PUBLIC HEALTH REPORTS

VOL. 39 FEBRUARY 1, 1924 No. 5

VISCOSITY AND TOXICITY OF ARSPHENAMINE SOLUTIONS.

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The occurrence of acute reactions, the so-called nitritoid crisis, sometimes following the intravenous injection of arsphenamine, has led pharmacologists to search for experimental evidence which might serve to explain the cause of these reactions and the mechanism by means of which they are produced.

At first it was thought that chemical impurities of the drug were largely to be held responsible. While this may be so in the case of products of careless manufacture, the view has gradually gained ground that variation of the physicochemical properties of the drug may exert a decided influence on the toxic action. Danysz (1917) believes that many of the reactions are due to precipitation of the drug in the circulating blood by certain blood constituents, the nature of which is not disclosed. The Salvarsan Committee of the British Medical Research Council (1919) expresses the opinion that variations in toxicity of different lots is probably related to small differences in the physical properties. Roth (1920) states that under well-controlled conditions, the toxicity of a 1 per cent solution of arsphenamine hydrochloride is four times greater than that of a 2 per cent alkaline solution of the same preparation containing the same impurities. Hunt (1921) finds that some preparations of arsphenamine are very toxic when the solutions are prepared at ordinary room temperature, and that the toxicity is greatly reduced by moderate heating or by allowing the solutions to stand for a time at room temperature. He suggests that these changes in toxicity may be due to a simultaneous change in the physical state of the solution. The same observation was made independently by G. C. Lake (unpublished observation). Karsner and Hanzlik (1920) and Oliver (1922) have found that arsphenamine causes intravascular agglutination of red blood corpuscles, resulting in the production of emboli. Jackson and Smith (1918) and Smith (1920) had previously observed that the pulmonary blood pressure in dogs shows a tremendous rise after a rapid arsphenamine injection, and

they also suggest that this disturbance of the circulation may be due to mechanical factors. Recently, Oliver (1922) made the interesting observation that the injection of an arsphenamine solution to which gelatine had been added as a protective colloid markedly reduces the toxicity. He makes a distinction between the immediate or physical toxicity and the late or chemical toxicity. The latter had been previously explained by Voegtlin and Smith (1920) as being due to the partial oxidation by the animal tissues of the arsphenamine molecule to the corresponding trivalent arsenious oxide, which is highly toxic to the animal and the parasites.

In a paper read before the American Society for Pharmacology and Experimental Therapeutics in December, 1922 (see Proceedings), we reported observations which furnish further convincing proof for the theory that, besides the chemical toxicity of arsphenamine, there is also a physicochemical factor which determines the toxicity of the drug. We have succeeded in correlating in a quantitative manner a physical property of arsphenamine solution, i. e., viscosity, with toxicity. For a number of years we had thought that there must be a physical factor which determines the toxicity of arsphenamine. How otherwise could be explained the very much higher toxicity of the hydrochloride over that of the sodium salt, and the very great influence of the rate of injection upon toxicity; and, furthermore, the complete agreement between these observations in animals and clinical experience? (Clinicians have warned against the use of solutions of the hydrochloride and against a fast rate of injection.)

Then, again, everyone who studies the behavior of arsphenamine is impressed by its colloidal nature. At the hydrogen ion concentration of the blood it is thrown out of solution as a voluminous gel; in other words, it behaves like an amphoteric colloid. It is therefore not surprising that arsphenamine should lead to severe disturbances in the colloidal equilibrium of the blood. Through a fortunate chance observation we were led to use the viscosity as a measure of the physicochemical properties of the drug. We had observed in testing a great variety of different arsphenamines that solutions of the same concentration showed a different degree of viscous appearance, and this seemed to be related to toxicity.

METHOD USED FOR DETERMINATION OF THE VISCOSITY OF ARSPHENAMINE SOLUTIONS.

The viscosity, or inner friction, of a liquid is most conveniently determined by means of the Ostwald viscosimeter, which consists of a glass bulb of known volume attached to a capillary tube, and a bulb or some other form of vessel at the other end of the capillary

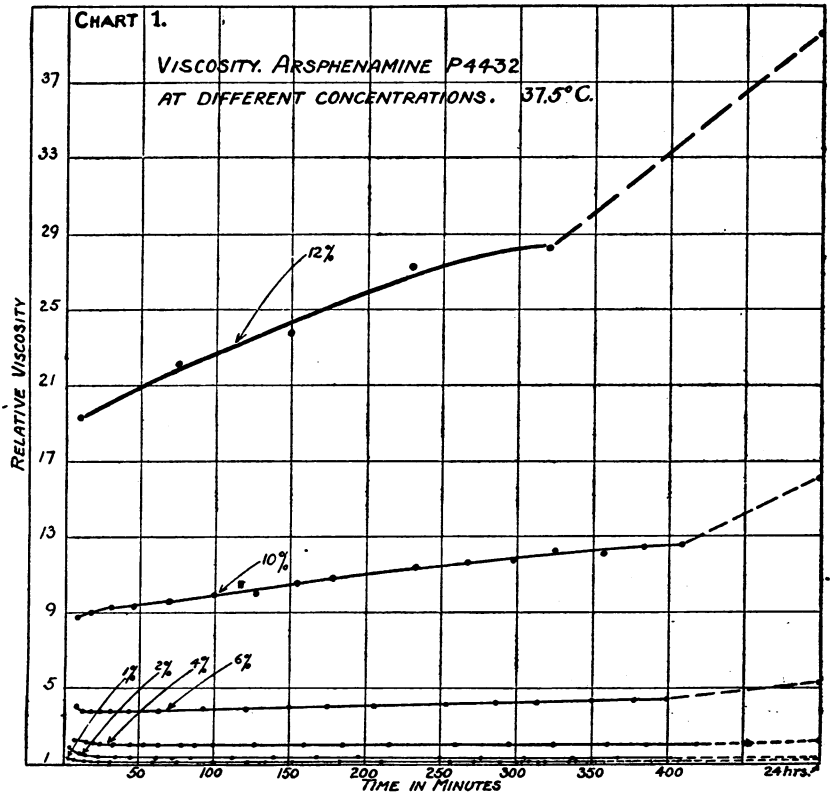
to receive the liquid. The time required for the liquid in the first bulb to flow through the capillary tube is determined and compared with the time required for the same volume of distilled water to flow through the same tube under the same pressure and at the same temperature. The relative viscosity expresses the viscosity of a given fluid in terms of the viscosity of water under constant conditions of pressure and temperature, the viscosity of water being taken as unity. The flow of water through the instrument used in this work was 189, 268, 304, and 484 seconds for temperatures of 37.5°, 21°, 15°, and 0° C., respectively, for ordinary barometric pressure. The figures given in this report have no absolute value, but are useful for comparative studies. In order to keep the temperature constant, the viscosimeter was immersed in a waterbath provided with a thermoregulator, so as to prevent variations in temperature greater than $\pm 0.1°$ C. The regulation of temperature is of the greatest importance, and care should always be exercised to adjust the temperature of the liquid at the time when a viscosity estimation is made. Other requirements which must be fulfilled are that the instrument must be carefully cleansed with water, followed by alcohol and ether, and that the solution be absolutely free from undissolved material.

EFFECT OF CONCENTRATION ON THE VISCOSITY OF ARSPHENAMINE SOLUTIONS.

It was of interest to determine by preliminary experiments the viscosity of arsphenamine solutions of different concentrations. For this purpose a certain lot of arsphenamine was dissolved in distilled water of the same temperature so as to yield solutions ranging in concentration from 1 to 12 per cent. The results are given in Chart 1. It will be seen that the initial viscosity of freshly prepared solutions is a function of the concentration. Whereas a 1 per cent solution of this particular arsphenamine has a relative viscosity only slightly above that of water, a 12 per cent solution is almost 20 times as viscous. Different preparations of arsphenamine yield somewhat different figures. These observations are a confirmation of those made by Klemensiewicz, who was the first investigator to determine the viscosity of arsphenamine, without, however, studying the toxicity.

It is furthermore shown by Chart 1 that the viscosity may change considerably as a result of allowing the solutions to stand. The more dilute solutions (1 to 4 per cent in this particular case) become less viscous on standing, whereas the viscosity of the more concentrated solutions increases very considerably, and saturated solutions have a tendency to gel after standing for a day. It is difficult to

explain these viscosity changes on the basis of the available evidence. It is possible that changes in polymerization may be held responsible or, what is more likely, changes in degree of hydration. Either of these changes would lead to a change in the size of the particles,



and this would obviously result in a change in viscosity. At any rate, these observations clearly indicate that, while standing, a freshly prepared arsphenamine solution undergoes certain physico-chemical changes which find expression in a change of viscosity.

RELATION BETWEEN VISCOSITY AND TOXICITY OF ARSPHENAMINE (HYDROCHLORIDE).

It has been shown previously (Voegtlin and Smith) that aqueous solutions of arsphenamine (as the hydrochloride) are very resistant to the oxidative action of atmospheric oxygen. In fact, it was found that the reducing power of such solutions, determined by titration with a standard iodine solution, is not changed for many hours by running a current of air through the solution. Hence it should be possible to detect a relation between the viscosity and toxicity of such solutions without running any danger of the results

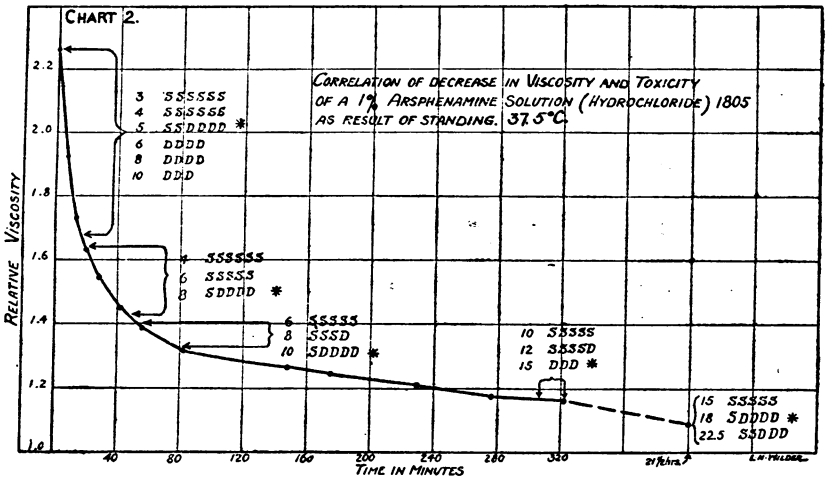
of such experiments being made unreliable on account of a chemical decomposition ("arsenoxide" formation) of the drug.

(*a*) *Effect of standing of solution on its viscosity and toxicity.*—As pointed out previously, dilute solutions of arsphenamine uniformly show a decrease of their viscosity on short standing. After a certain length of time (varying with the lot of arsphenamine under investigation) the viscosity then tends toward a constant value. Chart 2 illustrates this viscosity change. In this case a 1 per cent arsphenamine solution was made by rapidly dissolving the required amount of arsphenamine in distilled water of 37.5° C. in a tall glass cylinder immersed in a water bath of the same temperature, solution being facilitated by means of stirring with a glass rod. As soon as solution was completed, the viscosimeter, also immersed in the water bath, was filled with 5 c. c. of the solution and the viscosity was determined at once. The remaining solution in the cylinder was used for the toxicity determinations, part of the solution being taken as required and injected immediately into albino rats weighing from 100 to 150 grams. The rats were healthy, nonpregnant animals of our standard stock, fed on a diet of oats, bread, and milk until 18 hours before being used, when all food was withdrawn with the exception of water. The injections were made into the exposed leg vein at the standard rate of 0.5 c. c. per minute (no anesthetic used). The time at which each viscosity determination was made was carefully ascertained by noting the time at which the meniscus passed the upper and lower mark, respectively, of the viscosimeter, and then dividing this time in half. This time was then plotted on the chart and a curve drawn through successive points. As the viscosity of fresh solutions changes rapidly it was necessary to systematize the work in order to permit the injection of as many rats as possible with the smallest possible simultaneous change in viscosity.[1] The injection time was also obtained by taking the mean between the time of beginning and ending the injection. In this manner it was possible to tell how many animals survived or died when injected with a solution of a certain viscosity range. In Chart 2 and the subsequent charts and tables, S stands for survival of the animal for at least 24 hours and D for death within 24 hours after injection.[2] The figures attached to the viscosity curve indicate the dose of drug injected expressed in milligrams per kilo body weight. The dose (marked by an asterisk (*)) which killed the majority of the animals was always considered the minimum lethal dose.

[1] This was arranged by having one person make the solution and the viscosity determinations, a second and third person attend to the injections, and a fourth person note the symptoms and time of death of the animals. But even with this arrangement it was necessary to repeat the experiment a number of times with each lot of arsphenamine in order to get the toxic range for each range of viscosity.

[2] Inasmuch as the acute toxicity of the drug was under investigation, it appeared sufficient to observe the animals for only 24 hours.

Attention is first called to the remarkable regularity in the change in viscosity of the arsphenamine solution used in the work illustrated by Chart 2. The viscosity of the freshly made solution is more than twice (2.26) that of distilled water, and on standing for 16 minutes drops to 1.68. The M. L. D. (minimum lethal dose) for this viscosity range is 5 mg. per kilo. Between 20 and 25 minutes from the beginning of the experiment the relative viscosity gradually decreases from 1.63 to 1.42, and the M. L. D. for this range increases to 8 mg. per kilo.



The following viscosity range of 1.4 to 1.33 gives a M. L. D. of 10 mg. per kilo. Then, with a viscosity of 1.17, the M. L. D. is 15 mg. per kilo. After this the solution stood in the closed viscosimeter and cylinder over night at the same temperature. The following day, or 21½ hours after the beginning of the experiment, the viscosity had dropped to 1.08, and the M. L. D. had increased to 18 mg. per kilo. In other words, the gradual decrease in the viscosity of the solution during the 21½ hours of standing was accompanied by a decrease in toxicity of 72 per cent. We desire to call particular attention to the great regularity and accuracy of these changes in viscosity and toxicity and it may be stated that many repetitions of these experiments yielded exactly the same results.

Similar viscosity curves and toxicity changes were obtained with numerous other lots of arsphenamine secured from licensed manufacturers or prepared by us.

In view of the fact that concentrated solutions of arsphenamine exhibit (Chart 1) an increase in viscosity on standing, it would have been very interesting to determine whether this *increase in viscosity* is accompanied by an *increase of toxicity*, as should be expected. Unfortunately, this could not be done as the toxicity of more con-

centrated solutions was of such an order that the small volume of solution representing a single fatal dose for the rat could not possibly be measured with any degree of accuracy by means of the smallest syringe or gravity burette available and work on larger animals was precluded on account of the large number of animals required for this kind of work.

(*b*) *Correlation of viscosity and toxicity of arsphenamine hydrochloride of different manufacture.*—The next problem was to determine whether or not it was feasible to correlate the toxicity of different lots of arsphenamine with their viscosity. The arrangement for this work was exactly the same as that described in the preceding chapter. One per cent solutions of the hydrochloride of the different lots were prepared and their viscosity and toxicity determined immediately after solution of the drug was accomplished and at various intervals thereafter, the solutions being kept in closed glass cylinders at 37.5° C. This work required a very large number of animals and had to be confined to 11 different preparations. The results are so surprisingly consistent, however, that no reason exists which would invalidate the assumption that all arsphenamine preparations which pass the official toxicity requirement of a maximum tolerated dose (sodium salt) of 120 mg. per kilo behave in a similar way. The results obtained with these preparations were finally compiled in Table I. The first column of the table contains the relative viscosity figures. The headings of the other columns designate the lot number of the different arsphenamines, and below each lot number are given the minimum lethal doses, expressed as milligrams per kilo bodyweight. The first figure in each vertical column corresponds to the initial toxicity of the freshly prepared solution, and the lower figures to the toxicity after standing. As noted, some of the toxicity figures are those obtained after the solution had stood approximately 24 and 48 hours. The striking results are obvious, even from a cursory examination of the table.

