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PTEROYLGLUTAMIC ACID ("FOLIC ACID"), LIVER EXTRACT, AND AMINO ACIDS IN THE TREATMENT OF GRANULOCYTOPENIA IN RATS [1]

By Floyd S. Daft, *Senior Scientist (Biochemist), United States Public Health Service*

Kornberg, Daft and Sebrell (*1*) reported that weanling rats given a protein-free diet became leucopenic, granulocytopenic, and anemic. A few similar animals receiving diets containing 4 percent or 8 percent of casein as the sole source of protein developed white cell dyscrasias only. Employing rats which had become granulocytopenic on a protein-free diet, these investigators showed that prompt and substantial granulocyte responses could be elicited by treatment of the animals for 4 days with a combination of protein (casein) and pteroylglutamic acid (PGA, "folic acid"). Animals treated for the same length of time with PGA alone gave only small and irregular responses while those treated for a similar period with casein did not respond. (Of the animals treated with casein but not with PGA, none survived longer than 8 days). Kornberg (*2*), again employing rats which had become granulocytopenic on a protein-free diet, extended the therapeutic studies by substituting amino acids for casein. He demonstrated that all of the 10 amino acids deemed essential for the rat (*3*) are needed by these animals (in addition to PGA) for maximum and consistent granulocyte responses, although the omission of arginine did not completely eliminate the activity of the amino acid mixture.

Daft (*4*), in a preliminary note, reported some results of therapy of rats which had become granulocytopenic while receiving a diet containing 4 percent of casein (rather than a protein-free diet as in the earlier experiments). These animals gave leucocyte and granulocyte responses when treated either with PGA, purified liver extract, casein, or a mixture of the 10 "essential" amino acids. Hematocrit and weight responses, also, followed the administration of the casein or of the amino acid mixture (but not the administration of the PGA or liver extract). It was concluded from the data presented that the

[1] From the National Institute of Health.

rat is able to synthesize PGA, some factor other than PGA which is present in purified liver extract, or both of these substances, and that this synthesis is dependent upon or is influenced by the protein or amino acid content of the diet.

The present report is an elaboration and extension of the earlier note (*4*). Some progress has been made in the elucidation of the relationship of amino acid and vitamin deficiencies to the development of blood dyscrasias and in the explanation of the interchangeability of PGA, a factor in liver extract, and amino acids in successful therapy of granulocytopenic animals.

EXPERIMENTAL

Albino rats of the Wistar, Sprague-Dawley, or Osborne and Mendel strain at weaning or within a week thereafter were placed on a low-protein diet which consisted of "vitamin-free" casein (GBI) 4 percent, Crisco 8 percent, salt mixture No. 550 (*5*) 4 percent, $FeSO_4 7H_2O$ 0.18 percent, $CuSO_4 5H_2O$ 0.02 percent and dextrose 83.8 percent.[2] Into each 100 grams of diet were incorporated 1 mg. of thiamine hydrochloride, 2 mg. of riboflavin, 2 mg. of calcium pantothenate, 1 mg. of pyridoxine hydrochloride, and 200 mg. of choline chloride. Each rat received a supplement twice weekly of 0.25 ml. of corn oil containing 2000 units of vitamin A and 400 units of vitamin D (Natola).

After the rats had received this low-protein diet for variable periods of time (determined in each case by the weight behaviour and clinical condition of the animal), hematocrit determinations and total leucocyte and polymorphonuclear granulocyte counts were made on tail blood by techniques which have been described (*6*), and were repeated at irregular intervals until the animals were found to be granulocytopenic. (For this study, rats with counts of no more than 250 [3] polymorphonuclear granulocytes per cu. mm. were considered to be granulocytopenic.) Treatment was then initiated, and the effect on the blood values was followed by appropriate determinations after 4 and 10 days of therapy, respectively.[4] In many cases, additional determinations were made after 16, 22, 30, 40, and 50 days, treatment being continued in all instances. The animals were weighed routinely twice weekly and also at the beginning and end of each treatment period.

[2] Two groups of rats (see table 1, lines 21 and 22) were given diets with amino acid mixtures replacing a small portion of the dextrose. These diets were designed to be deficient in methionine and tryptophane, and methionine, tryptophane, and threonine, respectively. The composition of the amino acid mixtures is given in a footnote to table 1.

[3] On occasion, as noted in table 1, animals with slightly higher counts were employed.

[4] In a few instances, after 5 instead of 4, and 9 or 11 instead of 10 days of treatment.

RESULTS

The effects of various dietary changes on the levels of circulating leucocytes and polymorphonuclear granulocytes are summarized in table 1. For convenience, the response levels of granulocytes have been divided somewhat arbitrarily into four categories; from 0 to 450, from 500 to 950, from 1000 to 1950, and 2000 or more granulocytes per cu. mm. It appears probable that an increase to 1000 or more granulocytes per cu. mm. represents a definite, although not necessarily maximum, response and the fraction of treated animals attaining this level is given therefore in a separate column in the table.

The responses of individual rats to any given form of dietary therapy, proved to be extremely variable. As may be seen from table 1, responses to a single therapeutic regime were often distributed between all four response categories. Even where the responses lay almost entirely within one category (see line 14 of table 1) the variations in the individual figures were large (from 1,500 to 25,600 polymorphonuclear granulocytes per cu. mm. in the example chosen).

During treatment with PGA or liver extract, the granulocyte levels did not greatly increase (except in occasional animals) after the first 4 days of therapy.

No untreated controls are listed in the table. It may be stated, however, that observations have been made of a great many untreated or inadequately treated granulocytopenic animals and that very few have shown spontaneous remissions. All have died, usually within a few days.

It will also be noted from table 1 that niacinamide was given concomitantly in most tests of PGA and of liver extract. Niacinamide itself had little or no effect on the granulocyte level of these animals (see line 1, table 1) yet when given to animals which became granulocytopenic while receiving PGA, it appeared to exert some therapeutic benefit (see line 2, table 1). Since the liver extract employed (Lederle's 15-unit, injectable) contained niacin,[5] and in order to obtain comparable results, niacinamide was given as indicated during these therapeutic tests.

From the results given in table 1, it appears that:

(1) The administration of niacinamide alone had little effect (line 1). Some animals which became granulocytopenic while receiving PGA, however, appeared to respond when niacinamide was given in addition (line 2).

(2) The administration of PGA with or without niacinamide caused granulocyte responses in half or more of the animals so treated (lines 3, 4, and 5).

[5] Microbiological assays kindly run by Dr. James Hundley indicated approximately 2.8 mg. of niacin per ml. in the lot tested.

TABLE 1.—*Granulocyte responses following dietary therapy*

Material	Amount given (daily)	Route [2]	Number rats	Response pattern: After 4 days: 0–450	500–950	1,000–1,950	2,000 or more	1,000 or more	After 10 days [1]: 0–450	500–950	1,000–1,950	2,000 or more	1,000 or more	Average responses: Average number leucocytes per cu. mm.: Before treatment	After 4 days	After 10 days	Average number polymorphonuclear granulocytes per cu. mm.: Before treatment	After 4 days	After 10 days
				Granulocytes per cu. mm.					Granulocytes per cu. mm.										
1. Niacinamide	10 mg	O	11	9	1	0	1	1/11	3	3	0	0	0/6	3,800	3,990	3,560	110	450	480
2. Niacinamide [3] (with and following PGA).	10 mg	O	[3] 13	4	4	5	0	5/13	0	4	2	0	2/6	4,740	4,920	5,130	270	750	940
3. PGA	100 μg	O	10	1	4	2	3	5/10	0	5	2	3	5/10	4,930	10,540	6,400	130	4,510	1,470
4. PGA [4] (with and following niacinamide).	100 μg	O	13	1	4	6	2	8/13	2	3	4	3	7/12	4,640	7,760	6,460	100	1,270	1,180
5. PGA	100 μg	O	20	3	4	6	7	13/20	3	2	2	5	7/12	2,590	7,360	7,680	100	2,190	3,150
and niacinamide	10 mg	O																	
6. PGA	2 μg	O	10	3	3	1	3	4/10	1	2	1	3	4/7	3,240	6,550	6,380	80	1,580	1,870
and niacinamide	10 mg	O																	
7. PGA	2 μg	P	10	1	1	7	1	8/10	0	3	3	2	5/8	3,860	7,110	7,240	140	1,400	1,680
and niacinamide	10 mg	O																	
8. PGA	0.5 μg	P	10	2	6	1	1	2/10	2	2	3	0	3/7	3,720	5,260	6,130	130	810	760
and niacinamide	10 mg	O																	
9. Liver extract [5]	0.2 ml	O	10	2	6	2	0	2/10	----	----	----	----	----	3,710	5,170	----	140	720	----
and niacinamide	10 mg	O																	
10. Liver extract [5]	0.2 ml	P	10	1	3	4	2	6/10	1	2	2	0	2/5	4,750	6,710	5,620	150	1,420	780
and niacinamide	10 mg	O																	
11. Liver extract [5]	0.05 ml	P	10	4	3	3	0	3/10	1	2	2	2	4/7	4,390	6,060	6,100	100	810	1,460
and niacinamide	10 mg	O																	
12. Methionine	0.5 percent of diet	----	7	5	1	0	1	1/7	2	1	0	1	1/4	3,910	4,230	4,360	100	700	820
Threonine	0.5 percent of diet	----																	
and niacinamide	10 mg	O																	
13. Methionine	0.5 percent of diet	----	10	0	1	3	6	9/10	0	0	0	10	10/10	3,140	9,320	7,600	120	3,460	2,900
Threonine	0.5 percent of diet	----																	
and PGA	100 μg	O																	
14. Methionine	0.5 percent of diet	----	10	0	0	1	9	10/10	0	0	0	9	9/9	2,640	14,880	14,210	140	6,860	7,330
Threonine	0.5 percent of diet	----																	
PGA	100 μg	O																	
and niacinamide	10 mg	O																	
15. Methionine	0.5 percent of diet	----	8	2	1	3	2	5/8	1	1	1	5	6/8	3,370	6,880	7,000	140	1,420	2,910
Threonine	0.5 percent of diet	----																	
Liver extract, [5]	0.2 ml	P																	
and niacinamide	10 mg	O																	

16. Casein	87.3 percent of diet		[6] 7	1	2	3	1	4/7	0	0	5	2	7/7	4,130	6,520	7,660	220	1,480	2,110
17. "Essential" amino acids [7]			[8] 5	3	2	0	0	0/5	1	2	2	0	2/5	5,760	7,100	6,140	210	380	950
18. Same—substituted for casein.[9]			[10] 6	3	3	0	0	0/6	1	2	2	1	3/6	7,430	8,800	8,630	230	380	1,390
19. 5 amino acids [11]			21	21	0	0	0	0/21	6	0	2	2	4/10	3,450	2,990	4,280	140	140	740
20. Casein [12] and 3 amino acids	8 percent of diet		6	3	2	1	0	1/6	0	0	4	1	5/5	3,300	4,190	6,810	210	510	1,500
Methionine-, and tryptophane-deficient diets [13]																			
21. PGA or	100 μg [14]	O																	
PGA	100 μg	O	14	0	3	6	5	11/14	2	4	3	2	5/11	4,240	7,730	7,050	170	1,900	1,740
and niacinamide	10 mg	O																	
Methionine-, tryptophane-, and threonine-deficient diets [15]																			
22. PGA or	100 μg [16]	O																	
PGA	100 μg	O	8	4	4	0	0	0/8	3	2	0	0	0/5	3,620	3,990	4,010	190	450	470
and niacinamide	10 mg	O																	

[1] Some animals died between the 4th and 10th day of therapy; a few were discarded after the 4th day.

