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PREVALENCE OF COMMUNICABLE DISEASES IN THE UNITED STATES

December 31, 1939–January 27, 1940

The accompanying table summarizes the prevalence of eight important communicable diseases, based on weekly telegraphic reports from State health departments. The reports from each State are published in the PUBLIC HEALTH REPORTS under the section "Prevalence of disease." The table gives the number of cases of these diseases for the 4-week period ended January 27, 1940, the number reported for the corresponding period in 1939, and the median number for the years 1935–39.

DISEASES ABOVE MEDIAN PREVALENCE

Influenza.—For the country as a whole, the reported cases of influenza for the 4 weeks ended January 27 totaled 47,956, which was almost four times last year's figure for the corresponding period, which figure (12,765) also represents the 1935–39 average incidence for this period. The highest incidence is still reported from the South Atlantic, South Central, and Western regions. In the North Atlantic and North Central regions the numbers of cases appear to be about normal for this season of the year. While some States in which the disease has been unusually prevalent showed a decline during the last week of the period under consideration, the only region as a whole to show a decline was the Mountain region. There the cases dropped from approximately 6,000 for the preceding 4-week period to approximately 2,400 during the current period. With the exception of the year 1937, the current incidence is the highest recorded during this period since 1933.

The mortality rate for large cities rose from 11.2 per 1,000 population (annual basis) for the 4 weeks ended December 30 to 12.7 for the 4 weeks ended January 27, 1940. The average rate for the corresponding period in the years 1934–36, 1937, and 1938 was 12.9. The current rise is no doubt due in part to the increase of influenza cases. The rate is, however, only slightly above that for the corresponding period in each of the 2 preceding years.

Poliomyelitis.—The poliomyelitis incidence again declined, from 265 cases for the preceding 4-week period to 151 cases for the 4 weeks ended January 27. Compared with preceding years the incidence still maintained an increase of approximately 70 percent over the average seasonal level. In each section the number of cases was higher than the 1935–39 median figure for this period. The lowest incidence of this disease is usually reached during March or April.

Number of reported cases of 8 communicable diseases in the United States during the 4-week period Dec. 31, 1939–Jan. 27, 1940, the number for the corresponding period in 1939, and the median number of cases reported for the corresponding period in 1935–39 [1]

Division	Current period	1939	5-year median	Current period	1939	5-year median	Current period	1939	5-year median	Current period	1939	5-year median
	Diphtheria			Influenza [2]			Measles [3]			Meningococcus meningitis		
United States [1]	1,829	2,491	2,761	47,956	12,765	12,765	15,635	36,655	36,655	129	212	377
New England	53	65	65	124	50	118	2,583	2,994	3,472	7	6	11
Middle Atlantic	230	360	455	155	362	362	1,265	5,143	5,143	33	47	62
East North Central	351	517	614	692	398	621	2,371	3,634	3,634	21	22	79
West North Central	119	225	247	1,079	321	919	1,976	7,239	6,142	9	13	31
South Atlantic	420	514	517	25,134	5,419	5,419	584	5,098	5,098	20	46	77
East South Central	174	171	221	5,278	1,187	2,284	421	900	900	21	36	66
West South Central	297	377	422	10,968	3,856	3,856	883	1,482	998	3	16	30
Mountain	73	119	93	2,383	761	761	1,126	2,427	1,579	8	17	19
Pacific	112	143	157	2,143	411	644	4,426	7,738	1,079	7	9	16
	Poliomyelitis			Scarlet fever			Smallpox			Typhoid and paratyphoid fever		
United States [1]	151	67	85	16,487	20,581	23,787	320	1,548	1,144	329	458	464
New England	4	1	1	917	1,134	1,661	0	0	0	19	13	14
Middle Atlantic	13	2	8	4,190	4,059	5,556	0	0	0	57	82	72
East North Central	16	11	11	5,490	8,142	8,170	59	543	194	45	44	52
West North Central	20	7	7	1,891	2,593	3,676	122	450	450	16	39	47
South Atlantic	18	19	9	1,287	1,141	1,183	8	13	13	55	92	91
East South Central	10	7	7	629	665	620	0	20	16	12	38	49
West South Central	14	9	9	533	734	734	47	178	44	74	104	104
Mountain	14	1	2	569	631	990	64	212	166	33	26	24
Pacific	42	10	15	981	1,481	1,481	20	132	132	18	20	32

[1] 48 States. Nevada is excluded and the District of Columbia is counted as a State in these reports.
[2] 44 States and New York City.
[3] 47 States. Mississippi is not included.

DISEASES BELOW MEDIAN PREVALENCE

Diphtheria.—The incidence of diphtheria was the lowest for this period in the 12 years for which these data are available, and was possibly the lowest for all time. Reported cases for the 4 weeks ended January 27 numbered 1,829, as compared with 2,491 for the corresponding period in 1939, and with an average of approximately 2,800 cases in the years 1935–39. The decline occurred in all regions.

Measles.—The number of reported cases (15,635) of measles was also the lowest recorded for this period in recent years. During the corresponding period in 1939 the cases totaled 36,655, which figure also represents the 1935–39 average incidence for the period. The

incidence was comparatively low in all sections of the country except the Pacific region, where the number of cases was more than four times the 1935–39 median incidence for this period.

Meningococcus meningitis.—The incidence of meningococcus meningitis was also relatively low, 129 cases, as compared with 212, 377, and 542 cases for the corresponding period in 1939, 1938, and 1937, respectively. For the country as a whole the current incidence is the lowest for this period in the 12 years for which these data are available.

Scarlet fever.—The number of cases (16,487) of scarlet fever reported for the current period was only about 80 percent of the number recorded for the corresponding period in 1939, and about 70 percent of the 1935–39 median figure (23,787) for this period. In the South Atlantic and East South Central regions the incidence was at approximately the average level of recent years, but in all other sections the incidence was relatively low. In all regions except the Middle Atlantic, South Atlantic, and East South Central the incidence was the lowest in recent years.

Smallpox.—Smallpox remained at a comparatively low level. The number of cases reported for the current period was 320, as compared with 1,548, 2,435, and 1,144 for the corresponding period in 1939, 1938, and 1937, respectively. Each region of the country shared in the favorable situation of this disease that now exists. Very significant decreases were reported from the Central and Western regions, where smallpox has been unusually prevalent in certain States during the past three years.

Typhoid fever.—For the country as a whole the typhoid fever incidence (329 cases) was about 70 percent of the average (464 cases) seasonal incidence. The New England and Mountain regions reported a few more cases than might normally be expected, but in all other regions the incidence was relatively low. For this disease, also, the current incidence is the lowest for this period in the 12 years for which these data are available.

MORTALITY, ALL CAUSES

The average mortality rate from all causes in large cities for the 4 weeks ended January 27, based on data received from the Bureau of the Census, was 12.7 per 1,000 population (annual basis). The rate for the years 1935–39 was 13.6; the average rate for that period exclusive of 1937, a year in which influenza was unusually prevalent, is 12.9. Considering the rather high incidence of influenza the current mortality rate is, therefore, about normal.

LIMITATIONS OF EUGLENIDAE AS POLLUTED WATER INDICATORS

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Casual inspection of many of the streams of this country gives the impression that they might be suitable for fishing, bathing, public water supplies, stock-watering, boiler water supplies, or some of the myriad uses to which relatively pure waters can be put. Tracing the stream courses may reveal, however, that even those streams which look the best are heavily polluted by domestic sewage, cannery wastes, paper mill wastes, distillery wastes, or other injurious substances and that such flowing waters are largely useless or even harmful to man and his cattle, empty of fish, and shunned by waterfowl. Many of the streams of the eastern United States are vastly changed from what they were two or three generations ago and an awakening public interest in their decreasing economic, public health, recreational, and esthetic values is demanding that those responsible for stream abuse, whether cities, corporate interests, or private individuals, be compelled to stop such abuse, with its injurious effects upon the population at large.

Criteria of stream pollution may be all too evident in turbid, highly colored, offensive smelling streams. But for relatively clear, sparkling streams laboratory examination is often needed to determine the nature and extent of pollution. This examination is a public service usually performed by skilled scientific city, State, or Federal personnel. Chemical, bacteriological, and biological determinations of the sanitary conditions of waters are made in the laboratory.

Biological examinations may include several features, such as the microscopic life present or the animals living in or on the bottom of the stream. It has been stated that an abundance of certain microscopic organisms is a sure indication of organic pollution, usually with domestic sewage. One of the groups of such organisms used for this purpose has been the "*Euglenas* and their allies," a related group of green flagellates belonging to the lowest plant or animal classifications, the Algae or Protozoa, but difficult to place categorically in either because the organisms include some of the characteristics of each group. Kolkwitz and Marsson (*1*), Marsson (*2*), and Fair and Whipple (*3*) refer to the Euglenidae as indicators of pollution in the above manner.

EUGLENIDAE IN THE SCIOTO RIVER

Between April 1937 and November 1938, the senior author examined 884 samples taken from the Scioto River in south central Ohio. Samples were taken from as many as 18 stations along the

river and tributary creeks, and for the greater part of the time each point was sampled weekly. Half the samples were examined after formalin preservation and half as fresh unpreserved samples. Usually

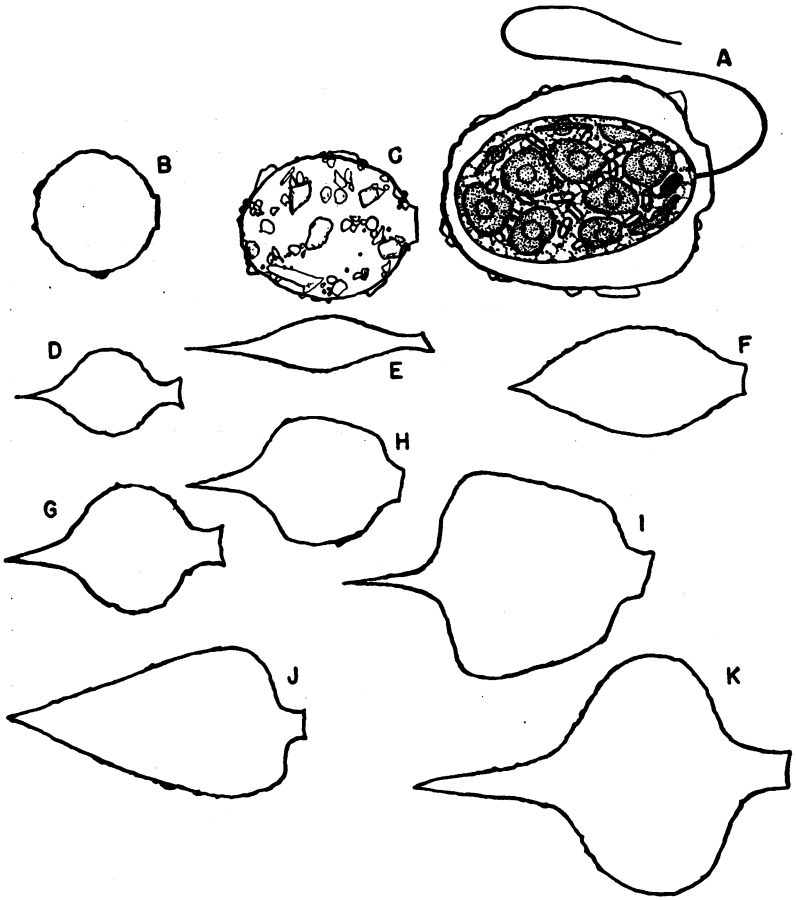

FIGURE 1.—Forms of *Trachelomonas* included in this paper under the species *urceolata*. In the Scioto River there is a completely intergrading series of these forms, all of them with a rough, thin, colorless shell to which sand and debris is attached.

(*A*) Diagrammatic view of the most common form showing type of chloroplast with central pyrenoid, location of stigma, and nature of paramylum. Note the encrusted shell with short neck, broadly rounded anteriorly.

(*B*) Shell type, near *T. scabra*.

(*C*) Shell showing nature of granular deposits.

(*D*)-(*K*) Series of intergrading forms. Any one of these might be identified as a distinct species or variety.

100 milliliters of river water were centrifuged until the suspended matter had been concentrated in a small amount of catch. All organisms were identified, if possible, and counted. The Scioto at times has a very large plankton content, but ample time was devoted

to the critical examination and enumeration of catches so that the nature and extent of the plankton population is very accurately known.

