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THE DISTRIBUTION OF IMMUNITY AGAINST ENCEPHALITIS VIRUS OF THE ST. LOUIS TYPE IN THE UNITED STATES AS DETERMINED BY THE SERUM-PROTECTION TEST IN WHITE MICE [1]

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During the 1933 outbreak of encephalitis in St. Louis, Muckenfuss, Armstrong, and McCordock (1) through the inoculation of rhesus monkeys isolated seven apparently similar strains of virus from fatal cases of that disease. The symptomatology and the pathological lesions produced in monkeys were strikingly similar to those seen in human beings suffering with that disease.

Additional similar strains of virus were soon isolated by Webster and Fite (2), and by Holden (3) through the inoculation of white mice with infectious tissues forwarded from the epidemic area. Webster and Fite (2) elicited further evidence of the etiological significance of the virus by demonstrating that sera from recovered encephalitis cases (St. Louis type) were capable of neutralizing the virus when serum-virus mixtures were incubated together prior to their inoculation into white mice while sera from noncontact individuals failed to show protective substances when similarly tested. Through the application of the serum-protection test it therefore should be possible to determine the distribution of specific antibodies among sera submitted to the test and thus to gain presumptive evidence as to the distribution of the virus among the tested population.

This communication is based on the results of the protection test performed with 524 human sera collected from 49 cities in 26 States and the District of Columbia and from 1 city of Canada.

COLLECTION OF SERA

The bloods for these tests were collected by Senior Surg. J. P. Leake, Passed Asst. Surg. W. G. Workman, and Asst. Surg. V. H. Haas.

[1] From the National Institute of Health, Washington, D. C.

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The blood was drawn into sterile vacuum tubes, which were mailed to the laboratory, where they were centrifuged and the sera removed and stored, without preservatives, at about 5° C. until used.

SOURCE AND HANDLING OF THE VIRUS

A virus strain (Freeman) isolated by Muckenfuss, Armstrong, and McCordock (1) at St. Louis, was employed throughout these tests.

Mouse-brain virus was collected as follows: The brains for virus were collected usually on the fifth day following intracerebral inoculation, the mice being etherized *in extremis*. Seven serial intracerebral transfers were carried out before beginning the actual testing of the sera, with the view to stabilizing the virulence of the virus for white mice. Thereafter the strain was maintained by making weekly serial intracerebral transfers. It was found, nevertheless, that the virus, with successive transfers, did tend to become more virulent for white mice, so that it was necessary to increase, from time to time, the dilutions of the virus used in the serum-protection tests.

The stock virus for carrying out the test was preserved by placing whole infected mouse brains in equal parts of neutral glycerine [2] and 0.85 percent saline held at about 5° C. until used.

TECHNIQUE OF TEST

Preparation of virus-serum mixtures.—In order to overcome the gradual loss of potency which virus undergoes with storage, brains of approximately equal ages were used throughout the various tests. This was accomplished by inoculating mice so that they would fall moribund on the last of each week, when their brains were removed. Virus for carrying out Monday and Tuesday tests (6 sera tested daily) was prepared by grinding together 1 brain harvested the preceding week-end with 2 brains harvested 1 week earlier; for Wednesday and Thursday tests 2 of the more recently harvested brains and 1 of the week earlier were used, while for Friday tests 3 brains of the most recent harvest were employed. The brains were finely ground in a mortar and suspended in 0.85 percent saline pH 7.6. The suspension made up to approximately 1:100 by weight was then centrifuged for 3 minutes at 1,500 revolutions per minute to remove coarse particles.[3] The supernatant fluid was next pipetted off and diluted to 1:1000, 1:10,000, 1:100,000, and 1:1,000,000 in saline.

[2] Method of removing mouse brains for virus: The animal was etherized *in extremis* and tacked belly down on a board. The head was next steadied by means of a Kelly forceps firmly clamped to the mouse's nose. The hair was next shaved from the top of the head and tincture of iodine was applied, after which a flame was passed over the animal to remove loose or long hairs. The skin was next split with a sterile scalpel by making a median incision from the forehead to the neck. The skin was then grasped beneath the head by means of a second Kelly clamp, which widened the incision over the top of the head and exposed the calvarium. The skull cap was next clipped around with sterile curved manicure scissors and elevated, and the brain was scooped out with a sterile scoop or with the blades of the manicure scissors and immediately placed in sterile 50-percent neutral glycerine for storage.

[3] The average weight of a mouse brain was found to be approximately 0.30 gram.

Four conical flasks were next arranged in order. Into the first flask was placed 0.3 cc of serum and 0.15 cc of 10^{-3} virus suspension, into flask no. 2 was placed 0.2 cc of serum and 0.1 cc of 10^{-4} virus suspension, into no. 3, 0.2 cc of serum and 0.1 cc of 10^{-5} suspension, and into flask no. 4, 0.2 cc of serum and 0.1 cc of 10^{-6} virus suspension. The mixtures were agitated thoroughly, then let stand for 2 hours at room temperature, following which 0.03 cc of each mixture was inoculated intracerebrally into each of four white mice by means of a 0.25-cc syringe and a 23-gage needle. Thus each such serum tested utilized 16 white mice.

A serum known to possess strong protective properties and a serum without protection were included in each test.

In order to test the sterility of the serum-virus mixtures 0.1 cc of the mixture with the lowest dilution of virus was cultured aerobically in nutrient agar. Approximately 50 percent of the mixtures showed a few colonies, but apparently they were usually of a type which caused no interference with the test.

Reading of results.—The mice were observed for 14 days, and the date of death was recorded for each mouse dying during this interval. When a serum test showed approximately the number of survivals shown by the positive serum control, it was recorded as showing strong protection; when it gave fewer survivors than the positive serum control, but definitely more than the negative serum control, it was recorded as showing moderate protection; when the excess of survivals given by the test serum over the negative control was so small as to be within the limits of variability inherent in a biological test, the serum was recorded as showing questionable protection; and when the number of deaths was as great as, or greater than, that with the negative control, the serum was recorded as negative.

The time of death also entered into consideration when recording the results of the test. When a negative serum and a potent virus were employed, the majority of deaths occurred on the 4th to 6th days. When the serum possessed some protective properties, however, deaths, when they occurred, tended to be later.

In order that the reading of the results should be purely objective, the clinical histories of the individuals from which sera were secured were withheld by the collectors until all the tests had been completed and the readings made.

Checks on the test.—The time of death and the symptoms, which are rather characteristic in mice, furnished a presumptive diagnostic criterion for establishing the cause of death as encephalitis. For the purpose of this test it was, however, felt that further confirmation should be sought through histologic studies. Therefore the brain of at least one mouse from animals dying from each virus dilution was examined histologically by Surg. R. D. Lillie or Passed Asst.

Surg. J. G. Pasternack. Among 1,876 brains thus studied, there were 1,737 which showed lesions consistent with a diagnosis of encephalitis. There were, however, 108 instances in which the sections examined failed to show recognizable lesions, and 16 which revealed a purulent type of encephalitis, presumably due to contaminating organisms. There were 15 additional mice which showed a meningeal reaction considered to be atypical for encephalitis.

These 139 possibly nonspecific deaths were scattered through 524 tests. Moreover, where a brain gave atypical or no recognizable pathology, others from different virus dilutions of the same test were usually found which gave typical reactions. It is felt, therefore, that these mice dying of questionable causes in no way influence the final results, which are considered to represent a true picture of the specific protection or lack of it in the sera tested.

White mice from various commercial sources have proved equally satisfactory for the test, insofar as their susceptibility to the virus was concerned.

A sample protocol of a test is given in table 1.

TABLE 1.—*Condensed protocol of a typical serum-protection test*

Experiment Ax 70, 1 to 24, May 1, 1934

Serum	Virus dilution	Day of death of mice	Number of mice surviving	Histologic report	Interpretation
H S, St. Louis	10^{-3}	7	3	Encephalitis slight	Strong protection.
	10^{-4}	7, 8	2	do	
	10^{-5}		4		
	10^{-6}		4		
G T, Paris, Ill	10^{-3}	5, 5, 5, 7	0	Encephalitis	No protection.
	10^{-4}	5, 5, 5, 5	0	do	
	10^{-5}	6, 7	2	Encephalitis (?)	
	10^{-6}	6, 6, 7	1	Negative	
W, St. Paul	10^{-3}	5, 5, 5, 5	0	Encephalitis slight	Do.
	10^{-4}	5, 5, 6, 11	0	Encephalitis ±	
	10^{-5}	6, 6, 6	1	Encephalitis	
	10^{-6}	10	3		
S, Pittsburgh	10^{-3}	5, 5, 5, 6	0	Encephalitis + +	Do.
	10^{-4}	5, 5, 5, 5	0	Encephalitis	
	10^{-5}	5, 6, 11	1	Negative (?)	
	10^{-6}	6	3	Negative	
L, Peoria, Ill	10^{-3}	8, 11	2	Encephalitis slight	Strong protection.
	10^{-4}		4		
	10^{-5}		4		
	10^{-6}		4		
R W, San Francisco	10^{-3}	5, 5, 5, 5	0	Encephalitis ±	Questionable protection.
	10^{-4}	5, 5, 5	1	Encephalitis	
	10^{-5}	6, 7	2	No report	
	10^{-6}		4		

RESULTS OF THE PROTECTION TEST ON 524 SERA

The serum-protection test as carried out on 524 sera gave the following results:

Strong protection	103
Moderate protection	55
	158
Questionable protection	56
No protection	310
Total sera	524

By reference to table 2 it may be noted that one or more sera possessing protective properties were encountered from 32 cities located in 21 States of the United States. Of 15 sera from New England, 1 showed protection; of 37 sera from the Middle Atlantic States, 2 showed protection; of 36 sera from the South Atlantic, 6 showed protection; of 109 sera from the East North Central States, 35 showed protection; and of 41 sera from the East South Central States, 11 showed protection. There were 174 sera from the West North Central States tested, 85 of which gave protection. The figures for this group of States include 103 sera from the St. Louis epidemic area, 61 of which gave protection. Among 36 sera from the West South Central States there were 6 which showed protection, while among 25 sera from the Mountain States 3 gave protection, and among 47 from the Pacific States there were 9 which showed protection.