[2] O=oral; P=parenteral.

[3] These animals became definitely or moderately granulocytopenic while receiving PGA, administration of which was continued during the period of niacinamide therapy. Seven of the 13 animals began the treatment period with granulocyte counts ranging from 300 to 400 cells per cu. mm.

[4] These animals became granulocytopenic while receiving niacinamide, administration of which was continued during the period of PGA therapy.

[5] Lederle's 15 unit injectable liver extract. Each of the lots used contained approximately 1 μg. of PGA per ml. as indicated by microbiological assay. (These assays were kindly performed by Miss Laura Stewart.) Tests of the liver extract on rats which became granulocytopenic while receiving succinyl sulfathiazole also indicated no more that 1 μg. of PGA per ml.

[6] Three of these 7 animals began the treatment period with granulocyte counts of 300, 350 and 400 cells per cu. mm., respectively.

[7] Two percent each of l-arginine monohydrochloride, l-histidine monohydrochloride H_2O, dl-isoleucine, dl-leucine, l-lysine monohydrochloride, dl-methionine, dl-phenylalanine, dl-threonine, dl-tryptophane and dl-valine and 2.4 percent of sodium bicarbonate substituted for 22.4 percent of the glucose of the basal diet.

[8] One of these 5 animals began the treatment period with a granulocyte count of 400 cells per cu. mm.

[9] Same as described under footnote 7 except that glucose was substituted for the 4 percent of casein.

[10] Two of these 6 animals began the treatment period with granulocyte counts of 300 and 400 cells per cu. mm., respectively.

[11] 0.5 percent dl-methionine, 0.2 percent of dl-tryptophane, 0.5 percent of dl-threonine, 0.25 percent of dl-phenylalanine and 0.75 percent of dl-isoleucine substituted for equivalent amounts of glucose in the basal diet.

[12] The casein was increased from 4 percent to 8 percent and 0.9 percent of dl-methionine, 0.5 percent of dl-tryptophane and 0.7 percent of dl-phenylalanine added. To compensate, the glucose was reduced to 77.7 percent.

[13] The methionine and tryptophane deficiencies were accentuated by replacing equivalent amounts of glucose with l-lysine monohydrochloride 0.30 percent, dl-phenylalanine 0.16 percent, dl-threonine 0.26 percent, dl-leucine 0.32 percent, dl-isoleucine 0.44 per cent, dl-valine 0.34 percent and sodium bicarbonate 0.14 percent.

[14] Six of the animals were treated with PGA and 8 were treated with PGA plus niacinamide. Responses were similar and are reported together.

[15] Same as described under footnote 13 except that the threonine was omitted.

[16] Two of the animals were treated with PGA and six were treated with PGA plus niacinamide. Responses were similar and are reported together.

(3) The incidence and magnitude of these responses were increased by the simultaneous administration of methionine and threonine (lines 13 and 14).

(4) The administration of liver extract (with niacinamide) also caused granulocyte responses. Since the liver extract contained only about 1 μg. of PGA per ml. (see footnote 5, table 1), it appears that its activity was approximately 10 times as great as could be accounted for on the basis of its PGA content (see lines 6, 7, 8, 9, 10, and 11). The remainder of the activity may possibly have been due to the anti-pernicious-anemia substance which the extract contained.

(5) The administration of casein (line 16), a mixture of the 10 "essential" amino acids (lines 17 and 18), a mixture of 5 of these amino acids (line 19) or a combination of a small amount of casein and 3 amino acids (line 20) caused definite granulocyte responses. In the case of the amino acid mixtures the responses were in general slow. The results of only the first 10 days of treatment are shown in the table. On continued treatment, all but 1 of the 11 rats receiving the 10 essential amino acids reached granulocyte levels of 1,000 cells per cu. mm. Two additional animals receiving the mixture of 5 amino acids responded similarly.

Weight and hematocrit responses during the first 10 days of therapy were frequently erratic and are therefore not included in table 1. Some data for longer periods of treatment are presented in table 2. It will be noted that treatment with PGA had little effect on these values in these animals while treatment with casein, with the essential amino acids or with certain amino acid-vitamin combinations resulted in both weight and hematocrit responses.

TABLE 2.—*Weight and hematocrit responses following dietary therapy*

Treatment	Number of rats	Average weight				Average hematocrit values			
		0 days	16 days	30 days	50 days	0 days	16 days	30 days	50 days
PGA 100 mg. daily	5	41	------	38	------	38.1	------	31.1	------
Methionine 0.5 percent of diet Threonine 0.5 percent of diet Niacinamide 10 mg. daily	3	32	------	------	47	28.6	------	------	39.0
Methionine 0.5 percent of diet Threonine 0.5 percent of diet PGA 100 μg daily	4	54	------	------	63	39.3	------	------	42.8
Methionine 0.5 percent of diet Threonine 0.5 percent of diet PGA 100 μg daily Niacinamide 10 mg. daily	7	40	------	------	63	31.1	------	------	39.2
Methionine 0.5 percent of diet Threonine 0.5 percent of diet Liver extract 0.2 ml. daily Niacinamide 10 mg. daily	7	32	------	------	65	33.7	------	------	42.2
Casein 87.3 percent of diet	6	31	67	------	------	28.3	41.1	------	------
Essential [1] amino acids	4	34	------	------	113	37.5	------	------	41.8
Same-substituted [2] for casein	5	41	------	------	106	32.6	------	------	43.7
5 amino acids [3]	4	39	------	------	63	33.7	------	------	34.5

[1] See footnote 7, table 1.
[2] See footnote 9, table 1.
[3] See footnote 11, table 1.

DISCUSSION

It is noteworthy that pteroylglutamic acid, another factor (or factors) present in liver extract, and certain amino acids are to a degree interchangeable in the correction of granulocytopenia in rats. It appears most unlikely that each of these substances can perform an identical or similar metabolic function in the animal body. A more probable explanation appears to be (a) that the vitamins in question can be synthesized by animal tissues, (b) that specific amino acids are used in these processes and (c) that when one or the other vitamin is supplied in the diet, the amounts of the specific amino acids which would have been used in the processes involved in synthesizing this factor are spared and are therefore available for other metabolic needs of the animal. It is obvious that if two vitamins were each capable of sparing, in this way, the same amino acid or acids, then, under appropriate circumstances, deficiency signs might be observed which could be corrected by either of the two vitamins or by the amino acid or acids in question. The illusion would thus be created that the two vitamins had similar functions in intermediate metabolism. The more nearly identical the kinds and amounts of amino acids which the two vitamins could spare, the more convincing would be the illusion.

Little information concerning specific amino acids which might be spared by the administration of PGA or liver extract can be given at the present time. Tryptophane-deficient animals develop blood dyscrasias which may be corrected partially or completely by niacin, liver extract (which however contains niacin) or PGA.[6] This fact might be interpreted as implicating tryptophane. It is perhaps noteworthy, also, that granulocytopenic animals deficient in methionine, tryptophane and threonine fail to respond as well to PGA or PGA plus niacinamide as similar animals not deficient in threonine (table 1, lines 21 and 22), and that threonine (plus methionine) enhances the therapeutic activity of PGA (lines 13 and 14). This suggests that PGA spares little or no threonine. Further work along similar lines is in progress.

If the general concept which has been outlined is correct it may of course apply to a great many situations which have been studied in this laboratory and elsewhere. The well-known interchangeability of PGA and the anti-pernicious-anemia factor in correcting the anemia and granulocytopenia of pernicious anemia is one example and the interchangeability of PGA and niacin mentioned in the preceding paragraph is a second. The same concept may also apply, at times, to cases involving other common deficiency signs.

[6] Daft, Floyd S. and Hundley, James: Unpublished results.

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SUMMARY

Weanling rats given a diet containing 4 percent of casein as the sole source of protein became anemic, leucopenic, and granulocytopenic. Treatment of such animals with pteroylglutamic acid or with 15-unit liver extract was followed by increases in the level of circulating white cells. The simultaneous administration of methionine and threonine increased the incidence and magnitude of these responses. The activity of the liver extract could not be accounted for on the basis of its pteroylglutamic acid content and may have been due, therefore, to the anti-pernicious-anemia substance which it contains. The administration of casein, a mixture of the 10 essential amino acids or certain other protein-amino acid mixtures resulted in granulocyte, hematocrit and weight responses.

The relationship of amino acid and vitamin deficiencies to the development of blood dyscrasias and the interchangeability of certain of these substances in the therapy of granulocytopenic animals are discussed.

REFERENCES

(1) Kornberg, Arthur; Daft, Floyd S., and Sebrell, W. H.: Granulocytopenia and anemia in rats fed diets of low casein content. Science, **103:** 646 (1946).
(2) Kornberg, Arthur: Amino acids in the production of granulocytes in rats. J. Biol. Chem., **164:** 203 (1946).
(3) Rose, W. C.: The nutritive significance of the amino acids. Physiol. Rev., **18:** 109 (1938).
(4) Daft, Floyd S.: Synthesis of B vitamins by the rat. Fed. Proc., **6:** 405 (1947).
(5) Spicer, S. S.; Daft, Floyd S.; Sebrell, W. H., and Ashburn, L. L.: Prevention and treatment of agranulocytosis and leukopenia in rats given sulfanilylguanidine or succinyl sulfathiazole in purified diets. Pub. Health Rep., **57:** 1559 (1942).
(6) Daft, Floyd S.; Kornberg, Arthur; Ashburn, L. L., and Sebrell, W. H.: Anemia and granulocytopenia in rats fed a diet low in pantothenic acid. Pub. Health Rep., **60:** 1201 (1945).

