-Apr. 28	13	5	

PLAGUE.

Place.	Date.	Cases.	Deaths.	Remarks.
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		
Horta	Mar. 23	1		Actual occurrence about Mar. 6, 1923.
Pico Island—				
Lages	Nov. 27-Dec. 15		8	
St. Michael Island				Nov. 12-Dec. 30, 1922: Cases, 100; deaths, 35. At localities 3-9 miles from Ponta Delgada. Dec. 31, 1922-Apr. 28, 1923: Cases, 179; deaths, 74. From 6 to 20 miles distant from port of Ponta Delegada.
Ponta Delgada	Nov. 26-Dec. 9	3		
Brazil:				
Bahia	Oct. 29-Dec. 30	5	5	
Do	Jan. 28-Apr. 21	3	2	
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				Dec. 1-31, 1922: Cases, 141; deaths, 129. Jan. 1-31, 1923: Cases, 73; deaths, 73.
Entebbe	Nov. 24-30	211	202	
Do	Mar. 1-31	18	15	
Canary Islands				Jan. 15-Mar. 17, 1923: Cases, 8; deaths, 7. Apr. 13, 1923: Present. 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-May 5	97	81	Plague rodents, 67.

[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 June 29, 1923—Continued.

PLAGUE—Continued.

Place.	Date.	Cases.	Deaths.	Remarks.
Chile:				
Antofagasta				Quarantine. Year, 1922: March, 1 case; May, 1 case.
China:				
Hongkong	Nov. 5-Dec. 23	14	12	
Do	Dec. 31-Apr. 28	12	9	
Manchuria—				
Harbin	Jan. 29-Feb. 4	7		
Ecuador:				
Guamote	Apr. 24	20	5	Railway town.
Guayaquil	Nov. 1-Dec. 31	9	3	Rats examined, 21,000; found infected, 90.
Do	Jan. 1-May 15	26	12	Rats examined, 35,990; found infected, 184.
Sabanilla	Mar. 1-15	1		Country estate.
Egypt				Jan. 1-Dec. 28, 1922: Cases, 485; deaths, 228. Jan. 1, 1922-Jan. 4, 1923: Cases, 487; deaths, 228. Jan. 1-Mar. 29, 1923: Cases, 134; deaths, 69. Mar. 19-25, 1922: Cases, 50—Assiout, 29; Fayoum, 4; Girgeh, 17.
City—				
Alexandria	Nov. 19-25	2		
Do	Jan. 8-10	1	1	
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. 29	56	28	Pneumonic, 8 cases, 4 deaths; bubonic, 36 cases; septicemic, 5 cases, 1 death.
Dakahlieh	Dec. 3	1	1	Pneumonic.
Fayoum	Mar. 25-28	3	1	Bubonic.
Girgeh	Mar. 24-27	6	4	Bubonic, 4: septicemic, 2.
Kena	Mar. 8	1	1	Pneumonic: 1 death.
Minieh	Nov. 18-27	2	1	
Do	Feb. 24		1	
France:				
St. Ouen	May 20-22	4	2	Vicinity of Paris.
Hawaii:				
Honokaa				Feb. 8-9, 1923: Plague rats, 3.
Do				Mar. 24-25, 1923: Plague rats, 2. In vicinity Pacific Sugar Co., near Honokaa.
Pohakea				Apr. 15, 1923: Plague rat.
India				Oct. 1-Dec. 30, 1922: Cases, 26,878; deaths, 20,095. Dec. 31, 1922-Apr. 28, 1923: Cases, 125,300; deaths, 98,326.
Bombay	Oct. 27-Dec. 30	41	32	
Do	Dec. 31-Apr. 21	813	650	
Calcutta	Feb. 11-May 5	45	45	
Karachi	Dec. 10-16	1	1	
Do	Dec. 31-May 12	230	176	
Madras Presidency	Nov. 19-Dec. 30	2,269	1,448	
Do	Dec. 31-May 12	6,246	5,389	
Madras	Nov. 19-25	1	1	
Do	Jan. 21-27	1	1	
Rangoon	Nov. 12-Dec. 30	52	49	
Do	Dec. 31-May 5	555	514	
Iraq (Mesopotamia):				
Bagdad	Oct. 1-Nov. 30	16		
Do	Jan. 1-Mar. 31	21		
Sumaichah	Mar. 14		30	Among Beni - Tenim tribes in vicinity. Locality about 30 miles from Bagdad.
Japan:				
Osaka				July 1-Nov. 30, 1922: Cases, 70.
Java				Oct. 1-Nov. 3, 1922: Cases, 900; deaths, 763. Jan. 1-Mar. 31, 1923: Cases, 1,993; deaths, 2,052.
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.

