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## FRACTIONATION OF CHAULMOOGRA OIL.<sup>1</sup>

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### Introduction.

The material known commercially as chaulmoogra oil has assumed considerable importance in recent years. For many years, perhaps for centuries, this oil has been used in India as a palliative in leprosy. In more recent times it has had more or less use in all countries where leprosy occurs. Taken by way of the mouth its administration is frequently attended by amelioration of the disease, although the intolerance exhibited by many persons limits its usefulness, and at best the action is slow.

New interest was aroused by the results obtained by intramuscular injections of this oil fluxed with olive oil, a line of experimentation to which the work of Heiser was especially stimulating. Leprologists believed that although chaulmoogra oil had by no means been proved a specific in leprosy, it was the most promising drug known in combating the disease.

The statements in the older literature dealing with the origin and composition of chaulmoogra oil are conflicting and unreliable. It was frequently stated to be the product of *Gynocardia odorata* and to contain "gynocardic acid" as its characteristic constituent. The true origin and nature of the oil were elucidated by Power and his collaborators in a series of papers from the Wellcome Chemical Research Laboratories.<sup>2</sup>

These authors showed that the true chaulmoogra oil is derived from the seeds of *Taraktogenos kurzii* and that the oils from two closely related species of *Hydnocarpus* were practically identical. The oil from *Gynocardia odorata*, however, is wholly different. The outstanding feature of the work of the above authors was the discovery of a new type of fatty acid present in *Taraktogenos* and *Hydnocarpus* oils. These acids are strongly dextro-rotatory, and the study of their

<sup>1</sup> From the Department of Chemistry, University of Hawaii. This article originally appeared in the *Journal of the American Chemical Society*, Vol. XLII, No. 12, December, 1920, and is reprinted here by permission.

<sup>2</sup> Power and Gornall, *J. Am. Chem. Soc.*, 85, 838, 851 (1904); Power and Barrowcliff, *ibid.*, 87, 881 (1905); Barrowcliff and Power, *ibid.*, 91, 457 (1907).

constitution indicated that they contain a 5-membered carbon ring with side chains of different lengths. Two acids of this series were isolated and studied: Chaulmoogric acid,  $C_{17}H_{31}.COOH$ , and hydnocarpic acid,  $C_{15}H_{27}.COOH$ . Chaulmoogric acid melts at  $68^{\circ}$ , has an iodine value of 90.1, and shows a specific rotation of  $+56^{\circ}$ ; hydnocarpic acid melts at  $59^{\circ}$ , possesses an iodine value of 100.2, and gives a specific rotation of  $+68.1^{\circ}$ . Structural formulas believed to be consistent with their experimental results were proposed.

Brill,<sup>3</sup> in a series of papers from Manila, confirmed the work of Power and his collaborators by isolating both chaulmoogric and hydnocarpic acids, and extended our knowledge of their distribution in several species of plants related to those examined by Power.

The following tabular statement shows some of the essential facts concerning these oils:

	Tarakto- genos <sup>a</sup> kurzii.	Hydno- carpus <sup>a</sup> wightiana.	Hydno- carpus <sup>a</sup> anthe- lenticus.	Hydno- carpus <sup>b</sup> venenata.	Hydno- carpus <sup>b</sup> alcalae.	Pangium- edule. <sup>b</sup>
Melting point.....	22	22	24	20	32	Cloudy at 2°.
Specific gravity.....	0.951 (24°)	0.958 (25°)	0.953 (25°)	0.948 (30°)	0.9502 (30°)	0.9049
Specific rotation.....	+52.0°	+57.7°	+52.5	+52.03°	+49.6°	+4.23°
Iodine value.....	103.2	101.3	86.4	99.1	93.1	113.1
Chaulmoogric acid.....	+	+	+	+	(90%)+	(?)
Hydnocarpic acid.....	+	+	+	+	-	(?)

<sup>a</sup> Power et al.

<sup>b</sup> Brill.

Goulding and Akers<sup>4</sup> showed that the oil from the seeds of *Oncoba eshinata*, an African plant belonging to the same family as *Tarakto-genos* and *Hydnocarpus*, yielded chaulmoogric acid to the extent of 87.5 per cent of its fatty acids.

It is therefore well established that optically active oils containing esters of acids of the chaulmoogric acid series are quite widely distributed in the seeds of members of the order *Flacourtiaceae*.

The injection of chaulmoogra oil, rendered more liquid by admixture with about an equal volume of olive oil and combined with other drugs, was tried at the Kalihi Leprosy Hospital in Honolulu by officers of the United States Public Health Service. The results led them to believe that there might be real value in such administration, and in the fall of 1915 they came to the chemical laboratory of the College of Hawaii for assistance. On the assumption that there was some therapeutic value in the oil, the most obvious line of experimentation was that directed to the isolation of the active agent or agents and the preparation of liquids more suitable for intramuscular or intravenous injections.

<sup>3</sup> H. C. Brill, *Philippine J. Sci.*, Section A, 11, 75 (1916); 12, 37 (1917); Brill and Williams, *Philippine J. Sci.*, Section A, 12, 207 (1917).

<sup>4</sup> Goulding and Akers, *Proc. Chem. Soc.*, 29, 197 (1913).

Since there was no method of testing for the curative principle, except the results of injections, the plan proposed was to split the oil up into fractions, test these and follow the clues which their clinical application might furnish. The form of material for administration presented some difficulties. The mixed fatty acids from chaulmoogra oil are solid at ordinary temperatures. The physicians were adverse to using the soluble salts for intravenous injections for fear of hemolysis. On making the ethyl esters of the fatty acids, we found them thin liquids, and experiment showed that they were readily absorbed from intramuscular injections.

Leprosy is a slow disease, and improvement, when it occurs, is a matter of months and even years. After several years' experience with ethyl esters of the fatty acids of chaulmoogra oil, the working hypothesis appeared justified that the fatty acids of the chaulmoogric acid series are specific in leprosy.

Reports of the earlier part of the clinical work have been published<sup>5</sup> and a later report will soon appear. In brief, it may be said that a considerable number of patients improved to the point of becoming clinically and bacteriologically free from leprosy, and that it was impossible to identify this effect with any one of the 4 fractions of fatty acids used.

It seemed important to test out the hypothesis stated above, by placing groups of lepers on treatment with the pure ethyl esters of chaulmoogric acid and hydnocarpic acid. This necessitated the preparation of considerable quantities of the pure acids and led to the following study of methods of fractionating chaulmoogra oil.

#### Experimental Study.

*Separation of fatty acids by crystallization from alcohol.*—Five hundred grams of the mixed fatty acids from chaulmoogra oil were dissolved by warming with 1,125 c. c. of 92 per cent alcohol, and allowed to crystallize over night in the refrigerator, which gave approximately a 30 per cent yield of a semi-crystalline material which, after repeated recrystallization from alcohol, gave about 18 grams of chaulmoogric acid melting at 68°.

By concentrating the mother liquors resulting from the above operations, further yields of less crystalline material were obtained, which, on extended recrystallization from alcohol, gave a few grams more of pure chaulmoogric acid, but no hydnocarpic acid. It was found that this semi-crystalline material, which may have represented a eutectic mixture of chaulmoogric and hydnocarpic acids, on recrystallization from alcohol rapidly improved in melting point until the range of 48–52° was reached, after which repeated crystallization

<sup>5</sup> Hollmann and Dean, *J. Cutaneous Diseases*, 37, 337. McDonald and Dean, *Public Health Reports*, Aug. 20, 1920.

had little effect beyond the separation of very small first crops melting at 52–54° which, if saved and combined with others of similar melting point and then recrystallized several times from alcohol, would afford fractions of a gram of pure chaulmoogric acid.

To determine whether or not a slower rate of crystallization than that obtained in the refrigerator would effect a more clean-cut separation of chaulmoogric acid and perhaps furnish the means for isolating hydnocarpic acid, the following experiment was tried.

Four hundred and seventy-nine grams of mixed fatty acids were dissolved in 1,000 c. c. of hot 92 per cent alcohol, and the resulting solution was cooled to room temperature and slowly evaporated in a current of air from an electric fan, during which time the temperature remained between 20° and 23°. As evaporation and precipitation progressed the following fractions were removed:

Fraction.	Time required to precipitate.	Yield.	Melting point.
	<i>Hours.</i>	<i>Grams.</i>	<i>°C.</i>
1.....	3	57	43–44
2.....	1	79	42–46
3.....	3	63	43–47
4.....	Overnight.	139	43–45
5.....	.....	40	25–35
6.....	.....	100	Below 25

The fourth fraction appeared to contain a small amount of oil occluded in the solid material.

To the small amount of mother liquor from this fourth fraction, water was added, which caused precipitation at first, then separation into aqueous and oily layers. The oil was taken up in ether, washed free from alcohol, and dried. On evaporating the ether an oily mass was obtained, which was separated, by pressing, into about 40 grams of low-melting solids and 100 grams of oil, which were designated as the fifth and sixth fractions, respectively.

The first and second fractions were combined and recrystallized from 92 per cent alcohol, which gave 35 grams of semi-crystalline material, melting at 44–45°, and the mother liquor, which was evaporated to dryness and combined with the original third, fourth, and fifth fractions. These combined materials were recrystallized from alcohol, but gave low-melting solids and mother liquors from which oily materials were obtained. On account of this, and the failure of the two fractions to give a crystalline material of appreciably improved melting point on recrystallization, this method was abandoned.

*Separation of fatty acids by means of barium acetate.*—The following experiment was undertaken to determine whether chaulmoogric and hydnocarpic acids could be obtained on a large scale from chaulmoogra oil by the barium acetate method which enabled Power and Barrowcliff to isolate hydnocarpic acid from chaulmoogra oil<sup>6</sup> and

which they used successfully in preparing this acid from the oil derived from the seeds of *Hydnocarpus wightiana*.<sup>7</sup>

Four hundred and seventy-eight grams of the mixed fatty acids from chaulmoogra oil were dissolved in one liter of 93.5 per cent alcohol, and boiled with animal charcoal for 1.5 hours to remove the resinous matter which imparted a yellow color to the solution. After filtering off the animal charcoal, which left the solution much lighter in color, another liter of alcohol was added and the solution warmed. To this was added, with constant stirring, 62 grams of barium acetate monohydrate dissolved in the least possible quantity of hot water, this being a slight excess over the calculated amount of barium acetate necessary to precipitate one-fourth of the fatty acids, figured in terms of chaulmoogric acid,  $C_{17}H_{31}.COOH$ . A pasty mass was immediately precipitated, which did not entirely dissolve on heating. When the solution was cool, a large flocculent precipitate separated, which was filtered off. To the resulting mother liquor a second and third 62-gram portion of barium acetate were added, which furnished the second and third fractions of barium salts, respectively; also a final mother liquor from which the alcohol was evaporated, leaving a pasty non-crystalline mass.

The three fractions of barium salts were warmed with an excess of dilute sulphuric acid, which caused precipitation of barium sulphate and liberation of free fatty acids which were liquid at the temperature employed and rose to the top of the aqueous layer in the form of a reddish-brown oil.

This treatment with dilute sulphuric acid had to be repeated several times, as it was found to be difficult to remove the last of the barium salts from the oily layer. During this process the discoloration of the fatty acids increased, owing probably to slight charring, in spite of the fact that the sulphuric acid used was quite dilute.

Fractions 1 and 2 were combined, dissolved in 93.5 per cent alcohol, and boiled with animal charcoal to remove charred matter, after which the solution was filtered and allowed to crystallize. The resulting material was small in amount and melted at 61°. After several recrystallizations it melted at 67–68°, and as this remained unchanged on recrystallization from a variety of solvents, the material was apparently chaulmoogric acid. The yield was less than 10 grams.

The third fraction and the residue from the final mother liquor were combined and treated in a similar manner. After two crystallizations the material melted at 62°; after four crystallizations it melted at 58°, and after two more crystallizations it melted at 60°. As the yield at this point was only a little over 0.2 gram, it was not practicable to recrystallize it again to determine whether the melting point had become

<sup>6</sup> *J. Chem. Soc.*, 87, 896 (1905).

<sup>7</sup> *Ibid.*, 87, 888 (1905).

stationary; but since a little of this material, mixed with an equal part of the chaulmoogric acid obtained from the first two fractions, melted at 55°, it was assumed that this was hydnocarpic acid rather than an impure chaulmoogric acid.

While the yields of both chaulmoogric and hydnocarpic acids could undoubtedly be increased by improved manipulation, this method was abandoned as unsuitable for producing these acids in sufficiently large quantities.

*Fractional distillation of ethyl esters under high vacuum.*—The mixed ethyl esters of the acids in chaulmoogra oil were prepared by passing dry hydrogen chloride into a mixture of equal volumes of dry alcohol and the mixed, free fatty acids. The resulting esters, after being washed and dried, had a specific gravity of 0.891 at 15.5° and were reddish-brown in color. By titration it was found that they contained about 5 per cent of uncombined acids.

The apparatus used for the distillation of these esters consisted of a 500 c. c. Kjeldahl flask with a fractioning column in the neck, composed of glass beads supported by a tight roll of wire gauze placed at the bottom of the neck. This roll of gauze also served the purpose of preventing frothing over. The flask was provided with a cork stopper, through which ran a thermometer, a dropping funnel, and a delivery tube. The delivery tube was constructed from a meter length of ordinary glass tubing, by making an approximately 80° bend in it sufficiently near one end so that the short arm would just reach through the cork.

Considerable difficulty was experienced in obtaining an air-tight joint at this point. The use of rubber stoppers was prohibited on account of the softening effect of the hot vapors. The best results were obtained by cutting a special cork on a turning lathe so that it could penetrate the neck of the flask about 1½ inches, making a good contact with the glass all the way, and yet be prevented from going too far by means of a shoulder left on the top of the cork. A coat of shellac over this made a fairly effective seal.

At the far end of this delivery tube, which on account of its length also acted as a condenser, was connected by means of a short length of pressure tubing a 3-way stopcock, through which the distillate could be directed into either of two graduated receivers. Beyond these receivers and connected to them by short lengths of glass tubing was a 4-way stopcock, by means of which either receiver could be connected with the outer air to release its vacuum while the other receiver was connected through a manometer to a powerful motor-driven vacuum pump. By means of this apparatus the fraction which had been collected in one of the receivers could be removed while the distillate was caught in the other, without the vacuum or the rate of distillation being disturbed.

Two 350-c. c. portions of the mixed ethyl esters were subjected to fractional distillation in this apparatus, the results of which are given in tabulated form below.

*Distillation of two 350 c. c. portions of mixed esters under pressure of 3 to 4 mm.*

Fraction.	Temperature range.	No. 1.	No. 2.
	° C.	C. c.	C. c.
A-1.....	Below 185	90	90
A-2.....	185-190	80	155
A-3.....	190-195	90	40
A-4.....	Above 195	70	45
Total volume recovered.....		330	339

As both portions of ethyl esters were from the same lot, it was assumed that fractions of approximately equal volume would be obtained in each case, when these were collected over the same temperature range. It will be noted, however, that there is a wide discrepancy between the volumes of fractions Nos. A-2, A-3, and A-4 obtained from these duplicate operations. This is accounted for by the fact that under the high vacuum employed here, slight variations in pressure, with the consequent changes in the rate of heating necessary to maintain a fairly even rate of distillation, cause a variation of 6° to 8° in the temperature recorded by the thermometer in the neck of the flask.

The corresponding fractions from these duplicate operations were combined and redistilled, introducing each combined fraction into the distilling flask through the dropping funnel, as soon as the previous fraction had nearly all distilled over.

The products of this operation were classified into four fractions according to the temperature at which they had distilled over. The results were as follows:

Fraction.	Volume.	Temperature range.
	C. c.	° C.
B-1.....	150	Below 185
B-2.....	290	185-190
B-3.....	60	190-195
B-4.....	50	Above 195
Total.....	550	.....

One-gram portions of each of the above fractions were saponified, and the melting points of the free acids taken, with the following results:

Fraction.	Melting point.
	° C.
B-1.....	51-53
B-2.....	50-52
B-3.....	43-48
B-4.....	56-57

These four fractions were redistilled in the manner just described, except that the pressure was reduced from 3-4 mm. to 1 mm. by the use of a more suitable grade of oil in the vacuum pump.

The yields and temperature ranges of the four fractions obtained are given herewith.

Fraction.	Volume.	Temperature ranges.
	<i>C. c.</i>	<i>° C.</i>
C-1.....	70	Below 175
C-2.....	340	175-180
C-3.....	50	180-185
C-4.....	70	Above 185
Total volume.....	530	.....

The results of this and the preceding distillation illustrate the wide difference in boiling-point range caused by a slight difference in the pressure.

One-gram portions from each of the above fractions were saponified and the melting points of the free acids taken, which were as follows:

Fraction.	Melting point.
	<i>° C.</i>
C-1.....	50-53
C-2.....	52-54
C-3.....	55-57
C-4.....	59-62

These four fractions were redistilled once more in the same manner as described above, with the following results:

Fraction.	Volume.	Temperature range.
	<i>C. c.</i>	<i>° C.</i>
D-1.....	260	Below 175
D-2.....	160	175-180
D-3.....	40	180-185
D-4.....	40	Above 185
Total volume.....	500	.....

The esters comprising these four fractions were saponified by heating with an excess of alcoholic potash and the resulting soaps decomposed with hydrochloric acid. The yields of free fatty acids and their melting points were as follows:

Fraction.	Grams.	Melting point.
		<i>° C.</i>
D-1.....	197.3	50-53
D-2.....	118.8	43-47
D-3.....	21.7	38-60
D-4.....	20.2	63-65
Total volume.....	358.0	.....



It was thought from the above results that the isolation of pure chaulmoogric and hydnocarpic acids, simply by distillation of their mixed ethyl esters, is not practicable, as the improvement in melting point between the fractions resulting from the second distillation and those resulting from the fourth distillation was so small. When, however, these fractions were recrystallized from alcohol, it was at once apparent that a partial separation had been effected. The results were as follows:

Fraction.	First crystallization from alcohol.		Recrystallization from alcohol.		Second recrystallization from alcohol.	
	Grams.	° C.	Grams.	° C.	Grams.	° C.
D-1.....	50.4	55-56	32	58	21.2	58.5-59.5
D-2.....	74.2	49-51	61.5	49-51	29	48-51
D-3.....	13.1	67-68	30	67-68	9.8	67.5-68
D-4.....	13.8	66-67	6	67-67.5	4.4	67.5-68

The 21.2 grams from Fraction D-1, melting at 58.5-59.5°, on being recrystallized from petroleum ether, benzene, and alcohol, respectively, gave small transparent plates melting at 59-60°, and this melting point did not change upon subsequent recrystallization. It is evident that this material was almost pure hydnocarpic acid.

Fractions D-3 and D-4, which furnished 14.2 grams of acids melting at 67.5 to 68°, proved to be almost pure chaulmoogric acid, as on recrystallizing once more this material came down in the form of glistening plates melting at 68°, and this melting point did not change on subsequent recrystallization.

This method was abandoned in favor of the more satisfactory method of direct fractional distillation of the fatty acids themselves, but the ester distillation method is thought to be a very promising one and will be investigated further.

*Fractional distillation of fatty acids.*—For the distillation *in vacuo* of the fatty acids themselves, which are solid at ordinary temperatures, it was necessary to modify the apparatus used in distilling the ethyl esters described above.

The delivery tube was shortened to 35 cm. in order that the distillate could pass through hot and not tend to solidify. The end of the delivery tube reached through a No. 10 two-hole stopper, through the other hole of which extended a short piece of glass tubing, which was connected with the vacuum line through a 3-way stopcock.

This large 2-hole stopper was inserted into a wide-mouthed dropping funnel, the stem of which was cut off 5 cm. below the valve, and inserted into one of the 2 openings of a No. 11 2-hole stopper which fitted into a graduated receiver. Through the other hole of this stopper was a short piece of glass tubing, which was connected to a

3-way stopcock, one branch of which communicated with the outer air, the other being connected with the 3-way stopcock in the vacuum line to which reference is made above.

By means of this apparatus, when a fraction of the desired size had collected in the graduated receiver the valve in the stem of the dropping funnel above the receiver could be closed, the vacuum could be communicated to the connection in the dropping funnel, while air could be allowed to enter the graduated receiver through the 3-way stopcock connected to it. In this way the receiver could be removed while the distillate meanwhile was collecting in the dropping funnel under a vacuum which had not been disturbed. Having replaced the graduated receiver and evacuated it, the one-way stopcock above it could be opened and the small amount of distillate in the dropping funnel allowed to flow down into the graduated receiver. The principle of this receiving apparatus was the same as that of the special receiver shown in Fig. 2, which was designed later to eliminate the difficulties encountered in operating this improvised apparatus, the worst of which were air leaks in the rubber connections and clogging up of the small bores of the stopcock by condensed fatty acids.

Three hundred and fifty c. c. of mixed fatty acids from chaulmoogra oil were distilled in this apparatus under a pressure of 1.5 mm., which increased to 3 mm. when the distillation was about half completed owing to an air leak. The results are given in tabulated form herewith.

Fraction.	Volume.	Temperature range.	Melting point of crude distillate.	Melting point of distillate crystallized from alcohol.
	<i>C. c.</i>	<i>° C.</i>	<i>° C.</i>	<i>° C.</i>
1.....	40	174-199	48-49	54-55
2.....	100	193-204	49-52	54-56
3.....	100	204-211	47-49	48-49
4.....	50	211-212	42-46	67-68
Total volume.....	290			

Thus 290 c. c. were recovered, the first 2 fractions of which, amounting to 140 c. c., on being recrystallized from 93.5 per cent alcohol 3 times gave approximately 15 grams of pure hydnocarpic acid melting at 59-60°, and the last fraction, amounting to 50 c. c., on being recrystallized twice, gave approximately 25 grams of pure chaulmoogric acid melting at 68°.

The third fraction, which melted at 47-49°, did not improve in melting point to any appreciable extent. It is thought to be a eutectic mixture of chaulmoogric and hydnocarpic acids.

Three separate portions of mixed fatty acids from the same lot, consisting in each case of 300 grams (325 c. c.), were distilled *in vacuo*, the results of which are given below. As in the case of the ethyl esters, there is a wide discrepancy in temperature range of the vapor for corresponding fractions owing to slight variations in the pressure and rate of heating.

Fraction.	First portion.			Second portion.		Third portion.	
	Volume.	Temp. range.	Av. pres.	Temp. range.	Av. pres.	Temp. range.	Av. pres.
	<i>C. c.</i>	<i>° C.</i>	<i>Mm.</i>	<i>° C.</i>	<i>Mm.</i>	<i>° C.</i>	<i>Mm.</i>
A-1.....	20	173-190	2.5	186-193	2.5	186-190	1.5
A-2.....	100	190-197	2.5	193-196	2.5	190-192	1.5
A-3.....	100	197-199	2.5	196-203	2.5	192-201	1.5
A-4.....	70	199-209	2.5	203-208.5	2.5	201-210	1.5

To try the effect of redistillation, the corresponding fractions from these distillations were combined and redistilled, adding each fraction through the small dropping funnel in the top of the distilling flask when the previous fraction was nearly all distilled over.

The results of this redistillation and the melting points of the crude distillates, and the small portions thereof crystallized from alcohol, were as follows:

Fraction.	Volume.	Temp. range.	Average pressure.	Melting points of distillates.	
				Crude.	Recrystallized.
	<i>C. c.</i>	<i>° C.</i>	<i>Mm.</i>	<i>° C.</i>	<i>° C.</i>
B-1.....	100	160-192	3	45-47	48-51
B-2.....	300	186-193	1.25	40.5-42.5	48-51
B-3.....	160	193-197	1.5	40-41	55-57
B-4.....	240	197-202.5	1.5	50-52	64-66

<sup>1</sup> Shut down overnight between fractions Nos. B-1 and B-2.

These four fractions of Series B were redistilled in the same way, cutting into six fractions.

Fraction.	Volume.	Temp. range.	Average pressure.	Melting points of distillate.	
				Crude.	Recrystallized.
	<i>C. c.</i>	<i>° C.</i>	<i>Mm.</i>	<i>° C.</i>	<i>° C.</i>
C-1.....	70	193-199.5	2	42-46	46-50
C-2.....	40	199.5-201	2.5	42-46	51-55
C-3.....	190	201-208.5	2.5	45-47	55-56
C-4.....	150	199-206	2.5	43-45	48-50
C-5.....	250	203.5-216	2.5	47-49	65-63
C-6.....	25	216-213	4	55-56.5	65.5-66.5

<sup>1</sup> Shut down overnight between fractions Nos. C-2 and C-4.

