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V. SULPHANILAMIDE, SERUM, AND COMBINED DRUG AND SERUM THERAPY IN EXPERIMENTAL MENINGOCOCCUS AND PNEUMOCOCCUS INFECTIONS IN MICE¹

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The discovery by Domagk (1) that certain sulphonamide compounds are curative in streptococcal infections opened a new field of investigation in chemotherapy of bacterial infections. Trefouel, Nitti, and Bovet (2) demonstrated that a relatively simple compound, p-aminobenzene sulphonamide (sulphanilamide), possesses curative action, and this work was soon followed by the report of Buttle, Gray, and Stephenson (3), showing, among other things, that sulphanilamide is capable of curing meningococcal infections in mice. Proom (4) continued the work upon meningococci and found that curative action could be demonstrated against as many as 1,000,000 fatal doses if adequate therapy was begun immediately after infection.² Inferior results were obtained when therapy was delayed. Proom showed that the drug is active against three strains of type I meningococcus and three strains of type II meningococcus. He also found that sulphanilamide is effective when given by mouth. Marshall, Emerson, and Cutting (5) studied the absorption and excretion of this drug and found it to be rapidly absorbed from the alimentary canal. They examined the spinal fluid of three patients who were receiving this therapy and found that concentrations slightly lower than those in the blood were reached in the spinal fluid.

In a previous communication (6) we have compared the activity of various sulphonamide compounds, including new ones made at this Institute by Dr. Hugo Bauer, upon pneumococcus, streptococcus, and meningococcus infections in mice. Prontosil and Prontosil Soluble were inferior to sulphanilamide. A new compound, di-sulphanilamide, was prepared, which, when tested against streptococcal and meningococcal infections, was found to have a therapeutic value at least five times as favorable as that of sulphanilamide when injected

¹ From the Divisions of Pharmacology and Biologics Control.

² Favorable clinical results have subsequently been reported by Schwentker, Gelman, and Long (*J. Am. Med. Assoc.*, 108: 1407 (1937)).

subcutaneously. Further work will be reported concerning the application of this and of other sulphonamide derivatives to therapeutic use.

The present report deals with five groups of experiments: (1) The effect of sulphanilamide upon meningococcus infections in mice; (2) a comparison of oral and subcutaneous administration of sulphanilamide; (3) a comparison of sulphanilamide and immune polyvalent serum in the treatment of meningococcus infections in mice; (4) the effect of combined drug and serum therapy in such infection; and (5) combined drug and serum therapy in pneumococcus infections in mice.

TECHNIQUE

The 20 strains of meningococci used in these studies were obtained from recent cases of meningococcus meningitis; 13 were of group I-III and 7 were of type II. They varied greatly in virulence for mice.

In some of our experiments the cultures were incubated 5 hours and in others 18 hours. In either case the growth from the rabbits' blood agar or serum glucose agar slants was suspended in Ringer's solution and diluted to approximately 2,000,000,000 meningococci per cc as determined by comparison with a standard suspension of 1,000 p. p. m. of silica (7). With such a suspension as a starting point, further dilutions were made in a 6 percent solution of mucin² prepared according to the method of Miller (8).

The number of meningococci in a fatal dose was determined by intraperitoneal injection of 0.5 cc of various dilutions into mice. A fatal dose was considered to be that number of meningococci which killed 80 to 100 percent of the mice within 48 hours. This dose, or some multiple of it, was used in the studies reported here. The fatal dose for these strains was usually 100,000 to 10,000,000, and was sometimes as great as 200,000,000. It was always smaller with 5-hour than with 18-hour cultures. Our strains were, therefore, definitely less virulent than those reported by Proom (4), and the number of micro-organisms used in our tests does not represent such a large number of fatal doses. All injections of meningococci were made intraperitoneally, and the suspensions were never allowed to stand longer than one-half hour.

The course of untreated meningococcus infection in mice has been described in detail by Miller (9). Symptoms may begin to develop within an hour or two after injection, and death occurs most often in 12 to 24 hours, though it may occur as early as 4 hours or later than 24. Death after 48 hours is usually due to some other cause in untreated animals, though delayed deaths occur not infrequently in the drug-treated animals.

² Granular mucin from the Wilson Laboratories, Chicago, Ill.

Sulphanilamide³ was powdered in a mortar and suspended in olive oil in 20 percent concentration. All injections of it were made subcutaneously in animals in the amounts designated in the individual experiments.

Two polyvalent antimeningococcic sera were used in some of these studies, one being a whole untreated immune serum and the other a concentrated preparation. Both of these had been used repeatedly in mouse-protection tests and had been found to be well above the average serum in protective action. A normal horse serum was included for comparative purposes.

Although many antimeningococcic sera protect mice against a few fatal doses, even in relatively high dilutions, few such sera protect against a large number of fatal doses. Hence by using multiples of the fatal dose for infection of the mice it is easy to find a range within which protection by serum is not complete, thus allowing comparison of the serum protection with the effect of the drug. The unconcentrated serum, designated A, was used in a dilution of 1:5, as was also the normal horse serum; the concentrated serum, designated B, was used in a 1:10 dilution. All serum injections (0.5 cc) were given intraperitoneally.

In some of these experiments in which the drug was the only therapeutic agent, it was given within a few minutes after the injection of meningococci; but in all of the studies of the comparative value of drug and serum they were both given 2 hours after the inoculation. By this time the animals were quite sick and the organisms had invaded the blood stream.

For the pneumococcus experiments a virulent type I strain (Mulford) was employed. One-half cc of an 18-hour broth culture diluted 10^{-7} regularly killed mice following intraperitoneal inoculation. In our experiments 100 lethal doses (10^{-5} dilution) were used.

The antipneumococcus serum contained 300 units (Felton) of type I antibodies and 150 units of type II antibodies per cc. Both drug and serum were given at an interval of 5½ hours after injection of pneumococci.

RESULTS

1. *The effect of sulphanilamide upon meningococcus infections in mice.*—Experiments carried out with 20 strains of meningococci have shown curative effects from sulphonamide therapy in all cases.

In nine of the experiments the drug was administered soon (5 to 20 minutes) after the mice had been inoculated with the meningococci. With five strains, 80 to 100 percent of the mice survived from 1 to 10 lethal doses of meningococci; with the remaining four strains there

³ Sulphanilamide was obtained from Winthrop Chemical Co. (Prontylin), from Merck & Co., and from Burroughs & Wellcome Co.

were 40 to 60 percent of survivors as a result of the drug treatment. Details of therapy are given in tables 1, 2, and 3.

TABLES 1, 2, 3.—Therapeutic action of sulphanilamide upon 20 strains of meningococci, serological types I, II, and III. 1 to 10 M. L. D. of organisms used

[S. A.—sulphanilamide; repeated figures (under "Therapy") represent doses on successive days; organisms injected intraperitoneally, drug subcutaneously. M=million; T=thousand; B. D.=twice daily]

TABLE 1

Meningococcus strain and type	Number of organisms	Therapy, grams per kilo	Number of mice	Deaths in days					Mortality percent
				1	2	3	4	5	
931 I	50 M	S. A.: 0.8 B. D., 0.5 B. D.	5	1	2				60
	50 M	None	5	5					100
	100 M	S. A.: 0.8 B. D., 0.5 B. D.	5	3	1				80
	100 M	None	5	5					100
931 I	100 M	S. A.: 1.0, 1.0, 0.5	5						0
	50 M	None	5	5					100
938 I	50 M	S. A.: 0.8 B. D., 0.5 B. D.	5						0
	50 M	None	5	5					100
	100 M	S. A.: 0.8 B. D., 0.5 B. D.	5						0
	100 M	None	5	5					100
937 I	50 M	S. A.: 1.0, 1.0, 0.5	5						0
	10 M	None	5	5					100
	50 M	None	5	5					100
	100 M	S. A.: 1.0, 1.0, 0.5	5						0
	100 M	None	5	5					100
962 I	5 M	S. A.: 0.5	20	3		5			40
	5 M	None	20	16		2	1		95
936 I	2 M	S. A.: 0.8 ¹	10		2				20
	2 M	None	10	9	1				100
	20 M	S. A.: 0.8	10		3	1			40
	20 M	None	10	10					100
1000 I	2 M	S. A.: 0.8 ¹	10	6					60
	2 M	None	10	10					100

¹ Therapy 2 hours after infection.

TABLE 2

Meningococcus strain and type	Number of organisms	Therapy, grams per kilo	Number of mice	Deaths in days					Mortality percent
				1	2	3	4	5	
504 II	10 M	S. A.: 1.0, 1.0, 0.5	5						0
	10 M	None	5	3					60
	100 M	S. A.: 1.0	10	2		1		1	40
	100 M	None	10	10					100
933 II	200 M	S. A.: 1.0 ¹	10	5		1			60
	200 M	None	10	7					70
985 II	100 M	S. A.: 1.0 ¹	10	5	3	1			90
	100 M	None	10	10					100
997 II	200 T	S. A.: 0.8 ¹	10						0
	200 T	None	10	8					80
	2 M	S. A.: 0.8 ¹	10		2	5			70
	2 M	None	10	10					100
909 II	20 M	S. A.: 0.8 ¹	10						0
	20 M	None	10	6	1				70
	200 M	S. A.: 0.8 ¹	10	7	1	1			90
	200 M	None	10	10					100

¹ Therapy 2 hours after infection.