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

Reports Received from December 30, 1922, to June 29, 1923—Continued.

PLAGUE—Continued.

Place	Date.	Cases.	Deaths.	Remarks.
Madagascar				Jan. 1-Dec. 30, 1922: Cases 143; Jan. 1-Mar. 31, 1923: Cases, 185; deaths, 130.
Provinces—				
Antisirabe	Jan. 16-Feb. 15	2	2	Bubonic and septicemic.
Diego Suarez	Jan. 1-Mar. 31	6	4	Do.
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.
Do	Mar. 1-15	1	1	Septicemic.
Miarinarivo				Dec. 14, 1922-Jan. 1, 1923: 1 case (European).
Tananarive				Jan. 1-Dec. 10, 1922. Cases, 73 (bubonic, 37; pneumonic, 8; septicemic, 28). Jan. 1-Mar. 31, 1923: Cases, 152; deaths, 113. Bubonic, pneumonic, septicemic.
Ambohimangakeley	Nov. 19-Dec. 10	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-Mar. 31	26	10	Bubonic and septicemic.
Mauritius				Year 1922: Cases, 98; deaths, 73. January, 1923: Cases, 18.
Mexico:				
Tampico	Mar. 23	2	1	Plague rodent found, Mar. 14, 1923.
Palestine:				
Jaffa	Nov. 27-Dec. 4	1		
Haifa	May 8-21	2		
Peru				Nov. 1-Dec. 31, 1922: Cases, 199; deaths, 98.
Do				Jan. 1-Apr. 30, 1923: Cases, 466; deaths, 212.
Localities—				
Ayabaca	Apr. 16-30			Present.
Barranco	Feb. 1-Apr. 30	3	1	
Callao	Mar. 1-Apr. 30	4	1	
Canete	Nov. 16-Dec. 31	56	19	Including vicinity.
Do	Jan. 1-Apr. 15	37	18	Do.
Casma	Jan. 1-31	1		At Campina.
Catacaos	Jan. 1-Apr. 30	12	3	
Cerro Azul	Apr. 1-15	1		
Chepen	Dec. 16-31	2	1	Present, Nov. 9-15, 1922.
Do	Jan. 1-Mar. 31	2		
Chiclayo (city and country).	Nov. 16-Dec. 15	17	7	
Do	Jan. 1-Apr. 30	38	20	
Cutervo	Feb. 16-Apr. 30	81	51	
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-Apr. 15	20	6	
Huancabamba	Apr. 1-15	1		Apr. 16-30, 1923: Present.
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-Apr. 15	10		
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-Apr. 30	27	14	
Lima (country)	Nov. 1-Dec. 31	14	5	
Do	Jan. 1-Apr. 30	16	4	
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	

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

Reports Received from December 30, 1922, to June 29, 1923—Continued.

PLAGUE—Continued.

Place.	Date.	Cases.	Deaths.	Remarks.
Peru—Continued.				
Localities—Continued.				
Mala	Dec. 1-31	2		
Do	Jan. 1-Apr. 30	5	1	
Miraflores	Jan. 1-Feb. 15	5	2	
Mochumi	Dec. 16-31	3	3	
Do	Feb. 1-Mar. 31	6	2	
Mollendo	Mar. 1-31	1		
Monsefu	Feb. 1-15	5	3	
Mosche	Nov. 16-30	2	1	
Paita	Dec. 16-31	3	2	
Do	Jan. 1-Apr. 30	19	14	
Piura	Nov. 16-Dec. 31	12	7	
Do	Jan. 1-Mar. 31	23	10	
Pueblo Nuevo	Dec. 1-31	7	4	
Do	Jan. 1-31	10	6	
Salaverry	Apr. 1-30	5	1	
San Pedro	Nov. 1-Dec. 31	8	4	
Do	Jan. 1-Feb. 28	7	4	
Santa Cruz (Hualgayoc)	Feb. 16-28	19	15	Apr. 16-30, 1923: Present.
Sullana	Nov. 16-30	3	3	
Do	Jan. 1-31	1	1	
Trujillo	Nov. 1-Dec. 31	3	1	
Do	Jan. 1-Mar. 31	66	17	District.
Tuman	Nov. 16-30	3		
Viru	Apr. 1-15	1		
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-Feb. 3	2	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-Apr. 28	133	111	
Spain:				
Barcelona	Nov. 15-Dec. 18	1		Sept. 24-Nov. 14, 1922: Cases, 23; deaths, 9.
Malaga	Feb. 27-May 14	5	1	17 suspected cases.
Straits Settlements:				
Singapore	Dec. 17-23	2	2	
Do	Jan. 21-May 5	21	18	
Syria:				
Beirut	Nov. 6-30	4	3	
Tunis:				
Ben-Gardane	Apr. 21	21		
Taguelmit	Apr. 1-30	30	30	Desert town. Probably outbreak reported for Ben-Gardane, Public Health Reports, May 18, 1923, p. 1110.
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.
Do	Apr. 23			Present.
Venezuela:				
Victoria	May 23	4	2	
West Africa:				
Senegal—				
Dakar	Feb. 1-Apr. 30	3	3	
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.