Five genera of green Euglenidae were found, comprising 48 species. In addition one group of *Euglena* and one of *Trachelomonas* were called simply "species," inasmuch as specific determinations were not possible. One group of several possible species of *Trachelomonas* was called *T. urceolata* (fig. 1) since it comprised a large intergrading series of forms. Total numbers of each recognizable species were tabulated for each station examined on a given date; then a separate sheet was made for each species showing the date of sampling and the

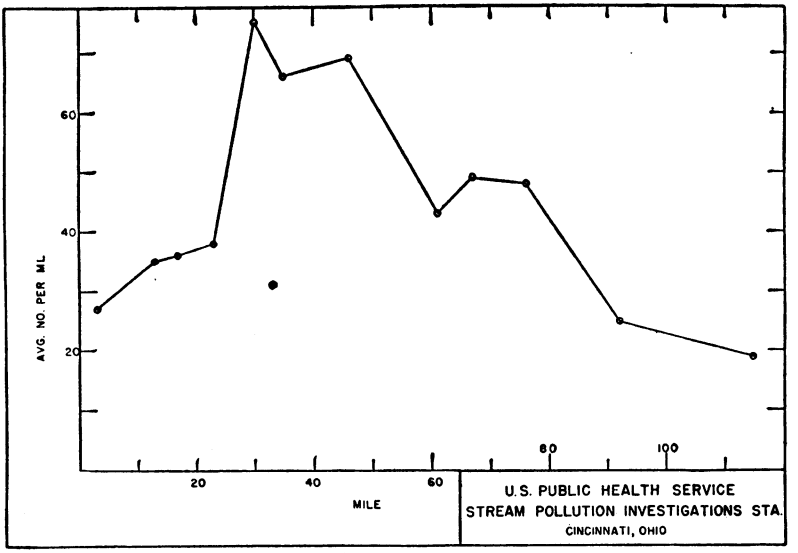

FIGURE 2.—Average number per ml. of green Euglenidae, exclusive of *Euglena viridis*, at Scioto River sampling stations, April 1937-December 1938.

numbers of that species present per milliliter of raw river water. This enabled one to determine almost at a glance whether that species had a seasonal or all-year distribution, how it was affected by rises in the river, and the time and place of its maximum occurrences.

Figure 2 shows the average numbers of green Euglenidae per milliliter at each station examined during 19 months. Figure 3 shows their seasonal distribution at mile 30 (Red Bridge), approximately 23 miles below the Columbus sewage outfall. From these two charts it is at once evident that the average number of green Euglenidae is high for the 76-mile stretch from Columbus to Kilgour Bridge, and that they show a pronounced seasonal distribution.

The first sampling point, mile 3, is just downstream from a low head dam at Columbus and the river there is unpolluted, receiving no sewage and being only a few miles below the Griggs and O'Shaughnessy

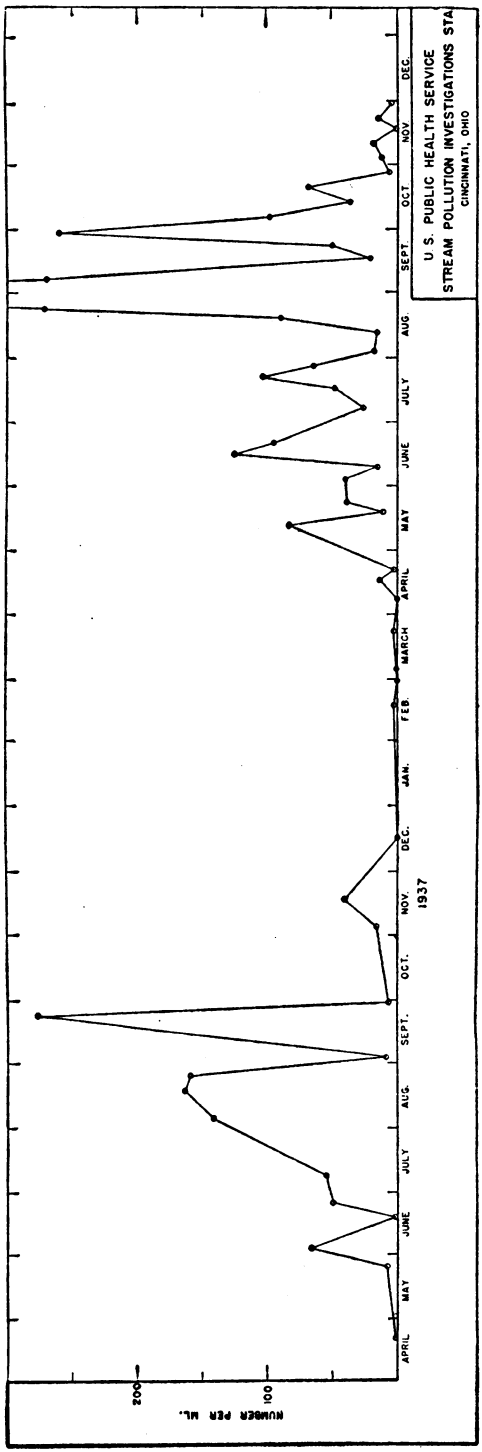

FIGURE 3.—Numbers of all green Euglenidae at mile 30 (Red Bridge) in the Scioto River, April 1937–December 1938.

reservoirs. At about mile 7 it receives the discharge of the Columbus sewage treatment plant, which during 1937 and 1938 poured a poorly treated effluent into the river. During the summer low water stages the river was visibly foul at least as far as mile 17. Much of this stretch was a region of slow flow, through pools separated by shallow riffles, offering an excellent chance for the rapid multiplication of plankton during low water, warm weather conditions. From about mile 17 a steady improvement in the condition of the river was noticeable and this visual evidence was supported by chemical and bacteriological findings. Certainly the river was not grossly polluted at mile 30 (Red Bridge) nor did it get sufficient sewage or waste materials at any point below to deteriorate the water markedly.

The zone in which the Euglenidae were most abundant during the 2 years was not the most foul water zone, but from mile 30 to mile 76 downstream. One sharp decrease in numbers occurred at mile 32, but there was an immediate rise and at this time there is no indication of what factor was responsible for the decrease here. In other words, the greatest numbers of green Euglenidae in the Scioto occur in the zone in which recovery from heavy pollution is taking place, and the decrease in numbers at mile 32 is a minor fluctuation.

Of course, the Scioto is a flowing stream and, because of the time element, enormous numbers of Euglenidae should not be expected at the precise point where it becomes heavily polluted by Columbus sewage, even if Euglenidae react favorably to sewage by multiplying rapidly. Des Cilleuls (*4*) has summarized the findings of many workers showing that plankton multiplication is rapid and most favored in still areas of streams such as bays, dead arms, and the like, and that these feed a constant supply of plankton into the current. There are numerous still areas in the Scioto within the heavily polluted stretch, and examination of samples from such points failed to reveal them as "breeding places" for Euglenidae. Weston and Turner (*5*) long ago pointed out that a sewage-polluted stream recovers biologically before it recovers chemically. At Red Bridge chemical recovery of the Scioto is generally very evident; hence biological recovery would be expected above this point. Actually, the increase of Euglenidae is slow between mile 7 and mile 23 (fig. 2), but rises sharply thereafter and remains high. If the stimulus to this high development is derived from pollution, either it is a very sustained one or it is due to some substance or condition not shown by chemical analysis.

If we examine individual species, most of them have their maximum occurrence in the recovery zone, even if their numbers are small. Some species, such as *Cryptoglena pigra*, *Euglena fusca*, or *Phacus anacoleus*, showed few numbers most of the time, but sometimes flared up suddenly into numbers somewhat comparable to the familiar blooms of *Euglenas* occasionally seen on ponds or temporary pools.

Others, such as *Euglena oxyuris* or *Trachelomonas volvocina*, were present most of the time over widely scattered mileages, but never attained large numbers. Still others, as *Euglena pisciformis*, *E. viridis*, *Trachelomonas crebea*, and *T. urceolata*, were common in occurrence much of the time. Figure 4 shows the average distribution of *E. viridis* in the Scioto during the period studied. The increase in numbers of *E. viridis* in the grossly polluted zone is striking compared to the behaviour of the Euglenidae as a whole. But the increase is short lived, for there is a decrease between mile 13 and mile 23, which allows a time interval when multiplication might be possible, or expected, if sewage provides a stimulus. Furthermore, the greatest

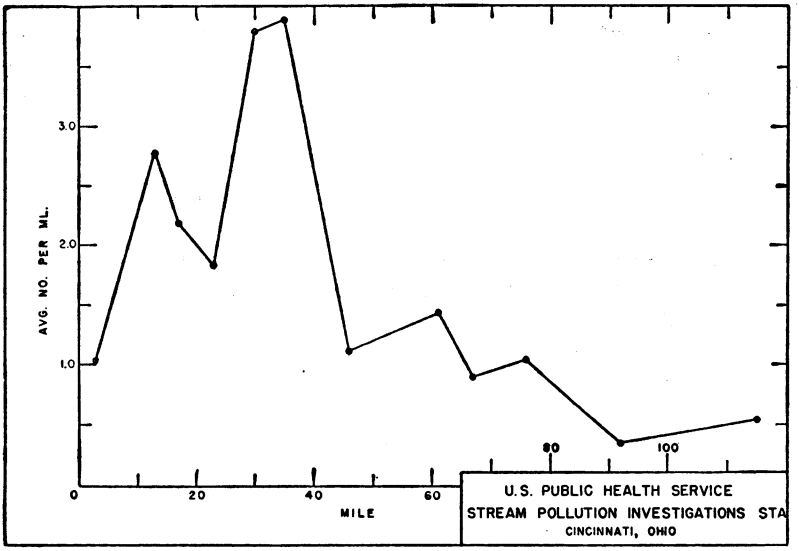

FIGURE 4.—Average number per ml. of *Euglena viridis* at Scioto River sampling stations, April 1937–December 1938.

numbers of *E. viridis* are in the cleaner waters between miles 30 and 40. For this particular species the data certainly suggest a favorable reaction to waters recently foul with organic matter.

Figure 5 shows a similar reaction for the group of Trachelomonads grouped as *T. urceolata*. But there is an initial decrease for these organisms where pollution is heaviest, and recovery in numbers is slow until past mile 23.

Of the individual species of Euglenidae whose total numbers and wide distribution are sufficient for critical use, *E. viridis* comes nearest to indicating a preference for polluted water, and yet even its maximum and greatest occurrence is in the recovery zone. Figure 5 shows a much greater average occurrence of *T. urceolata* in the zone still further down.

If any individual set of samples is selected for analysis, false conclusions may easily be drawn. Table 1 shows a few instances of the

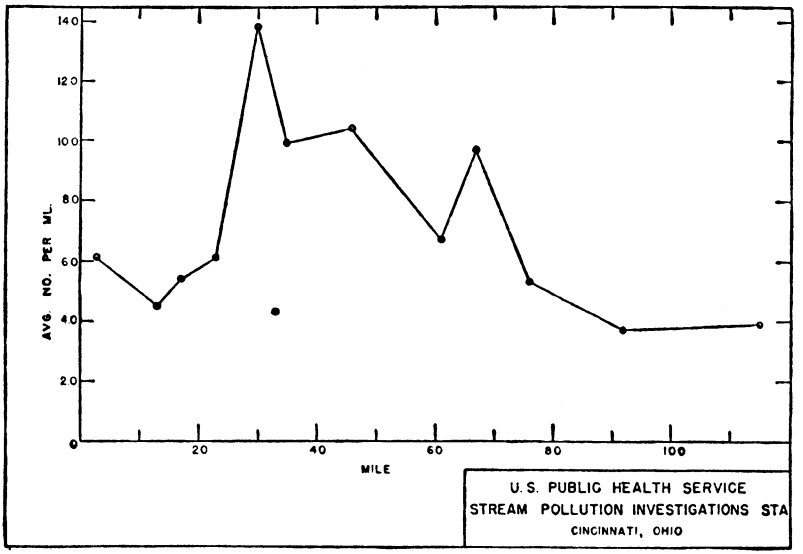

FIGURE 5.—Average number per ml. of *Trachelomonas urceolata* group at Scioto River sampling stations, April 1937–December 1938.

distribution of certain species on certain dates, with maxima for the same species at one time in the zone of greatest pollution, at another

TABLE 1.—*Distribution of various Euglenidae in the Scioto River on certain dates. Numbers per milliliter of raw water*

Species	Dates	Sanitary condition of water																	
		Clean	Polluted		Transitional		Clean												
		Sampling stations in river miles below Columbus, Ohio																	
		3	13	17	23	30	33	35	46	61	67	76	92	120	(a)	(b)	(c)	(d)	(e)	(f)
Euglena fusca	June 20, 1938	--	2	26	16	14	---	14	*40*	6	---	---	---	---	2	---	---	---	---	---
Euglena fusca	July 27, 1938	---	---	1	---	---	---	---	*18*	2	8	4	---	---	---	---	---	---	---	---
Euglena pisciformis	Aug. 5, 1937	2	*42*	34	14	40	2	16	---	4	---	---	---	---	---	---	---	---	---	---
Euglena pisciformis	Aug. 30, 1933	4	1	1	4	*110*	---	30	1	2	1	---	---	---	---	1	---	---	---	---
Euglena polymorpha	Aug. 5, 1937	18	64	38	*68*	28	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Euglena polymorpha	Aug. 30, 1938	8	18	21	*265*	---	256	44	12	11	---	---	---	---	4	34	9	---	---	---
Euglena viridis	Aug. 18, 1937	---	34	*50*	32	44	4	42	---	10	---	---	---	---	---	---	---	---	---	---
Euglena viridis	Aug. 30, 1938	---	1	1	2	*100*	---	46	6	---	6	---	---	---	1	2	---	---	---	---
Lepocinclis texta	July 22, 1938	2	*10*	5	---	1	---	---	---	2	2	1	---	---	---	---	---	---	---	---
Lepocinclis texta	July 27, 1938	3	2	3	1	*22*	---	---	16	---	6	---	---	---	---	---	---	---	---	---
Trachelomonas crebea	May 23, 1938	2	28	25	24	16	---	---	*104*	*104*	80	3	80	80	1	1	1	2	---	1
Trachelomonas crebea	Aug. 19, 1938	30	40	*120*	40	40	---	---	90	60	40	---	100	4	10	6	1	---	3	---
Trachelomonas urceolata	June 15, 1938	70	2	20	20	20	---	*120*	50	10	100	---	10	---	2	---	---	---	22	---
Trachelomonas urceolata	June 20, 1938	10	---	20	*60*	20	---	30	4	2	12	---	20	---	12	16	10	---	---	---

NOTE.—Tributary streams near junction with Scioto River:
(a) Big Walnut. (d) Deer Creek.
(b) Little Walnut. (e) Paint Creek.
(c) Darby Creek. (f) Salt Creek.

time in the recovery zone. Such instances demonstrate the necessity for using average distribution figures. It has not been possible thus far to trace one of these maxima downstream. While aggregations of plankton organisms move down to some extent, it has not yet been shown whether the observed maxima move at current speed, whether they lag, or whether they are dispersed as the current carries them into a changed environment. Such information would be useful and work on this point is urgently needed.