TABLE 2.—*Source of sera and results of serum-protection tests*

City and State	Strong protection	Moderate protection	Questionable protection	No protection	Total
NEW ENGLAND STATES					
Boston and Northampton, Mass.	0	1	2	6	9
Springfield, Mass.	0	0	2	4	6
Total	0	1	4	10	15
MIDDLE ATLANTIC STATES					
Buffalo, N. Y.	0	0	1	6	7
New York, N. Y.	2	0	1	9	12
Philadelphia, Pa.	0	0	2	7	9
Pittsburgh, Pa.	0	0	0	9	9
Total	2	0	4	31	37

TABLE 2.—*Source of sera and results of serum-protection tests*—Continued

City and State	Strong protection	Moderate protection	Questionable protection	No protection	Total
SOUTH ATLANTIC STATES					
Dover, Del	0	0	0	1	1
Washington, D. C	0	2	0	3	5
Richmond, Va	0	2	0	6	8
Atlanta, Ga	0	0	0	5	5
Jacksonville, Fla	0	1	1	6	8
Key West, Fla	0	1	1	7	9
Total	0	6	2	28	36
EAST NORTH CENTRAL STATES					
Columbus, Ohio	1	0	0	8	9
Cincinnati, Ohio	5	3	1	12	21
Cleveland, Ohio	1	2	1	8	12
Indianapolis, Ind	1	0	3	6	10
Chicago, Ill	0	0	1	6	7
Goldengate, Ill	0	0	0	1	1
Paris, Ill	9	2	0	9	20
Peoria, Ill	1	0	0	3	4
Detroit, Mich	1	1	3	7	12
Grand Rapids, Mich	7	1	1	4	13
Total	26	9	10	64	109
-Pur	17	7	10	55	89
EAST SOUTH ATLANTIC STATES					
Louisville, Ky	1	7	0	3	11
Memphis, Tenn	0	0	0	7	7
Nashville, Tenn	2	1	1	8	12
Birmingham, Ala	0	0	1	10	11
Total	3	8	2	28	41
WEST NORTH CENTRAL STATES					
Duluth, Minn	0	1	0	8	9
Minneapolis, Minn	1	0	1	8	10
St. Paul, Minn	1	2	0	7	10
St. Cloud, Minn	0	0	0	2	2
Grinnell, Waverly, and Des Moines, Iowa	0	0	2	5	7
St. Joseph, Mo	7	2	1	2	12
Columbia, Mo	4	0	1	7	12
St. Louis (epidemic area), Mo	45	16	11	31	103
Omaha, Nebr	6	0	1	2	9
Total	64	21	17	72	174
-St.L	19	5	6	41	61
WEST SOUTH CENTRAL STATES					
New Orleans, La	0	3	1	7	11
Dallas, Tex	0	0	3	7	10
Houston, Tex	2	1	0	12	15
Total	2	4	4	26	36
MOUNTAIN STATES					
Hamilton and Stevensville, Mont	0	0	1	1	2
Denver, Colo	1	1	0	10	12
Salt Lake City, Utah	1	0	2	8	11
Total	2	1	3	19	25

TABLE 2.—*Source of sera and results of serum-protection tests*—Continued

City and State	Strong protection	Moderate protection	Questionable protection	No protection	Total
PACIFIC STATES					
Seattle, Wash.	0	1	5	6	12
Portland, Oreg.	1	1	0	9	11
Los Angeles, Calif.	2	1	3	5	11
San Francisco, Calif.	1	2	1	9	13
Total	4	5	9	29	47
MISCELLANEOUS					
Toronto, Canada	0	0	0	2	2
Address unknown	0	0	1	1	2
Total	0	0	1	3	4
Grand total	103	55	56	310	524

Protection with sera from the St. Louis (1933) epidemic area.—Fifty-two sera were collected from the St. Louis area, 39 of which were from patients who had recovered from clinically diagnosed encephalitis, of which 37, or 94.8 percent, showed definite protection (table 3).

There were 7 additional sera probably from encephalitis cases in which the clinical records, however, were incomplete, of which 5 showed protection. In addition, there were 6 cases diagnosed as questionable encephalitis, 1 serum of which gave protection.

It therefore appears that recovery from an attack of encephalitis (St. Louis type) is usually followed by the development of specific antibodies which are demonstrable by the serum-protection test in blood drawn from 4 to 10 months following the attack. In five instances blood was drawn twice from the same individual, with an interval of several months intervening between bleedings. No definite loss in protective properties was detected in the later bleedings as compared with the earlier ones. Moreover, among 11 sera collected from Paris, Ill., from 16 to 22 months following the attacks of encephalitis in 1932, there were 10 which showed protective properties. It appears, therefore, that the protective antibodies tend to persist following the attack.

TABLE 3.—*Protection tests with St. Louis sera*

Clinical diagnosis, July to September 1933	Date blood was drawn	Strong protection	Moderate protection	Questionable protection	No protection	Total
Encephalitis	Jan. 2-5, 1934	15	3	1	0	19
Do	Feb. 5, 1934	2	0	0	0	2
Do	May 17, 1934	14	3	1	0	18
Total		31	6	2	0	39
Percent		94.8		5.1		
Questionable encephalitis	Jan. 2-5, 1934	1	0	0	3	4
Do	May 17, 1934	0	0	0	2	2
Total		1	0	0	5	6
Clinical records incomplete	Feb. 5, 1934	2	0	0	0	2
Do	May 17, 1934	3	0	1	1	5
Total		5	0	1	1	7
Grand total		37	6	3	6	52

Serum protection by clinical diagnosis (specificity).—By reference to table 4 it may be noted that among 524 sera tested there were 129 in which the clinical diagnosis was "encephalitis epidemica", presumably meaning the St. Louis type, of which 85, or 65.8 percent, showed protection against the Freeman strain of St. Louis virus. Six sera from cases which were diagnosed as "questionable encephalitis" gave 1 showing protection; 29 cases of "encephalitis lethargica" gave 4 showing protection; while 20 sera from "atypical encephalitis" gave 8 which showed protection.

Instances of neurological ailments wherein the clinical diagnosis was at variance with the serum-protection test would be readily explained by assuming an error on the part of the clinician; however, such a contention cannot be positively maintained. Individuals who suffered with clinically diagnosed encephalitis at St. Louis during the 1933 outbreak have been encountered who failed to show specific protection. On the other hand, among sera from 99 persons suffering with other than central nervous affections there were 13 which gave protection.

These 13 sera were from individuals suffering with the following diagnosed conditions: 2 had surgical conditions, and 1 each had general debility, sinus infection, pellagra, tertiary syphilis, hemiplegia, interstitial nephritis, fracture, pulmonary tuberculosis, gonorrhea, lung abscess, and auricular fibrillation.

That these conditions were not of themselves accountable for the presence of the protective antibodies against encephalitis in these 13 cases is indicated by the fact that instances were encountered of others suffering from these same ailments whose serum failed to show protection. Moreover, sera from 113 apparently normal individuals who gave no history of central nervous diseases or of any recent illness were investigated and 11, or 9.7 percent, gave definite protection.

TABLE 4.—*Clinical diagnosis and results of serum-protection tests*

Clinical diagnosis	Strong protection	Moderate protection	Questionable protection	No protection	Total
Encephalitis, epidemic	66	19	10	34	129
Encephalitis, questionable	1	0	0	5	6
Encephalitis, atypical	3	5	0	12	20
Encephalitis, lethargica	4	0	2	23	29
Encephalitis, unclassified	0	2	0	5	7
Encephalitis, meningo, acute	0	0	1	0	1
Menengo-encephalopathy, epidemic	0	0	2	5	7
Poliomyelitis	0	0	1	11	12
Encephalitis, traumatic	0	1	0	0	1
Encephalitis, post pneumonia	0	0	0	1	1
Encephalitis, post pertussis	0	0	0	1	1
Encephalitis, post vaccinal	0	0	1	1	2
Encephalitis, post influenza	1	0	0	0	1
Epilepsy, Jacksonian	0	0	0	2	2
Other diseases, not neural	4	9	14	72	99
Diagnosis not given	10	2	3	22	37
Normal controls (contacts with encephalitis cases)	8	12	8	28	56
Normal controls (no special contacts)	6	5	14	88	113
Total	103	55	56	310	524

It would appear, therefore, that the protection test as here performed is either not entirely specific or, if specific, that immunity has occasionally been attained through inapparent as well as through apparent infection with the widely distributed virus of the disease.