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

Reports Received from December 30, 1922, to June 29, 1923—Continued.

SMALLPOX.

Place.	Date.	Cases.	Deaths.	Remarks.
Algeria:				
Algiers	Dec. 1-10	1		
Do	Jan. 1-Mar. 31	4		
Arabia:				
Aden	Nov. 19-Dec. 23	7	3	
Do	Jan. 7-Mar. 31	23	2	
Barbadoes (West Indies)	Apr. 26			Present. (Reported as alastrim.
Bolivia:				
La Paz	Jan. 1-Mar. 31	17	15	
Brazil:				
Bahia	Nov. 5-11	1		
Do	Mar. 4-31	2	1	
Para	Feb. 12-Mar. 25	14		
Pernambuco	Jan. 21-Apr. 21	19	2	
Rio de Janeiro	Nov. 25-Dec. 30	40	15	
Do	Dec. 31-May 12	62	27	
Sao Paulo	Oct. 16-22	1	1	
Do	Jan. 8-Feb. 25	5	6	
British East Africa:				
Kenya Colony—				
Mombasa	Mar. 25-May 5	2	1	
Tanganyika Territory	Oct. 8-Dec. 23	193	10	
Do	Jan. 7-Apr. 14	70	8	
Uganda	Sept. 1-Dec. 31	3	1	Jan. 1-31, 1923: Cases, 3; deaths, 1.
Entebbe	Nov. 24-30	3	3	
Do	Mar. 1-31	14	21	
Canada:				
Alberta—				
Calgary	Mar. 4-10	1		
British Columbia—				
Fernie	Mar. 18-24	1		
Vancouver	Apr. 1-May 26	86		
Manitoba—				
Winnipeg	Dec. 10-30	14		
Do	Jan. 21-May 26	70		
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-May 31, 1923: Cases, 138.
Hamilton	Dec. 31-Feb. 24	7		
Niagara Falls	Dec. 3-30	10		
Do	Dec. 31-May 5	17		
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		
Do	May 6-19	2		
Ceylon:				
Colombo	Nov. 12-Dec. 24	9	4	1 case, 1 death outside city.
Do	Feb. 18-May 5	6		
Chile:				
Antofagasta	Apr. 1-7	1		
Concepcion	Oct. 30-Dec. 25		7	
Do	Feb. 1-May 7	3	2	Mar. 1-Apr. 30, 1923: Deaths, 9.
Valparaiso	Oct. 2-Dec. 30		153	In hospital Dec. 26, 1922, 83 cases.
Do	Jan. 9-Feb. 10		90	Dec. 31, 1922-Jan. 27, 1923: Deaths, 66. Feb. 16, 1923: 80 cases present (estimated). Jan. 29-May 12, 1923: Deaths, 224.
China:				
Amoy	Nov. 5-Dec. 23		3	Nov. 26-Dec. 30, 1922: Present.
Do	Jan. 7-May 12		15	
Antung	Nov. 13-Dec. 10	2		
Do	Feb. 26-May 6	2		
Canton	Oct. 1-Nov. 30			Prevalent.
Do	Jan. 21-Mar. 31			Present.
Changsha	Feb. 11-17	1		
Chungking	Nov. 5-Dec. 30			Do.
Do	Dec. 31-May 12			Do.
Foochow	Nov. 12-Dec. 30			Do.
Do	Dec. 31-May 12			Do.