TABLES 1, 2, 3.—*Therapeutic action of sulphanimide upon 20 strains of meningococci, serological types I, II, and III. 1 to 10 M. L. D. of organisms used—Continued.*

[S. A. = sulphanimide; repeated figures (under "Therapy") represent doses on successive days; organisms injected intraperitoneally, drug subcutaneously. M = million; T = thousand; B. D. = twice daily]

TABLE 3

Meningococcus strain and type	Number of organisms	Therapy, grams per kilo	Number of mice	Deaths in days					Mortality, percent
				1	2	3	4	5	
934 III.....	50 M.....	S. A.: 0.8 B. D., 0.5 B. D.....	5				1		20
	50 M.....	None.....	5	5					100
	100 M.....	S. A.: As above.....	5			1			20
	100 M.....	None.....	5	5					100
936 III.....	50 M.....	S. A.: 0.8 B. D., 0.5 B. D.....	5	1					20
	50 M.....	None.....	5	5					100
	100 M.....	S. A.: As above.....	5		2	1			60
	100 M.....	None.....	5	5					100
850 III.....	200 M.....	S. A.: 0.5.....	20	2		5	1		40
	200 M.....	None.....	20	16			1		95
850 III.....	200 M.....	S. A.: 0.8 ¹	10	7		1			80
	200 M.....	None.....	10	10					100
952 III.....	100 M.....	S. A.: 1.0 ¹	10	1					10
	100 M.....	None.....	10	8					80
1001 III.....	20 M.....	S. A.: 0.8 ¹	10	1					10
	20 M.....	None.....	10	8					80
	200 M.....	S. A.: 0.8 ¹	10	1	1				20
	200 M.....	None.....	10	10					100
1004 I, III.....	10 M.....	S. A.: 1.0 ¹	10	1		3			40
	10 M.....	None.....	10	8					80
1010 I, III.....	10 M.....	S. A.: 0.8 ¹	10	1					10
	10 M.....	None.....	10	9					90

¹ Therapy 2 hours after infection.

With 11 strains of meningococci an interval of 2 hours was allowed to elapse before therapy was administered. This therapy consisted of a single subcutaneous injection of 0.8 to 1.0 gram per kilo of sulphanimide in oil. While this does not represent adequate therapy for maximum curative results, a high percentage of survivors resulted in most cases. With 7 of the strains, 60 to 100 percent of the treated animals survived, while with the other 4 strains 10 to 40 percent survived. Of these 4 strains, 3 were of low virulence, requiring 100 to 200 million organisms per mouse as the minimum fatal dose.

These results are in general accord with those of Proom (4), although not quite as striking as his. This may be explained by the fact that the organisms which he employed were more virulent than ours, and also that the therapy which he gave was more extensive.

2. *Comparison of oral and subcutaneous administration of sulphanimide.*—Proom has demonstrated that excellent results in meningococcus infections in mice can be obtained by either the oral or subcutaneous administration of the drug. He gave two and one-half times the amount by mouth as was given by injection and obtained approximately similar curative effects. However, his experiments were not designed for comparative purposes.

We have compared the activity of sulphanilamide when given in identical doses by mouth and subcutaneously. In two series of experiments the drug was more effective by subcutaneous administration. Whether or not this same superiority of injection over oral dosage would be manifest on continued administration of the drug cannot be decided from these experiments, since an equilibrium of the drug in the body is reached after several days of medication (5). In clinical cases, subcutaneous medication would seem indicated at the onset of therapy to ensure the most rapid and effective results.

3. *Comparison of sulphanilamide and serum therapy in meningococcus infections in mice.*—With 10 of the strains of meningococci studied as noted above, comparison was made between drug and serum therapy. Treatment consisted of a single dose of drug or serum 2 hours after intraperitoneal inoculation of the meningococci. Sulphanilamide was given subcutaneously in oil 0.8 to 1.0 gram per kilo. Serum A, diluted 1:5, was used with 4 strains, while serum B (concentrated), diluted 1:10, was administered to the other 6 strains.

With 3 of the 10 strains the drug was more effective, with 4 of them the serum was somewhat more effective, while with the remaining 3 strains no appreciable differences could be noted (table 4). This series of experiments is obviously too small to permit generalization, but it should be pointed out that no correlation was apparent between either the serological type of meningococcus or the virulence of the organism, and the degree of effectiveness of drug or serum.

TABLE 4.—A comparison of the therapeutic activity of sulphanilamide and serum on 10 strains of meningococci (for details, see table 5)

[Roman numerals refer to serological type, and figures in parentheses represent number in millions of organisms injected (1 to 10 M. L. D.). Variations in therapeutic results occur which cannot be correlated to the type of organism or its virulence]

S. A. more effective	Serum more effective	S. A. and serum equally effective
<i>Strain</i>	<i>Strain</i>	<i>Strain</i>
997 II (2 M). 998 II (20 M). 1001 III (200 M).	985 II (100 M). 996 I (20 M). 1000 I (2 M). 1004 I, III (10 M).	850 III (200 M). 933 II (200 M). 1010 I, III (10 M).

For practical purposes this would suggest that both drug and serum therapy be employed clinically in the treatment of meningococcal meningitis, as it is at present not possible to predict which type of treatment will give the more favorable results. An examination of our results with this combined therapy provides an added reason for the adoption of such a procedure.

4. *Combined drug and serum therapy in meningococcal infections in mice.*—In all of the experiments in which a comparison was attempted between drug and serum treatment, a series of animals was included to which both drug and serum were given.

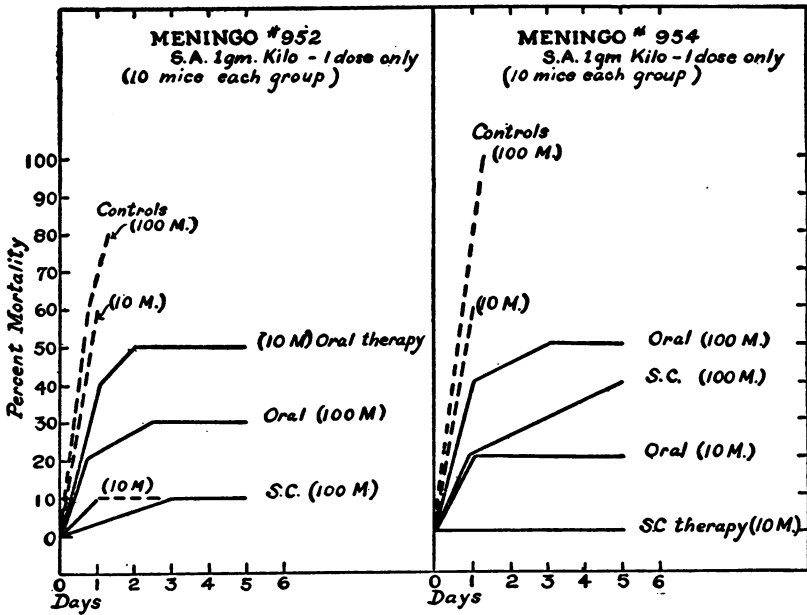


FIGURE 1.—Comparison of oral and subcutaneous therapy with sulphanilamide in meningococcus infection⁸ in mice. 1 gm per kilo in each case, orally (stomach tube) suspended in acacia. S. C. in oil. One dose only.

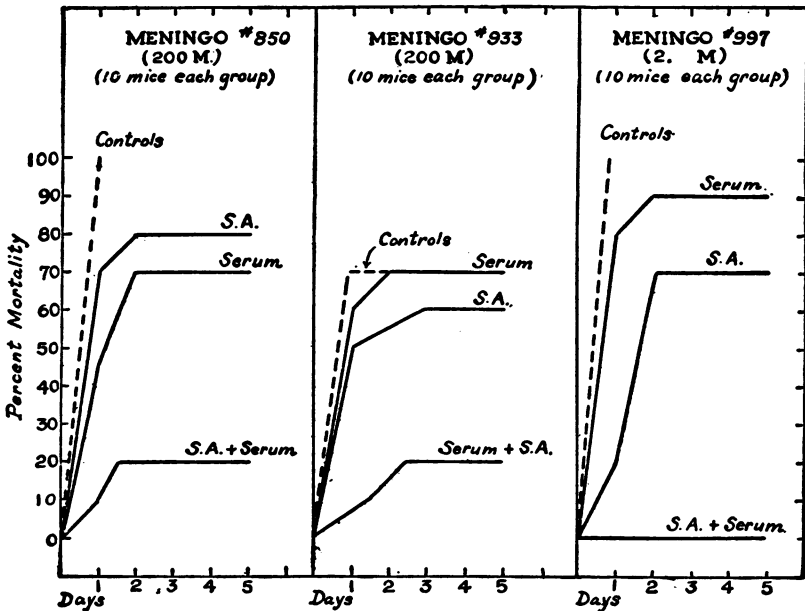


FIGURE 2.—Three experiments with meningococcus infections showing the marked curative effect of combined drug and serum therapy where each alone yielded poor results. Therapy 2 hours after infection. For details consult table 5.

In 6 of the 10 experiments, 90 to 100 percent of mice survived with either the serum or drug alone, so that any added benefit from the combination could not be determined. With 4 strains, conditions were attained whereby neither the drug nor serum gave a high percentage of cure, and in each such instance the combined use of sulphanilamide and serum resulted in a much more favorable outcome (table 5). In three of the four experiments (upon strains 850, 933, 997) the effect of combination therapy was greater than the additive effect of drug and serum alone, suggesting a synergistic action (fig. 2).