Fractions C-2 and C-3, and C-5 and C-6 were combined, necessitating a new designation of the series, as follows:

Fraction C-1 becomes.....Fraction C-a  
 Fractions C-2 and C-3 become.....Fraction C-b  
 Fraction C-4 becomes.....Fraction C-c  
 Fractions C-5 and C-6 become.....Fraction C-d

Each of these four resulting fractions was redistilled independently, dividing the distillate from each into fractions when necessary. The results are given herewith in tabulated form.

Fraction distilled.	Volume.	Fraction received.	Volume.	Temperature range.	Pressure.	Melting points of distillates.	
						Crude.	Recrystallized from alcohol.
	<i>C. c.</i>		<i>C. c.</i>	<i>° C.</i>	<i>Mm.</i>	<i>° C.</i>	<i>° C.</i>
C-a.....	70	D-1	60	164-178	1.25	43-45	45-47
C-b.....	230	D-2	150	165-177	1	47-49	53-55
		D-3	60	177-180	1	47-49	52-54
C-c.....	150	D-4	100	174-178	1	45-48	51-53
		D-5	40	178-188	1	41-43	57-59
C-d.....	175	D-6	100	174-192	1	39-42	55-59
		D-7	160	192-199	1.25	51-53	63-65

In order to combine fractions of similar melting point and reduce the total number, Fraction D-1 was kept separate and designated as D-a; Fractions D-2, D-3, and D-4 were combined and designated as D-b; Fractions D-5 and D-6 were combined and designated as D-c; Fraction D-7 was kept separate and designated as D-d.

Fraction.	Weight.	Weight obtained.	Substance.	Melting points.
	<i>Grams.</i>	<i>Grams.</i>		<i>° C.</i>
D-a.....	59	0.6	Hydnocarpic acid.....	59-60
		1.4	Material.....	62-63
		21.0	Material.....	45-53
		31.0	Oily material.....	
D-b.....	287	82	Hydnocarpic acid.....	59-60
		112.5	Material.....	45-53
		65	Oily material.....	
D-c.....	130	18.4	Chaulmoogric acid.....	67-68
		54	Material.....	45-53
		45	Oily material.....	
D-d.....	168	59.6	Chaulmoogric acid.....	67-68
		25.4	Material.....	45-53
		68	Oily material.....	
Total for the entire 4 fractions of.....		78	Chaulmoogric acid.....	67-68
		1.4	Unknown acid.....	62-63
		82.6	Hydnocarpic acid.....	59-60
		212.9	Material.....	45-63
		209	Oily material.....	
		583.9		

Each of these resulting four fractions was subjected to an extended fractional crystallization from alcohol, involving from 25 to 33 recrystallizations in each case. Work was continued on each of the

four fractions until nothing remained but pure chaulmoogric or hydnocarpic acids, or oily material, or solids which did not improve in melting point on further crystallization.

The results are briefly summarized in the preceding table.

It was found that the 212 grams of miscellaneous material from all four fractions, melting between 45–53°, could in each case be purified by recrystallization from alcohol until its melting point became approximately 48–52°, after which further recrystallization had little effect.

In order to determine whether this was a lower homologue of chaulmoogric and hydnocarpic acids, or a eutectic mixture of the two, 139 grams of this material, melting at 48–52°, was subjected to further distillation *in vacuo*. During the distillation the temperature fluctuated between 188° and 195°, and the pressure between 1.5 and 3 mm. The distillate was cut into four 30-c. c. fractions, on which the following data were gathered:

	1		2		3		4	
	Grams.	°C.	Grams.	°C.	Grams.	°C.	Grams.	°C.
Melting points of crude distillates.....	27	49-51	27	50.5-52	27	50.5-52	27	50-51.5
Crystallized from alcohol.....	25	46-49	16	49.5-52	20	49.5-52	19.5	50-53
Recrystallized from alcohol.....	21	49.5-52	4.3	57-58	18.5	51-53	11.2	53-55
Recrystallized again from alcohol.....	14.5	49.5-52	2.4	59-60	17	56-57	9	53-55
Recrystallized again from alcohol.....					6.5	58.5-59.5		
Recrystallized from P. ether.....	4	56-57					2	57-58

While these results are rather indeterminate, they indicate a material which approximates a eutectic mixture which neither the fractional distillation nor crystallization could separate effectively.

From the foregoing it is apparent that the original experiment on direct fractional distillation of the mixed fatty acids, which gave four fractions melting at 54–55°, 54–56°, 48–49°, and 67–68°, respectively, after one crystallization from alcohol, effected a separation of chaulmoogric and hydnocarpic acids which was as good as, if not better than, the one just described, which involved three redistillations of the fractions obtained by distilling once and gave six fractions melting, after one crystallization from alcohol, at 45–47°, 53–55°, 52–54°, 51–53°, 57–59°, 55–59°, and 63–65°, respectively. It was therefore decided to distil the mixed fatty acids only once, and to attempt to get larger yields of pure acids by making that one distillation more efficient by means of improved apparatus and by cutting into fractions at the most advantageous points.

In order to determine the best possible points for cutting fractions, a new vacuum distillation was run on a 300-gram portion of mixed fatty acids and the distillate cut into fifteen 20-c. c. fractions. The

melting point of each of these fractions was taken, and the fraction was then crystallized from alcohol in such a manner as to give a first crop, second crop, and residue of approximately equal weights. The melting points of these three crops were taken and are given in graphic form herewith, together with the melting points of the crude distillates. (Fig. 1.)

On the strength of the above melting-point diagram, Fractions 1-6, inclusive, were combined and worked for hydnocarpic acid, of

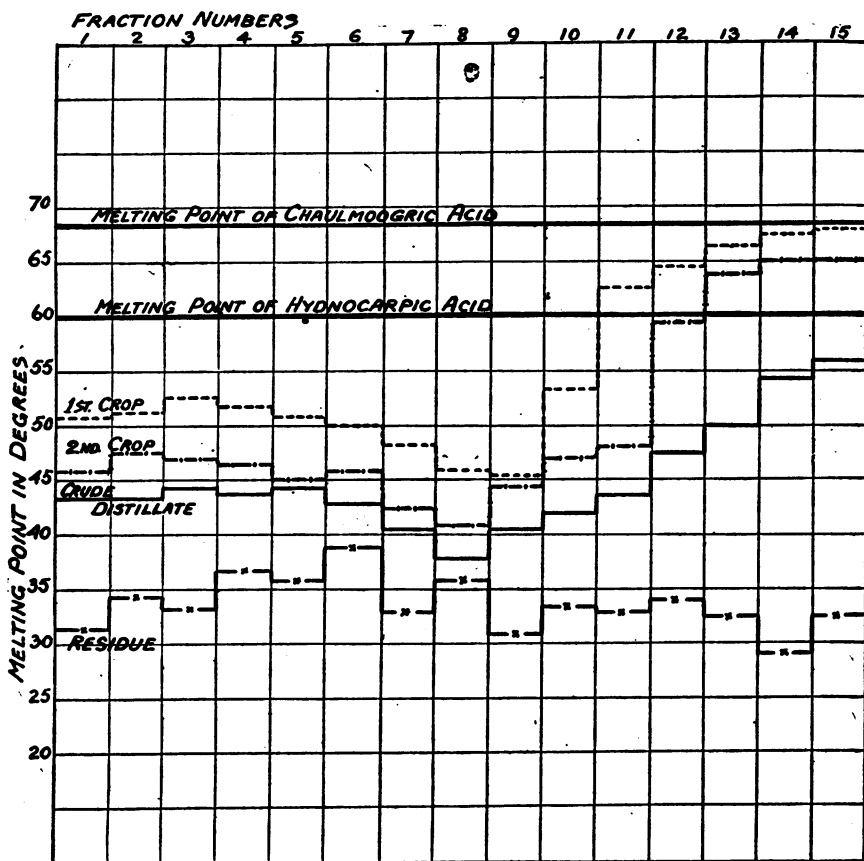


Fig. 1.

which they furnished 20 grams. Fractions 12-15, inclusive, were worked for chaulmoogric acid, of which they furnished 32 grams, Fractions 7-11, inclusive, were combined and crystallized from alcohol. but it was found that the melting point quickly rose to the 48-52° range, after which, repeated recrystallization had little effect. This was apparently a eutectic mixture of hydnocarpic and chaulmoogric acids.

From this time up to the present (August, 1920), the work has been severely handicapped by a radical lowering in the quality of

the chaulmoogra oil coming on the American market. In place of the clear amber colored oil obtainable in the fall of 1919, it is now necessary to continue investigation on a dark reddish-brown oil which is about 70 per cent by volume solid matter. This inferior product has nearly the normal amount of chaulmoogric acid in it, but the hydnocarpic acid content is only about one-third as great as in previous lots.

An improved apparatus, which was first employed in making the fractional distillation next to be described, was identical with that shown in Fig. 2, except that it had a 2-liter side neck flask of the Claisen type, with a fractionating column of glass beads and short lengths of glass tubing about 12.5 cm. high in the side neck.

The large capacity of this flask permitted the vacuum distillations in kilogram lots of mixed acids, and up to the present time these flasks, which were made of heavy Pyrex glass, have shown no tendency to collapse under high vacuum, the only weak points being the junctures of the side and main neck, and of the side neck and delivery tube.

In order to throw more light on the character of the mixed acids from chaulmoogra oil, 1,000 grams of the mixed acids (1,084 c. c.) was distilled and cut into 18 fractions of 50 c. c. each. The temperature curves of the vapor and of the liquid in the distilling flask are given in Fig. 3. The melting points, indices of refraction, iodine numbers, specific rotations, and apparent molecular weights for each of the 18 fractions are given in Fig. 4.

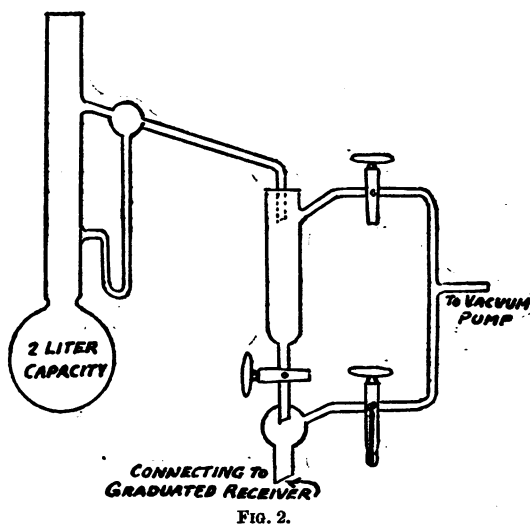


FIG. 2.

#### Interpretation of Results.

An inspection of the data presented shows that the distillation is not effective in segregating any liquid fatty acids which may be present, since all fractions solidify on cooling and require temperatures of at least 40° to liquefy them.

The higher boiling fractions give evidence of being much nearer to pure chaulmoogric acid than the lower fractions to hydnocarpic. Evidently the lower fractions contain material of higher molecular weight, lower or no rotatory power, lower iodine absorption, and lower indices of refraction. Oleic and palmitic acids, both of which were identified in chaulmoogra oil, by Power, would have the effects in-

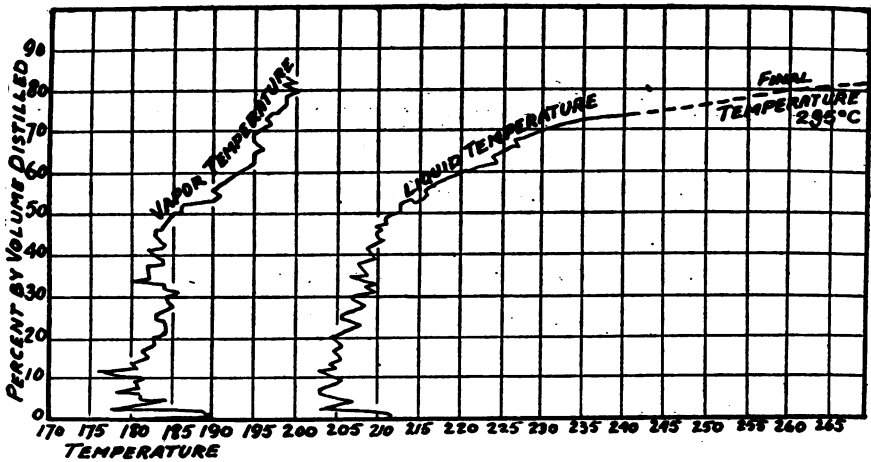


FIG. 3.

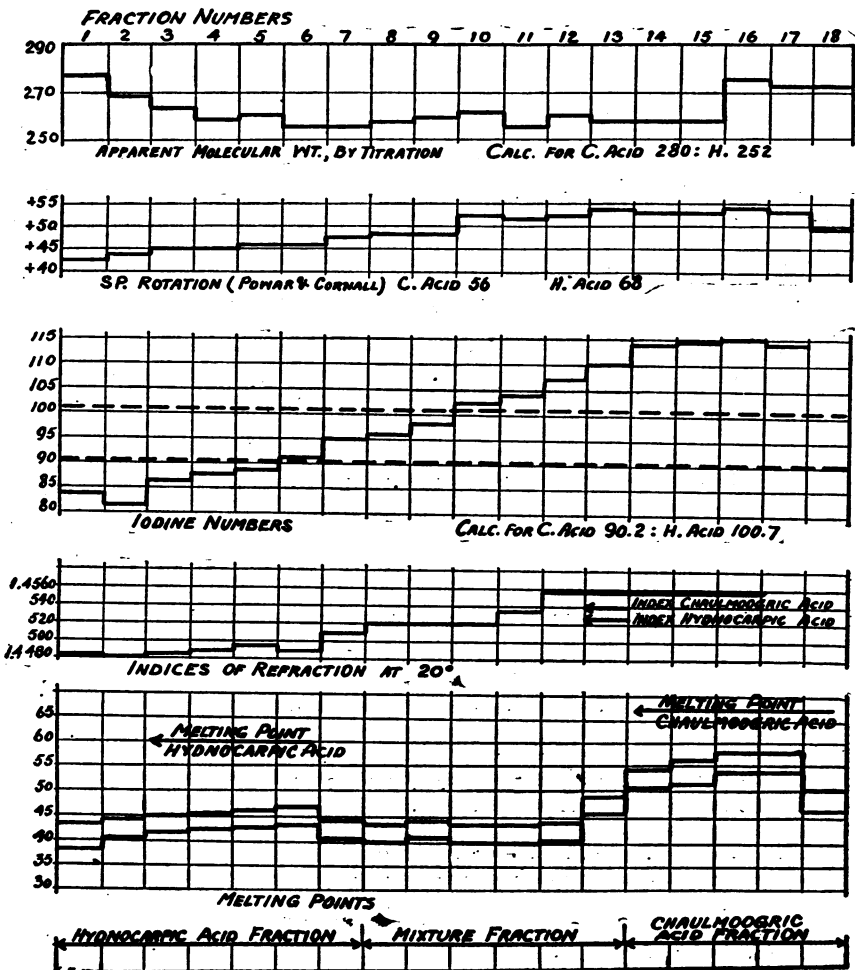


FIG. 4.



licated. With the chaulmoogric acid fractions there appears to be relatively little optically inactive material, but some materials which raise both the iodine value and the indices of refraction, indicative of more highly unsaturated acids.

No evidence of any members of the chaulmoogric series below hydnocarpic acid nor above chaulmoogric appears.

After a careful consideration of the probable composition of each of the 18 fractions, based on data shown in Fig. 4, Fractions 1-6, inclusive, were combined and worked for hydnocarpic acid, of which they gave 48 grams. Fractions 14-18, inclusive, were combined and worked for chaulmoogric acid, of which they gave 110 grams. Fractions 7-13, inclusive, were combined and redistilled to determine whether this would afford a separation of the hydnocarpic and chaulmoogric acids which they were thought to contain in the form of a eutectic mixture. The results of this distillation are given herewith.

Fraction.	Volume.	Temp. range of vapor.	Average pressure.	Melting points of distillates.
	<i>C. c.</i>	<i>° C.</i>	<i>Mm.</i>	<i>° C.</i>
1.....	50	185-196	3.25	43-49
2.....	50	196-198.5	3.5	43-49
3.....	50	198-201.5	4	42-46
4.....	50	201-209	4.5	32-49
5.....	30	209-210	4.5	50-57

A comparison of the melting points of these fractions with those of the 7 fractions from which the distillation was made, 41-44°, 40-43°, 41-43.5°, 40-43°, 40-43°, 41-44°, and 45-48°, respectively, shows very plainly that a partial separation was effected by this second distillation. This was confirmed by the extraction of a small amount of hydnocarpic acid from the combined Fractions 1 and 2, and a small amount of chaulmoogric acid from Fraction 5. The greater part, however, of the products of this distillation improved in melting point on recrystallization until the 48-52° range was reached, after which further crystallization had little effect.

This shows that it is unprofitable to redistil the mixture fraction *by itself*. It has been found, however, that the addition of the mixture fraction to the next lot of mixed fatty acids to be distilled increases very materially the yield of hydnocarpic and chaulmoogric acids which can be obtained from such distillations.

Reference to Fig. 4 will show that the portion of the distillate designated as the hydnocarpic acid fraction consisted of the first 300 c. c. distilled off from one kg. (1,084 c. c.) of mixed fatty acids; that the mixture fraction consisted of the next 350 c. c. to distil over, while the chaulmoogric acid fraction included all the remainder of the distillate (approximately 250 c. c.).

It has been found lately that in the case of low-grade chaulmoogra oil, better results are obtained by cutting the distillate from one kg. of material (300 c. c. of mixture fraction from previous distillation plus sufficient crude mixed fatty acids to make 1,000 grams) as follows:

Hydnocarpic acid fraction.....	First 350 c. c.
Mixture fraction.....	Next 300 c.c.
Chaulmoogric acid fraction.....	250 c. c.

Having established a satisfactory procedure for carrying out the fractional distillation of the mixed fatty acids, attention was turned to the second phase of the separation, namely, fractional crystallization. An extended investigation of the relative efficiency of a variety of solvents in various proportions to the weights of the material being crystallized brought out the following facts.

For the chaulmoogric acid fraction the most effective solvent is 80 per cent alcohol in the proportion of 20 c. c. of solvent to 5 grams of solute.

For the mixture fraction no solvent has been found which will effectively separate the 2 acids.

For the hydnocarpic acid fraction, 80 per cent alcohol in the ratio of 20 c. c. of solvent to 5 grams is the most efficient for solutes whose melting point is below 35°. After this point has been passed, the most satisfactory solvent is petroleum ether, in the ratio of 30 c. c. of solvent to 5 grams of solute.

When the 80 per cent alcohol is used, the best results are obtained by allowing the solution to stand overnight in an ordinary refrigerator (about 16°). When petroleum ether is used, the treatment is the same until nearly pure hydnocarpic acid has been obtained, which crystallizes best at ordinary room temperature, the time required being 1 to 3 hours.

A scheme for the systematic fractional crystallization of chaulmoogric and hydnocarpic acid fractions has been worked out which has given excellent results. For the chaulmoogric acid fraction, 10 receptacles of appropriate size were placed in a rack and the receptacles marked consecutively for material melting: (1) Below 25°; (2) 25-35°; (3) 35-45°; (4) 45-50°; (5) 50-55°; (6) 55-60°; (7) 60-63°; (8) 63-65°; (9) 65-67°; (10) pure chaulmoogric acid 68°.

A corresponding set of receptacles was devoted to the hydnocarpic fraction, marked for the following melting point temperature ranges: (1) Below 25°; (2) 25-30°; (3) 30-35°; (4) 35-40°; (5) 40-45°; (6) 45-50°; (7) 50-53°; (8) 53-56°; (9) 56-59°; (10) pure hydnocarpic acid 60°.

In carrying out a fractional crystallization, the crude distillate is first allowed to crystallize from the proper solvent in such a way that a first and second crop, amounting in each case to approximately

$\frac{1}{3}$  of the original weight of the material, are obtained. The final mother liquor is washed with hot water to remove alcohol, and the resulting oil is dried. This gives a first crop, second crop, and residue, which, after taking their melting points, are placed in the receptacles, whose indicated melting point ranges cover that of the product as nearly as possible.

All three of these are recrystallized simultaneously from the appropriate solvent, producing 3 first crops, 3 second crops, and 3 residues, which are classified according to their melting points. Thus it frequently results that a first crop from low-melting material and a second crop from material of intermediate melting point and a residue from high-melting material will all melt at about the same point; and since they will be put in the same receptacle, they will automatically be combined and recrystallized together in the next operation.

Thus, with a minimum amount of time and effort, the pure acids move to one end of the series of receptacles, the liquid material moves to the opposite end, while any other solid acids of definite melting point will automatically accumulate in one of the intermediate receptacles.

Up to the present time no such solid acids have been definitely isolated, but there is reason to believe that several such exist, and this subject, together with the composition of the liquid portions, will be dealt with in a later paper.

As the greater part of this paper has been devoted to tracing the development of this work, with frequent references to the present practice, it is thought worth while at this point to give in some detail the complete method in use at the present time for the practically quantitative extraction of chaulmoogric and hydnocarpic acids from chaulmoogra oil.

Two hundred and forty grams of sodium hydroxide are dissolved in one liter of hot water and thoroughly mixed with 1,500 grams of chaulmoogra oil in a 5-liter, round-bottom flask, and heated in an autoclave under 15 pounds of steam pressure for one hour. Loss by frothing is prevented by inserting a loosely fitting wooden plug or stopper in the neck of the flask, through which runs a piece of 16 mm. i. d. glass tubing, which extends about 35 cm. above the flask, where 2 right angle bends lead it into an 800 c. c. beaker, which is placed on a shelf in the autoclave. A piece of cheesecloth, tied over the top of the beaker, through which the bent tube projects, effectively prevents loss from spattering.

After removing the flask containing the sodium soaps from the autoclave, the contents are poured into about 3 or 4 liters of hot water in a large precipitating jar, and stirred until dissolved.

The soap solution is now acidified with commercial hydrochloric acid, and the liberated fatty acids rise to the top of the water in the form of a thick oily layer. By means of a siphon, the aqueous layer, which contains sodium chloride and glycerol, is drawn off and discarded. The remaining oil is washed with successive portions of hot water and finally transferred to a hot-water funnel, where, in the course of one or two hours' heating, all the water separates from the liquefied fatty acids. The latter are strained through linen of fine mesh before being allowed to solidify. The usual yield of crude mixed fatty acids is between 1,350 and 1,400 grams.

One kg. (1084 c. c. when liquefied) of these mixed fatty acids was subjected to vacuum distillation in the apparatus shown in Fig. 2.<sup>3</sup>

The vacuum is applied before the temperature of the liquid in the flask rises above 100°, otherwise serious frothing-over may result. It is best to have both of the 3-way stopcocks open for the vacuum, also the one-way stopcock between the receiving chamber and the graduated receiver. There is usually a tendency for a little of the fatty acid vapor to solidify in the stopcocks, interfering with the vacuum. This difficulty may be obviated by playing a jet of steam against the stopcock. As the stopcocks must remain air-tight, even while hot, it is best to use a mixture of vaseline and talcum powder as a lubricant in them.

The first 350 c. c. which distil over are worked for hydnocarpic acid. The next 300 c. c., composing the mixture fraction, are set aside to be redistilled as part of the next lot of mixed fatty acids. The remainder of the distillate is worked for chaulmoogric acid.

The chaulmoogric acid fraction is recrystallized from 80 per cent alcohol, using the proportions of 20 c. c. to 5 grams of the acids, and following the systematic scheme for recrystallizing given above.

The hydnocarpic acid fraction is treated in the same way, except that material which melts above 35° is recrystallized from petroleum ether, using 30 c. c. of solvent to 5 grams of solute.

The amounts of chaulmoogric and hydnocarpic acids present vary largely according to the quality of the oil; but from even low grade oil, starting with 1000 grams of mixed acids, this method will give at least 50 grams of pure hydnocarpic acid and 100 grams of pure chaulmoogric acid.

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<sup>3</sup> It has been found that a very effective column for the neck of the flask is obtained by locating 4 diaphragms of 3 mm. mesh wire gauze at intervals of about 37 mm., the lowest being at the bottom of the neck and the highest being about 5 cm. below the outlet into the delivery tube. Resting on the lowest of these diaphragms are as many 25-mm. lengths of glass tubing, 5.5 mm. inside diameter, placed vertically, as the neck of the flask will accommodate. On the next diaphragm a similar set of 4 mm. tubes; on the next a set of 2.5 mm. tubes, while on the highest diaphragm are placed 3 mm. glass beads to a thickness of about 25 mm. The large tubes at the bottom take care of the heavy back-flow of liquid at that point. The increasing density of the column near the top gives an increasingly thorough washing to the up-coming gases. The breaks between sectors in the column prevent the gas pressure from below forcing condensed liquid up through the column.