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

Reports Received from December 30, 1922, to June 29, 1923—Continued.

SMALLPOX—Continued.

Place.	Date.	Cases.	Deaths.	Remarks.
China—Continued.				
Hankow	Dec. 31-Jan. 20	4	1	
Hongkong	Nov. 5-11		1	
Do	Dec. 31-Mar. 31	85	67	
Manchuria—				
Dairen	Apr. 2-May 6	5		
Harbin	Nov. 20-Dec. 31	13		
Do	Jan. 8-May 5	11		
Mukden	Nov. 19-Dec. 16			Present.
Do	Jan. 7-Feb. 3			Do.
Nanking	Nov. 5-Dec. 23			Do.
Do	Jan. 7-Apr. 14			Do.
Shanghai	Jan. 15-May 6	10	13	Cases, foreign: deaths, Chinese.
Tientsin	Feb. 18-Apr. 7	2		Reported from foreign office.
Chosen (Korea):				
Chemulpo	Oct. 1-Dec. 31	135	92	
Do	Jan. 1-Apr. 30	42	22	
Fusan	Nov. 1-Dec. 31	4		
Do	Jan. 1-Apr. 30	18	2	
Gensan	Dec. 1-31	6	2	
Do	Mar. 1-31	2	1	
Seoul	Oct. 1-Dec. 31	19	1	
Do	Jan. 1-Apr. 30	100	39	
Colombia:				
Buenaventura	Jan. 25-Feb. 20	48		Estimated, 50 cases present; type, mild; among colored population. Feb. 16-26, 1923: 6 to 9 cases 2 miles from town limits.
Santa Marta	Apr. 18			Mild outbreak.
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. Jan. 1-31, 1923: Cases, 3.
Province—				
Bohemia	Oct. 1-31	1		
Moravia	do	1		
Slovakia	Oct. 1-Nov. 30	2		
Dominica (West Indies)				Feb. 26-May 7, 1923: Present with several thousand cases (estimated) reported Feb. 26. 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:				
Babahoyo	Apr. 1-15	1		
Guayaquil	Dec. 1-31	10		
Do	Jan. 1-May 7	15		
Egypt:				
Alexandria	Feb. 19-May 5	2		
Cairo	Jan. 29-Feb. 18	3		
Port Said	Jan. 21-27	1		
Esthonia				Oct. 1-Dec. 31, 1922: Cases, 61. Jan. 1-Apr. 30, 1923: Cases, 40.
Finland				Apr. 16-30, 1923: One case.
France:				
Paris	Dec. 1-10	1		
Do	Mar. 4-10	1		
Germany:				
Bremen	Dec. 3-9	1		
Great Britain:				
Liverpool	Dec. 11-17	1		From vessel.
Do	Apr. 22-May 12	4		From S. S. Oak Branch, from South American ports. May 6-12, 1923: On vessels, of which one from Antwerp, one coastwise.
London	Nov. 26-Dec. 23	3		
Nottingham	Nov. 19-Dec. 13	4		
Do	Jan. 7-Apr. 14	17		

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

Reports Received from December 30, 1922, to June 29, 1923—Continued.

SMALLPOX—Continued.