The evidence at present, as brought out by Colebrook, Buttle, and O'Meara (10), and by Long and Bliss (11), indicates that sulphanilamide acts by exerting a bacteriostatic and bactericidal action in the body. The solution to the problem is not as yet complete, since Colebrook, Buttle, and O'Meara could find no appreciable bacteriostatic action against streptococci in the blood of treated mice (as compared with results in man and in the monkey), while the drug is quite effective against streptococcal infections in mice. Furthermore, Rosenthal (12) found that sulphanilamide was more than 100 times as bacteriostatic and (or) bactericidal against pneumococci than against streptococci in the test tube, while in mice the drug is more effective against streptococci.

Some preliminary experiments have shown that sulphanilamide in the test tube is inhibitory (12), in low concentration, to the growth of meningococci. There is adequate reason to believe that serum and drug operate through different mechanisms and that the best results in the therapy of meningitis can be obtained by employing both forms of treatment. Our animal experiments lend support to this belief.

TABLE 5.—Comparative results with 10 strains of meningococci with sulphanilamide, serum, and combined drug and serum therapy (10 mice were used in each group. 1 to 10 M. L. D. organisms intraperitoneally. Therapy, 1 injection only, 2 hours after infection. Drug given subcutaneously, serum intraperitoneally)

Meningococcus strain and type	Number of organisms	Therapy	Deaths in days					Mortality, percent
			1	2	3	4	5	
998 L.....	2 M.....	S. A.: 0.8 gm per kilo.....	1	1				20
	2 M.....	Serum B, 1:10.....						0
	2 M.....	S. A. +serum.....						0
	2 M.....	None.....	9	1				100
	20 M.....	S. A.: 0.8.....		3	1			40
	20 M.....	Serum B, 1:10.....						0
	20 M.....	S. A. +serum.....	1					10
	20 M.....	None.....	10					100
1000 L.....	2 M.....	S. A.: 0.8 gm per kilo.....	4	2				60
	2 M.....	Serum B, 1:10.....						0
	2 M.....	S. A. +serum.....	1					10
	2 M.....	None.....	10					100
1004 I, III.....	10 M.....	S. A.: 1.0 gm per kilo.....	1		3			40
	10 M.....	Serum A, 1:5.....						0
	10 M.....	S. A. +serum.....			1			10
	10 M.....	None.....	8					80

TABLE 5.—Comparative results with 10 strains of meningococci with sulphanilamide, serum, and combined drug and serum therapy (10 mice were used in each group. 1 to 10 M. L. D. organisms intraperitoneally. Therapy, 1 injection only, 2 hours after infection. Drug given subcutaneously, serum intraperitoneally)—Continued

Meningococcus strain and type	Number of organisms	Therapy	Deaths in days					Mortality, percent
			1	2	3	4	5	
1010 I, III	10 M	S. A.: 1.0 gm per kilo						0
	10 M	Serum A, 1:5						0
	10 M	S. A. + serum		1				10
	10 M	None	7					70
933 II	200 M	S. A.: 1.0 gm per kilo	5		1			60
	200 M	Serum A, 1:5	6		1			70
	200 M	S. A. + serum		1	1			20
	200 M	None	7		1			70
985 II	100 M	S. A.: 1.0 gm per kilo	8	1				90
	100 M	Serum A, 1:5	5					50
	100 M	S. A. + serum	2		2	1		50
	100 M	None	10					100
	10 M	None	10					100
997 II	200 T	S. A.: 0.8 gm per kilo						0
	200 T	Serum B, 1:10	2	2				40
	200 T	S. A. + serum	1					10
	200 T	None	8					80
	2 M	S. A.: 0.8 gm per kilo	2	5				70
	2 M	Serum B, 1:10	8	1				90
	2 M	S. A. + serum						0
	2 M	None	10					100
999 II	20 M	S. A.: 0.8 gm per kilo						0
	20 M	Serum B, 1:10	8					30
	20 M	S. A. + serum						0
	20 M	None	6	1				70
1001 III	20 M	S. A.: 0.8 gm per kilo	1					10
	20 M	Serum B, 1:10						0
	20 M	S. A. + serum						0
	20 M	None	8					80
	200 M	S. A.: 0.8 gm per kilo	1	1				20
	200 M	Serum B, 1:10	7	2				90
	200 M	S. A. + serum		1				10
850 III	200 M	None	10					100
	200 M	S. A.: 0.8 gm per kilo	7	1				80
	200 M	Serum B, 1:10	5	2				70
	200 M	S. A. + serum	1	1				20
	200 M	None	10					100

5. Combined sulphanilamide and serum therapy in pneumococcus infections in mice.—We have previously shown that sulphanilamide possesses chemotherapeutic activity against types I, II, and III pneumococcus infections in mice (13). The action in mice is not nearly so striking as it is against hemolytic streptococcus infections. More favorable results have been obtained in rats in recent experiments by Gross and Cooper (14) against type III organisms and by ourselves (6) against types I, II, and III pneumococci.

While appropriate serum therapy is undoubtedly superior to drug therapy in their present stages of development, there is still much to be desired in the serum treatment of pneumococcus infections. In view of our favorable results with combined therapy against the meningococcus, a few experiments of a similar nature were carried out upon the pneumococcus.

Preliminary tests were made to determine the dilution of serum which would save only a small percentage of mice that had been inoculated with pneumococci 5½ hours previously. With the serum employed, this proved to be 0.5 cc of a 1:150 dilution when injected subcutaneously. The pneumococcus used was a virulent type I (Mulford strain); the same quantity was injected in all cases, representing approximately 100 lethal doses of organisms.

Sulphanilamide was given subcutaneously in oil, also at 5½ hours after the intraperitoneal injection of pneumococci. The doses were smaller than those originally used by us against pneumococcus

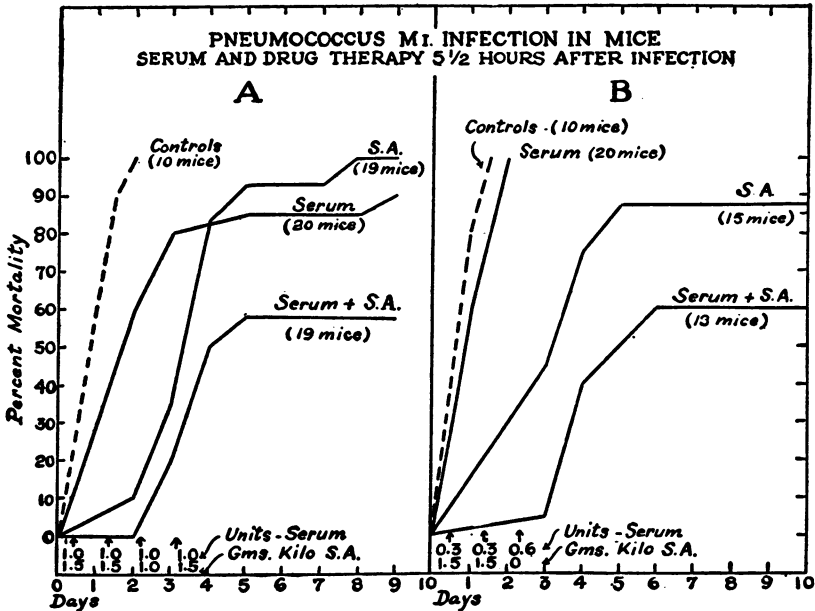


FIGURE 3.—The increased effectiveness of combined drug and serum therapy in type I pneumococcus infection in mice. Treatment S. C. begun 5½ hours after inoculation. Units of serum (Felton) and dosage of sulphanilamide indicated by arrows on the chart.

infections in mice (12), although here too the drug produced spasticity and incoordination in some of the animals.

Two series of experiments were performed. Under the conditions of the experiment, 0 to 12 percent of the animals survived when drug or serum alone was used. With combined drug and serum therapy 40 to 45 percent of survivors resulted (fig. 3).

As in the studies with meningococci, the combination of drug and serum resulted in a greater percentage of surviving mice than was accounted for by the sum of the effects of drug and serum alone.

While our experimental findings indicate that striking clinical results are not to be expected from sulphanilamide therapy in systemic pneumococcus infections, they do suggest that drug therapy be used as an adjunct to serum, or in those cases where serum is ineffective

or not available. It should be emphasized that sulphanilamide is not an innocuous drug and that the large doses necessary for therapeutic effect must be administered under careful supervision.

SUMMARY

Sulphanilamide has shown a marked therapeutic action in mice in which a meningococcic infection has been produced experimentally. Twenty strains of meningococci representing types I, II, and III have been used, and a high percentage of treated animals survived fatal doses of the microorganisms even when the single drug injection was given 2 hours after inoculation with the bacteria.

The drug has been found to be more effective by subcutaneous injection than by mouth when administered in the same dosage.

A comparison was made between sulphanilamide and serum therapy with 10 strains of meningococci. With three the drug was more effective, with four the serum was more effective, and with three strains the activity was equal. No correlation existed between therapeutic response and the serological type or virulence of the organism.

The combination of serum and drug therapy yielded much better results than either alone. In four experiments in which poor curative effects were obtained with serum or drug only, combined therapy resulted in the survival of most of the mice. A synergistic action seemed to exist, since the increased effectiveness of combined therapy was greater than the additive effects of drug and serum alone.

The superiority of combined drug and serum therapy was likewise demonstrated in mice infected with type I pneumococci.

The results of these experiments suggest that a combination of drug and serum therapy in meningococcus and pneumococcus infections in man is worthy of trial.