That immunity through subclinical infection does occur is indicated by the fact that among 56 normal encephalitis contacts at St. Louis, 5 of whom were physicians who had been in contact with cases throughout the 1933 epidemic and 51 of whom had lived in homes where encephalitis developed, there were 20, or 35.7 percent, whose serum showed protective antibodies, while, as above noted, there were but 11 from a total of 113 normal individuals having no history of contact, or 9.7 percent whose serum showed protection. Moreover, Armstrong (4) has shown that white mice which failed to develop recognizable symptoms following the intranasal inoculation of Freeman virus were, after a lapse of 3 weeks, immune in the majority of instances to 100 minimal fatal doses of the same virus given intracerebrally, which killed all of the control groups of mice. The spread of encephalitis in the St. Louis outbreak as reported by Leake (5) and by Bredeck (6) was, moreover, strikingly similar to that of poliomyelitis, a disease wherein immunity through subclinical infection with a widely distributed virus is an acknowledged occurrence. In view of these facts it appears unnecessary to assume the existence of a nonspecific type of protection in order to explain the results of the tests here reported, but on the other hand it is felt that the test is a highly specific one and that the virus of the disease is widely distributed throughout the United States.

It appears also that the St. Louis type is immunologically distinct from the lethargic type of encephalitis, since among 29 cases of the latter there were but 4 whose sera gave protection, or approximately

the ratio shown by normal individuals with no known exposure. Moreover, the fact that all of 12 sera from cases of poliomyelitis failed to show protective antibodies against encephalitis virus, while in 5 cases of post-infectious encephalitis all except one (from a patient who lived in an epidemic area) failed to give protection, indicates that these diseases are also etiologically distinct from the St. Louis type of encephalitis.

Webster and Fite (2, 9, 10), Cox and Fite (7), and Brodie (8), by means of the serum protection test, arrived at a similar conclusion for herpes, vesicular stomatitis, encephalomyelitis, encephalitis lethargica, poliomyelitis, Australian X disease, Japanese encephalitis, louping-ill, and rabies.

While the protection test appears to be highly specific, the number of sera so far studied is too small to furnish evidence as to the relative prevalence of neutralizing antibodies in the sera from different States or for the United States as a whole, but it does indicate that the virus probably is rather widely distributed throughout this country. The number of sera tested is likewise too small to permit conclusions as to the distribution of protective properties in the sera from various age groups.

SUMMARY

1. The technique of the serum-protection test is described.

2. Serum-protection tests carried out on 524 human sera collected from 49 cities located in 26 States and the District of Columbia gave definite protection in 158 or 30.1 percent, questionable protection in 56, or 10.7 percent, and no protection in 310, or 59.1 percent.

3. Sera giving definite protection were collected from 32 cities located in 21 States and the District of Columbia.

4. Of sera from 39 cases of clinically definite encephalitis from the St. Louis epidemic (1933), collected 4 to 10 months following the attack, 37, or 94.8 percent, showed protection.

5. Among 113 normal controls having no known exposure to encephalitis cases there were 11, or 9.4 percent, whose sera gave protection, while among 56 normal controls who had been in contact with cases there were 20, or 35.7 percent, whose sera showed definite protection.

6. A positive serum-protection test is believed to be evidence that the serum donor had been in contact with the virus of encephalitis and had suffered either a clinical or subclinical type of infection.

7. The serum-protection tests here reported indicate that the St. Louis (1933) type of encephalitis is immunologically distinct from encephalitis lethargica, poliomyelitis, and the post-infectious encephalitides.

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WHAT EVERY PERSON SHOULD KNOW ABOUT MILK

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Of all things of life which affect human welfare none is more important than food. Food is to man what coal is to the furnace or gasoline to the automobile. Food furnishes man with internal heat, without which even overcoats would not keep him warm. Properly selected food provides mankind with the mental and physical energy which has been the mainspring of all civilization, it repairs the structural damage which the wear and tear of life inflict upon our bodies, and it helps make us resistant to disease. On the other hand, improperly selected food is responsible for a large proportion of human ills, from a simple stomachache to the shortening of life itself. In short, food is all-important in the human economy.

Of all of the kinds of food none is more important than milk, the principal food of infants and small children. There are three important questions about milk which every person should be able to answer. They are:

(1) Why is milk such an excellent food, and how much of it should be included in the diet?

(2) How can milk be safeguarded to prevent it from transmitting disease?

(3) How can consumers be certain that the milk they drink has been thus safeguarded?

(1) *Why is milk such an excellent food, and how much of it should be included in the diet?*

In the first place milk is the only food specifically prepared by nature for the young of mammals. Nearly everyone will immediately agree that a substance specifically prepared by nature for no other

purpose than for food is most likely to contain the food elements needed to sustain life and justly deserves the title recently conferred upon it, namely, "the most nearly perfect food."

It is by no means sure that we know all of the attributes which the perfect food should have, but we can at least discuss some of them.

It will be obvious that one of the most important attributes which a food should possess is that it be a good source of energy, since every living thing needs a fresh supply of energy every day. Milk is such a food and, furthermore, is a cheap form of energy. The equivalent energy value in the form of certain other widely used foods is more expensive.

Milk is also a good muscle builder. It is rich in protein, which is required for muscle building. A child cannot grow and form strong muscles without protein. A full-grown adult cannot keep in health without it. As to the quantity of protein available in milk, Rose states: "A quart of milk yields more than an ounce of pure protein of the highest quality", that is, more than one-third of the total daily protein requirement of an adult.

Again, milk is a good tooth and bone builder, for it contains plenty of lime. Children particularly need lime, and the lime should be in a form which is easily utilized by the body. This is above all true of the lime in milk. One cup of milk contains as much lime as 3½ cups of carrots, 7 eggs, or 42 slices of bread.

Milk is a far more concentrated food from the standpoint of solids than most of us imagine. We think of milk as a liquid not much above the consistency of water; but it contains 13 percent of solids by weight, which is more than is contained in onions, beets, carrots, squash, pineapple, turnips, oysters, cabbage, radishes, cauliflower, spinach, watermelon, pumpkin, tomatoes, asparagus, celery, lettuce, or cucumbers. When we buy 1 pint or 1 pound of milk, therefore, we buy more actual dry solid food than when we buy 1 pound of any of the other above-mentioned foods.

Milk is also an excellent source of fat. This, of course, is obviously in the form of cream, which, with the milk sugar, is directly related to its fuel value.

Milk is an excellent source of vitamin A. Professor Sherman, of Columbia University, one of the outstanding diet specialists of the world, has stated, as a result of his own extensive research, that "milk is the most important of all foods as a source of vitamin A." The same author has stated, in his book on "Chemistry of Food and Nutrition": "Of the three vitamins A, B, and C, vitamin A is the factor of greatest practical importance to nutrition and health, because so many of our staple foods are poor in vitamin A, and because a dietary poor in this vitamin causes such wide-spread weakening of the body and increases its susceptibility to so many infectious diseases."

In the January 1932 issue of the American Journal of Public Health, the work of Professor Mellenby and his wife on vitamin A (British Medical Journal, Oct. 3, 1931) was discussed. As a result of their work with 550 pregnant women, these authors reported a significant reduction in morbidity following the administration of a preparation containing vitamins A and D; and the authors conclude, on the experimental evidence, that the vitamin-D fraction had little to do with the results.

Again, Professor Mellenby and his wife have for some 5 years taken cod-liver oil (a rich source of vitamin A) daily and report that during this time they have been practically free from ordinary colds. This latter, as the editor of the Journal says, is of course not a controlled experiment; but the work on pregnant women was controlled, as 275 of the women received the vitamin A preparation and the remaining 275 did not. These statements are very interesting in view of the widespread feeling that vitamin A gives protection against infection.

Milk seems also to be a good source of vitamin G. This vitamin, as the result of the renowned work of the late Surg. Joseph Goldberger, of the Public Health Service, has been found to be valuable both in preventing and in curing pellagra, a dietary deficiency disease. Since milk contains vitamin G, the consumption of milk has been stressed by Goldberger and others as one important measure for combating pellagra.

Finally, milk is one of the most digestible of foods. It is easily and completely digested by most persons. Crumbine and Tobey state that the coefficient of digestibility of milk is from 97 to 98 percent.

It may be asked why milk was called the most nearly perfect food rather than "the perfect food." This is because, while it is the most nearly perfect food, it is not absolutely perfect, and what has been said would not be complete without reference to its shortcomings. Milk does not seem to be an entirely dependable source of the other vitamins, nor does it contain sufficient iron, and experiments have shown that infants and young animals restricted entirely to milk over considerable periods of time develop anemia.

For this reason, and also because variety in the diet stimulates the appetite, we should not try to live on milk alone. The diet of normal children should include a quart of milk daily, supplemented with a wise selection of other foods, among which should be included orange juice, cod-liver oil, and green vegetables. Normal adults may wisely include at least a pint of milk in their daily diet. Of course, abnormal adults or children should receive and follow competent medical advice.

It seems reasonable to believe that in the future public-health officials will not always grade milk on the basis of its cleanliness and safety alone, but will also grade it with reference to its nutritive value.