TABLE I.—*Relation between viscosity and toxicity (M. L. D.) of various 1 per cent arsphenamine solutions (hydrochloride).*

[Viscosity determined at 37.5° C. Rate of injection 2 minutes per c. c. M. L. D. expressed as mg. per kilo.]

Relative viscosity.	M. L. D. of Lot No.—										
	1680	1824	1820	1805	Y 123	1823	1821	1812	M. D.	1806	G 73
3.081	4										
2.710	4										
2.290		5									
2.105	5										
2.075			5								
1.973				5							
1.883	6										
1.850					7						
1.790						6					
1.750	7										
1.650							7				
1.585								10			
1.570						8					
1.533		8		8							
1.515	8										
1.425							10				
1.418					10						
1.410									10		
1.370				10							
1.343						15					
1.290								15			
1.258			10								
1.205							12				
1.178					15						
1.168				15							
1.140							15				
1.123		15									
1.114			18								
1.100			[1] 25								
1.095	[2] 15				21			18			
1.090							18				
1.088						18					
1.085				[1] 18							
1.084											18
1.082										20	
1.078						[1] 25					
1.074		25									
1.065									25		
1.060							25				
1.057								[1] 30			28
1.053		[1] 30								◆	
1.044										28	45
1.036					[1] 35		[1] 42		42		
1.034										32	
1.026									[1] 85		
1.021											[1] 60

[1] After solution had stood 24 hours. [2] After solution had stood 48 hours.

First of all it will be seen that, with very few exceptions, in the lower part of the table a certain viscosity corresponds to a certain toxicity, this relation evidently being absolutely independent of the method of preparation of the drug. The slight discrepancies are easily explained by the slight inaccuracies of the toxicity test.

It is furthermore evident that the *initial* viscosity and toxicity of freshly prepared solutions show very great variations between the different lots of the drug. For instance, Lot 1680 has an initial relative viscosity of 3.081 and an initial M. L. D. of 4 mg. per kilo, whereas Lot 1806 has an initial viscosity of 1.082 and an initial M. L. D. of 20 mg. per kilo; in other words, the higher the initial viscosity of a given preparation the greater is its toxicity.

TABLE II.—*Influence of rate of injection upon toxicity of 0.5 per cent arsphenamine solution.*

Relative viscosity.	Rate of injection.	Minimum lethal dose.
1.037–1.021	2 minutes per c. c.	60 mg. S. 80 mg. S. 100 mg. S. 120 mg. SSSS. 140 mg. S. 150 mg. DDDDS.* 200 mg. DDDD.
1.043–1.021	1 minute per c. c.	120 mg. SDD.* 150 mg. DDDDD.
1.021	0.5 minute per c. c.	40 mg. SSS. 60 mg. SS. 80 mg. SSD. 100 mg. S. 120 mg. DDD.*

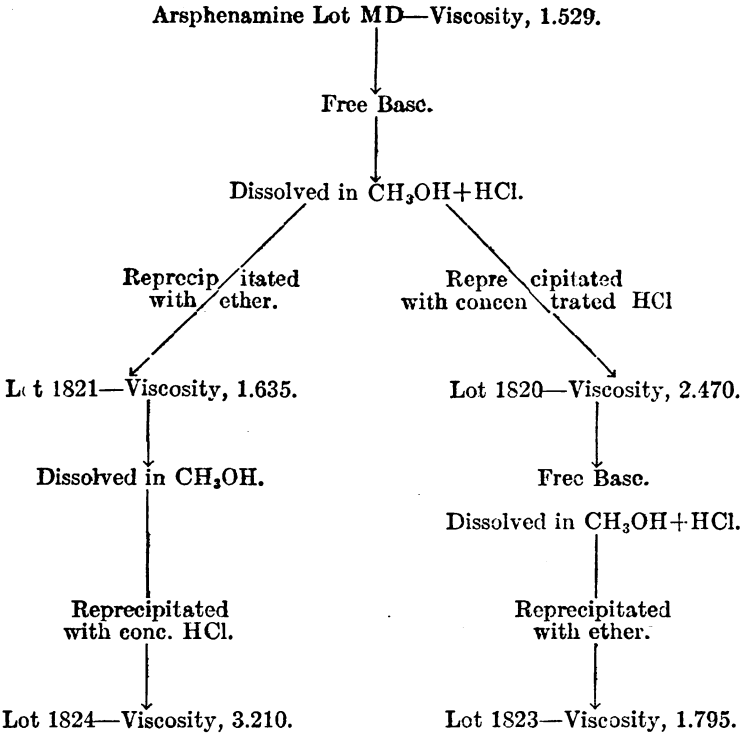
(*c*) *Effect of change in rate of injection upon toxicity.*—It was of interest to determine the influence of a change in the rate of injection upon the toxicity of arsphenamine solutions of approximately the same viscosity. Table II illustrates a typical experiment of this kind. Evidently the rate of injection has some influence upon the toxicity of a 0.5 per cent solution of arsphenamine hydrochloride, but this influence is not very great. For an injection rate of 2 minutes per cubic centimeter, the M. L. D. was 150 mg. per kilo; for a rate of 1 minute per cubic centimeter it was 120 mg. per kilo; and for a rate of 0.5 minute per cubic centimeter, 120 mg. per kilo. It would appear, then, that a fast rate of injection produces a slightly higher toxicity when rather *dilute* (0.5 per cent) solutions of the hydrochloride are used. Incidentally we call attention to the fact that this acid solution of *low* viscosity is tolerated in doses which correspond to the official requirement for the maximum tolerated dose of solutions of the sodium salt of arsphenamine. The data given in Table I, on the other hand, show that a solution of the hydrochloride with *high* viscosity (Lot 1680) may be 37 times more toxic (M. L. D. 4 mg. per kilo).

From the practical standpoint of the clinical use of arsphenamine these observations are rather significant. It has sometimes happened that, by mistake, arsphenamine has been injected as the hydrochloride instead of the sodium salt. Severe acute reactions and even deaths have been attributed to this error. The data so far mentioned in this paper furnish good evidence why such untoward reactions should occur with the use of the hydrochloride of the drug. A freshly made 1 per cent solution of Lot 1680 kills a rat within a few minutes in a dose of 4 mg. per kilo. Assuming that the toxicity in the rat and in man is of about the same order, 0.24 gram would be the fatal dose for a patient weighing 60 kilos. This dose is considerably below the maximum therapeutic dose, and hence it is not at all surprising that deplorable toxic reactions should

be observed when arsphenamine is injected in the form of the hydrochloride instead of the sodium salt.

(*d*) *Cause of difference in viscosity of different arsphenamine preparations.*—Our extensive experience in the examination of arsphenamine obtained from various manufacturers has shown us that the various products exhibit marked differences in their solubility in water. Some brands are very easily soluble and yield very fluid solutions; other brands are very difficultly soluble and often require heating and yield viscous solutions. It appeared quite possible that this difference in solubility might be caused by differences in the method of final precipitation of the drug. The hydrochloride can be obtained in two ways: (1) By precipitation of a methyl alcoholic solution of the drug with ether, or (2) by precipitation of an aqueous solution with fairly concentrated hydrochloric acid. The first method is the one described in the original directions of Ehrlich and Bertheim and the second was used by Kober (1921) and Christiansen (1920). Kober and Christiansen call attention to the difficulty met with in dissolving their products, whereas the old German product always was easily soluble. It should be particularly emphasized that Kober used the hydrosulphite reduction and Christiansen the hypophosphorous acid method. Yet, both obtained products of low solubility with the final hydrochloric acid precipitation, a fact which indicates that the method of reduction is not the factor which controls the physical properties of the product. In order to determine the influence of the method of final precipitation upon the viscosity of the product, the experiment illustrated by Table III was carried out.

TABLE III.—*Influence of method of precipitation of arsphenamine on initial relative viscosity of a 1 per cent solution of the resulting preparations.*



Fifty grams of arsphenamine, Lot MD, were dissolved in 1,500 c. c. of water; 120 c. c. of 1.5 *N* NaOH were then added to precipitate the free base. This was filtered off on a Büchner funnel (filtrate was clear and colorless). The precipitate was washed with water and packed down. The moist precipitate was mixed with methyl alcohol and filtered again, washed with methyl alcohol, and sucked off as completely as possible. It was then mixed with 250 c. c. methyl alcohol. Then a solution of methyl alcohol containing gaseous HCl was added dropwise until all the precipitate went into solution. This solution was divided into two portions (*a* and *b*). Portion (*a*) was precipitated by pouring it into a large volume of cold (0° C.) 15 per cent hydrochloric acid, filtering off and washing with alcohol containing HCl, then ether. Before the material had thoroughly dried, it was separated roughly into two portions. One portion was allowed to dry completely in desiccator. This is Lot 1820. The other portion was dissolved in 200 c. c. water, precipitated with 75 c. c. 1.5 *N* NaOH, and the free base so formed was filtered off (filtrate was clear and colorless) and washed with water. The precipitate was taken out of funnel, mixed with methyl alcohol, and again filtered. It was then suspended in 75 c. c. methyl alcohol and dissolved by

the addition of methyl alcohol containing gaseous HCl. The solution was poured into 900 c. c. anhydrous ether under stirring. It was filtered off, washed with ether, and dried in desiccator; 7.1 grams were obtained. This is Lot 1823. The (*b*) portion mentioned above was precipitated by pouring into anhydrous ether, filtered off, and washed with anhydrous ether. It was then dried in desiccator; 20 grams were obtained. This is Lot 1821.

Ten grams of Lot 1821 were dissolved in 75 c. c. absolute methyl alcohol, then poured with stirring into 500 c. c. cold (0° C.) 15 per cent hydrochloric acid. The precipitate was filtered off, washed with alcohol containing HCl and anhydrous ether, then dried in vacuum desiccator; 9.7 grams were obtained. This is Lot 1824.

The lots precipitated by means of aqueous hydrochloric acid were without exception difficult to dissolve in water (requiring more time), and their initial relative viscosity was much higher than that of the lots precipitated by ether. (See Table III.) The viscosity figures given in Table III always refer to a freshly prepared 1 per cent solution of the hydrochloride.

This experiment was repeated with another commercial lot of arsphenamine with similar results. Moreover, five lots of arsphenamine prepared by us according to the method of Christiansen from pure oxyaminophenylarsonic acid, and which were precipitated by aqueous hydrochloric acid, also had a very high initial viscosity. Everything then points to the method of precipitation as representing the principal factor which determines the solubility, viscosity, and toxicity of arsphenamine (hydrochloride).

VISCOSITY AND TOXICITY OF ALKALINE ARSPHENAMINE SOLUTIONS.

The relative viscosity of a freshly prepared 1 per cent solution of the disodium salt is consistently lower than that of a freshly prepared 1 per cent solution of the hydrochloride. The viscosity of the former approaches that of water. Some of the data bearing upon this point are given in Table IV.

As in the case of solutions of the hydrochloride, the viscosity of the alkaline solution shows a gradual decline on standing at ordinary temperature, not, however, as great as with the former. This reduction of viscosity is accompanied by a marked reduction in the toxicity. Table V, contains by way of illustration two typical experiments. Other experiments with other lots of arsphenamine have yielded similar results. It will be noted that the initial viscosity of Lot G73 is 1.112 at 15° C. Rats were at once injected with this solution with increasing doses as rapidly as possible, at a rate of injection of two minutes per cubic centimeter. During this time the viscosity fell gradually to 1.078. The minimum lethal dose for this range is

100 mg. per kilo body weight. After the solution had stood for 30 minutes at 15° C. another series of rats were injected under exactly the same conditions. The data show that the toxicity had decreased about one-third, so that the minimal lethal dose was 150 mg. per kilo.

TABLE IV.—*Viscosity of freshly prepared alkaline arsphenamine solutions (1 per cent).*

Lot number.	Relative viscosity of solutions of disodium salt.	Relative viscosity of solutions of hydrochloride, 1 per cent.	Lot number.	Relative viscosity of solutions of disodium salt.	Relative viscosity of solutions of hydrochloride, 1 per cent.
G 71	1.049	1.152	69	1.058	1.120
2432	1.065	1.195	6600	1.065	1.126
2357	1.049	1.150	6515	1.058	1.319
G 68	1.065	1.130	6587	1.079	1.370
73	1.057	1.130	122	1.058	1.770

TABLE V.—*Influence of standing on viscosity and toxicity of a 2 per cent alkaline arsphenamine solution.*

Relative viscosity.	Temperature of solution.	Rate of injection.	Toxicity.
LOT G 73.			
1.112-1.078	15° C.	2 min. per c. c.	80 mg. S. 90 mg. SD. 100 mg. SDDD.* 110 mg. DDD. 120 mg. DD. 130 mg. D.
After standing for 30 min. at 15° C.: 1.078-1.074	15° C.	2 min. per c. c.	120 mg. S. 130 mg. SS. 140 mg. SSDD. 150 mg. SDD.* 160 mg. D. 170 mg. D. 180 mg. D. 200 mg. D.
LOT MD.			
1.300-1.212	21° C.	2 min. per c. c.	75 mg. D. 140 mg. SDD.* 180 mg. DDD.
After standing for 30 min. at 21° C.: 1.127-1.101	21° C.	2 min. per c. c.	180 mg. SSSS. 220 mg. SDD.*

In the case of Lot MD the viscosity of the freshly prepared solution was 1.300 at 21° C. It decreased gradually to 1.212 on standing at this temperature. The minimum lethal dose for this freshly prepared solution was 140 mg. per kilo. Further standing

reduced the viscosity from 1.127 to 1.101. For this viscosity range the minimum lethal dose is 220 mg. per kilo, i. e., almost 60 per cent higher than that of the freshly prepared solution.

A similar effect is produced by short heating of the freshly prepared solution in an atmosphere of pure hydrogen. It was thought desirable to preclude all possibility of oxidation by the elimination of oxygen and by using a low temperature for making the solution. The data in Table VI show that the viscosity of a freshly prepared 2 per cent alkaline solution of Lot 73 is 1.099 at 0° C. Rats injected with this solution under standard conditions are killed by 120 mg. per kilo. The solution was heated in a current of hydrogen for 20 minutes to 55° C., followed by rapid cooling to 0° C. This treatment reduced the viscosity to 1.061; and the minimum lethal dose is now increased to about 220 mg. per kilo.

These results then clearly show that a decrease of viscosity of a solution of the disodium salt of arsphenamine produced either by allowing the solution to stand for a short time at room temperature or by heating the solution under conditions which preclude any oxydative changes leads to a striking decrease in toxicity. The remarkable feature of these results is that considerable changes in toxicity find an expression in a relatively slight viscosity change.

TABLE VI.—*Influence of heating in a current of hydrogen on the viscosity and toxicity of a 2 per cent alkaline arsphenamine solution (G 73).*

Relative viscosity.	Temperature of solution.	Rate of injection.	Toxicity.
1.099-1.070	0° C.	2 min. per c. c.	100 mg. S. 120 mg. SDDD.* 140 mg. SDD.
After heating for 20 min. to 55° C. 1.061-1.058	0° C.	2 min. per c. c.	160 mg. S. 180 mg. S. 200 mg. S. 220 mg. D.* 240 mg. D. 260 mg. D.