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TREATMENT OF MALARIA

Some helpful references to the treatment of malaria are those appearing in the Indian Medical Gazette¹ and the Quarterly Bulletin of the League of Nations.² In his paper, Colonel J. A. Sinton, of the Indian Medical Service, recommends two mixtures, as follows:

Mixture A (Alkaline mixture)

Sodium bicarbonate.....	4.0 g (60 grains).
Sodium citrate.....	2.6 g (40 grains).
Calcium carbonate or chloride.....	0.2 g (3 grains).
Water sufficient to make.....	28.5 cc (1 ounce).

This mixture should be well shaken before using.

Mixture B (Cinchona mixture)

Quinine sulphate (or cinchona febrifuge).....	0.65 g (10 grains)*
Citric acid.....	2.0 g (30 grains).
Magnesium sulphate.....	4.0 g (60 grains).
Water sufficient to make.....	28.5 cc (1 ounce).

Although originally quinine was given three times daily for 7 days, it now seems that twice daily for 5 days produces the same result. The dosage is as follows:

After a preliminary purgation, 1 ounce of mixture A (alkali) is given, repeated in 1 hour and again repeated after 1 hour. One-half hour after the third dose of alkali, 1 ounce of mixture B (quinine) is given. On the same day another ounce of quinine mixture is given, preceded at least one-half hour by an ounce of alkali mixture. Two doses of quinine mixture preceded by an ounce of alkali mixture (one-half hour before) are given twice daily for the next 4 days. During the week following the 5 days of quinine, the patient received daily one-fourth grain (0.015 g) of plasmochin.

During the week of plasmochin treatment the patient should be seen each day by the physician. The occurrence of any symptom of plasmochin poisoning requires cessation of the drug. Continuance of the drug may be followed by serious consequences. Symptoms of plasmochin poisoning: Blue or grayish lips; epigastric pain; sudden weakness; abdominal cramp.

Atabrine may be substituted for quinine; dosage of atabrine is 0.1 g, in tablet form, three times daily. This also is a 5-day treatment.

When the primary attack is treated with one of the two drugs (quinine or atabrine), a relapse should be treated with the other.

¹ Sinton, J. A.: A suggested standard treatment of malaria based upon the results of the controlled investigation of 3,700 cases. Indian Medical Gazette, vol. 65, pp. 603-620. November 1930.

² The therapeutics of malaria. 3d. General Report of the Malaria Commission. Quarterly Bulletin of the Health Organization of the League of Nations, vol. 2, no. 2, pp. 185-285, June 1933.

UTILIZATION OF RADIO PRATIQUE AT NEW YORK, FEBRUARY 1 TO APRIL 30, 1937

A report on the inauguration of radio pratique at the port of New York on February 1, 1937, published in the PUBLIC HEALTH REPORTS for April 23, outlined the procedure and gave a summary of the entries of vessels availing themselves of the privilege up to March 26. The accompanying table summarizes the record for the first 3 months of operation under this practice at New York. From February 1 to April 30, 1937, radio pratique was extended in 235 instances. As the vessels entered port on 78 days during this period, an average of a little more than three vessels a day utilized this procedure.

Nationality and number of lines and vessels using radio pratique

Nationality	Number of lines	Eligible vessels	Number of times radio pratique used
American.....	6	25	73
British.....	3	22	80
German.....	3	11	32
French.....	1	6	14
Italian.....	1	2	8
Swedish.....	1	3	8
Dutch.....	1	4	13
Polish.....	1	2	6
Norwegian.....	1	2	1
Total.....	18	76	235

A total of 76 vessels of 822,308 net tons, belonging to 18 steamship companies under 9 flags, made use of radio pratique during the first 3 months of operation. The 235 entries of these vessels under this procedure totaled 2,750,383 net tons and carried 92,154 passengers and 92,856 crew members.

THE PATHOLOGY OF TULARAEMIA

A monograph comprising 14 articles dealing with the pathologic anatomy and histology of tularaemia in man and in laboratory, wild, and domestic mammals and birds has recently been issued by the United States Public Health Service.¹

The section on human pathology brings together all the published surgical and post-mortem pathologic material and adds a considerable number of unpublished cases. Material from many of the published autopsies was obtained and restudied for the preparation of this

¹ The Pathology of Tularaemia. By E. Francis, R. D. Lillie, and R. R. Parker. National Institute of Health Bulletin No. 167. 217 pp., 108 halftone illus. Government Printing Office, Washington, D. C., 1937. Price 46 cents.

article. The material is considered by organs and according to the duration of the disease, and at the end of each of the longer sections a summary of the morphology and development of the lesions is presented. Full reference to the previously published accounts is made in the text in connection with each case considered under each organ. The several articles on animal pathology are similarly arranged as far as the material available warrants.

The monograph is not indexed, but a detailed table of contents and a list of illustrations are provided. A comprehensive general bibliography of 105 references, alphabetically arranged, concludes the bulletin.

DEATHS DURING WEEK ENDED MAY 8, 1937

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

	Week ended May 8, 1937	Correspond- ing week, 1936
Data from 86 large cities of the United States:		
Total deaths.....	8,489	9,044
Average for 3 prior years.....	8,937	-----
Total deaths, first 18 weeks of year.....	177,777	174,146
Deaths under 1 year of age.....	531	591
Average for 3 prior years.....	589	-----
Deaths under 1 year of age, first 18 weeks of year.....	10,951	10,625
Data from industrial insurance companies:		
Policies in force.....	69,591,303	68,210,894
Number of death claims.....	13,214	13,873
Death claims per 1,000 policies in force, annual rate.....	0.9	10.6
Death claims per 1,000 policies, first 18 weeks of year, annual rate.....	11.3	11.0

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

Cases of certain communicable diseases reported by telegraph by State health officers for weeks ended May 15, 1937, and May 16, 1936

Division and State	Diphtheria		Influenza		Measles		Meningococcus meningitis	
	Week ended May 15, 1937	Week ended May 16, 1936	Week ended May 15, 1937	Week ended May 16, 1936	Week ended May 15, 1937	Week ended May 16, 1936	Week ended May 15, 1937	Week ended May 16, 1936
New England States:								
Maine.....	1	1	1	1	3	375	0	0
New Hampshire.....					23	85	0	0
Vermont.....	3	2				437	0	0
Massachusetts.....	1	9			763	1,614	6	8
Rhode Island.....					74	68	0	0
Connecticut.....	7	1	1	2	333	233	0	2
Middle Atlantic States:								
New York.....	41	37	17	13	1,664	3,170	6	27
New Jersey.....	14	12	4	3	1,814	499	0	2
Pennsylvania.....	16	34			1,530	616	3	12
East North Central States:								
Ohio.....	24	24	57	75	2,096	542	5	13
Indiana.....	13	7	11	40	609	36	5	6
Illinois.....	86	39	21	29	296	35	3	15
Michigan.....	8	12			195	164	4	3
Wisconsin.....	10	6	14	53	44	167	0	0
West North Central States:								
Minnesota.....	4	1	1	1	15	530	3	3
Iowa.....	4	5	2		8	5	0	4
Missouri.....	21	12	82	73	39	30	3	4
North Dakota.....	1	1	1	12	2	1	1	0
South Dakota.....	1	1				1	0	0
Nebraska.....	4	1	1		14	41	4	2
Kansas.....	2	8	1	20	41	8	0	0
South Atlantic States:								
Delaware.....					28	27	0	0
Maryland *.....	7	5	8	3	446	454	2	11
District of Columbia.....	3	17			104	186	2	7
Virginia *.....	3	7		68	496	136	6	8
West Virginia.....	1	7	20	39	39	74	9	8
North Carolina.....	18	14	7	5	237	47	5	8
South Carolina.....	6	4	115	126	74	32	2	3
Georgia *.....	8	9					4	1
Florida.....	7	4		7		25	1	3
East South Central States:								
Kentucky.....	2	6	5	58	382	38	11	20
Tennessee.....	9	4	97	71	98	23	5	9
Alabama *.....	8	5	47	54	11	30	5	1
Mississippi *.....	2	6					0	0

See footnotes at end of table.