EUGLENIDAE IN OTHER SITUATIONS

If the green Euglenidae are not found predominantly in the zones of highest pollution, what is their ecologic status relative to pollution? In June 1938, a biological survey of the Licking River of Kentucky was made at a time when the river was clear and rather low. The main stream, rising in mountainous country, gets the sewage of a very small population, and flows rather swiftly until it meets the South Fork at Falmouth, Ky. The South Fork, which is much shorter, gets the sewage of several good-sized towns, Paris, Cynthiana, and Mount Sterling, but also has a much slower current, and has low head dams in three places. It is nowhere grossly polluted, and at Cynthiana is used as a water supply, although only a short distance below Paris. Examination at seven points on the North Fork, down almost to Falmouth, gave a total of 6 species of green Euglenidae of which only three, *Euglena* species, *Trachelomonas urceolata*, and *T. volvocina*, were sufficiently abundant to count, 2, 4, and 2 per milliliter, respectively. On the South Fork, however, 15 species were found, in numbers from 1 to 180 per milliliter. All of these were forms normally found in the Scioto, the most abundant being *Euglena gracilis*, 180 per milliliter, *Euglena* species, 100 per milliliter, *Trachelomonas crebea*, 90 per milliliter, *T. urceolata*, 160 per milliliter, and *T. volvocina*, 30 per milliliter. These counts were made where there was no visible evidence of sewage pollution. The North Fork water was turbid with silt, and not aged greatly, due to rapid run-off. The South Fork water was relatively clear, but possibly older water, and, in addition, it had been polluted by sewage but not sufficiently to show visual evidence.

These two streams, the Scioto and Licking Rivers, present instances where there are large populations of green Euglenidae in areas below sewer outfalls. The maximum population of such plankton is not in grossly polluted water, however, but below such stretches. The North Fork of the Licking also offers an instance of a moderately large and rapidly flowing stream which contains almost no sewage and has a small population of euglenid flagellates. A parallel case is the Great Miami River and its tributary, the Whitewater River.

The latter is relatively swift and gets little sewage, whereas the Great Miami is slowed up by dams, gets the sewage and industrial wastes of several cities, and at times has many Euglenidae. The Whitewater is less turbid than the North Fork of the Licking, and the Great Miami is comparatively clear but sometimes contains paper-mill wastes.

These instances show that Euglenidae are certainly abundant in some waters containing sewage. It is our contention that clarity of water and age of water are factors favoring their development also, and that the pollution of a river by domestic sewage is not alone sufficient to cause the development of a large population of these green flagellates. Pollution, followed by ageing and clarifying of water, may be more favorable to their development, and a seasonal

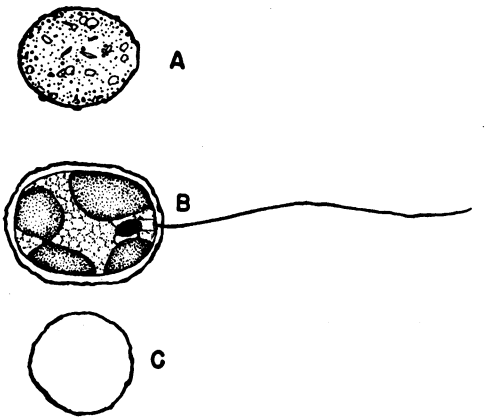

FIGURE 6.—*Trachelomonas crebea*. Smaller (as a rule) forms than those in figure 1, with a thin deep brown shell, fewer chloroplasts, which are large and usually without pyrenoids. *A*, *B*, and *C* represent the greatest variation in shell form for this species and *B* shows the internal structure.

factor may also be added. Pollution certainly seems to be a contributing factor, but to use these organisms as indicators of sewage contamination would require that sewage be more than a contributing factor for their excessive increase. In 1938, 48 samples were taken from the Cumberland and Duck Rivers in Tennessee. The upper watershed of the Cumberland is very rugged and run-off is fast, while the water at the time the samples were taken was decidedly turbid with erosion silt. In 183 miles of the Cumberland above mile 198 (from the mouth) the only Euglenidae found were *Trachelomonas crebea* and *T. urceolata* (figs. 1 and 6) which occurred in 3 samples, and a species of *Euglena* in one sample. Apparently, age of water, silt, and lack of organic contamination militated against the organisms. At mile 218, the Cumberland begins to get material quantities of sewage; between miles 198 and 218 the sewered population numbers 26,000, and industrial wastes are poured into the river from two cheese

plants, a condensed milk plant, a woolen mill, and a large viscose rayon plant. At about mile 190, Nashville, with a population of 150,000, empties its untreated sewage into the river. Sixteen miles below this point the greatest numbers of Euglenidae were found. While they were found in all samples between miles 88 and 198, their total and average numbers were very low as compared with samples from the Scioto at the same time of year and only nine species were identified. One additional group, termed *Euglena* sp., was present in small numbers, but the bulk of the population was made up of *Trachelomonas crebea* and *T. urceolata* whose distribution in the Scioto is quite variable. *Euglena viridis* occurred in small numbers in only three samples, not being found above mile 150. Evidently the addition of the sewage of a large city failed to be more than a very mild stimulus to the development of Euglenidae in the Cumberland River.

In September 1939, the senior author again made a careful survey of the Cumberland, examining fresh samples taken from numerous stations above, at, and below Nashville. The stream was very low, the temperature high, the flow was very sluggish and the stream clear. Despite these supposedly favorable conditions, the numbers of Euglenidae were few and there was no material increase at or below Nashville, although the polluted condition of the river was all too apparent.

With regard to the Duck River, the Tennessee health authorities (*6*) state that between miles 150 and 174 from the mouth the river carries a heavy load of sewage pollution. Six known species of Euglenidae, and one unidentified (*gracilis* group(?)) *Euglena* were found in these samples in 1938 as follows:

River miles	98	122	130	136	186	216	225
Numbers of Euglenidae per milliliter	26	80	106	436	38	29	4

Almost all of these were *Trachelomonas urceolata* and *Euglena* sp. The large numbers at mile 136 are not due to sewage; to quote from Dr. Williams (*6*), "This (sewage) pollution is not present at mile 136 since this point is above Columbia (Tenn.), and the nearest known pollution is that from Shelbyville, which is about 80 miles upstream." Actually, despite the sewage of Columbia, entering at mile 130, there is a steady decrease of these green flagellates downstream.

The Duck River was also surveyed in September 1939, and while a heterogenous plankton was present, there was no large population of Euglenidae anywhere in the stream, regardless of the presence or absence of sewage. In short, biological surveys of these two streams have flatly failed to show that sewage encourages the growth of Euglenidae.

DISCUSSION

Sudden enormous increases of microorganisms, often with little or no indication of the cause, are well known to biologists. This is especially true of Euglenidae, and is shown perhaps in the numbers at Red Bridge (fig. 3) in September and August 1937 and 1938. An examination of the data for suspended solids, 5-day B. O. D., pH, 37° agar counts, and coliform counts of bacteria shows no correlative aspect for the rise in August, the sudden drop on September 3, and the subsequent sharp rise and fall in 1937. The decline in early August 1938 was due to a rain, either dilution of the volume of river water or the attendant jump in suspended solids (largely silt) from 160 p. p. m. to 530 p. p. m. There was a prompt recovery, however, to 790 organisms per milliliter of raw river water; then another heavy rain about September 12 decreased numbers to about 25 per milliliter. The increases are very difficult to account for and can hardly be attributed to changes in the river traceable to sewage. No known river factor, light, temperature, chemical composition, and the like, undergoes such violent fluctuations as shown by figure 3, not even volume and turbidity following a rain.

The species listed for the Scioto are fairly well recognized. Only one group of the genus *Euglena*, comprising possibly *Euglena agilis*, *E. gracilis*, and *E. pisciformis*, offers much difficulty. Of these the senior author (*7*) has found only one, *E. gracilis*, abundant in sewage plants. Peterson (*8*) has reported *E. polymorpha* as abundant in this same plant. *Euglena polymorpha* has been noted (*9*) as a bloom on an unpolluted country pond, and we have also noted it as a bloom on water in a cedar swamp at Woods Hole, Mass. We have found *E. sanguinea* as a common late summer bloom on hot, muddy ponds or borrow pits. Eddy (*10*) has reported it as a bloom on sink holes in southern Illinois. *E. mutabilis* has been found as a dominant (*11*) in highly acid coal mine drainage. We have procured *E. deses* in large numbers from stagnant, but not sewage-polluted drainage ditches *E. oxyuris* has been reported by Senior-White (*12*) as high as 100 per milliliter in a "foul tank" used as a buffalo wallow at Delhi, India. *E. viridis* has constituted 98 percent of the population of a small pool fed by a small city sewer during street construction in Cincinnati. Eddy (*13*) reported a number of Euglenidae in the Sangamon River in 1929, but never as many as 1 per milliliter; he considers the river "a fairly clean stream." Kofoid (*14*) found many of these species in the Illinois River between 1894 and 1899, inclusive, when it was a clean stream, not getting the sewage of Chicago through the drainage canal. He recorded 24 species of this group, all but two of which have been found in the Scioto. *Euglena viridis* was most abundant, *E. oxyuris* next. None of the other abundant Scioto River Euglenidae

were found in large numbers by him, but *Trachelomonas volvocina* occurred in the Illinois in abundance. In 1921–22 Purdy (*15*) reexamined the plankton of the Illinois and found only *Euglena viridis* in noteworthy numbers. Allen (*16*) found six species of Euglenidae in net samples from the San Joaquin River, but it is difficult to relate them to pollution. Such a search through the literature fails to show a definite correlation between sewage pollution and species, or even numbers, of Euglenidae present. *Euglena viridis* and *E. oxyuris* have been shown to be present in large numbers in polluted waters, but we question that they do not occur abundantly elsewhere. We believe that the finding of other species in great abundance where there is no evidence for sewage pollution shows that the group as a whole should not be used as indicating sewage pollution. We do believe that the evidence from the Scioto River studies indicates only one species, *E. viridis*, to be valuable as such an indicator, and even it may occur in abundance in a zone where pollution is revealed only by careful chemical and bacteriological studies. Furthermore, of the Euglenidae as a whole, our experimental studies and a survey of the literature indicate that only the following species tend to occur in abundance in sewage-polluted water: *Cryptoglena pigra*, *Euglena fusca*, *E. gracilis*,[1] *E. oxyuris*, *E. pisciformis*, *E. polymorpha*, *E. viridis*, *Lepocinclis texta*, *Phacus pyrum*, *Trachelomonas crebea*, and *T. urceolata*.

Since some of these have been found by us and by other observers in huge numbers in environments not polluted by sewage, or in situations far from sewage pollution where recovery of a sick water was taking place, we believe that it is more accurate to state that the abundance of these organisms *may* mean pollution; it probably means the presence of organic substances, or end products of decomposition of organic compounds. We do not believe they should be regarded as indicators of sewage pollution, unless other evidence is adduced in support.

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THE BACTERIAL ASSAY OF RIBOFLAVIN IN THE URINE AND TISSUES OF NORMAL AND DEPLETED DOGS AND RATS

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Snell and Strong (*1*) have reported a method for the assay of riboflavin using the *Lactobacillus casei*. They observed that their microbiological assays checked very well with rat assays performed on the same materials. In order to determine the efficacy of this test in following the nutritional status of experimental animals, we have applied their technique to the assay of urine and tissues obtained from normal and riboflavin deficient dogs and rats.