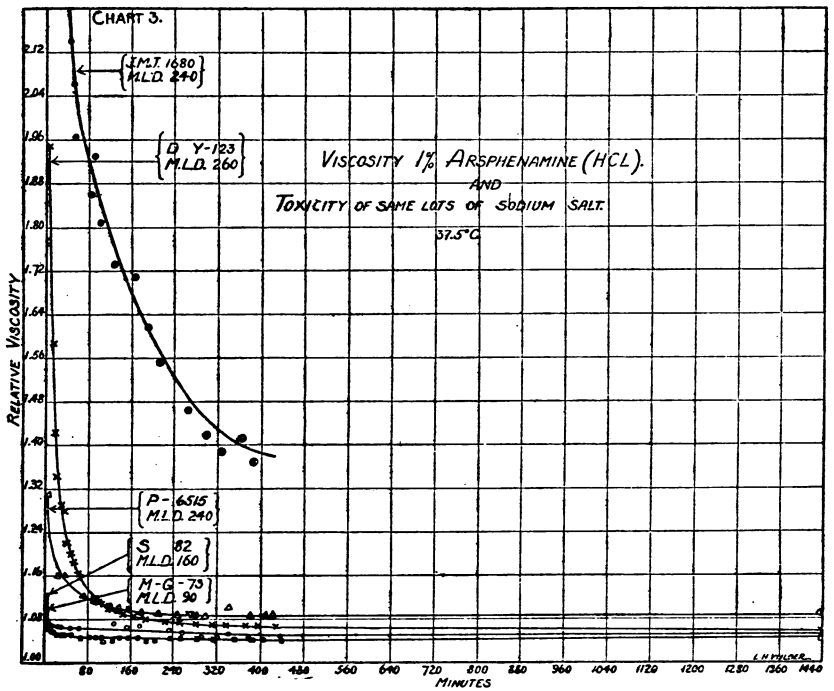
Relation between viscosity of hydrochloride and toxicity of sodium salt.—We finally call attention to some experiments illustrated by Chart 3, which is intended to express the relation which apparently exists between the viscosity of various lots of arsphenamine determined on a 1 per cent solution of the hydrochloride, on the one hand, and the toxicity of the same lots as the disodium salt.

The chart gives only a few of the data. It was found quite generally that products which were difficultly soluble in water and yielded highly viscous solutions of the hydrochloride showed a very low toxicity when tested on rats in the form of the disodium salt; and, vice versa, preparations which were easily soluble in water and

yielded less viscous solutions of the hydrochloride were found to be much more toxic when tested as the disodium salt. We do not offer any explanation of this paradox, contenting ourselves at present simply by stating the facts.

SIGNIFICANCE OF RESULTS.

The data described in this paper are of both theoretical and practical interest. They show clearly that the observations of previous workers indicating that the toxic action of arsphenamine upon the higher animals involves a physicochemical factor are correct, as it



is possible to correlate in a quantitative manner a physical property of the drug, i. e., its viscosity, with the degree of toxicity. It was proved that under conditions which preclude any oxidative change in the drug, profound physicochemical alterations may take place, and that this change is accompanied by a parallel change in toxicity. The elucidation of the nature of these changes in the drug solution *in vitro* and of those in the toxicity remains to be settled by further investigation. It is very likely that the decrease in toxicity accompanying the decrease in viscosity is essentially due to dispersion of the particles of the solution, thereby reducing the power of such solutions to enter into reactions with the colloidal constituents of the blood. We want to emphasize in this place again that arsphena-

mine behaves like an amphoteric colloid, such as proteins. Its acid and basic properties are revealed by the formation of easily soluble salts with acids and strong alkalies. In the neighborhood of the hydrogen ion concentration of the blood, the neutral "base" is thrown out of solution as a gelatinous precipitate. A pH of 7.2 might therefore be considered as the approximate isoelectric point of arsphenamine. The hydrochloride can be precipitated (salted out) by an excess of concentrated hydrochloric acid. Starting with the insoluble "base," then, we can gradually convert the drug into ionized acid or basic salts by the addition of alkalies or acids, and this is obviously followed by a partial dispersion of the colloid. The known properties of arsphenamine, therefore, do not conflict with the view expressed above, namely, that the reduction in viscosity and toxicity may primarily be due to dispersion. In this connection it would be of interest to determine the viscosity of arspehnamine over a range from pH 3 to pH 10.

As far as we are aware, this work is the first in which the quantitative changes in viscosity occurring in a drug solution have so satisfactorily expressed similar changes in toxicity. It may not be amiss to suggest that viscosity measurements, which are so easily made, might be very useful in the study of problems connected with the toxic action of substances of a more or less colloidal character, such as those responsible for the so-called anaphylactoid reactions of Hanzlik and Karsner, and perhaps also the action of toxins. It is certainly surprising to find in the literature so few data in which viscosity has been made use of for biological research, whereas many papers deal with surface tension and osmotic pressure.[3]

From a practical standpoint, the work indicates that the toxicity of arsphenamine is subject to very great changes according to the manner in which the drug is handled before injection. It shows that if, by mistake, a freshly prepared highly viscous preparation of arsphenamine hydrochloride is injected, severe reactions and even death may be the result. After the solution has stood for some time, the chance of the production of toxic reactions is much reduced, both with the acid and alkaline solution. Finally, these results emphasize again that for purposes of accurate biological standardization of this drug, the conditions for preparing the solutions previous to injection must be absolutely uniform, otherwise the results are not reliable. As the viscosity of the alkaline solution adjusts itself in the course of about 30 minutes, and as this is accompanied by a similar adjustment of the toxicity, it is plain that this precaution, which has recently been observed in the official toxicity control of arsphenamine, rests on a scientific basis.

[3] The last two properties of arsphenamine were studied by us without enabling us to correlate differences in toxicity with differences in either osmotic pressure (freezing-point method) or surface tension.

CONCLUSIONS.

This investigation indicates that there is a close parallelism between the viscosity and toxicity of arsphenamine solutions and, hence, proves conclusively that, besides the chemical factor (arsenoxide formation), there is a physicochemical factor which determines the toxicity of the drug.

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SOME OBSERVATIONS ON THE DISPERSAL OF ADULT ANOPHELES.

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The observations here reported were made during the summers of 1920 and 1922 in a rice-growing region near Stuttgart, Ark., where the great number of *Anopheles*, especially of *A. quadrimaculatus*, gave abundant material for investigation.

Several closely related questions were considered.

1. NIGHTLY DISPERSAL OF ANOPHELES FROM DAYTIME RESTING PLACES.

Roubaud [1] could recover none of a large number of *A. maculipennis* which had been stained in a barn six days previously. He is of the opinion that the anopheline population of a resting place is rapidly renewed. It seemed worth while to repeat these observations with different species of *Anopheles* and under varying conditions.

[1] Roubaud, E.: Ann. d. l'Inst. Past. XXXIV ,1920, p. 181.

In the vicinity of Stuttgart the chief daytime resting places of *Anopheles* were barns, especially those in which animals were housed during the night. Enormous numbers also congregated in privies, hollow stumps and trees, under bridges, and in the other usual resting places of these mosquitoes. Many hundreds could be regularly found under the mummified skin of a dead horse in a wood.

A protocol of one experiment will illustrate the method and results:

Experiment No. 3.—Place: A small barn in which horses were housed during the night. August 24, 1920, an estimated number of 4,000 *Anopheles* were found resting beneath the roof and eaves. Stained with an aqueous solution of eosin sprayed by means of an atomizer. As a control, 98 mosquitoes were caught immediately after the staining and tested for stain with a solvent composed of alcohol, 3 parts; glycerine, 3 parts; chloroform, 1 part. Sixty per cent proved to be stained, so it was estimated that fully 2,400 *anophelines* had been stained in the barn. On subsequent days, batches of mosquitoes, taken at random, were caught in the barn and in neighboring places and tested for stain with the solvent. Results are given in Tables I and II.

TABLE I.—*Test for stained mosquitoes recovered in the barn where stain was used.*

Interval after date of staining (days).	Number tested (all *A. quadrimaculatus.*)			Found stained.			
				Number.			Per cent both sexes of number tested.
	Female.	Male.	Total.	Female.	Male.	Total.	
1	950	80	1,030	249	28	277	26.9
2	547	71	618	27	2	29	4.7
3	613	40	653	4	0	4	0.6
4	526	62	588	2	0	2	0.3
6	1,064	92	1,156	1	0	1	0.1

Among the 4,045 *Anopheles* caught during the five days of testing there were only 9 *A. crucians*, all female. Of these, two of the four taken on the first day after the staining were colored, and none thereafter.

TABLE II.—*Test for stained mosquitoes recovered from the vicinity of the barn where the stain was used.*

Place.	Distance from barn in which staining was done.	Interval after date of staining (days).	Numbers tested (all *A. quadrimaculatus*).			Found stained.		
			Female.	Male.	Total.	Number.		Per cent both sexes of number tested.
						Female.	Male.	
Horse barn	100 feet	1	709	5	705	0	0	0.0
		2	214	1	215	0	0	0.0
Chicken house	do	1	347	19	366	1	0	0.3
		2	196	13	209	4	0	1.9
		3	269	6	275	0	0	0.0
		4	185	15	200	1	0	0.5
		6	256	11	267	0	0	0.0
Privy No. 1	200 feet	1	324	127	451	1	0	0.2
		2	427	130	557	2	0	0.3
		3	350	17	367	0	0	0.0
		4	543	111	654	0	0	0.0
Privy No. 2	1,440 feet	1	250	204	454	0	1	0.2
		10	167	129	296	0	0	0.0
Negro cabin	500 feet	1	72	10	82	1	0	1.2
		2	125	13	138	0	0	0.0
		3	94	6	100	0	0	0.0
		11	56	6	62	0	0	0.0
Hollow trees, etc., in wood.	⅛ to ¼ mile	1	119	132	251	0	0	0.0
		2	47	30	77	0	0	0.0
		3	63	57	120	0	0	0.0

Only 11 *A. crucians* were found in the course of the tests made of localities in the vicinity of the barn where staining was done. None was stained.

It is interesting to note the varying proportion of males found in the different localities covered in experiment 3, a proportion which, in that region, at least, was usually in inverse ratio to the number of blood-engorged females. The barn in which the staining was done contained 8.5 per cent males among the *Anopheles* caught for testing; the horse barn, 0.7 per cent; the chicken house, 4.8 per cent; privy No. 1, near the barns, 18.9 per cent; privy No. 2 in a wood near rice fields, but distant from a house or pasture, 44.4 per cent; negro cabin, 9.2 per cent; wood, in this case the most distant locality from any breeding place, 48.8 per cent. The high proportion of males, and with it a high proportion of empty females, was clearly associated with the distance from a source of blood, not the distance from a breeding place.

About 96 per cent of the females found in the "stained" barn contained blood or ova, and practically all of the stained mosquitoes recovered in the course of experiment 3 were blood-engorged or gravid females.

The weather during experiment 3 was cool, but tended to grow warmer toward the end of the experiment. Mornings were mostly foggy, and the humidity was high at night. There was very little wind.

Experiment No. 4.—September 15, 1920: Privy No. 2, described in connection with experiment No. 3, housed a large number of *Anopheles* and was selected for experiment. Since the time of the August experiment, cattle had been introduced into a pasture adjoining this privy, but the privy itself was rarely used and contained no source of blood. The proportion of males was now 37.3 per cent, and 72 per cent of the females were blood engorged. Practically all were *A. quadrimaculatus*. Methylene blue stain, aqueous solution, was used in order to avoid confusion with the previous experiment in which eosin was used. A batch of 139, collected 6 hours after staining, were tested with the solvent, and 99 per cent proved to be stained. Estimated number stained, 2,500. Results are given in Table III.

TABLE III.—*Test for stained mosquitoes recovered in the privy where the stain was used.*

Interval after date of staining (days).	Number tested (all *A. quadrimaculatus*).	Per cent found stained of number tested.
1	140	35.7
2	264	9.1
3	337	3.0
4	369	6.7
5	315	1.3
6	337	0.0

Mosquitoes from localities in the vicinity of the privy were tested. Large sample catches were taken daily from a barn 1,500 feet from the privy. About 1 per day, or 0.2 to 0.3 per cent of the number examined, was found blue colored during the first four days after the staining. None was found afterwards. A barn 1,440 feet distant in the opposite direction gave almost exactly the same proportion stained and on the same days. Four other localities, 1,340 to 2,500 feet from the privy, gave no positives. Practically all mosquitoes tested were *A. quadrimaculatus*.

On the day of staining, observations were made at this privy of the flight of mosquitoes at dawn and dusk. At earliest dawn, mosquitoes began flying into the privy and their entrance continued for about 40 minutes. They began flying out at dusk, and their exit continued during about 25 minutes, after which time but a small proportion (about one-fourth) of the number present during the day remained.

Two other experiments, one in the same privy as that of experiment No. 4 and one in a barn, gave very similar results.

Experiment No. 5.—On September 22, 1923, a somewhat different experiment was undertaken. *Anopheles* in a large series of buildings in a certain area were stained with eosin, and those in hollow trees, stumps, and the like, in a neighboring wood, with methylene blue. The staining in each locality was repeated during two or three days

in order to stain as many as possible. The experiment was begun at the approach of cooler weather and just before a period of rapid diminution of *Anopheles* as the result of draining the rice fields. At different dates, extending from September 25 to October 20, *Anopheles* were caught in the places where they had been stained and in neighboring resting places and were tested for stain. Owing to the rapid diminution of *Anopheles*, the numbers caught on the later dates were small, but the proportion tested was larger than tested in midsummer when anophelines were very abundant. Comparatively few stained specimens were recovered, and none was found later than four days after the last application of stain. The distribution of stained mosquitoes found showed that mosquitoes had flown from barns to woods and from woods to barns, but no evidence was obtained of a tendency to seek woods as cooler weather approached, and the total numbers diminished rapidly in the woods as elsewhere.

Two red-stained *Anopheles*, including a female with blood or ova, had flown to a wood where there was neither water nor blood supply. The nearest "red-stained" locality, a large barn, was 1,770 feet away. A negro cabin, unscreened and occupied, gave 11 red-stained specimens out of a total of only 114 examined on the day following the last staining. The nearest "red-stained locality," a barn about 500 feet away, gave, on the same date, a smaller proportion of red-stained specimens than did the cabin in which no stain had been used. In previous experiments the percentage recovered in a stained locality had always exceeded that found in the neighborhood.

There was a light frost on the night of September 30, but no other frost occurred until October 27. All stained specimens were found on or before September 29.

A few more staining experiments of this nature were made during the summer of 1922 in the same region. A batch tested the day after staining showed 3.4 per cent stained; one three days after, 1.4 per cent. The summer of that year was hot and dry.

All experiments agree in indicating an early dispersal of *A. quadrimaculatus* from daytime resting places. Never over 40 per cent were recovered in a resting place one day after staining, and practically none six days after. Dispersal was practically as rapid and complete from a barn containing a nightly blood supply as from a privy where no blood could be obtained. The distribution of stained specimens recovered in certain experiments would indicate that stimuli other than the requirements of blood, oviposition, and fertilization had directed the flight of females. Possibly flock movements or meteorological stimuli were concerned as well.

It is improbable that the mosquitoes were injured by the aqueous stain used, judging by the longevity of controls stained and kept in cages. Certain experiments in which no stain was used also indicated a large daily "turnover" in the mosquito population of a resting place. *Anopheles* were destroyed or removed from such places, and on the succeeding day the numbers were as large as ever.

2. LONGEVITY OF ANOPHELES IN RESTING PLACES WHEN THE NOCTURNAL FLIGHT IS PREVENTED.

Nicholls[2] confined *A. albimanus* in a large room where fruit was furnished as food and an opportunity was given the mosquitoes to take human blood nearly every other day. The last were alive on the thirty-first day, none surviving the thirty-fourth. Roubaud[3] confined *A. maculipennis* in a large space with domestic animals. One or two at most survived at the end of 12 days.

In some preliminary experiments we liberated about 250 *Anopheles*, practically all *A. quadrimaculatus*, in a dark closet and supplied them with water but with no source of blood. Only one or two survivors were found three days later. A batch of mosquitoes, including both *A. quadrimaculatus* and *A. crucians*, were confined in a large sleeping net hung in a dark room. Water was supplied and a fowl kept under the net. Seven days later no survivors were found. Numerous dead mosquitoes were found on the floor.

A more complete experiment was carried out, the details of which follow:

A chicken house, the floor dimensions of which were about 10 by 12 feet, partly shaded, and near rice fields, was found to be a preferred daytime resting place for *Anopheles*. From 1,000 to 2,000 of them were found congregated under the roof of the house on three visits prior to the day of the experiment. This number was probably a conservative estimate, since over 2,000 were caught there and counted in the course of some staining experiments made at a later date when numbers had apparently not materially diminished. No mosquitoes were introduced at any time.