Recently it has become quite apparent that the kind of feed a cow gets very much affects the nutritive value of the milk she gives. Therefore it may be anticipated that some time in the future grade A milk may be required to have been produced by cows which receive at least a standard balanced ration so that their milk may possess the maximum food value for human beings.

(2) *How can milk be safeguarded to prevent it from transmitting disease?*

It seems a pity that milk can be such an excellent food and at the same time so dangerous if not properly safeguarded. But it is unfortunately true that milk is not only a good food for human beings, but also a good food for certain types of disease organisms, such as those causing typhoid fever and diphtheria. Then, again, milk may sometimes, without our knowledge, come from sick cows. In such cases their milk may at the time of milking contain large numbers of the organisms of such diseases as septic sore throat, undulant fever, and tuberculosis.

Occasionally there occur milk-borne outbreaks of appalling magnitude. Only a few years ago a milk-borne outbreak in Montreal caused over 5,100 persons to be stricken with typhoid fever, and killed over 500 of them. Fortunately most disease outbreaks caused by unsafe milk are not nearly so serious as the Montreal outbreak, but the United States Public Health Service receives reports each year of from 30 to 50 outbreaks.

This fact is tremendously significant to all of us who drink milk—*and especially to all of us who have children.*

Among the diseases which may be transmitted through milk are tuberculosis, typhoid fever, scarlet fever, diphtheria, septic sore throat, and undulant fever. Let us confine ourselves for the moment to but three of them—tuberculosis, typhoid fever, and septic sore throat.

Suppose you were a dairyman. What would you do, short of pasteurization, to make sure that none of your customers would ever contract any of these diseases by drinking your milk?

Well, in the case of tuberculosis, almost the only thing you could do would be to have your cows tested for tuberculosis and kill those that showed they had it.

Suppose you did that. Suppose you had a herd of 50 splendid, pure-bred cattle, that you had them all tested, found 3 or 4 of them to be tuberculous, had these 3 or 4 slaughtered, and then continued with your business. Would you have protected your customers from contracting bovine tuberculosis? If I were one of your customers, could you give me real assurance that I would never regret having permitted my children to drink the milk from your dairy?

Certainly the four you had slaughtered would no longer be a menace. But suppose that a year later, when you came to test again, you found

another cow to be tuberculous. Then you would face a very serious question. You would wonder how many months it had been tuberculous. You would be assailed by the disturbing thought that perhaps some innocent child had received through your milk supply the germs of tuberculosis, an infection which might not disclose itself until considerable time had elapsed, until, perhaps, the child and the parents had forgotten that you had ever been their dairyman.

Do not let anyone benumb your conscience into believing that this does not happen. It does happen, again and again, even at certified and grade A raw-milk dairies, and slaughtering the infected cows does not undo the damage they have already done.

Now let us pass on to typhoid fever. If you were the owner of a raw-milk dairy, what would be the most effective thing you could do, short of pasteurization, to make sure that your milk supply would not carry typhoid fever to your customers?

Of course, if one of your milkers or other helpers contracted typhoid fever, you would at once have him quarantined or sent to a hospital; and if you were prompt and careful, there would probably be very little danger. But, unfortunately, that is not usually the way epidemics of typhoid fever are caused by milk. When milk becomes infected with typhoid fever it is usually not a sick person who is at fault, but, instead, a perfectly well individual, one who had had typhoid fever perhaps years ago and who possibly did not even know that what he had was typhoid fever. Nevertheless, he has, as a result of this possibly unrecognized sickness, become what is known as a typhoid carrier. Such a man is, so far as we know, a perfectly well individual. He doesn't look sick and he doesn't feel sick. But, unfortunately, he still carries typhoid fever germs, either in his gall bladder or elsewhere, from which they are discharged with his feces or urine, and thus accidently now and then find their way to his hands, his clothing, and eventually to the dairy equipment and to the milk supply.

Of course, the typhoid-fever carrier is not aware of his condition. If he were, he would, in most cases, be honest enough ro refuse to imperil the lives of his fellow beings by continuing to work at a dairy. But that is the dangerous thing about it. The typhoid carrier is usually ignorant of the fact that he is a menace, a carrier of disease and death.

Knowing these facts, then, what would you do if you were the owner of a raw-milk dairy? Possibly you would do what is required by the Public Health Service milk ordinance for grade A raw-milk employees who have at any previous time had typhoid fever. You would have everyone at your dairy send samples of their feces and urine to the health department laboratory so that it could be determined whether they contained any typhoid organisms. Fortunately

scientists have discovered an excellent method of recognizing typhoid fever germs.

Now suppose you took this precaution and the laboratory reported that so far as it could determine none of the specimens of feces or urine contained the germs of typhoid fever. Could you then rest assured that none of your employees is a typhoid-fever carrier, and that none of your customers would ever contract typhoid fever from the milk you sold them?

Unfortunately, the answer must be no. Many typhoid-fever carriers do not discharge the typhoid-fever germs every day, and on the day the specimens were collected and sent to the laboratory the carrier, if there had been one at your dairy, may or may not have been discharging the organisms. If he was discharging them, the chance that the laboratory would find them is excellent; but if he was not discharging them the laboratory could not, of course, find them.

There is, therefore, no way to make absolutely sure that raw milk will never contain the germs of typhoid fever; and if you knew as much about the danger as the health officer does, you, as a dairyman, would live constantly in fear lest some morning you awaken to find the newspapers pointing the finger of accusation at you and your milk supply.

We have now discussed 2 of the 3 diseases we intended to discuss.

How about the third—septic sore throat? What could you, if you were a producer of high-grade raw milk, do to prevent the transmission of this disease through your milk supply to your customers?

Frankly, I do not know. A milker may think he has an ordinary cold, when really it is septic sore throat. He may then infect the milk supply directly, or he may infect a cow's udder during the milking process, and the milk from that cow may later be simply teeming with the organisms of the disease.

Suppose we were to examine every milker's throat every day and every cow's udder every day. Even then we would not have done away with the danger, because by the time the report came back from the laboratory some of the milk would have been consumed. Of course, I need not tell you that a daily examination would be out of the question, if for no other reason than the expense entailed.

A septic sore throat outbreak can be very serious. In Portland, Oreg., several years ago, a milker infected a cow's udder; and before the resulting epidemic was quelled, 487 persons sickened and 22 died.

To repeat, I do not know of any way in which you could guarantee that septic sore throat would not be spread through your raw-milk supply.

It seems impossible, then, to escape the conclusion that all milk should be either pasteurized or boiled to make it safe.

Should we rely upon boiling? That is what is done in many parts of Europe and South America, and, as a result, they have in those

places practically no milk-borne disease. But with these people boiling milk is a matter of daily habit. In most of the areas in question, the housewife does not have ice, and milk is boiled to keep it from souring.

In this country we have to deal with two factors: First, that most families do have ice or electric refrigerators and can keep milk sweet; and second, that many people do not like the taste of boiled milk.

If health officers simply said to all of the people, "Boil your milk", they could not depend upon a sufficient number doing it to prevent epidemics. Again, the adults and children who now drink raw milk because they like its flavor would not drink so much milk if it had to be boiled, and we must, by all means, encourage people to drink enough milk. It is just as important to do this as it is to make milk safe.

There is, then, only one other thing we can do (short of putting chemicals into the milk, and nobody wants to do that), and that is to pasteurize the milk. That is why most health authorities today feel that *all* milk should be pasteurized. The most common method of pasteurizing milk commercially is to heat it to 142° F. and hold it at that temperature for 30 minutes. This treatment kills or renders harmless all disease organisms which may be transmitted through milk. Higher temperatures for shorter periods are also effective.

You need not be worried about the effect of heating milk upon its food value. The vast majority of health officers and physicians today believe that pasteurizing milk has no significant effect upon its food value, especially when it is remembered that all children should receive a supplementary diet in addition to milk. Vitamin C is affected by heat, but this is not significant, since the amount of this vitamin present even in raw milk is frequently insufficient, and it is therefore necessary to feed children orange or tomato juice or some other high-bearing source of vitamin C, regardless of whether the milk they drink is raw or pasteurized. Therefore, since the child will get all the vitamin C it needs anyway, why take a chance on disease by insisting upon giving it raw milk?

Several years ago the Public Health Service conducted an intensive study of about 3,700 children to determine whether those who drank heated milk actually throve less well than those who drank raw milk. The results of the studies showed that the average weight of the children receiving raw milk was 33.2 pounds, whereas the average weight of the children receiving heated milk was 33.6 pounds; also the average height of the children receiving raw milk was 37.4 inches, whereas the average height of the children receiving heated milk was 37.5 inches. Furthermore, from the parents' reports it was found that the children who drank raw milk suffered with communicable diseases

more frequenly than did the children who drank heated milk only. The final conclusion of the study was that, taking into account the average supplementary American child diet, children who are fed pasteurized or other heated milk thrive as well as children who are fed raw milk, and contract certain communicable diseases less frequently.

"But," you may say, "many people do not like the flavor of pasteurized milk, and I am one of them."