Place.	Date.	Cases.	Deaths.	Remarks.
Greece:				
Kalamata	Jan. 13-Feb. 13		1	
Patras	Jan. 21-Apr. 22		112	
Saloniki	Nov. 6-Dec. 31	6	5	
Do	Jan. 15-Apr. 29	22	7	
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-Apr. 14, 1923: Cases, 31,473; deaths, 7,442.
Bombay	Nov. 5-Dec. 30	22	10	
Do	Dec. 31-Apr. 21	512	231	
Calcutta	Nov. 12-Dec. 30	46	23	
Do	Dec. 31-Apr. 28	198	102	
Karachi	Nov. 26-Dec. 30	6		
Do	Dec. 31-May 7	89	38	
Madras	Nov. 12-Dec. 30	71	23	
Do	Dec. 31-May 12	373	122	
Rangoon	Nov. 5-Dec. 30	27	6	
Do	Jan. 7-May 5	554	238	
Iraq (Mesopotamia):				
Bagdad	Oct. 1-Nov. 30	568	361	
Do	Jan. 1-Mar. 31	38	50	
Italy:				
Catania	Apr. 16-22	1		
Turin	Jan. 29-Apr. 29	24		
Genoa	Apr. 1-10	1		From vessel.
Jamaica				Dec. 31, 1922-May 26, 1923: Cases, 913. Previously recorded as alastrim.
Kingston	Mar. 11-May 26	20		
Japan:				
Kobe	Jan. 13-May 18	9	2	
Nagasaki	Apr. 30-May 6	1		
Taiwan Island	Mar. 4-10	1	1	
Yokohama	Jan. 22-Mar. 25	2		
Java:				
East Java—				
Soerabaya	Nov. 5-11	4		
Do	Feb. 4-Apr. 21	39	5	
West Java—				
Batavia	Nov. 11-Dec. 22	25	1	City and Province.
Do	Jan 27-May 4	84	12	Province.
Latvia				Oct. 1-Dec. 31, 1922: Cases, 7. Mar. 1-31, 1923: Cases, 5.
Martinique				Mar. 25-Apr. 21, 1923: Present. Reported as alastrim.
Fort de France	Mar. 25-Apr. 21			Present.
Mexico:				
Chihuahua	Dec. 4-17		4	
Do	Jan. 1-May 27	81	30	
Guadalajara	Dec. 1-31	4		
Do	Jan. 1-Apr. 30	129	47	
Mexico City	Nov. 12-Dec. 23	43		Including municipalities in Federal District.
Do	Dec. 31-May 19	496		Do.
Nogales	Dec. 10-19		1	
Do	Dec. 31-Feb. 10		2	
Saltillo	Jan. 28-Feb. 3		1	
San Luis Potosi	Jan. 14-20		1	
Do	Apr. 29-May 19		2	
Sonora, State				Nov. 1-30, 1922: Present in northern section.
Empalme	Nov. 1-30	4	1	
Tabasco, State				Present in some localities, Mar. 26, 1923.
Torreon	Dec. 1-31		1	
Vera Cruz	Feb. 26-June 3	12	7	
Palestine				Jan. 23-Feb. 19, 1923: Cases, 8; northern district.

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

Reports Received from December 30, 1922, to June 29, 1923—Continued.

SMALLPOX—Continued.

Place.	Date.	Cases.	Deaths.	Remarks.
Persia:				
Tabriz	Dec. 18-31		2	
Do	Jan. 15-Feb. 28		5	
Teheran	Oct. 24-Dec. 22		139	
Do	Dec. 20-Mar. 31		59	
Peru				Feb. 1-28, 1923: Cases, 8; deaths, 1.
Callao	Nov. 1-15	2		
Lima (city)	Dec. 1-15	3	1	
Do	Mar. 1-31	2	2	
Lima (country)	Nov. 1-15	2	1	
Do	Feb. 16-28	2		City and country.
Poland				Oct. 1-Dec. 23, 1922: Cases, 132; deaths, 26. Jan. 1-Mar. 3, 1923: Cases, 114; deaths, 22.
Portugal:				
Lisbon	Nov. 19-Dec. 30	143	34	
Do	Dec. 31-May 12	87	88	Dec. 25-31, 1922: Deaths, 12. Mar. 26-May 19, 1923: Cases, 107; deaths, 28.
Oporto	Oct. 15-Dec. 30	24	12	
Do	Dec. 31-June 2	23	12	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—				
Ukraine				Jan.-Sept. 1922: Cases, 8,744.
St. Lucia Island	Apr. 26			Present.
Siam:				
Bangkok	Apr. 22-28	5	1	
Siberia:				
Vladivostok	Mar. 1-31	1		Present in Nikolsk, Slassk, and Ussurisk Counties.
Sierra Leone:				
Freetown	Feb. 16-28	1		
Koinadugu	Apr. 1-30	8		District.
Society Islands:				
Tahiti	May 13-26	1	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-May 28	93	5	
Straits Settlements:				
Singapore	Apr. 22-28	1		
Switzerland:				
Basel	Feb. 23-Apr. 19	9		
Berne	Nov. 19-Dec. 30	85		
Do	Dec. 31-May 12	194		
Lucerne	Jan. 1-Mar. 31	22		
Zurich	Nov. 19-Dec. 30	19		
Do	Jan. 14-May 19	75		
Syria:				
Aleppo	Nov. 19-Dec. 23	38	20	
Do	Dec. 31-Apr. 14	30	6	
Beirut	Dec. 11-20	1		
Do	Apr. 11-20	1		
Damascus	Nov. 1-Dec. 31	97	16	
Do	Jan. 1-May 1	28		
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-May 5	416	496	Apr. 21-27, 1923: Many cases reported.