The method of Snell and Strong is dependent upon the observation that the amount of growth of a specific strain of *Lactobacillus casei* and the resulting acid production is proportional to the amount of riboflavin in an otherwise riboflavin deficient medium. It may be outlined briefly as follows: With each set of assays a control group of tubes is prepared containing 10 ml. of medium; duplicate tubes contain 0.0, 0.05, 0.075, 0.1, 0.15, 0.2, and single tubes contain 0.3 and 0.5 micrograms of riboflavin, respectively. In a similar manner the unknown material is added in the form of an aqueous extract to duplicate sets of tubes in graded amounts. All tubes are autoclaved, cooled, and inoculated with 0.1 ml. of a saline suspension of a 24-hour culture of *Lactobacillus casei*. After incubation at 37° C. for 72 hours the acid formed in each tube is titrated with 0.1 normal sodium hydroxide. Over the range from 0.05 to 0.25 micrograms of riboflavin the turbidity resulting from bacterial growth and the acid production is

proportional to the amounts of riboflavin in the tubes. A curve, therefore, can be constructed from the titration values of the controls from which the riboflavin content of the unknown tubes can be interpolated. Preliminary experiments using the microbiological assay were performed in this laboratory. It was observed that the method was sensitive to ± 0.01 to 0.02 gamma of riboflavin and it was possible to repeat assays on the same material within ± 10 percent.

EXPERIMENTAL METHODS

A. Selection of animals (dogs).—Adult mongrel dogs were used in these experiments. One female dog (No. 388) and 7 male dogs (Nos. 358, 391, 392, 396, 401, 407, and 429) were standardized for a minimum of 134 days on stock diet 326. These animals were in excellent condition when they began a basal nicotinic acid deficient diet on October 3, 1938. They were observed on this diet under varying doses of nicotinic acid but with a constant supplement of 10.4 gamma of riboflavin per 100 calories of ration until February 27, 1939, when the experiments here reported were started. The urine of all these animals was examined at intervals for riboflavin. Three of these dogs (Nos. 392, 396, and 407) were used to determine the riboflavin content of tissues in depleted animals. They remained on a basal diet with no addition of riboflavin for 121, 104, and 47 days, respectively.

As controls for the riboflavin content of the urine, 1 female dog (No. 430) and 8 male dogs (Nos. 431, 432, and 433) were standardized for a minimum of 132 and a maximum of 252 days on stock diet 326. They were in excellent condition when they began a high liver and high yeast diet 515 on March 8, 1939.

As controls for the riboflavin content of tissues, 1 male dog (No. 443) and 2 female dogs (Nos. 417 and 437) were standardized on diet 326 for 33, 362, and 132 days, respectively, when each was sacrificed.

B. Selection of animals (rats).—Rats were reared on stock diet 507 and then assembled in lots of 4 animals. The influence of riboflavin deficiency was tested in both sexes by means of litter mates of the same sex in control and depleted lots. Lots 1850 and 1851 were 72 days of age and lots 1841, 1842, 1843, and 1844 ranged from 25 to 27 days of age when they were placed on basal diet 513. Lots 1860 and 1861 ranged from 20 to 23 days of age when they were placed on diet 513, a paired feeding technique being used. Control lots 1850, 1841, 1843, and 1860 received a supplement of 50 gamma of riboflavin daily.

C. Diets and supplements served dogs and the riboflavin assay values of these diets.—

1. Stock diet 326 for dogs, as used by Goldberger and his associates, contains graham flour 63,[1] whole milk powder 20, dried pig liver 10, brewer's yeast 3.3, calcium carbonate 1,[1] sodium chloride 1,[1] and cod-liver oil 1.7 parts per 100. The riboflavin assay of this diet diluted with water for serving showed 5.5 gamma per gram. When this value is corrected for the added water, the riboflavin content of the diet is 22 gamma per gram. (All the diets were assayed by the bacterial method of Snell and Strong (*1*) as they were served to the animals.)

[1] These ingredients are stirred into water and cooked in a double boiler of enamelware for about 1½ hours. The other ingredients are well stirred in, the total weight brought to 2,400 grams with water (so that 1 gram represents 1 calorie). This finished mixture is fed to the dog *ad libitum*. Each day the food served to every dog is weighed; the following day the residue is deducted and the net food intake recorded.

2. High liver, high yeast diet 515 for dogs contains graham flour 46,[1] whole milk powder 16, dried pork liver 19.5, brewer's yeast 15, cod-liver oil 1.5, calcium carbonate 1,[1] and sodium chloride 1[1] part per 100. The riboflavin assay of this diet diluted with water for serving showed 10.2 gamma per gram. When this value is corrected for the added water, the riboflavin content of the diet is 40 gamma per gram.

3. Riboflavin deficient diet 507 for dogs contains cornmeal 74,[1] leached casein 16, Osborne and Mendel salt mixture 3.6,[1] cod-liver oil 2.4, and cottonseed oil 5 parts per 100. The riboflavin assay of this diet diluted for serving showed 0.17 gamma per gram. When this value is corrected for the added water, the riboflavin content is 0.65 gamma per gram. (The riboflavin values of the dog and rat diets with a high riboflavin content are probably reasonably correct, but the values given for diets with a low riboflavin content are probably too high, because in the latter case it is necessary to add a large amount of extraneous material to the assay tubes and this interferes with the performance of the test. This is in accord with the observations of Snell and Strong (*1*).) This basal diet is deficient in nicotinic acid as well as riboflavin. Dogs 391, 392, 396, 401, and 407 received sufficient nicotinic acid daily to protect them from any symptoms of blacktongue. Dogs 358, 388, and 429 were deprived of nicotinic acid during most of the period when urine was collected for riboflavin assay. (Dogs 388 and 429 died of blacktongue in April 1939.) From October 3, 1938, to May 31, 1939, each dog received 10.4 gamma of riboflavin per 100 calories of ration. On May 31, 1939, dogs 392 and 407 were given in their food a dose of riboflavin equivalent to 100 times their previous intake. This represented 7.75 mg. for dog 392 and 7.25 mg. for dog 407. (On June 4, 1939, dog 391 died of acute hemorrhagic pancreatitis.) On June 5, 1939, dogs 358 and 401 were given 100 times their daily riboflavin intake by intramuscular injection. This was 11.5 mg. for dog 358 and 7.25 mg. for dog 401. Between May 31, 1939, and June 5, inclusive, dogs 358, 391, 392, 396, 401, and 407 received their daily supplement of 10.4 micrograms of riboflavin except as above mentioned. On June 6, 1939, there were 5 dogs (Nos. 358, 392, 396, 401, and 407) remaining on the experiment and their daily supplement of riboflavin was discontinued.

D. Diets and supplements served rats and the riboflavin assay values of these diets.—

1. Stock diet 516 for rats contains whole ground soft wheat 28, whole ground yellow corn 28, ground green leaf alfalfa 10, dried pork liver 6, whole-milk powder 25, cod-liver oil 1, ground bone meal 1.5, and sodium chloride 0.5 parts per 100. In addition each rat received a moderate amount of lettuce daily. The riboflavin assay of this diet, excluding the lettuce, showed 19 gamma per gram.

2. Riboflavin deficient diet 513 for rats contains corn starch 55, leached and alcohol extracted casein 15, cod-liver oil 2, cottonseed oil 4, Osborne and Mendel salt mixture 4, and ether extracted rice polish 20 parts per 100. The riboflavin assay showed 1.2 gamma per gram of basal diet. Control lots 1841, 1843, 1850, and 1860 on this diet received 50 gamma per day of riboflavin for 5 days a week and 100 gamma per day 1 day a week. This was mixed with the food.

Rats were fed *ad libitum* except for the young rats in lots 1860 and 1861 which were placed on paired feeding technique.

E. Collection and preservation of urine and method of assaying for riboflavin.—The method of urine collection from dogs has been previously reported (*2*). Briefly, the procedure is as follows: After voluntary urination each dog received by stomach tube the maximum amount of water which he would comfortably retain. The urine was collected during a subsequent 4-hour period in dark-colored bottles. Male dogs were catheterized for residual urine. An aliquot of

[1] See footnote 1, p. 281.

the entire specimen was then either passed through a Berkefeld filter No. N [2] immediately or temporarily refrigerated and then filtered. The urine was collected about once weekly from the dogs beginning on February 27, 1939, and continued in the case of dog 392 to August 24, 1939. The urine collection may be divided into three periods in relation to the riboflavin intake of the dogs. There was first a period of 8 months on a very low maintenance supplement of 10.4 gamma per 100 calories of food intake. Specimens of urine were collected during the last 3 months of this period. There was then a brief period of 6 days when 4 dogs were given 100 times their customary supplement of riboflavin. There was finally a period of 2 to 4 months, depending on the length of life of the animal, during which no supplement of riboflavin was given. All of the urines from any given dog or lot of rats were assayed at one time and the urines of control and depleted animals were tested simultaneously insofar as feasible.

The assay technique of Snell and Strong (*1*) was followed except for three modifications.[3] 1. Owing to the small amount of urine preserved for testing, only 5 ml. instead of 10 ml. total volume of solution were used in each assay tube. 2. Samples of urine from depleted animals which contained small amounts of riboflavin were tested at two different levels, and a few samples were tested at one level only. 3. It was found necessary to adjust the pH of the urine to approximately 6.7.

The urine of control dogs was customarily added to 2.5 ml. of basal medium in amounts ranging from 0.05 to 0.25 ml. The urine of depleted dogs was usually added to the basal medium in amounts ranging from 1.0 to 2.5 ml. In amounts from 0.05 to 0.25 ml. the urine of control dogs showed no evidence of inhibiting substances for the *Lactobacillus casei*. In the case of some depleted dog urines, however, the riboflavin assay values obtained with the addition of 2.5 ml. of urine to the basal medium were 10 to 30 percent lower than those observed with the addition of 1 ml. of the same urine to the basal medium. This suggested that the urine of some depleted dogs contained one or more inhibiting substances for the *Lactobacillus casei*. This effect was not observed consistently in the depleted dogs and was not of sufficient magnitude to influence the results materially.

F. Method of assaying tissues.—The animal was sacrificed and exsanguinated immediately. The tissues were removed at once and a small portion weighed in an Erlenmeyer flask. Water was added and the mixture autoclaved according to the method of Snell and Strong (*1*). After autoclaving, the tissue was macerated with a glass rod, the mixture was centrifugalized, the supernatant liquid was decanted and adjusted to a pH of approximately 6.7. Aliquots of the extract so prepared were used for the microbiological assay. It was noted that blood contained one or more factors which inhibit significantly the growth of the *Lactobacillus casei*. The extent of this inhibition was of sufficient magnitude to make the results on blood assays of little or no value. Extracts of all other tissues tested showed no evidence of any appreciable inhibiting effect for the growth of this organism.

G. Clinical course of animals.—It has been previously reported from this laboratory (*9*) that adult dogs seldom show symptoms of riboflavin deficiency until death is imminent. The dogs in this experiment were continued on a low maintenance diet of riboflavin (10.4 gamma per 100 calories of food) from October 3, 1938, to June 6, 1939. During this period one dog, No. 407, developed a purulent conjunctivitis of the left eye. This symptom was first noted on May 20, 1939,

[2] It has been observed that Berkefeld filters will absorb variable amounts of riboflavin from urine. In the case of urines containing as little as 0.02 gamma per ml. this may be as much as 50 percent.

[3] The original culture of *Lactobacillus casei* used in these experiments was supplied through the courtesy of Dr. E. E. Snell.

or 7½ months after beginning this regime. He was given 7.25 mg. of riboflavin in 1/50 normal acetic acid on May 31, 1939. On June 6 the inflammation and purulent discharge from the left eye was greatly improved and the daily supplement of riboflavin was discontinued. On June 22 there was definite evidence of cataract formation with beginning opacity of the left cornea and lens. On June 30, 1939, the right eye showed beginning purulent inflammation; there was redness of the tongue and the floor of the mouth and superficially ulcerated lesions on the scrotum. This animal was sacrificed in coma on July 23, 1939. The autopsy examination showed a cataract of the left eye, purulent conjunctivitis of the right eye, scrotal dermatitis, atrophy of the testicles and a "yellow liver." Dog 392 developed scrotal dermatitis and a bilateral cataract and was sacrificed on October 15, 1939, upon the onset of coma. Autopsy examination showed a "yellow liver." Dog 396 displayed no symptoms of riboflavin deficiency at any time and was sacrificed on September 18, 1939. No other animals remained on the riboflavin deficient regime sufficiently long to manifest symptoms of this deficiency.

The control rats on diet 513 plus 50 gamma of riboflavin per day were normal. The young males in lots 1841 and 1843 which received this supplement showed an average gain of 31 grams per week during the first 8 weeks. The young adults in lot 1850 showed an average gain of 22 grams per week during the first 8 weeks.