## INTRAVENOUS ADMINISTRATION TO MICE, RATS, AND GUINEA PIGS.

By GEORGE B. ROZE, Pharmacologist, Hygienic Laboratory, United States Public Health Service.

Intravenous administration to small laboratory animals, such as mice, rats, and guinea pigs, although quite easy for the experienced operator, is usually rather difficult for the beginner. This mode of administration has lately taken on a new interest by reason of the fact that it is now employed in the United States for the official biological standardization of arsphenamine and allied compounds.

Intravenous administration as carried out by the Hygienic Laboratory of the United States Public Health Service, either when employing the official method for biologically standardizing arsphenamine or in investigations bearing upon possible modifications in the official method, differs in some respects from the methods commonly employed; and as numerous requests for a description of the several procedures have been received by the Hygienic Laboratory, a somewhat detailed account of them is given here.

*White mouse.*—The lateral veins of the tail of the white mouse were found to be best suited for intravenous administration purposes. The tail must be free from localized or generalized thickening of the epidermis so as to permit the ready entrance of a No. 23, B. & S. gauge needle. The use of a rather long needle, 1 inch in length, was found to be essential; it does not bend easily and therefore can be directed forward more readily than a smaller one.

A mouse weighing between 15 and 20 grams practically always possesses a soft, pliable tail which can be used without any preparation. When a mouse weighing over 20 grams is used, the lateral veins of the tail are usually covered with rather dense tissue, which precludes their use unless the tail is immersed for about a half minute in warm water (about 50° C.). This procedure both softens the skin and dilates the underlying vessels so that the vessels may be successfully used.

For holding the mouse, a small tin mailing tube attached to an iron stand is employed. One end of the metal mailing tube is fitted with a cork having at the circumference a V-shaped opening, which will admit the tail. The other end of the tube contains several small openings for the purpose of admitting air. (See Fig. 1.)

The mouse is grasped by the tail with the thumb and forefinger of the left hand and placed in the above-described metal mailing tube, and the cork is inserted so that the tail protrudes through the V-shaped opening. The tail is now straightened by gentle but firm traction and without twisting. The dorsal vein should then appear above, and each lateral to the left and right, respectively.

The syringe, usually a 1 cubic centimeter, all glass, tuberculin type, graduated to  $\frac{1}{100}$  of a cubic centimeter, is balanced between

the first and middle fingers of the right hand, as shown in Figure 1, the hand resting on the little finger; the thumb is thus free to operate the piston of the syringe. With the syringe held nearly parallel to the tail, the needle is pushed through the skin over one of the lateral veins (usually the left) and then anteriorly and downward into the vein. If an entrance into the vessel is not effected, either raising or lowering the point of the needle while advancing it further will usually succeed in locating the lumen of the vessel.

*White rat.*—The official method for standardizing arsphenamine and allied compounds requires that either the right or left saphenous vein of the white rat shall be employed for the intravenous administration of these compounds. At the Hygienic Laboratory, however, the right vein is more frequently employed, and the procedure is essentially as follows: The animal is tied securely by the legs, back downward, to a flat operating board, by means of strings long enough to permit the hind legs to be lifted easily.

The operating board actually used in the Hygienic Laboratory is exceedingly simple, consisting of a piece of flat board having the dimensions 18 inches by 8 inches by 1 inch. At the end of the board to which the head is tied are two glass pegs about 1 inch long, set in at an angle in order to hold the string which is looped over the front legs of the animal. Nails in the other end of the board receive the strings which are looped to the hind legs. (See Fig. 4.)

After shaving the hair over the skin area covering the left saphenous vein, the left foot is grasped between the third and middle fingers of the left hand, and an incision about one-fourth to one-half of an inch long is made about one-fourth of an inch to the left of and parallel to the vein. (See Step 1, Fig. 5.) The skin is then rolled over to the right with the first finger of the left hand by drawing the skin on the back of the leg to the left. (See Step 2, Fig. 5.) This will bring the vessel into view. An assistant then makes compression to dilate the vessel. If a syringe is used, it is preferable to employ a 1 cubic centimeter all-glass tuberculin type, graduated to  $\frac{1}{10}$  of a cubic centimeter and fitted with a No. 26 B. & S. gauge needle, five-eighths of an inch in length. The syringe is balanced between the first and middle fingers of the right hand, the hand resting on the little finger; the thumb is thus free to operate the piston of the syringe. The needle is then passed through the fascia and upper surfaces of the muscles, about one-eighth of an inch to the left of the vein and almost parallel to it. Advancing the needle slightly farther, the direction is changed so that the needle will enter the vein from the side. (See Step 3, Fig. 5.) After the injection is made, the skin, which was pulled to the right to permit the vessel to come into view, is released, and this skin flap and the muscles act as effective me-

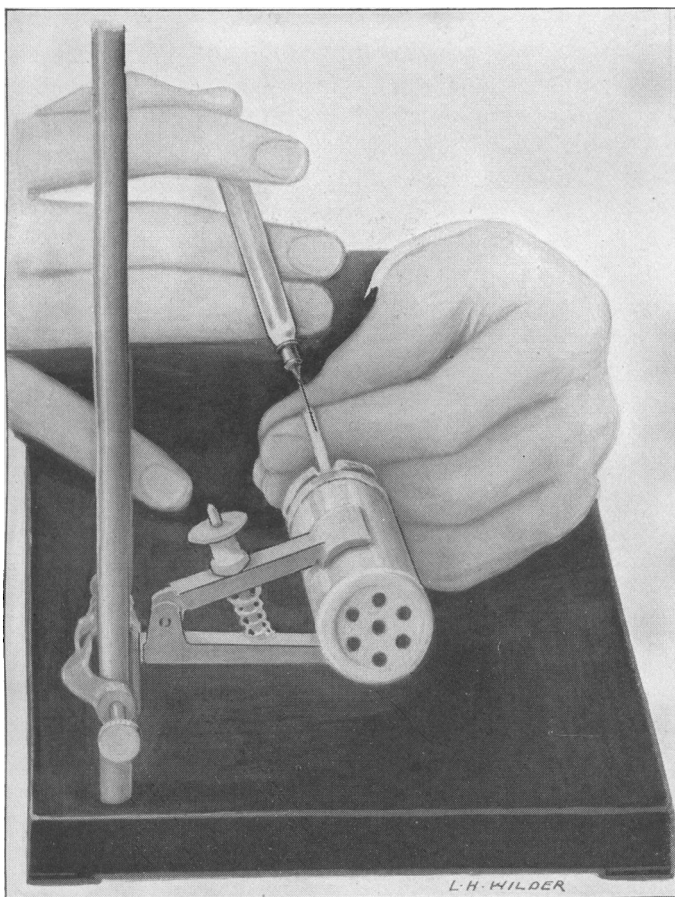


Fig. 1.—Method for intravenous administration to the white mouse.

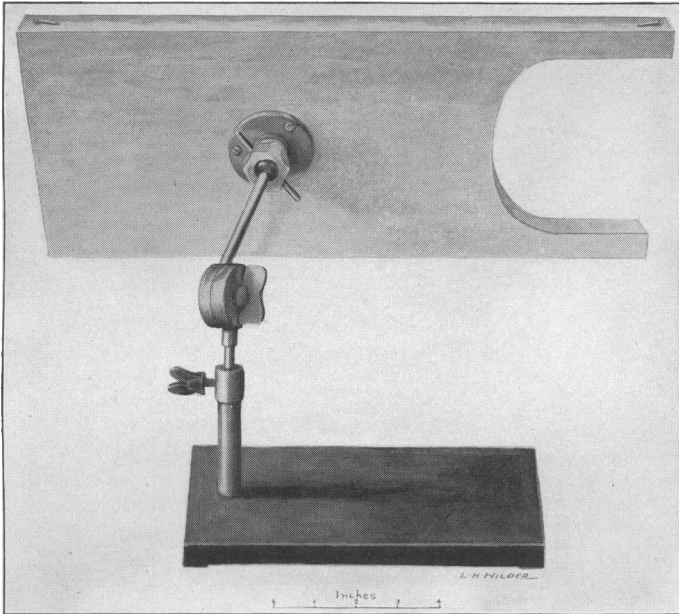


Fig. 2.—Operating board used for intravenous administration to the guinea pig.

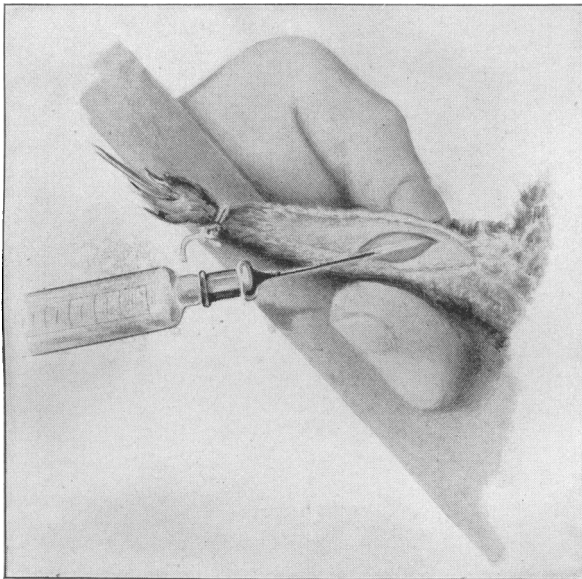


Fig. 3.—Position of vein used for intravenous administration to the guinea pig.



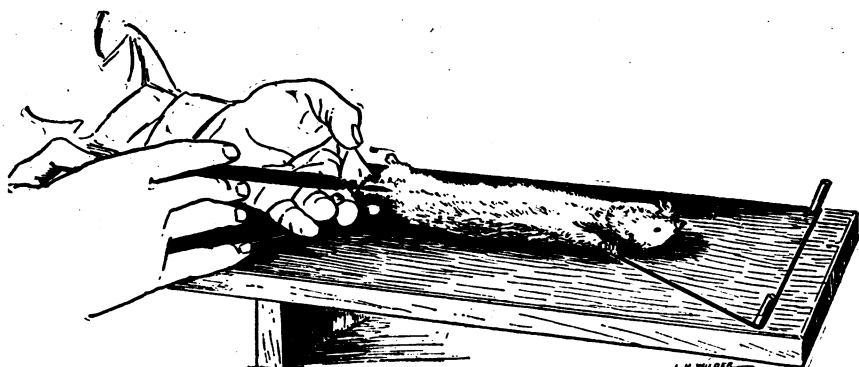


FIG. 4.—Method for intravenous administration to the white rat.

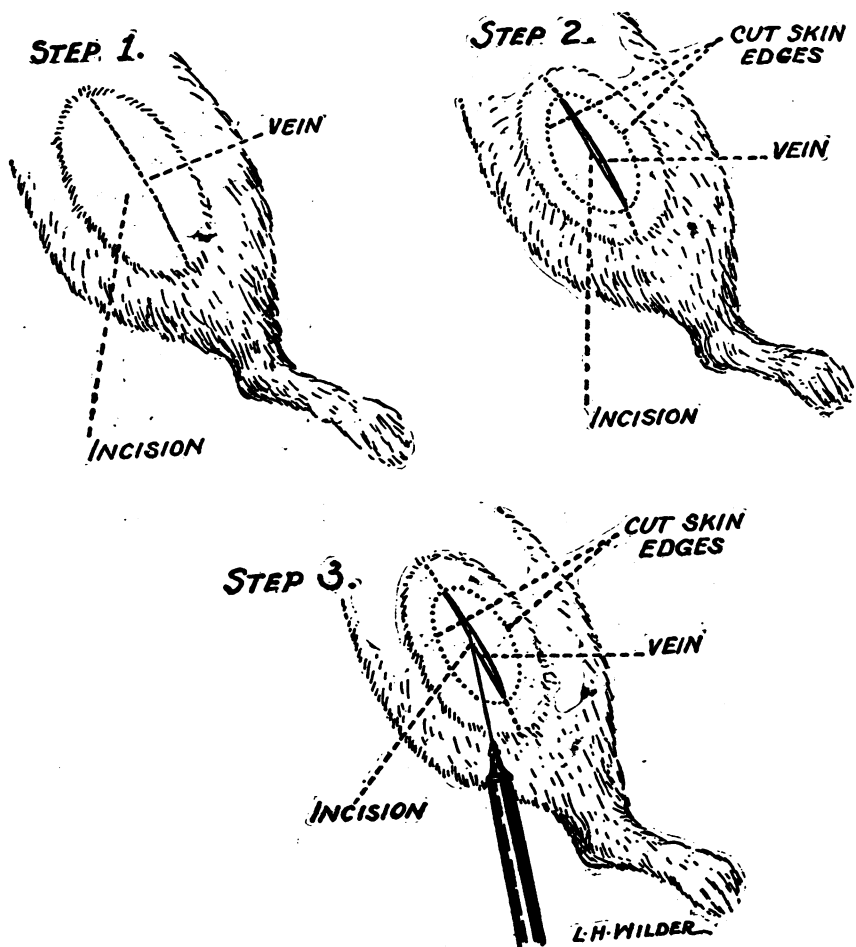


FIG. 5.—The three steps employed for intravenous administration to the white rat.

chanical checks to hemorrhage, which is quite profuse if the needle is inserted directly into the vein.

If a burette is employed and the injection made by gravity instead of by means of a syringe, a flexible rubber tube is attached to the burette, while the other end of the tube carries a glass tube which is drawn out and ground to fit a No. 23 B. & S. gauge needle 1 inch long. The glass tube is handled in the same way as the syringe, and

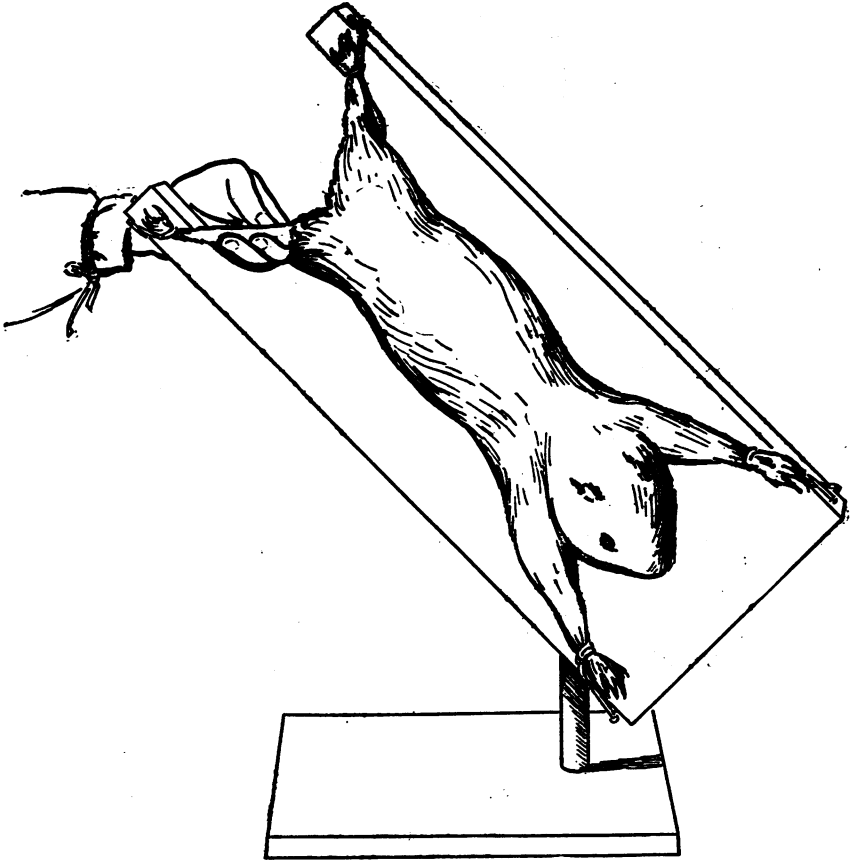


FIG. 6.—Method for intravenous administration to the guinea pig.

the vessel is entered in the same manner as was described under the syringe method.

*Guinea pig.*—The large superficial vein lying on the dorsal and inner aspect of the hind leg of the guinea pig is well adapted for intravenous administration. Occasionally, however, the vessel may run anteriorly. To use the above-described vessel for intravenous administration a special operating board is required. The board proper is similar to an ordinary animal board, except that the end to which the hind legs of the animal are tied has a U-shaped piece cut

from it as shown in the illustration. (Fig. 2.) The board is mounted near the center on an extension shaft which is fitted with two joints, the one at the end to which the board is attached being a ball-and-socket joint and the other an adjustable swivel joint. The shaft is screwed into a metal base which has sufficient weight to hold the board steady when placed in any position.

The procedure for making the injection is as follows: With the board properly placed in a horizontal position, the animal is tied to it securely, abdomen downward, by means of strings. The board is then placed in a vertical position and rotated on its vertical axis slightly so as to bring the dorsal aspect of the right hind leg into view. After clipping the hair from the leg and shaving it, the leg is lifted up slightly by the first or first and second fingers and the vein dilated by suitable compression. (Fig. 6.) The vessel can now usually be seen through the skin. A small incision, usually about one-fourth of an inch long, is made diagonally across the leg from the outer lower to the upper and inner aspect, but a trifle to the left of the vessel. The subcutaneous tissue is then pushed aside with a fine pointed forceps, thereby permitting the vessel to come into view.

The vessel is then entered directly (Fig. 3) or in the same manner as has been described for the rat—that is, by passing the needle of the tuberculin syringe through the fascia and muscles to the left of the vessel and then entering the vessel from the side. The vessel when dilated permits the ready entrance of a No. 23 B. & S. gauge needle. However, the needle usually employed is a No. 26 B. & S. gauge, five-eighths of an inch in length. The needle is always introduced well into the lumen of the vein. If entrance into the vessel is direct, subsequent hemorrhage may be controlled readily by pinching it with a small forceps.

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## PRELIMINARY NOTE ON A STABLE SILVER VITAMINE COMPOUND OBTAINED FROM BREWER'S YEAST.

By **ATHERTON SEIDELL**, Technical Assistant, United States Public Health Service.

Since the discovery in 1915<sup>1</sup> that fullers' earth possesses a remarkable adsorptive power for vitamine, the product resulting from this attraction has been used by me as the starting point for all subsequent attempts to isolate a pure, stable, antineuritic compound. The vitamine-fullers' earth combination has, for convenience, been designated as "activated" fullers' earth, and a large quantity of it was prepared and carefully standardized for its antineuritic power by tests on pigeons. Repeated tests on some of the samples showed that no loss of activity occurred during a period of more than five years. Until recently all of the attempts to obtain a pure vitamine

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<sup>1</sup> Seidell, Atherton, "A Stable Form of Vitamine, etc.": Public Health Reports, 31, 364-370, Feb. 13, 1916.

from "activated" fullers' earth have yielded products which, although highly antineuritic, were not sufficiently stable or well characterized to warrant further study as to their composition. The work up to now has, therefore, been useful only in showing the procedures by which a well-defined antineuritic can not be obtained.

Briefly, "activated" fullers' earth is prepared as follows: Well-washed and pressed brewer's yeast is allowed to autolyze in a warm place for 48 hours or more. The resulting thick liquid is filtered through paper, and to the clear filtrate there are added 50 grams of fullers' earth per liter. The particular variety of fullers' earth is that obtained from Surrey, England, and is imported by Eimer & Amend. The mixture is well shaken at intervals for one-half hour, and the solid is filtered off with the aid of a large Buchner funnel. It is washed with water and finally with alcohol and ether to facilitate subsequent drying.

The extraction of the vitamine from its combination with fullers' earth has been found to be most conveniently accomplished by means of saturated aqueous barium hydroxide solution, used in the proportion of 1 liter per 100 grams of the "activated" fullers' earth. The mixture is violently shaken for three minutes and the solid removed as quickly as possible. A De Laval cream separator, with the disks removed from the bowl, has been found to be very efficient for this purpose. The nearly clear liquid is immediately acidified with a slight excess of concentrated sulphuric acid, added to the actively stirred liquid. About 10 grams, or a moderate excess, of powdered barium carbonate is then added to remove the excess of sulphuric acid. The mixture is filtered after about one-half hour. Nearly saturated lead acetate solution is added to the filtrate until no further precipitate is obtained. The latter is then removed and the excess of lead in the liquid precipitated with hydrogen sulphide. The filtrate from the lead sulphide is then evaporated rapidly under diminished pressure to about one-tenth to one-twentieth its original volume. A white, amorphous precipitate begins to separate when the volume becomes small. This undoubtedly nonvitamine material is filtered off, and the evaporation is continued in a vacuum desiccator. Additional amounts of the amorphous white product separate and are removed from time to time. The liquid will finally be reduced to a thick, viscous mass, which yields no further quantities of the amorphous white precipitate. This crude vitamine extract may then be evaporated to complete dryness in a vacuum desiccator, and in this condition it appears to retain its antineuritic properties indefinitely. One such sample, after having been kept in the laboratory for almost two years, was found to be very active when tested on pigeons.

The test for antineuritic properties, which has been used exclusively upon the vitamine fractions obtained in this work, is con-

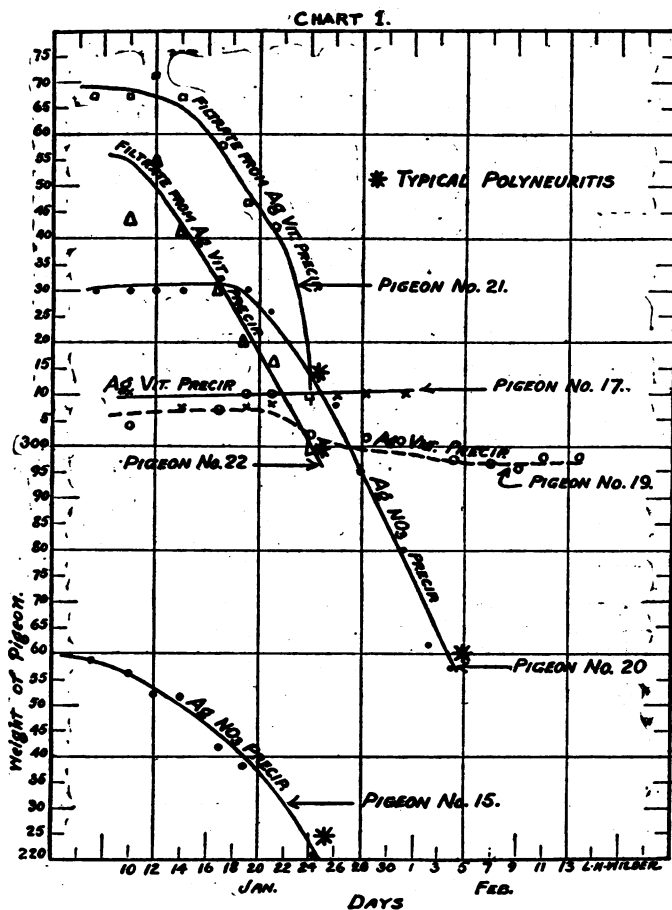
ducted as follows: Groups of about 10 pigeons each are kept in inclosures of some 400 cubic feet and supplied with water and ample amounts of polished rice. Each pigeon is numbered by means of a leg band and is weighed three times weekly. The samples to be tested are administered in gelatin capsules immediately after weighing each pigeon. Maintenance of weight under these conditions shows that the sample being tested contains at least the minimum amount of vitamine required to replace the deficiency of the rice diet. Rapid loss in weight, followed by polyneuritis, occurs among the control pigeons and those receiving doses of samples deficient in antineuritic vitamine.

Using an amount of the crude vitamine extract, prepared as described above, from 300 grams of "activated" fullers' earth, it has been found that after diluting to a volume of about 25 cubic centimeters and gradually adding an almost saturated aqueous silver nitrate solution, a voluminous silver precipitate is obtained. This is removed most conveniently by centrifugation and is washed once by centrifugation, using an amount of water equal to the volume of the precipitate. The decanted solution and wash water, after being tested with the reagent for complete precipitation, are mixed and filtered. To this solution is then added an excess of fairly concentrated aqueous ammoniacal silver nitrate solution, made by adding ammonia to aqueous silver nitrate until the black precipitate, which at first separates, just redissolves. This causes the separation of another voluminous silver precipitate, which is likewise removed by centrifugation and washed as before. These two precipitates and the filtrate from the second one were subjected to tests on pigeons and it was found that of the three samples, the second, obtained by means of ammoniacal silver nitrate, was highly antineuritic.

The results of this experiment are shown in Chart 1. For convenience, the precipitate obtained by means of ammoniacal silver nitrate is designated as silver vitamine precipitate, "Ag. Vit. Precip." The results show very strikingly that neither the silver nitrate precipitate nor the filtrate from the ammoniacal silver nitrate precipitate contains an appreciable amount of the protective vitamine.