August 22, 1922: While mosquitoes were in the house the door and window were screened and all cracks stopped with cotton. A pig weighing about 25 pounds was placed in the house, and the door was tightly closed. The number of mosquitoes in the house rapidly decreased from day to day, and on August 28, six days later, only two survivors could be found. Dead mosquitoes were found on a white cloth stretched over a bench in the chicken house.

[2] Nicholls, L.: Bull. Entomol. Res., III, 1912, p. 251.
[3] Rouaaud, E.: Ann. de l'Inst. Past., XXXIV, 1920 ,p. 181.

August 28: Door was opened. August 29 (morning): *Anopheles* had reentered the house; 1,100 were counted. All openings were again securely closed with screen or cotton. On September 4 only two survivors were found. Some large holes were then made in the screens, imitating a poorly screened house. September 5: Only 17 *Anopheles* had entered during the night. The door was opened widely that evening. September 6: The usual number of *Anopheles*, 1,000 to 2,000, were present.

The pig was kept in the chicken house during the entire time of the experiment. A shower fell on the first day, and the weather was relatively cool until August 28; thereafter it was hot and dry. Practically all the *Anopheles* were *A. quadrimaculatus*.

These experiments indicate that *A. quadrimaculatus* trapped in a large inclosure suffer a very high mortality even when confined in a house which they have chosen for a resting place and when supplied with abundant opportunities of obtaining blood. It is known, of course, that mosquitoes may be kept in cages for periods of time much longer than is necessary for the maturing of sporozoites; but in these cages they are protected from natural enemies and afforded a proper degree of moisture. It is the experience of most of us who have undertaken a long series of infection experiments that, even when all care is taken to keep *Anopheles* alive in cages, a disappointingly small proportion of the females exposed to the carrier survive 12 days or more.

3. LONGEVITY OF ANOPHELES UNDER NATURAL CONDITIONS.

Le Prince and Orenstein,[4] in their experiments in Panama, recovered stained *Anopheles* 12 to 14 days after the last staining. The longest period of time elapsing between staining and recovery of *Anopheles* in our experience was 25 days. Two female *A. quadrimaculatus*, both with blood and ova, survivors of a lot stained August 24, were found September 18 in a barn in which no stain had been used. The eosin color which they showed on testing was distinct and unmistakable. The barn in which they were found was 4,200 feet from the nearest "red-stained" locality. It is possible that the mosquitoes came from an earlier experiment in which comparatively few mosquitoes were stained. In that case the distance traveled would be only 2,500 feet, but the time of survival would then be 31 days. A female *A. quadrimaculatus* was found stained in a barn in which eosin had been used 24 days previously (experiment No. 3, Aug. 24). It was the only one found red stained among 2,564 *Anopheles* caught in that barn and tested during the period Septem-

[4] Le Prince, J. A., and Orenstein, A. J.: Mosquito Control in Panama. G. P. Putnam's Sons, New York and London, 1916, p. 113.

ber 16–21 in the course of an experiment in which methylene blue was used.

It will be remembered that no survivors were found four days after staining in the autumn experiment described (experiment No. 5), which was undertaken in part to determine longevity in cooler weather and with a much diminished anopheline production.

During August and September, 1922, a more extensive experiment was undertaken in the hope of obtaining further data on longevity under natural conditions. An estimated number of over 60,000 *Anopheles* were stained. Those of one part of the region about Stuttgart, Ark., were stained with eosin, and those of another part with methylene blue, aqueous solutions. The stain was repeated in many localities in order to stain as many as possible. In estimating numbers stained, allowance is made for those stained twice. A sample taken immediately after staining in one locality gave 100 per cent stained; in another locality, a lot caught six hours after staining gave 89.3 per cent stained.

On September 8, 19 days after the last application of stain, we began making collections and testing with a solvent for stain; these collections were continued until September 13. In all, over 15,000 were caught and tested. Not one was found stained. About 64 per cent were collected in places where stain had been used, the remainder from places in their immediate neighborhood. The weather was hot and dry during the greater part of the time covered by this experiment. During the 1920 experiments there was more rain and a greater average humidity.

4. DISPERSAL OF ANOPHELES FROM AN EXTENSIVE BREEDING PLACE.

A number of surveys were made in the town of Stuttgart, a place of about 5,000 inhabitants, in order to determine the extent to which *A. quadrimaculatus* bred in rice fields penetrated into the town. Our observations served little more than to confirm the well-known fact that numbers rapidly diminish toward the center of a town. Where thousands could be found in barns at the edge of the town, only dozens could be found in similar places at the center. The total number found well within the town, however, was large enough to make one wonder why so many of them were willing to leave a plentiful supply of blood and breeding places at the farms and penetrate half a mile into a well-screened town, where there were comparatively few domestic animals to attract them.

Further data regarding the spread of *Anopheles* from rice fields were obtained in 1922, when dry weather had reduced mosquito breeding to a very small amount in a region adjoining the rice fields. We made a survey in that region, mostly through a wooded country

opened by a railway along which were scattered houses and farms. A search was made for *Anopheles* under bridges and in barns and other buildings. Numbers tended to diminish gradually as one went farther from the rice fields, but hundreds were found in a barn about 1 mile from the nearest irrigated field. Beyond that point numbers were very small. Other observations tended to confirm the conclusion that during that summer, at least, *Anopheles* in effective numbers had spread about a mile from rice fields over a relatively open country.

DISCUSSION OF RESULTS IN RELATION TO SCREENING.

Our results indicate that *A. quadrimaculatus*, even in the case of females engorged with blood, do not under natural conditions remain long in a resting place; further, that they soon die when confined in such resting places, even when supplied with a source of blood. So far as limited numbers indicate, the same conclusions hold true with *A. crucians*. So it would seem probable that any females so securely entrapped that escape is impossible are likely to die within a few days; and that, however less desirable poor or badly tended screens are than good ones, they are not likely to serve over any long period of time as dangerous traps for infected mosquitoes.

In the vicinity of Stuttgart, Ark., the number of *Anopheles quadrimaculatus* is enormous, but the malaria rate is comparatively low. Screening, although poor in many houses, is almost universal and may be one important factor in the prevention of malaria there.

These results, however, are not to be construed as in any degree minimizing the desirability of securing the most perfect screening against mosquitoes which it is practicable to secure. They indicate, in effect, merely that it would be better not to tear out imperfect screening which, at the time, it would be impracticable to replace by better.

SUMMARY.

1. Nocturnal dispersion of *A. quadrimaculatus* from a resting place is nearly complete by the end of six days.

2. When confined in such a resting place, mortality is very high; in our experiments nearly all were dead within six days.

3. Longevity in midsummer and under natural conditions may be at least 25 days, but the proportion which could be recovered three days after staining was very small.

4. *Anopheles* in effective numbers spread about a mile from rice fields into an open country.

Acknowledgment.—Through the courtesy of Mr. H. W. Van Hovenberg, sanitary engineer of the St. Louis & Southwestern Railway Co., Mr. H. H. Stage, entomologist of that company, was detailed to Stuttgart and gave us material assistance during a part of this work.

RECORD OF PLAGUE INFECTION IN CALIFORNIA.

The accompanying table, giving a record of plague infection in California, is taken from a report recently received from Senior Surgeon J. C. Perry, Director, Public Health District No. 7, and is published here merely as a matter of historical interest.

This record shows that the last case of human plague in California occurred August 18, 1923, and the last case of squirrel plague on June 6, 1923. Intensive measures, including inspection and poisoning operations, are being carried on against the ground squirrel (*Citellus beecheyi*) in several counties of the San Francisco Bay district.

Record of plague infection.

Place.	Date of last case of human plague.	Date of last case of rat plague.	Date of last case of squirrel plague.	Total number rodents found infected since May, 1907.
City:				
San Francisco	Aug. 18, 1923	Oct. 23, 1908	May 21, 1917	398 rats, 1 squirrel.
Oakland	Sept. 10, 1919	Dec. 1, 1908	Sept. 4, 1919	126 rats, 3 squirrels.
Berkeley	Aug. 28, 1907	None	None	None.
Los Angeles	Aug. 11, 1908	do	Aug. 21, 1908	1 squirrel.
Santa Cruz	None	do	May 5, 1920	2 squirrels.
County:				
Alameda (exclusive of Oakland and Berkeley).	June 29, 1922	Oct. 17, 1909, wood rat.	July 8, 1922	466 squirrels, 1 wood rat, 3 plague-like squirrels.
Contra Costa	July 13, 1915	None	June 6, 1923	1,752 squirrels.
Fresno	None	do	Oct. 27, 1911	1 squirrel.
Merced	do	do	May 15, 1920	8 squirrels.
Monterey	do	do	June 16, 1920	41 squirrels, 1 plague-like squirrel.
San Benito	June 8, 1921	do	May 26, 1921	102 squirrels, 1 plague-like squirrel.
Santa Clara	Aug. 31, 1910	do	June 29, 1920	44 squirrels.
San Joaquin	Sept. 18, 1911	do	May 17, 1920	22 squirrels.
San Luis Obispo	None	do	Jan. 29, 1910	1 squirrel.
Santa Cruz	July 18, 1922	do	Sept. 27, 1922	40 squirrels.
Stanislaus	None	do	June 18, 1920	15 squirrels.
San Mateo	do	do	June 23, 1920	22 squirrels.

THE VILLAGE OF "HEALTHVILLE."

At the recent Virginia Educational Conference held in Richmond, there was an interesting exhibit called "Healthville," built by the Westhaven Junior Community League of Norfolk County and exhibited under the auspices of the Cooperative Education Association of Virginia. The village consisted of several small communities ingeniously built and arranged along a miniature railroad. The stations had such significant names as Bathtub Village, Orange Valley, Spinach Greens, Height-Weight Village, East Toothbrush, and Bookland. Long Sleep Mountain (windows open), the highest peak in Healthville, was stated to be "10 hours above wake level." The construction of Healthville was one of several health-work projects employed to present to the pupils of the Westhaven schools some fundamental health rules and secure the formation of good health habits by enlisting their interest and imagination.

DEATHS DURING WEEK ENDED JANUARY 19, 1924.

Summary of information received by telegraph from industrial insurance companies for week ended January 19, 1924, and corresponding week of 1923. (From the Weekly Health Index, January 22, 1924, issued by the Bureau of the Census, Department of Commerce.)

	Week ended Jan. 19, 1924.	Corresponding week, 1923.
Policies in force	55, 879, 075	51, 851, 429
Number of death claims	12, 312	11, 168
Death claims per 1,000 policies in force, annual rate	11. 5	11. 2

Deaths from all causes in certain large cities of the United States during the week ended January 19, 1924, infant mortality, annual death rate, and comparison with corresponding week of 1923. (From the Weekly Health Index, January 22, 1924, issued by the Bureau of the Census, Department of Commerce.)

City.	Week ended Jan. 19, 1924.		Annual death rate per 1,000, corresponding week, 1923.	Deaths under 1 year.		Infant mortality rate, week ended Jan. 19, 1924.[2]
	Total deaths.	Death rate.[1]		Week ended Jan. 19, 1924.	Corresponding week, 1923.	
Total	7,655	13.2	14.8	1,012	1,055	.....
Akron	31	7.8	9.0	5	14	53
Albany [3]	35	15.4	19.5	5	5	110
Atlanta	72	16.5	24.3	11	24	.....
Baltimore [3]	231	15.3	17.0	32	36	93
Birmingham	66	17.1	16.2	12	9	.....
Boston	220	14.8	20.6	38	39	105
Bridgeport	33	12.0	16.7	3	7	47
Buffalo	119	11.4	14.8	15	24	64
Cambridge	30	14.0	17.3	10	6	173
Camden [3]	44	18.2	24.8	8	4	126
Canton	15	7.6	.....	4	.....	84
Chicago [3]	647	11.5	11.3	94	81	87
Cincinnati	126	16.1	21.3	7	11	44
Cleveland	209	11.9	12.0	37	28	97
Columbus	65	12.7	20.4	6	4	57
Dallas	41	11.4	14.9	7	8	.....
Dayton	39	12.0	12.6	3	8	50
Denver	97	18.3	17.1	13	16	.....
Des Moines	29	10.4	8.5	3	4	.....
Detroit	234	12.3	15.1	49	54	91
Duluth	21	10.1	10.8	2	2	43
Erie	25	11.3	12.5	2	2	41
Fall River [3]	45	19.4	19.0	9	9	127
Flint	21	8.8	11.5	9	3	155
Fort Worth	20	7.0	7.6	3	3	.....
Grand Rapids	24	8.4	16.4	3	5	47
Houston	41	13.4	13.1	5	7	.....
Indianapolis	91	13.5	14.0	14	8	105
Jacksonville, Fla	33	16.8	18.8	2	0	.....
Jersey City	56	9.4	13.5	9	11	65
Kansas City, Kans	29	12.8	16.7	5	10	100
Kansas City, Mo	83	12.0	17.0	9	15	.....
Los Angeles	237	17.6	16.3	19	18	59
Louisville	61	12.3	18.0	6	11	58
Lowell	39	17.6	18.1	7	4	125
Lynn	17	8.5	15.2	3	5	76
Memphis	43	13.0	26.1	5	12	.....
Milwaukee	113	12.0	11.3	22	20	101
Minneapolis	103	12.9	11.2	12	10	64
Nashville [3]	46	19.4	28.1	8	4	.....
New Bedford	41	16.1	15.6	5	6	78
New Haven	23	6.8	9.9	3	6	39
New Orleans	161	20.5	18.8	16	22	.....
New York	1,468	12.7	12.8	193	179	78
Bronx Borough	185	11.1	9.5	29	15	102
Brooklyn Borough	470	11.2	11.5	53	53	57
Manhattan Borough	653	15.1	15.7	92	93	90

[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 1923. Cities left blank are not in the registration area for births.
[3] Deaths for week ended Friday, January 18, 1924.

Deaths from all causes in certain large cities of the United States during the week ended January 19, 1924, infant mortality, annual death rate, and comparison with corresponding week of 1923. (From the Weekly Health Index, January 22, 1924, issued by the Bureau of the Census, Department of Commerce)—Continued.

City.	Week ended Jan. 19, 1924.		Annual death rate per 1,000, corresponding week, 1923.	Deaths under 1 year.		Infant mortality rate, week ended Jan. 19, 1924.
	Total deaths.	Death rate.		Week ended Jan. 19, 1924.	Corresponding week, 1923.	
New York--Continued.						
Queens Borough	113	10.6	8.5	12	12	66
Richmond Borough	47	18.8	23.3	7	6	128
Newark, N. J.	96	11.2	13.0	18	9	84
Norfolk	34	10.8	12.5	6	5	109
Oakland	64	13.5	13.7	4	3	50
Omaha	41	10.3	10.5	4	8	43
Paterson	31	11.5	10.5	2	1	33
Philadelphia	562	15.0	19.2	74	78	94
Pittsburgh	194	16.2	20.8	27	36	92
Portland, Oreg.	77	14.4	14.9	6	6	62
Providence	69	14.8	24.3	11	14	90
Richmond	54	15.3	15.6	6	12	71
Rochester	70	11.2	14.1	9	16	71
St. Louis	195	12.5	13.8	17	14	.....
St. Paul	61	13.0	11.4	7	6	60
Salt Lake City [3]	37	15.0	13.6	4	1	66
San Francisco	163	15.5	15.3	12	12	72
Schenectady	19	9.9	.....	4	.....	113
Seattle	79	13.0	9.2	7	7	68
Somerville	25	13.0	18.5	4	3	109
Spokane	28	14.0	10.5	0	2	0
Springfield, Mass.	33	11.6	11.2	3	3	51
Syracuse	43	11.9	15.5	8	7	89
Tacoma	26	13.2	8.2	2	3	46
Toledo	64	12.1	13.9	6	9	57
Trenton	39	15.7	21.7	3	3	49
Utica	22	10.9	21.2	1	9	22
Washington, D. C.	142	16.9	18.1	8	12	46
Waterbury	14	7.3	10.6	4	2	89
Wilmington, Del.	31	13.5	15.9	7	3	152
Worcester	76	20.3	13.6	9	5	108
Yonkers	24	11.4	12.1	3	4	66
Youngstown	18	7.1	11.8	3	8	43

[3] Deaths for week ended Friday, January 18, 1924.