The depleted young rats in lots 1842 and 1844 attained weight equilibrium in 7 to 8 weeks and then gradually lost weight. The depleted adult rats in lot 1851 continued to gain for a period of about 14 weeks. During the succeeding 3 weeks there was little variation in weight and the experiment was terminated. In order to avoid complications from other diseases in the depleted animals all of the rats were in relatively good condition when they were sacrificed for tissue assay. They showed, however, such symptoms as depilation about the eyes, face, and scrotum, encrustations of the vibrissae, and loss of muscle tone.

RESULTS

Urine.—The urine of some depleted dogs showed the presence of one or more inhibiting substances for the growth of the *Lactobacillus casei*. This effect was not of sufficient magnitude, however, to influence the results materially. The urine of both control and depleted dogs was passed through a Berkefeld filter. These filters absorb variable amounts of riboflavin. For these reasons, the urine assay values herein reported cannot be taken to represent the absolute amounts of riboflavin present in the urine. Since, however, all the urines received the same treatment, they are satisfactory for a comparison of the relative excretion of riboflavin in the urine of control and depleted animals.

The riboflavin assay values obtained on dog urine are presented in table 1.

Under the conditions of this experiment, the riboflavin assay values observed on the urine of control dogs was about 20 times that found in depleted dogs.

On May 31, 1939, dog 392 was given 7.75 mg. and dog 407 was given 7.25 mg. of riboflavin by stomach tube. The urine from each of these dogs was collected for a 4-hour period 24 hours later and showed a

TABLE 1.—*Riboflavin assay values of dog urine* [1]

Control dogs (high yeast and liver diet 515)				Depleted dogs (basal diet 507)[2]			
Dog No.	Number of assays	Gamma per ml.	Gamma q.4 hrs. per kg.	Dog No.	Number of assays	Gamma per ml.	Gamma q.4 hrs. per kg.
430	4	[3] 0.65±0.117	[3] 39.2±2.84	396	8	[3] 0.019±0.001	[3] 1.0 ±0.22
431	4	.36± .092	19.3±4.95	388	2	.01± .0	.45± .16
432	6	.25± .06	11.5±1.86	392	10	.018± .0024	1.06± .12
433	7	.35± .042	19.4±1.61	391	8	.013± .0002	.58± .055
				401	10	.020± .005	1.28± .36
				407	14	.018± .00025	1.00± .075
				358	10	.024± .00045	1.28± .11
				429	6	.025± .00045	2.35± .55
Mean of group		.40	22.4			.018	1.13
S. E. M. of group [4]		± .08	±5.9			± .002	± .2

[1] As explained in the text, the riboflavin values given in this table are suitable for a comparison of control and depleted dog urine, but should not be interpreted as representing absolute amounts of riboflavin contained in the urine.

[2] The riboflavin values for depleted dogs given in the table comprise 68 assays. Fifty-five of these were performed when the dogs were receiving 10.4 gamma of riboflavin per 100 calories of food, the remaining 13 during a period when no supplement of riboflavin was given. The riboflavin content of the urine showed no decreases after the maintenance supplement was discontinued.

[3] Mean for each animal±the standard error of the mean.

[4] S. E. M.=standard errors of the mean (4).

riboflavin assay value as low as that obtained during the administration of 10.4 gamma per 100 calories of food. On June 5, dog 401 was given 7.25 mg. of riboflavin by intramuscular injection. The urine collected for a 4-hour period 24 hours later showed a riboflavin assay value below the average of this dog while on a low maintenance dose. But in the case of dog 358, which received 11.5 mg. of riboflavin by intramuscular injection on June 5, 1939, urine collected during the succeeding 4 hours showed an assay value of 4.95 gamma per ml. or 2.525 mg. excreted for a 4-hour period. The amount of this injection was 100 times the former daily intake and the excretion during the succeeding 4 hours as determined by this assay was 206 times the mean output during a low maintenance period.

The depleted dogs excreted riboflavin in small amounts over a relatively limited range. There were no assays on the urines of the dogs from October 3, 1938, when the low riboflavin diets were begun, until February 27, 1939. The assays were started on the latter date and continued through August 24, 1939. The quantity of riboflavin in the urines remained fairly constant after February 27, 1939, irrespective of whether the animals were continued on low maintenance intakes or were completely deprived of riboflavin supplements. The supplements were discontinued on June 6, 1939.

The rat urine assay values do not permit a quantitative interpretation of results respecting absolute quantities of riboflavin for reasons mentioned in the case of dog urine. It only permits a comparison of the control and depleted animals.

The riboflavin assay values obtained on rat urine are presented in table 2.

TABLE 2.—*Riboflavin assay values of rat urine* [1]

Control rats (basal diet 513 plus 50 gamma/day riboflavin)			Depleted rats (basal diet 513)		
Rat lot [2] number	Number of assays	Gamma q.5 hours per lot	Rat lot [2] number	Number of assays	Gamma q. 5 hours per lot
1841 [3]	3	1.7	1842 [3]	3	0.29
1843 [4]	3	.77	1844 [4]	3	.37
1850 [5]	5	1.57	1851 [5]	5	.58
Average		1.36			.41

[1] As explained in the text, the riboflavin values given in this table are suitable for a comparison of control and depleted rat urine, but should not be interpreted as representing absolute amounts of riboflavin contained in the urine.

[2] There are 4 rats in each lot. The animals in lot 1841, for example, are litter mates of the same sex as rats in lot 1842, etc.

[3] In the case of lots 1841 and 1842, the first sample was obtained 6 weeks and the last sample 10 weeks after the diet was started.

[4] In the case of lots 1843 and 1844, the first sample was obtained 7 weeks and the last sample 10 weeks after the diet was started.

[5] In the case of lots 1850 and 1851, the first sample was obtained 3 weeks and the last sample 15 weeks after the diet was started.

Under the conditions of this experiment, the riboflavin assay values observed on control rats was about 3 times that found in the urine of depleted rats.

Tissues.—Although marked differences were observed respecting the riboflavin content of corresponding tissues in control and depleted dogs, the variations within each group were so great that none of the differences were statistically significant.

The differences between the means (4) of the riboflavin content of the liver and muscle of control and riboflavin deficient adult rats are highly significant ($p<0.01$) as are the differences between the means of the riboflavin content of the liver, kidney, and muscle of the rats on stock diet 516 and depleted rats.

TABLE 3.—*Riboflavin content of dog tissues expressed as gamma/gram of fresh tissue. (The values given represent the mean for all the animals of a group ± the standard error of the mean (4))*

Tissue	Control dogs (stock diet 326)		Depleted dogs [1] (basal diet 507)	
	Number of animals	Gamma/gram	Number of animals	Gamma/gram
Liver	3	30 ± 7.4	3	12 ±2.3
Kidney	3	44 ±22	3	20 ±2.3
Muscle	3	6.6 ± 1.66	2	3.1 ± .1
Suprarenal	3	10.4 ± 2.69	2	5.2 ± .1
Heart	3	14 ± 3.9	2	10 ±.71
Brain	3	3.4 ± 1.11	2	2.6 ± .3
Skin	3	1.11± .32	2	.9 ±.38
Blood	3	.63± .11	2	.38±.13

[1] Each of the depleted dogs was on a daily dose of 10.4 gamma/100 calories of food for 245 days. One of them then received one dose of 7.25 mg. of riboflavin by mouth. From this time until they were either sacrificed or developed terminal symptoms of riboflavin deficiency none of them received a supplement of riboflavin; this constituted an average of 91 days.

TABLE 4.—*Riboflavin content of adult rat tissues expressed as gamma/gram of fresh tissue. (The values given represent the mean for all the animals of a group ± the standard error of the mean (4))*

Tissue	3 controls (stock diet 516, gamma/gram)	4 controls [1] (basal diet 513, gamma/gram)	4 depleted [1] (basal diet 513, gamma/gram)
Liver	37 ±0.71	33 ±3.55	15 ±1.69
Kidney	32 ± .58	23 ±3.71	20 ±1.79
Muscle	3.2± .29	3.5 ± .57	1.4 ± .17
Heart		17 ±2.63	13 ± .87
Brain		3.3 ± .43	2.8 ± .35
Skin		.92± .31	.96± .32
Blood		.22± .043	.26± .03

[1] Controls and depleted rats on basal diet 513 were sacrificed after they had been on the experiment for an average of 130 days.

The differences between means of the tissues of control and depleted young rats which have been on a paired feeding regime are highly significant ($p<0.01$) for all tissues except brain and blood.

TABLE 5.—*Riboflavin content of young rat tissues expressed as gamma/gram of fresh tissues (paired feeding)*

Tissue	Lot 1860 (4 controls,[1] basal diet 513 gamma/gram)	Lot 1861 (4 depleted,[1] basal diet 513 gamma/gram)
Liver	41 ±1.85	15 ±0.76
Kidney	27.5 ± .29	22 ±1.32
Muscle	3.5 ± .1	1.6 ± .14
Heart	17.5 ±1.69	11 ± .96
Brain	3.6 ± .03	2.8 ± .3
Skin	1.89± .09	1.39± .006
Blood	.25± .028	.21± .015

[1] Controls and depleted rats were sacrificed after they had been on the experiment for an average of 63 days.

DISCUSSION

A marked reduction in the riboflavin content of the urine of deficient dogs and rats occurs before the animals manifest significant symptoms of riboflavin deficiency. Even though the deficient diet is continued for a long period a small amount of riboflavin persists in the urine. The excretion level of depleted dogs fluctuates in a limited range and tends to be constant for each animal. Vivanco (*5*) using a fluorimetric method, found a marked reduction in the flavin excretion of deficient rats. This investigator could not detect any flavin in the rat urine after 14 days on the deficient diet. However, the method employed by Vivanco is not sufficiently sensitive to detect less than 0.1 gamma of riboflavin (*6*). Emmerie (*7*) placed a healthy human subject on a diet which was calculated to contain 100 gamma per day of riboflavin. During 13 days on this flavin-restricted diet the urinary excretion of flavin varied from 60 to 43 percent of that while on a normal diet. The observations of the investigators cited, together with ours, indicate that the nutritional status of animals respecting

riboflavin can be followed by the determination of this substance in the urine.

The reduced riboflavin content of many tissues in depleted rats, as determined by this bacterial assay, is consistent with the reduced amount of riboflavin in the diet of these animals. Our observations on the riboflavin content of muscle and liver in normal and depleted animals are in agreement with György et al. (*8*) and Carlsson and Sherman (*9*). They are not in accord, however, with the observation of Randoin, Raffy, and Gourévitch (*10*) that the riboflavin content of the liver, heart, lung, and kidney of young rats on a stock diet was no greater than that of similar rats on a riboflavin deficient diet. Each of these groups of workers employed the rat assay method. Kuhn et al. (*11*) and Schormüller (*12, 13*) used physico-chemical methods and the values they reported are considerably lower than those herein presented. Mickelsen, Waisman, and Elvehjem (*14*) have recently reported the riboflavin content of several normal animal tissues in different species using the method of Snell and Strong, and the magnitude as well as the relative amounts of riboflavin in various tissues are in agreement with the findings herein reported.

SUMMARY

1. A microbiological method using the *Lactobacillus casei* was employed for the assay of riboflavin in the urine and tissues of normal and depleted dogs and rats.

2. There is a definite reduction of riboflavin in the urine of depleted dogs and rats as compared to control animals on stock diets, or basal diets adequately supplemented with riboflavin. This depletion of riboflavin content of the urine is observed before the animals manifest significant symptoms of riboflavin deficiency.

3. The riboflavin content of several tissues of depleted dogs and rats was reduced as compared to control animals on stock diets, or basal diets appropriately supplemented with riboflavin.

4. These observations indicate that the bacterial method of Snell and Strong for the assay of riboflavin is a useful adjunct in determining the nutritional status of dogs and rats respecting riboflavin.

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PUBLIC HEALTH SERVICE PUBLICATIONS

A List of Publications Issued During the Period July–December 1939

There is printed herewith a list of publications of the United States Public Health Service issued during the period July–December 1939.

The purpose of the publication of this list is to provide a complete and continuing record of Public Health Service publications, for reference use by librarians, scientific workers, and others interested in particular fields of public health work, and not to offer the publications for indiscriminate free public distribution.

These current lists of publications will be issued in limited numbers for selected distribution to scientific personnel and librarians who have a special need for them and who may find it desirable to bring together in one file a complete list of Service publications.

Those publications marked with an asterisk (*) can be obtained only by purchase from the Superintendent of Documents, Government Printing Office, Washington, D. C., at the prices noted.

Periodicals

*Public Health Reports (weekly), July–December, vol. 54, Nos. 27 to 52, pages 1195 to 2333. 5 cents a number.

*Venereal Disease Information (monthly), July–December, vol. 20, Nos. 7 to 12, pages 185 to 396. 5 cents a number.

Reprints From the Public Health Reports

2086. The induction of carditis by the combined effects of hyperthyroidism and infection. By Mark P. Schultz. July 7, 1939. 24 pages; 10 plates.