When the ammoniacal silver nitrate precipitate, obtained as above described, is suspended in water, and a slight excess of hydrochloric acid is added, the silver is rapidly transformed to silver chloride, which may be easily removed from the clear aqueous solution. The latter, when subjected to slow evaporation in a vacuum desiccator containing stick sodium hydroxide as the drying agent, begins to yield well-formed crystals when the volume is reduced to about 10 cubic centimeters. Several crops of these crystals were easily obtained, but, when tested on pigeons, were found to possess no antineuritic properties. (See Chart 2.) When the mother liquor had been

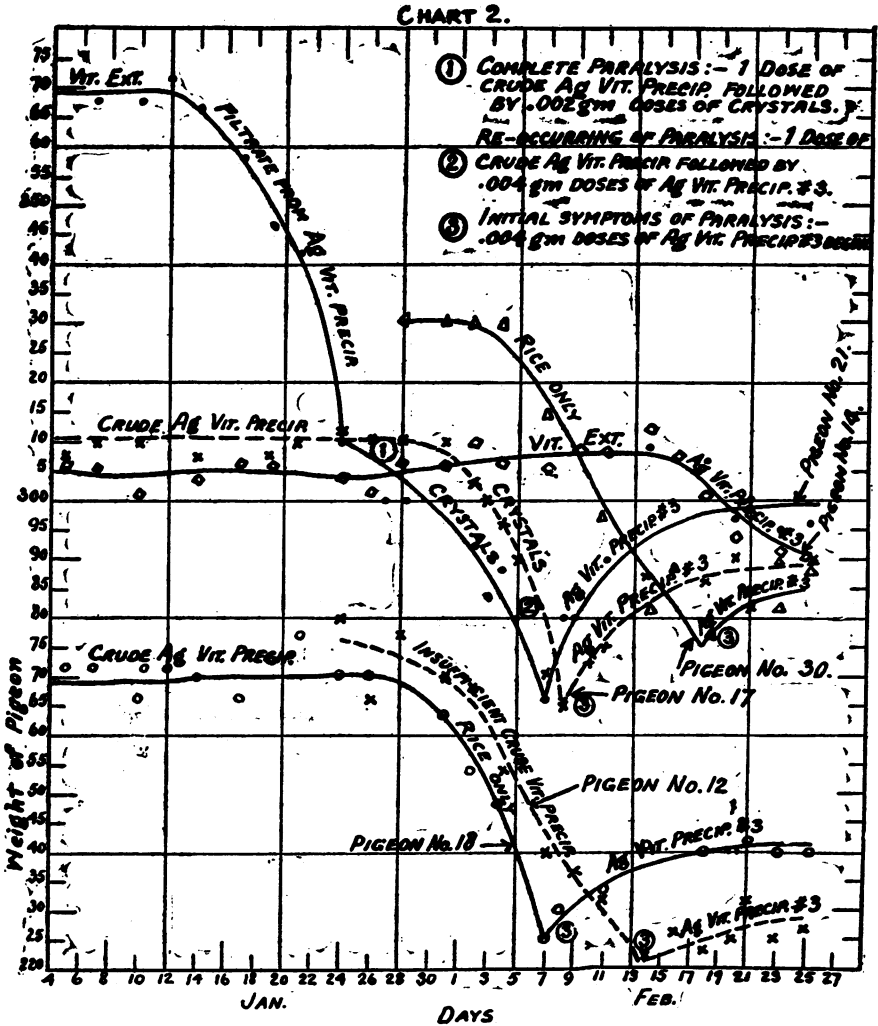
reduced to a volume of about 3 cubic centimeters, it began to change in color from pale yellowish to reddish and showed no further tendency to yield crystals. In one instance, when the evaporation was accidentally carried further, the whole mass turned to a black, thick, viscous liquid. If the slightly reddish liquid is diluted with a small volume of water and aqueous silver nitrate solution added carefully, silver chloride continues to separate until the excess of hydrochloride has just been removed. The end point for this removal is



very sharp. The filtrate from this silver chloride precipitate, when treated with ammoniacal silver nitrate, yields again the voluminous silver vitamine precipitate, which now, however, is free from the crystallizable inactive fraction described above. The yield of dried precipitate from 300 grams of "activated" fullers' earth was 0.7 gram. Results of the tests of the above-mentioned crystals, as well as of the ammoniacal silver nitrate precipitate as originally obtained, "Crude Ag. Vit. Precip.," and after removal of the inactive

crystallizable material and reprecipitation by means of ammoniacal silver nitrate, "Ag. Vit. Precip. # 3," are shown in Chart 2.

It is apparent from a consideration of Charts 1 and 2 that when a concentrated solution obtained by barium hydroxide extraction of "activated" fullers' earth is precipitated with aqueous silver nitrate, that portion of the extract thus removed contains none or very little



of the vitamine. The ammoniacal silver nitrate precipitate, on the other hand, carries with it both a non- (or difficultly) crystallizable antineuritic substance and an easily crystallizable non-vitamine compound. After the removal of this latter, the reprecipitated silver compound is found to retain its antineuritic properties apparently unimpaired. This compound is only slightly soluble in water, but

readily yields up its antineuritic constituent when suspended in dilute hydrochloric acid. It appears to suffer no change on drying, and the present experiments show that samples still protect pigeons on a rice diet from polyneuritis after a period of nearly three weeks.<sup>1</sup>

A determination of the silver present, made by ignition, showed 54.85 per cent Ag. The doses given the pigeons shown on Chart 2 were 0.004 gram on alternate days, i. e., 0.002 gram per day of the silver compound, which is equivalent to slightly less than 0.001 gram of the antineuritic portion of the material.

Whether the silver vitamine precipitate obtained as described above is a pure compound is, of course, not known at present. It is possible that two or more substances are present in combination with the silver and that different samples which are prepared will vary somewhat in composition. It is believed, however, to be an exceptionally favorable product on which to concentrate efforts toward the identification of the antineuritic vitamine. Attention is, therefore, now being directed toward this part of the problem.

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**INDEX TO PUBLIC HEALTH REPORTS, VOL. 35, PART 2, 1921.**

The index, with title page, to Vol. 35, Part 2 of Public Health Reports for 1920 is now available and may be had on application to the Surgeon General, United States Public Health Service, Washington, D. C.

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**DEATHS DURING WEEK ENDED MAR. 19, 1921.**

*Summary of information received by telegraph from industrial insurance companies for week ended Mar. 19, 1921, and corresponding week, 1920. (From the "Weekly Health Index," Mar. 22, 1921, issued by the Bureau of the Census, Department of Commerce.)*

	Week ended Mar. 19, 1921.	Corresponding week, 1920.
Policies in force.....	46, 293, 930	41, 997, 632
Number of death claims.....	9, 434	13, 276
Death claims per 1,000 policies in force.....	10. 6	16. 5

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<sup>1</sup> NOTE.—Since this was written the tests (Chart 2) have been continued for an additional period of three weeks, during which time no polyneuritic symptoms developed in any case. Each bird, however, decreased slightly in weight, possibly as a result of the absence of a growth-promoting principle in the purified antineuritic product.



Deaths from all causes in certain large cities of the United States during the week ended Mar. 19, 1921, infant mortality, annual death rate, and comparison with corresponding week of preceding years. (From the "Weekly Health Index," Mar. 22, 1921, issued by the Bureau of the Census, Department of Commerce.)

City.	Estimated population, July 1, 1921.	Week ended Mar. 19, 1921.		Average annual death rate per 1,000. <sup>2</sup>	Deaths under 1 year.		Infant mortality rate, week ended Mar. 19, 1921. <sup>3</sup>
		Total deaths.	Death rate. <sup>1</sup>		Week ended Mar. 19, 1921.	Previous year or years. <sup>2</sup>	
Akron, Ohio.....	208,435	45	11.3	12.4	8	8	77
Albany, N. Y.....	115,071	34	15.4	C 23.8	7	C 9	157
Atlanta, Ga.....	207,473	74	18.6	C 16.1	14	C 7	.....
Baltimore, Md.....	754,537	240	17.3	A 21.3	22	A 33	62
Birmingham, Ala.....	186,133	61	17.1	A 19.8	8	A 8	.....
Boston, Mass.....	757,634	233	16.0	A 19.6	36	A 39	97
Bridgeport, Conn.....	148,967	25	8.7	A 18.9	5	A 11	63
Buffalo, N. Y.....	519,608	119	11.9	C 14.2	27	C 19	104
Cambridge, Mass.....	110,444	29	13.7	A 16.5	5	A 4	89
Camden, N. J.....	119,672	40	17.4	.....	7	.....	.....
Chicago, Ill.....	2,780,655	668	12.5	A 17.3	111	A 148	.....
Cincinnati, Ohio.....	403,418	117	15.1	C 21.3	16	C 31	106
Cleveland, Ohio.....	831,138	201	12.6	C 13.6	11	C 15	110
Columbus, Ohio.....	245,358	60	14.7	C 15.1	8	C 11	93
Dallas, Tex.....	165,282	33	10.4	A 17.0	4	A 3	.....
Dayton, Ohio.....	158,119	40	13.2	C 13.4	4	C 4	82
Denver, Colo.....	283,152	85	16.8	A 14.6	7	.....	.....
Detroit, Mich.....	1,070,450	208	10.1	.....	54	.....	102
Fall River, Mass.....	120,668	42	18.1	C 19.1	7	C 8	210
Grand Rapids, Mich.....	141,197	40	14.8	C 12.1	7	C 6	118
Houston, Tex.....	144,340	35	12.6	.....	15	.....	.....
Indianapolis, Ind.....	325,215	67	10.7	C 13.6	10	C 9	78
Jersey City, N. J.....	302,788	69	11.9	C 21.3	11	C 22	.....
Kansas City, Kans.....	169,909	41	20.6	.....	5	.....	119
Los Angeles, Calif.....	611,630	179	15.3	A 15.3	15	A 13	71
Louisville, Ky.....	236,083	65	14.4	C 24.8	2	C 13	23
Lowell, Mass.....	113,757	34	15.6	A 20.5	7	A 10	113
Milwaukee, Wis.....	468,396	87	9.7	A 15.1	12	A 31	82
Minneapolis, Minn.....	302,815	115	15.3	C 11.5	17	C 9	68
Nashville, Tenn.....	119,526	37	16.1	C 21.4	5	C 6	.....
New Bedford, Mass.....	125,012	30	18.4	A 17.6	2	A 8	154
New Haven, Conn.....	167,007	36	11.2	C 20.8	9	C 17	24
New Orleans, La.....	204,657	120	15.9	A 20.3	17	A 14	.....
New York, N. Y.....	5,751,387	1,450	13.1	C 19.4	214	C 275	84
Newark, N. J.....	424,885	105	12.9	C 16.7	17	C 21	.....
Norfolk, Va.....	171,260	25	10.2	.....	0	.....	0
Oakland, Calif.....	228,472	40	9.2	A 12.6	6	A 4	76
Omaha, Nebr.....	197,066	47	12.4	.....	6	.....	.....
Paterson, N. J.....	137,463	53	20.1	.....	6	.....	.....
Philadelphia, Pa.....	1,868,212	550	15.4	19.2	68	65	82
Pittsburgh, Pa.....	596,413	208	18.2	C 17.7	28	C 33	90
Portland, Ore.....	264,859	77	15.2	C 16.4	11	C 6	110
Providence, R. I.....	239,645	78	17.0	C 17.7	9	C 16	.....
Richmond, Va.....	175,636	49	14.5	C 20.5	7	C 12	85
Rochester, N. Y.....	308,229	62	10.6	C 14.2	15	C 15	116
St. Louis, Mo.....	786,164	296	13.7	C 18.2	6	C 23	.....
St. Paul, Minn.....	237,781	60	13.2	C 11.9	7	C 5	70
Salt Lake City, Utah.....	121,506	30	12.9	A 13.3	6	.....	93
San Francisco, Calif.....	530,540	134	13.4	C 16.0	17	C 13	90
Seattle, Wash.....	327,227	81	12.9	A 9.3	7	A 7	58
Spokane, Wash.....	104,422	22	11.0	C 15.5	2	C 2	44
Springfield, Mass.....	136,877	43	16.5	.....	6	.....	90
Syracuse, N. Y.....	177,265	42	12.4	C 16.6	8	C 12	96
Toledo, Ohio.....	253,696	69	14.2	A 18.3	9	A 10	91
Trenton, N. J.....	122,760	31	13.2	A 24.4	5	A 10	.....
Washington, D. C.....	454,026	128	14.7	A 18.8	12	A 14	70
Wilmington, Del.....	115,406	26	12.0	C 19.3	2	.....	.....
Worcester, Mass.....	154,972	68	19.2	C 16.4	10	C 10	107
Yonkers, N. Y.....	103,324	24	12.1	A 12.6	2	A 5	45
Youngstown, Ohio.....	139,432	41	15.3	.....	9	.....	114

<sup>1</sup> Annual rate per 1,000 population.

<sup>2</sup> "A" indicates data for the corresponding week of the years 1913 to 1917, inclusive. "C" indicates data for the corresponding week of the year 1918.

<sup>3</sup> Deaths under 1 year per 1,000 births—an annual rate based on deaths under 1 year for the week and estimated births for 1920. Cities left blank are not in the registration area for births.

<sup>4</sup> Enumerated population Jan. 1, 1920.

<sup>5</sup> Data based on statistics of 1915, 1916, and 1917.

# 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.

#### Telegraphic Reports for Week Ended Mar. 26, 1921.

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

ALABAMA.		CONNECTICUT.	
	Cases.		Cases.
Chicken pox.....	26	Chicken pox.....	46
Diphtheria.....	12	Conjunctivitis (infectious).....	1
Hookworm.....	138	Diphtheria:	
Measles.....	18	Bridgeport.....	10
Mumps.....	19	New Haven.....	9
Pneumonia.....	8	Scattering.....	33
Smallpox:		German measles.....	2
Jefferson County.....	43	Influenza.....	6
Tuscaloosa County.....	11	Lethargic encephalitis.....	6
Scattering.....	63	Measles:	
Tuberculosis.....	16	Farmington.....	15
Typhoid fever.....	17	Greenwich.....	19
Whooping cough.....	11	Middletown (C.).....	18
		New Britain.....	15
		New Hartford.....	9
		Scattering.....	44
		Mumps.....	82
		Pneumonia (lobar).....	42
		Poliomyelitis.....	1
		Scarlet fever:	
		Bridgeport.....	9
		New Haven.....	29
		Stamford (C.).....	8
		Scattering.....	59
		Tetanus.....	1
		Trichinosis.....	1
		Tuberculosis (all forms).....	21
		Whooping cough.....	65
		DELAWARE.	
		Chicken pox.....	9
		Diphtheria.....	4
		Influenza.....	1
		Measles.....	1
		Mumps.....	6
		Pneumonia.....	5
		Scarlet fever:	
		Wilmington.....	11
		Scattering.....	5
		Tuberculosis.....	15
		Typhoid fever.....	1
		Whooping cough.....	14
ARKANSAS.			
Cerebrospinal meningitis.....	1		
Chicken pox.....	72		
Diphtheria.....	6		
Hookworm.....	3		
Influenza.....	17		
Malaria.....	34		
Measles.....	157		
Pellagra.....	6		
Smallpox.....	15		
Scarlet fever.....	13		
Tuberculosis.....	8		
Typhoid fever.....	9		
Whooping cough.....	6		
CALIFORNIA.			
Cerebrospinal meningitis.....	4		
Influenza.....	158		
Lethargic encephalitis.....	4		
Smallpox:			
Marysville.....	8		
Orange.....	9		
San Francisco.....	22		
Scattering.....	51		
Typhoid fever.....	23		

FLORIDA.	Cases.
Diphtheria.....	10
Malaria.....	4
Pneumonia.....	4
Scarlet fever.....	1
Smallpox.....	81
Trachoma.....	3
Typhoid fever.....	15

GEORGIA.	
Cerebrospinal meningitis.....	1
Chicken pox.....	34
Diphtheria.....	11
Dysentery (amebic).....	1
Dysentery (bacillary).....	4
Hookworm.....	46
Influenza.....	12
Malaria.....	21
Measles.....	106
Mumps.....	16
Pneumonia.....	20
Poliomyelitis.....	1
Scarlet fever.....	7
Septic sore throat.....	5
Smallpox.....	87
Tuberculosis (pulmonary).....	11
Typhoid fever.....	4
Whooping cough.....	10

ILLINOIS.	
Cerebrospinal meningitis:	
Cicero.....	1
Chicago.....	1
Mark.....	1
Standard.....	1
Diphtheria:	
Chicago.....	188
Scattering.....	56
Influenza.....	19
Lethargic encephalitis—Chicago.....	2
Pneumonia.....	232
Poliomyelitis:	
Oakford.....	1
Piatt County—Willow Branch Township.....	1
Scarlet fever:	
Chicago.....	135
Decatur.....	11
Peoria.....	17
Springfield.....	10
Scattering.....	142
Smallpox:	
East St. Louis.....	15
Palestine.....	9
Rockford.....	10
Scattering.....	129
Typhoid fever.....	9

INDIANA.	
Cerebrospinal meningitis:	
Clay County.....	1
Howard County.....	1
Diphtheria.....	37
Scarlet fever.....	257
Smallpox.....	162
Typhoid fever.....	6

IOWA.	Cases.
Cerebrospinal meningitis—Burlington.....	1
Diphtheria.....	20
Scarlet fever.....	103
Smallpox:	
Green Island.....	8
Oelwein.....	13
Scattering.....	171

KANSAS.	
Chicken pox.....	80
Diphtheria.....	66
German measles.....	7
Influenza.....	21
Lethargic encephalitis.....	2
Measles.....	536
Mumps.....	23
Pellagra.....	1
Pneumonia.....	31
Scarlet fever.....	112
Septic sore throat.....	1
Smallpox.....	190
Tuberculosis.....	57
Typhoid fever.....	3
Whooping cough.....	64

LOUISIANA.	
Cerebrospinal meningitis.....	1
Diphtheria.....	8
Scarlet fever.....	6
Smallpox.....	68
Typhoid fever.....	7

MAINE.	
Cerebrospinal meningitis.....	1
Chicken pox.....	17
Diphtheria.....	15
Influenza.....	1
Measles.....	141
Mumps.....	10
Pneumonia.....	13
Scarlet fever.....	29
Smallpox.....	1
Tuberculosis.....	9
Typhoid fever.....	2
Whooping cough.....	12

MARYLAND. <sup>1</sup>	
Chicken pox.....	68
Diphtheria.....	44
German measles.....	4
Influenza.....	157
Lethargic encephalitis.....	4
Malaria.....	1
Measles.....	121
Mumps.....	43
Ophthalmia neonatorum.....	3
Pneumonia (all forms).....	121
Scarlet fever.....	52
Septic sore throat.....	2
Smallpox.....	26
Tuberculosis.....	67
Typhoid fever.....	12
Whooping cough.....	135

<sup>1</sup> Week ended Friday.

MASSACHUSETTS.	
	Cases.
Cerebrospinal meningitis.....	5
Chicken pox.....	272
Conjunctivitis (suppurative).....	9
Diphtheria.....	172
German measles.....	23
Influenza.....	29
Lethargic encephalitis.....	5
Measles.....	605
Mumps.....	132
Ophthalmia neonatorum.....	12
Pneumonia (lobar).....	104
Polioomyelitis.....	1
Scarlet fever.....	261
Septic sore throat.....	1
Smallpox.....	3
Trachoma.....	3
Tuberculosis (all forms).....	186
Typhoid fever.....	10
Whooping cough.....	223

MINNESOTA.	
Cerebrospinal meningitis.....	1
Chicken pox.....	36
Diphtheria.....	36
Influenza.....	10
Measles.....	60
Pneumonia.....	6
Scarlet fever.....	165
Smallpox:	
Minneapolis.....	65
Scattering.....	185
Tuberculosis.....	86
Typhoid fever:	
Minneapolis.....	66
Scattering.....	16
Whooping cough.....	10

MISSISSIPPI.	
Cerebrospinal meningitis.....	1
Diphtheria.....	7
Scarlet fever.....	6
Smallpox.....	40
Typhoid fever.....	3

MISSOURI.	
Cerebrospinal meningitis.....	1
Chicken pox.....	136
Diphtheria.....	87
Epidemic sore throat.....	25
Influenza.....	41
Measles.....	199
Mumps.....	65
Ophthalmia neonatorum.....	1
Scarlet fever.....	140
Smallpox.....	233
Trachoma.....	5
Tuberculosis.....	38
Typhoid fever.....	2
Whooping cough.....	147

MONTANA.	
Cerebrospinal meningitis—Lewistown.....	1
Diphtheria.....	3
Scarlet fever.....	3
Smallpox.....	22

NEBRASKA.	
	Cases.
Chicken pox.....	35
Diphtheria:	
Omaha.....	8
Scattering.....	5
Measles:	
Omaha.....	12
Peru.....	56
Scattering.....	7
Mumps.....	11
Scarlet fever:	
Lincoln.....	11
Omaha.....	14
Scattering.....	45
Smallpox:	
Omaha.....	15
Stanton County.....	13
Superior.....	8
Walhill.....	16
Scattering.....	80
Typhoid fever.....	1
Whooping cough.....	4

NEW JERSEY.	
Cerebrospinal meningitis.....	1
Chicken pox.....	217
Diphtheria.....	133
Influenza.....	41
Measles.....	182
Paratyphoid fever.....	2
Pneumonia.....	192
Scarlet fever.....	240
Smallpox.....	15
Trachoma.....	2
Typhoid fever.....	7
Whooping cough.....	276

NEW MEXICO.	
Chicken pox.....	18
Conjunctivitis.....	1
Diphtheria.....	42
Favus.....	1
German measles.....	1
Influenza.....	2
Malaria.....	1
Measles.....	120
Mumps.....	27
Pneumonia.....	12
Scarlet fever.....	7
Septic sore throat.....	2
Smallpox.....	3
Tuberculosis.....	91
Typhoid fever.....	3
Whooping cough.....	41

NEW YORK.	
(Exclusive of New York City.)	
Cerebrospinal meningitis:	
Buffalo.....	2
Champlain.....	1
Hamburg.....	1
Millbrook.....	1
New Rochelle.....	3
Poughkeepsie.....	1
Diphtheria.....	205
Influenza.....	35

NEW YORK—continued.

	Cases.
Lethargic encephalitis.....	5
Measles.....	934
Pneumonia.....	278
Polioomyelitis—Ticonderoga.....	1
Scarlet fever.....	252
Smallpox:	
Rose.....	9
Scattering.....	29
Typhoid fever.....	23
Whooping cough.....	383

NORTH CAROLINA.

Cerebrospinal meningitis.....	1
Chicken pox.....	190
Diphtheria.....	31
German measles.....	2
Measles.....	591
Polioomyelitis.....	1
Scarlet fever.....	14
Septic sore throat.....	2
Smallpox.....	143
Typhoid fever.....	7
Whooping cough.....	316

SOUTH DAKOTA.

Chicken pox.....	7
Diphtheria.....	6
Influenza.....	4
Measles.....	13
Pneumonia.....	5
Scarlet fever.....	31
Smallpox.....	79
Tuberculosis.....	14
Whooping cough.....	4

TEXAS.

Chicken pox.....	47
Influenza.....	104
Lethargic encephalitis.....	2
Measles.....	114
Scarlet fever.....	5
Typhoid fever.....	3
Typhus fever:	
Galveston.....	2
San Marcos.....	1

VERMONT.

	Cases.
Chicken pox.....	33
Diphtheria.....	3
German measles.....	2
Measles.....	143
Mumps.....	22
Pneumonia.....	5
Smallpox.....	31
Scarlet fever.....	15
Whooping cough.....	39

VIRGINIA.

Smallpox—Floyd County.....	1
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WEST VIRGINIA.

Diphtheria.....	12
Measles:	
Charleston.....	13
Wheeling.....	13
Scattering.....	28
Scarlet fever.....	18
Smallpox:	
Bluefield.....	8
Scattering.....	14
Typhoid fever.....	2

WISCONSIN.

Milwaukee:	
Cerebrospinal meningitis.....	1
Chicken pox.....	26
Diphtheria.....	27
Lethargic encephalitis.....	2
Measles.....	7
Scarlet fever.....	29
Smallpox.....	24
Tuberculosis.....	14
Typhoid fever.....	2
Whooping cough.....	12
Scattering:	
Chicken pox.....	140
Diphtheria.....	45
German measles.....	1
Influenza.....	19
Measles.....	115
Scarlet fever.....	192
Smallpox.....	137
Tuberculosis.....	9
Typhoid fever.....	4
Whooping cough.....	130

Kentucky Report for Week Ended Mar. 19, 1921.