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 January 26, 1924.

ALABAMA.

	Cases.
Chicken pox	73
Diphtheria	11
Influenza	102
Malaria	16
Measles	521
Mumps	14
Pneumonia	110
Scarlet fever	14
Smallpox	9
Trachoma	9
Tuberculosis	25
Typhoid fever	7
Whooping cough	32

ARIZONA.

Chicken pox	4
Diphtheria	2
Measles	48
Mumps	4
Scarlet fever	9
Smallpox	6
Tuberculosis	1
Whooping cough	1

ARKANSAS.

Chicken pox	43
Diphtheria	6
Influenza	193
Malaria	19
Measles	125
Mumps	8
Paratyphoid fever	4
Pellagra	4
Scarlet fever	4
Smallpox	8
Trachoma	1
Tuberculosis	10
Typhoid fever	5
Whooping cough	45

CALIFORNIA.

	Cases.
Cerebrospinal meningitis:	
Alameda County	1
Butte County	1
Stockton	1
Diphtheria	311
Influenza	44
Jaundice (epidemic)—Los Angeles County	1
Lethargic encephalitis:	
Fort Bragg	1
Los Angeles	1
San Francisco	3
Measles	574
Poliomyelitis:	
Los Angeles	1
Glenn County	1
Scarlet fever	315
Smallpox:	
Compton	20
Long Beach	30
Los Angeles	139
Pomona	12
Los Angeles County	61
Scattering	52
Typhoid fever	5

COLORADO.

(Exclusive of Denver.)

Chicken pox	32
Diphtheria	9
Jaundice (epidemic)	5
Measles	91
Mumps	29
Pneumonia	5
Scarlet fever	38
Septic sore throat	1
Smallpox	3
Tuberculosis	38
Typhoid fever	6
Whooping cough	1

CONNECTICUT.

	Cases.
Chicken pox	101
Diphtheria	60
German measles	2
Influenza	5
Lethargic encephalitis	1
Measles	107
Mumps	84
Pneumonia (lobar)	13
Scarlet fever	177
Smallpox	1
Trachoma	1
Trichinosis	1
Tuberculosis (all forms)	65
Typhoid fever	5
Whooping cough	40

DELAWARE.

Chicken pox	11
Diphtheria:	
Wilmington	11
Scattering	2
Influenza	6
Measles	1
Pneumonia	5
Scarlet fever:	
Wilmington	11
Scattering	6
Tuberculosis	3
Typhoid fever	1
Whooping cough	5

FLORIDA.

Diphtheria	10
Influenza	7
Malaria	8
Pneumonia	5
Scarlet fever	2
Smallpox	10
Typhoid fever	2

GEORGIA

Chicken pox	6
Diphtheria	13
German measles	6
Hookworm disease	2
Influenza	65
Leprosy	1
Malaria	5
Measles	193
Mumps	2
Pneumonia	18
Scarlet fever	3
Pellagra	1
Smallpox	26
Tuberculosis (all forms)	8
Typhoid fever	1
Whooping cough	15

ILLINOIS.

Diphtheria:	
Cook County	146
Kane County	12
Rock Island County	9
Scattering	58
Influenza	24
Lethargic encephalitis—Cook County	1
Measles	498

ILLINOIS—continued.

	Cases.
Pneumonia	378
Poliomyelitis:	
Clark County	1
Cook County	1
Scarlet fever:	
Cook County	167
Kane County	18
Macon County	13
Lake County	9
Scattering	124
Smallpox	12
Tuberculosis	293
Typhoid fever	35
Whooping cough	148

INDIANA.

Chicken pox	78
Diphtheria:	
Allen County	15
Delaware County	15
Marion County	20
Noble County	9
Warren County	10
Scattering	69
Influenza	43
Measles	518
Pneumonia	12
Scarlet fever:	
Lake County	11
St. Joseph County	10
Scattering	72
Smallpox:	
Delaware County	50
Grant County	9
Scattering	32
Tuberculosis	13
Whooping cough	106

IOWA.

Diphtheria	34
Scarlet fever	80
Smallpox	10
Typhoid fever	2

KANSAS.

Chicken pox	118
Diphtheria	51
German measles	5
Influenza	6
Measles	397
Mumps	159
Pneumonia	58
Poliomyelitis	1
Scarlet fever	101
Smallpox	44
Tetanus	1
Trichinosis	1
Tuberculosis	25
Typhoid fever	3
Whooping cough	89

LOUISIANA.

Diphtheria	29
Hookworm disease	88
Influenza	66
Measles	345
Pneumonia	50

LOUISIANA—continued.

	Cases.
Scarlet fever	6
Smallpox	7
Trachoma	29
Tuberculosis	31
Typhoid fever	9
Whooping cough	16

MAINE.

Cerebrospinal meningitis	2
Chicken pox	64
Conjunctivitis (infectious)	5
Diphtheria	14
German measles	21
Influenza	13
Measles	131
Mumps	53
Pneumonia	7
Scarlet fever	48
Septic sore throat	1
Typhoid fever	1
Tuberculosis	7
Vincent's angina	1
Whooping cough	60

MARYLAND.[1]

Cerebrospinal meningitis	1
Chicken pox	219
Diphtheria	42
German measles	2
Impetigo contagiosa	1
Influenza	70
Malaria	1
Measles	91
Mumps	6
Ophthalmia neonatorum	1
Paratyphoid fever	1
Pneumonia (all forms)	121
Poliomyelitis	1
Scarlet fever	112
Septic sore throat	2
Smallpox	3
Tuberculosis	42
Typhoid fever	7
Whooping cough	50

MASSACHUSETTS.

Cerebrospinal meningitis	2
Chicken pox	379
Conjunctivitis (suppurative)	17
Diphtheria	246
Dysentery	1
German measles	17
Hookworm disease	1
Influenza	12
Lethargic encephalitis	4
Measles	443
Mumps	265
Ophthalmia neonatorum	20
Pneumonia (lobar)	103
Poliomyelitis	4
Scarlet fever	450
Septic sore throat	3

[1] Week ended Friday.

MASSACHUSETTS—continued.

	Cases.
Smallpox	2
Tetanus	1
Trachoma	1
Trichinosis	13
Tuberculosis (all forms)	128
Typhoid fever	9
Whooping cough	136

MICHIGAN.

Diphtheria	254
Measles	474
Pneumonia	131
Scarlet fever	415
Smallpox	130
Tuberculosis	187
Typhoid fever	7
Whooping cough	87

MINNESOTA.

Cerebrospinal meningitis	1
Chicken pox	142
Diphtheria	98
Influenza	2
Measles	307
Pneumonia	8
Scarlet fever	316
Smallpox	45
Trachoma	7
Tuberculosis	126
Typhoid fever	6
Whooping cough	10

MISSISSIPPI.

Cerebrospinal meningitis	1
Diphtheria	10
Scarlet fever	2
Smallpox	7
Typhoid fever	7

MISSOURI.

(Exclusive of Cape Girardeau.)

Cerebrospinal meningitis	2
Chicken pox	100
Diphtheria	216
Influenza	24
Measles	871
Mumps	34
Pneumonia	47
Scarlet fever	145
Septic sore throat	3
Smallpox	6
Tetanus	1
Trachoma	1
Tuberculosis	68
Typhoid fever	5
Whooping cough	99

MONTANA.

Diphtheria	1
Scarlet fever	31
Smallpox	56
Typhoid fever	2

NEW JERSEY.

	Cases.
Chicken pox	336
Diphtheria	157
Influenza	34
Measles	333
Pneumonia	172
Poliomyelitis	2
Scarlet fever	190
Smallpox	18
Trachoma	1
Typhoid fever	6
Whooping cough	135

NEW MEXICO.

Chicken pox	14
Diphtheria	20
Influenza	3
Measles	38
Mumps	6
Pneumonia	11
Scarlet fever	6
Tuberculosis	15
Typhoid fever	12

NEW YORK.

(Exclusive of New York City.)

Cerebrospinal meningitis	2
Diphtheria	162
Influenza	34
Lethargic encephalitis	3
Measles	991
Pneumonia	292
Scarlet fever	412
Smallpox	2
Typhoid fever	34
Whooping cough	366

NORTH CAROLINA.

Cerebrospinal meningitis	1
Chicken pox	265
Diphtheria	42
German measles	7
Measles	1,850
Ophthalmia neonatorum	3
Scarlet fever	51
Septic sore throat	2
Smallpox	125
Whooping cough	747

OREGON

Chicken pox	22
Diphtheria:	
Portland	9
Scattering	10
Influenza	3
Lethargic encephalitis	[1] 1
Measles	413
Mumps	4
Pneumonia	[1] 6
Scarlet fever	18
Septic sore throat	2
Smallpox:	
Portland	12
Scattering	10
Tuberculosis	9
Typhoid fever	3
Whooping cough	9

[1] Deaths.

SOUTH DAKOTA.

	Cases.
Cerebrospinal meningitis	1
Chicken pox	64
Diphtheria	5
Influenza	14
Measles	264
Mumps	3
Pneumonia	3
Scarlet fever	62
Smallpox	5
Tuberculosis	1
Whooping cough	11

TEXAS.

Anthrax	1
Cerebrospinal meningitis	1
Chicken pox	25
Diphtheria	40
Influenza	25
Measles	116
Mumps	12
Pneumonia	13
Scarlet fever	25
Smallpox	23
Tuberculosis	18
Typhoid fever	2
Whooping cough	13

VERMONT.

Chicken pox	26
Diphtheria	22
Measles	101
Mumps	26
Pneumonia	1
Scarlet fever	13
Smallpox	2
Typhoid fever	2
Whooping cough	108

VIRGINIA.

Smallpox—Campbell County	1

WASHINGTON.

Chicken pox	85
Diphtheria:	
Pierce County	10
Scattering	24
Measles	2,818
Mumps	33
Pneumonia	1
Scarlet fever:	
King County	21
Spokane	43
Scattering	63
Smallpox:	
Spokane	43
Tacoma	10
Scattering	18
Tuberculosis	15
Typhoid fever	3
Whooping cough	22

WEST VIRGINIA.

Diphtheria	18
Scarlet fever	15
Typhoid fever	7

WISCONSIN.

Milwaukee:	Cases.
Chicken pox	7
Diphtheria	21
Measles	3
Pneumonia	6
Scarlet fever	41
Tuberculosis	17
Whooping cough	50
Scattering:	
Chicken pox	192
Diphtheria	80

WISCONSIN—continued.

Scattering—Continued.	Cases.
German measles	2
Influenza	29
Measles	234
Pneumonia	31
Poliomyelitis	1
Scarlet fever	327
Smallpox	22
Tuberculosis	52
Typhoid fever	5
Whooping cough	104

Reports for Week Ended January 19, 1924.

DISTRICT OF COLUMBIA.

	Cases.
Chicken pox	62
Diphtheria	11
Measles	4
Scarlet fever	36
Smallpox	4
Tuberculosis	21
Typhoid fever	1
Whooping cough	5

NEBRASKA.

Chicken pox	27
Diphtheria	15
Measles	197
Mumps	4
Scarlet fever	56

NEBRASKA—continued.

	Cases.
Smallpox	1
Whooping cough	6

NORTH DAKOTA.

Chicken pox	14
Diphtheria	12
German measles	2
Measles	265
Mumps	2
Pneumonia	16
Scarlet fever	54
Smallpox	8
Trachoma	1
Tuberculosis	7
Whooping cough	7

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.
October, 1923.										
Oklahoma	1	104	37	2	48	1	2	94	78	214
November, 1923.										
California	15	1,234	102	11	1,187	4	39	883	374	96
December, 1923.										
Idaho	.....	38	.....	.....	1,031	.....	.....	253	17	2
Illinois	4	1,118	100	3	1,953	.....	6	1,123	21	277
Iowa	2	173	.....	.....	283	.....	.....	338	30	16
Kansas	2	371	23	.....	614	.....	2	364	49	10
Maine	.....	81	7	.....	204	.....	1	138	2	15
Michigan	15	945	.....	.....	1,901	.....	.....	1,373	422	52
Mississippi	.....	138	1,206	3,327	1,880	146	1	37	82	46
New York	9	1,761	186	3	4,760	.....	36	2,205	56	92
North Carolina	3	379	.....	.....	4,979	.....	2	295	413	42
Oregon	1	331	3	.....	3,123	.....	1	102	66	11
Pennsylvania	10	2,016	.....	1	2,600	1	1	1,950	19	152
South Carolina	.....	164	45	5	690	1	.....	16	84	7
South Dakota	2	46	7	.....	893	.....	.....	256	13	4
Washington	2	164	.....	.....	5,036	.....	3	292	249	27
West Virginia	.....	222	123	.....	88	.....	2	271	12	44
Wisconsin	4	588	109	.....	1,358	.....	5	1,196	110	19

RECIPROCAL NOTIFICATION, DECEMBER, 1923.

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

Referred by—	Diphtheria.	Scarlet fever.	Smallpox.	Tuberculosis.	Typhoid fever.	Whooping cough.
Connecticut				1		1
Illinois			3	11	2	
Massachusetts					1	
Minnesota				28	1	
New Jersey					1	
New York	1	2	2			

CITY REPORTS FOR WEEK ENDED JANUARY 12, 1924.

The figures given in the following table are taken from reports made by city health officers to the Public Health Service.

The cities have been selected because of their locations, the aim being to cover the country as nearly as possible by reports from representative cities. Some cities are omitted because reports are not received.

The cities included in the table have an aggregate population of about 29,600,000.

Diphtheria.—Diphtheria appears to be slightly less prevalent in the cities included in the table than it was during the corresponding week last year. The number of cases reported is nearly the same as the calculated expectancy. This is a favorable showing, as the calculated expectancy is lower than the average for the last nine years.

Influenza.—Although influenza reports are incomplete, it is evident that the disease was less prevalent during the week ended January 12, 1924, than it was at the same time in 1923.

Scarlet fever.—In cities in most sections of the country the number of cases of scarlet fever reported during the week ended January 12, 1924, was somewhat greater than the calculated expectancy, and also slightly greater than last year.

Smallpox.—Smallpox of a mild type appears to be unusually prevalent on the Pacific coast. Cities in the East North Central and the South Atlantic States report more cases of this disease than last year. Very few deaths from smallpox are reported.

Typhoid fever.—A very slight increase over last year in the number of cases of typhoid fever is accounted for by outbreaks in two cities. The number of cases of typhoid fever reported is now so small that a local outbreak stands out prominently in the figures.

CITY REPORTS FOR WEEK ENDED JANUARY 12, 1924—Continued.

The "calculated expectancy," given for diphtheria, poliomyelitis, scarlet fever, smallpox, and typhoid fever, is the result of an attempt to ascertain from previous occurrence how many cases of the disease under consideration may be expected to occur during a certain week in the absence of epidemics. It is based on reports to the Public Health Service during the past nine years. It is in most instances the median number of cases reported in the corresponding week of the preceding years. When the reports include several epidemics, or when for other reasons the median is unsatisfactory, the epidemic periods are excluded and the calculated expectancy is the mean of the number of cases reported for the week during nonepidemic years.

If reports have not been received for the full nine years, data are used for as many years as possible, but no year earlier than 1915 is included. In obtaining the calculated expectancy, the figures are smoothed when necessary to avoid abrupt deviations from the usual trend. For some of the diseases given in the table the available data were not sufficient to make it practicable to compute the calculated expectancy.