2087. The incidence of cancer in Atlanta, Ga., and surrounding counties. By Joseph W. Mountin, Harold F. Dorn, and Bert R. Boone. July 14, 1939. 20 pages.

2088. Allergic irritability in rheumatic and nephritic patients. By Mark P. Schultz. July 14, 1939. 6 pages.

*2089. The diagnosis of oxyuriasis. Comparative efficiency of the NIH swab examination and stool examination by brine and zinc sulfate floatation for *Enterobius vermicularis* infection. By Willi Sawitz, Vada L. Odom, and David R. Lincicome. June 30, 1939. 12 pages. 5 cents.

2090. Studies on the standardization of gas gangrene antitoxin (*Sordellii*). By Sarah E. Stewart and Ida A. Bengtson. August 4, 1939. 6 pages.

2091. Report on market-milk supplies of certain urban communities, July 1, 1937–June 30, 1939. August 11, 1939. 5 pages.

2092. Public Health Service publications. A list of publications issued during the period January–June 1939. August 11, 1939. 6 pages.

2093. Disabling morbidity among employees in the soap industry, 1930–34, inclusive. By Hugh P. Brinton and Harry E. Seifert. July 21, 1939. 16 pages.

*2094. Treatment of induced malaria in Negro paretics with mapharsen and tryparsamide. By Martin D. Young and Sol B. McLendon. August 18, 1939. 4 pages. 5 cents.

2095. Dermatitis caused by a new insecticide. By Louis Schwartz and Leon H. Warren. August 4, 1939. 10 pages.

2096. Dental programs sponsored by health agencies in 94 selected counties. By Joseph W. Mountin and Evelyn Flook. September 8, 1939. 12 pages.

2097. The solubility of lead arsenate in body fluids. By Lawrence T. Fairhall. September 8, 1939. 8 pages.

2098. The National Health Survey. Scope and method of the Nation-wide canvass of sickness in relation to its social and economic setting. By George St. J. Perrott, Clark Tibbitts, and Rollo H. Britten. September 15, 1939. 25 pages.

2099. A procedure for putting health department reports to work. By Mayhew Derryberry and J. O. Dean. September 22, 1939. 10 pages.

*2100. The experimental transmission of poliomyelitis to the Eastern cotton rat *Sigmodon hispidus hispidus*. By Charles Armstrong. September 22, 1939. 4 pages. 5 cents.

2101. The treatment of lymphopathia venereum with sodium sulfanilyl sulfanilate and sodium sulfanilate. By Arthur Hebb, S. G. Sullivan, and Lloyd D. Felton. September 29, 1939. 20 pages.

2102. The protection of mice against *Hemophilus influenzae* (non-type-specific) with sulfapyridine. By Margaret Pittman. September 29, 1939. 6 pages.

2103. Possible relation of calcium deficiency to the utilization of vitamin B_1. Preliminary report. By L. F. Badger and E. Masunaga. September 29, 1939. 4 pages.

*2104. Stabilized method of forecasting population. By Bernard D. Karpinos. October 6, 1939. 15 pages. 5 cents.

*2105. Studies of a filter-passing infectious agent isolated from ticks. V. Further attempts to cultivate in cell-free media. Suggested classification. By Herald R. Cox. October 6, 1939. 6 pages. 5 cents.

*2106. Cultivation of Phase I, *II. pertussis*, in a semisynthetic liquid medium. By J. W. Hornibrook. October 13, 1939. 4 pages. 5 cents.

*2107. The influence of transplanted normal tissue on breast-cancer ratios in mice. By John J. Bittner. October 6, 1939. 5 pages. 5 cents.

2108. Studies in chemotherapy. X. Colorimetric tests for aromatic hydroxylamines and for further oxidation products of aromatic amines. Their demonstration in the urine following sulfanilamide administration. By Sanford M. Rosenthal and Hugo Bauer. October 20, 1939. 11 pages.

*2109. Recovery of the virus of poliomyelitis from the stools of healthy contacts in an institutional outbreak. By S. D. Kramer, A. G. Gilliam, and J. G. Molner. October 27, 1939. 9 pages. 5 cents.

2110. Directory of State and insular health authorities, July 1, 1939. October 27, 1939. 14 pages.

2111. Disabling morbidity, and mortality among white and Negro male employees in the slaughter and meat packing industry, 1930–34, inclusive. By Hugh P. Brinton. November 3, 1939. 13 pages.

*2112. Studies on oxyuriasis. XIV. Controlled tests with various methods of therapy. By Willard H. Wright, Frederick J. Brady, and John Bozicevich. November 10, 1939. 12 pages. 5 cents.

2113. The significance of the excretion of lead in the urine. By Lawrence T. Fairhall and R. R. Sayers. November 10, 1939. 4 pages.

2114. Riboflavin deficiency in man (ariboflavinosis). By W. H. Sebrell and R. E. Butler. December 1, 1939. 11 pages.

2115. Comparison of occupational class and physicians' estimate of economic status. By Jennie C. Goddard. December 8, 1939. 7 pages.

2116. Effect of fluorides on salivary amylase. By F. J. McClure. December 8, 1939. 6 pages.

2117. The cultivation of *Rickettsia diaporica* in tissue culture and in the tissues of developing chick embryos. By Herald R. Cox and E. John Bell. December 8, 1939. 8 pages.

2118. Relapsing fever: *Ornithodoros hermsi* a vector in Colorado. By Gordon E. Davis. December 8, 1939. 3 pages.

2119. Disabling morbidity among employees in the slaughter and meat packing industry, 1930–34, inclusive. By Hugh P. Brinton, Harry E. Seifert, and Elizabeth S. Frasier. December 15, 1939. 24 pages.

2120. *Rickettsia diaporica:* Recovery of three strains from *Dermacentor andersoni* collected in southeastern Wyoming: Their identity with Montana strain 1. By Gordon E. Davis. December 15, 1939. 9 pages.

2121. The relation between the trypanocidal and spirocheticidal activities of neoarsphenamine. V. The spirocheticidal activity of the several American brands of neoarsphenamine. By T. F. Probey. December 22, 1939. 6 pages.

2122. Hemorrhagic adrenal necrosis in rats on deficient diets. By Floyd S. Daft and W. H. Sebrell. December 22, 1939. 4 pages.

2123. Hemorrhagic cortical necrosis of adrenals in rats on deficient diets. By A. A. Nelson. December 22, 1939. 7 pages; 2 plates.

2124. Chloropicrin as a prewarning gas in ship fumigation. By G. C. Sherrard. December 29, 1939. 6 pages; 2 plates.

2125. Successful transfer of the Lansing strain of poliomyelitis virus from the cotton rat to the white mouse. By Charles Armstrong. December 29, 1939. 4 pages.

Supplements to the Public Health Reports

*151. The ratproofing of new ships. By P. W. Clark. 1939. 50 pages; 32 plates. 15 cents.
154. Business census of hospitals, 1935. General report. By Elliott H. Pennell, Joseph W. Mountin, and Kay Pearson. 1939. 38 pages.
155. The Kolb classification of drug addicts. By M. J. Pescor. 1939. 10 pages.
156. Diphtheria. Its prevention and control. 1939. 21 pages.
157. Laws pertaining to the admission of patients to mental hospitals throughout the United States. By Grover A. Kempf. 1939. 29 pages.

Public Health Bulletins

248. Cancer mortality in the United States. I. Trend of recorded cancer mortality in the death registration States of 1900 from 1900 to 1935. By Mary Gover. 1939. 58 pages.
251. Dental health organizations in State departments of health of the United States. By F. C. Cady. 1939. 86 pages.

National Institute of Health Bulletin

172. Fluorides in food and drinking water. A comparison of effects of water-ingested versus food-ingested sodium fluoride. By F. J. McClure. 1939. 53 pages; 27 half-tones.

Miscellaneous Publication

80. The communicable diseases. By A. M. Stimson. 1939. 111 pages.

Unnumbered Publications

Index to Public Health Reports, vol. 54, pt. 1, January–June 1939. 27 pages.
What to know, what to do about cancer. Folder.

Reprints from Venereal Disease Information

111. Sulfanilamide in gonococcal infection: The results of treatment and the leukocyte response. By W. H. Y. Smith, Clarence K. Weil, and B. Cosby Bird. Vol. 20, May 1939. 5 pages.
112. The advantages of the vacuum tube for the collection of serologic specimens. By O. C. Wenger. Vol. 20, May 1939. 3 pages.
113. Postgraduate course in syphilis control. By R. H. Kampmeier and E. Gurney Clark. Vol. 20, June 1939. 4 pages.
114. Electrosurgical treatment of gonorrheal endocervicitis. By Samuel Goldblatt. Vol. 20, June 1939. 7 pages.
115. Venereal disease contact-tracing in Camden, New Jersey. By A. J. Casselman and Anabel Cadwallader. Vol. 20, July 1939. 10 pages.
116. The outlook for syphilis control. By Louise Pearce. Vol. 20, August 1939. 8 pages.
117. The quantitative Kahn reaction. By Reuben L. Kahn. Vol. 20, September 1939. 3 pages.
118. Tryparsamide in the treatment of syphilis. By Josephine Hinrichsen. Vol. 20, October 1939. 30 pages.

119. Spirochete counts in early syphilis. By George Vryonis and Hugh J. Morgan. Vol. 20, November 1939. 5 pages.

Venereal Disease Folders

4. Syphilis on the job.
5. Gonorrhea, the crippler.

Supplements to Venereal Disease Information

10. Control of the venereal diseases in the United States. Present and future plans. 25 pages.

DEATHS DURING WEEK ENDED JANUARY 27, 1940

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

	Week ended Jan. 27, 1940	Corresponding week, 1939
Data from 88 large cities of the United States:		
Total deaths	9,645	9,115
Average for 3 prior years	9,733	
Total deaths, first 4 weeks of year	37,979	36,362
Deaths under 1 year of age	497	523
Average for 3 prior years	563	
Deaths under 1 year of age, first 4 weeks of year	2,189	2,135
Data from industrial insurance companies:		
Policies in force	66,405,318	68,208,999
Number of death claims	14,326	14,854
Death claims per 1,000 policies in force, annual rate	11.3	11.3
Death claims per 1,000 policies, first 4 weeks of year, annual rate	10.3	10.1

PREVALENCE OF DISEASE

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

REPORTS FROM STATES FOR WEEK ENDED FEBRUARY 10, 1940

Summary

A slight decline was shown in influenza for the week ended February 10, with a total of 16,583 cases reported, as compared with 17,641 for the preceding week. The number of cases reported in the corresponding median week of the 5-year period 1935–39 was 4,577, while the 5-year average was 9,732. The 5-year average is influenced by the moderate epidemic of 1937, when 37,101 cases were reported for the peak week of January 30.

The highest incidence persists in the Southern States, with 12,793 cases, or 77 percent of the total, being reported from the South Atlantic and West South Central groups. The East South Central States showed a considerable decline for the current week, as did the North Central and Pacific States.

While it is too early to make any prediction regarding the course of the disease in the next few weeks, it is of interest to note that, in the moderate epidemic years of 1929, 1933, and 1937, the peak was reached in January.

With reference to the virulence of the disease during the current season, as indicated by excess mortality in large cities, the week of February 3 was the first week of 1940 in which the number of deaths in 88 large cities reporting to the Bureau of the Census was above the 3-year average (1937–39). The number of pneumonia deaths in 90 cities distributed throughout the United States, as reported to the Public Health Service, has remained below the 5-year average for each week in 1940 up to and including the week ended February 3.

Favorable conditions continue with reference to the other 8 communicable diseases reported weekly by telegraph to the Public Health Service, all of which, except poliomyelitis, were below the 5-year median. Only 21 cases of poliomyelitis were reported as compared with 18 for the median expectancy.