Cases of certain communicable diseases reported by telegraph by State health officers for weeks ended May 15, 1937, and May 16, 1936—Continued

Division and State	Diphtheria		Influenza		Measles		Meningococcus meningitis	
	Week ended May 15, 1937	Week ended May 16, 1936	Week ended May 15, 1937	Week ended May 16, 1936	Week ended May 15, 1937	Week ended May 16, 1936	Week ended May 15, 1937	Week ended May 16, 1936
West South Central States:								
Arkansas.....	5	5	50	96	11	3	1	1
Louisiana.....	12	12	17	506	11	27	1	4
Oklahoma.....	2	7	14	66	60	46	1	2
Texas.....	32	37	230	211	758	325	8	7
Mountain States:								
Montana.....				58	10	5	0	0
Idaho.....			35	1	22	21	1	0
Wyoming.....	1				28	2	1	0
Colorado.....	6	1			25	19	1	1
New Mexico.....	1	4	2	10	72	44	0	0
Arizona.....	6		52	48	66	110	0	1
Utah.....					40	22	1	1
Pacific States:								
Washington.....	1	1			62	414	2	2
Oregon.....	4	2	30	19	15	151	0	0
California.....	31	26	76	259	212	1,908	3	7
Total.....	386	396	959	2,013	12,870	12,781	115	205
First 19 weeks of year.....	9,258	10,266	268,978	132,942	153,122	190,966	3,111	4,591

Division and State	Poliomyelitis		Scarlet fever		Smallpox		Typhoid fever	
	Week ended May 15, 1937	Week ended May 16, 1936	Week ended May 15, 1937	Week ended May 16, 1936	Week ended May 15, 1937	Week ended May 16, 1936	Week ended May 15, 1937	Week ended May 16, 1936
New England States:								
Maine.....	0	0	17	22	0	0	0	3
New Hampshire.....	0	0	5	1	0	0	0	1
Vermont.....	0	0	7	7	0	0	0	0
Massachusetts.....	0	1	233	218	0	0	2	2
Rhode Island.....	0	0	48	27	0	0	0	0
Connecticut.....	0	0	169	36	0	0	1	1
Middle Atlantic States:								
New York.....	0	3	910	781	0	0	6	17
New Jersey.....	0	0	241	285	0	0	0	4
Pennsylvania.....	1	1	479	338	0	0	3	4
East North Central States:								
Ohio.....	0	0	501	320	0	0	5	5
Indiana.....	1	2	129	134	21	3	1	4
Illinois.....	1	1	628	680	43	13	1	6
Michigan.....	2	0	721	284	9	2	6	8
Wisconsin.....	0	1	285	431	1	7	1	1
West North Central States:								
Minnesota.....	0	0	163	366	21	4	6	0
Iowa.....	0	0	161	137	31	31	0	1
Missouri.....	1	0	24	140	0	29	3	3
North Dakota.....	0	0	23	39	5	3	0	0
South Dakota.....	0	0	40	53	1	32	0	0
Nebraska.....	0	0	76	87	7	16	0	0
Kansas.....	0	0	201	212	9	25	1	3
South Atlantic States:								
Delaware.....	0	0	2	2	0	0	0	0
Maryland.....	0	0	33	43	0	0	2	2
District of Columbia.....	0	0	10	24	0	0	0	0
Virginia.....	0	0	18	51	0	1	7	6
West Virginia.....	0	0	48	26	0	0	3	6
North Carolina.....	0	1	22	11	0	1	4	4
South Carolina.....	0	2		3	0	0	1	5
Georgia.....	1	0	9	25	0	0	13	11
Florida.....	0	0	7	9	0	0	2	6

See footnotes at end of table.

Cases of certain communicable diseases reported by telegraph by State health officers for weeks ended May 15, 1937, and May 16, 1936—Continued

Division and State	Poliomyelitis		Scarlet fever		Smallpox		Typhoid fever	
	Week ended May 15, 1937	Week ended May 16, 1936	Week ended May 15, 1937	Week ended May 16, 1936	Week ended May 15, 1937	Week ended May 16, 1936	Week ended May 15, 1937	Week ended May 16, 1936
East South Central States:								
Kentucky.....	0	0	36	20	0	0	7	4
Tennessee.....	0	0	17	17	0	0	3	5
Alabama ¹	1	0	8	4	0	0	4	3
Mississippi ²	5	0	6	5	0	2	3	2
West South Central States:								
Arkansas.....	0	1	16	3	1	0	1	1
Louisiana.....	0	0	18	5	0	0	14	3
Oklahoma.....	1	0	21	56	1	1	3	7
Texas ⁴	4	1	93	46	6	7	7	14
Mountain States:								
Montana ³	0	2	17	114	18	16	0	1
Idaho ³	0	0	19	17	1	3	0	1
Wyoming ³	0	0	7	20	5	0	0	0
Colorado.....	0	0	24	66	15	3	3	0
New Mexico.....	0	0	21	61	0	0	4	0
Arizona.....	0	0	16	44	0	0	2	2
Utah ³	0	0	10	68	0	4	0	0
Pacific States:								
Washington.....	1	0	22	61	6	5	1	0
Oregon ¹	0	0	45	25	25	13	1	4
California.....	3	5	177	337	24	2	8	6
Total.....	22	21	5,733	5,761	250	223	129	154
First 19 weeks of year.....	415	313	29,276	144,358	5,967	4,279	2,119	2,112

¹ New York City only.

² Week ended earlier than Saturday.

³ Rocky Mountain spotted fever, week ended May 15, 1937, 14 cases, as follows: Maryland, 1; Virginia, 1; Montana, 1; Idaho, 3; Wyoming, 5; Oregon, 3.

⁴ Typhus fever, week ended May 15, 1937, 24 cases, as follows: Georgia, 18; Alabama, 5; Texas, 1.

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	Menin- gococ- cus menin- gitis	Diph- theria	Influn- za	Mala- ria	Mea- sles	Pel- lagra	Pollo- mye- litis	Scarlet fever	Small- pox	Ty- phoid fever
<i>February 1937</i>										
Georgia.....	11	46	4,801	282	38	16	6	57	0	12
Puerto Rico.....		36	278	714	130	1	0	0	0	102
Wisconsin.....	8	9	1,279		72		0	1,334	20	1
Wyoming.....		1	131		4		0	74	18	1
<i>March 1937</i>										
Arizona.....	3	16	395	5	963		0	54	0	1
Wisconsin.....	6	14	385		114		0	1,884	28	17
Wyoming.....					7		0	117	14	0
<i>April 1937</i>										
California.....	16	129	1,192	9	1,114	12	14	908	103	24
Colorado.....	4	26			53		0	150	36	
Indiana.....	18	37	373		1,209		2	1,030	55	3
Nebraska.....	7	10			144		2	432	47	1
New Jersey.....	18	50	36		11,218			852	0	9
North Carolina.....	32	61	243		860	43	1	162	3	16
Ohio.....	25	70	213	1	3,771		2	1,455	4	26
South Carolina.....		49	2,064	696	182	94	1	15	2	7
Wyoming.....		1			44		0	78	22	0

Summary of Monthly Reports from States—Continued

February 1937		March 1937—Continued		April 1937—Continued	
Chicken pox:	Cases	German measles:	Cases	Mumps:	Cases
Georgia	107	Arizona	9	California	3,397
Puerto Rico	44	Wisconsin	71	Colorado	42
Wisconsin	2,126	Mumps:		Indiana	278
Wyoming	30	Arizona	105	Nebraska	131
Conjunctivitis infectious:		Wisconsin	1,262	New Jersey	1,407
Georgia	7	Wyoming	198	Ohio	525
Dysentery:		Ophthalmia neonatorum:		South Carolina	71
Georgia (amoebic)	20	Wisconsin	1	Wyoming	194
Georgia (bacillary)	4	Septic sore throat:		Ophthalmia neonatorum:	
Puerto Rico	57	Wisconsin	21	California	2
Wisconsin (amoebic)	1	Wyoming	2	New Jersey	14
Encephalitis, epidemic or		Trachoma:		Ohio	72
lethargic:		Arizona	25	South Carolina	3
Wisconsin	1	Undulant fever:		Paratyphoid fever:	
Filariasis:		Wisconsin	7	California	2
Puerto Rico	1	Whooping cough:		Colorado	1
German measles:		Arizona	47	North Carolina	1
Wisconsin	54	Wisconsin	766	South Carolina	1
Hookworm disease:		Wyoming	2	Psittacosis:	
Georgia	1813			California	1
Leprosy:				Puerperal septicemia:	
Puerto Rico	3			Ohio	5
Mumps:				Rabies in animals:	
Georgia	149			California	213
Puerto Rico	16			Indiana	38
Wisconsin	831			New Jersey	14
Wyoming	114			South Carolina	41
Ophthalmia neonatorum:				Rabies in man:	
Puerto Rico	2			California	1
Paratyphoid fever:				Rocky Mountain spotted	
Georgia	2			fever:	
Puerperal septicemia:				Wyoming	1
Puerto Rico	3			Septic sore throat:	
Rabies in man:				California	13
Georgia	1			Colorado	5
Septic sore throat:				Nebraska	4
Georgia	42			North Carolina	6
Wisconsin	9			Ohio	113
Wyoming	3			Wyoming	9
Tetanus:				Tetanus:	
Puerto Rico	9			California	12
Tetanus, infantile:				New Jersey	1
Puerto Rico	4			Ohio	2
Trachoma:				Trachoma:	
Puerto Rico	1			California	9
Tularaemia:				Trichinosis:	
Georgia	4			Ohio	1
Typhus fever:				Tularaemia:	
Georgia	23			Ohio	3
Undulant fever:				South Carolina	1
Georgia	3			Typhus fever:	
Wisconsin	3			Colorado	1
Whooping cough:				North Carolina	5
Georgia	95			South Carolina	7
Puerto Rico	49			Undulant fever:	
Wisconsin	434			California	11
Wyoming	9			Nebraska	1
				New Jersey	5
				North Carolina	1
				Ohio	5
				Vincent's infection:	
				Colorado	1
				Whooping cough:	
				California	2,740
				Colorado	187
				Indiana	357
				Nebraska	86
				New Jersey	522
				North Carolina	529
				Ohio	1,635
				South Carolina	185
				Wyoming	13

March 1937

Chicken pox:	
Arizona	73
Wisconsin	2,372
Wyoming	30
Dysentery:	
Arizona	11
Wisconsin (amoebic)	1
Encephalitis, epidemic or	
lethargic:	
Arizona	2
Wisconsin	2

Actinomycosis:	
California	1
Botulism:	
California	1
Chicken pox:	
California	4,312
Colorado	200
Indiana	451
Nebraska	248
New Jersey	1,796
North Carolina	669
Ohio	2,853
South Carolina	118
Wyoming	27
Dengue:	
South Carolina	2
Diarrhea:	
Ohio (enteritis in-	
cluded)	6
South Carolina	290
Dysentery:	
California (amoebic)	13
California (bacillary)	12
New Jersey (amoebic)	2
New Jersey (bacillary)	2
North Carolina (bacil-	
lary)	3
Encephalitis, epidemic or	
lethargic:	
California	2
Colorado	1
New Jersey	2
Ohio	3
Food poisoning:	
California	73
German measles:	
California	168
New Jersey	287
North Carolina	1,085
Ohio	98
South Carolina	1
Granuloma, coccidioid:	
California	5
Hookworm disease:	
California	1
South Carolina	86
Jaundice, epidemic:	
California	11
Lead poisoning:	
Ohio	17

RODENT PLAGUE IN GRANT COUNTY, OREG.