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

Reports Received from December 30, 1922, to June 29, 1923—Continued.

SMALLPOX—Continued.

Place.	Date.	Cases.	Deaths.	Remarks.
Union of South Africa				Oct 1-Dec. 31, 1922: Cases—Colored, 64; deaths, 1; white, cases, 4.
Do				Jan. 1-Mar. 31, 1923: Cases, 54; colored, 31; white, 4; deaths, 3 (colored).
Cape Province				Oct. 1-Dec. 31, 1922: Cases—Colored, 48; deaths, 1; white, 4 cases.
Do				Jan. 1-Mar. 31, 1923: Cases 36 (colored, 18; white, 4). Deaths, colored, 2.
Do	Dec. 31-Apr. 21			Outbreaks.
East London	Jan. 7-13	2		
Natal				Dec. 1-31, 1922: Cases, 6 (colored).
Do				Jan. 1-Feb. 28, 1923: Cases, 7; deaths, 1 (colored).
Do	Feb. 4-10			Outbreaks.
Orange Free State				Dec. 1-31, 1922: Cases, 2 (colored).
Do				Jan. 1-31, 1923: Cases, 3 (colored).
Do	Jan. 14-Feb. 3			Outbreaks.
Southern Rhodesia	Nov. 9-15	3		
Transvaal				Oct. 1-Dec. 31, 1922: Cases, 10.
Do				Jan. 1-Mar. 31, 1923: Cases, 12 (colored): deaths, 1.
Do	Dec. 31-Apr. 15			Outbreaks.
Johannesburg	Nov. 1-30		1	
Do	Jan. 1-31	1		
Uruguay:				
Montevideo	do	8		
Yugoslavia				Aug. 1-31, 1922: Cases, 30; deaths, 12.
Do				Dec. 31, 1922-Mar. 24, 1923: Cases, 567; deaths, 100.
Bosnia-Herzegovina				Dec. 31, 1922-Mar. 24, 1923: Cases, 266; deaths, 35.
Croatia—				
Zagreb	Apr. 1-7	1		
Serbia				Aug. 1-31, 1922: Cases, 26. Dec. 31-Mar. 24, 1923: Cases, 70; deaths, 21.
Belgrade	Nov. 12-Dec. 31	10	4	
Do	Mar. 18-Apr. 28	2	2	
On vessels:				
S. S. Bahia	Mar. 4-10	1		At Pernambuco, Brazil.
S. S. Craftsman	May 6-12	1		At Liverpool from Antwerp. Left, May 19, for Glasgow; left May 25, for San Francisco.
S. S. Hedsley	do	1		At Liverpool. Coastwise.
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. Oak Branch	Apr. 22-28	2		At Liverpool, from South American ports. (Iquique, Chile, Mar. 17; Balboa, Apr. 1, 1923.)
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-Apr. 30	76	25	
Oran	Jan. 11-20	1	1	
Austria:				
Vienna	Jan. 7-17	1		
Bolivia:				
La Paz	Jan. 1-Mar. 31	31	24	
Brazil:				
Pernambuco	Dec. 3-9	2	2	
Porto Alegre	Nov. 19-Dec. 16	3		
Do	Feb. 25-Mar. 3		3	
Bulgaria:				
Sofia	Feb. 4-Apr. 14	7		Paratyphus, 4 cases; 1 death

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

Reports Received from December 30, 1922, to June 29, 1923—Continued.

TYPHUS FEVER—Continued.