DEATHS DURING WEEK ENDED NOV. 29, 1947

[From the Weekly Mortality Index, issued by the National Office of Vital Statistics]

	Week ended Nov. 29, 1947	Corresponding week 1946
Data for 93 large cities of the United States:		
Total deaths	8,952	8,588
Median for 3 prior years	9,406	
Total deaths, first 48 weeks of year	439,496	432,098
Deaths under 1 year of age	646	728
Median for 3 prior years	678	
Deaths under 1 year of age, first 48 weeks of year	35,171	31,859
Data from industrial insurance companies:		
Policies in force	67,036,867	67,331,042
Number of death claims	10,914	10,587
Death claims per 1,000 policies in force, annual rate	8.5	8.2
Death claims per 1,000 policies, first 48 weeks of year, annual rate	9.2	9.4

A SERUM PROTECTION TEST IN TULAREMIC INFECTIONS IN WHITE RATS [1]

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Previous studies demonstrated that white rats possess some resistance to infection with *Pasteurella tularensis* (*1*, *2*) and that this resistance can be enhanced by administration of suitable vaccines (*2*, *3*). These observations suggested that white rats might be employed as test animals to determine whether or not specific antitularense serum contains protective antibodies.

The data presented here show that specific immune serums possess antibodies capable of protecting white rats against experimental tularemic infections. The protective capacity of immune serum is manifested by an increase in the length of time elapsing between administration of the infective dose and occurrence of death, and by a decreased mortality rate among groups of rats treated with immune serum as compared to groups of rats receiving normal serum.

Francis and Felton (*4*) presented evidence of the ineffectiveness of specific immune serum to protect mice against infection with *P. tularensis*. Mice, guinea pigs, and rabbits are, however, uniformly highly susceptible to tularemia and a fatal infection develops when an infection is established in these animals. It would appear, therefore, that attempts to evaluate the protective capacity of specific antitularense serums might better be made in animals which possess some resistance to infection rather than in highly susceptible hosts.

MATERIALS AND METHODS

The white rats employed in these experiments were obtained from the animal colony maintained at the National Institute of Health. Animals weighing from 90 to 125 grams were selected without regard to sex.

Fully virulent strains of *P. tularensis* were employed to infect the animals. The virulence of the cultures was determined frequently by inoculation of mice and rabbits with serial tenfold dilutions of suspensions of organisms in 0.85 percent salt solution. Subcultures were obtained from rabbits which succumbed to the infection, and these were employed as the infective material. A fully virulent culture may be defined as one which, when diluted to the end point, causes death of inoculated rabbits and mice regardless of the difference in weight of the two hosts.

Serums were obtained from various sources and include serums from rabbits immunized with formalinized suspensions of infected yolk sac, formalinized allantoic fluid from infected eggs, or with saline suspensions of killed *P. tularensis* grown on glucose cystine blood agar, and

[1] From the Division of Infectious Diseases, National Institute of Health.

serums from goats immunized with killed suspensions of this organism. A sample of antitularense horse serum kindly furnished by Dr. Lee Foshay of the University of Cincinnati was studied. A series of serums from a human given two subcutaneous injections of an ether-extracted vaccine was studied. A number of serums from human cases of tularemia were also employed. Control serums consisted of normal human serum, normal rabbit serum, and serum from a human case of brucellosis.

In general the test was performed as follows: A fully virulent strain of *P. tularensis* was grown on the slanted surface of glucose-cystine-blood agar for 24 hours at 37° C. The growth was then removed and suspended in 0.85 percent salt solution; the organisms evenly distributed in the salt solution by repeated aspiration into a pipette, and the suspension adjusted to a density which, by experience, corresponded to about 10^8 organisms per cc. Serial tenfold dilutions were made in saline to an endpoint of 10^{-10} and five mice each were injected intraperitoneally with 0.5 cc. of each dilution from 10^{-5} to 10^{-10} in order to determine the infective titer of the original bacterial suspension. The serum-organism mixtures were made by mixing 4.4 cc. of salt solution and 1.0 cc. of serum in a conical container and adding to the diluted serum 0.6 cc. of either the 10^{-3} or 10^{-4} dilution of the original suspension of organisms. Each serum was tested against both dilutions of infective material. The mixtures were allowed to stand at room temperature for 1 hour before being injected intraperitoneally, in 0.5 cc. doses, into groups of rats.

EXPERIMENTS

The initial experiment was performed by infecting rats with a suspension of the spleen of a mouse moribund after having been infected with *P. tularensis*. The serums employed were obtained from rabbits: N. R. was a normal rabbit serum; Y was a pooled lot from 4 rabbits immunized with a 10 percent suspension of infected yolk sac and killed with 0.2 percent formalin; A was a pooled lot of serum from 4 rabbits immunized with allantoic fluid infected with *P. tularensis* and killed with 0.2 percent formalin. Serum N. R. did not contain agglutinins against this organism; serum Y contained agglutinins to a titer of 1:1280; serum A, to a titer of 1:160.

The suspension of mouse spleen employed had an LD_{50} of 3.16×10^{-8} per 0.5 cc. when injected intraperitoneally into mice. Fifty rats were injected intraperitoneally with 0.5 cc. of a 1:100 dilution of infective tissue. Lots of 10 rats each were immediately given 0.5 cc. of serums N. R., A, or Y intraperitoneally. The remaining 20 rats were given no treatment until the following day when lots of 10 rats each were given 0.5 cc. of serum A or Y intraperitoneally. The results are shown in table 1, and demonstrate that immune rabbit

TABLE 1.—*The effect of rabbit immune serum upon white rats infected with* P. tularensis *when serum is administered intraperitoneally with the infecting dose or withheld for 24 hours.*

Serum	Amount	Time of administration of serum	Infective material	Dosage	No. of rats in group	Deaths among rats, by days													Rats surviving	
						1	2	3	4	5	6	7	8	9	10	11	12	13	14	Number	Percent
N. R.[1]	0.5 cc	Immediate	Infected mouse spleen	0.5 cc. 10^{-3} dilution [2]	10	---	9	---	1	---	---	---	---	---	---	---	---	---	---	0	0
Y [3]	0.5 cc	do	do	do	10	---	---	1	---	---	---	1	1	2	1	1	---	---	---	3	30
Y [3]	0.5 cc	Delayed 24 hrs	do	do	10	---	7	2	---	---	1	---	---	---	---	---	---	---	---	0	0
A [4]	0.5 cc	Immediate	do	do	10	---	---	3	---	2	1	1	---	---	---	1	---	---	---	2	20
A [4]	0.5 cc	Delayed 24 hrs	do	do	10	---	8	---	---	1	---	---	---	---	---	---	---	1	---	0	0

[1] Normal rabbit serum.
[2] L. D_{50} for mice=3.16×10^{-3} per 0.5 cc.
[3] Immune rabbit serum—immunized with yolks as antigen.
[4] Immune rabbit serum—immunized with allantoic fluid antigen.

TABLE 2.—*The effect upon tularemia in white rats of 3 intraperitoneal injections of 0.5 cc of 1:2 dilution of serum administered with the infecting dose and repeated in 24 and 48 hours.*

Serum	Number of doses	Agglutination titer of serum	Number of rats	Infective material	Number of rats dying, by days														Total dying	Rats surviving	
					1	2	3	4	5	6	7	8	9	10	11	12	13	14		Number	Percent
N. R.[1]	3	Negative	25	*P. tularensis* RHP strain [2]	---	---	5	9	4	1	---	---	1	---	---	---	---	---	20	5	20
I. R.[3]	3	1:640	25	do	---	---	1	---	---	---	3	5	---	3	1	3	---	---	16	9	36
Foshay [4]	3	1:1280	25	do	---	---	---	1	1	---	1	4	4	2	2	2	1	1	19	6	24
I. H.[5]	3	1:640	25	do	---	---	---	---	---	---	---	---	2	2	1	2	---	1	8	17	68

[1]=Normal rabbit serum.
[2] LD_{50} for mice=$2:08 \times 10\text{-}10$ per 0.5 cc.
[3]=Immune rabbit serum.
[4]=Foshay's immune horse serum.
[5]=Immune human serum.

serum contains protective antibodies. These antibodies were capable of protecting rats when serum was administered simultaneously with the infective dose, but they were of little value if serum was withheld until 24 hours after infection had been instituted.

Further study indicated that there was a fairly high mortality rate among animals receiving a single injection of serum when the serum was withheld 24 hours after intraperitoneal introduction of an infective dose of organisms. Another injection of serum given 24 hours after the first dose did not materially alter the mortality rate nor the rate of death among infected rats. Administration of a third and a fourth dose of serum at the end of 72 and 96 hours after infection produced only slight effect upon the mortality rate and upon the rate of death.

The value of multiple administrations of immune serum in preventing or modifying the course of tularemia in white rats was tested. Four groups of 25 rats each were injected intraperitoneally with 0.5 cc. of a 10^{-6} dilution of culture of P. tularensis (strain RHP) suspended in 0.85 percent salt solution. The serums employed were N. R., (from a normal rabbit), I. R. (from a rabbit immunized with an ether extracted yolk sac vaccine), F (from a horse which had been immunized according to Foshay's method, received through the courtesy of Dr. Foshay) and I. H. (from a human convalescent from tularemia). The agglutination titers of these serums against *P. tularensis* are presented in table 2. The serums were diluted to 1:2, and 0.5 cc. amounts of each were administered intraperitoneally to a separate lot of rats immediately after the infective dose of organisms had been given, and at intervals of 24 and 48 hours.

The results obtained indicate that serum derived from a human convalescent was most effective in preventing and modifying the course of tularemia in white rats. There seemed to be little difference in the protective capacity of serums from immunized rabbits or horses, but both appeared to modify the course of infection in the treated groups.

Serums 28109, B. G., and S. C. (having agglutination titers of 1:1280, 1:1280, and 1:640, respectively) were tested to determine their ability to modify infections with *P. tularensis* in white rats. A normal human serum was employed as a control. The mixtures of serums and bacterial suspensions were made as previously described except that final dilutions of 10^{-3}, 10^{-4} and 10^{-5} of the original bacterial suspensions were employed. The mixtures were allowed to stand at room temperature for one hour prior to being injected intraperitoneally into white rats in 0.5 cc. amounts. The animals were observed for a period of 14 days before the experiment was terminated. Results are presented in table 3.