Plague infection was demonstrated on May 10, 1937, in tissue from a ground squirrel, *Citellus oregonus*, shot on a ranch 9 to 12 miles east of John Day, Grant County, Oreg.

WEEKLY REPORTS FROM CITIES

City reports for week ended May 8, 1937

This table summarizes the reports received weekly from a selected list of 140 cities for the purpose of showing a cross section of the current urban incidence of the communicable diseases listed in the table. Weekly reports are received from about 700 cities, from which the data are tabulated and filed for reference.

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Small-pox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Data for 90 cities:											
5-year average...	203	181	58	7,564	711	2,422	23	437	31	1,493	-----
Current week...	146	100	51	4,841	647	2,562	19	374	18	1,506	-----
Maine:											
Portland.....	0	-----	0	0	1	1	0	0	0	3	20
New Hampshire:											
Concord.....	0	-----	0	0	1	1	0	0	0	0	11
Manchester.....	0	-----	1	0	2	0	0	0	0	0	16
Nashua.....	0	-----	0	1	2	0	0	0	0	0	4
Vermont:											
Barre.....	0	-----	0	0	1	4	0	0	0	8	5
Burlington.....	0	-----	0	4	0	0	0	0	0	0	9
Rutland.....	0	-----	0	1	0	1	0	0	0	2	6
Massachusetts:											
Boston.....	1	-----	0	43	17	64	0	7	1	51	210
Fall River.....	0	-----	0	31	4	1	0	2	0	1	34
Springfield.....	0	-----	0	0	1	3	0	0	0	2	32
Worcester.....	0	-----	0	34	5	4	0	3	0	21	-----
Rhode Island:											
Pawtucket.....	0	-----	0	0	0	3	0	0	0	0	17
Providence.....	0	-----	0	149	11	41	0	2	0	15	70
Connecticut:											
Bridgeport.....	0	-----	0	12	4	80	0	0	0	0	36
Hartford.....	1	-----	0	25	1	8	0	3	0	1	34
New Haven.....	0	-----	0	10	1	11	0	2	1	4	31
New York:											
Buffalo.....	0	-----	3	102	13	18	0	11	1	21	166
New York.....	38	7	5	786	119	458	0	85	3	78	1,531
Rochester.....	0	1	0	1	4	6	0	1	1	5	56
Syracuse.....	0	-----	0	30	2	38	0	1	0	36	51
New Jersey:											
Camden.....	1	2	2	21	3	4	0	2	0	2	45
Newark.....	0	-----	0	306	14	11	0	8	0	16	123
Trenton.....	0	-----	0	3	6	7	0	1	0	1	42
Pennsylvania:											
Philadelphia.....	2	6	5	49	37	254	0	17	2	55	470
Pittsburgh.....	3	1	1	179	21	54	0	10	1	34	185
Reading.....	0	-----	0	484	1	12	0	0	0	1	22
Scranton.....	0	-----	-----	2	-----	16	0	-----	0	0	-----
Ohio:											
Cincinnati.....	2	-----	1	208	25	12	0	8	0	9	159
Cleveland.....	2	6	1	342	25	142	0	4	0	39	196
Columbus.....	1	3	3	25	3	6	0	2	0	24	81
Toledo.....	0	1	1	313	2	2	0	5	0	28	67

City reports for week ended May 8, 1937—Continued

State and city	Diph- theria cases	Influenza		Meas- les cases	Pneu- monia deaths	Scar- let fever cases	Small- pox cases	Tuber- culosis deaths	Ty- phoid fever cases	Whoop- ing cough cases	Deaths, all causes
		Cases	Deaths								
Indiana:											
Anderson.....	0		6	3	0	9	0	0	0	0	8
Fort Wayne.....	0		0	1	2	2	0	2	1	0	21
Indianapolis.....	1		1	581	9	42	0	6	1	47	104
Muncie.....	0		0	0	1	3	0	2	0	0	12
South Bend.....	0		0	0	1	3	0	1	0	1	22
Terre Haute.....	4		0	3	0	2	2	0	0	0	8
Illinois:											
Alton.....	0		0	0	1	10	0	0	0	0	12
Chicago.....	18	16	3	140	42	255	0	28	0	67	676
Elgin.....	0		0	0	2	1	0	0	0	5	14
Moline.....	0		0	0	1	0	0	1	0	0	11
Springfield.....	0		0	1	2	4	0	0	0	2	19
Michigan:											
Detroit.....	5		4	25	38	374	1	18	1	70	268
Flint.....	0		0	66	6	14	0	0	1	5	30
Grand Rapids.....	0		0	92	2	12	0	0	0	31	53
Wisconsin:											
Kenosha.....	0		0	0	0	4	0	0	0	3	11
Milwaukee.....	0	1	1	11	10	71	0	1	0	21	107
Racine.....	0		0	0	0	13	0	1	0	0	15
Superior.....	1		0	9	1	2	0	0	0	13	4
Minnesota:											
Duluth.....	0		0	0	2	13	0	0	0	3	15
Minneapolis.....	2		0	5	5	20	0	1	0	30	85
St. Paul.....	0	2	2	0	6	2	0	1	0	100	71
Iowa:											
Cedar Rapids.....	0			2		3	0		0	2	
Davenport.....	0			0		0	0		0	0	
Des Moines.....	0			0		43	0		0	0	19
Sioux City.....	0			0		5	0		0	1	
Waterloo.....	0			0		6	0		0	0	
Missouri:											
Kansas City.....	0		1	3	15	99	0	8	0	13	102
St. Joseph.....	1		1	0	6	27	12	1	0	2	35
St. Louis.....	6	1	0	23	3	150	0	9	0	68	186
North Dakota:											
Fargo.....	0		0	0	1	2	0	0	0	0	5
Grand Forks.....	0			0		0	0		0	3	
Minot.....	0		0	0	0	0	1	0	0	0	8
South Dakota:											
Aberdeen.....	0			0		5	0		0	0	
Sioux Falls.....	0		0	0	0	0	0	0	0	0	6
Nebraska:											
Omaha.....	0		0	1	6	10	1	3	0	16	61
Kansas:											
Lawrence.....	0		0	0	0	0	0	0	0	0	4
Topeka.....	0		0	0	1	13	0	0	0	27	9
Wichita.....	0		0	11	5	9	0	1	0	13	21
Delaware:											
Wilmington.....	0		0	7	0	4	0	0	0	5	
Maryland:											
Baltimore.....	6	5	1	349	21	27	0	20	0	92	222
Cumberland.....	0		0	0	0	1	0	0	0	4	13
Frederick.....	0		0	4	0	0	0	0	0	0	5
Dist. of Columbia:											
Washington.....	5		0	103	5	13	0	12	0	9	156
Virginia:											
Lynchburg.....	0		0	8	3	0	0	0	0	15	9
Richmond.....	0		0	2	3	2	0	0	1	6	57
Roanoke.....	0		0	176	0	0	0	0	0	5	15
West Virginia:											
Charleston.....	0		0	0	3	1	0	0	0	0	21
Huntington.....	0		1	1		7	0		0	0	
Wheeling.....	0		0	2	2	0	0	0	0	15	17
North Carolina:											
Gastonia.....	0		0	0	0	0	0	0	0	1	
Raleigh.....	0		0	1	1	0	0	0	0	0	6
Wilmington.....	0		0	0	3	0	0	0	0	0	17
Winston-Salem.....	0		0	0	0	1	0	0	0	4	13
South Carolina:											
Charleston.....	0	18	1	1	4	0	0	1	0	0	21
Columbia.....	0		0	0	1	0	0	1	0	0	7
Florence.....	0		0	0	0	0	0	0	0	0	5
Greenville.....	0		0	0	1	0	1	0	0	1	19