Place.	Date.	Cases.	Deaths.	Remarks.
Chile:				
Antofagasta	Nov. 12-Dec. 30	24	5	Nov. 11-Dec. 5, 1922: Cases, 10; deaths, 2. Quarantine station: October, 1922—1 fatal case on vessel from Valparaiso; November, 1922—cases, 7; December, 1922—cases, 9; remaining, Dec. 31, 3 cases.
Do	Dec. 31-Apr. 7	4	2	
Concepcion	Oct. 17-Dec. 18		9	
Do	Dec. 26-Apr. 23		16	Apr. 1-30, 1923: Deaths, 4.
Iquique	Jan. 14-Mar. 31		3	
Talcahuano	Nov. 12-Dec. 23	10	6	
Do	Jan. 7-May 12	10	3	
Valparaiso	Dec. 3-30		9	
Do	Dec. 31-May 12		56	Daily hospital average, reported Feb. 16, 1923, 25 cases.
China:				
Antung	Nov. 13-Dec. 10	7		
Do	Apr. 2-May 13	12		
Hankow	May 13-19	1		
Manchuria—				
Harbin	Nov. 20-26	7		
Do	Jan. 1-May 6	9		
Cuba:				
Matanzas	Dec. 25-31	1	1	
Czechoslovakia				Jan. 1-Feb. 28, 1923: Cases, 121; deaths, 5.
City—				
Prague	Nov. 19-25	1		
Province—				
Bohemia	Nov. 1-30	1		
Russinia	Oct. 1-Dec. 31	25		
Slovakia	Nov. 1-30	2		
Danzig (Free City)	Jan. 7-Feb. 24	2		Including 1 from Poland.
Egypt:				
Alexandria	Nov. 19-Dec. 31	2	1	
Do	Jan. 22-May 13	14	6	Imported, 2.
Cairo	Oct 1-Dec. 31	19	9	
Do	Jan. 1-Mar. 11	13	6	Feb. 26-Mar. 4, 1923: One case relapsing fever.
Port Said	Mar. 25-May 26	3		
Esthonia				Oct. 1-Dec. 31, 1922: Cases, 6. Recurrent typhus: Cases, 10. Year 1922: Cases, 159; recurrent typhus, 91 cases.
Do				Jan. 1-Apr. 30, 1923: Cases, 24. Recurrent typhus, Jan. 1-31, cases, 4. Paratyphus, Apr. 1-30, 1923: Cases, 6.
Libau	Dec. 24-30	1		
Narva				Year 1922: Cases, 140. Recurrent typhus: Cases, 83.
Finland				Feb. 16-Mar. 15, 1923: Cases, 7; recurrent typhus, 1.
Do	Apr. 16-30	3		
France:				
Marseille	Mar. 1-31		1	
Germany:				
Berlin	Nov. 26-Dec. 2		1	
Coblenz	Dec. 10-16	1		
Do	Mar. 25-31	1		
Dresden	Dec. 10-16	1		
Königsberg	Mar. 24-Apr. 7	2		
Great Britain:				
Glasgow	Jan. 7-Feb. 17	4	1	
Greece:				
Athens	Mar. 1-Apr. 30		9	
Corfu Island	Feb. 8			Present.
Leucadia	Jan. 17			Do.
Patras	Nov. 19-25		1	
Do	Jan. 1-Apr. 22	3	32	
Piræus				Jan. 13-Mar. 31, 1923: Deaths, 12.
Prevesa	Jan. 17			Present.
Saloniki	Dec. 18-24	3		Among refugees.
Do	Jan. 7-Apr. 29	124	12	Refugees. Recurrent typhus fever, Mar. 12-Apr. 1, 1923. Cases, 4; deaths, 1.
Zante	Jan. 17			Present.
Guatemala:				
Guatemala City	Jan. 1-31		1	

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

Reports Received from December 30, 1922, to June 29, 1923—Continued.

TYPHUS FEVER—Continued.