That may be quite true; but it is true only when a low grade, unclean milk is used for pasteurization or when a high grade milk is improperly pasteurized. Pasteurization will not remove the bad flavor from bad milk, and even good milk can be damaged by pasteurizing it improperly. But if high grade milk is properly pasteurized, there is no change in the flavor. To prove this, your health officer may conduct the following demonstration:

He should satisfy himself that the local pasteurization plants are strictly observing the grade A requirements and that there is no real flavor difference, such as might result from the use of a higher pasteurizing temperature than is required or from exposure of the milk to copper. Then one of the local pasteurization plants may furnish both raw and pasteurized milk in quart bottles to the Rotary and other civic luncheons, the bottles being marked with distinguishing marks unknown to the drinkers. Each member should be provided with six glasses, placed in a row in front of him. A small portion of pasteurized milk should be placed in 3 of the glasses and a small portion of raw milk in the other 3 in an order unknown to anyone but the health officer. The members should not be told how many glasses contain pasteurized milk. Then each member should be asked to tell by tasting which of the six glasses contain pasteurized milk. (It is fundamentally important that the raw and pasteurized milk be identically the same milk, except for the fact of pasteurization. This condition is accomplished best by obtaining the raw milk directly from the pasteurizer just prior to the pasteurization process, after thorough mixing, and then obtaining the pasteurized milk from the same batch of milk.)

Each guest should be provided with a small card. The glasses should be considered as being numbered from left to right and each guest should be asked to write on the card the numbers representing the glasses containing pasteurized milk. Then someone from the speaker's table should announce the true content of each of the six glasses, and all of the members who guess correctly may be awarded a prize of some sort.

If pasteurization really imparted an undesirable flavor to milk, most of the guests should give correct answers for all six glasses. If pasteurized milk really cannot be detected by flavor, most of the

members should fail in reporting all six glasses correctly. In tabulating the answers, each guest who fails to report all six glasses correctly should be listed as "wrong." A very few may guess correctly just by chance. This chance is the same as that of throwing all 6 heads when pitching 6 pennies at a time, usually not more than 1 or 2 times in 100 throws ($p=0.0156$).

After this guessing contest has been tried upon at least 100 persons in the city, the results may be published in the newspapers as evidence of the fact that proper pasteurization really does not affect the flavor of milk.

Of course we should not rely upon pasteurization as a cure-all and neglect all precautions at the farm, even if the flavor problem did not exist. The pasteurization process is operated by human beings and therefore is not entirely foolproof, though it is nearly so. We should firmly insist that the milk we drink be not only properly pasteurized but also carefully produced, so that we will have the maximum practicable protection all along the line from the cow to the consumer.

(3) *How can consumers be certain that the milk they drink has been thus safeguarded?*

As above stated, milk which has been properly safeguarded must have been both carefully produced and properly pasteurized. Is the milk you buy such milk? The first thing you must know before you can be sure of this is whether the milk regulations in force in your city correctly prescribe the methods of production and pasteurization. There has been much disagreement on this point among health officers in the past, and obviously not all health officers have been correct. In some cities the milk is not carefully produced before pasteurization, and in others important pasteurization principles are ignored or faulty pasteurization machines used, and yet the milk may be sold as grade A or otherwise designated as safe.

To remedy this situation the Public Health Service has for a number of years been urging American States and cities to adopt one uniform system of effective control. The model uniform regulations are carefully reviewed annually by a National Advisory Board, composed of 11 experts in milk-control work.

Under the regulations approved by this board, grade A pasteurized milk is milk which has been both carefully produced and properly pasteurized and is as safe as any milk can be made. Grade A raw and certified milks are raw milks which are as safe as *any raw milk* can practicably be made. If you prefer to buy either of these raw grades, you can secure the added protection of pasteurization at home as follows: Place the milk in an aluminum vessel on a hot flame and heat to 155° F., stirring constantly; then immediately set the vessel in cold water and continue stirring until cool.

If you buy grade A pasteurized milk, however, no additional home treatment is necessary.

About 600 American municipalities have already adopted these uniform milk regulations and are grading milk in accordance therewith. In such cities a milk distributor who is found to violate any grade A requirement is demoted or degraded by the health officer, and must remove the grade A caps and substitute B, C, or D caps, depending upon the nature of the violation. This attracts your attention if your milk distributor becomes careless. Finally, the health officer may revoke the permit of such a distributor if he persists in failure to safeguard the milk he sells.

You may wish to know what you should do if your municipality has not as yet adopted these nationally recommended uniform milk regulations. The best thing to do is to call on your health officer and discuss the matter with him. In most cases he will appreciate that and welcome your assistance in urging the city authorities to adopt the ordinance and provide the necessary inspectors.

However, your health officer may have already worked out a good milk ordinance of his own and he may be justly proud of the results he has accomplished. If he is in doubt as to whether the local ordinance is in all respects the equivalent of the United States Public Health Service ordinance, he may consult the State milk-control authority or the Public Health Service. Even if your local milk ordinance is a good one, however, your health officer and you may agree that there are advantages of economy and efficiency in the adoption of a standard. There is no profit in difference for difference sake. Of course, if your local ordinance is really better than the nationally recommended standard, your city should not drop the improvements; but it should be made quite certain that they are real improvements. If so, they should be brought to the attention of the Public Health Service, which should incorporate them in its standard.

One final doubt may still assail you. You may want to know how you can be sure that the local milk inspectors do not give a dairy a grade A rating when it does not deserve it. This is a very real problem which is taken care of by another part of the general national milk sanitation program of the United States Public Health Service. It recommends that the State milk control authority in each State should periodically measure the excellence of the milk sanitation work done in each municipality in the State by means of a rating method devised by the Public Health Service, and award ratings. If the city milk-control work is found to rate 90 percent or more, the name of that city is included in a list published periodically by the Public Health Service. A copy of this list may be secured by addressing the Public Health Service. You and your fellow milk consumers should leave no stone unturned in helping your health officer qualify your city for inclusion in this list.

Last of all, the Public Health Service itself occasionally rates cities in the various States and thus standardizes the State rating work. This gives you the assurance that the ratings awarded by the State department are comparable with similar ratings in other States.

SUMMARY

(1) Milk is an excellent food because (*a*) it is a natural food, (*b*) it is a cheap source of energy, (*c*) it is a good muscle builder, (*d*) it is a good tooth and bone builder, (*e*) it is a highly concentrated food, (*f*) it is an excellent source of vitamins A and G, and (*g*) it is highly digestible.

Normal children should consume a quart of milk a day, normal adults a pint, together with a well-balanced supplementary diet, which in the case of children should include such foods as orange juice, cod liver oil, and green vegetables. Abnormal children or adults should receive and follow competent medical advice.

(2) Milk may be safeguarded so as to prevent it from transmitting such diseases as tuberculosis, typhoid fever, scarlet fever, diphtheria, septic sore throat, and undulant fever by careful production and proper pasteurization. Neither production precautions alone nor pasteurization alone are adequate. Both are necessary to assure the maximum protection from cow to consumer.

(3) Consumers may assure themselves that the milk they drink has been thus properly safeguarded by purchasing only grade A pasteurized milk as defined by the United States Public Health Service milk ordinance, or by pasteurizing at home certified or grade A raw milk as defined by this ordinance. Consumers should ascertain whether the local milk ordinance is equivalent to the uniform milk ordinance recommended by the Public Health Service, and if not, they should offer to assist the local health officer in having all of its provisions incorporated in the local milk ordinance, or, better still, in having the present ordinance repealed and the recommended uniform ordinance adopted outright.

To insure that the ordinance is strictly enforced, the local milk control work should be rated at least biennially by the State milk control authority, and the rating should be not less than 90 percent, based upon the standard rating method recommended by the Public Health Service. Cities with 90 percent ratings are listed periodically by the United States Public Health Service. Copies of the list and of the recommended uniform milk ordinance may be secured by addressing the Public Health Service at Washington.

COURT DECISION ON PUBLIC HEALTH

Provision of city ordinance requiring permit for sale of milk upheld.—(Iowa Supreme Court; *City of Des Moines* v. *Fowler et al.*, 255 N. W. 880; decided June 23, 1934.) State statutory provisions of Iowa gave municipalities the power by ordinance to (*a*) provide for the inspection of milk, skimmed milk, buttermilk, and cream, and (*b*) establish and enforce sanitary requirements for the production, handling, and distribution of such products. The city of Des Moines adopted an ordinance which, by section 3 thereof, required a permit from the city health department as a prerequisite to selling milk, etc., in the city. The defendants were charged with violating the said section by selling cream in the city without a permit.

In the supreme court the contention was made that the ordinance was invalid because "it attempts to confer upon the health department the power to issue a permit; that the power to issue permits necessarily implies the power to prohibit; and that the power to regulate, which was delegated to the city under the statute, does not include or imply the power to prohibit, which it must be construed to possess if permits are required." Concerning this the supreme court stated, in part, as follows:

* * * We think it must be conceded, however, that in conferring upon cities the power by ordinance to provide for the matters which the statute enumerated, it was intended that the cities could provide in such ordinances for all such requirements as were reasonably necessary for carrying out their purposes. It would be a useless and an impotent gesture to confer upon cities the power to enact such ordinances if such cities could not exercise the power to enforce the ordinances thus enacted. We think that the inspection and regulations which it was intended by the statute that cities should exercise would reasonably and necessarily imply the creation of the machinery and procedure for carrying them into effect.