City reports for week ended May 8, 1937—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	Cases	Deaths								
Georgia:												
Atlanta.....	1	3	0	0	0	6	2	0	7	0	13	76
Brunswick.....	0		0	0	0	0	0	0	0	0	1	5
Savannah.....	0	3	0	0	0	4	0	0	2	1	0	39
Florida:												
Miami.....	1		0	1	2	0	0	2	0	0	0	38
Tampa.....	1		0	12	0	0	0	2	0	0	7	24
Kentucky:												
Ashland.....	0		1	140	1	1	0	0	2	0	0	17
Covington.....	0		0	0	1	1	3	0	1	0	1	15
Lexington.....	0		0	2	1	0	0	3	0	0	18	20
Louisville.....	2		0	30	3	18	0	6	0	0	28	86
Tennessee:												
Knoxville.....	2		1	0	3	0	0	3	0	0	0	32
Memphis.....	1		1	33	6	1	0	4	0	0	47	71
Nashville.....	0		1	15	5	4	0	1	0	0	7	47
Alabama:												
Birmingham.....	1	5	0	13	6	1	0	3	0	0	4	49
Mobile.....	0		4	0	2	1	0	0	0	0	0	20
Montgomery.....	0	3					0			0	3	
Arkansas:												
Fort Smith.....	0			0			0	0		0		
Little Rock.....	0		0	0	5	4	0	1	0	0	0	6
Louisiana:												
Lake Charles.....	0		0	0	1	0	0	1	0	0	0	4
New Orleans.....	6	3	2	4	11	17	0	12	1	1	1	123
Shreveport.....	0		0	0	3	0	0	2	0	0	0	41
Oklahoma:												
Muskogee.....	0			2		0	0		0	0		
Oklahoma City.....	1	6	0	21	6	10	0	2	0	0	5	58
Tulsa.....	0			4		3	0		1	13		
Texas:												
Dallas.....	0	2	1	167	5	9	0	2	0	32		58
Fort Worth.....	0		0	21	3	9	0	6	0	10		40
Galveston.....	0		0	0	0	1	0	2	0	0		9
Houston.....	6	6	0	3	8	7	0	6	0	23		91
San Antonio.....	0		2	2	3	0	0	9	0	0		68
Montana:												
Billings.....	0		0	0	1	0	0	0	0	0	0	5
Great Falls.....	0		0	0	1	0	0	0	0	0	0	12
Helena.....	0	1	1	0	0	1	1	0	0	0	0	4
Missoula.....	0		0	0	0	0	0	0	0	0	0	4
Idaho:												
Boise.....	0		0	0	0	1	0	0	0	1		7
Colorado:												
Colorado Springs.....	0		0	0	1	6	0	1	0	0	0	8
Denver.....	3		0	15	7	16	0	6	0	23		79
Pueblo.....	0		0	0	0	0	0	0	0	0		4
New Mexico:												
Albuquerque.....	0		0	2	0	4	0	5	0	5		15
Utah:												
Salt Lake City.....	0		0	23	3	3	0	1	0	23		41
Washington:												
Seattle.....	0		1	3	1	1	0	3	0	50		87
Spokane.....	1		0	25	3	6	0	0	0	18		21
Tacoma.....	0		1	0	5	3	0	0	0	1		32
Oregon:												
Portland.....	0	1	1	4	4	22	2	3	0	1		79
Salem.....	0	1		0		0			0	0		
California:												
Los Angeles.....	25	7	0	28	25	32	2	21	0	100		321
Sacramento.....	1		0	31	1	5	0	0	0	6		30
San Francisco.....	0	1	1	11	8	14	0	7	1	33		165

City reports for week ended May 8, 1937—Continued

State and city	Meningococcus meningitis		Polio-myelitis cases	State and city	Meningococcus meningitis		Polio-myelitis
	Cases	Deaths			Cases	Deaths	
Massachusetts:				District of Columbia:			
Boston.....	5	4	0	Washington.....	1	0	0
Fall River.....	1	1	0	Virginia:			
Rhode Island:				Richmond.....	1	1	0
Providence.....	1	1	0	North Carolina:			
New York:				Wilmington.....	1	1	0
Buffalo.....	1	0	0	South Carolina:			
New York.....	6	4	1	Charleston.....	1	1	0
New Jersey:				Georgia:			
Newark.....	1	1	0	Atlanta.....	1	0	0
Pennsylvania:				Kentucky:			
Philadelphia.....	1	0	0	Ashland.....	1	0	0
Pittsburgh.....	1	0	0	Louisville.....	1	1	0
Ohio:				Tennessee:			
Cincinnati.....	2	1	0	Knoxville.....	0	0	1
Cleveland.....	1	0	0	Alabama:			
Toledo.....	1	0	0	Birmingham.....	4	2	0
Illinois:				Louisiana:			
Chicago.....	3	1	1	New Orleans.....	1	0	0
Michigan:				Shreveport.....	0	1	0
Detroit.....	1	0	0	Texas:			
Minnesota:				Houston.....	4	0	2
Minneapolis.....	1	0	0	San Antonio.....	0	0	2
Missouri:				Colorado:			
St. Joseph.....	0	1	0	Denver.....	0	1	0
St. Louis.....	2	0	0	California:			
Maryland:				Los Angeles.....	1	1	2
Baltimore.....	6	1	0	San Francisco.....	0	0	1

Encephalitis, epidemic or lethargic.—Cases: New York, 1; Pittsburgh, 1; Louisville, 1.
Pellagra.—Cases: Charleston, S. C., 4; Atlanta, 2; Memphis, 1; Nashville, 1; Birmingham, 1; Montgomery, 1; San Francisco, 1.
Typhus fever.—Cases: Atlanta, 1; Savannah, 1.

FOREIGN AND INSULAR

CUBA

Provinces—Notifiable diseases—4 weeks ended May 1, 1937.—During the 4 weeks ended May 1, 1937, cases of certain notifiable diseases were reported in the Provinces of Cuba as follows:

Disease	Pinar del Rio	Habana	Matanzas	Santa Clara	Camaguey	Oriente	Total
Cancer.....		1	1	9		2	13
Chicken pox.....			4	6	2	7	19
Diphtheria.....	1	1	1	3	2	1	9
Dysentery (amoebic).....				1			1
Hookworm disease.....				1			1
Leprosy.....		1	1	1	2	4	9
Malaria.....	72	41	6	137	81	234	571
Measles.....	26		21			4	51
Pollomyelitis.....						1	1
Trachoma.....				43			43
Tuberculosis.....	38	16	5	68	24	47	198
Typhoid fever.....	9	43	11	37	11	130	241
Yaws.....						1	1

DOMINICAN REPUBLIC

Compulsory diphtheria immunization.—According to a report from the American Legation at Ciudad Trujillo, Santo Domingo, dated May 7, 1937, a Presidential decree dated May 6, 1937, made diphtheria immunization compulsory for all school children in the Dominican Republic. A mild epidemic of diphtheria was reported in the Republic.

ITALY

Communicable diseases—4 weeks ended February 28, 1937.—During the 4 weeks ended February 28, 1937, cases of certain communicable diseases were reported in Italy as follows:

Disease	Feb. 1-7		Feb. 8-14		Feb. 15-21		Feb. 22-28	
	Cases	Com-munes affected	Cases	Com-munes affected	Cases	Com-munes affected	Cases	Com-munes affected
Anthrax.....	5	5	14	12	9	9	8	8
Cerebrospinal meningitis.....	26	25	23	19	35	32	48	38
Chicken pox.....	497	162	512	187	520	171	545	176
Diphtheria.....	473	262	482	264	597	309	532	286
Dysentery.....	7	6	10	10	7	7	7	5
Hookworm disease.....	2	5	2	5	1	1	8	1
Lethargic encephalitis.....	1	1	3	3	2	2	2	2
Measles.....	1,926	305	2,004	311	2,306	280	2,264	307
Mumps.....	461	139	436	108	620	131	743	149
Paratyphoid fever.....	15	14	20	19	32	26	18	17
Pollomyelitis.....	16	14	9	9	15	13	14	12
Fuerperal fever.....	34	32	43	36	36	34	46	38
Scarlet fever.....	332	121	348	126	323	132	361	120
Typhoid fever.....	127	91	143	102	176	113	161	115
Undulant fever.....	60	46	72	43	64	48	85	50
Whooping cough.....	651	110	531	191	554	173	605	172

SIAM

Cholera.—A report dated April 28, 1937, from the American consulate general at Bangkok, Siam, states that the cholera epidemic increased during April to an alarming extent both in Bangkok and throughout the country. There were 948 cases and 504 deaths in Bangkok from April 1 to 24 as compared with 226 cases and 153 deaths for the entire month of March. For the entire country there were 2,954 cases and 1,928 deaths from April 1 to 24, as compared with 1,803 cases and 1,195 deaths for the whole of March. The increase in cholera for April brings the total number of cases officially reported in the country since the beginning of the outbreak in December 1936, to 7,135, of which 4,629 resulted in death. According to the report the epidemic is the most formidable of any in recent years; and in view of the hot season, no abatement may be expected in the near future.