Place.	Date.	Cases.	Deaths.	Remarks.
Hungary:				
Budapest	Jan. 14-May 12	44	12	
Iraq (Mesopotamia):				
Bagdad	Feb. 1-Mar. 31	2		
Ireland:				
Belmullet	June 15-Dec. 14	20		In County Mayo.
Italy:				
Catania	May 7-13	1		
Trieste	Feb. 25-Mar. 3	1		
Latvia				Oct. 1-Dec. 31, 1922: Cases, 74. Recurrent typhus: Cases, 10. Feb. 1-Mar. 31, 1923: Cases, 93. Recurrent typhus, 2 cases; paratyphus, 2 cases.
Libau	Apr. 25-May 1	2		
Mexico:				
Guadalajara	Mar. 1-Apr. 30	2	1	
Mexico City	Nov. 12-Dec. 30	90		Including municipalities in Federal District.
Do	Dec. 31-May 19	233		Do.
San Luis Potosi	Jan. 28-May 26		5	
Netherlands:				
Rotterdam	Apr. 29-May 12	3		
Palestine				Dec. 5-25, 1922: Cases, 3; in northern section. Feb. 27-Mar. 5, 1923—1 case in northern section. Apr. 17-23, 1923: One case relapsing fever.
Jaffa	Dec. 12-18	2		
Do	Jan. 16-May 7	10		
Jerusalem	Dec. 26-Jan. 1	1		
Samaria	Apr. 24-30	1		
Paraguay:				
Asuncion	Jan. 1-27		1	
Persia:				
Tabriz	Dec. 18-31		3	
Do	Jan. 15-28		1	
Teheran	Sept. 24-Nov. 24		3	
Do	Feb. 14-May 31		6	
Poland				Oct. 1-Dec. 23, 1922: Cases, 1,916; deaths, 130. Recurrent typhus: Cases, 2,071; deaths, 56. Jan. 1-Mar. 3, 1923: Cases, 3,547; deaths, 278. Recurrent typhus: Cases, 897; deaths, 22.
Portugal:				
Lisbon	Mar. 26-Apr. 1		1	
Oporto	Oct. 15-Dec. 2	1	1	
Do	Mar. 11-May 26	16	2	
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		
Kishineff	Apr. 1-30	16		District.
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.
Do	Jan. 1-Mar. 31	215		Remittent, 1 case; indefinite, 33.
Spain:				
Barcelona	Nov. 30-Dec. 27		3	
Do	Jan. 11-Mar. 28		2	
Madrid	Dec. 1-31		1	
Do	Feb. 1-28		1	
Syria:				
Aleppo	Dec. 10-16	1	1	
Do	Jan. 7-May 19	117	24	Generally among refugees.
Beirut	Oct. 1-22	1		
Do	Mar. 1-Apr. 20	85		
Tunis:				
Tunis	Apr. 16-May 13	1	1	

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

Reports Received from December 30, 1922, to June 29, 1923.—Continued.

TYPHUS FEVER—Continued.

Place.	Date.	Cases.	Deaths.	Remarks.
Turkey:				
Constantinople	Nov. 27-Dec. 2	3		
Do	Dec. 31-May 12	199	371	Mar. 31-Apr. 6, 1923: Many cases reported.
Union of South Africa				Oct. 1-Dec. 31, 1922: Colored—cases, 3,097; deaths, 298; white—cases, 11; deaths, 2.
Do				Jan. 1-Mar. 31, 1923: Total cases, 1,253, deaths, 111. (Colored—cases, 1,238; deaths, 110; white—cases, 15; 1 death.)
Cape Province				Oct. 1-Dec. 31, 1922: Colored—cases, 2,799; deaths, 250; white—cases, 6; death, 1.
Do				Jan. 1-Mar. 31, 1923: Colored—cases, 1,000, deaths, 79; white—9 cases, 1 death.
Do	Dec. 31-Apr. 21			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-Mar. 31, 1923: Colored—cases, 53; deaths, 10; white—1 case.
Do	Feb. 4-Apr. 14			Outbreaks.
Orange Free State				Oct. 1-Dec. 31, 1922: Colored—cases, 91; deaths, 8; white—cases, 3; deaths, 1.
Do				Jan. 1-Mar. 31, 1923: Colored—cases, 120; deaths, 11; white—2 cases.
Do	Jan. 7-Apr. 28			Outbreaks.
Transvaal				Oct. 1-Dec. 31, 1922: Colored—cases, 64; deaths, 8.
Do				Jan. 1-Mar. 31, 1923: Colored—cases, 65; deaths, 11; white—cases, 2.
Do	Jan. 14-Mar. 17			Outbreaks.
Johannesburg	Nov. 1-30	3	6	
Do	Jan. 1-Feb. 28	38	8	
Venezuela:				
Maracaibo	Jan. 21-May 19		2	
Yugoslavia				Dec. 31, 1922-Mar. 24, 1923: Cases, 106; deaths, 20.
Bosnia-Herzegovina	Aug. 1-31	1		Recurrent fever, 1 case.
Do	Dec. 31-Mar. 24	51		
Croatia—				
Zagreb	Apr. 1-28	3		
Serbia				Aug. 1-31, 1922: Recurrent typhus fever: Cases, 4. Dec. 31-Mar. 24, 1923: Cases, 25.
Belgrade	Mar. 18-May 5	10		

YELLOW FEVER.

Place.	Date.	Cases.	Deaths.	Remarks.
Brazil:				
Bahia	Dec. 31-May 12	113	33	
Colombia:				
Bucaramanga	May 3-19	39	2	Outbreak of epidemic reported Mar. 12, 1923; information showing diagnosis of yellow fever received under date of May 16, 1923. Declared epidemic by Colombian Government May 20, 1923.
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.

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