* * * While the section of the ordinance involved in this case contains the provision that no one shall offer or sell milk or dairy products who does not secure a permit from the health department of the city of Des Moines, it does not follow that the issuance of such a permit is an arbitrary matter. The evidence does show that such permits were issued pursuant to applications made by those desiring to sell milk and dairy products in said city, and that such applications call for information to which the city would reasonably be entitled so that it might make an inspection of the conditions under which such milk and dairy products were being produced and handled, and thus determine whether or not the sanitary requirements of the ordinance were being complied with, as a prerequisite to the issuance of such permit.

* * * While the production and sale of milk and dairy products may be a useful employment, the prohibition of which could not be enforced under authority to license, as stated in *City of Burlington* v. *Bumgardner*, (42 Iowa 673), nevertheless, the production and sale and method of handling such products are matters that involve the health of the inhabitants of cities, and, the power having been given to cities, by the statute now in force, to inspect such products and enact requirements governing their production, handling, and distribution, we think it cannot be said that the provision for a permit as contained in the

ordinance is an arbitrary attempt to prohibit the defendants in the operation of a useful business and the conducting of a useful employment. On the contrary, we think the requirement of such permit must be held to be a reasonable part of the machinery and procedure which the city must employ in keeping a record and providing a method of identification of those who have complied with its regulations, in order that it may exercise and enforce the powers conferred by the statute and undertaken in the ordinance.

* * * * * * *

We do not think the unreasonableness of the ordinance has been sufficiently established in this case to justify a court in holding it invalid.

DEATHS DURING WEEK ENDED NOV. 24, 1934

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

	Week ended Nov. 24, 1934	Corresponding week, 1933
Data from 86 large cities of the United States:		
Total deaths	8,134	8,235
Deaths per 1,000 population, annual basis	11.3	11.5
Deaths under 1 year of age	582	608
Deaths under 1 year of age per 1,000 estimated live births	54	[1] 52
Deaths per 1,000 population, annual basis, first 47 weeks of year	11.3	10.9
Data from industrial insurance companies:		
Policies in force	67,055,908	67,410,169
Number of death claims	12,961	13,329
Death claims per 1,000 policies in force, annual rate	10.1	10.3
Death claims per 1,000 policies, first 47 weeks of year, annual rate	9.8	9.8

[1] Data for 81 cities.

PREVALENCE OF DISEASE

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

UNITED STATES

CURRENT WEEKLY STATE REPORTS

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

Reports for Weeks Ended Dec. 1, 1934, and Dec. 2, 1933

Cases of certain communicable diseases reported by telegraph by State health officers for weeks ended Dec. 1, 1934, and Dec. 2, 1933

Division and State	Diphtheria		Influenza		Measles		Meningococcus meningitis	
	Week ended Dec. 1, 1934	Week ended Dec. 2, 1933	Week ended Dec. 1, 1934	Week ended Dec. 2, 1933	Week ended Dec. 1, 1934	Week ended Dec. 2, 1933	Week ended Dec. 1, 1934	Week ended Dec. 2, 1933
New England States:								
Maine	2	5	1	2	12	1	0	0
New Hampshire					17	26	0	0
Vermont	3	4			7	58	0	0
Massachusetts	7	20			98	372	1	0
Rhode Island	2	4			1	1	0	0
Connecticut	2	4	1	4	258	10	2	2
Middle Atlantic States:								
New York	47	48	[1] 42	[1] 30	622	363	2	2
New Jersey	23	29	38	19	48	44	1	1
Pennsylvania	34	76			486	258	1	5
East North Central States:								
Ohio	128	119	58	154	244	114	2	0
Indiana	57	96	20	46	219	31	0	3
Illinois	68	43	37	19	598	36	4	5
Michigan	14	23	5	3	94	52	0	0
Wisconsin	8	18	5	24	234	81	0	1
West North Central States:								
Minnesota	4	15	1		205	53	0	0
Iowa [2]	17	19			406	4	1	1
Missouri	51	79	70	7	71	41	3	2
North Dakota	3	23		2	53	15	0	0
South Dakota	1	5	1		39	219	0	0
Nebraska	12	4	1		11	6	0	0
Kansas	11	26			175	6	1	1
South Atlantic States:								
Delaware	2				1	1	0	0
Maryland [3]	23	23	7	17	38	2	0	0
District of Columbia	6	17		1	2	18	0	0
Virginia	99	89			123	46	2	3
West Virginia	47	56	31	57	157	2	1	4
North Carolina	50	62	5	9	230	347	2	4
South Carolina	9	16	239	587	2	187	0	0
Georgia [3 4]	24	28				126	0	1
Florida	17	15		2	1	1	0	0
East South Central States:								
Kentucky	78	126	46	35	144	8	0	0
Tennessee	42	6	40	37	28	87	1	2
Alabama [3]	36	49	103	65	52	51	1	0
Mississippi [3]	13	25					1	0

Footnotes at end of table.

Cases of certain communicable diseases reported by telegraph by State health officers for weeks ended Dec. 1, 1934, and Dec. 2, 1933—Continued

Division and State	Diphtheria		Influenza		Measles		Meningococcus meningitis	
	Week ended Dec. 1, 1934	Week ended Dec. 2, 1933	Week ended Dec. 1, 1934	Week ended Dec. 2, 1933	Week ended Dec. 1, 1934	Week ended Dec. 2, 1933	Week ended Dec. 1, 1934	Week ended Dec. 2, 1933
West South Central States:								
Arkansas	32	22	93	42	4	213	0	0
Louisiana	25	36	5	4	8	3	0	0
Oklahoma [3]	14	73	16	39	1	43	0	3
Texas [3]	83	305	117	139	11	19	1	1
Mountain States:								
Montana	12	3	-------	5	18	-------	0	0
Idaho	-------	-------	-------	1	4	5	1	0
Wyoming	-------	1	-------	-------	6	34	2	0
Colorado	7	3	-------	37	140	3	1	0
New Mexico	5	16	10	2	62	26	0	0
Arizona	4	8	28	21	17	3	0	0
Utah [3]	1	1	2	-------	9	75	1	0
Pacific States:								
Washington	3	9	-------	-------	131	113	0	0
Oregon	1	-------	18	14	10	22	1	0
California	45	38	28	57	111	162	1	2
Total	1,172	1,687	1,068	1,481	5,208	3,388	34	43

Division and State	Poliomyelitis		Scarlet fever		Smallpox		Typhoid fever	
	Week ended Dec. 1, 1934	Week ended Dec. 2, 1933	Week ended Dec. 1, 1934	Week ended Dec. 2, 1933	Week ended Dec. 1, 1934	Week ended Dec. 2, 1933	Week ended Dec. 1, 1934	Week ended Dec. 2, 1933
New England States:								
Maine	0	1	26	10	0	0	2	1
New Hampshire	0	0	8	22	0	0	1	0
Vermont	0	0	13	6	0	0	1	0
Massachusetts	0	1	127	171	0	0	1	1
Rhode Island	0	0	20	18	0	0	0	0
Connecticut	0	1	38	54	0	0	0	0
Middle Atlantic States:								
New York	3	5	371	380	0	0	11	5
New Jersey	0	0	90	133	0	0	8	6
Pennsylvania	2	6	289	494	0	0	13	23
East North Central States:								
Ohio	3	5	662	697	2	4	8	9
Indiana	0	1	176	198	3	2	4	7
Illinois	2	1	538	358	2	0	20	12
Michigan	4	0	168	203	1	3	9	6
Wisconsin	2	2	384	133	31	17	2	1
West North Central States:								
Minnesota	3	3	112	53	6	2	1	0
Iowa [3]	0	0	54	86	1	33	1	0
Missouri	0	0	104	163	2	1	16	10
North Dakota	1	0	49	37	1	0	0	1
South Dakota	0	0	13	11	14	0	0	0
Nebraska	0	1	28	23	4	2	2	5
Kansas	5	1	48	120	5	3	3	3
South Atlantic States:								
Delaware	0	0	5	5	0	0	0	3
Maryland [3]	1	3	86	96	0	0	5	5
District of Columbia	0	0	26	12	0	0	1	1
Virginia	0	0	99	133	0	0	17	13
West Virginia	0	2	152	151	0	1	15	6
North Carolina	0	0	73	156	0	0	7	3
South Carolina	0	0	10	21	0	0	3	9
Georgia [3 4]	0	0	28	22	0	0	4	9
Florida	0	0	6	4	0	0	1	2
East South Central States:								
Kentucky	1	0	76	142	1	0	15	14
Tennessee	0	0	76	120	1	0	12	12
Alabama [3]	0	2	33	46	0	2	2	11
Mississippi [3]	0	0	32	24	0	1	11	4

Footnotes at end of table.