Telegraphic morbidity reports from State health officers for the week ended February 10, 1940, and comparison with corresponding week of 1939 and 5-year median

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

Division and State	Diphtheria			Influenza			Measles			Meningitis, meningococcus		
	Week ended—		Median, 1935–39	Week ended—		Median, 1935–39	Week ended—		Median, 1935–39	Week ended—		Median, 1935–39
	Feb. 10, 1940	Feb. 11, 1939		Feb. 10, 1940	Feb. 11, 1939		Feb. 10, 1940	Feb. 11, 1939		Feb. 10, 1940	Feb. 11, 1939	
NEW ENG.												
Maine	1	6	2	1	1	3	209	16	155	0	0	0
New Hampshire	0	0	0	2	-----	-----	52	3	18	0	1	0
Vermont	0	0	0	-----	-----	-----	3	27	27	0	0	0
Massachusetts	3	2	3	-----	-----	-----	272	822	612	0	2	2
Rhode Island	1	1	1	-----	-----	-----	111	13	26	0	0	0
Connecticut	0	2	2	2	26	9	177	609	340	0	0	0
MID. ATL.												
New York	22	37	34	[1] 36	183	50	267	1,246	1,246	0	3	4
New Jersey	8	9	11	29	61	30	66	27	219	0	0	1
Pennsylvania	24	33	45	-----	-----	-----	80	170	283	7	7	7
E. NO. CEN.												
Ohio	15	15	27	22	-----	20	22	24	181	1	3	3
Indiana	18	39	39	90	21	52	6	14	32	0	0	4
Illinois	30	32	36	134	227	72	30	36	37	0	0	12
Michigan [2]	9	12	12	11	1	3	251	323	323	0	0	1
Wisconsin	4	1	1	77	65	65	182	708	708	0	1	1
W. NO. CEN.												
Minnesota	3	7	4	1	1	4	359	1,307	120	0	0	1
Iowa	3	8	8	25	8	8	97	154	55	1	0	1
Missouri	10	10	22	33	42	184	5	10	17	0	0	1
North Dakota	3	2	2	61	15	15	13	296	15	0	0	0
South Dakota	1	5	2	4	10	-----	7	319	4	0	0	0
Nebraska	0	3	4	2	-----	5	31	22	22	0	1	1
Kansas	10	17	11	101	3	61	301	20	20	1	0	2
SO. ATL.												
Delaware	0	1	1	-----	-----	-----	1	0	24	0	0	0
Maryland [2]	7	9	9	263	103	103	4	1,080	112	2	0	4
Dist. of Col	0	5	10	19	5	5	2	21	11	1	0	1
Virginia	12	26	24	2,662	553	-----	42	99	163	2	1	10
West Virginia	11	8	17	460	26	151	15	23	23	4	1	3
North Carolina [3]	25	20	23	121	18	67	107	859	778	1	2	3
South Carolina [3]	3	18	3	1,331	701	1,009	6	23	23	2	4	1
Georgia [3]	2	11	11	728	118	490	76	128	0	0	1	1
Florida [3]	4	10	9	50	1	4	41	94	36	0	0	0
E. SO. CEN.												
Kentucky	10	6	9	86	51	101	35	108	108	0	3	6
Tennessee [3]	9	13	16	424	75	176	54	64	64	2	4	5
Alabama [3]	5	5	12	536	186	334	73	284	256	2	1	1
Mississippi [3]	4	6	8	-----	-----	-----	-----	-----	-----	2	3	1
W. SO. CEN.												
Arkansas	8	8	8	1,698	87	166	4	112	13	0	1	3
Louisiana [3]	11	18	13	360	20	44	15	177	71	0	3	0
Oklahoma	8	4	9	664	207	284	4	195	59	1	1	2
Texas [3]	51	29	51	4,437	621	901	270	130	130	3	1	5
MOUNTAIN												
Montana	1	1	2	7	42	42	28	440	20	0	0	1
Idaho	1	3	0	6	-----	5	163	106	74	1	0	0
Wyoming	2	1	1	4	-----	-----	4	92	13	0	0	0
Colorado	9	12	3	26	93	-----	32	61	61	0	1	0
New Mexico	1	3	5	7	9	9	9	51	29	0	0	0
Arizona	2	6	4	297	114	175	13	7	10	0	0	1
Utah [2]	0	0	0	125	24	-----	190	131	24	1	1	0
PACIFIC												
Washington	3	2	2	35	1	4	676	208	107	0	1	2
Oregon	2	1	1	107	40	76	247	34	34	0	0	1
California	22	24	27	1,499	43	461	433	2,261	282	1	1	6
Total	378	491	583	16,583	3,802	4,577	5,085	12,954	12,954	35	48	104
6 weeks	2,628	3,518	4,055	82,180	20,877	20,877	25,982	61,192	61,192	198	323	552

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended February 10, 1940, and comparison with corresponding week of 1939 and 5-year median—Continued

Division and State	Poliomyelitis			Scarlet fever			Smallpox			Typhoid and paratyphoid fever		
	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39
	Feb. 10, 1940	Feb. 11, 1939		Feb. 10, 1940	Feb. 11, 1939		Feb. 10, 1940	Feb. 11, 1939		Feb. 10, 1940	Feb. 11, 1939	
NEW ENG.												
Maine	0	0	0	19	28	25	0	0	0	0	2	1
New Hampshire	0	0	0	4	13	10	0	0	0	0	0	0
Vermont	0	0	0	9	8	16	0	0	0	0	0	0
Massachusetts	1	0	0	134	255	250	0	0	0	2	1	1
Rhode Island	0	0	0	12	5	30	0	0	0	0	1	1
Connecticut	0	0	0	90	122	97	0	0	0	3	0	0
MID. ATL.												
New York	2	2	1	665	647	699	0	0	0	6	2	5
New Jersey	0	0	0	333	172	164	0	0	0	2	0	1
Pennsylvania	0	1	1	370	487	487	0	0	0	8	8	8
E. NO. CEN.												
Ohio	1	1	0	277	517	472	0	17	3	0	0	3
Indiana	0	1	0	221	304	269	6	115	2	1	5	1
Illinois	0	0	0	583	518	756	2	3	11	1	4	3
Michigan [1]	1	0	1	261	504	497	2	25	3	0	4	4
Wisconsin	1	0	0	160	298	361	5	12	11	0	2	2
W. NO. CEN.												
Minnesota	0	1	0	112	154	150	5	4	8	0	0	0
Iowa	4	0	0	70	161	182	9	79	33	0	1	1
Missouri	0	0	0	91	100	145	2	13	17	1	1	2
North Dakota	0	0	0	28	9	9	0	1	2	0	1	1
South Dakota	0	0	0	39	21	23	4	1	6	0	0	0
Nebraska	0	0	0	20	36	53	0	2	5	0	0	0
Kansas	0	0	0	75	179	209	1	5	10	0	1	0
SO. ATL.												
Delaware	0	0	0	10	0	7	0	0	0	0	0	0
Maryland [2]	0	0	0	62	53	73	0	0	0	2	1	1
Dist. of Col	0	0	0	21	18	18	0	0	0	1	0	0
Virginia	0	0	0	28	54	54	0	0	0	1	4	4
West Virginia	0	0	0	77	53	50	0	2	0	0	2	2
North Carolina [3]	0	0	0	53	83	50	0	0	0	3	1	2
South Carolina [3]	0	0	0	3	11	6	0	0	0	3	3	3
Georgia [3]	2	0	0	25	22	14	2	0	0	2	3	3
Florida [3]	0	1	0	11	12	10	0	0	0	4	2	2
E. SO. CEN.												
Kentucky	0	1	1	94	77	61	0	1	0	3	7	4
Tennessee [3]	0	1	1	64	44	37	1	4	1	0	3	3
Alabama [3]	2	2	1	13	24	22	0	0	1	3	4	1
Mississippi [2]	2	1	1	3	6	8	0	1	0	1	0	1
W. SO. CEN.												
Arkansas	0	1	0	3	12	15	[4] 3	0	1	2	3	1
Louisiana [3]	0	1	0	13	7	14	0	0	0	2	12	12
Oklahoma	1	0	0	31	71	32	1	21	2	1	7	3
Texas [3]	1	0	1	75	89	89	1	39	25	3	10	10
MOUNTAIN												
Montana	0	0	0	53	21	34	0	0	11	0	1	1
Idaho	1	0	0	42	26	17	1	1	2	1	0	0
Wyoming	0	0	0	4	6	18	0	0	5	0	1	0
Colorado	0	0	0	59	37	80	13	13	5	0	0	1
New Mexico	0	1	0	13	20	25	0	0	0	3	3	3
Arizona	0	0	0	13	4	22	1	8	0	0	0	0
Utah [2]	0	0	0	31	15	66	0	0	0	0	0	0
PACIFIC												
Washington	0	0	0	59	70	62	3	2	16	3	2	2
Oregon	0	0	0	22	47	47	0	2	2	1	1	1
California	2	2	2	140	200	227	1	11	11	10	4	4
Total	21	17	18	4,595	5,620	6,662	61	382	371	73	107	107
6 weeks	203	102	124	25,951	31,802	36,535	[4] 453	2,385	1,828	476	661	698

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended February 10, 1940, and comparison with corresponding week of 1939 and 5-year median—Continued

Division and State	Whooping cough	
	Week ended	
	Feb. 10, 1940	Feb. 11, 1939
NEW ENG.		
Maine	77	63
New Hampshire	4	1
Vermont	47	26
Massachusetts	144	262
Rhode Island	13	55
Connecticut	64	76
MID. ATL.		
New York	394	508
New Jersey	95	461
Pennsylvania	341	466
E. NO. CEN.		
Ohio	92	216
Indiana	46	19
Illinois	80	410
Michigan [2]	115	189
Wisconsin	93	326
W. NO. CEN.		
Minnesota	25	56
Iowa	10	25
Missouri	15	10
North Dakota	18	10
South Dakota	11	2
Nebraska	4	10
Kansas	55	12
SO. ATL.		
Delaware	9	4
Maryland [2]	165	42
Dist. of Col	15	45
Virginia	57	70
West Virginia	6	25
SO. ATL.—continued		
North Carolina [3]	76	313
South Carolina [3]	6	106
Georgia [3]	38	20
Florida [3]	18	41
E. SO. CEN.		
Kentucky	60	10
Tennessee [3]	41	38
Alabama [3]	7	21
Mississippi [3]	------	------
W. SO. CEN.		
Arkansas	6	11
Louisiana [3]	[4] 9	11
Oklahoma	4	2
Texas [3]	118	69
MOUNTAIN		
Montana	1	13
Idaho	5	1
Wyoming	2	1
Colorado	20	58
New Mexico	37	21
Arizona	26	5
Utah [2]	552	41
PACIFIC		
Washington	19	31
Oregon	36	12
California	154	92
Total	3,230	4,306
6 weeks	[4] 16,720	26,011

[1] New York City only.
[2] Period ended earlier than Saturday.
[3] Typhus fever, week ended Feb. 10, 1940, 19 cases as follows: North Carolina 2; South Carolina, 3; Georgia, 5; Florida, 1; Tennessee, 2; Alabama, 2; Louisiana, 1; Texas, 3.
[4] Later reports increase to 14 the number of reported cases of whooping cough in Louisiana for the week ended Jan. 20, and reduce to 2 the smallpox cases reported in Arkansas for the week ended Feb. 3. See Public Health Reports of Jan. 26 and Feb. 9, 1940, pp. 176 and 257.

WEEKLY REPORTS FROM CITIES

City reports for week ended Jan. 27, 1940

This table summarizes the reports received weekly from a selected list of 140 cities for the purpose of showing a cross section of the current urban incidence of the communicable diseases listed in the table.

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Data for 90 cities:											
5-year average	190	1,322	158	3,335	994	1,920	42	381	18	1,197	----
Current week [1]	100	1,252	86	826	678	1,402	3	348	24	755	----
Maine:											
Portland	0	----	0	20	4	1	0	0	0	26	34
New Hampshire:											
Concord	0	----	0	0	1	0	0	1	0	0	10
Manchester	0	----	0	0	1	0	0	0	0	0	18
Nashua	0	----	0	4	0	0	0	0	0	0	6
Vermont:											
Barre											
Burlington	0	4	0	0	0	0	0	0	0	0	11
Rutland	0	----	0	0	0	0	0	0	0	0	7
Massachusetts:											
Boston	2	----	0	16	4	46	0	5	1	54	222
Fall River	1	----	0	6	1	3	0	0	0	7	27
Springfield	0	----	0	0	0	5	0	0	0	4	40
Worcester	0	----	0	1	14	13	0	0	0	1	68
Rhode Island:											
Pawtucket	0	----	0	0	0	1	0	0	0	1	16
Providence	0	----	1	92	8	6	0	1	0	3	71
Connecticut:											
Bridgeport	0	----	0	0	1	3	0	0	0	0	36
Hartford	0	1	0	0	1	3	0	0	9	2	35
New Haven	0	3	1	0	4	6	0	1	0	0	68
New York:											
Buffalo	1	----	0	2	9	7	0	11	0	8	149
New York	28	16	4	18	92	321	0	58	2	91	1,595
Rochester	0	1	0	1	3	12	0	1	1	14	70
Syracuse	0	----	0	0	9	11	0	1	0	27	63
New Jersey:											
Camden	2	1	3	0	4	3	0	0	0	0	41
Newark	0	6	1	3	8	16	0	11	0	12	126
Trenton	0	----	3	0	9	5	0	2	0	0	56
Pennsylvania:											
Philadelphia	1	51	4	8	42	69	0	25	3	56	615
Pittsburgh	6	22	10	2	17	54	0	4	0	2	201
Reading	0	----	1	0	0	0	0	0	0	8	25
Scranton	1	----	----	1	----	4	0	----	0	0	----
Ohio:											
Cincinnati	2	1	1	2	8	16	0	4	0	8	149
Cleveland	0	54	1	1	15	42	0	9	0	25	226
Columbus	0	1	1	0	9	17	0	2	0	8	105
Toledo	0	2	2	0	5	12	0	4	0	8	78
Indiana:											
Anderson	0	----	0	0	1	5	0	1	0	4	16
Fort Wayne											
Indianapolis	2	----	0	3	17	19	0	4	0	7	129
Muncie	0	----	0	0	0	1	0	0	0	0	12
South Bend	0	----	0	0	0	0	0	0	0	0	17
Terre Haute	1	----	0	0	5	2	0	0	0	0	30
Illinois:											
Alton	0	----	0	0	4	1	0	0	0	0	13
Chicago	4	13	5	18	43	244	0	41	0	38	807
Elgin	0	----	0	0	1	5	0	0	0	3	7
Moline	1	----	0	0	0	4	0	0	0	0	16
Springfield	0	----	0	0	2	8	0	0	0	2	23
Michigan:											
Detroit	4	1	3	9	22	78	0	13	2	29	291
Flint	0	----	0	1	1	18	0	2	0	4	22
Grand Rapids	0	----	1	1	3	28	0	1	0	8	31
Wisconsin:											
Kenosha	0	----	0	0	1	6	0	0	0	1	12
Madison	0	----	0	0	0	2	0	0	0	2	8
Milwaukee	0	----	0	2	6	31	0	2	0	11	133
Racine	0	----	0	0	0	6	0	0	0	2	14
Superior	1	----	0	4	0	1	0	0	0	0	

[1] Figures for Barre, Fort Wayne, and Little Rock estimated; reports not received.