TABLE 3.—*Protection conferred upon white rats against infection with* P. tularensis *by human immune serum.*

Serum	Dilution of bacterial suspension[1]	Dilution of serum	Deaths among rats in days													Percent survivors
			1	2	3	4	5	6	7	8	9	10	11	12	13	
N. H. S.[2]	10^{-3}	1:6	---	4	6	---	---	---	---	---	---	---	---	---	---	0
	10^{-4}	1:6	---	---	5	2	1	1	---	---	---	1	---	---	---	0
	10^{-5}	1:6	---	---	6	3	1	---	---	---	---	---	---	---	---	0
S. C.[3]	10^{-3}	1:6	---	---	---	1	3	2	2	1	1	---	---	---	---	0
	10^{-4}	1:6	---	---	---	---	---	---	1	---	1	---	---	1	1	60
	10^{-5}	1:6	---	---	---	---	---	1	2	---	2	---	---	---	---	50
B. G.[3]	10^{-3}	1:6	---	---	---	---	1	1	5	---	3	---	---	---	---	0
	10^{-4}	1:6	---	---	---	---	1	---	2	---	---	---	---	---	---	70
	10^{-5}	1:6	---	---	---	---	---	---	1	---	1	---	---	---	1	70
28109[3]	10^{-3}	1:6	---	1	---	4	---	1	2	1	---	---	---	---	---	10
	10^{-4}	1:6	---	---	1	---	---	---	---	---	1	---	---	---	---	80
	10^{-5}	1:6	---	---	---	---	1	---	---	---	---	---	---	---	---	90

[1] L D_{50} for mice=1.0×10^{-10} per 0.5 cc.
[2] Normal human serum. [3] Immune human serum.

The three human immune serums possessed considerable ability to protect white rats against infection with the specific organism. Among the rats receiving the greatest number of bacteria the protective capacity was manifested by a prolongation of the time elapsing from administration of the serum-organism mixture until death occurred. Among animals receiving greater dilutions of infective suspensions and the same amount of serum, the protective capacity of specific antiserum is displayed by a decreased mortality rate as well as by a prolonged survival time among the treated animals.

Serums from immunized goats (G_2, G_4) and rabbits (R_1, R_2), a normal rabbit (N. R.), a human case of brucellosis (69), and human cases of tularemia (1, 2, 66, 73, 74) were then tested. The agglutination titers of these serums are presented in table 4. Suspensions of a fully virulent strain of *P. tularensis* (R H P) were made in serial tenfold dilutions in 0.85 percent salt solution. The LD_{50} of the original bacterial suspension was 2.5×10^{-8} per 0.5 cc. Mixtures of serum and the bacterial suspension were made containing 1/12 cc. of serum and either a 10^{-4} or a 10^{-5} dilution of the original bacterial suspension per 0.5 cc. The resultant mixtures were injected intraperitoneally into groups of 10 rats each in 0.5-cc. amounts. The results are shown in table 4. Serum from a patient with brucellosis did not contain antibodies capable of protecting white rats against infections with *P. tularensis*. The serums from immunized goats and rabbits contained specific protective antibodies. There was variation in the protection afforded by human convalescent serums, but all exhibited some degree of protection.

Serums from an individual vaccinated with an ether-extracted, formalin-killed vaccine were studied in another test (table 5). Serum 28235 was used as a negative control. It had been obtained prior to vaccination of the individual. Serum 7-10 was obtained 2 weeks after vaccination had been completed and had an agglutination titer of 1:160, while serum 28410 was drawn 28 days following completion

of vaccination and had an agglutination titer of 1:80 against *P. tularensis*. Serums 28366, W. Va. and Gill were from patients convalescent from the tularemia and all had titers of 1:1280 against the causative agent. The technique employed was that described under materials and methods.

TABLE 4.—*The effect of immune serum given simultaneously with 0.5 cc. of an infective suspension of* P. tularensis *(strain RHP) to white rats, by the intraperitoneal route*

Serum	Agglutination titer vs. *P. tularensis*	Dilution of infective suspension [6]	Deaths among rats by days														No. rats dying	No. rats surviving	Percent of rats surviving
			1	2	3	4	5	6	7	8	9	10	11	12	13	14			
N.R.[1]	Neg.	10^{-4}	---	---	3	5	2	---	---	---	---	---	---	---	---	---	10	0	0
		10^{-5}	---	---	2	4	1	---	2	---	---	---	---	---	1	---	10	0	0
R_1 [2]	1:2560	10^{-4}	---	---	---	---	1	6	---	2	1	---	---	---	---	---	10	0	0
		10^{-5}	---	---	---	---	---	---	---	1	---	1	1	---	---	---	3	7	70
R_2 [2]	1:640	10^{-4}	---	---	---	---	---	2	3	---	1	1	---	1	1	---	9	1	10
		10^{-5}	---	---	---	---	---	---	3	2	1	2	---	---	---	---	8	2	20
G_2 [3]	1:1280	10^{-4}	---	---	---	1	1	1	1	2	1	---	1	---	---	---	8	2	20
		10^{-5}	---	---	---	---	---	---	---	1	1	1	---	---	---	---	3	7	70
G_4 [2]	1:1280	10^{-4}	---	---	---	1	---	3	---	1	1	---	---	---	---	---	6	4	40
		10^{-5}	---	---	---	---	---	---	---	---	---	---	1	2	---	---	3	7	70
1 [4]	1:2560	10^{-4}	---	---	---	---	---	---	---	1	---	---	---	---	---	---	1	9	90
		10^{-5}	---	---	---	---	---	---	---	---	---	---	---	---	---	---	0	10	100
2 [4]	1:2560	10^{-4}	---	---	---	---	---	---	2	1	1	1	---	---	---	1	6	4	40
		10^{-5}	---	---	---	---	---	---	---	---	---	1	---	2	---	---	3	7	70
66 [4]	1:1280	10^{-4}	---	---	---	---	---	---	1	1	2	1	1	---	---	---	6	4	40
		10^{-5}	---	---	---	---	---	---	---	---	1	1	1	1	---	---	4	6	60
69 [4]	*P. tularensis*: neg. *Br. abortus*: 1:160	10^{-4}	---	---	4	2	2	---	1	1	---	---	---	---	---	---	10	0	0
		10^{-5}	---	---	---	1	2	3	1	2	---	---	---	---	---	---	9	1	10
73 [4]	1:320	10^{-4}	---	---	---	1	---	2	3	---	1	---	1	---	---	---	8	2	20
		10^{-5}	---	---	---	---	---	1	---	---	2	1	1	---	---	---	5	5	50
74 [4]	1:1280	10^{-4}	---	---	1	---	1	1	1	1	1	---	---	---	---	---	6	4	40
		10^{-5}	---	---	---	---	---	---	---	2	2	---	---	---	---	1	5	5	50

[1]=normal rabbit serum.
[2]=immune rabbit serum.
[3]=immune goat serum.
[4]=immune human serum.
[5]=human serum (brucellosis).
[6]= L D_{50} for mice=2.5×10^{-8} per 0.5 cc.

The data are presented in table 5. They demonstrate the ability of human convalescent serums to protect rats against infections with *P. tularensis*. Vaccination appeared to confer some protective ca-

TABLE 5.—*The effect, upon tularemic infection in white rats, of serums from a human vaccinated against tularemia and from humans convalescent from tularemia*

Serum	Agglutination titer vs. *P. tularensis*	Dilution of infective suspension [4]	Deaths among rats, by days														Number of rats dying	Rats surviving	
			1	2	3	4	5	6	7	8	9	10	11	12	13	14		Number	Percent
28235 [1]	Neg.	10^{-4}	---	---	3	4	1	---	1	1	---	---	---	---	---	---	10	0	0
		10^{-5}	---	---	2	3	1	1	3	---	---	---	---	---	---	---	10	0	0
7-10 [2]	1:160	10^{-4}	---	---	3	1	1	---	3	1	---	---	---	---	---	---	9	1	10
		10^{-5}	---	---	1	---	3	---	---	3	1	1	---	---	---	---	9	1	10
28410 [3]	1:80	10^{-4}	---	---	---	2	1	1	2	1	---	---	1	---	---	---	8	2	20
		10^{-5}	---	---	---	---	---	2	2	1	1	---	1	---	---	---	7	3	30
28366	1:1280	10^{-4}	---	---	---	1	1	2	3	---	---	---	---	1	---	---	8	2	20
		10^{-5}	---	---	---	---	---	---	2	---	1	2	---	---	---	---	5	5	50
W. Va.	1:1280	10^{-4}	---	---	---	2	1	1	2	2	---	---	---	---	---	---	8	2	20
		10^{-5}	---	---	---	---	---	2	1	1	---	1	---	---	---	---	5	5	50
Gill	1:1280	10^{-4}	---	---	---	---	2	---	---	---	1	1	---	---	1	---	5	5	50
		10^{-5}	---	---	---	---	---	---	---	1	---	---	---	---	---	---	1	9	90

[1] Normal human serum.
[2] Serum from vaccinated human.
[3] Immune convalescent human serum.
[4] LD_{50} for mice=3.16×10^{-10} per 0.5 cc.

pacity to human serum which was manifested to a greater degree in the serum obtained 28 days after completion of vaccination. The immunity due to vaccination did not, however, approach that observed in serum from convalescent patients.

DISCUSSION

The results obtained from these experiments indicate that specific immune serum (when serum and organisms are mixed in vitro prior to injection) has the property, in many instances, of modifying the course of tularemic infection in white rats. The changes produced are manifested primarily by an increase in the survival time after administration of the mixture of human immune serum and organisms. A decreased mortality rate among the treated rats is also apparent.

Serums which cause a prolonged survival time among animals infected with the larger number of organisms usually produce a decreased mortality rate among rats infected with a smaller number of organisms.

While it was possible to demonstrate a slight to moderate amount of protective antibody in serums obtained from animals and man immunized with killed *P. tularensis* vaccines, the protection conferred usually did not approach that conferred by serums from individuals convalescent from the disease.

CONCLUSIONS

A serum protection test against *P. tularensis* infection in white rats has been devised.

Immune serums withheld for 24 hours after administration of *P. tularensis* fail to protect white rats against infection.

Serum from patients convalescent or recovered from tularemia definitely decreases the mortality rate and increases the survival time of groups of white rats infected with *P. tularensis*.

Serums from a vaccinated human and from immunized goats and rabbits protect rats infected with *P. tularensis* but are usually less effective than human convalescent serum.

REFERENCES

(*1*) Downs, C. M., Coriell, L. L., Pinchot, G. B., Maumenee, E., Klauber, A., Chapman, S. S., and Owen, B.: The comparative susceptibility of various laboratory animals to *B. tularense*. Federation Proceedings, **5** (1): 246, (1946).