Division, State, and city.	Chicken pox, cases reported.	Diphtheria.		Influenza.		Measles, cases reported.	Mumps, cases reported.	Pneumonia, deaths reported.	Scarlet fever.	
		Cases, calculated expectancy.	Cases reported.	Cases reported.	Deaths reported.				Cases, calculated expectancy.	Cases reported.
NEW ENGLAND.										
Maine:										
Lewiston	1	2	0	0	0	1	1	2	1	1
Portland	.....	3	0	0	0	7	.....	4	2	1
New Hampshire:										
Concord	0	1	0	0	0	4	0	0	1	0
Nashua	0	1	0	0	0	13	0	0	2	0
Vermont:										
Barre	5	0	0	0	1	4	0	0	0	2
Burlington	.....	1	0	0	0	0	.....	1	2	2
Massachusetts:										
Boston	111	66	57	2	3	99	24	42	53	124
Fall River	15	7	5	1	0	1	0	6	3	2
Springfield	26	4	7	1	0	28	9	5	6	13
Worcester	19	5	16	0	0	2	46	7	10	27
Rhode Island:										
Pawtucket	1	2	2	0	0	0	0	0	1	2
Providence	0	16	18	1	0	1	0	6	9	56
Connecticut:										
Bridgeport	0	9	8	1	3	0	0	0	5	5
Hartford	.....	7	8	0	0	12	.....	3	8	36
New Haven	37	8	2	0	2	3	52	7	7	19
MIDDLE ATLANTIC.										
New York:										
Buffalo	0	28	27	1	0	22	0	20	19	35
New York	315	275	214	47	15	485	132	230	172	194
Rochester	27	13	7	0	0	0	1	6	10	13
Syracuse	38	10	14	0	0	58	2	5	12	65
New Jersey:										
Camden	.....	5	8	0	0	0	.....	3	2	4
Newark	49	26	19	17	1	12	40	14	23	18
Trenton	3	6	22	1	1	9	0	8	3	5
Pennsylvania:										
Philadelphia	.....	75	124	2	4	37	.....	108	53	62
Pittsburgh	.....	25	32	0	3	15	.....	53	23	47
Reading	.....	5	9	0	0	1	.....	1	2	2
EAST NORTH CENTRAL.										
Ohio:										
Cincinnati	16	19	12	0	0	35	3	12	10	8
Cleveland	105	36	39	10	3	7	90	25	43	32
Columbus	.....	6	10	0	0	2	.....	6	6	9
Indiana:										
Fort Wayne	0	3	12	0	0	3	0	4	2	13
Indianapolis	0	22	7	0	2	14	119	16	15	7
South Bend	.....	2	11	0	0	1	.....	1	4	10
Terre Haute	0	2	1	0	1	2	0	4	2	2
Illinois:										
Chicago	252	176	136	21	7	56	91	78	170	145
Cicero	12	3	2	0	0	0	9	1	1	1
Springfield	4	3	0	1	1	0	0	4	2	6
Michigan:										
Detroit	99	83	72	1	3	87	52	36	78	82
Flint	30	9	16	0	0	134	12	4	10	3
Grand Rapids	.....	5	1	0	0	4	.....	2	6	13
Saginaw	10	2	2	0	0	14	16	1	2	20

CITY REPORTS FOR WEEK ENDED JANUARY 12, 1924—Continued.

Division, State, and city.	Chicken pox, cases reported.	Diphtheria.		Influenza.		Measles, cases reported.	Mumps, cases reported.	Pneumonia, deaths reported.	Scarlet fever.	
		Cases, calculated expectancy.	Cases reported.	Cases reported.	Deaths reported.				Cases, calculated expectancy.	Cases reported.
EAST NORTH CENTRAL—continued.										
Wisconsin:										
Madison	17	1	3	0	0	0	0	0	3	7
Milwaukee	96	23	19	0	0	4	0	8	37	34
Racine	3	2	8	0	0	2	0	1	4	32
Superior	1	1	3	0	0	5	0	1	2	0
WEST NORTH CENTRAL.										
Minnesota:										
Duluth	4	4	2	0	0	20	0	5	5	16
Minneapolis	94	20	33	0	0	21	0	15	24	92
St. Paul	.....	16	9	0	0	21	.....	10	14	47
Iowa:										
Des Moines	1	4	3	0	.....	16	0	.....	9	5
Sioux City	2	2	4	0	.....	10	0	.....	3	5
Waterloo	4	1	0	0	.....	9	3	.....	2	6
Missouri:										
Kansas City	24	14	4	3	4	111	9	11	12	13
St. Joseph	5	5	1	0	0	62	3	10	4	3
St. Louis	26	73	38	0	0	6	6	.....	28	70
North Dakota:										
Fargo	0	0	0	0	0	0	0	0	1	0
Grand Forks	1	1	0	0	.....	0	.....	.....	1	2
South Dakota:										
Sioux Falls	1	1	1	0	0	108	.....	0	2	2
Nebraska:										
Omaha	13	6	4	0	0	28	.....	11	7	4
Kansas:										
Topeka	26	3	1	0	0	25	0	1	3	0
Wichita	11	3	5	0	0	23	100	4	3	5
SOUTH ATLANTIC.										
Delaware:										
Wilmington	.....	2	8	0	0	1	.....	11	2	0
Maryland:										
Baltimore	182	37	27	26	2	29	3	39	30	54
Cumberland	.....	1	0	3	0	0	.....	0	1	1
Frederick	0	1	1	0	0	0	0	0	.....	0
District of Columbia:										
Washington	50	20	18	1	0	8	0	16	20	21
Virginia:										
Lynchburg	11	1	0	0	0	1	1	3	0	0
Norfolk	0	4	4	0	0	47	0	8	1	1
Richmond	.....	6	7	0	0	1	.....	7	5	13
Roanoke	4	2	1	0	1	2	0	1	1	4
West Virginia:										
Charleston	0	2	4	0	0	0	0	3	1	1
Huntington	.....	3	1	0	0	0	.....	4	1	1
Wheeling	5	1	3	0	0	0	0	5	1	4
North Carolina:										
Raleigh	20	1	2	0	0	3	0	0	0	4
Wilmington	0	1	2	0	0	31	0	5	1	1
Winston-Salem	0	1	1	0	0	99	0	5	1	2
South Carolina:										
Charleston	0	2	0	0	0	19	0	5	1	1
Columbia	4	1	2	0	0	67	7	5	1	1
Greenville	3	1	0	0	0	17	3	2	0	1
Georgia:										
Atlanta	1	3	4	3	2	19	2	20	4	4
Brunswick	0	0	0	0	0	4	0	0	0	0
Savannah	0	2	2	0	0	15	0	5	1	0
Florida:										
St. Petersburg	0	.....	0	0	0	60	0	1	.....	0
Tampa	0	2	0	0	0	16	0	2	1	0

CITY REPORTS FOR WEEK ENDED JANUARY 12, 1924—Continued.

Division, State, and city.	Chicken pox, cases reported.	Diphtheria.		Influenza.		Measles, cases reported.	Mumps, cases reported.	Pneumonia, deaths reported.	Scarlet fever.	
		Cases, calculated expectancy.	Cases reported.	Cases reported.	Deaths reported.				Cases, calculated expectancy.	Cases reported.
EAST SOUTH CENTRAL.										
Kentucky:										
Covington	0	2	4	1	1	0	0	2	1	7
Louisville	.....	10	2	3	0	0	.....	15	5	7
Tennessee:										
Memphis	28	7	7	0	0	62	7	7	3	7
Nashville	0	2	1	0	1	0	0	8	2	1
Alabama:										
Birmingham	2	2	5	3	2	29	9	8	4	5
Mobile	0	1	1	0	2	0	0	0	1	0
Montgomery	.....	1	0	3	0	1	.....	3	1	0
WEST SOUTH CENTRAL.										
Arkansas:										
Fort Smith	5	1	0	0	.....	3	0	.....	1	0
Little Rock	3	1	1	3	.....	3	8	.....	2	5
Louisiana:										
New Orleans	3	14	16	5	3	30	0	17	3	4
Shreveport	0	.....	3	0	0	14	1	3	.....	1
Oklahoma:										
Oklahoma	2	2	1	0	2	11	2	3	3	0
Texas:										
Dallas	8	6	11	1	1	317	16	4	2	5
Galveston	0	2	2	0	0	0	0	4	1	1
Houston	.....	3	1	0	0	1	.....	3	0	3
San Antonio	1	1	2	0	1	7	1	13	1	1
MOUNTAIN.										
Montana:										
Billings	2	1	0	1	0	138	0	0	2	1
Great Falls	13	1	1	0	0	39	0	0	1	4
Helena	0	.....	0	0	0	0	0	1	.....	0
Missoula	3	0	1	0	0	1	0	1	1	1
Idaho:										
Boise	.....	1	0	.....	.....	0	.....	.....	1	1
Colorado:										
Denver	30	8	9	0	0	31	2	21	8	12
Pueblo	3	5	2	.....	1	123	1	3	2	2
New Mexico:										
Albuquerque	.....	1	0	0	0	8	.....	1	1	1
Utah:										
Salt Lake City	42	3	6	0	0	126	19	5	5	4
Nevada:										
Reno	0	0	0	0	0	0	0	1	0	0
PACIFIC.										
Washington:										
Seattle	11	6	4	0	.....	1,315	1	.....	9	16
Spokane	7	3	3	0	.....	409	0	.....	2	7
Tacoma	14	2	5	0	.....	171	4	.....	4	1
Oregon:										
Portland	23	7	10	0	0	147	2	10	7	1
California:										
Los Angeles	72	25	74	20	4	27	0	25	15	85
Sacramento	.....	2	11	0	0	3	.....	3	2	3
San Francisco	.....	18	71	6	1	108	.....	17	15	33

CITY REPORTS FOR WEEK ENDED JANUARY 12, 1924—Continued.

Division, State, and city.	Population July 1, 1923, estimated.	Smallpox.			Tuberculosis deaths reported.	Typhoid fever.			Whooping cough, cases reported.	Deaths, all causes.
		Cases, calculated expectancy.	Cases reported.	Deaths reported.		Cases, calculated expectancy.	Cases reported.	Deaths reported.		
NEW ENGLAND.										
Maine:										
Lewiston	33,790	0	0	0	0	0	1	0	0	17
Portland	73,129	0	0	0	0	1	0	0	.....	25
New Hampshire:										
Concord	22,408	0	0	0	0	0	0	0	0	8
Nashua	29,234	0	0	0	0	0	0	0	0	5
Vermont:										
Barre	[1] 10,008	0	0	0	0	0	0	0	5	3
Burlington	23,613	0	2	0	1	0	0	0	.....	8
Massachusetts:										
Boston	770,400	0	0	0	15	1	0	0	10	225
Fall River	120,912	0	0	0	1	1	0	0	19	28
Springfield	144,227	0	0	0	2	0	0	0	0	42
Worcester	191,927	0	0	0	2	0	1	0	1	51
Rhode Island:										
Pawtucket	68,799	0	0	0	2	0	0	0	0	14
Providence	242,378	0	0	0	2	0	0	0	2	51
Connecticut:										
Bridgeport	[1] 143,555	0	0	0	2	0	0	0	0	31
Hartford	[1] 138,036	0	0	0	3	0	0	0	.....	37
New Haven	172,967	0	0	0	1	0	0	0	4	46
MIDDLE ATLANTIC.										
New York:										
Buffalo	536,718	0	0	0	14	1	0	0	50	166
New York	5,927,625	0	0	0	[2] 80	14	21	2	102	1,497
Rochester	317,867	0	0	0	3	1	0	0	17	60
Syracuse	184,511	0	0	0	0	1	2	0	4	36
New Jersey:										
Camden	124,157	0	0	0	5	0	1	0	.....	28
Newark	438,699	0	1	0	4	1	0	0	20	106
Trenton	127,390	0	0	0	4	1	0	0	0	52
Pennsylvania:										
Philadelphia	1,922,788	0	0	0	33	5	3	1	.....	564
Pittsburgh	613,442	0	0	0	14	3	1	0	.....	186
Reading	110,917	0	0	0	0	0	1	0	.....	25
EAST NORTH CENTRAL.										
Ohio:										
Cincinnati	406,312	2	1	0	10	1	1	0	18	118
Cleveland	888,519	2	2	0	21	2	1	0	36	196
Columbus	261,082	0	1	0	3	1	0	0	.....	67
Indiana:										
Fort Wayne	93,573	2	1	0	0	0	0	0	2	16
Indianapolis	342,718	3	17	0	8	1	2	0	13	100
South Bend	76,709	0	0	0	0	0	1	0	.....	13
Terre Haute	68,939	0	0	0	1	0	0	0	5	22
Illinois:										
Chicago	2,886,121	2	3	0	41	4	21	2	21	815
Cicero	55,968	0	0	0	3	0	0	0	0	7
Springfield	61,833	0	0	0	1	0	0	0	4	28
Michigan:										
Detroit	995,668	5	25	1	19	3	0	0	24	277
Flint	117,968	2	1	0	3	1	0	0	0	29
Grand Rapids	145,947	1	3	0	2	1	0	0	.....	40
Saginaw	69,754	0	0	0	2	1	0	0	6	23
Wisconsin:										
Madison	42,519	0	0	0	0	0	0	0	1	3
Milwaukee	484,595	5	1	0	6	1	0	0	49	93
Racine	64,393	1	1	0	1	0	0	0	2	18
Superior	[1] 39,671	2	2	0	0	0	1	0	.....	9
WEST NORTH CENTRAL.										
Minnesota:										
Duluth	106,289	1	11	0	1	0	0	0	0	22
Minneapolis	409,125	14	6	0	6	1	0	0	0	102
St. Paul	241,891	17	25	0	4	0	0	0	.....	71

[1] Population Jan. 1, 1920.

[2] Pulmonary only.

CITY REPORTS FOR WEEK ENDED JANUARY 12, 1924—Continued.

Division, State, and city.	Population July 1, 1923, estimated.	Smallpox.			Tuberculosis deaths reported.	Typhoid fever.			Whooping cough, cases reported.	Deaths, all causes.
		Cases, calculated expectancy.	Cases reported.	Deaths reported.		Cases, calculated expectancy.	Cases reported.	Deaths reported.		
WEST NORTH CENTRAL—contd.										
Iowa:										
Des Moines	140,923	3	2	.....	.....	0	0	.....	0	.....
Sioux City	79,662	3	0	.....	.....	0	0	.....	0	.....
Waterloo	39,667	0	0	.....	.....	0	0	.....	4	.....
Missouri:										
Kansas City	351,819	10	0	0	15	0	0	0	6	121
St. Joseph	78,232	1	0	0	3	0	0	0	0	28
St. Louis	803,853	2	1	0	11	3	1	0	47	244
North Dakota:										
Fargo	24,841	1	0	.....	.....	0	0	.....	0	8
Grand Forks	14,547	0	0	.....	.....	0	0	.....	.....	.....
South Dakota:										
Sioux Falls	29,206	2	1	0	0	0	0	0	1	6
Nebraska:										
Omaha	204,382	5	0	0	0	1	0	0	.....	51
Kansas;										
Topeka	52,555	1	0	0	1	0	0	0	2	21
Wichita	79,261	2	5	0	1	0	0	0	2	21
SOUTH ATLANTIC.										
Delaware:										
Wilmington	117,728	0	0	0	1	1	0	0	.....	35
Maryland:										
Baltimore	773,580	0	0	0	27	3	2	1	18	254
Cumberland	32,361	0	0	0	0	0	0	0	.....	11
Frederick	11,301	.....	0	0	0	0	0	0	0	5
District of Columbia:										
Washington	[1] 437,571	0	1	1	9	2	1	0	3	135
Virginia:										
Lynchburg	30,277	0	0	0	0	0	0	0	10	12
Norfolk	159,089	0	0	0	2	0	0	0	7	.....
Richmond	181,044	0	0	0	5	1	0	0	.....	63
Roanoke	55,502	0	0	0	0	0	2	0	2	15
West Virginia:										
Charleston	45,597	0	0	0	3	0	0	0	0	20
Huntington	57,918	0	0	0	2	0	0	0	.....	21
Wheeling	[1] 56,208	0	0	0	0	1	2	0	0	15
North Carolina:										
Raleigh	29,171	0	0	0	1	0	0	0	2	10
Wilmington	35,719	0	0	0	0	0	0	0	0	12
Winston-Salem	56,230	3	3	0	3	0	0	0	0	25
South Carolina:										
Charleston	71,245	0	0	0	2	0	0	0	2	24
Columbia	39,688	0	0	0	3	0	0	0	1	24
Greenville	25,789	0	0	0	0	0	0	0	1	6
Georgia:										
Atlanta	222,963	3	48	0	8	0	0	0	.....	101
Brunswick	15,937	0	0	0	0	0	0	0	0	3
Savannah	89,448	0	0	0	3	1	2	0	0	45
Florida:										
St. Petersburg	24,403	.....	0	0	0	.....	0	0	0	10
Tampa	56,050	0	0	0	1	1	0	0	0	19
EAST SOUTH CENTRAL.										
Kentucky:										
Covington	57,877	0	0	0	1	0	0	0	0	13
Louisville	257,671	0	0	0	3	1	0	0.	.....	104
Tennessee:										
Memphis	170,067	1	0	0	0	0	0	0	7	51
Nashville	121,128	1	0	0	4	1	0	0	0	59
Alabama:										
Birmingham	195,901	0	7	0	4	1	0	0	3	54
Mobile	63,858	0	0	0	3	0	0	2	0	25
Montgomery	45,383	0	0	0	0	0	0	0	.....	21

[1] Population Jan. 1, 1920.