Cases of certain communicable diseases reported by telegraph by State health officers for weeks ended Dec. 1, 1934, and Dec. 2, 1933—Continued

Division and State	Poliomyelitis		Scarlet fever		Smallpox		Typhoid fever	
	Week ended Dec. 1, 1934	Week ended Dec. 2, 1933	Week ended Dec. 1, 1934	Week ended Dec. 2, 1933	Week ended Dec. 1, 1934	Week ended Dec. 2, 1933	Week ended Dec. 1, 1934	Week ended Dec. 2, 1933
West South Central States:								
Arkansas	0	0	29	18	1	0	15	2
Louisiana	1	0	21	29	0	4	10	9
Oklahoma [4]	0	0	16	64	2	0	14	17
Texas [3]	4	3	41	152	5	6	50	33
Mountain States:								
Montana	0	1	8	16	0	0	0	0
Idaho	0	0	3	5	0	6	1	0
Wyoming	0	0	28	8	1	0	0	1
Colorado	1	1	121	38	1	10	13	1
New Mexico	1	1	19	26	0	0	6	7
Arizona	1	1	17	8	0	0	0	1
Utah [2]	0	1	28	11	1	0	0	0
Pacific States:								
Washington	9	0	32	24	33	1	6	5
Oregon	2	4	56	49	1	7	1	1
California	24	4	185	164	5	6	9	27
Total	70	51	4,624	4,914	124	111	321	286

[1] New York City only.
[2] Week ended earlier than Saturday.
[3] Typhus fever, week ended Dec. 1, 1934, 14 cases as follows: Georgia, 2; Alabama, 8; Texas, 4.
[4] Dengue: Georgia, 275 cases.
[5] Exclusive of Oklahoma City and Tulsa.

SUMMARY OF MONTHLY REPORTS FROM STATES

The following summary of cases reported monthly by States is published weekly and covers only those States from which reports are received during the current week:

State	Meningococcus meningitis	Diphtheria	Influenza	Malaria	Measles	Pellagra	Poliomyelitis	Scarlet fever	Smallpox	Typhoid fever
September 1934										
North Dakota	3	12	----	----	33	----	7	108	1	21
October 1934										
California	8	201	105	67	617	4	178	889	1	82
Mississippi	5	130	1,501	7,648	137	273	2	100	7	26
Nevada	1	3	8	----	----	----	3	8	0	3
North Dakota	0	14	1	----	161	----	1	92	1	4
Washington	1	8	28	1	454	----	128	226	93	24
Wisconsin	10	40	57	----	552	----	41	1,717	81	20

September 1934

North Dakota:	Cases
Chicken pox	23
Mumps	4
Undulant fever	1
Vincent's infection	9
Whooping cough	411

October 1934

Chicken pox:	
California	655
Mississippi	144
Nevada	10
North Dakota	45
Washington	269
Wisconsin	1,426
Dysentery:	
California (amoebic)	19
California (bacillary)	32
Mississippi (amoebic)	66
North Dakota (amoebic)	1
Washington (bacillary)	1
Wisconsin (amoebic)	1
Enteritis:	
Washington (under 2 years)	5
Washington (over 2 years)	8
Food poisoning:	
California	38
German measles:	
California	73
Washington	16
Wisconsin	228
Granuloma, coccidioidal:	
California	3
Hookworm:	
Mississippi	246
Impetigo contagiosa:	
Washington	3
Leprosy:	
California	1
Lethargic encephalitis:	
California	2
Washington	2
Mumps:	
California	392
Mississippi	148
North Dakota	4
Washington	115
Wisconsin	196
Ophthalmia neonatorum:	
California	2
Wisconsin	2
Paratyphoid fever:	
California	6
Washington	3
Psittacosis:	
California	2
Puerperal septicemia:	
Mississippi	60
Rabies in animals:	
California	61
Mississippi	5
Washington	6
Relapsing fever:	
California	6
Septic sore throat:	
California	19
Washington	4
Wisconsin	2
Tetanus:	
California	5
Trachoma:	
California	21
Mississippi	8
Trichinosis:	
California	10
Tularaemia:	
Wisconsin	6
Undulant fever:	
California	9
Wisconsin	7
Vincent's infection:	
North Dakota	8
Whooping cough:	
California	428
Mississippi	571
Nevada	2
North Dakota	211
Washington	111
Wisconsin	955

DENGUE IN SOUTHEASTERN STATES

During the week ended December 1, 1934, 275 cases of dengue were reported in the State of Georgia.

The following table shows the number of cases of dengue reported in Florida for the weeks ended November 17 and November 24, 1934:

Locality	County	Number of cases week ended—	
		Nov. 17, 1934	Nov. 24, 1934
Fort Lauderdale	Broward	2	
Jacksonville	Duval	1	3
Miami	Dade	5	7
Orlando	Orange	1	1
Tampa	Hillsborough	9	2
Total		18	13

WEEKLY REPORTS FROM CITIES

City reports for week ended Nov. 24, 1934

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								
Maine:											
Portland	0	------	0	0	0	4	0	0	0	3	13
New Hampshire:											
Concord	0	------	0	0	0	0	3	0	0	0	6
Nashua	1	------	0	0	0	2	0	0	0	0	--------
Vermont:											
Barre	0	------	0	0	0	0	0	0	0	0	6
Burlington	0	------	0	0	0	3	0	0	1	0	11
Massachusetts:											
Boston	6	------	0	4	17	36	0	4	0	46	213
Fall River	0	------	0	21	2	0	0	1	0	6	26
Springfield	0	------	0	8	1	3	0	0	0	0	21
Worcester	0	------	0	0	10	10	0	1	0	14	51
Rhode Island:											
Pawtucket	--------	------	0	--------	6	--------	--------	0	--------	--------	25
Providence	0	------	0	0	2	8	0	1	0	3	61
Connecticut:											
Bridgeport	0	------	0	1	2	8	0	1	0	0	35
Hartford	0	------	0	156	1	6	0	0	0	1	34
New Haven	0	------	1	1	0	0	0	0	1	1	30
New York:											
Buffalo	2	------	0	32	26	27	0	9	0	24	137
New York	34	41	9	29	142	124	0	68	8	290	1,475
Rochester	0	------	0	64	5	26	0	0	0	11	61
Syracuse	0	------	0	0	3	10	0	0	0	22	38
New Jersey:											
Camden	1	1	0	2	2	6	0	1	0	1	31
Newark	4	5	2	3	7	11	0	7	1	41	89
Trenton	1	------	0	0	1	16	0	3	1	0	35
Pennsylvania:											
Philadelphia	8	3	2	2	24	79	0	19	1	189	502
Pittsburgh	9	2	2	38	27	47	0	11	2	18	166
Reading	1	------	0	1	2	4	0	0	0	2	24
Ohio:											
Cincinnati	10	------	2	1	6	28	0	5	0	4	147
Cleveland	9	25	0	2	8	40	0	5	1	33	161
Columbus	11	------	0	15	4	35	0	2	0	1	77
Toledo	1	------	0	13	3	23	0	4	1	7	63
Indiana:											
Fort Wayne	9	------	0	1	4	1	0	1	0	0	25
Indianapolis	5	------	1	2	14	32	0	5	0	16	--------
South Bend	0	------	0	34	0	1	0	0	0	1	12
Terre Haute	1	------	0	0	3	1	0	0	0	0	21
Illinois:											
Chicago	19	8	3	40	65	236	0	40	2	48	709
Springfield	1	------	0	1	2	0	0	1	0	5	17
Michigan:											
Detroit	10	5	0	17	22	75	0	11	2	55	220
Flint	0	------	0	4	3	24	0	1	0	8	43
Grand Rapids	1	------	0	1	0	15	0	0	0	1	32
Wisconsin:											
Kenosha	0	------	0	3	0	7	0	0	0	12	9
Milwaukee	0	------	0	39	5	210	1	4	0	96	84
Racine	0	------	0	1	0	10	0	1	0	8	9
Superior	0	------	0	0	0	1	0	0	0	0	7
Minnesota:											
Duluth	0	------	0	45	0	2	0	2	0	0	23
Minneapolis	3	------	0	93	7	21	0	2	0	13	101
St. Paul	0	1	1	0	9	8	0	0	0	7	63
Iowa:											
Davenport	0	------	--------	1	--------	0	0	--------	0	0	--------
Des Moines	2	------	--------	0	--------	10	0	--------	0	0	30
Sioux City	1	------	0	1	0	1	0	0	0	3	0
Waterloo	3	------	0	102	0	3	0	0	0	0	1
Missouri:											
Kansas City	1	------	1	1	15	6	0	3	0	7	91
St. Joseph	4	------	0	2	3	1	0	0	0	0	30
St. Louis	23	------	0	6	12	26	0	6	4	14	207
North Dakota:											
Fargo	0	------	0	0	1	8	0	0	0	9	9
Grand Forks	0	------	--------	0	--------	7	1	--------	0	1	--------
South Dakota:											
Aberdeen	0	------	--------	0	--------	3	2	--------	0	16	--------
Sioux Falls	0	------	--------	0	--------	1	0	--------	0	0	--------