(*2*) Larson, C. L.: Immunization of white rats against infections with *Pasteurella tularensis*. Pub. Health Rep. **60**: 725–734 (June 29) 1945.

(*3*) Coriell, L. L., Downs, C. M., Eigelsbach, H. T., Pinchot, G. B., Owen, B., Hamilton, B., Spencer, G. R., and Buchele, L. The immunization of white rats against tularemia. J. Bact. **51**: 623 (May) 1946.

(*4*) Francis, E., and Felton, L. D. Antitularemic serum. Pub. Health Rep. **57**: 44–55 (Jan. 9) 1942.

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INCIDENCE 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 DECEMBER 6, 1947

Summary

Of 3,008 cases of influenza reported for the current week (as compared with 2,951 last week and 2,813 for the 5-year (1942–46) median, 2,607 occurred in the 5 States reporting more than 66 cases each, as follows (last week's figures in parentheses): Virginia 379 (282), South Carolina 476 (553), Texas 1,512 (1,501), Alabama 106 (56), and Oklahoma 134 (90). Since July 26 (approximate average date of seasonal low incidence), 25,204 cases have been reported (same period last year, and also 5-year median, 24,102), of which 3 States (Virginia, South Carolina, and Texas) reported 20,195 cases, or 80 percent of the total (last year 81 percent).

A total of 132 cases of poliomyelitis was reported, as compared with 141 last week, 241 for the corresponding week last year, and a 5-year median of 133. Increases occurred in 2 of the 4 States reporting more than 6 cases—New York (11 to 17) and Idaho (15 to 19). Ohio reported 17 cases (last week 19) and California 13 (same number last week). The total for the 38-week period since March 15 (average date of seasonal low incidence) is 9,964, as compared with 24,296 for the corresponding period last year and a 5-year median of 13,046.

For the current week, 4 cases of smallpox were reported—1 each in Ohio, Iowa, Kansas and North Carolina; 5 cases of infectious encephalitis (in 5 States), and 8 cases of Rocky Mountain spotted fever—6 in North Carolina and 1 each in Iowa and Maryland. Current figures slightly above the 5-year medians are reported for diphtheria, the dysenteries (combined), measles, Rocky Mountain spotted fever, undulant fever (2-year average), and whooping cough. Of the diseases included in the following tables, cumulative figures above the respective expectancies have been reported for only amebic and undefined dysentery, infectious encephalitis, influenza, Rocky Mountain spotted fever, tularemia, undulant fever, and whooping cough.

During the current week 10,111 deaths were recorded in 93 large cities in the United States, as compared with 8,952 last week, 9,716 and 9,945, respectively, for the corresponding weeks of 1946 and 1945, and a 3-year (1944–46) median of 9,716. The total for the year to date is 449,607, as compared with 441,814 for the corresponding period last year. Infant deaths for the week in the same cities totaled 724, as compared with 646 last week and a 3-year median of 640. The cumulative figure is 35,895, as compared with 32,620 for the same period last year.

Telegraphic morbidity reports from State health officers for the week ended Dec. 6, 1947, and comparison with corresponding week of 1946 and 5-year median

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

Division and State	Diphtheria			Influenza			Measles			Meningitis, meningococcus		
	Week ended—		Median 1942–46	Week ended—		Median 1942–46	Week ended—		Median 1942–46	Week ended—		Median 1942–46
	Dec. 6, 1947	Dec. 7, 1946		Dec. 6, 1947	Dec. 7, 1946		Dec. 6, 1947	Dec. 7, 1946		Dec. 6, 1947	Dec. 7, 1946	
NEW ENGLAND												
Maine	2	2	2	------	9	------	4	311	8	1	0	0
New Hampshire	0	0	0	7	1	------	------	4	8	1	1	0
Vermont	0	0	0	------	------	------	1	163	34	0	1	0
Massachusetts	12	14	9	------	------	------	65	161	213	1	4	6
Rhode Island	1	0	0	------	2	1	------	14	14	0	1	1
Connecticut	0	1	1	------	------	2	6	55	16	7	3	3
MIDDLE ATLANTIC												
New York	15	29	19	[1] 10	4	5	284	268	268	7	6	13
New Jersey	11	8	3	3	6	10	126	72	30	5	3	5
Pennsylvania	6	11	11	([2])	6	6	115	470	447	0	4	10
EAST NORTH CENTRAL												
Ohio	10	23	17	2	11	11	110	128	36	4	3	4
Indiana	11	18	13	17	6	10	36	5	7	1	3	3
Illinois	5	4	5	7	1	9	389	16	69	2	4	12
Michigan [3]	0	10	9	1	2	2	500	10	38	0	2	2
Wisconsin	1	1	1	2	30	34	71	47	47	0	1	3
WEST NORTH CENTRAL												
Minnesota	9	9	9	------	------	2	411	5	5	0	2	1
Iowa	4	3	4	------	------	------	48	10	31	2	0	0
Missouri	14	11	10	6	2	3	2	------	6	3	0	2
North Dakota	1	2	2	------	------	10	83	1	3	0	0	0
South Dakota	1	0	0	------	------	------	5	1	1	0	0	0
Nebraska	2	1	2	7	5	5	3	9	9	0	1	0
Kansas	4	6	6	1	18	18	7	8	11	0	0	0
SOUTH ATLANTIC												
Delaware	0	0	0	------	------	------	------	1	1	0	0	0
Maryland [3]	9	24	10	4	2	8	1	12	7	2	1	4
District of Columbia	0	0	0	------	------	3	4	------	3	1	3	1
Virginia	19	25	21	379	422	422	34	61	61	1	6	6
West Virginia	7	5	6	32	42	42	272	42	8	2	1	1
North Carolina	35	6	20	------	------	------	1	97	34	0	0	1
South Carolina	12	11	9	476	423	517	1	26	26	0	0	1
Georgia	22	15	15	12	16	116	3	39	4	1	1	2
Florida	17	12	5	7	8	6	8	15	3	0	4	3
EAST SOUTH CENTRAL												
Kentucky	12	34	13	4	------	3	10	------	6	1	0	2
Tennessee	8	7	9	24	25	40	18	4	7	3	0	3
Alabama	13	9	12	106	41	80	15	3	3	3	0	3
Mississippi [3]	15	20	12	7	------	------	2	------	------	4	1	1
WEST SOUTH CENTRAL												
Arkansas	12	15	15	63	39	87	26	13	19	2	2	2
Louisiana	9	4	7	29	1	13	------	1	3	1	0	1
Oklahoma	20	4	6	134	15	180	1	1	10	2	2	1
Texas	46	14	42	1,512	1,343	1,352	195	43	43	4	3	3
MOUNTAIN												
Montana	4	0	0	10	------	21	195	25	25	0	0	1
Idaho	1	0	1	9	14	3	4	8	8	0	0	0
Wyoming	0	1	0	------	------	11	31	4	9	0	0	0
Colorado	4	3	3	31	33	46	22	9	12	1	2	1
New Mexico	4	3	3	2	------	------	1	32	1	0	0	0
Arizona	0	1	1	66	261	261	4	33	5	1	2	0
Utah [3]	30	2	1	2	1	3	2	8	12	0	1	1
Nevada	0	0	0	------	------	------	2	------	1	0	0	0
PACIFIC												
Washington	0	5	5	------	------	------	54	17	43	1	2	2
Oregon	1	0	5	25	9	16	14	22	30	2	0	2
California	10	28	23	11	15	50	179	123	123	3	7	12
Total	419	401	401	3,008	2,813	2,813	3,365	2,397	2,787	69	77	118
49 weeks	41,539	15,178	14,643	326,717	214,299	160,734	203,740	655,433	580,588	3,253	5,465	7,618
Seasonal low week [4]	(27th) July 5–11			(30th) July 26–Aug. 1			(35th) Aug. 30–Sept. 5			(37th) Sept. 13–19		
Total since low	5,342	6,550	7,302	25,204	24,102	24,102	18,238	15,348	18,530	612	799	1,123

[1] New York City only. [2] Philadelphia only. [3] Period ended earlier than Saturday.
[4] Dates between which the approximate low week ends. The specific date will vary from year to year.

Telegraphic morbidity reports from State health officers for the week ended Dec. 6, 1947, and comparison with corresponding week of 1946 and 5-year median—Con.