CITY REPORTS FOR WEEK ENDED JANUARY 12, 1924—Continued.

Division, State, and city.	Population July 1, 1923, estimated.	Smallpox.			Tuberculosis deaths reported.	Typhoid fever.			Whooping cough, cases reported.	Deaths, all causes.
		Cases, calculated expectancy.	Cases reported.	Deaths reported.		Cases, calculated expectancy.	Cases reported.	Deaths reported.		
WEST SOUTH CENTRAL.										
Arkansas:										
Fort Smith	30,635	0	0	.....	.....	0	0	.....	1	.....
Little Rock	70,916	1	0	.....	.....	0	0	.....	0	.....
Louisiana:										
New Orleans	404,575	4	1	0	17	4	6	0	0	155
Shreveport	54,590	.....	9	0	7	.....	0	0	0	34
Oklahoma:										
Oklahoma	101,150	2	0	0	2	0	2	0	0	28
Texas:										
Dallas	177,274	3	0	0	3	0	1	1	0	47
Galveston	46,877	0	0	0	2	1	1	0	0	23
Houston	151,970	1	0	0	3	0	0	0	.....	57
San Antonio	184,727	0	0	0	11	0	0	0	0	66
MOUNTAIN.										
Montana:										
Billings	16,027	0	0	0	0	0	0	0	0	3
Great Falls	27,787	2	0	0	0	0	0	0	2	9
Helena	[1] 12,037	.....	0	0	1	.....	0	0	0	8
Missoula	[1] 12,668	0	1	0	0	0	0	0	0	8
Idaho:										
Boise	22,806	0	0	0	0	0	0	0	0	6
Colorado:										
Denver	272,031	8	0	0	7	0	0	0	6	102
Pueblo	43,519	0	0	0	0	0	1	0	0	8
New Mexico:										
Albuquerque	16,648	0	0	0	6	1	0	0	.....	12
Utah:										
Salt Lake City	126,241	4	1	0	1	0	1	0	1	33
Nevada:										
Reno	12,429	0	0	0	0	0	0	0	0	3
PACIFIC.										
Washington:										
Seattle	[1] 315,685	3	3	.....	.....	0	2	.....	0	.....
Spokane	104,573	6	24	.....	.....	0	0	.....	0	.....
Tacoma	101,731	1	2	.....	.....	1	0	.....	1	.....
Oregon:										
Portland	273,621	6	8	0	2	1	0	0	2	.....
California:										
Los Angeles	666,853	2	131	0	33	2	1	0	2	274
Sacramento	69,950	0	0	0	1	0	0	0	.....	24
San Francisco	539,038	0	0	0	12	1	1	0	.....	167

[1] Population Jan. 1, 1920.

CITY REPORTS FOR WEEK ENDED JANUARY 12, 1924—Continued.

Division, State, and city.	Cerebro-spinal meningitis.		Lethargic encephalitis.		Pellagra.		Poliomyelitis (infantile paralysis).			Typhus fever.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Calculated expectancy.	Cases.	Deaths.	Cases.	Deaths.
NEW ENGLAND.											
New Hampshire:											
Nashua	0	1	0	0	0	0	0	0	0	0	0
Massachusetts:											
Boston	1	0	1	0	0	0	0	1	0	0	0
Rhode Island:											
Pawtucket	0	1	0	0	0	0	0	0	0	0	0
MIDDLE ATLANTIC.											
New York:											
Buffalo	1	0	0	0	0	0	0	0	0	0	0
New York	4	2	3	4	0	0	1	3	0	0	0
Pennsylvania:											
Philadelphia	1	0	0	0	0	0	0	0	0	0	0
EAST NORTH CENTRAL.											
Ohio:											
Cincinnati	0	0	0	1	0	0	0	0	0	0	0
Cleveland	1	0	0	0	0	0	0	0	0	0	0
Illinois:											
Chicago	0	2	0	0	0	0	1	1	0	0	0
Michigan:											
Detroit	0	0	2	1	0	0	0	0	0	0	0
Flint	1	0	0	0	0	0	0	0	0	0	0
WEST NORTH CENTRAL.											
Missouri:											
St. Louis	1	0	0	0	0	0	0	0	0	0	0
SOUTH ATLANTIC.											
Maryland:											
Baltimore	0	0	1	1	0	0	0	0	0	1	0
Virginia:											
Roanoke	1	1	0	0	0	0	0	0	0	0	0
West Virginia:											
Wheeling	0	0	1	1	0	0	0	0	0	0	0
North Carolina:											
Raleigh	0	0	0	1	0	0	0	0	0	0	0
South Carolina:											
Columbia	0	1	0	0	0	2	0	0	0	0	0
Georgia:											
Atlanta	0	0	0	0	0	1	0	0	0	0	0
EAST SOUTH CENTRAL.											
Alabama:											
Birmingham	0	0	0	0	0	1	0	0	0	0	0
WEST SOUTH CENTRAL.											
Texas:											
Houston	0	0	0	0	0	2	0	0	0	0	0
MOUNTAIN.											
New Mexico:											
Albuquerque	0	0	0	0	0	0	.....	1	0	0	0
PACIFIC.											
California:											
San Francisco	1	1	0	0	0	0	0	0	0	0	0

FOREIGN AND INSULAR.

PLAGUE ON VESSEL.

Mombasa, British East Africa.

Under date of December 18, 1923, four cases of plague were reported removed from a plague-infected ship arrived at Mombasa, British East Africa, December 11, 1923. Two of the cases ended fatally. The name and itinerary of the vessel were not stated.

BELGIUM.

Communicable Diseases—Brussels—November, 1923.

Communicable diseases were notified at Brussels, Belgium, during the month of November, as follows:

Disease.	Cases.	Deaths.
Cerebrospinal meningitis	1	1
Diphtheria	5	.....
Measles	10	.....
Scarlet fever	19	.....
Smallpox	10	.....
Tuberculosis	28	108
Typhoid fever	3	1

Population, census Dec. 31, 1922, 811,690. Present officially estimated, 803,578.

BRAZIL.

Death from Leprosy—Para.

During the week ended December 16, 1923, a death from leprosy was notified at Para, Brazil.

CUBA.

Communicable diseases—Habana.

Communicable diseases have been notified at Habana, as follows:

Disease.	Jan. 1–10, 1924.		Remaining under treatment Jan. 10, 1924.
	New cases.	Deaths.	
Cerebrospinal meningitis	1	1	.....
Chicken pox	3	.....	6
Diphtheria	5	.....	8
Leprosy	.....	.....	14
Malaria	19	.....	[1] 34
Measles	4	.....	4
Scarlet fever	.....	.....	1
Typhoid fever	12	2	[2] 16

[1] From the interior, 28.

[2] From the interior, 10.

ECUADOR.

Plague.

During the period December 1 to 15, 1923, 11 cases of plague with 4 deaths were notified at Guayaquil, Ecuador, and 1 case at Vino del Milagro. At Jipijapa (Manabi) plague was reported present.

Plague—Infected Rats—Guayaquil.

During the period under report, out of 16,754 rats taken at Guayaquil, 57 rats were found plague infected.

ESTHONIA.

Communicable Diseases—November, 1923.

During the month of November, 1923, communicable diseases were reported in the Republic of Esthonia as follows:

Disease.	Cases.	Remarks.
Cerebrospinal meningitis	1	
Diphtheria	29	
Measles	10	
Scarlet fever	49	
Smallpox	32	
Tuberculosis	96	
Typhoid fever	65	Paratyphus fever, 8 cases.

GERMANY.

Paratyphus Fever—Munich.

During the week ended December 8, 1923, 2 cases of paratyphus fever with 1 death were reported at Munich, Germany.

GUADELOUPE (WEST INDIES).

Smallpox (Reported as Alastrim).

Information received under date of January 2, 1924, shows that smallpox (reported as alastrim) continues present in Guadeloupe. Cases of the disease were stated to be present at Moule, a town in the vicinity of Pointe à Pitre, and in the southern section of the capital, Basse-Terre.

ITALY.

Quarantine Against Malaga and Las Palmas.

According to information dated December 19, 1923, vessels arriving at Italian ports from Malaga, Spain, and Las Palmas, Canary Islands, have been made subject to quarantine measures against plague.

JAMAICA.

Smallpox (Reported as Alastrim)—Typhoid Fever—Chicken Pox.

WEEK ENDED DECEMBER 22, 1923.[1]

During the week ended December 22, 1923, 17 cases of smallpox (reported as alastrim) were notified in the Island of Jamaica.

During the period under report, 16 cases of typhoid fever were notified at Kingston and 1 case was notified for the surrounding country.

WEEK ENDED JANUARY 5, 1924.

During the week ended January 5, 1924, 24 cases of smallpox (alastrim) were notified in the Island of Jamaica. Of these, 2 cases were notified in the parish of Kingston.

During the same period, 16 cases of typhoid fever were notified at Kingston and 3 cases in the surrounding country.

CHICKEN POX—ST. ANDREW.

During the week ended January 5, 1924, three cases of chicken pox were notified in St. Andrew, Jamaica.

PERSIA.

Mortality from Communicable Diseases—Teheran.

During the period September 24–October 23, 1923, deaths from communicable diseases were reported at Teheran, Persia, as follows: Measles, 8; poliomyelitis, 2; smallpox, 1; tuberculosis, 39; typhoid fever, 9; typhus fever, 1.

POLAND.

Communicable Diseases—October 21–November 3, 1923.

Communicable diseases have been notified in Poland as follows:

October 21–27, 1923.

Disease.	Cases.	Deaths.	Districts showing greatest number of deaths.
Cerebrospinal meningitis	11	7	Not reported.
Diphtheria	132	9	Posen.
Measles	358	5	Warsaw.
Scarlet fever	627	49	Tarnopol.
Smallpox	3	2	Krakow.
Tuberculosis	61	147	Warsaw.
Typhoid fever	517	52	Lodz.
Typhus fever	38	3	Lwow.
Typhus fever, recurrent	16	.....	Not reported.
Whooping cough	172	4	Stanislawow.

[1] Public Health Reports, Jan. 18, 1924, p. 133 ,and Jan. 25, 1924, p. 172.

October 28–November 3, 1923.

Disease.	Cases.	Deaths.	Districts showing greatest mortality.
Cerebrospinal meningitis	11	6	Lodz.
Diphtheria	104	8	Warsaw.
Measles	245	8	Do.
Scarlet fever	600	59	Lwow.
Smallpox	6	.....	Not reported.
Tuberculosis	47	135	Warsaw.
Typhoid fever	380	37	Lodz.
Typhus fever	36	8	Kielce.
Typhus fever, recurrent	6	.....	Not reported.
Whooping cough	199	3	Lwow.

Population, census of Sept. 30, 1923, 27,160,163.

Dysentery—Malaria.

During the period under report, dysentery and malaria were reported in Poland as follows: Week ended October 27, 1923—*dysentery*, 197 cases, 43 deaths, district of highest mortality, Lwow; *malaria*, 21 cases. Week ended November 3, 1923—*dysentery*, 112 cases, 22 deaths, district of highest mortality, Stanislawow; *malaria*, 13 cases.

PORTUGAL.

Plague—Lisbon.

Information has been received showing the occurrence at Lisbon, Portugal, from December 13 to 21, 1923, of seven cases of plague.

SOVIET RUSSIA.

Anthrax.

Under date of November 11, 1923, an epidemic outbreak of anthrax, believed to have originated in Siberia, was reported as having occurred in different localities of Soviet Russia, with greatest prevalence reported in the Crimea.

Malaria.

Under date of December 22, 1923, malaria was reported widely prevalent in epidemic form in Soviet Russia, and the president of the all-Russia central executive committee had permitted the commissariat of health to convoke the second all-Russia malaria congress at Moscow on January 14, 1924.

Malaria was stated to have become a veritable scourge in the trans-Caucasus Republics during the past few years, data for 1921 and 1922, compiled by the Gruzinian people's commissariat, showing an incidence in various localities of Gruzia up to 80 per cent or more of the population. It is reported to be the most important of all the communicable diseases in Armenia, in the valley of the Araxes, cases of the disease constituting 50 per cent of all diseases. It was stated that, in the lower areas of the trans-Caucasus, over 1,000,000

persons were infected, most of whom were not receiving medical treatment; also that malaria was retarding the agricultural and industrial development of the region, decreasing the population, and reducing the efficiency of labor. In the district of Chavka practically all workers were stated to be ill with the disease.

Some drainage to prevent mosquito breeding has been done in the Batum Sea shore district, but it was said that little had been done in the trans-Caucasus. Because of the prohibitive cost, regular quinine treatment could not be carried out in Gruzia.

TURKEY.

Cholera—Plague—Constantinople.

During the week ended December 8, 1923, a death from cholera was reported at Constantinople, Turkey. During the two weeks ended December 15, 1923, five cases of plague with two deaths were reported at Constantinople.

UNION OF SOUTH AFRICA.

Further Information Relative to Typhus Fever—Durban.[1]

Further information relative to the outbreak of typhus fever at Durban, Natal, Union of South Africa, reported November 23, 1923, shows the occurrence of 23 new cases during the week ended November 24, 1923, and one case during the week ended December 1, 1923.

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 lists of countries included or the figures for the particular countries for which reports are given.

Reports Received During Week Ended February 1, 1924.[a]

CHOLERA.

Place.	Date.	Cases.	Deaths.	Remarks.
China:				
Hongkong	Nov. 18-24	1		
India				Nov. 11-17, 1923: Cases, 1,401; deaths, 847.
Madras	Dec. 9-15	3	2	
Turkey:				
Constantinople	Dec. 2-8		1	

PLAGUE.

British East Africa:				
Kenya—				
Mombasa	Dec. 9-15	4	2	Removed from ship arrived at Mombasa, Dec. 11, 1923.
Tanganyika	Nov. 4-24	5		
Ceylon:				
Colombo	Nov. 25-Dec. 8	10	6	Plague-infected rats, five (5). Found, Nov. 25-Dec. 1, 1923.

[1] Public Health Reports, Jan. 11, 1924, p. 82, and Jan. 18, 1924, p. 134.
[a] From medical officers of the Public Health Service, American consuls, and other sources.

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

Report Received During Week Ended February 1, 1924—Continued.

PLAGUE—Continued.