	Cases.	Scarlet fever:	Cases.
Cerebrospinal meningitis—Graves County.....	1	Hopkins County.....	45
Chicken pox.....	59	Jefferson County.....	27
Diphtheria:		Kenton County.....	8
Jefferson County.....	12	Scattering.....	17
Scattering.....	12	Septic sore throat.....	1
Dysentery.....	2	Smallpox:	
German measles.....	2	Hopkins County.....	22
Influenza.....	64	Muhlenberg County.....	9
Measles:		Nicholas County.....	8
Boyd County.....	15	Scattering.....	50
Grant County.....	14	Trachoma.....	11
Jefferson County.....	18	Tonsillitis.....	3
Marion County.....	15	Tuberculosis:	
Scattering.....	29	Jefferson County.....	13
Mumps.....	14	Scattering.....	14
Pneumonia.....	39	Typhoid fever.....	8
Scabies.....	1	Whooping cough.....	27

**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.	Pollomyelitis.	Scarlet fever.	Smallpox.	Typhoid fever.
1921.										
Arizona (January).....		15			72			19	37	1
Arizona (February).....	1	7	1		61			14	37	
Idaho (February).....		9	5		336			43	100	3
Illinois (February).....	26	1,342	410	37	4,165		7	2,520	1,607	73
Iowa (February).....	1	138	12		526			529	1,112	
Kansas (February).....	5	303	42	2	1,599	1	4	515	667	14
Maine (February).....	1	56	7		934			95	10	14
Minnesota (February).....	3	257	9		113		2	735	1,832	39
Mississippi (February).....	1	95	1,041	3,773	987	209		42	338	80
New Jersey (February).....	11	815	247	2	849			1,291	10	24
New York (February).....	42	3,354	616		6,660		10	3,809	65	126
North Dakota (February).....	2	94	50		286			143	230	9
Oregon (February).....	1	173	5		679			96	241	4
Pennsylvania (February).....	21	1,802			5,877		3	3,618	39	111
South Carolina (February).....		122		19	231	1		8	194	13
Virginia (February).....	8	247	2,468	143	4,202	4	4	250	352	60
Washington (February).....	4	118			465			200	532	13

**RECIPROCAL NOTIFICATION.**

**Minnesota—February, 1921.**

Cases of communicable diseases referred during February, 1921, to other State health departments by Department of Health of the State of Minnesota.

Disease and locality of notification.	Referred to health authority of—	Why referred.
Diphtheria: Hibbing, St. Louis County.	Negaunee, Marquette County, Mich.....	Diphtheria case left Hibbing for Negaunee, Mich.
Typhoid fever: Maple Ridge Township, Isanti County.	Surgeon General.....	Patient was fireman on boat running between Duluth and Buffalo, N. Y., touching at Huron, Ohio, Chicago, and Minneapolis.
Tuberculosis: Mayo Clinic, Rochester, Olmsted County.	Fulton, Whiteside County, Ill..... Charleston, Coles County, Ill..... Marshalltown, Marshall County, Iowa..... Garden Grove, Decatur County, Iowa..... Booneville, Copper County, Mo..... Howell, Colfax County, Nebr..... Sisseton, Roberts County, S. Dak..... Milwaukee, Milwaukee County, Wis..... Potosi, Grant County, Wis..... Cumberland, Barren County, Wis..... Fond du Lac, Fond du Lac County, Wis..... Yorkton, Saskatchewan, Canada..... Moose Jaw, Saskatchewan, Canada..... Oakburn, Manitoba, Canada.....	11 active cases, 1 moderately advanced case, 1 incipient case, and 1 quiescent case left Mayo Clinic for their homes.
Buena Vista Sanatorium, Wabasha, Wabasha County.	Newark, Licking County, Ohio.....	Patient left sanatorium for home.

**PLAGUE.<sup>1</sup>****HUMAN CASES OF PLAGUE REPORTED.**

Place.	Period covered.	Cases.	Deaths.	Remarks.
California: San Benito County.....	1921. Feb. 7.....	.....	1	

<sup>1</sup>A summary of the reports received of the occurrence of plague and the finding of plague-infected rodents in the United States during 1920 was published in Public Health Reports, Jan. 7, 1921, p. 15.

**PLAGUE-INFECTED RODENTS.**

Place.	Period covered.	Rodents found plague infected.
Florida: Pensacola.....	1921. Jan. 1 to Mar. 9..... Mar. 10-26.....	4 0
Louisiana: New Orleans.....	Jan. 1 to Feb. 19..... Feb. 20 to Mar. 26.....	33 0

**CITY REPORTS FOR WEEK ENDED MAR. 12, 1921.****ANTHRAX.**

Place.	Cases.	Deaths.
Pennsylvania: Philadelphia.....	1	.....

**CEREBROSPINAL MENINGITIS.**

The column headed "Median for previous years" gives the median number of cases reported during the corresponding weeks of the years 1915 to 1921, inclusive. In instances in which data for the full six years are incomplete, the median is that for the number of years for which information is available.

Place.	Median for previous years.	Week ended Mar. 12, 1921.		Place.	Median for previous years.	Week ended Mar. 12, 1921.	
		Cases.	Deaths.			Cases.	Deaths.
California:				New Jersey:			
Berkeley.....	0	1	1	Elizabeth.....	0	.....	1
Los Angeles.....	1	1	.....	Newark.....	0	2	.....
San Francisco.....	0	.....	1	New York:			
Connecticut:				Cohoes.....	0	.....	1
New Britain.....	0	1	1	New York.....	7	10	4
Illinois:				Ohio:			
Chicago.....	2	1	.....	Cleveland Heights.....	.....	.....	1
East St. Louis.....	0	1	.....	Hamilton.....	0	.....	1
Kansas:				Oklahoma:			
Kansas City.....	1	2	.....	Oklahoma City.....	0	.....	1
Massachusetts:				Pennsylvania:			
Boston.....	2	1	.....	Philadelphia.....	2	.....	1
Fall River.....	0	.....	1	Pittsburgh.....	0	1	.....
Michigan:				Tennessee:			
Highland Park.....	0	1	.....	Nashville.....	0	.....	1
Minnesota:				Texas:			
Minneapolis.....	0	1	.....	Galveston.....	0	1	1
Missouri:				Waco.....	0	.....	1
St. Louis.....	3	1	1	Wisconsin:			
				Eau Claire.....	1	1	.....
				Milwaukee.....	1	1	.....

**CITY REPORTS FOR WEEK ENDED MAR. 12, 1921—Continued.**

**DIPHTHERIA.**

See p. 684; also Telegraphic weekly reports from States, p. 672, and Monthly summaries by States, p. 676.

**INFLUENZA.**

Place.	Cases.	Deaths.	Place.	Cases.	Deaths.
<b>Alabama:</b>			<b>Michigan:</b>		
Anniston.....	1		Detroit.....	2	1
Birmingham.....		1	<b>Minnesota:</b>		
Mobile.....		1	Minneapolis.....		1
Montgomery.....	4		<b>Missouri:</b>		
<b>Arkansas:</b>			Kansas City.....	2	2
Little Rock.....	1		St. Louis.....	4	2
<b>California:</b>			<b>New Jersey:</b>		
Alameda.....	1	1	Bayonne.....	2	
Berkeley.....	7		Belleville.....	3	
Los Angeles.....	8	1	Kearny.....	10	
Oakland.....	10	1	Newark.....	51	3
Sacramento.....	4		Orange.....	1	
San Diego.....	5		Trenton.....		2
San Francisco.....	22	1	West Orange.....	2	
Stockton.....	4		<b>New York:</b>		
<b>Connecticut:</b>			Albany.....	1	
New Britain.....	2		Buffalo.....	4	
<b>District of Columbia:</b>			Cohoes.....	1	
Washington.....	8	2	Mount Vernon.....	6	
<b>Georgia:</b>			New York.....	124	20
Atlanta.....	15		Peekskill.....	1	1
<b>Illinois:</b>			Saratoga Springs.....	1	
Chicago.....	13	5	<b>North Carolina:</b>		
<b>Indiana:</b>			Salisbury.....	2	
Indianapolis.....		1	<b>Ohio:</b>		
<b>Kansas:</b>			Cincinnati.....	2	2
Wichita.....	1		Cleveland.....		1
<b>Louisiana:</b>			Hamilton.....		1
Baton Rouge.....	2		Toledo.....		1
New Orleans.....	2		<b>Pennsylvania:</b>		
<b>Maryland:</b>			Philadelphia.....	14	10
Baltimore.....	169	7	<b>Texas:</b>		
<b>Massachusetts:</b>			Dallas.....	2	2
Boston.....	14	1	<b>Vermont:</b>		
Fall River.....	1	1	Rutland.....	1	
North Adams.....	3		<b>Virginia:</b>		
Quincy.....	1		Norfolk.....	1	
Worcester.....	4		Richmond.....		2
			Roanoke.....	10	

**LEPROSY.**

<b>California:</b>			<b>Massachusetts:</b>		
San Diego.....	1		Southbridge.....	1	
San Francisco.....	1				
<b>Illinois:</b>					
Rock Island.....	1				

**LETHARGIC ENCEPHALITIS.**

<b>Massachusetts:</b>			<b>Virginia:</b>		
Boston.....	4	1	Norfolk.....	2	
Everett.....	1		<b>Wisconsin:</b>		
Haverhill.....	1		Milwaukee.....	1	
Lynn.....	1				

**MALARIA.**

<b>Alabama:</b>			<b>Georgia—Continued.</b>		
Montgomery.....	1		Macon.....	1	
<b>Georgia:</b>			Savannah.....	2	
Atlanta.....	1				
Brunswick.....	2				



## CITY REPORTS FOR WEEK ENDED MAR. 12, 1921—Continued.

## MEASLES.

See p. 684; also Telegraphic weekly reports from States, p. 672, and Monthly summaries by States, p. 676.

## PELLAGRA.

Place.	Cases.	Deaths.	Place.	Cases.	Deaths.
Alabama:			Louisiana:		
Anniston.....	1	.....	Baton Rouge.....	1	.....
Georgia:			Monroe.....		1
Brunswick.....	1	.....	Texas:		
.....		1	Waco.....		1

## PNEUMONIA (ALL FORMS).

Place.	Cases.	Deaths.	Place.	Cases.	Deaths.
Alabama:			Indiana:		
Anniston.....	3	.....	East Chicago.....		2
Birmingham.....		6	Elkhart.....		1
Mobile.....		2	Hammond.....		3
Montgomery.....	2	1	Indianapolis.....		4
Tuscaloosa.....	2	.....	La Fayette.....		1
Arizona:			Logansport.....		2
Tucson.....		2	Mishawaka.....		1
Arkansas:			Muncie.....		2
Hot Springs.....		1	Iowa:		
Little Rock.....	2	.....	Dubuque.....	1	.....
North Little Rock.....		1	Keokuk.....	1	.....
California:			Kansas:		
Berkeley.....		1	Arkansas City.....	3	.....
Long Beach.....		1	Fort Scott.....		1
Los Angeles.....	38	15	Hutchinson.....	1	.....
Oakland.....		8	Kansas City.....	10	.....
Pasadena.....	6	.....	Lawrence.....		2
Riverside.....		1	Topeka.....		2
Sacramento.....		5	Wichita.....	3	1
San Bernardino.....		1	Kentucky:		
San Diego.....		2	Covington.....		3
San Francisco.....	19	10	Louisville.....		10
Santa Barbara.....		1	Louisiana:		
Stockton.....		3	Baton Rouge.....		4
Colorado:			New Orleans.....		26
Colorado Springs.....	3	1	Maine:		
Denver.....		13	Auburn.....		1
Pueblo.....		5	Bath.....	1	.....
Connecticut:			Lewiston.....		2
Bridgeport.....		5	Portland.....	2	.....
Greenwich.....	3	.....	Sanford.....	3	.....
Hartford.....	11	1	Waterville.....	1	.....
Meriden.....	1	.....	Maryland:		
Milford.....		1	Baltimore.....	116	61
New Britain.....		2	Cumberland.....	3	2
Norwalk.....		2	Massachusetts:		
Delaware:			Attleboro.....		1
Wilmington.....		6	Beverly.....	2	.....
District of Columbia:			Boston.....	42	28
Washington.....		20	Braintree.....		1
Georgia:			Brockton.....		2
Atlanta.....		6	Cambridge.....		6
Brunswick.....		1	Chelsea.....	3	2
La Grange.....	3	.....	Danvers.....	1	.....
Rome.....	3	.....	Easthampton.....		1
Savannah.....		5	Everett.....	2	.....
Illinois:			Fall River.....		14
Alton.....		1	Gardner.....	1	.....
Aurora.....	3	1	Garfield.....	1	.....
Bloomington.....		3	Haverhill.....		5
Blue Island.....	2	1	Holyoke.....	2	1
Chicago.....	272	67	Lawrence.....		1
Decatur.....		4	Leominster.....	2	.....
East St. Louis.....		4	Lowell.....		6
Elgin.....		1	Lynn.....	6	2
Forest Park.....	3	.....	Malden.....	2	1
Freeport.....		1	Medford.....		3
Galesburg.....		2	Methuen.....		1
La Salle.....	3	.....	New Bedford.....		4
Mattoon.....	2	.....	Newton.....	5	1
Peoria.....		4	Northampton.....	1	.....
Rock Island.....	4	1	Norwood.....		2
Springfield.....		6	Pittsfield.....		3

CITY REPORTS FOR WEEK ENDED MAR. 12, 1921—Continued.

PNEUMONIA (ALL FORMS)—Continued.

Place.	Cases.	Deaths.	Place.	Cases.	Deaths.
Massachusetts—Continued.			New York—Continued.		
Quincy.....		2	Newburgh.....		2
Somerville.....	6	3	New York.....	400	219
Southbridge.....		2	Niagara Falls.....	9	2
Springfield.....	8	5	North Tonawanda.....	2	1
Waltham.....		3	Port Chester.....		1
Woburn.....		1	Poughkeepsie.....	2	1
Worcester.....		13	Rochester.....	31	11
Michigan:			Rome.....	1	
Ann Arbor.....	2		Saratoga Springs.....	1	
Detroit.....	62	26	Schenectady.....	4	2
Flint.....	2	1	Syracuse.....	10	6
Grand Rapids.....	10	1	Troy.....	10	4
Highland Park.....		1	Watervliet.....		1
Ironwood.....		2	White Plains.....	3	1
Ishpeming.....	1		Yonkers.....	7	1
Kalamazoo.....	7	5	North Carolina:		
Marquette.....	1		Charlotte.....		2
Muskegon.....	1		Durham.....		1
Pontiac.....		3	Greensboro.....		1
Port Huron.....		2	Salisbury.....		2
Sault Ste. Marie.....	1		Wilmington.....		1
Minnesota:			Winston-Salem.....		2
Duluth.....		3	Ohio:		
Mankato.....	5		Akron.....	8	
Minneapolis.....		12	Barberton.....		1
St. Paul.....		12	Canton.....		2
Missouri:			Cincinnati.....		16
Independence.....		2	Cleveland.....	35	25
Kansas City.....		13	Columbus.....		6
St. Joseph.....		2	Dayton.....	2	
Montana:			East Cleveland.....	2	
Billings.....		1	Elyria.....	1	
Butte.....		2	Hamilton.....		4
Great Falls.....	3	1	Lima.....		2
Nebraska:			Mansfield.....		2
Lincoln.....		1	Marion.....	1	
Omaha.....		7	Middletown.....		1
New Hampshire:			Newark.....		5
Berlin.....		1	Niles.....	5	1
Manchester.....		1	Piqua.....	2	
New Jersey:			Springfield.....		4
Atlantic City.....	5		Toledo.....		1
Belleville.....	2		Youngstown.....	2	1
Bloomfield.....	1		Oklahoma:		
Clifton.....		1	Oklahoma City.....		1
East Orange.....	4		Oregon:		
Elizabeth.....		4	Portland.....		7
Garfield.....	1		Pennsylvania:		
Gloucester City.....	1		Philadelphia.....	172	91
Hackensack.....		1	Rhode Island:		
Harrison.....	2		Newport.....		1
Hoboken.....		6	Pawtucket.....		4
Irrington.....	2		Providence.....		4
Jersey City.....	19		South Carolina:		
Kearny.....	3		Charleston.....		3
Montclair.....	4	2	Columbia.....	1	
Morristown.....		2	South Dakota:		
Newark.....	105	17	Sioux Falls.....	2	1
Orange.....		6	Tennessee:		
Passaic.....	7	2	Nashville.....		7
Paterson.....	2		Texas:		
Perth Amboy.....		5	Beaumont.....		3
Phillipsburg.....		2	Dallas.....	16	2
Plainfield.....	1		El Paso.....		7
Roosevelt.....		2	Fort Worth.....		2
Summit.....		2	Galveston.....		1
Trenton.....		6	Waco.....		1
West Hoboken.....		2	Utah:		
New York:			Salt Lake City.....		1
Albany.....	14		Vermont:		
Buffalo.....	40	2	Burlington.....		2
Cohoes.....	4		Virginia:		
Elmira.....	2		Alexandria.....	4	3
Glens Falls.....	1		Norfolk.....		1
Herkimer.....	1		Petersburg.....		3
Ithaca.....		2	Richmond.....	10	5
Jamestown.....	2		Roanoke.....	10	3
Lackawanna.....	5	1	West Virginia:		
Lockport.....	2		Huntington.....		2
Middletown.....	7	2	Wheeling.....		2
Mount Vernon.....	13	1			

## CITY REPORTS FOR WEEK ENDED MAR. 12, 1921—Continued.

## PNEUMONIA (ALL FORMS)—Continued.

Place.	Cases.	Deaths.	Place.	Cases.	Deaths.
Wisconsin:			Wisconsin—Continued.		
Beloit.....		1	Superior.....		1
Green Bay.....		1	Wausau.....	1	
Madison.....		2	Wyoming:		
Racine.....		6	Cheyenne.....		1

## POLIOMYELITIS (INFANTILE PARALYSIS).

The column headed "Median for previous years" gives the median number of cases reported during the corresponding weeks of the years 1915 to 1920, inclusive. In instances in which data for the full six years are incomplete, the median is that for the number of years for which information is available.

Place.	Median for previous years.	Week ended Mar. 12, 1921.		Place.	Median for previous years.	Week ended Mar. 12, 1921.	
		Cases.	Deaths.			Cases.	Deaths.
Illinois:				New York:			
Springfield.....	0	1		New York.....	0	1	1
New Jersey:							
Jersey City.....	0	1					

## RABIES IN ANIMALS.

Place.	Cases.	Deaths.	Place.	Cases.	Deaths.
Michigan:			New Jersey:		
Pontiac.....	1		Montclair.....	1	
Missouri:					
Kansas City.....	2				

## SCARLET FEVER.

See p. 684; also Telegraphic weekly reports from States, p. 672, and Monthly summaries by States, p. 676.

## SMALLPOX.

The column headed "Median for previous years" gives the median number of cases reported during the corresponding weeks of the years 1915 to 1920, inclusive. In instances in which data for the full six years are incomplete, the median is that for the number of years for which information is available.

Place.	Median for previous years.	Week ended Mar. 12, 1921.		Place.	Median for previous years.	Week ended Mar. 12, 1921.	
		Cases.	Deaths.			Cases.	Deaths.
Alabama:				Colorado:			
Birmingham.....	3	14		Colorado Springs.....	1	1	
Mobile.....	1	4		Denver.....	10	11	
Montgomery.....	0	12		Pueblo.....	0	7	
Tuscaloosa.....	0	2		District of Columbia:			
Arkansas:				Washington.....	0	5	
Fort Smith.....	5	1		Georgia:			
Hot Springs.....	1	3		Atlanta.....	5	29	
California:				Brunswick.....	1	7	
Alameda.....	0	1		La Grange.....		7	
Berkeley.....	0	3		Macon.....	2	2	
Long Beach.....	0	1		Rome.....	0	3	
Los Angeles.....	2	6		Savannah.....	0	4	
Oakland.....	1	13		Valdosta.....		3	
Richmond.....		6		Illinois:			
Sacramento.....	0	3		Bloomington.....	0	3	
San Francisco.....	8	59		Centralia.....	2	4	
Santa Barbara.....	0	1		Chicago.....	2	9	

CITY REPORTS FOR WEEK ENDED MAR. 12, 1921—Continued.

SMALLPOX—Continued.

Place.	Median for previous years.	Week ended Mar. 12, 1921.		Place.	Median for previous years.	Week ended Mar. 12, 1921.	
		Cases.	Deaths.			Cases.	Deaths.
Illinois—Continued.				Montana:			
East St. Louis.....	0	18	1	Great Falls.....	2	4	.....
Forest Park.....	0	1	1	Nebraska:			
Freeport.....	0	2	1	Lincoln.....	4	3	.....
Galesburg.....	0	1	1	Omaha.....	11	20	.....
La Salle.....	0	1	1	Nevada:			
Mattoon.....	0	1	1	Reno.....	1	10	.....
Peoria.....	4	1	1	New York:			
Rockford.....	0	12	1	New York.....	0	3	.....
Rock Island.....	0	1	1	North Tomawanda.....	0	2	.....
Springfield.....	1	2	2	North Carolina:			
Bloomington.....	0	4	4	Wilmington.....	0	2	.....
Elkhart.....	0	13	10	North Dakota:			
Evansville.....	4	10	13	Fargo.....	0	5	.....
Indiana:				Grand Forks.....	1	5	.....
Indianapolis.....	10	25	25	Ohio:			
Kokomo.....	1	2	2	Akron.....	0	4	.....
LaFayette.....	1	2	2	Canton.....	1	13	.....
Logansport.....	4	4	4	Cincinnati.....	2	8	.....
Marion.....	0	11	11	Cleveland.....	3	1	.....
Mishawaka.....	1	5	5	Columbus.....	0	35	.....
Muncie.....	4	1	1	Dayton.....	0	4	.....
Richmond.....	0	4	4	Elyria.....	1	1	.....
South Bend.....	1	10	10	Findlay.....	0	2	.....
Terre Haute.....	1	11	11	Hamilton.....	1	1	.....
Iowa:				Kenmore.....	0	3	.....
Cedar Rapids.....	7	13	13	Lancaster.....	0	2	.....
Clinton.....	0	12	12	Lima.....	2	13	.....
Council Bluffs.....	4	2	1	Marion.....	2	2	.....
Davenport.....	11	5	1	Middletown.....	1	2	.....
Des Moines.....	3	5	5	Newark.....	0	8	.....
Dubuque.....	2	4	2	Toledo.....	5	27	.....
Iowa City.....	0	2	2	Oklahoma:			
Mason City.....	3	2	2	Oklahoma City.....	12	5	.....
Muscatine.....	0	5	5	Tulsa.....	6	5	.....
Sioux City.....	8	30	30	Oregon:			
Kansas:				Portland.....	5	17	.....
Arkansas City.....	1	1	1	Pennsylvania:			
Fort Scott.....	1	9	9	Bethlehem.....	0	1	.....
Hutchinson.....	0	4	4	South Carolina:			
Kansas City.....	4	14	14	Charleston.....	0	5	.....
Leavenworth.....	2	1	1	Columbia.....	0	1	.....
Salina.....	1	38	38	Tennessee:			
Topoka.....	5	3	3	Chattanooga.....	2	16	.....
Wichita.....	10	19	19	Knoxville.....	1	2	.....
Kentucky:				Nashville.....	0	4	.....
Louisville.....	1	2	2	Texas:			
Paducah.....	1	2	2	Beaumont.....	0	1	.....
Louisiana:				Dallas.....	12	14	.....
Baton Rouge.....	0	3	3	El Paso.....	0	3	.....
New Orleans.....	7	15	1	Galveston.....	1	1	.....
Maine:				Waco.....	2	10	.....
Bath.....	2	2	2	Utah:			
Waterville.....	1	1	1	Salt Lake City.....	5	24	.....
Massachusetts:				Washington:			
Salem.....	3	3	3	Bellingham.....	3	2	.....
Michigan:				Everett.....	1	4	.....
Ann Arbor.....	0	3	3	Seattle.....	3	36	.....
Benton Harbor.....	0	1	1	Spokane.....	6	22	.....
Detroit.....	5	48	1	Tacoma.....	3	1	.....
Flint.....	1	2	2	Yakima.....	10	1	.....
Highland Park.....	0	2	2	West Virginia:			
Holland.....	0	1	1	Charleston.....	0	2	.....
Pontiac.....	0	3	3	Wisconsin:			
Sault Ste. Marie.....	0	4	4	Appleton.....	1	2	.....
Minnesota:				Beloit.....	2	1	.....
Austin.....	4	4	4	Eau Claire.....	3	3	.....
Duluth.....	1	4	4	Green Bay.....	0	3	.....
Minneapolis.....	23	111	111	Kenosha.....	0	4	.....
Rochester.....	4	4	4	La Crosse.....	1	0	.....
St. Cloud.....	1	6	6	Madison.....	1	23	.....
St. Paul.....	4	51	51	Marinette.....	1	2	.....
Winona.....	0	7	7	Milwaukee.....	3	24	.....
Missouri:				Oshkosh.....	1	1	.....
Kansas City.....	3	38	38	Racine.....	1	1	.....
St. Louis.....	5	14	14	Sheboygan.....	0	11	.....
				Superior.....	1	6	.....