Division and State	Poliomyelitis			Scarlet fever			Smallpox			Typhoid and paratyphoid fever		
	Week ended—		Median 1942–46	Week ended—		Median 1942–46	Week ended—		Median 1942–46	Week ended—		Median 1942–46
	Dec. 6, 1947	Dec. 7, 1946		Dec. 6, 1947	Dec. 7, 1946		Dec. 6, 1947	Dec. 7, 1946		Dec. 6, 1947 [3]	Dec. 7, 1946	
NEW ENGLAND												
Maine	1	0	1	28	51	30	0	0	0	0	0	0
New Hampshire	0	1	0	3	0	6	0	0	0	0	0	0
Vermont	0	1	0	1	9	7	0	0	0	0	0	0
Massachusetts	2	5	4	105	140	233	0	0	0	4	5	2
Rhode Island	0	0	0	5	11	9	0	0	0	1	0	0
Connecticut	0	2	0	14	16	34	0	0	0	0	0	0
MIDDLE ATLANTIC												
New York	17	25	14	190	226	278	0	0	0	4	2	5
New Jersey	0	6	4	58	94	76	0	0	0	0	1	1
Pennsylvania	3	5	3	144	139	213	0	0	0	3	1	4
EAST NORTH CENTRAL												
Ohio	17	9	4	233	302	302	1	0	0	3	0	2
Indiana	3	9	1	52	88	65	0	0	1	[6]0	4	1
Illinois	6	26	4	85	105	161	0	0	0	2	1	1
Michigan [2]	6	17	3	66	132	154	0	0	0	0	0	1
Wisconsin	1	8	3	45	59	113	0	0	0	0	1	1
WEST NORTH CENTRAL												
Minnesota	1	10	0	52	37	56	0	0	0	0	0	0
Iowa	2	4	2	49	37	52	1	0	0	0	0	0
Missouri	1	9	2	20	32	48	0	0	0	2	0	1
North Dakota	0	5	0	13	8	8	0	0	0	0	0	0
South Dakota	0	5	0	1	11	11	0	0	0	0	0	0
Nebraska	[6]1	10	0	12	32	32	0	0	0	0	0	0
Kansas	0	9	3	24	30	67	1	1	1	0	0	0
SOUTH ATLANTIC												
Delaware	0	0	0	5	8	7	0	0	0	0	0	0
Maryland [2]	4	4	1	32	25	58	0	0	0	4	0	1
District of Columbia	1	2	1	11	2	20	0	0	0	0	0	0
Virginia	1	6	2	37	60	60	0	0	0	0	2	2
West Virginia	2	2	1	42	23	50	0	0	0	2	2	1
North Carolina	5	2	2	22	27	81	1	0	0	1	2	1
South Carolina	3	0	0	2	5	12	0	0	0	0	0	1
Georgia	0	2	1	17	17	28	0	0	0	3	2	3
Florida	2	1	1	6	5	13	0	0	0	1	2	1
EAST SOUTH CENTRAL												
Kentucky	1	0	1	37	29	49	0	0	0	2	1	1
Tennessee	4	1	1	58	27	57	0	0	0	0	0	2
Alabama	1	1	1	18	11	20	0	0	0	1	0	0
Mississippi [2]	1	4	0	14	17	17	0	0	0	0	1	1
WEST SOUTH CENTRAL												
Arkansas	1	2	2	5	10	10	0	0	0	0	2	2
Louisiana	0	2	1	9	0	8	0	0	0	7	1	1
Oklahoma	1	3	1	11	6	26	0	0	0	0	0	1
Texas	1	8	8	47	28	63	0	0	0	2	3	10
MOUNTAIN												
Montana	0	0	0	12	4	14	0	0	0	1	2	0
Idaho	19	1	0	1	26	27	0	0	0	0	0	0
Wyoming	0	0	0	7	2	3	0	0	0	0	0	0
Colorado	0	2	2	40	18	36	0	0	0	2	3	0
New Mexico	0	0	1	9	11	11	0	0	0	0	0	0
Arizona	1	1	1	6	16	16	0	0	0	0	0	0
Utah [2]	4	1	1	9	13	35	0	0	0	0	0	0
Nevada	0	0	0	0	0	0	0	0	0	0	0	0
PACIFIC												
Washington	2	7	7	50	35	38	0	0	0	1	4	0
Oregon	4	3	2	17	38	38	0	0	0	1	1	1
California	13	20	16	113	139	179	0	0	0	3	1	3
Total	132	241	133	1,837	2,161	2,967	4	1	11	50	44	71
49 weeks	[6]10,576	24,763	13,443	78,001	106,885	131,727	160	327	371	[6]3,723	3,876	5,246
Seasonal low week [4]	(11th) Mar. 15–21			(32nd) Aug. 9–15			(35th) Aug. 30–Sept. 5			(11th) Mar. 15–21		
Total since low	[6]9,964	24,296	13,046	15,898	20,590	31,081	13	48	64	[6]3,238	3,401	4,430

[2] Period ended earlier than Saturday.
[4] Dates between which the approximate low week ends. The specific date will vary from year to year.
[5] Including paratyphoid fever reported separately, as follows: Massachusetts 3 (salmonella infection); Georgia 1; Oregon 1; California 1.
[6] Delayed reports (included in cumulative totals only): Poliomyelitis, Nebraska 3 cases; typhoid fever, Indiana 2 cases.

Telegraphic morbidity reports from State health officers for the week ended Dec. 6, 1947, and comparison with corresponding week of 1946 and 5-year median—Con.

Division and State	Whooping cough			Week ended Dec. 6, 1947							
	Week ended—		Median 1942–46	Dysentery			Encephalitis, infectious	Rocky Mt. spotted fever	Tularemia	Typhus fever, endemic	Undulant fever
	Dec. 6, 1947	Dec. 7, 1946		Amebic	Bacillary	Unspecified					
NEW ENGLAND											
Maine	49	13	35								1
New Hampshire		17	8								
Vermont	50	16	30								3
Massachusetts	177	182	150		2						1
Rhode Island	18	15	24								
Connecticut	89	58	73								
MIDDLE ATLANTIC											
New York	206	261	320	12	2		1			1	4
New Jersey	169	192	164								2
Pennsylvania	159	163	163				1				
EAST NORTH CENTRAL											
Ohio	169	119	127			3					
Indiana	58	20	20						1		4
Illinois	84	100	101	1			1		1		8
Michigan [3]	133	160	186	6							5
Wisconsin	120	225	135						1		7
WEST NORTH CENTRAL											
Minnesota	84	6	30								3
Iowa	13	49	23					1			6
Missouri	32	18	8			1			1		1
North Dakota	9		3								
South Dakota	1		2								2
Nebraska	20	18	7								
Kansas	39	4	18						1		2
SOUTH ATLANTIC											
Delaware	2	4	1								
Maryland [3]	70	64	64			3		1			1
District of Columbia	11	4	6								
Virginia	97	84	54			24			2		
West Virginia	21	26	26								
North Carolina	52	53	59					6	1		1
South Carolina	102	30	32	4	2						
Georgia	4	15	15							3	1
Florida	16	37	13	3						2	
EAST SOUTH CENTRAL											
Kentucky	21	1	15				1	(7)		1	
Tennessee	53	11	14			1			2	1	3
Alabama	21	13	5								2
Mississippi [3]				2						2	1
WEST SOUTH CENTRAL											
Arkansas	31	5	5	12	1	1					
Louisiana	11	1	2							1	
Oklahoma	8	7	11						2		1
Texas	216	157	150	6	470	93				7	6
MOUNTAIN											
Montana	7	11	11								
Idaho	19		3								
Wyoming	1	6	2								
Colorado	87	6	14	1	1						20
New Mexico	16	5	2	1	1						
Arizona	16	6	7			12	1				
Utah [3]	7	2	17						1		4
Nevada											
PACIFIC											
Washington	41	10	25	1							1
Oregon	6	11	12								
California	102	47	108	4	3					1	5
Total	2,717	2,252	2,432	53	482	138	5	8	13	19	95
Same week, 1946	2,252			55	350	86	4	1	66	48	105
Median, 1942–46	2,432			46	350	98	8	0	35	112	[8] 87
49 weeks: 1947	146,855			2,822	15,785	9,329	608	[7] 565	1,285	1,857	5,790
1946	93,755			2,310	15,742	6,107	592	567	962	3,263	5,038
Median, 1942–46	118,689			1,835	17,099	7,293	605	453	753	4,304	[8] 4,854

[3] Period ended earlier than Saturday.
[7] Delayed reports (included in cumulative totals only): Rocky Mountain spotted fever, Kentucky 2 cases.
[8] 2-year average, 1945–46.
Anthrax: New Jersey 2 cases. *Psittacosis:* Ohio 3 cases.
Alaska: Chickenpox 6, tonsilitis 3.
Territory of Hawaii: Amebic dysentery 1, influenza 1, typhoid fever 1, endemic typhus fever 2, whooping cough 12.

WEEKLY REPORTS FROM CITIES [1]

City reports for week ended Nov. 29, 1947

This table lists the reports from 86 cities of more than 10,000 population distributed throughout the United States, and represents a cross section of the current urban incidence of the diseases included in the table.

Division, State, and City	Diphtheria cases	Encephalitis, infectious, cases	Influenza		Measles cases	Meningitis, meningococcus, cases	Pneumonia deaths	Poliomyelitis cases	Scarlet fever cases	Smallpox cases	Typhoid and paratyphoid fever cases	Whooping cough cases
			Cases	Deaths								
NEW ENGLAND												
Maine:												
Portland	0	0		0		0	0	0	0	0	0	3
New Hampshire:												
Concord	0	0		0		0	0	0	0	0	0	
Massachusetts:												
Boston	2	0		0	19	0	5	0	13	0	0	8
Fall River	0	0		0		0	1	0	1	0	0	14
Springfield	0	0		0		0	0	0	6	0	0	1
Worcester	0	0		0		0	6	0	9	0	0	8
Rhode Island:												
Providence	0	0		0		0	1	0	1	0	0	9
Connecticut:												
Bridgeport	0	0		0		0	0	0	0	0	0	
Hartford	0	0		0		0	0	0	0	0	0	6
New Haven	0	0		0	1	0	1	0	1	0	0	2
MIDDLE ATLANTIC												
New York:												
Buffalo	2	0		0	1	1	3	0	3	0	0	24
New York	11	1	1	0	42	1	62	2	30	0	1	41
Rochester	0	0		0		0	1	4	5	0	0	9
New Jersey:												
Camden	1	0	1	0		0	3	0	1	0	0	
Newark	0	0		0		0	3	0	7	0	0	7
Trenton	0	1		0		0	2	0	0	0	0	1
Pennsylvania:												
Philadelphia	1	0	1	0	14	1	13	0	29	0	0	42
Pittsburgh	1	1		1		1	10	0	5	0	0	22
Reading	0	0		0	1	0	0	0	1	0	0	
EAST NORTH CENTRAL												
Ohio:												
Cincinnati	1	0		0		1	0	3	14	0	1	3
Columbus	2	0		0	14	0	0	2	10	0	0	20
Indiana:												
Fort Wayne	0	0		0		0	4	0	5	0	0	1
Indianapolis	4	0		0	1	1	3	0	11	0	0	6
South Bend	0	0		0	1	0	0	0	0	0	0	1
Terre Haute	0	0		0		0	0	0	1	0	0	
Illinois:												
Chicago	0	0	1	3	104	1	32	2	23	0	0	24
Michigan:												
Detroit	0	0		1	3	0	9	0	27	0	0	35
Flint	0	0		0	2	0	5	0	2	0	0	5
Grand Rapids	0	0		0	19	0	0	0	1	0	0	8
Wisconsin:												
Kenosha	0	0		0		0	0	0	0	0	0	1
Milwaukee	0	0		0	5	0	0	0	8	0	0	12
Racine	1	0		0		0	0	0	1	0	0	2
Superior	0	0		0		0	0	0	1	0	0	8
WEST NORTH CENTRAL												
Minnesota:												
Duluth	1	0		1	6	0	0	0	4	0	0	8
Minneapolis	0	0		0	124	0	1	0	25	0	0	22
St. Paul	0	0		0	7	0	4	0	4	0	0	26
Missouri:												
Kansas City	0	0		0	3	0	3	0	3	0	0	15
St. Joseph	0	0		0		0	0	0	4	0	0	
St. Louis	3	0		0	2	0	5	0	5	0	0	9

[1] In some instances the figures include nonresident cases.