PLAGUE 1

[C Indicates cases; D, deaths; P, present]

Place	Sept. 27- Oct. 31, 1936	Nov. 1-28, 1936	Nov. 29- Dec. 24, 1936	Dec. 27, 1936- Jan. 30, 1937	Week ended—												May 1, 1937
					February 1937			March 1937			April 1937						
					6	13	20	27	6	13	20	27	3	10	17	24	
Algeria:																	
Algeria.....			1														
Plague-infected rats.....	2																
Argentina. (See table below.).....																	
Belgian Congo.....	3																
Bolivia. (See table below.).....																	
Brazil. (See table below.).....																	
British East Africa:																	
Kenya.....	16	18	8	20		2	5	1	1	2	1	4	6	8	3	5	16
Tanganyika.....	C	81	52	36		21	19	10	10	5	12	7	17	6	6	6	7
Uganda.....	D	79	50	24		6	6	7	10	4	8	6	17	5	5	7	
Ceylon:																	
Colombo.....	C	3	4	3	3	3	3	2	1	3	1	1	2	2			1
Colombo.....	D	1	3	3	3	3	3	2	1	3	1	1	2				1
Colombo.....		7	1	4	12	6	9	2	1	2	1	1	1				
China:																	
Plague-infected rats.....																	
Amsuy.....	C																
Fukien Province.....	C																
Hainan Island.....	C																
Dutch East Indies:																	
Java and Madura.....	C	391	817	452	583	137	145										
Java and Madura.....	C	391	315	452	577	138	145										
Java—Batavia.....	C																
Ecuador (see also table below):																	
Babahoyo.....	C	5	5	2	3	1											
Babahoyo.....	C	6	6														
Plague-Infected rats.....																	
Bajada del Morro.....	C	3	21	13	17	9	5	2	10	7	5	9	12	5	4	4	1
Guayaquil.....	C	5	11	5	11	5	3	3	6	3	6	4	8	5	4	6	2
Guayaquil.....	D	1	14	8	10	7	9	3	14	5	7	5	16	13	7	9	8
Playas.....	C	4	7	11	1												
Playas.....	C																
Egypt:																	
Alexandria: Plague-infected rats.....	P	1	2	2		1							2	16	18	10	4
Asuyt Province.....	C	13															
Bahaira Province.....	C	1															

1 Including plague in the United States and its possessions.

2 Suspected.

3 Imported, pneumonic plague.

4 Imported.

5 Includes 1 case of pneumonic plague.

Place	October 1936	November 1936	December 1936	January 1937	February 1937	March 1937
Tunisia: Tunis.....	C	5	1	1	1	1
Plague-infected rats.....		3	3	3	3	3
Union of South Africa (see also table below).....	C	3	3	5	7	16
United States:						
California:						
Eldorado County—Plague-infected chipmunk.....		1				
Monterey County. ¹						
Placer County. ²						
San Bernardino County. ³						
Oregon: ⁴						
Grant County ⁵ —Plague-infected ground squirrel.						
Lake County—Plague-infected fleas.						
On vessel: S. S. <i>Magister</i> at Kingston from Maranhao, Para, and Manaus. C						1

Place	October 1936	November 1936	December 1936	January 1937	February 1937	March 1937
Argentina:						
Buenos Aires—						
Plague-infected rats.....	4					
Catamarca Province.....	1					
Cordoba Province.....			4			
Salta Province.....			5			
San Luis Province.....			1			
Bolivia: Chuquisaca Depart- ment.....						
Brazil:						
Ceara State.....				P	5	10
Paraniba State.....				1		
Paranibanco State.....				4		
Recusor (see also table above):						
Manabi.....						
Bahia.....					4	7
Manta.....					8	12
Indochina (see also table above):						
Cambodia.....						
CochinChina.....	160	188	176	170	210	1
Madagascar (central region).....	164	174	167	161	169	1
Peru:						
Cajamarca Department.....	10	33	16	23	23	28
Cuzco.....		0				1
Lambayeque Department.....		3				4
Libertad Department.....	6	19	14	15	12	12
Lima Department.....	9	2		4	5	1
Lima City.....						1
Piura Department.....				2	2	14
Union of South Africa (see also table above).....	11	5	2	2	3	

¹ Suspected.
² During the week ended May 15, 1937, 2 plague-infected rats were reported in Peanhu Sector, Hamakus District, Island of Hawaii, Hawaii Territory.
³ For 2 weeks.

⁴ Plague-infected fleas have been reported in California as follows: According to information dated Nov. 10, 31 fleas taken from 24 Fisher squirrels shot in Holcomb Valley, in San Bernardino County, have been proved positive for plague. A report dated Oct. 13, 1936, states that fleas from ground squirrels in Monterey County and from chipmunks and ground squirrels in Placer County have been proved plague-infected.

⁵ Plague-infection has been reported in Oregon as follows: During the week ended May 15, 1937, 1 plague-infected ground squirrel in Grant County; during the week ended May 8, 56 plague-infected fleas taken from 36 ground squirrels in Lake County.

⁶ Pneumonic plague.

⁷ Includes 44 cases of pneumonic plague.

⁸ Includes 66 cases of pneumonic plague.

	28	16	38	88	19	26	1	4	1	2
Siam: Tak Province.....	C									
Sierra Leone.....	C									
French Somaliland.....	C									
Southern Rhodesia.....	C									
Sudan (Anglo-Egyptian).....	C									
Tunisia.....	C									

‡ For 2 weeks. † For 7 weeks. ‡ For 4 weeks.

On vessels—Continued.

S. S. <i>Indurpa</i> at Rangoon from Gopalpur.....	1 case.	Dec. 30, 1936
S. S. <i>Egra</i> at Rangoon from Calcutta.....	1 case.	Jan. 4, 1937
S. S. <i>Tampo Maru</i> at Singapore from Japan.....	1 death.	Jan. 16, 1937
S. S. <i>Juna</i> at Rangoon from Fuzhou.....	1 case.	Jan. 27, 1937
S. S. <i>Jorai Maru</i> at Molli from Keelung.....	2 cases.	Jan. 28, 1937
S. S. <i>Tybedak</i> at Surabaya from Shanghai.....	1 case.	Jan. 28, 1937
S. S. <i>Colorado Springs</i> at Manila from Shanghai.....	1 case.	Feb. 1, 1937
S. S. <i>Nikko Maru</i> at Molli from Tsingtao.....	1 case.	Feb. 7, 1937
S. S. <i>Bhadrawati</i> at Bombay from Vengurla.....	1 case.	Feb. 18, 1937

Place	October 1936	November 1936	December 1936	January 1937	February 1937	March 1937
Angola.....	124	25	24			
Argentina.....	C					
Corrientes Province.....	1		1			
Entre Rios Province.....	194	18				
Los Andes Territory.....	12					
Salta Province.....	31		2			
Belgian Congo.....	110	117	98	111	158	
Bolivia.....	4			28	1	5
Bahamas.....	2			1	41	
Dahomey.....	11					
Eritrea (see also table above).....	C					
Finland.....	1	10	1	1	1	1
France.....	1	1	1	1	2	505
Guatemala.....	39	159	219	306	352	70
Indochina (see also table above).....	12	33	38	84	70	97
Mexico (see also table above):						
Aguascalientes State—Aguascalientes.....				1	1	2
Colima State.....						

Place	October 1936	November 1936	December 1936	January 1937	February 1937	March 1937
Mexico—Continued.						
Jalisco State—Guadalajara.....	C					
Mexico State.....	C					
Mexico, D. F.....	6					
Mexico City.....	D					
Morelos State.....	C					
Nayarit State.....	C					
Nuevo Leon State—Monterrey.....	C					
Puebla State—Puebla.....	C					
San Luis Potosi State—San Luis Potosi.....	C					
Sonora State.....	C					
Morocco.....	C					
Nyasaland.....	C					
Palestine.....	C					
Peru.....	24	13	162	113	59	
Portugal (see also table above).....	52	7	8	3	6	

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

TYPHUS FEVER—Continued

[O indicates cases; D, deaths; P, present]

Place	October 1936	November 1936	December 1936	January 1937	February 1937	March 1937	Place	October 1936	November 1936	December 1936	January 1937	February 1937	March 1937
Bolivia.....				24	26	30	Mexico—Continued.						
Bulgaria.....			19	15			Puebla State: Puebla.....	2		9	7	3	
China: Manchuria—Harbin.....		1	7	8	35		Queretaro State.....	3			1	2	
Chosen.....	24	30	28	88	149		San Luis Potosi State: San Luis Potosi.....						
Czechoslovakia.....			3	15	12		Morocco (see also table above):	1	5	7	7		
France.....		1	1	7			Feu.....		1	2			27
Greece (see also table above):		11	11	2	2	4	Rumania.....	80	60	62			
Guatemala.....		17	33	28	19	4	Turkey.....	60	178	380	943	1,018	
Lithuania.....		2	2	13	10	23	Union of South Africa:	21	18	21	24	7	
Mexico (see also table above):							Istanbul.....	3	4	1	7	3	
Agua Calientes State: Agua Calientes.....				2	3		Cape Province.....	75	74	61	52	12	
Mexico State.....				8			Natal.....	7	19	4	4	1	
Mexico, D. F.....				1			Orange Free State.....	43	9	8	6	11	
Mexico City.....	14			14	18		Transvaal.....	4	11	6	13	1	
Oaxaca State.....	2		5	6	6		Yugoslavia.....		7	49	159	126	

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

YELLOW FEVER—Continued

[C indicates cases; D, deaths; F, present]

Place	Sept. 27-Oct. 31, 1936	Nov. 1-25, 1936	Nov. 25-Dec. 26, 1936	Week ended—																
				January 1937			February 1937			March 1937			April 1937							
				2	9	16	23	30	6	13	20	27	6	13	20	27	3	10	17	24
Nigeria:																				
Calabar.....																				
Maiduguri.....		1																		
Uyo.....		1		1																
Senegal:																				
Bamby.....			1																	
Dakar.....																				
Diakhao.....													1							
Fatick.....																				
M'Bour.....																				
Thies Circle—																				
Khombole.....																				
Thies.....		1																		
Khombole.....		1																		
Sierra Leone.....																				
Sudan (French):																				
Katlougou.....																				
Koulikoro.....		1																		
Mahina.....		2																		
Segou.....		1																		

1 Suspected.
 2 Yellow fever has been reported in Senegal as follows: Dakar, week ended May 15, 1937, 1 suspected case; Diakhao, week ended May 1, 1 case, 1 death; Fatick, week ended May 8, 1 case.
 3 During the week ended May 8, 1937, 1 suspected case of yellow fever with 1 death was reported in Mahina, Sudan.

X