## CITY REPORTS FOR WEEK ENDED MAR. 12, 1921—Continued.

## TETANUS.

Place.	Cases.	Deaths.	Place.	Cases.	Deaths.
Alabama:			Maryland:		
Birmingham.....	1		Baltimore.....		1
California:			New York:		
Los Angeles.....	2		New York.....	1	1
Georgia:			Ohio:		
Savannah.....		1	Cleveland.....	1	1
Illinois:			South Carolina:		
Chicago.....	1		Charleston.....		1
			Columbia.....	1	

## TUBERCULOSIS.

See p. 684; also Telegraphic weekly reports from States, p. 672.

## TYPHOID FEVER.

The column headed "Median for previous years" gives the median number of cases reported during the corresponding weeks of the years 1915 to 1920, inclusive. In instances in which data for the full six years are incomplete, the median is that for the number of years for which information is available.

Place.	Median for previous years.	Week ended Mar. 12, 1921.		Place.	Median for previous years.	Week ended Mar. 12, 1921.	
		Cases.	Deaths.			Cases.	Deaths.
Alabama:				Nebraska:			
Birmingham.....	0	1		Lincoln.....	0	1	
California:				New Hampshire:			
Los Angeles.....	2	2		Dover.....	0	1	
Pasadena.....	0		1	New Jersey:			
Sacramento.....	0	1		Montclair.....	0	1	
San Francisco.....	0	2		Newark.....	1	1	1
Colorado:				Roosevelt.....	1	1	1
Denver.....	0	1		Trenton.....	0	1	
Connecticut:				New York:			
Fairfield.....		1		Lackawanna.....	0	1	
Meriden.....	0	1		New York.....	8	14	3
District of Columbia:				North Tonawanda.....	0	5	
Washington.....	1	2		Rochester.....	0	2	
Illinois:				Saratoga Springs.....	0	1	
Decatur.....	0	1		Syracuse.....	0	1	
Springfield.....	0	1		Ohio:			
Indiana:				Akron.....	0	1	
East Chicago.....	0		1	Chillicothe.....	0		1
Evansville.....	0	1		Cincinnati.....	0	1	
Hammond.....	1	1		Cleveland.....	2	1	
Kokomo.....	0	1	1	Columbus.....	0	1	
Muncie.....	0		1	Dayton.....	0	1	
Kansas:				Youngstown.....	0		1
Arkansas City.....		1		Oklahoma:			
Salina.....		1		Oklahoma City.....	0		1
Topeka.....	0	2	1	Oregon:			
Louisiana:				Portland.....	0	1	
New Orleans.....	1	3	1	Pennsylvania:			
Maine:				Allentown.....	1	1	
Portland.....	0	1		Lancaster.....	0	1	
Waterville.....		1		New Castle.....	0	1	
Maryland:				Philadelphia.....	6	2	1
Baltimore.....	4	3	1	Texas:			
Massachusetts:				El Paso.....	0	1	
Attleboro.....	0	1		Washington:			
Boston.....	2	2	1	Tacoma.....	0	2	
Fall River.....	0	3		West Virginia:			
Pittsfield.....	0	1		Bluefield.....	1	1	
Michigan:				Wheeling.....	0	1	1
Grand Rapids.....	2		1	Wisconsin:			
Kalamazoo.....	0	1		Green Bay.....	0	1	
Minnesota:				Sheboygan.....	0	3	
Rochester.....		1		Superior.....	0	3	
Missouri:				Wausau.....	2	1	
Independence.....	1	1	1				
St. Louis.....	2	1					

CITY REPORTS FOR WEEK ENDED MAR. 12, 1921—Continued.

DIPHTHERIA, MEASLES, SCARLET FEVER, AND TUBERCULOSIS.

Place.	Population January 1, 1921, subject to correction.	Total deaths from all causes.	Diphtheria.		Measles.		Scarlet fever.		Tuberculosis.	
			Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
<b>Alabama:</b>										
Anniston.....	17, 734				1				1	
Birmingham.....	178, 270	40	2		8			7	4	
Mobile.....	60, 151	23	1		9		1		1	
Montgomery.....	43, 464	14		1				4	2	
<b>Arizona:</b>										
Tucson.....	20, 292	18								6
<b>Arkansas:</b>										
Fort Smith.....	28, 811		3		85		1			
Hot Springs.....	11, 665	12								1
Little Rock.....	64, 997				38		2			
North Little Rock.....	14, 048	3			5					
<b>California:</b>										
Alameda.....	28, 806	7	2	1	1		1			
Berkeley.....	55, 886	12	4				1		1	
Eureka.....	12, 923	2					12		2	
Long Beach.....	55, 593	21	3		46				3	4
Los Angeles.....	576, 673	165	33	1	291	1	11	1	34	30
Oakland.....	216, 361	51	2		6		9		4	3
Pasadena.....	45, 354	15	1		69		4		2	
Richmond.....	16, 843	4	3	1			3			
Riverside.....	19, 341	8			97					2
Sacramento.....	65, 857	28	6				1		3	5
San Bernardino.....	18, 721	13			4					3
San Diego.....	74, 683	35	1		13		1		5	6
San Francisco.....	508, 410	137	41	7	29		13		45	13
Santa Barbara.....	19, 441	5							2	1
Santa Cruz.....	10, 917	6								
Stockton.....	40, 293	11	1						1	1
Vallejo.....	21, 107	2			2		1			
<b>Colorado:</b>										
Colorado Springs.....	30, 105	12			32		2		7	3
Denver.....	259, 369	77	23		146	2	21			14
Greely.....	10, 883	3								
Pueblo.....	42, 908		2	1	58		7			1
Trinidad.....	10, 903				7		1			
<b>Connecticut:</b>										
Bridgeport.....	143, 538	41	7	1	2		18		7	3
Bristol.....	20, 620	1	2		4		2		2	
Fairfield (town).....	11, 475		1		2		2		1	
Greenwich (town).....	22, 123		2		20				4	
Hartford.....	128, 046	30	5		6		3		7	1
Manchester.....	18, 370	4			6		2			
Meriden (town).....	34, 739		2				1			
Milford (town).....	10, 193	1					2			
New Britain.....	59, 316	12	4		32		3			1
Norwalk.....	27, 700	9					2			
Stamford (city).....	35, 086				2		2		2	
<b>Delaware:</b>										
Wilmington.....	116, 168	25	1				10			2
<b>District of Columbia:</b>										
Washington.....	437, 571	127	18	2	204		33		26	12
<b>Georgia:</b>										
Atlanta.....	200, 616	56	4		29		4	1	1	9
Brunswick.....	14, 412	4	1							
La Grange.....	17, 038				78				2	
Macon.....	52, 995	15	2		3		1		3	3
Rome.....	13, 252				5		2			
Savannah.....	83, 252	31	4				1		1	3
<b>Idaho:</b>										
Boise.....	21, 393	4			13					
<b>Illinois:</b>										
Alton.....	24, 682	7			11				1	
Aurora.....	31, 377	9			3		1	1	1	1
Bloomington.....	28, 725	6					4		2	
Blue Island.....	11, 424	2					2			
Centralia.....	12, 491	2								
Chicago.....	2, 701, 705	655	227	16	371	5	158	7	240	54
Danville.....	33, 750	6					1		2	
Decatur.....	43, 818	14	2		1		2			2
East St. Louis.....	66, 740	17	2		7		9			2
Elgin.....	27, 454	8			175	1				
Evanston.....	37, 215	10	7				3			
Forest Park.....	10, 768	2			9					

## CITY REPORTS FOR WEEK ENDED MAR. 12, 1921—Continued.

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

Place.	Population January 1, 1920, subject to cor- rection.	Total deaths from all causes.	Diphtheria.		Measles.		Scarlet fever.		Tuber- culosis.	
			Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
<b>Illinois—Continued.</b>										
Freeport.....	19,669	8		1	1		1			2
Galesburg.....	23,531	3			22		3			
Kewanee.....	16,026	3								
La Salle.....	13,050	3								
Pekin.....	12,086						5			
Peoria.....	76,121	20	5		2		28			2
Quincy.....	35,978	8	2		30	2			5	
Rock Island.....	35,177	6	2				2		1	1
Springfield.....	59,183	26			2		31	1		3
<b>Indiana:</b>										
Bloomington.....	11,595	0								
East Chicago.....	35,967	8								1
Elkhart.....	24,277	6					5		2	
Elwood.....	10,790	5								1
Evansville.....	85,264	19	5				1			
Frankfort.....	11,585	2					1		1	
Hammond.....	36,004	9	2	2			1			
Huntington.....	14,000	3			3	1	13			
Indianapolis.....	314,194	82	8		10		56	2	19	10
Kokomo.....	30,067	7			1		1		1	
La Fayette.....	22,486	7			1		4		1	
Logansport.....	21,626	7	1	1	1		1		1	
Marion.....	23,747	5	2	1			4			1
Mishawaka.....	15,195	5								
Muncie.....	36,624	14	1		7		11			2
Richmond.....	26,765	8					2		1	
South Bend.....	70,983	8			1		7			
Terr Haute.....	66,083	16	4		6		9			3
<b>Iowa:</b>										
Burlington.....	21,057						2			
Cedar Rapids.....	45,566		1				1			
Clinton.....	24,151				3					
Council Bluffs.....	38,162	10	1				5			
Davenport.....	56,727				2		5			
Des Moines.....	126,468	1	8	1	7		2			
Dubuque.....	39,141		2		1		6			
Iowa City.....	11,267				2					
Keokuk.....	14,423		1		38					
Marshalltown.....	15,731				22		7			
Mason City.....	20,065	1					11			
Muscatine.....	16,068	4			23		2			
Sioux City.....	71,227		4				2			
<b>Kansas:</b>										
Arkansas City.....	11,273	1			9		2			
Coffeyville.....	13,452	3	1							
Fort Scott.....	10,693	2	6							
Hutchinson.....	23,296				3		5			
Kansas City.....	101,177		7		11		5		2	
Lawrence.....	12,456	4			1		2			
Leavenworth.....	16,912		3		2		2			
Parsons.....	16,028	3								
Salina.....	15,085	4	2		7		1			
Topeka.....	50,022	17			24		5		10	
Wichita.....	72,128	22	2	1	115		5		1	1
<b>Kentucky:</b>										
Covington.....	57,121	11					1		1	3
Lexington.....	41,534	17			4		1			3
Louisville.....	234,891	76	8		3		28	1	14	3
Paducah.....	24,735				2				1	
<b>Louisiana:</b>										
Baton Rouge.....	21,782	10	2		8		2		2	
New Orleans.....	387,219	134	5		27	1	11		20	12
<b>Maine:</b>										
Auburn.....	16,965	2			9		1		1	
Bath.....	14,751	2					2			
Lewiston.....	31,791	10	2		5		2			
Portland.....	69,272		2		35		3			
Sanford.....	10,491	3	1							
Waterville.....	13,351		1		4		2			
<b>Maryland:</b>										
Baltimore.....	733,826	290	25	5	53	1	23		24	21
Cumberland.....	29,837	11	1						2	3

CITY REPORTS FOR WEEK ENDED MAR. 12, 1921—Continued.

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

Place.	Population January 1, 1920, subject to correction.	Total deaths from all causes.	Diphtheria.		Measles.		Scarlet fever.		Tuberculosis.	
			Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
<b>Massachusetts:</b>										
Adams.....	12,967	1	2				3			
Amesbury.....	10,086	3	1							
Arlington.....	18,665	4					2		1	
Attleboro.....	19,731	8					1			1
Belmont.....	10,749	1				2			1	
Beverly.....	22,561	7								
Boston.....	748,060	229	58	2	85	2	80	3	42	11
Braintree.....	10,580	2			1		1			1
Brockton.....	66,138	13	3				2			
Brookline.....	37,748	8	3				6			
Cambridge.....	109,694	29			42	1	4		5	5
Chelsea.....	43,184	10	4		7		2		1	3
Clinton.....	12,979	0	1		1		1		1	
Danvers.....	11,108		3	1	1		1		2	1
Dedham.....	10,792	3								
Easthampton.....	11,261	1	1							
Everett.....	40,120	8	4		1		4		1	1
Fall River.....	120,485	61	7	1	17	1	11		6	2
Gardner.....	16,971	7			7				1	1
Greenfield.....	15,462	2					6			1
Haverhill.....	53,884	21	5		1		4		4	
Holyoke.....	60,203	13			5		1			1
Lawrence.....	94,270	16	5		4		8		9	2
Leominster.....	19,744	6			29		4			
Lowell.....	112,479	32	5	2	32		1		6	2
Lynn.....	98,148	27	2	1			7		1	1
Malden.....	49,103	9	2		2		10			
Medford.....	39,038	13	3		1		3			
Melrose.....	18,204	8	1				4		1	
Methuen.....	15,189	8	1				3			
New Bedford.....	121,217	30			1		10		12	5
Newburyport.....	15,618	3					1			
Newton.....	46,054	9	1				3		3	1
North Adams.....	22,282	5			24	1	2			1
Northampton.....	21,951	8			10		1		1	
Norwood.....	12,627	13			2		2		1	
Peabody.....	19,552	2							2	
Pittsfield.....	41,751	16	2		30		4		1	3
Plymouth.....	13,045	6								
Quincy.....	47,876	13	1		1		3			2
Salem.....	42,529	15			5		1			
Somerville.....	93,091	21	4				4		6	
Southbridge.....	14,245	5							2	
Springfield.....	129,563	42	3	1	7	1	9		3	3
Wakefield.....	13,025	2								
Waltham.....	30,915	10	3				1		1	
Watertown.....	21,457	6			1				1	
Westfield.....	18,604	3							2	
Winthrop.....	15,455	0			1		1			
Woburn.....	16,574	9								1
Worcester.....	179,754	17	3	1	71		16		8	3
<b>Michigan:</b>										
Ann Arbor.....	19,516	11	1				15			
Benton Harbor.....	12,233	0	1				2			
Detroit.....	993,739	226	122	7	37		97	3	45	16
Flint.....	91,599	13	6		1		4			
Grand Rapids.....	137,634	24	4	2	2		4	1	7	
Highland Park.....	46,999	4	3		1		8			
Holland.....	12,166	5								
Ironwood.....	15,739	6			5		1		1	1
Ishpeming.....	10,500	2	2							
Kalamazoo.....	48,858	31					18		6	3
Marquette.....	12,718	7							2	1
Muskegon.....	36,570	7	3	1			2			
Pontiac.....	34,273	25	2		1		7	1		4
Port Huron.....	25,944	6					2			
Sault Ste. Marie.....	12,066	3			8					
<b>Minnesota:</b>										
Austin.....	10,118	2					1			
Duluth.....	98,917	23	2				4			1
Hibbing.....	15,089	3					1			
Mankato.....	12,469	4								
Minneapolis.....	380,582	90	12		1		88	1	22	11



## CITY REPORTS FOR WEEK ENDED MAR. 12, 1921—Continued.

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

Place.	Popula- tion January 1, 1920, subject to cor- rection.	Total deaths from all causes.	Diphtheria.		Measles.		Scarlet fever.		Tuber- culosis.	
			Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
<b>Minnesota—Continued.</b>										
Rochester.....	13,722		1		2		1			
St. Cloud.....	15,873		1		5					
St. Paul.....	234,595	72	20	1	3		25		13	5
Winona.....	19,143						2			
<b>Missouri:</b>										
Cape Girardeau.....	10,252	3					4			
Independence.....	11,686	6							1	1
Kansas City.....	324,410	100	14	2	51	1	9		7	9
St. Joseph.....	77,939	31	1		21		3			3
St. Louis.....	772,997	198	58	3	5		53		42	13
<b>Montana:</b>										
Anaconda.....	11,668	3								1
Billings.....	15,100	3			23		1		1	
Butte.....	41,611	12								
Great Falls.....	24,121	5			43				2	
<b>Nebraska:</b>										
Lincoln.....	54,934	22			3		14			1
Omaha.....	191,601	56	6	2	17		12		1	4
<b>Nevada:</b>										
Reno.....	12,016	3								
<b>New Hampshire:</b>										
Berlin.....	16,104	2								
Concord.....	22,167	12			1					
Dover.....	13,029	2			8		1			
Keene.....	11,210								2	
Manchester.....	78,384	22	3	1			5		3	2
<b>New Jersey:</b>										
Asbury Park.....	12,400	2	1							
Atlantic City.....	50,682	8	3		10		9		2	
Bayonne.....	76,754		2				3		1	
Belleville.....	15,660				4		2		1	
Bloomfield.....	22,019	1			3		1		2	
Clifton.....	26,470	4			4		5			
East Orange.....	50,710	10	8		13		1		2	
Elizabeth.....	95,682	2	2		10		6		4	
Englewood.....	11,627	6					4			
Garfield.....	19,381				1				1	
Gloucester City.....	12,162		3				1		1	
Hackensack.....	17,687	10	4							1
Hoboken.....	68,166	19	4	2	7		2			4
Irvington.....	25,480		1		1		3			
Jersey City.....	287,864		27		15		17		20	
Kearny.....	26,724	10	2		6		3		1	1
Montclair.....	28,810	4			9		1			
Morristown.....	12,548	6		1			18			
New Brunswick.....	32,779		6				1		1	
Newark.....	414,216	113	25	4	30	2	75		32	7
Orange.....	33,283	10			19				1	
Passaic.....	63,824	19	1		7	1	7	1		
Paterson.....	135,666		6		6		6		4	
Perth Amboy.....	41,707	13	12	1	2		5		1	1
Phillipsburg.....	16,923	6								
Plainfield.....	27,700	3			5		2		1	
Rahway.....	11,042	3	1				1			
Roosevelt.....	11,047	6								
Summit.....	10,174	5	1				1		2	1
Trenton.....	119,289	44	6		7		14	1	7	5
West Hoboken.....	40,068	7					2		2	
West New York.....	29,926	2	1		1					
West Orange.....	15,573	3	2		4					
<b>New York:</b>										
Albany.....	113,344				71		6			
Binghamton.....	66,800	19	7	1	8		11			1
Buffalo.....	566,775	167	43	2	47		14	1	26	12
Cohoes.....	22,987	9	1				1			
Elmira.....	45,305	8			4					
Geneva.....	14,648	2								1
Glens Falls.....	16,638	3	1		14					
Herkimer.....	10,453				1					
Hudson.....	11,745	3								
Ithaca.....	17,004	7			11					
Jamestown.....	38,917	8	4		3					
Lackawanna.....	17,918	3	2		4				1	

**CITY REPORTS FOR WEEK ENDED MAR. 12, 1921—Continued.**  
**DIPHTHERIA, MEASLES, SCARLET FEVER, AND TUBERCULOSIS—Continued.**

Place.	Population January 1, 1920, subject to correction.	Total deaths from all causes.	Diphtheria.		Measles.		Scarlet fever.		Tuberculosis.	
			Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
<b>New York—Continued.</b>										
Lockport.....	21,308	5			24		1		1	1
Middletown.....	18,420	3	3		1		4		1	1
Mount Vernon.....	42,726	3	2		1		1		1	
Newburgh.....	30,306	12					3			
New York.....	5,621,151	1,494	458	19	210	6	582	11	1,336	1,130
Niagara Falls.....	50,760	15	9		4		10		1	1
North Tonawanda.....	15,482	4	4		1				1	
Ogdensburg.....	14,609	9			1				1	
Olean.....	20,506	4								
Peekskill.....	15,868	6	1				2			1
Plattsburg.....	10,909	1								
Port Chester.....	16,573	6			46	2	5			
Poughkeepsie.....	35,000	11	2		1		2			
Rochester.....	295,750	74	41	2	2	1	31	1	12	3
Rome.....	26,241		8		21				1	
Saratoga Springs.....	13,181	4			39				1	
Schenectady.....	88,723	14	5		13				1	
Syracuse.....	171,717	54	22	1	44		12		5	3
Troy.....	72,013	30			69		4		2	2
Watervliet.....	16,073	4							2	
White Plains.....	21,031	4			1		1			
Yonkers.....	100,226	27	7		24		7	1		2
<b>North Carolina:</b>										
Charlotte.....	46,338	15			26				6	
Durham.....	21,719	8	1							2
Greensboro.....	19,961	3								
Rocky Mount.....	12,742	7								
Salisbury.....	13,884	4	1		16				2	
Wilmington.....	33,372	9			168					1
Winston-Salem.....	48,365	17			123				2	3
<b>North Dakota:</b>										
Fargo.....	21,961	4	1	1	10					
Grand Forks.....	14,010	0	1		4					
<b>Ohio:</b>										
Akron.....	208,435	41	10		11		9		25	
Alliance.....	21,603	9			1		1			1
Barberton.....	18,811	4	1		1					
Bucyrus.....	10,425	0	2						1	
Canton.....	67,691	27	2		10		3			1
Chillicothe.....	15,831	4								1
Cincinnati.....	401,247	143	19	1	8	1	23	1	12	16
Cleveland.....	796,836		3		34		67	3	30	18
Columbus.....	237,031	60	12	1	2		7		3	4
Dayton.....	152,559	35	2		2		4		6	
East Cleveland.....	27,292						2		5	
Elyria.....	20,474	3								
Findlay.....	17,021	2					10			
Fremont.....	12,468	2					1			
Hamilton.....	39,675	14					8			
Kenmore.....	12,683								1	
Lancaster.....	14,706	5			7					2
Lima.....	41,305	11	1							3
Lorain.....	37,295		2		3		1			
Mansfield.....	27,824	7					3	1	1	1
Middletown.....	23,594	10			4	1	2			
Newark.....	26,718	10	4				3		4	
New Philadelphia.....	10,718						1			
Niles.....	13,080	3			8		2		1	
Norwood.....	24,966	3					2			
Piqua.....	15,044	2							1	1
Sandusky.....	22,897	8					3		1	1
Springfield.....	60,840	18	6		15		4		1	
Steubenville.....	28,508	8					2			
Toledo.....	243,109	55	14	2	4		13		1	5
Youngstown.....	132,358	34	3		27		6	1		
Zanesville.....	29,599	9	4							
<b>Oklahoma:</b>										
Oklahoma City.....	91,258	22	1		2		4		2	3
Tulsa.....	72,075		2						2	
<b>Oregon:</b>										
Portland.....	258,288	53	21		119		2		6	4

<sup>1</sup> Pulmonary tuberculosis only.