City reports for week ended Nov. 29, 1947—Continued

Division, State, and city	Diphtheria cases	Encephalitis, infectious, cases	Influenza		Measles cases	Meningitis, meningococcus, cases	Pneumonia deaths	Poliomyelitis cases	Scarlet fever cases	Smallpox cases	Typhoid and paratyphoid fever cases	Whooping cough cases
			Cases	Deaths								
WEST NORTH CENTRAL—continued												
North Dakota:												
Fargo	0	0	------	0	33	0	1	1	1	0	0	2
Nebraska:												
Omaha	0	0	------	0	1	0	4	4	0	0	0	1
Kansas:												
Topeka	0	0	------	0	2	0	0	0	0	0	0	1
Wichita	0	0	------	0	------	0	2	0	1	0	0	2
SOUTH ATLANTIC												
Delaware:												
Wilmington	0	0	------	0	------	1	0	0	0	0	0	------
Maryland:												
Baltimore	0	0	3	2	0	0	9	0	5	0	0	44
Cumberland	2	0	------	0	------	0	0	0	1	0	0	1
Frederick	0	0	------	0	------	0	0	0	0	0	0	------
District of Columbia:												
Washington	1	0	------	0	2	0	4	0	5	0	0	10
Virginia:												
Lynchburg	0	0	------	0	------	0	0	0	0	0	0	3
Richmond	0	0	------	2	------	0	3	0	3	0	0	10
Roanoke	0	0	------	0	------	0	0	0	0	0	0	------
West Virginia:												
Charleston	0	0	------	0	------	0	1	0	4	0	0	1
Wheeling	0	0	------	0	------	0	1	0	0	0	0	1
North Carolina:												
Raleigh	0	0	------	0	------	0	1	0	1	0	0	5
Wilmington	3	0	------	0	------	0	0	0	1	0	0	------
Winston-Salem	0	0	------	0	------	0	1	0	1	0	0	------
South Carolina:												
Charleston	0	0	23	0	------	0	0	0	0	0	0	4
Georgia:												
Atlanta	0	0	3	0	------	0	3	0	4	0	0	4
Brunswick	0	0	------	0	------	0	1	0	0	0	0	------
Savannah	0	0	1	1	------	0	2	1	4	0	0	------
Florida:												
Tampa	1	0	1	0	1	0	2	0	2	0	0	5
EAST SOUTH CENTRAL												
Tennessee:												
Memphis	0	0	4	0	------	0	6	0	1	0	0	5
Nashville	0	0	------	1	------	0	4	0	1	0	0	4
Alabama:												
Birmingham	1	0	------	1	------	0	6	0	0	0	0	2
Mobile	0	0	3	1	------	1	0	0	2	0	0	------
WEST SOUTH CENTRAL												
Arkansas:												
Little Rock	0	0	1	1	------	0	0	0	1	0	0	------
Louisiana:												
New Orleans	1	0	1	2	------	0	9	0	3	0	1	------
Shreveport	0	0	------	0	------	0	4	0	0	0	2	------
Oklahoma:												
Oklahoma City	0	0	2	0	------	0	2	0	3	0	0	1
Texas:												
Dallas	1	0	------	0	------	0	2	0	3	0	0	2
Galveston	0	0	------	0	------	0	0	0	0	0	0	1
Houston	0	0	------	0	4	0	7	2	0	0	0	1
MOUNTAIN												
Montana:												
Billings	0	0	------	0	34	0	1	0	0	0	0	3
Great Falls	0	0	------	0	------	0	1	0	1	0	0	------
Helena	0	0	------	0	1	0	0	0	0	0	0	------
Missoula	1	0	------	0	------	0	1	0	0	0	0	------
Idaho:												
Boise	0	0	------	0	------	0	0	0	0	0	0	------
Colorado:												
Denver	6	0	2	0	3	1	6	2	10	0	0	25
Pueblo	0	0	------	0	------	0	1	0	1	0	0	12
Utah:												
Salt Lake City	0	0	------	0	6	0	0	1	2	0	0	1

City reports for week ended Nov. 29, 1947—Continued

Division, State, and City	Diphtheria cases	Encephalitis, infectious, cases	Influenza		Measles cases	Meningitis, meningococcus, cases	Pneumonia deaths	Poliomyelitis cases	Scarlet fever cases	Smallpox cases	Typhoid and paratyphoid fever cases	Whooping cough cases
			Cases	Deaths								
PACIFIC												
Washington:												
Seattle	0	0	------	1	3	0	3	0	5	0	0	8
Spokane	0	0	------	0	1	0	3	0	4	0	0	------
Tacoma	0	0	------	0	6	0	0	0	3	0	0	2
California:												
Los Angeles	3	0	2	0	3	1	1	1	22	0	0	10
Sacramento	0	0	------	0	-------	0	1	0	0	0	0	------
San Francisco	0	0	------	0	42	0	4	0	6	0	0	6
Total	50	3	50	18	511	11	274	25	362	0	5	580
Corresponding week, 1946[1]	61	------	36	13	337	------	298	------	413	0	3	558
Average 1942–46[1]	84	------	400	[2] 25	[2] 664	------	[2] 334	------	740	0	11	624

[1] Exclusive of Oklahoma City.
[2] 3-year average, 1944–46.
[3] 5-year median, 1942–46.

Dysentery, amebic.—Cases: New York 6; Memphis 1; New Orleans 1; Los Angeles 1.
Dysentery, bacillary.—Cases: Worcester 1.
Dysentery, unspecified.—Cases: Baltimore 1.
Leprosy.—Cases: New York 2.
Typhus fever, endemic.—Cases: New York 1; Atlanta 2.

Rates (annual basis) per 100,000 population, by geographic groups, for the 86 cities in the preceding table (latest available estimated population, 33,193,900)

	Diphtheria case rates	Encephalitis, infectious, case rates	Influenza		Measles case rates	Meningitis, meningococcus, case rates	Pneumonia death rates	Poliomyelitis case rates	Scarlet fever case rates	Smallpox case rates	Typhoid and paratyphoid fever case rates	Whooping cough case rates
			Case rates	Death rates								
New England	5.3	0.0	0.0	0.0	53	0.0	36.8	0.0	81	0.0	0.0	134
Middle Atlantic	7.5	1.4	1.4	0.5	27	1.9	45.7	2.8	38	0.0	0.5	69
East North Central	5.5	0.0	0.7	2.7	102	2.1	36.3	4.8	71	0.0	0.7	86
West North Central	8.0	0.0	0.0	2.0	354	0.0	39.8	9.9	94	0.0	0.0	171
South Atlantic	11.4	0.0	50.7	8.2	5	1.6	45.8	1.6	51	0.0	0.0	144
East South Central	5.9	0.0	41.3	17.7	0	5.9	94.4	0.0	24	0.0	0.0	65
West South Central	5.9	0.0	11.7	8.8	12	0.0	70.3	5.9	29	0.0	8.8	15
Mountain	55.6	0.0	15.9	0.0	349	7.9	79.4	23.8	111	0.0	0.0	326
Pacific	4.7	0.0	3.2	1.6	87	1.6	19.0	1.6	63	0.0	0.0	41
Total	7.9	0.5	7.9	2.8	80	1.7	43.2	3.9	57	0.0	0.8	91

FOREIGN REPORTS

CANADA

Provinces—Communicable diseases—Week ended November 15, 1947.—During the week ended November 15, 1947, cases of certain communicable diseases were reported by the Dominion Bureau of Statistics of Canada as follows:

Disease	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	Total
Chickenpox		10	3	147	219	37	41	67	123	647
Diphtheria				25	7	3	1	5		41
Dysentery, bacillary									2	2
German measles				3	17		1	2	3	26
Influenza		14			3					17
Measles		3		203	190	25	47	7	84	559
Meningitis, meningococcus				1	1					2
Mumps		27		58	188	17	14	16	13	333
Poliomyelitis				2	12	8	2		2	26
Scarlet fever		2	18	77	83	14	2	4	9	209
Tuberculosis (all forms)		1	5	106	22	51	1	5	49	240
Typhoid and paratyphoid fever				9	3	1	1	2	3	19
Undulant fever		1		3	2			2	3	11
Venereal diseases:										
Gonorrhea	1	13	14	104	86	39	19	42	117	435
Syphilis	3	18	6	69	53	10	10	10	45	224
Other forms									7	7
Whooping cough				53	64	32	13	24	58	244

WORLD DISTRIBUTION OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER

From consular reports, international health organizations, medical officers of the Public Health Service, and other sources. The reports contained in the following tables must not be considered as complete or final as regards either the list of countries included or the figures for the particular countries for which reports are given.

CHOLERA

[C indicates cases]

NOTE.—Since many of the figures in the following tables are from weekly reports, the accumulated totals are for approximate dates.

Place		January–September 1947	October 1947	November 1947—week ended—				
				1	8	15	22	29
AFRICA								
Egypt	C	523	10,972	6,444	2,797	925	178	48
Alexandria	C	9	141	63	31	7		
Cairo	C		118	8				
Ismailiya	C	18	72	1				
Port Said	C		11	1				
Suez	C	5	13	8				
ASIA								
Arabia: Amirate of Dubay	C				1			
Burma	C	257		2				
Moulmein	C	64		2				
Rangoon	C	4						
China:								
Anhwei Province	C	5	1					
Chekiang Province	C	200						
Pingyang	C	123						
Wenchow	C	1						

See footnotes at end of table.

CHOLERA—Continued

Place		January–September 1947	October 1947	November 1947—week ended— 1	8	15	22	29
ASIA—continued								
China—Continued								
Formosa (Island of)	C	14						
Fukien Province	C	16						
Foochow	C	2						
Honan Province	C	417						
Hunan Province	C	16						
Kiangsi Province	C	95						
Kiangsu Province	C	712	18					
Chinkiang	C	8						
Shanghai	C	35	18					
Tsingkiang	C	9		6				
Kwangtung Province	C	6						
Hong Kong	C	6						
Szechwan Province	C	5						
India	C	103,976	18,220					
Ahmadabad	C	11	16					
Allahabad	C	69	1					
Bombay	C	108	6					
Calcutta	C	4,224	165	32	27	32	45	
Cawnpore	C	303	21	3	3		1	
Chittagong	C	30	2					
Lahore	C	1,153	735	95	89			
Lucknow	C	269	17	1				
Madras	C	3	8	5		5	3	
Nagpur	C	20	13	3				
New Delhi	C	29	6					
India (French):								
Chandernagor	C	32						
Karikal	C	4						
Pondicherry	C	34	2					
India (Portuguese)	C	28		23				
Indochina (French):								
Annam	C	20						
Cambodia	C	947	44				[1] 42	
Cochinchina	C	463	28				[1] 19	
Bien Hoa	C	7						
Chaudoc	C	1		1				
Cholon	C	33						
Giadinh	C	11						
Longxuyen	C	6		4	16			
Mytho	C	5			1			
Rachgia	C	22						
Saigon	C	134	1					
Vinh-long	C	8						
Laos	C	55						
Tonkin	C	67						
Siam (Thailand)	C	3,335	15					
Bangkok	C	776	1		1			
Straits Settlement: **Penang**	C		[2] 1					

[1] For the period Nov. 1–20, 1947.
[2] Suspected.