City reports for week ended Jan. 27, 1940—Continued

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Minnesota:											
Duluth	0	------	0	175	1	1	0	1	0	0	25
Minneapolis	1	------	2	8	8	19	0	2	0	9	114
St. Paul	0	------	0	0	10	22	0	0	0	19	62
Iowa:											
Cedar Rapids	0	------	--------	15	-------	5	0	-------	0	0	--------
Davenport	0	------	--------	0	-------	4	0	-------	0	0	--------
Des Moines	1	------	0	5	0	11	0	0	0	0	49
Sioux City	0	------	--------	0	-------	3	0	-------	0	0	--------
Waterloo	0	------	--------	1	-------	2	0	-------	0	1	--------
Missouri:											
Kansas City	0	------	0	1	18	16	0	2	0	0	124
St. Joseph	0	------	0	0	3	1	1	3	0	0	31
St. Louis	2	1	0	2	22	18	2	5	0	8	227
North Dakota:											
Fargo	0	------	0	0	0	1	0	0	0	0	10
Grand Forks	0	------	--------	1	-------	0	0	-------	0	0	--------
Minot	0	------	0	0	0	1	0	0	0	0	6
South Dakota:											
Aberdeen	0	------	--------	2	-------	0	0	-------	0	1	--------
Sioux Falls	0	------	0	0	0	2	0	0	0	0	6
Nebraska:											
Lincoln	0	------	--------	2	-------	1	0	-------	0	0	--------
Omaha	0	------	0	5	6	2	0	2	0	0	7
Kansas:											
Lawrence	2	23	0	0	0	1	0	0	0	0	6
Topeka	0	1	1	0	4	4	0	0	0	0	21
Wichita	0	2	0	113	4	4	0	3	0	0	33
Delaware:											
Wilmington	0	------	0	0	4	7	0	1	0	6	36
Maryland:											
Baltimore	1	49	3	2	19	10	0	14	1	76	267
Cumberland	0	------	0	0	2	0	0	0	0	0	23
Frederick	0	------	0	0	1	1	0	0	0	0	11
Dist. of Col.:											
Washington	5	19	5	1	12	31	0	12	0	1	160
Virginia:											
Lynchburg	1	------	0	0	2	0	0	0	0	0	13
Norfolk	1	41	0	0	3	3	0	1	0	1	25
Richmond	0	------	2	0	6	1	0	3	0	0	57
Roanoke	0	------	1	1	1	6	0	0	0	0	28
West Virginia:											
Charleston	0	1	0	0	2	1	0	0	0	0	21
Huntington	1	------	--------	0	-------	3	0	-------	0	0	--------
Wheeling	0	------	0	1	2	3	0	0	0	0	19
North Carolina:											
Gastonia	0	------	--------	1	-------	0	0	-------	0	0	--------
Raleigh	0	------	0	1	1	1	0	0	0	0	9
Wilmington	0	------	0	0	1	0	0	0	0	0	11
Winston-Salem	0	------	0	1	1	2	0	1	0	0	10
South Carolina:											
Charleston	0	309	7	0	3	0	0	2	0	0	38
Florence	0	------	0	0	6	0	0	0	0	0	20
Greenville	0	------	0	0	0	0	0	0	0	0	2
Georgia:											
Atlanta	0	140	1	3	11	4	0	8	0	1	83
Brunswick	0	------	0	0	0	0	0	0	0	0	1
Savannah	0	250	2	0	3	3	0	2	0	0	38
Florida:											
Miami	1	5	0	0	6	0	0	0	0	0	45
Tampa	1	------	0	3	2	1	0	1	0	0	21
Kentucky:											
Ashland	1	------	0	1	1	0	0	0	0	1	5
Covington	2	------	0	0	3	1	0	1	0	0	16
Lexington	0	------	0	0	5	0	0	1	0	0	17
Louisville	0	11	0	1	8	9	0	3	0	56	92
Tennessee:											
Knoxville	0	------	0	0	2	11	0	1	0	1	31
Memphis	0	15	2	1	5	17	0	3	0	7	92
Nashville	0	------	1	9	10	1	0	4	0	1	87
Alabama:											
Birmingham	0	25	2	1	5	2	0	1	0	1	55
Mobile	1	17	1	0	3	2	0	1	0	0	25
Montgomery	1	36	--------	15	-------	1	0	-------	0	0	--------

City reports for week ended Jan. 27, 1940—Continued

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Arkansas:											
Fort Smith	0	19		0		3	0		1	0	
Little Rock											
Louisiana:											
Lake Charles	1		0	0	0	0	0	0	0	0	9
New Orleans	3	39	1	0	26	13	0	12	3	9	194
Shreveport	1		0	0	12	0	0	6	2	0	69
Oklahoma:											
Oklahoma City	0		1	0	2	6	0	2	0	0	37
Tulsa	0			0		4	2		0	13	
Texas:											
Dallas	6	4	0	1	6	2	0	0	0	4	79
Fort Worth	0		0	1	3	7	0	1	0	6	49
Galveston	2		0	1	7	5	0	2	0	0	23
Houston	4	38	1	0	11	2	0	7	0	0	91
San Antonio	0	3	3	59	14	0	0	10	0	0	102
Montana:											
Billings	0		0	0	2	2	0	0	0	0	8
Great Falls	0		0	0	0	0	0	0	0	0	6
Helena	0		0	1	0	1	0	0	0	0	6
Missoula	0		0	0	0	0	0	0	0	2	6
Idaho:											
Boise	0		0	0	0	0	0	0	0	0	6
Colorado:											
Colorado Springs	0		0	0	0	2	0	0	0	0	18
Denver	7		3	5	11	7	0	3	0	2	99
Pueblo	0		0	0	4	0	0	0	0	4	17
New Mexico:											
Albuquerque	0		0	0	1	2	0	3	0	0	19
Utah:											
Salt Lake City	0		1	22	2	4	0	1	0	96	32
Washington:											
Seattle	1		0	112	5	7	0	2	0	17	114
Spokane	1	1	0	0	3	4	0	0	0	2	34
Tacoma	0		0	73	3	12	0	0	0	0	32
Oregon:											
Portland	2	36	0	30	6	8	0	2	0	10	84
Salem	0	1		5		0	0		0	0	
California:											
Los Angeles	3	156	2	13	10	36	0	24	0	12	358
Sacramento	1	5	3	0	8	2	0	2	0	0	37
San Francisco	3	4	2	1	11	19	0	8	0	18	204

State and city	Meningitis, meningococcus		Poliomyelitis cases	State and city	Meningitis, meningococcus		Poliomyelitis cases
	Cases	Deaths			Cases	Deaths	
Massachusetts:				Michigan:			
Boston	1	0	0	Detroit	1	1	0
Rhode Island:				Tennessee:			
Providence	1	0	0	Memphis	1	0	0
New York:				Louisiana:			
New York	1	0	0	Shreveport	0	1	0
Pennsylvania:				Idaho:			
Philadelphia	1	0	0	Boise	0	1	0
Pittsburgh	1	0	0	Utah:			
Ohio:				Salt Lake City	0	0	1
Toledo	0	1	0	California:			
Indiana:				Sacramento	0	0	2
Indianapolis	1	0	0				

Encephalitis, epidemic or lethargic.—Cases: Boston, 1; New York, 2; San Antonio, 1.
Pellagra.—Cases: Charleston, S. C., 1; Atlanta, 1.
Typhus fever.—Cases: New York, 1; Charleston, S. C., 1; Savannah, 1; Fort Worth, 1; Los Angeles, 1.

FOREIGN REPORTS

CUBA

Habana—Communicable diseases—4 weeks ended January 13, 1940.—During the 4 weeks ended January 13, 1940, certain communicable diseases were reported in Habana, Cuba, as follows:

Disease	Cases	Deaths	Disease	Cases	Deaths
Diphtheria	11		Scarlet fever	2	
Malaria		1	Tuberculosis	5	2
Poliomyelitis	1		Typhoid fever	39	4

Provinces—Notifiable diseases—4 weeks ended January 6, 1940.—During the 4 weeks ended January 6, 1940, cases of certain notifiable diseases were reported in the Provinces of Cuba as follows:

Disease	Pinar del Rio	Habana	Matanzas	Santa Clara	Camaguey	Oriente	Total
Cancer	2			5		2	9
Diphtheria	1	17	1	2	1		22
Hookworm disease	1	48					49
Leprosy		12		1		2	15
Malaria	5	4	1	10	6	47	73
Measles			1	4			5
Scarlet fever		1					1
Tuberculosis	12	31	25	28	14	41	151
Typhoid fever	18	82	8	81	4	20	213

PANAMA CANAL ZONE

Notifiable diseases—October–December 1939.—During the months of October, November, and December 1939, certain notifiable diseases were reported in the Panama Canal Zone and terminal cities as follows:

Disease	October		November		December	
	Cases	Deaths	Cases	Deaths	Cases	Deaths
Chickenpox	4		11		13	
Diphtheria	19		12	1	8	
Dysentery (amoebic)	9	2	17	2	14	3
Dysentery (bacillary)	15	14	8	6	5	
Leprosy	1		1	1		
Malaria	83	2	125	6	196	8
Measles	2		4			
Meningitis, meningococcus			1			
Mumps			1			
Paratyphoid fever			2		1	
Pneumonia		12		16		25
Poliomyelitis			1		1	1
Relapsing fever			2			
Scarlet fever	3					
Tuberculosis		40		18		42
Typhoid fever			1		2	

SWEDEN

Notifiable diseases—November 1939.—During the month of November 1939, cases of certain notifiable diseases were reported in Sweden as follows:

Disease	Cases	Disease	Cases
Cerebrospinal meningitis	2	Poliomyelitis	49
Diphtheria	54	Scarlet fever	3,182
Dysentery	9	Syphilis	40
Epidemic encephalitis	1	Typhoid fever	3
Gonorrhea	913	Undulant fever	8
Paratyphoid fever	19	Weil's disease	10

YUGOSLAVIA

Communicable diseases—4 weeks ended December 31, 1939.—During the 4 weeks ended December 31, 1939, certain communicable diseases were reported in Yugoslavia as follows:

Disease	Cases	Deaths	Disease	Cases	Deaths
Anthrax	13	4	Paratyphoid fever	19	----
Cerebrospinal meningitis	45	10	Poliomyelitis	2	2
Diphtheria and croup	854	79	Scarlet fever	362	7
Dysentery	7	3	Sepsis	8	5
Erysipelas	219	10	Tetanus	13	10
Favus	13	----	Typhoid fever	428	35
Leprosy	----	4	Typhus fever	20	3

REPORTS OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER RECEIVED DURING THE CURRENT WEEK

NOTE.—A cumulative table giving current information regarding the world prevalence of quarantinable diseases appeared in the PUBLIC HEALTH REPORTS of January 26, 1940, pages 182–186. A similar table will appear in future issues of the PUBLIC HEALTH REPORTS for the last Friday of each month.

Cholera

India—Madras.—During the week ended January 27, 1940, 1 case of cholera was reported in Madras, India.

Plague

Egypt—Asyut Province—Abutig District.—During the week ended January 27, 1940, 11 cases of plague with 3 deaths were reported in Abutig District, Asyut Province, Egypt.

Yellow Fever

Colombia—Antioquia Department.—Yellow fever has been reported in Antioquia Department, Colombia, as follows: Caracoli, December 24, 1939, 1 death; Jordan, December 1, 1939, 1 death; San Carlos, December 16, 1939, 1 death.

French Equatorial Africa—Fort Archambault.—On January 26, 1940, 1 fatal case of suspected yellow fever was reported in Fort Archambault, French Equatorial Africa.

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