**CITY REPORTS FOR WEEK ENDED MAR. 12, 1921—Continued.**  
**DIPHTHERIA, MEASLES, SCARLET FEVER, AND TUBERCULOSIS—Continued.**

Place.	Popula- tion January 1, 1920, subject to cor- rection.	Total deaths from all causes.	Diphtheria.		Measles.		Scarlet fever.		Tuber- culosis.	
			Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
<b>Pennsylvania:</b>										
Allentown.....	73,502		14		24		19		3	
Ambridge.....	12,730				19					
Beaver Falls.....	12,802				4					
Berwick.....	12,181		1				3			
Bethlehem.....	50,358		7		23		28			
Braddock.....	20,879		6		1		1			
Butler.....	25,778		1		4		2			
Canonsburg.....	10,682								1	
Chambersburg.....	13,171		3		2		2			
Charleroi.....	11,516		2				1			
Chester.....	58,039		2		2		3			
Coatesville.....	14,515						7			
Columbia.....	10,836		3						1	
Connellsville.....	13,804		1				4			
Dickson City.....	11,049		1				2			
Dubois.....	18,681		1		10					
Dunmore.....	20,250		4				1			
Easton.....	33,813				15		5			
Erie.....	93,372		5		15		2			
Farrell.....	15,586		2				1			
Harrisburg.....	75,917		6		6		3			
Homestead.....	20,452				1				1	
Jeannette.....	10,627						1			
Johnstown.....	67,327		2		6		13		1	
Lancaster.....	53,150		10				7			
Lebanon.....	24,643						1			
McKeesport.....	45,975		5		3		1		1	
McKee's Rocks.....	16,713		1		2					
Mahanoy City.....	15,599				1					
Monessen.....	18,179		1		20				1	
Mount Carmel.....	17,469		1		1				1	
New Castle.....	44,938		2				1			
New Kensington.....	11,987						1			
Norristown.....	32,319		1		1		5			
North Braddock.....	14,928				4		1			
Oil City.....	21,274		2				4			
Olyphant.....	10,236		1							
Philadelphia.....	1,823,158	566	98	10	66		214	4	69	47
Phoenixville.....	10,484				1					
Pittsburgh.....	588,192		33		84		45		16	
Pittston.....	18,497				1					
Plymouth.....	16,500		1							
Pottstown.....	17,431						5			
Pottsville.....	21,876				10		3			
Punxsutawney.....	10,311		1		4					
Reading.....	107,784		8		9		8		1	
Scranton.....	137,783		2		4		7			
Shamokin.....	21,204		3							
Sharon.....	21,747		2						2	
Sunbury.....	15,721		3				2			
Swissvale.....	10,908				4					
Tamaqua.....	12,333				1		7			
Uniontown.....	15,692		6		2		3			
Warren.....	14,256						1			
Washington.....	21,480				2		2		1	
West Chester.....	11,717		1				3			
Wilkinsburg.....	24,403		2		1		1			
Williamsport.....	36,198		1		1		3			
York.....	47,512		11				4		3	
<b>Rhode Island:</b>										
Cranston.....	29,407	10			26					1
East Providence (town).....	21,793		1		2		1			
Newport.....	33,253	7	1				2			1
Pawtucket.....	64,248	22	1				4			1
Providence.....	237,595	59	10		61	2	12			4
<b>South Carolina:</b>										
Charleston.....	67,957	17			3					1
Columbia.....	37,524		2		33		1			
<b>South Dakota:</b>										
Sioux Falls.....	25,176	5			4		7			1
<b>Tennessee:</b>										
Chattanooga.....	57,895		1				3			
Knoxville.....	77,818		2		2		4		3	
Nashville.....	118,342	42	2		8	1	8		2	



## FOREIGN AND INSULAR.

### AUSTRALIA.

#### Poliomyelitis (Infantile Paralysis)—Sydney.

Epidemic poliomyelitis (infantile paralysis) has been reported at Sydney, New South Wales, Australia, with 21 cases notified in December, 1920, and 13 cases notified during January, 1921, occurring within the metropolitan area. The last previously reported epidemic prevalence of poliomyelitis at Sydney occurred early in the year 1916 with widespread diffusion and 186 cases with 17 fatalities. (Census population, 1911, 626,695; officially estimated population (1921), 828,700.)

### CANADA.

#### Communicable Diseases—Province of Ontario—February, 1921.

The following table shows the number of cases of communicable diseases occurring in the Province of Ontario, Canada, during the month of February, 1921, as compared with the same month of the year 1920. The number of fatalities from these diseases is also shown. Population, estimated in 1920, 2,523,200.

Disease.	February, 1921.		February, 1920.	
	Cases.	Deaths.	Cases.	Deaths.
Cerebrospinal meningitis.....	12	12	13	10
Diphtheria.....	565	59	551	84
Measles.....	395	8	1,623	36
Pneumonia (with influenza).....	53	17	20,158	1,345
Pneumonia (primary).....		374		970
Poliomyelitis (infantile paralysis).....			2	1
Scarlet fever.....	622	15	646	24
Smallpox.....	867	5	883	9
Tuberculosis.....	194	147	201	183
Typhoid fever.....	37	10	42	16

Smallpox was reported present in the Province of Ontario, with a total of 867 cases with 5 fatalities. The cases were distributed in 33 counties and 114 municipalities.

Venereal diseases were notified in the Province of Ontario during the month of February, 1921, as follows: Chancroid, 8 cases; gonorrhoea, 221 cases; syphilis, 240 cases; total, 269 reported cases. The total number of reported cases in February, 1920, was 158.

**CHINA.**

**Plague—Manchuria Province—Peking.**

During the month of January, 1921, 80 cases of pneumonic plague were reported at Jalainor coal mines, in the vicinity of Manchuria Station, Chinese Eastern Railway, and one case of plague was reported at the city of Peking.

Under date of March 16, 1921, a daily average of 40 fatalities from plague was reported at Harbin, Manchuria.

**CUBA.**

**Communicable Diseases—Habana.**

Communicable diseases have been notified at Habana as follows:

Disease	Feb. 21-28, 1921.		Re- main- ing under treat- ment Feb. 28, 1921.	Disease.	Feb. 21-28, 1921.		Re- main- ing under treat- ment Feb. 28, 1921.
	New cases.	Deaths.			New cases.	Deaths.	
Cerebrospinal meningitis.....	3	1	2	Paratyphoid fever.....	.....	.....	1
Chicken pox.....	4	.....	8	Scarlet fever.....	3	.....	5
Leprosy.....	.....	.....	14	Smallpox.....	.....	.....	36
Malaria.....	39	.....	50	Typhoid fever.....	5	2	34
Measles.....	6	.....	10				

<sup>1</sup> From the interior 1, from abroad 1.  
<sup>2</sup> From the interior 40, from abroad 1.

<sup>3</sup> From the interior 3.  
<sup>4</sup> From the interior 23.

**JAMAICA.**

**Infectious Disease (Alastrim or Kaffir Pox).**

During the week ended March 5, 1921, 371 new cases of alastrim or Kaffir pox were reported in the island of Jamaica.

**Quarantine Regulations—1921.**

Under date of February 22, 1921, the quarantine board of Jamaica issued a revised set of regulations governing vessels arriving at Jamaican ports. The regulations pertain to the rat guarding of all vessels while in port, and to special rules applying to those vessels which have cleared from countries infected with plague, yellow fever, influenza, and smallpox.

**MEXICO.**

**Plague—Tampico.**

Two cases of plague were reported at Tampico, Mexico, March 23, 1921; total number of cases reported from July 26, 1920, to March 23, 1921, 6.

**Plague—Infected Rats—Vera Cruz.**

Two plague-infected rodents were reported found at Vera Cruz, Mexico, during the week ended March 27, 1921.

**POLAND.****Typhus Fever—November, 1920.**

Information received from the ministry of public health of Poland shows the occurrence during the month of November, 1920, of 3,059 cases of typhus fever with 350 fatalities. The distribution of cases was reported as follows:

District.	Cases.	Deaths.	District.	Cases.	Deaths.
Galicja.....	1,992	286	Silesia.....	6	.....
Kielce.....	279	15	Warsaw.....	191	15
Lodz.....	83	6	Warsaw city.....	88	8
Lublin.....	403	20			
Posen.....	17	.....	Total.....	3,059	350

**PORTO RICO.****Plague-Infected Rats Found—Feb. 17–Mar. 3, 1921.**

During the period from February 17 to March 3, 1921, out of 3,437 rats examined at San Juan, Porto Rico, 19 rats were found plague infected.

**PORTUGUESE WEST AFRICA.****Loanda, Angola—Rat Plague.**

Plague in rats was reported March 18, 1921, at Loanda, Angola, Portuguese West Africa.

**RUSSIA.****Typhus Fever—Ruthenia.**

Information dated March 5, 1921, obtained from reports of census taking in the province of Ruthenia, Russia, shows the existence in the Province of a great number of previously unreported cases of typhus fever with 200 fatalities of recent occurrence.

**UNION OF SOUTH AFRICA.****Plague—Smallpox—Typhus Fever.<sup>1</sup>**

During the two weeks ended February 5, 1921, plague, smallpox, and typhus fever were reported in the Union of South Africa as follows:

*Plague.*—In the Orange Free State, two fatal cases, one occurring in the Hoopstad district and one in the Bothaville area of the Kroonstad district. Both cases were in Europeans and occurred on farms.

*Smallpox.*—Fresh outbreaks of smallpox were reported in three districts of the Cape Province, in the Durban district of Natal, and on farms in one district in the Orange Free State and one district in

<sup>1</sup> Public Health Reports, Feb. 25, 1921, p. 420.

the Transvaal. Previous outbreaks were reported as under control measures in these three States.

*Typhus fever.*—Fresh outbreaks of typhus fever were reported in rural districts in the Cape Province and in the Orange Free State, and one case was reported in the Johannesburg district of the Transvaal. Measures directed against spread of typhus fever from previous outbreaks were reported carried out in many localities in the Cape Province, Natal, and Orange Free State.

VIRGIN ISLANDS.

Contagious Diseases—February, 1921.

The occurrence of contagious diseases in the Virgin Islands during the month of January, 1921, has been reported as follows:

Disease.	Cases.	Remarks.	Disease.	Cases.	Remarks.
In St. Thomas and St. John:			In St. Croix:		
Chancroid.....	5	4 imported.	Chancroid.....	1	
Dengue.....	3		Dysentery.....	7	Entamebic.
Fish poisoning (Karrang).....	1		Filariasis.....	6	Bancrofti.
Gonorrhoea.....	7	3 imported. 1 St. John.	Gonorrhoea.....	4	
Malaria.....	2	Subtertian. Imported.	Pellagra.....	1	
Mumps.....	162		Schistosomiasis.....	1	
Pellagra.....	1		Trachoma.....	3	
Syphilis.....	13	2 imported.	Uncinariasis.....	2	Necator Americanus.
Tuberculosis.....	1	Chronic pulmonary. St. John.			

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

Reports Received During Week Ended Apr. 1, 1921.<sup>1</sup>

CHOLERA.

Place.	Date.	Cases.	Deaths.	Remarks.
India:				
Bombay.....	Jan. 23-29.....	1	1	
Calcutta.....	Jan. 30-Feb. 12.....	99	53	
Madras.....	Feb. 6-12.....	74	43	
Rangoon.....	Jan. 23-Feb. 5.....	7	6	
Philippine Islands:				
Manila.....	Jan. 30-Feb. 12.....	4		

PLAGUE.

Brazil:				
Ceara.....	Dec. 27-Feb. 5.....		11	
Porto Alegre.....	Feb. 13-19.....		1	
British East Africa:				
Kenya Colony—				
Kisumu.....	Dec. 25-Jan. 22.....			Present.
Mombasa.....	Dec. 26-Jan. 15.....			Do.
Nairobi.....	Jan. 2-15.....	5	4	Pneumonia reported present.
China:				
Manchuria—				
Changchaun.....	Feb. 16.....	15		Mar. 18, 1921: Fatal cases reported daily, about 40.
Harbin.....				In vicinity of station, at Jalainar casernes.
Manchuria Station.....	Jan. 1-31.....	80		
Peking.....	Jan. 25.....	1		In Chinese quarter.
Egypt:				
Cities—				
Alexandria.....	Jan. 17.....	1		Jan. 1-Feb. 3, 1921: Cases, 12; deaths, 9.
Suez.....	Jan. 19-Feb. 2.....	3	1	One fatal case, pneumonic.

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



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

### Reports Received During Week Ended Apr. 1, 1921—Continued.

#### PLAGUE—Continued.

Place.	Date.	Cases.	Deaths.	Remarks.
<b>India</b> .....				Jan. 23-29, 1921: Cases, 4,420; deaths, 3,228.
Bombay.....	Jan. 23-29.....	1	1	
Calcutta.....	Jan. 30-Feb. 12.....	1	1	
Madras Presidency.....	Feb. 6-12.....	1,147	851	
Rangoon.....	Jan. 23-Feb. 5.....	32	29	
<b>Java:</b>				
West Java—				
Batavia.....	Jan. 13-26.....	1	2	
<b>Mexico:</b>				
San Luis Potosi (State)—				
Carbonera.....				Dec. 1920-Feb. 12, 1921: Cases, 24.
Cerritos.....	Jan. 30-Feb. 5.....	1		At Tepatates ranch. Oct., 1920-Feb. 12, 1921: Cases, 51.
Tampico.....	Mar. 23.....	2		Mar. 21-27, plague-infected rats found, 2.
Vera Cruz.....				Mar. 21-27, plague-infected rats found, 19.
<b>Porto Rico</b> .....				Feb. 17-Mar. 3, plague-infected rats found, 19.
<b>Portuguese West Africa:</b>				
Angola—				
Loanda.....	Mar. 18.....			Rat plague present.
<b>Union of South Africa:</b>				
Orange Free State—				
Hoopstad District.....	Jan. 23-Feb. 5.....	1	1	In European. On farm.
Kroonstad District.....	do.....	1	1	Do.

#### SMALLPOX.

<b>Bolivia:</b>				
La Paz.....	Dec. 1-31.....	8	4	
<b>Brazil:</b>				
Rio de Janeiro.....	Jan. 9-Feb. 5.....	16	4	
<b>Canada:</b>				
Manitoba—				
Winnipeg.....	Feb. 20-26.....	6		
Nova Scotia—				
Sydney.....	Mar. 6-19.....	11		
Ontario.....				Feb. 1-28, 1921: Cases, 867; deaths, 5. Reported in 114 localities.
Hamilton.....	Mar. 13-19.....	4		
London.....	Mar. 6-12.....	4		
North Bay.....	Feb. 27-Mar. 12.....	4		
Ottawa.....	Mar. 13-19.....	29		
Toronto.....	do.....	4		
Saskatchewan—				
Moose Jaw.....	Mar. 6-12.....	3		
Regina.....	do.....	1		
<b>China:</b>				
Manchuria—				
Mukden.....	Feb. 6-12.....			Present.
Shanghai.....	Feb. 7-13.....	1		
Tientsin.....	Jan. 30-Feb. 5.....	1		In famine camp, 40 cases.
<b>Colombia:</b>				
Santa Marta.....	Feb. 27-Mar. 5.....			Present.
<b>Cuba:</b>				
Lugareno.....	Mar. 7-13.....	2		Vicinity of Nuevitas.
<b>Egypt:</b>				
Alexandria.....	Feb. 5-13.....	4	1	
Port Said.....	Dec. 25-31.....		1	
<b>France:</b>				
Paris.....	Jan. 11-20.....	4		
Rouen.....	Feb. 13-19.....	1		
<b>Great Britain:</b>				
Glasgow.....	Feb. 27-Mar. 5.....	1		
<b>Honduras:</b>				
Ceiba.....	Feb. 27-Mar. 5.....	1		
<b>India:</b>				
Bombay.....	Jan. 23-29.....	15	6	
Calcutta.....	Jan. 30-Feb. 5.....	3	3	
Karachi.....	Feb. 6-12.....	2		
Madras.....	Feb. 6-12.....	3	2	
Rangoon.....	Jan. 31-Feb. 6.....	1	1	
<b>Italy:</b>				
Genoa.....	Feb. 7-13.....	3		
Messina.....	Jan. 31-Feb. 6.....	4		In province.
<b>Java:</b>				
West Java—				
Krawang.....	Jan. 13-26.....	26	7	
Lebak.....	do.....	15	5	

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

**Reports Received During Week Ended Apr. 1, 1921—Continued.**

**SMALLPOX—Continued.**

Place.	Date.	Cases.	Deaths.	Remarks.
Mexico:				
Chihuahua.....	Feb. 28-Mar. 13....	2	3	
Torreon.....	Jan. 1-Feb. 28.....	6	3	
Panama:				
Colon.....	Mar. 2-14.....	9		
Portugal:				
Lisbon.....	Feb. 19-26.....		1	
Rumania:				
Kiseneff.....	Jan. 1-Mar. 18.....	18		District.
Spain:				
Barcelona.....	Feb. 3-16.....	7		
Malaga.....	Jan. 1-31.....		16	
Valencia.....	Feb. 13-26.....	3		
Tunis:				
Tunis.....	Feb. 19-25.....	7	3	
Union of South Africa:				
Cape Province.....	Jan. 23-Feb. 5.....			Outbreak in 3 districts.
Natal—				
Durban District.....	do.....			Outbreak.
Orange Free State.....	do.....			Outbreak in 1 district.
Transvaal.....	do.....			Do.
On vessel:				
S. S. Ventura.....	Jan. 18.....	1		At Sydney, Australia, from San Francisco, Calif., via Honolulu, and Pago Pago, Samoa.

**TYPHUS FEVER.**

Bolivia:				
La Paz.....	Dec. 1-31.....	13	9	
Bulgaria:				
Sofia.....	Feb. 13-19.....	1		
Chile:				
Concepcion.....	Jan. 25-Feb. 20.....		2	Present in vicinity. Year 1920, in public hospital, 88 cases, 13 deaths.
Egypt:				
Alexandria.....	Feb. 5-18.....	2	2	
Great Britain:				
Belfast.....	Feb. 20-21.....	3		
Dublin.....	do.....	1		
Japan:				
Nagasaki.....	Feb. 14-20.....	1		
Jugoslavia:				
Belgrade.....	Jan. 9-22.....	2		
Zagreb.....	Feb. 6-12.....	1	1	
Mexico:				
San Luis Potosi.....	Feb. 27-Mar. 5.....		1	
Poland:				
Districts—				Nov. 1-30, 1920: Cases, 3,059; deaths, 350.
Galicia.....	Nov. 1-30.....	1,192	286	
Kielce.....	do.....	279	15	
Lodz.....	do.....	83	6	
Lublin.....	do.....	493	29	
Posen.....	do.....	17		
Silesia.....	do.....	6		
Warsaw.....	do.....	191	15	
Warsaw city.....	do.....	88	8	
Russia:				
Province—				
Ruthenia.....	Mar. 5.....		200	From recent census returns.
Turkey:				
Constantinople.....	Feb. 19-26.....	6		
Union of South Africa:				
Cape Province.....	Jan. 23-Feb. 5.....			Outbreak in rural districts.
East London.....	Jan. 29-Feb. 5.....	3	2	
Orange Free State.....	Jan. 23-Feb. 5.....			Do.
Transvaal—				
Johannesburg District.....	do.....	1		

**YELLOW FEVER.**

Mexico:				
Vera Cruz.....	Mar. 14-20.....	1		

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

## Reports Received from Jan. 1 to Mar. 25, 1921.

### CHOLERA.

Place.	Date.	Cases.	Deaths.	Remarks.
China:				
Canton.....	Nov. 1-30.....	7	6	
Changsha.....	Nov. 29.....			Present.
Chungking.....	do.....			Do.
Chosen (Korea).....				Aug. 1-Dec. 2, 1920: Cases, 24,017; deaths, 13,329.
India:				Sept. 26-Oct. 9, 1920: Deaths, 2,672. Oct. 31-Dec. 11, 1920: Deaths, 7,184.
Bombay.....	Dec. 5-11.....	1	1	
Do.....	Jan. 16-22.....	1		
Calcutta.....	Oct. 31-Dec. 25.....	321	283	
Do.....	Dec. 26-Jan. 29.....	274	236	
Madras.....	Dec. 12-18.....	3	1	
Do.....	Dec. 26-Feb. 5.....	56	22	
Rangoon.....	Nov. 28-Dec. 25.....	9	8	
Do.....	Dec. 26-Jan. 22.....	15	14	
Indo-China.....				July 1-31, 1920: Cases, 136; deaths, 98.
Saigon.....	Dec. 27-Jan. 9.....	1	1	Including surrounding country.
Japan:				
Taiwan Island (Formosa).....	Nov. 11-Dec. 31.....	219	93	
Do.....	Jan. 1-20.....	2		
Java:				
West Java—				
Bandoeang.....	Oct. 29-Nov. 11.....	2	1	
Batavia.....	Nov. 25-Dec. 1.....	1		
Philippine Islands:				
Manila.....	Nov. 7-Dec. 25.....	9		
Do.....	Jan. 9-29.....	5		
Provinces—				
Cagayan.....	Oct. 3-Nov. 20.....	11	9	
Samar.....	Aug. 1-7.....	1	1	
Poland.....				Oct. 1-31, 1920: Cases, 26; deaths, 13.
Eastern frontier—				Present.
Bialystok.....	Dec. 16.....			Do.
Galicia.....	Nov. 1-30.....	19	11	Do.
Grodno.....	do.....			Present in Russian prison camp.
Olitza.....	do.....			
Posen.....	do.....			
Stralkowo.....	do.....			
Strelmo.....	do.....	1	1	
Warsaw.....	Oct. 1-31.....	2		In district.
Do.....	Dec. 16.....	5		Nov. 1-30, 1920: Cases, 7; deaths, 2.
Russia:				
Lithuania.....				Feb. 19, 1921: Cases reported, 35; mortality, 30 per cent.
Riga.....	Jan. 22.....			Present.
Siam:				
Bangkok.....	Oct. 9-Nov. 7.....	7	1	
Do.....	Dec. 26-Jan. 1.....	1		

### PLAGUE.

Algeria:				
Algiers.....	Nov. 1-Dec. 31.....	3	1	
Do.....	Jan. 1-31.....	3	1	
Argentina:				Jan. 1-31, 1921: 3 plague rodents found.
Rosario.....				
Azores:				Total, Oct. 1-Dec. 10, 1920: Cases, 149; deaths, 49. In vicinity of Ponta Delgada.
St. Michaels.....				
Brazil:				
Bahia.....	Oct. 31-Dec. 18.....	6	4	
Do.....	Dec. 26-Jan. 29.....	9	6	
Ceara.....	Oct. 17-Dec. 26.....		5	
Pernambuco.....	Oct. 18-Dec. 5.....	11	3	
Porto Alegre.....	Nov. 14-Dec. 11.....		2	
Do.....	Dec. 26-Jan. 29.....		6	
British East Africa:				Outbreak Nov. 8, 1920: Cases reported, 1,067.
Kenya Colony—				Present.
Kisumu.....	Oct. 31-Dec. 25.....			
Mombassa.....	do.....	2	2	
Nairobi.....	do.....	16	11	
Uganda.....	do.....	111	103	Entire protectorate.
Do.....	July 1-Nov. 5.....	259	63	Do.

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

Reports Received from Jan. 1 to Mar. 25, 1921—Continued.