PLAGUE

[C indicates cases; D, deaths]

AFRICA								
Belgian Congo	C	[1] 14	3					
British East Africa:								
Kenya	C	51	1	1				
Uganda	C	1						
Egypt: **Alexandria**	C	22						
Madagascar	C	[2] 199	6					
Mananjary	C	5						
Union of South Africa	C	[3] 25				1	6	
ASIA								
Burma	C	1,248	1					
Bassein	C	[4] 2						
Mandalay	C	17						
Rangoon	C	18	1					
China:								
Chekiang Province	C	116						
Formosa (Island of)	C	1						
Fukien Province	C	655						
Amoy	C	13						
Foochow	C	31						
Kiangsi Province	C	158	1					
Nanchang	C	36	1					

See footnotes at end of table.

PLAGUE—Continued

Place		January–September 1947	October 1947	November 1947—week ended— 1	8	15	22	29
ASIA—continued								
China—Continued								
Kiangsu Province	C	30						
Shanghai	C	28						
Kwangtung Province	C	77						
Yunnan Province	C	199	[4] [5] 12					
India	C	68,756	1,675					
Indochina (French):								
Annam	C	79	2		1			
Cochinchina	C	31						
Java	C	37	1					
Korea	C	22						
Manchuria	D	[6] 100						
Palestine	C	39					1	1
Siam (Thailand)	C	46	2					
Syria	C	6						
Turkey: Akcakale	C	19						
EUROPE								
Germany: East Prussia. [7]								
Portugal: Azores	C	4						
Turkey (see Turkey in Asia).								
NORTH AMERICA								
Canada. [8]								
SOUTH AMERICA								
Argentina:								
Cordoba Province	C	1						
Santa Fe Province	C	3						
Brazil: [9]								
Ceara State	C	2						
Minas Geraes State	C	7						
Parahyba State	C	1						
Pernambuco State	C	1						
Ecuador:								
Chimborazo Province	C	4						
Loja Province	C	7	8					
Peru:								
Lambayeque Department	C	10						
Libertad Department	C	19	1					
Lima Department	C	39	3					
Piura Department	C	[10] 78						
OCEANIA								
Hawaii Territory: Plague infected rats [11]		1						

[1] Includes 5 cases of pneumonic plague.
[2] Includes 64 cases of pneumonic plague.
[3] Includes 2 cases of pneumonic plague.
[4] Imported.
[5] Pneumonic.
[6] Period not specified.
[7] During the month of June 1947, an outbreak of plague with high mortality occurred in Königsberg, East Prussia, Germany.
[8] For the period July 5 to Sept. 20, 1947, 6 lots of plague infected fleas from squirrels were reported in Alberta and Saskatchewan Provinces, Canada.
[9] In addition, 7 cases of plague were reported in Brazil for the period Jan. 1 to May 31, 1947, specific localities not being given.
[10] In addition 82 cases with 65 deaths in Ayabaca Province and 58 cases with 48 deaths in Huancabamba Province, all unconfirmed, were reported for the period September 1946 to March 1947.
[11] Plague infection was also reported in Hawaii Territory as follows: On Jan. 9, 1947, in a pool of 31 rats, on Mar. 20, 1947, in a pool of 32 fleas collected from 59 rats.

SMALLPOX

[C indicates cases; P, present]

AFRICA								
Algeria	C	140	24					
Angola	C	[1] 158						
Basutoland	C	1						
Bechuanaland	C	29						
Belgian Congo	C	[1] 2,100	[1] 172	[1] 67	[1] 62			
British East Africa:								
Kenya	C	383	32	3				
Nyasaland	C	1,020	336	145				
Tanganyika	C	2,277	180	63				
Uganda	C	304	223					

See footnotes at end of table.

SMALLPOX—Continued

Place		January–September 1947	October 1947	November 1947—week ended— 1	8	15	22	29
AFRICA—continued								
Cameroon (French)	C	122	10		7			
Dahomey	C	138	2				5	
Egypt	C	498						
Ethiopia	C	30						
French Equatorial Africa	C	7	2					
French Guinea	C	358	50		7			
Gambia	C	6						
Gold Coast	C	633	144	5				
Ivory Coast	C	2,283	232		65			
Liberia	C	37						
Libya	C	2,067	54	13	15	21	29	
Mauritania	C	23						
Morocco (French)	C	56			1			
Morocco (Int. Zone)	C	12						
Morocco (Spanish)	C	29						
Mozambique	C	3						
Nigeria	C	4,537	197					
Niger Territory	C	2,473						
Portuguese Guinea	C	3						
Rhodesia:								
Northern	C	59	1		10			2
Southern	C	439	24					
Senegal	C	16						
Sierra Leone	C	359						
Sudan (Anglo-Egyptian)	C	288	9	4	104	41		
Sudan (French)	C	370	9					
Swaziland	C	[1] 10						
Togo (French)	C	[1] 85	2					
Tunisia	C	668	12					
Union of South Africa	C	503	P	P	P	P		
ASIA								
Arabia	C	1						
Burma	C	2,730	58	16	5			
Ceylon	C	1						
China	C	2,870	6		6	6	12	
India	C	46,786	309					
India (French)	C	10						
India (Portuguese)	C	3		9				
Indochina (French)	C	4,169	107					
Iran	C	75						
Iraq	C	14		2	7	1	17	
Japan	C	382	5					
Korea	C	125						
Malay States (Federated)	C	3,550	100	28	59			
Manchuria	C	7						
Portuguese Timor	C	32						
Siam (Thailand)	C	1,206	58					
Straits Settlements	C	98	1					
Syria	C	3						
Turkey (see Turkey in Europe).								
EUROPE								
Belgium	C	[1] 23						
France	C	48						
Germany	C	12						
Great Britain: England and Wales	C	77						
Greece	C	10						
Irish Free State	C	[2] 1						
Italy	C	68						
Luxemburg	C	[2] 2						
Portugal	C	62	17	34				
Spain	C	23	5					
Switzerland	C	[2] 1						
Turkey	C	3						
NORTH AMERICA								
Guatemala	C	13						
Mexico	C	859						
Panama (Republic)	C	[2] 1						
SOUTH AMERICA								
Argentina	C	26	8					
Brazil	C	366	3	4	1			
Colombia	C	3,189	250					
Ecuador	C	[1] 1,098	[1] 584					
Paraguay	C	[1] 325	[1] 334					
Peru	C	271						
Uruguay	C	[1] 261						
Venezuela	C	[1] 3,937	[1] 288				[1] 40	

[1] Includes alastrim. [2] Imported.

TYPHUS FEVER*

[C indicates cases; P, present]

Place		January-September 1947	October 1947	November 1947—week ended—				
				1	8	15	22	29
AFRICA								
Algeria	C	187	10					
Basutoland	C	15						
Bechuanaland	C	1						
Belgian Congo	C	307	28	16	6			
British East Africa:								
Kenya [1]	C	18						
Uganda	C	2						
Egypt	C	102						
Eritrea	C	579		6	18			
Ethiopia	C	255						
French West Africa [2]	C	2						
Gold Coast	C	5						
Libya	C	183						
Morocco (French)	C	119	5					
Morocco (International Zone)	C	27						
Morocco (Spanish)	C	88						
Nigeria [1]	C	16						
Rhodesia:								
Northern	C		1					
Southern	C	1						
Senegal	C	2						
Sierra Leone	C	3						
Tunisia [1]	C	646						
Union of South Africa [1]	C	283	P	P		P		
ASIA								
Arabia [1]	C	2						
Burma	C	3						
Ceylon	C	[3] 1						
China [1]	C	85						
India	C	7						
Indochina (French)	C	66	3		4		3	
Iran	C	235						
Iraq	C	275	16					
Japan	C	1,006	10	2	7		1	
Java	C	1						
Korea	C	1,261						
Malay States (Federated) [1]	C	50						
Manchuria	C	12						
Palestine [1]	C	198	1	1	2			
Siam (Thailand)	C	4						
Straits Settlements	C	7		1				
Syria	C	31	1					
Trans-Jordan	C	19	1					
Turkey (see Turkey in Europe).								
EUROPE								
Austria [1]	C	8						
Bulgaria	C	800	13					
Czechoslovakia	C	32	6		3			
France	C	4						
Germany	C	19						
Great Britain: Malta and Gozo [3]	C	20	2					
Greece [1]	C	293	46	5	5	5	10	7
Hungary	C	581	7	2			5	
Italy	C	53						
Sicily	C	29						
Netherlands	C	1						
Norway [2]	C	1						
Poland	C	442	24	4				
Portugal	C	4						
Rumania [1]	C	21,320						
Spain	C	131	22					
Switzerland [2]	C	6						
Turkey	C	491	28	8	2	13	50	13
Yugoslavia	C	179	13	5				
NORTH AMERICA								
Costa Rica [2]	C	101						
Cuba [2]	C	9						
Guatemala	C	316						
Jamaica [3]	C	37			1			
Mexico	C	1,625						

See footnotes at end of table.

TYPHUS FEVER*—Continued

Place		January–September 1947	October 1947	November 1947—week ended— 1	8	15	22	29
NORTH AMERICA—continued								
Nicaragua	C		2					
Panama Canal Zone	C	13						
Panama (Republic)	C	[4] 18						
Puerto Rico [2]	C	44	7					
Virgin Islands [2]	C	2						
SOUTH AMERICA								
Argentina [1]	C	16						
Brazil	C	22	11	4	1	3		
Chile [1]	C	398						
Colombia	C	1,823	201					
Curacao [2]	C	1						
Ecuador [1]	C	477	49					
Peru	C	740						
Venezuela [1]	C	144						
OCEANIA								
Australia [2]	C	134	6					
Hawaii Territory [2]	C	30				1		

*Reports from some areas are probably murine type, while others probably include both murine and ouse-borne types.
[1] Includes murine type.
[2] Murine type.
[3] Imported.
[4] Includes imported cases.

YELLOW FEVER

[C indicates cases; D, deaths]

AFRICA								
Sudan (French): Bamako	C		2		1			
SOUTH AMERICA								
Brazil:								
Bahia State	D	1						
Para State	D	1						
Colombia:								
Antioquia Department	C	[1] 7						
Boyaca Department	D	3						
Caldas Department	D	6						
Cundinamarca Department	D	2						
Intendencia of Meta	D	7						
North Santander Department	D	1						
Santander Department	D	29						
Tolima Department	D	3						
Peru: Huanuco Department	D	2						

[1] Includes deaths used as cases.

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