Place.	Date.	Cases.	Deaths.	Remarks.
Ecuador:				
Guayaquil	Dec. 1–15	11	4	Rats taken, 16,751; found infected, 57.
Jipijapa	do			Present.
Vino del Milagro	do	1		
India				Nov. 11–17, 1923: Cases, 4,285; deaths, 2,950.
Bombay	Dec. 2–8	1	1	
Karachi	Dec. 9–22	8	6	
Madras Presidency	Dec. 9–15	237	138	
Rangoon	Dec. 2–8	1	1	
Portugal:				
Lisbon	Dec. 13–21	7		
Syria:				
Beirut	Dec. 1–10	1		
Turkey:				
Constantinople	Dec. 2–15	5	2	
On vessel:				
Ship ——	Dec. 11	4	2	At Mombasa, British East Africa.

SMALLPOX.

Brazil:				
Pernambuco	Nov. 25–Dec. 1	1	1	
Belgium:				
Brussels	Nov. 1–30	10		
British East Africa:				
Tanganyika	Oct. 21–27	6		
China:				
Amoy	Dec. 2–8			Present.
Chungking	Dec. 2–15			Present.
Foochow	Dec. 9–15			Present.
Hongkong	Nov. 18–Dec. 8	322	257	
Manchuria—				
Harbin	Nov. 26–Dec. 9	8		
Nanking	Dec. 2–15			Present.
Esthonia				Nov. 1–30, 1923: Cases, 32.
Guadeloupe (West Indies)				Jan. 2, 1924: Present.
India				Nov. 11–17, 1923: Cases, 1,020; deaths, 253.
Bombay	Dec. 2–8	10	4	
Madras	Dec. 9–15	2		
Rangoon	Dec. 2–8	2	1	
Indo-China:				
City—				
Saigon	Nov. 18–Dec. 1	23	15	Including 100 sq. km. of surrounding country.
Jamaica				Dec. 16–22, 1923: Cases, 17 (reported as alastrim). For week ended Dec. 29, 1923, see Public Health Reports, Jan. 25, 1924.
Do				Dec. 30, 1923–Jan. 5, 1924: Cases 24. (Reported as alastrim.)
Kingston	Dec. 30–Jan. 5	2		
Java:				
East Java—				
Soerabaya	Nov. 4–10	70	10	
West Java—				
Batavia	Nov. 17–23	32	4	
Mexico:				
Manzanillo	Dec. 4–10	5	1	
Mexico City	Dec. 9–22	19		
Vera Cruz	Jan. 6–13		1	
Persia:				
Teheran	Sept. 24–Oct. 23		1	
Poland				Oct. 21–Nov. 3, 1923: Cases, 9; deaths, 2.
Portugal:				
Oporto	Dec. 16–29	13	9	
Siam:				
Bangkok	Nov. 25–Dec. 1			Epidemic.
Spain:				
Valencia	Dec. 23–29	33	2	
Switzerland:				
Berne	Dec. 16–22	3		
Syria:				
Damascus	Dec. 9–15	3		
Turkey:				
Constantinople	Dec. 2–8	1		

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

Reports Received During Week Ended February 1, 1924—Continued.

SMALLPOX—Continued.

Place.	Date.	Cases.	Deaths.	Remarks.
Union of South Africa:				
Cape Province	Nov. 18-24			Outbreaks.
Orange Free State	....do			Do.
Transvaal	Nov. 18-Dec. 1			Do.
On vessels:				
S. S. Torres	Jan. 14	1		At New Orleans quarantine station from Tampico, Mexico, via ports. Case in seaman signed on at Galveston, Tex., on outward voyage.
S. S. Vasari	Dec. 31	1		At Trinidad, West Indies, from Buenos Aires, Argentina. Vessel left Buenos Aires Dec. 15, 1923, for New York, via Santos, Rio de Janeiro, Trinidad, Barbados.

TYPHUS FEVER.

Bulgaria:				
Sofia				Dec. 2-15, 1923: Paratyphus fever, cases four (4).
Egypt:				
Cairo	Oct. 8-14	24	1	
Esthonia				Nov. 1-30, 1923: Paratyphus fever, 8 cases.
Mexico:				
Mexico City	Dec. 9-22	31		Including municipalities in Federal district.
Persia:				
Teheran	Sept. 24-Oct. 23		1	
Poland				Oct. 21-Nov. 3, 1923: Cases, 74; deaths, 11. Recurrent typhus: Cases 22.
Union of South Africa:				
Cape Province	Nov. 25-Dec. 1			Outbreaks.
Natal—				
Durban	Nov. 18-Dec. 1	24		Week ended Nov. 24, 1923, 23 cases; week ended Dec. 1, 1923, 1 case.
Transvaal	....do			Outbreaks.

Reports Received from December 29, 1923, to January 25, 1924.[1]

CHOLERA.

Place.	Date.	Cases.	Deaths.	Remarks.
India				Oct. 14-Nov. 10, 1923: Cases, 3,343; deaths, 2,217.
Calcutta	Nov. 11-Dec. 8	41	27	
Madras	Nov. 25-Dec. 8	6	1	
Rangoon	Nov. 11-Dec. 1	2	2	
Siam:				
Bangkok	Nov. 18-24	2		

PLAGUE.

Azores:				
St. Michael Island	Oct. 20-Nov. 10	9	5	At localities 3 to 9 miles from port of Ponta Delgada.
Bolivia:				
La Paz	Oct. 1-31		3	
Brazil:				
Bahia	Nov. 11-17	1	1	Nov. 25-Dec. 8, 1923: Cases, 2; deaths, 1.

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

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

Reports Received from December 29, 1923, to January 25, 1924—Continued.

PLAGUE—Continued.

Place.	Date.	Cases.	Deaths.	Remarks.
British East Africa:				
Kenya—				
Mombasa	Oct. 14-20	1	1	Infected rats, 2.
Nairobi	Nov. 1-21	40	.....	In rural districts, several hundred.
Tanganyika	.....	.....	.....	To Oct. 20, 1923: Cases, 34; deaths, 25.
Uganda	Aug. 1-Oct. 31	734	719	
Canary Islands:				
Las Palmas	Oct. 15-Nov. 15	14	14	
San Juan de la Rambla	Dec. 11	1	.....	Locality 52 km. from Teneriffe.
Ceylon:				
Colombo	Nov. 11-24	4	3	Plague rodents, 11.
Ecuador:				
Guayaquil	Nov. 16-30	4	2	Rats taken: 18,316; found infected, 37.
Jipijapa	do	.....	.....	Present.
Egypt	.....	.....	.....	Jan. 1-Dec. 13, 1923: Cases, 1,479; deaths, 708.
City—				
Alexandria	Jan. 1-Dec. 13	65	33	Date of last case, Nov. 29, 1923.
Cairo	do	1	1	Date of last case, Mar. 17, 1923.
Port Said	do	51	29	Date of last case, Sept. 10, 1923.
Suez	do	42	23	Date of last case, Dec. 6, 1923.
Hawaii:				
Paauhau	.....	.....	.....	Dec. 14, 1923: One plague rat.
India	.....	.....	.....	Oct. 14-Nov. 10, 1923: Cases, 11,672; deaths, 7,293.
Bombay	Oct. 28-Nov. 17	2	2	
Karachi	Nov. 11-Dec. 8	33	27	
Madras Presidency	Nov. 4-Dec. 8	1,026	636	Presidency.
Rangoon	Nov. 4-24	8	4	
Indo-China:				
Saigon	Oct. 28-Nov. 17	18	6	Including 100 square kilometers in surrounding country.
Iraq:				
Bagdad	Nov. 11-17	1	.....	
Java	.....	.....	.....	Oct. 1-31, 1923: Deaths, 902.
Province—				
Djokjakarta	Oct. 1-31	.....	56	
Kedoe	do	.....	252	
Pekalongan	do	.....	25	
Samarang	do	.....	218	
Soerabaya	do	.....	3	Nov. 11-17, 1923: One case.
Soerakarta	do	.....	348	
Madagascar:				
Tananarive Province	Oct. 1-15	32	28	Bubonic, pneumonic, septicemic
Tananarive Town	do	22	22	Oct. 16-29, 1923: Deaths, 11; European, 2.
Peru	.....	.....	.....	Nov. 1-30, 1923: Cases, 23; deaths, 18.
Locality—				
Canete	Nov. 1-30	1	1	
Chepen	do	1	.....	
Chiclayo	do	1	1	
Lima (city)	do	15	12	
Lima (country)	do	4	4	
Lurin	do	1	.....	
Portuguese West Africa:				
Angola—				
Loanda	Oct. 8-28	.....	12	
Siam:				
Bangkok	Nov. 4-17	2	2	
Spain:				
Malaga	Dec. 17	2	.....	
Straits Settlements:				
Singapore	Nov. 11-24	2	2	
Syria:				
Beirut	Nov. 1-30	2	.....	
Turkey:				
Constantinople	Dec. 9-15	1	1	

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

Reports Received from December 29, 1923, to January 25, 1924—Continued.

SMALLPOX

Place.	Date.	Cases.	Deaths.	Remarks.
Algeria:				
Algiers	Nov. 1-30	1		
Bolivia:				
La Paz	Oct. 1-Nov. 30	20	10	
Brazil:				
Pernambuco	Nov. 4-24	14	2	
Rio de Janeiro	Nov. 18-24	3	1	
Sao Paulo	Sept. 3-9	1		
British East Africa:				
Tanganyika Territory	Sept. 30-Oct. 20	8	1	
Uganda	Sept. 1-30	6	1	
Zanzibar	Sept. 1-Oct. 31	116	18	Sept. 1-30, 1923: In areas 27 miles from town of Zanzibar. Oct. 1-31, 1923: In vicinity, 1 case, 1 death. In Mkokotoni district, 30 cases, 14 deaths reported.
Canada:				
British Columbia—				
Vancouver	Dec. 2-22	7		
Manitoba—				
Winnipeg	Nov. 25-Dec. 29	21	3	
New Brunswick—				
Madawaska County	Dec. 8-15	1		
Ontario—				
Fort William and Port Arthur.	Dec. 16-29	3		Occurring at Fort William.
Quebec—				
Montreal	Nov. 30-Jan. 5	1		
Saskatchewan—				
Regina	Dec. 9-15	1		
Ceylon:				
Colombo	Nov. 11-17	1		Port case.
Chile:				
Concepcion	Oct. 1-31		7	Nov. 12-Dec. 3, 1923: Deaths, 5.
Talcahuano	Nov. 26-Dec. 2	3		
Valparaiso	Dec. 9-15		1	
China:				
Amoy	Nov. 18-Dec. 1			Present.
Chungking	Nov. 4-24			Present and endemic.
Foochow	Nov. 4-Dec. 8			Present.
Hongkong	Oct. 28-Nov. 17	137	169	
Manchuria—				
Harbin	Nov. 12-25	5		
Shanghai	Dec. 29			Prevalent.
Chosen: (Korea)				
Seoul	Nov. 1-30	1		
Colombia:				
Buenaventura	Nov. 18-Dec. 15	8		
Ecuador:				
Esmeraldas	Nov. 16-30	4		
Egypt:				
Port Said	Nov. 24-Dec. 2	1		
Greece:				
Saloniki	Oct. 22-Nov. 4		7	
Guadeloupe (West Indies):				
Basse Terre	Dec. 18			Present.
Marie Galante	do			Off shore island; present.
Pointe à Pitre	do			Present in vicinity.
India				Oct. 14-Nov. 10, 1923: Cases, 2,655; deaths, 548.
Bombay	Oct. 28-Dec. 1	28	12	
Madras	Nov. 4-Dec. 8	6	2	
Rangoon	Nov. 4-Dec. 1	7	3	
Indo-China:				
City—				
Saigon	Nov. 4-17	27	9	Including 100 square kilometers of surrounding country.
Iraq:				
Bagdad	Oct. 24-Nov. 17	14	8	
Jamaica				Nov. 25-Dec. 29, 1923; Cases, 98.
Kingston	Nov. 25-Dec. 29	3		Report for week ended Dec. 22, 1923, not yet received.
Java:				
East Java—				
Soerabaya	Oct. 28-Nov. 3	110	14	
West Java—				
Batavia	Oct. 27-Nov. 16	11	5	

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

Reports Received from December 29, 1923, to January 25, 1924—Continued.

SMALLPOX—Continued.

Place.	Date.	Cases.	Deaths.	Remarks.
Latvia				Oct. 1-31, 1923: Cases, 3.
Mexico:				
Mexico City	Nov. 25-Dec. 8	13		Including municipalities in Federal District.
Vera Cruz	Nov. 3-Dec. 30		4	
Poland				Oct. 7-20, 1923: Cases, 8.
Portugal:				
Lisbon	Nov. 11-Dec. 22	19	8	
Oporto	Nov. 25-Dec. 15	26	14	
Siam:				
Bangkok	Oct. 28-Nov. 24	29	17	
Siberia:				
Dauria Station	Oct. 21			Present. Locality on Chita Railway, Manchurian frontier.
Sierra Leone:				
Sherbro District—				
Tagbail	Nov. 1-15	3		
Spain:				
Barcelona	Nov. 15-21		1	
Valencia	Nov. 25-Dec. 22	119	9	
Switzerland:				
Berne	Nov. 18-Dec. 15	9		Corrected.
Syria:				
Aleppo	Nov. 25-Dec. 1	1		In vicinity, at Djisr Choughour.
Damascus	Nov. 16-22	1		
Tunis:				
Tunis	Oct. 27-Nov 2	5	1	
Turkey:				
Constantinople	Nov. 11-17	2		
Union of South Africa				Oct. 1-31, 1923: Colored, cases, 41: deaths, 2; white, cases, 3.
Cape Province	Oct. 28-Nov. 3			Outbreaks.
Natal	do			Do.
Orange Free State	do			Do.
Transvaal—				
Johannesburg	Nov. 25-Dec. 1	1		
Uruguay:				
Montevideo	Oct. 1-31	1		

TYPHUS FEVER.

Algeria:				
Algiers	Nov. 1-30	3	1	
Bolivia:				
La Paz	Oct. 1-Nov. 30	18	2	
Chile:				
Antofagasta	Dec. 2-8	4		
Concepcion	Oct. 1-31		1	
Talcahuano				Dec. 5, 1923: 3 cases under treatment.
Valparaiso	Nov. 25-Dec. 15		29	Dec. 24, 1923: In hospital, 34 cases.
China:				
Antung	Nov. 12-Dec. 9	2		
Chungking	Nov. 18-24			Present.
Egypt:				
Alexandria	Nov. 19-Dec. 9	2		
Cairo	Sept. 10-23	2	3	
Hungary				July 1-Aug. 31, 1923: Cases, 24.
Latvia				Oct. 1-31, 1923: Cases, 12; paratyphus fever, 7; recurrent typhus, 3.
Mexico:				
Mexico City	Nov. 25-Dec. 8	40		Including municipalities in Federal District.
Poland				Sept. 23-Oct. 20, 1923: Cases, 133; deaths, 13.
Spain:				
Barcelona	Nov. 29-Dec. 12		2	
Turkey:				
Constantinople	Nov. 11-Dec. 15	13		

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

Reports Received from December 29, 1923, to January 25, 1924—Continued.

TYPHUS FEVER—Continued.

Place.	Date.	Cases.	Deaths.	Remarks.
Union of South Africa				Oct. 1-31, 1923: Colored, 287 cases, 58 deaths; white, 2 cases; total, 289 cases, 58 deaths.
Cape Province				Oct. 1-31, 1923: Colored, cases, 245; deaths, 47.
Do	Oct. 28-Nov. 17			Outbreaks.
Natal				Oct. 1-31, 1923: Colored, cases, 4; deaths, 3.
Do	Oct. 28-Nov. 3			Outbreaks.
Durban	Nov. 24	72		Cases occurring among native stevedores in the harbor area of the port and confined to one barracks.
Orange Free State				Oct. 1-31, 1923: Colored, cases, 25; deaths, 8.
Transvaal				Oct. 1-31, 1923: Colored, cases, 13.
Do	Oct. 28-Nov. 3			Outbreaks.
Johannesburg	Nov. 11-17	1		
Yugoslavia:				
Croatia—				
Zagreb	Dec. 2-15	3		
Serbia—				
Belgrade	Nov. 25-Dec. 1	1		

YELLOW FEVER.

Brazil:				
Pernambuco City	Nov. 16	3	2	