City reports for week ended Nov. 24, 1934—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								
Nebraska:											
Omaha	9		0	0	4	17	0	0	0	1	44
Kansas:											
Topeka											
Wichita	1		0	2	2	3	0	0	0	1	30
Delaware:											
Wilmington	0		0	0	5	2	0	1	0	6	38
Maryland:											
Baltimore	4	3	1	1	12	44	0	16	0	37	197
Cumberland	0		0	0	1	8	0	0	0	0	12
Frederick	1		0	0	0	0	0	1	0	0	2
Dist. of Columbia:											
Washington	15	1	1	1	17	24	0	13	0	9	161
Virginia:											
Lynchburg	3		0	3	0	7	0	0	0	3	13
Norfolk	2		0	0	4	9	0	1	0	9	39
Richmond	4		0	0	5	2	0	3	2	2	59
Roanoke	5			0		9	0		0	0	19
West Virginia:											
Charleston	3		0	1	1	2	0	0	0	0	8
Huntington	1			0		2	0		0	0	
Wheeling	0		1	1	3	16	0	0	1	10	14
North Carolina:											
Raleigh											
Wilmington	2		0	0	3	2	0	0	0	0	13
Winston-Salem	4		0	0	2	6	0	1	0	17	17
South Carolina:											
Charleston	0	22	0	0	1	5	0	2	0	0	24
Columbia	0		0	0	3	0	0	0	0	0	9
Greenville	0		0	0	2	1	0	0	0	0	17
Georgia:											
Atlanta	4	4	0	0	8	8	0	3	0	8	93
Brunswick	0		0	0	2	2	0	0	0	0	7
Savannah	0	2	0	0	4	0	0	1	0	0	37
Florida:											
Miami	10		0	0	4	0	0	0	0	0	24
Tampa	4		0	0	4	3	0	0	0	0	37
Kentucky:											
Ashland	0		0	0	0	1	0	0	1	0	0
Lexington	6	7	0	0	2	6	0	2	2	2	21
Louisville	16		3	0	5	23	0	1	1	3	89
Tennessee:											
Memphis	10		1	0	1	5	0	6	1	11	76
Nashville	2		1	0	4	11	0	5	0	4	54
Alabama:											
Birmingham	3	2	1	1	7	7	0	4	1	5	78
Mobile	1		3	0	3	0	0	1	0	0	26
Montgomery	2	1		0		0	0		0	0	
Arkansas:											
Fort Smith	1			0		1	0		0	2	
Little Rock	1		0	0	0	1	0	1	0	0	1
Louisiana:											
New Orleans	22	3	3	3	7	10	0	10	2	0	160
Shreveport	1		0	0	3	0	0	0	0	0	22
Oklahoma:											
Oklahoma City	0	10	1	0	5	1	0	3	0	0	59
Texas:											
Dallas	11		0	0	4	0	0	4	1	1	63
Fort Worth	3		0	0	2	8	0	1	3	0	41
Galveston	11		0	0	3	5	0	1	0	0	15
Houston	16		0	0	7	4	0	3	1	0	70
San Antonio	2		1	0	8	1	0	6	0	0	53
Montana:											
Billings	3		0	10	0	0	0	0	0	0	7
Great Falls	0		0	0	1	0	0	1	0	0	11
Helena	0		0	0	0	1	0	0	0	0	2
Missoula	0		0	0	0	0	0	0	0	8	4
Idaho:											
Boise	0		0	0	1	1	0	0	0	0	6
Colorado:											
Denver	6	49	0	87	4	135	1	2	0	0	81
Pueblo	2		0	0	0	3	0	0	0	0	7
Utah:											
Salt Lake City	0		0	9	3	29	0	1	0	28	40
Nevada:											
Reno	0		0	0	0	0	0	1	0	0	6

City reports for week ended Nov. 24, 1934—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								
Washington:											
Seattle	4			1	8	6	2	7	2	3	90
Spokane	0		0	9	3	3	0	0	0	2	28
Tacoma	0		2	0	4	2	18	0	0	0	37
Oregon:											
Portland	0		0	1	3	18	0	0	0	1	64
Salem	0	1		0		0	0		0	0	
California:											
Los Angeles	16	19	1	8	13	33	0	20	0	3	285
Sacramento	0		0	1	3	9	0	1	1	2	21
San Francisco	2	2	0	2	14	11	0	12	0	12	178

State and city	Meningococcus meningitis		Poliomyelitis cases	State and city	Meningococcus meningitis		Poliomyelitis cases
	Cases	Deaths			Cases	Deaths	
New York:				Kentucky:			
New York	5	2	0	Lexington	0	0	2
Pennsylvania:				Alabama:			
Philadelphia	2	1	0	Birmingham	1	0	0
Ohio:				Oklahoma:			
Cleveland	0	0	1	Oklahoma City	0	1	0
Indiana:				Texas:			
Indianapolis	0	0	1	Houston	0	0	1
Illinois:				Washington:			
Chicago	3	0	0	Seattle	0	0	2
Michigan:				Spokane	0	0	1
Detroit	0	0	3	Tacoma	0	0	2
Minnesota:				Oregon:			
Duluth	0	0	1	Portland	1	0	1
Minneapolis	0	0	1	California:			
Missouri:				Los Angeles	0	0	9
Kansas City	1	0	0	Sacramento	0	0	1
St. Louis	1	0	0				
Maryland:							
Baltimore	0	0	2				

Dengue.—Cases: Atlanta, 1; Savannah, 6; Miami, 7; Tampa, 1.
Lethargic encephalitis.—Cases: New York City, 3; Springfield, Ill., 1; Minneapolis, 1; St. Louis, 1.
Pellagra.—Cases: Baltimore, 2; Washington, D. C., 2; Dallas, 1; San Francisco, 1.
Typhus fever.—Cases: Baltimore, 1; Charleston, S. C., 2; Dallas, 1.

FOREIGN AND INSULAR

CANADA

Provinces—Communicable diseases—2 weeks ended November 17, 1934.—During the 2 weeks ended November 17, 1934, cases of certain communicable diseases were reported by the Department of Pensions and National Health of Canada, as follows:

Disease	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	Total
Cerebrospinal meningitis			1	1	1	1	1			5
Chicken pox		9	15	326	653	168	303	68	164	1,706
Diphtheria		5	11	72	24	54	16	1		183
Dysentery				13	2				3	18
Erysipelas		1		12	2	4	1	2	1	23
Influenza		10		16	5		10		14	55
Measles	1	1,356	591	371	141	102	87	4	8	2,661
Mumps					183	9	11	5	41	249
Paratyphoid fever					3			1		4
Pneumonia		4			14		3		4	25
Poliomyelitis				4	12		2	1	2	21
Scarlet fever	3	21	52	337	284	64	35	31	65	892
Smallpox								2		2
Trachoma					2		12		5	19
Tuberculosis			15	114	112	26	8	1	34	310
Typhoid fever	1	2	15	58	37	2	1	3	6	125
Undulant fever					1		8			9
Whooping cough		22	9	325	258	24	56	6	34	734

CZECHOSLOVAKIA

Communicable diseases—September 1934.—During the month of September 1934, certain communicable diseases were reported in Czechoslovakia, as follows:

Disease	Cases	Deaths	Disease	Cases	Deaths
Anthrax	3		Malaria	290	
Cerebrospinal meningitis	3	2	Paratyphoid fever	23	
Chicken pox	52		Poliomyelitis	9	1
Diphtheria	2,892	206	Puerperal fever	45	22
Dysentery	257	38	Scarlet fever	2,660	22
Influenza	11	1	Trachoma	111	
Lethargic encephalitis	1		Typhoid fever	724	45

YUGOSLAVIA

Communicable diseases—October 1934.—During the month of October 1934, certain communicable diseases were reported in Yugoslavia, as follows:

Disease	Cases	Deaths	Disease	Cases	Deaths
Anthrax	67	2	Poliomyelitis	5	1
Cerebrospinal meningitis	9	3	Scarlet fever	609	7
Diphtheria and croup	1,823	173	Sepsis	11	3
Dysentery	863	104	Tetanus	64	21
Erysipelas	195	7	Typhoid fever	1,824	181
Measles	1,176	41	Typhus fever	31	2
Paratyphoid fever	44	2			

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

(NOTE.—A table giving current information of the world prevalence of quarantinable diseases appeared in the PUBLIC HEALTH REPORTS for Nov. 30, 1934, pp. 1438-1452. A similar cumulative table will appear in the PUBLIC HEALTH REPORTS to be issued Dec. 28, 1934, and thereafter, at least for the time being, in the issue published on the last Friday of each month.)

Cholera

India—Negapatam.—During the week ended November 3, 1934, one fatal imported case of cholera was reported at Negapatam, India.

Plague

Argentina—Santa Fe.—A newspaper report of November 23, 1934, states that one case of bubonic plague occurred on November 22, 1934, in the western zone of Santa Fe city, Argentina. No official report of this case has been received.

Egypt—Asyut Province.—During the week ended November 24, 1934, 2 cases of plague, with 2 deaths, were reported in Asyut Province, Egypt.

Hawaii Territory—Hawaii Island—Hamakua District—Kalopa Homesteads.—Two plague-infected rats, 1 on November 19 and 1 on November 21, 1934, have been reported at Kalopa Homesteads, Hamakua District, Island of Hawaii, Hawaii Territory.

Morocco—Tangier.—For the period October 30 to November 7, 1934, 7 cases of plague, with 2 deaths, were reported in Tangier, Morocco. All sanitary measures have been taken.

Typhus fever

Egypt—Port Said.—On November 18, 1934, one case of typhus fever was reported at Port Said, Egypt.

Yellow fever

Colombia—Restrepo.—A report dated November 28, 1934, states that three deaths from yellow fever have occurred at Restrepo, Intendencia of Meta, Colombia, a distant region of the interior and difficult of access.

Gambia—St. Marys Island.—On November 12, 1934, two suspected cases of yellow fever were reported in St. Marys Island, Gambia.

Gold Coast—Saltpond District—Kokobee.—On November 21, 1934, one case of yellow fever was reported at Kokobee, Saltpond District, Gold Coast.

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