### PLAGUE—Continued.

Place.	Date.	Cases.	Deaths.	Remarks.
Ceylon:				
Colombo.....	Nov. 7-Dec. 18.....	81	60	
Do.....	Jan. 16-29.....	35	28	
Chile:				
Antofagasta.....	Nov. 24-Dec. 5.....	6	2	
Do.....	Dec. 27-Jan. 2.....	2		
China:				
Chihli Province.....				Present on Tientsin & Tukow R. R., 70 miles east of Tientsin. Pneumonic.
Fan Yuan.....	Mar. 3.....		50	In Northern Shantung Province.
Hongkong.....	Nov. 7-Dec. 18.....	6	6	
Do.....	Jan. 9-15.....	1	1	
Kwantung Province.....	Dec. 29.....			Reported present in Tapu district.
Manchuria Province— Harbin.....	Feb. 2-Mar. 10.....		53	West of Harbin, Feb. 7, 1921, 400 fatal cases reported. Feb. 14, 1921, fatal cases, 1,200. To Mar. 14, 1921: 4,000 fatal cases. Pneumonic.
Manchuria station.....	do.....		203	
Tsitsihar.....	do.....			Present.
Shanghai.....				Two plague rats found, Dec. 20 and Dec. 31, 1920.
Ecuador,				
Guayaquil.....	Nov. 16-Dec. 31.....	111	36	
Do.....	Jan. 1-Feb. 15.....	135	47	
Egypt:				
Cities—				Jan. 1-Dec. 30, 1920: Cases, 462; deaths, 239. Jan. 1-27, 1921: Cases, 10; deaths, 9.
Alexandria.....	Jan. 22.....		1	
Port Said.....	Oct. 22-28.....	1	1	
Do.....	Jan. 22.....	1	1	
Suez.....	Nov. 18-27.....	10	3	
Do.....	Jan. 5-22.....	7	6	Pneumonic, 6 cases; septicemic, 1 case.
Province—				
Assiout.....	Nov. 24.....	3	2	
France:				
Marseille.....	June-Aug. 31.....	58	20	In suburbs, June-Nov. 2, 1920: Cases, 38; deaths, 19.
Paris.....	June-Oct. 15.....	50	11	Jan. 1-13, 1921: Cases, 3; deaths, 1. (Suspect.)
Do.....				
Great Britain:				
Dublin.....				1 case reported Dec. 15, 1920; date of occurrence, Oct. 18, 1920.
Liverpool.....				Plague-infected rat found, period Nov. 23-Dec. 11, 1920.
Greece:				
Kavala.....	Oct. 25-Nov. 7.....	2		
India:				
Bombay.....	Nov. 28-Dec. 25.....	5	5	Oct. 24-Dec. 25, 1920: Cases, 21,376; deaths, 14,874. Jan. 2-23, 1921: Cases, 8,837; deaths, 6,860.
Do.....	Dec. 26-Jan. 22.....	5	4	
Calcutta.....	Nov. 14-20.....	46	44	
Karachi.....	Dec. 25-31.....	2	2	
Madras.....	Dec. 5-25.....	7	4	
Do.....	Jan. 9-29.....	3	1	
Madras Presidency.....	Nov. 14-Dec. 25.....	4,349	2,991	
Do.....	Dec. 26-Feb. 5.....	5,726	4,083	
Rangoon.....	Oct. 31-Dec. 25.....	30	28	
Do.....	Dec. 26-Jan. 22.....	23	24	
Indo-China:				
Saigon.....	Dec. 27-Jan. 9.....	2	2	July 1-31, 1920: Cases, 98; deaths, 74. Including surrounding country.
Java:				
West Java— Batavia.....	Nov. 21-Dec. 1.....	3	3	
Jugoslavia:				
Cattaro.....	Feb. 23.....	3		Among French troops.
Madagascar:				
Tamatave.....	Mar. 9.....			Present.
Mesopotamia:				
Bagdad.....	Oct. 1-31.....	25	7	
Mexico:				
Carbonera.....	Dec. 5-20.....	3	1	State of San Luis Potosi.
Do.....	Dec. 26-Jan. 8.....	3		
Cerritos.....	Dec. 5-20.....	7	8	Do.
Do.....	Dec. 26-Jan. 15.....	4		

**CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued.****Reports Received from Jan. 1 to Mar. 25, 1921—Continued.****PLAGUE—Continued.**

Place.	Date.	Cases.	Deaths.	Remarks.
Peru.....				July-December, 1920: Cases, 292; deaths, 136. Jan.-Feb. 16, 1921: Cases, 96; deaths, 48.
Departments—				July-December, 1920: Cases, 23; deaths, 10. Jan. 1-31, 1921: Cases, 3; deaths, 2.
Callao-Lima.....				
Callao.....	Feb. 1-15.....	2		
Libertad.....	do.....	1		
Trujillo-Salaverry..	Dec. 27-Feb. 13.....	9	1	
Lima.....	Feb. 1-15.....	14	4	
Piura.....	do.....	21	10	
Porto Rico:				
San Juan.....	Feb. 18-25.....	7		
Russia:				
Batum.....	Nov. 24-Dec. 3.....	38		Epidemic outbreak.
Siam:				
Bangkok.....	Dec. 5-11.....	1	1	
Straits Settlements:				
Singapore.....	Oct. 31-Nov. 6.....	1	1	
Tunis:				
Ben Gardane.....				June-July, 1920: Cases, 6. November-December, 1920: Cases, 10, in surrounding territory.
Zarzis.....	Jan. 15.....	10		In military territory, South Tunis.
Turkey:				
Constantinople.....	Nov. 21-27.....	1	2	
Union of South Africa:				
Orange Free State—				
Hoopstad district.....	Nov. 28-Dec. 18.....	3	1	1 European, 2 natives. On Vryheid Farm. (Public Health Reports, June 25, 1920, p. 1360.)
On vessel:				
S. S. Kronprincessan Victoria.	Jan. 15.....			At Stockholm, Sweden. Rat plague found. Vessel left Buenos Aires, Argentina, Nov. 17, 1920. Stopped at Goteborg and Malmo, Sweden. Left Malmo Jan. 11, 1921. Rats found dead Jan. 13, 1921, at Stockholm.

**SMALLPOX.**

Algeria:				
Algiers.....	Jan. 1-31.....	5		
Austria:				Aug. 29-Dec. 25, 1920: Cases, 75.
Azores:				
Ponta Delgada.....	Dec. 18-24.....	7		
Bolivia:				
La Paz.....	Oct. 1-Nov. 30.....	11	3	
Brazil:				
Bahia.....	Oct. 31-Dec. 25.....	6		
Do.....	Jan. 8-15.....	4		
Pernambuco.....	Oct. 18-Dec. 19.....	102	2	
Do.....	Dec. 27-Jan. 16.....	26		
Rio de Janeiro.....	Oct. 24-Dec. 25.....	198	24	
Do.....	Dec. 26-Jan. 8.....	5	2	
Sao Paulo.....	Dec. 13-19.....		1	
British East Africa:				
Uganda.....				May 1-June 30, 1920: Cases, 272.
Bulgaria:				
Sofia.....	Nov. 7-13.....	2		
Canada:				
Alberta—				
Calgary.....	Dec. 12-18.....	2		
Do.....	Jan. 2-Feb. 19.....	15		
British Columbia—				
Fernie.....	Feb. 6-12.....	2		
Vancouver.....	Dec. 5-11.....	1		
Do.....	Dec. 26-Feb. 26.....	19		
Victoria.....	Jan. 30-Mar. 5.....	5		
Manitoba—				
Winnipeg.....	Jan. 16-Feb. 19.....	9		

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

**Reports Received from Jan. 1 to Mar. 25, 1921—Continued.**

**SMALLPOX—Continued.**

Place.	Date.	Cases.	Deaths.	Remarks.
<b>Canada—Continued.</b>				
<b>New Brunswick—</b>				
Bonaventure and Gaspé Counties.	Feb. 1-23.	4		From lumber camp on Canadian Government Railway, Feb. 5, 1921, 5 cases.
Campbellton	Jan. 9-15.			Present.
Gloucester County	Jan. 23-29	1		
Madawaska County	Jan. 30-Feb. 19.	2		
Restigouche County	Dec. 12-18.	1		
Do.	Feb. 6-19.	2		
St. Stephen	Feb. 27-Mar. 5	1		
York County	do.	6		
<b>Nova Scotia—</b>				
Sydney	Feb. 13-19.	2		
Yarmouth	Jan. 9-Mar. 5.	7		
<b>Ontario.</b>				
Hamilton	Dec. 19-31.	9		November-December, 1920: Cases, 992; deaths, 5. Jan. 1-31, 1921: Cases, 902; deaths, 3.
Do.	Jan. 2-Mar. 12.	55		
Kingston	Dec. 26-Jan. 19.	9		
London	Jan. 2-Mar. 5.	26		
Montreal	do.	6		
Niagara Falls.	Dec. 12-18.	1		
North Bay	Dec. 12-25.	4		
Do.	Jan. 2-Feb. 26.	21		
Ottawa	Dec. 12-25.	75	1	
Do.	Dec. 26-Mar. 12.	565	2	
Peterborough	Dec. 26-Feb. 5.	2		
Sarnia	Feb. 20-Mar. 5.	2		
Sault Ste. Marie.	Jan. 9-Feb. 12.	48		
Toronto	Dec. 12-25.	7		
Do.	Dec. 26-Mar. 12.	52		
<b>Quebec—</b>				
Quebec	Jan. 23-Feb. 19.	2		
<b>Saskatchewan—</b>				
Moose Jaw	Dec. 19-25.	1		
Do.	Jan. 2-Mar. 5.	39		
Regina	Dec. 12-25.	11		
Do.	Jan. 2-Mar. 5.	49		
Saskatoon	Dec. 16-22.	20		
Do.	Jan. 9-Feb. 19.	18		
<b>Ceylon:</b>				
Colombo	Nov. 21-Dec. 25.	18	7	
Do.	Dec. 26-Jan. 29.	4		
<b>Chile:</b>				
Iquique				Epidemic with high mortality.
<b>China:</b>				
Amoy	Nov. 7-Dec. 25		7	
Do.	Dec. 26-Jan. 22.		3	
Antung	Dec. 20-26.	1		
Do.	Jan. 10-Feb. 13.	2	2	
Canton	Dec. 1-31.			Present.
Chungking	Nov. 7-Dec. 25			Do.
Do.	Dec. 26-Jan. 22.			Do.
Foochow	Nov. 7-Dec. 25			Do.
Do.	Dec. 26-Jan. 29.			Do.
Hankow	Jan. 2-22	2	1	
<b>Manchuria Province—</b>				
Dairen	Nov. 16-Dec. 20.	12	3	
Do.	Dec. 26-Jan. 23.	94	16	
Mukden	Dec. 12-18.			Prevalent.
Do.	Jan. 16-22.			Do.
Nanking	Nov. 14-Dec. 18.			Present.
Do.	Dec. 26-Feb. 5.			Do.
Tientsin	Nov. 14-Dec. 4.	2		Dec. 12-25, 1920: Cases, 160; a camp for famine refugees.
Do.	Dec. 26-Jan. 29.	4		In camp for famine refugees, 437.
Tsinanfu	Oct. 31-Nov. 12.	20		Statistics of Shantung Christian Hospital.
Tsingtau	Jan. 3-9.	1		
<b>Chosen (Korea):</b>				
Chemulpo	Dec. 1-31.	1		
Fusan	Nov. 1-30.	1		
Do.	Jan. 1-31.	4	1	
Gensan	Dec. 1-31.	15	12	
Do.	Jan. 1-31.	24	8	
<b>Colombia:</b>				
Barranquilla	Jan. 16-22.			Present.
Santa Marta	Dec. 5-25.			Do.
Do.	Dec. 26-Feb. 26.			Do.

**CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued.****Reports Received from Jan. 1 to Mar. 25, 1921—Continued.****SMALLPOX—Continued.**

<b>Cuba:</b>				
Antilla.....	Dec. 7-27.....	10		For port of Preston.
Do.....	Jan. 2-Mar. 5.....	70		Do.
Cienfuegos.....	Dec. 26-Jan. 8.....			Stated to be present in virulent form in Camaguey Province.
Habana.....	Dec. 31-Feb. 16.....	11		1 from Jatibonico, Cuba; 1 from Jamaica.
Matanzas.....	Jan. 2-29.....	6		From Lugareno, a small station on railway, 16 miles distant, 1 case, week ended Dec. 12, 1920.
Nuevitás.....	Dec. 6-19.....	2		
Do.....	Jan. 3-Mar. 6.....	22		
Santiago.....	Nov. 20-Dec. 10.....	26		
Do.....	Feb. 1-20.....	145		
Czechoslovakia.....				July 11-Aug. 14, 1920; Cases, 141; deaths, 29.
Danzig.....	Dec. 5-18.....	2		
Dominican Republic.....				Nov. 15-Dec. 25, 1920; Cases, 9; occurring in 4 localities.
Santo Domingo.....	Jan. 9-Feb. 19.....	13	1	
<b>Ecuador:</b>				
Guayaquil.....	Nov. 16-Dec. 31.....	33	2	
Do.....	Jan. 1-Feb. 15.....	32		
<b>Egypt:</b>				
Alexandria.....	Dec. 17-31.....	3	1	
Do.....	Jan. 1-Feb. 4.....	4		
Cairo.....	Oct. 1-Dec. 9.....	3		
Port Said.....	Nov. 19-25.....	1		
<b>France:</b>				
Paris.....	Nov. 1-30.....	2	1	
Do.....	Jan. 1-10.....	1	1	
Rouen.....	Nov. 21-Dec. 31.....	7	2	
St. Etienne.....	Dec. 3-15.....	2	1	
Do.....	Jan. 23-Feb. 12.....	3		
Germany.....				Aug. 29-Nov. 6, 1920: Cases, 40.
<b>Great Britain:</b>				
Glasgow.....	Dec. 25.....	11	2	
Do.....	Jan. 2-Feb. 19.....	21	8	
Liverpool.....	Jan. 30-Feb. 5.....	1		
London.....	Dec. 26-Jan. 1.....	1		
<b>Greece:</b>				
Saloniki.....	Nov. 15-Dec. 26.....	39	14	In surrounding country: Cases 21; deaths, 2.
Do.....	Dec. 27-Jan. 2.....	13	9	Sept. 22, 1920-Jan. 8, 1921: Cases, 2,262; deaths, 64.
<b>Haiti:</b>				
Cape Haitien.....	Feb. 13-26.....	14		In 8 interior towns, 20 cases. In one locality, 18 cases. In country district, vicinity of Port au Prince, cases numerous. From date of outbreak to Feb. 11, 1921: Cases, 2,874; deaths, 221.
Port au Prince.....	Sept. 22-Dec. 2.....	486	2	
<b>Honduras:</b>				
Ceiba.....	Feb. 13-26.....	3		
<b>India:</b>				
Bombay.....	Nov. 7-Dec. 25.....	11	3	Sept. 26-Oct. 9, 1920: Deaths, 250. Oct. 31-Dec. 11, 1920: Deaths, 3,902.
Do.....	Dec. 26-Jan. 22.....	31	6	
Calcutta.....	Dec. 5-11.....	2	2	
Do.....	Jan. 2-29.....	6	2	
Karachi.....	Jan. 16-22.....	8	2	
Madras.....	Nov. 14-Dec. 18.....	7	5	
Do.....	Dec. 26-Feb. 5.....	14	2	
Rangoon.....	Nov. 21-Dec. 25.....	5	1	
Do.....	Jan. 2-8.....	2		
Indo-China.....				July 1-21, 1920: Cases, 107; deaths, 24.
<b>Italy:</b>				
Catania.....	Nov. 29-Dec. 5.....	1		In Province, Nov. 29-Dec. 5, 1920: Cases, 32. Jan. 3-16, 1921: Cases, 32. Jan. 17-Feb. 6, 1921: Cases, 45.
Do.....	Dec. 27-Jan. 2.....			In vicinity, 2 cases.
Messina (city and Province).....	Jan. 3-30.....	17	2	Dec. 5, 1920-Jan. 16, 1921: Cases, 25.
Palermo.....	Oct. 30-Dec. 27.....	410	124	
Do.....	Jan. 26-Feb. 8.....	102	15	
<b>Java:</b>				
<b>West Java:</b>				
Bandoeng.....	Nov. 19-25.....	1	1	Nov. 12-Dec. 29, 1920: Cases, 72; deaths, 6. Jan. 6-12, 1921: One case, one death.
Batavia.....	Nov. 12-Dec. 25.....	14	5	
Indramayoe.....	Nov. 12-Dec. 29.....	1		
do.....		1		
Krawang.....		1		
<b>Jugoslavia:</b>				
Zagreb.....	July 25-Aug. 28.....	128	42	Feb. 7-13, 1920: Cases, 122; deaths, 27.
Do.....	Jan. 9-Feb. 5.....	2	1	
Luxembourg.....	Dec. 15-Jan. 1.....	1		

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

**Reports Received from Jan. 1 to Mar. 25, 1921—Continued.**

**SMALLPOX—Continued.**

Place.	Date.	Cases.	Deaths.	Remarks.
Madeira:				
Funchal.....	Dec. 5-18.....		2	
Do.....	Dec. 23-Feb. 19.....		5	
Mesopotamia:				
Bagdad.....	Nov. 1-Dec. 31.....	2		
Mexico:				
Chihuahua.....	Dec. 6-25.....	11	3	
Do.....	Dec. 27-Feb. 15.....		12	
Guadalajara.....	Dec. 1-31.....	1		
Do.....	Jan. 1-31.....	1		
Mexico City.....	Nov. 14-Dec. 25.....	17		Including municipalities in the Federal district.
Do.....	Jan. 2-Feb. 5.....	22		Do.
Salina Cruz.....	Jan. 1-31.....	1		
San Luis Potosi.....	Feb. 6-12.....		1	
Tecate.....	Jan. 17.....	3		
Newfoundland:				
St. Johns.....	Jan. 22-23.....	1		
Norway:				
Stavanger.....	Jan. 23-29.....	3		
Panama:				
Colon.....	Jan. 5-Mar. 1.....	83		Jan. 1-29, 1921: Cases, 45. Mild. Sept.-Oct., 1920: Cases, 175; deaths, 37.
Poland:				
Warsaw.....	Sept. 1-30.....	3		
Portugal:				
Lisbon.....	Nov. 28-Dec. 18.....		5	
Do.....	Dec. 23-Feb. 5.....		11	
Portuguese East Africa:				
Gaza district.....	Dec. 18-23.....			Present.
Inhambane district.....	Dec. 26-Jan. 1.....			Do.
Lourenco Marques.....	Oct. 24-Dec. 11.....	10		Reported present in interior of Chai-Chai district.
Que'Imane.....	do.....	3		
Russia:				
Esthonia Province.....	Dec. 1-31.....	17		
Reval.....	Oct. 1-Nov. 30.....	28		
Riga.....	Nov. 1-Dec. 31.....	17		
Siberia—				
Vladivostok.....	Oct. 1-Nov. 30.....	2	1	
Spain:				
Barcelona.....	Nov. 18-Dec. 29.....		13	
Do.....	Jan. 13-Feb. 2.....		11	
Corunna.....	Dec. 12-15.....		1	
Madrid.....	Nov. 1-30.....		1	Year ended Dec. 31, 1920: Deaths, 9.
Do.....	Feb. 6-13.....		1	
Malaga.....	Oct. 1-Dec. 31.....		77	
Tarragona.....	Jan. 33-Feb. 19.....		2	
Valencia.....	Dec. 5-25.....	3		
Do.....	Dec. 26-Feb. 5.....	12	1	
Syria:				
Aleppo.....	Nov. 14-Dec. 4.....			Dec. 12-25, 1920: Present.
Do.....	Jan. 16-Feb. 5.....			Present.
Tunis:				
Tunis.....	Nov. 30-Dec. 28.....	10	18	
Do.....	Jan. 8-Feb. 18.....	18	16	
Turkey:				
Constantinople.....	Nov. 21-Dec. 11.....	4		
Do.....	Jan. 2-Feb. 12.....	17		
Union of South Africa:				
Johannesburg.....	Oct. 1-31.....	1		
Uruguay:				
Montevideo.....	Dec. 1-31.....	6	2	
On vessels:				
S. S. Alfonso XIII.....	Dec. 27.....	1		At Habana, Cuba, from ports in northern Spain.
S. S. Cadiz.....	Jan. 5.....	1		At Habana, Cuba, from Mediterranean ports.
U. S. S. Mississippi.....	Feb. 18-20.....	22		In Canal Zone.
S. S. Ohioan.....	Jan. 4.....	1		At San Pedro, Calif., from New York, via Balboa, Canal Zone.

**TYPHUS FEVER.**

Algeria:			
Algiers.....	Jan. 1-31.....	2	
Belgium:			
Ghent.....	Dec. 12-18.....	5	



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

Reports Received from Jan. 1 to Mar. 25, 1921—Continued.

### TYPHUS FEVER—Continued.

Place.	Date.	Cases.	Deaths.	Remarks.
Brazil:				
Ceara.....	Oct. 17-Dec. 26....		3	
Bulgaria:				
Sofia.....	Jan. 2-8.....	2		
Chile:				
Concepcion.....	Oct. 27-Dec. 27....		25	
Do.....	Dec. 28-Jan. 24....		7	
Coquimbo.....	Dec. 1-7.....		1	
Valparaiso.....	Oct. 25-Nov. 27....		13	
China:				
Manchuria (Province)—				
Harbin.....	Nov. 22-28.....	1		On Chinese Eastern Railway.
Do.....	Jan. 3-9.....	1		
Manchuria Station.....	Nov. 22-28.....	2		Do.
Do.....	Jan. 10-16.....	1		
Chosen (Korea):				
Seoul.....	Dec. 1-31.....	1		
Do.....	Jan. 1-31.....	1		
Czechoslovakia:				
Prague.....	Feb. 1-7.....	1		July 11-Aug. 28, 1920: Cases, 138; deaths, 18. Reported present Feb. 19, 1921.
Danzig.....	Dec. 20.....	1		In emigrant from Brest-Litovsk; with 2 weeks' stay at Warsaw.
Do.....	Jan. 16-Feb. 5.....	3	1	
Egypt:				
Alexandria.....	Nov. 19-Dec. 31....	13	6	
Do.....	Jan. 1-Feb. 4.....	11	4	
Cairo.....	Oct. 1-Dec. 28....	44	32	Sept. 12-Dec. 25, 1920: Cases, 259, including 11 in a camp. Dec. 26, 1920-Jan. 8, 1921: Cases, 7.
Germany:				
Great Britain:				
Belfast.....	Dec. 5-25.....	13		
Do.....	Jan. 9-29.....	3	1	
Dublin.....	Nov. 28-Dec. 18....	4	3	
Do.....	Jan. 9-Feb. 19....	9	2	
Greece:				
Drama.....	Nov. 22-28.....	1		
Patras.....	Nov. 29-Dec. 5.....		1	
Saloniki.....	Oct. 25-Dec. 26....	34	9	
Serres.....	Nov. 8-14.....	1		
Hungary:				
Budapest.....	Nov. 8-Dec. 5.....	2		Aug. 3-Dec. 5, 1920: Cases, 38.
Italy:				
Naples.....	Feb. 23.....	2		
Trieste.....	Feb. 14.....	30		Among emigrants intending to come to United States.
Japan:				
Nagasaki.....	Nov. 15-Dec. 26....	10	1	
Do.....	Dec. 27-Feb. 13....	11	5	
Jugoslavia:				
Zagreb.....	July 25-Aug. 28....	27	5	Feb. 7-13, 1920: Cases, 84; deaths, 2; Dec. 12-25, 1920: Cases, 112. City and county.
Do.....	Dec. 12-25.....	27		
Do.....	Dec. 26-Feb. 5.....	36	4	
Malta.....	Dec. 1-31.....	1		
Mesopotamia:				
Bagdad.....	Nov. 1-30.....	1	1	
Mexico:				
Guadalajara.....	Dec. 1-31.....	11		
Do.....	Jan. 1-31.....	6	3	Including municipalities in the Federal district.
Mexico City.....	Nov. 14-Dec. 25....	67		Do.
Do.....	Dec. 26-Feb. 5.....	111		Present.
San Luis Potosi.....	Dec. 5-31.....			Do.
Do.....	Jan. 16-22.....			
Netherlands:				
Rotterdam.....	Jan. 23-29.....	1		
Poland:				
Warsaw.....	Dec. 16.....	8		Sept.-Oct., 1920: Cases, 3,845; deaths, 371. Dec. 1-31, 1920: Cases, 4,644; deaths, 550. Jan. 1-31, 1921: Cases, 5,308; deaths, 597.
Portugal:				
Oporto.....	Nov. 28-Dec. 4.....	1		
Do.....	Dec. 26-Jan. 1.....	3	1	

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

**Reports Received from Jan. 1 to Mar. 25, 1921—Continued.**

**TYPHUS FEVER—Continued.**

Place.	Date.	Cases.	Deaths.	Remarks.
Russia:				
Province—				
Esthonia.....				Sept. 1-Dec. 31, 1920: Cases, 455.
Latvia.....				
Riga.....	Nov. 1-Dec. 31....	185		
Do.....	Jan. 1-7.....	21		
Lithuania.....				Feb. 19, 1921: Cases, 175; mortality, 5 to 6 per cent.
Ruthenia.....				Feb. 19, 1921: Occurrence of about 5 fatal cases daily.
Ukraine.....				Do.
Turkey:				
Constantinople.....	Nov. 21-Dec. 25....	25	1	
Do.....	Jan. 2-Feb. 20.....	34		
Union of South Africa:				
Cape Town.....	Dec. 20-26.....	16	5	
On vessels:				
S. S. Presidente Wilson....	Feb. 1-6.....	15		At New York. From Trieste, Italy, Jan. 15; Naples, Jan. 18; and Algiers, Jan. 22, 1921.
S. S. San Giusto.....	Feb. 10-Mar. 3....	22		At New York. From Trieste, Jan. 23, and Naples, Jan. 26, 1921.

**YELLOW FEVER.**

Brazil:				
Pernambuco.....	Nov. 14-21.....	1	1	
Mexico:				
Orizaba.....	Dec. 5-18.....	2	1	
Papantla.....	do.....	8	2	
Do.....	Jan. 9-15.....		1	
Tampico.....	Dec. 12-18.....	1	1	
Tuxpam.....	Dec. 5-18.....	9	4	
Do.....	Dec. 26-Jan. 1.....	5	1	
Vera Cruz.....	Dec. 5-26.....	8	3	
Do.....	Dec. 26-Feb. 20.....	5	1	
Zamora.....	Dec. 12-18.....	1	1	Also called Guitierrez. State of Vera Cruz.
Peru:				
Department—				
Lambayeque.....				Outbreak reported Jan. 22, 1921.
Chiclayo.....	Feb. 1-15.....	11	3	
Eten.....	do.....	7	1	
Ferrenafe.....	Jan. 1-31.....	18	17	
Do.....	Feb. 1-15.....	38	15	
Lambayeque.....	Jan. 1-31.....	2	1	
Do.....	Feb. 1-15.....	2		
On vessel:				
S. S. Savoia.....	Jan. 11-15.....	4		At Habana, Cuba, from Vera Cruz, Mexico. Vessel arrived Habana Jan. 10, 1920, with three cases sickness on board. Two cases confirmed. Two cases developed later on board; confirmed Jan. 15. Savoia left Vera Cruz Jan. 6, 1921.