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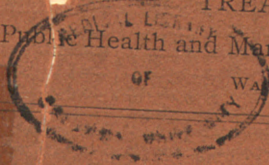
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1903

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TREASURY DEPARTMENT.

Public Health and Marine-Hospital Service of the United States.



OF WALTER WYMAN, Surgeon-General.

HYGIENIC LABORATORY.—BULLETIN No. 14.

M. J. ROSENAU, Director,

July, 1903.

U.S. Nat
Inst of Health

SPOTTED FEVER (TICK FEVER) OF THE ROCKY MOUNTAINS.

Public Health

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NO. 14

A NEW DISEASE.

By JOHN F. ANDERSON.



WASHINGTON:
GOVERNMENT PRINTING OFFICE.

1903.

NOTICE TO LIBRARIANS AND BIBLIOGRAPHERS, CONCERNING THE SERIAL PUBLICATIONS OF THIS SERVICE.

The Hygienic Laboratory was established in New York, at the Marine Hospital on Staten Island, August, 1887. It was transferred to Washington, with quarters in the Butler Building, June 11, 1891, and a new laboratory building, to be located in Washington, was authorized by act of Congress, March 3, 1901.

The following *bulletins* [Bulls. Nos. 1-7, 1900 to 1902, Hyg. Lab., U. S. Mar.-Hosp. Serv., Wash.] have been issued:

- No. 1.—Preliminary note on the viability of the *Bacillus pestis*. By M. J. Rosenau.
- No. 2.—Formalin disinfection of baggage without apparatus. By M. J. Rosenau.
- No. 3.—Sulphur dioxide as a germicidal agent. By H. D. Geddings.
- No. 4.—Viability of the *Bacillus pestis*. By M. J. Rosenau.
- No. 5.—An investigation of a pathogenic microbe (*B. typhi murium* Danyz) applied to the destruction of rats. By M. J. Rosenau.
- No. 6.—Disinfection against mosquitoes with formaldehyd and sulphur dioxide. By M. J. Rosenau.

No. 7.—Laboratory technique: Ring test for indol, by S. B. Grubbs and Edward Francis; Collodium sacs, by S. B. Grubbs and Edward Francis; Microphotography with simple apparatus, by H. B. Parker.

By act of Congress, approved July 1, 1902, the name of the "United States Marine-Hospital Service" was changed to the "Public Health and Marine-Hospital Service of the United States," and three new divisions were added to the Hygienic Laboratory.

Since the change of name of the service the bulletins of the Hygienic Laboratory have been continued in the same numerical order, as follows:

- No. 8.—Laboratory course in bacteriology and pathology. By M. J. Rosenau.
- No. 9.—Presence of tetanus in commercial gelatin. By John F. Anderson.
- No. 10.—Report upon the prevalence and geographic distribution of hookworm disease (uncinariasis or ancylostomiasis) in the United States. By Ch. Wardell Stiles.
- No. 11.—Experimental investigation of *Trypanosoma Lewis*. By Edward Francis.
- No. 12.—The bacteriological impurities of vaccine virus; an experimental study. By M. J. Rosenau.
- No. 13.—A statistical study of the intestinal parasites of 500 white male patients at the United States Government Hospital for the Insane; by Philip E. Garrison, Braxton H. Ransom, and Earle C. Stevenson. A parasitic roundworm (*Agamomermis culicis* n. g., n. sp.) in American mosquitoes (*Culex sollicitans*); by Ch. Wardell Stiles. The type species of the cestode genus *Hymenolepis*; by Ch. Wardell Stiles.
- No. 14.—Spotted fever (tick fever) of the Rocky Mountains; a new disease. By John F. Anderson.

In citing these bulletins, beginning with No. 8, bibliographers and authors are requested to adopt the following abbreviations: Bull. No. —, Hyg. Lab., U. S. Pub. Health & Mar.-Hosp. Serv., Wash., pp. —.

MAILING LIST.

The Laboratory will enter into exchange of publications with medical and scientific organizations, societies, laboratories, journals, and authors. Its publications will also be sent to nonpublishing societies and individuals in case sufficient reason can be shown why such societies or individuals should receive them. All applications for these publications should be addressed to the "Surgeon-General, U. S. Public Health and Marine-Hospital Service, Washington, D. C."

TREASURY DEPARTMENT.

Public Health and Marine-Hospital Service of the United States.

WALTER WYMAN, Surgeon-General.

Public Health

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no. 14

HYGIENIC LABORATORY.—BULLETIN No. 14.

M. J. ROSENAU, Director.

July, 1903.

SPOTTED FEVER (TICK FEVER) OF THE ROCKY MOUNTAINS.

A NEW DISEASE.

Gift

By JOHN F. ANDERSON.



WASHINGTON:
GOVERNMENT PRINTING OFFICE.

1903.

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MAP SHOWING THE LOCATION OF REPORTED CASES OF SPOTTED FEVER.

SPOTTED FEVER (TICK FEVER) OF THE ROCKY MOUNTAINS; A NEW DISEASE.

By JOHN F. ANDERSON,

Passed Assistant Surgeon and Assistant Director Hygienic Laboratory, U. S. Public Health and Marine-Hospital Service.

INTRODUCTION.

In obedience to instructions of April 22, 1903, to proceed to Montana to investigate the so-called spotted fever which has prevailed at times in the Bitter Root Valley, I left Washington April 24.

I first visited Great Falls, Mont., for the purpose of conferring with Dr. A. F. Longeway, secretary of the Montana State Board of Health; from there I went to Missoula, situated at the foot of the Bitter Root Valley, and made that place my headquarters. The Montana State University very courteously offered me the use of its laboratory. Dr. J. J. Buckley, chief surgeon of the Northern Pacific Railroad, also offered me the use of his laboratory, which was accepted.

As is shown in the report, the disease is not confined to the Bitter Root Valley, but exists in Nevada and Idaho; and since writing my report I have been informed of cases in Wyoming.

The good results that have followed the administration of large doses of quinine—the five cases in which it was used having recovered—give much hope that this disease, which is so much dreaded, may in the future be robbed of many of its terrors.

I have suggested as a name for the disease "Tick Fever," as there are already two diseases sometimes called "spotted fever."

I desire to express to Dr. J. J. Buckley, of Missoula, for the use of his laboratory, and to the physicians of Missoula and the Bitter Root Valley, my sincerest thanks for their kind assistance in my investigation of the disease and for many personal courtesies; also, to Dr. L. B. Wilson, of the University of Minnesota, for help and data in regard to the disease.

To Surg. Gen. Walter Wyman I am much indebted for the detail and resulting opportunity to study this new and most interesting disease.

ETIOLOGY.

1. GEOGRAPHIC DISTRIBUTION.

Montana.—The disease has been known in the valley of the Bitter Root River in western Montana for about twenty years. It is sharply localized on the west bank of the Bitter Root River, no cases having been known to occur in persons on the east side of the river who had not a short time previously visited the west side. The infected locality extends from Loo Loo to Como, a distance of about 50 miles. Certain places in the valley seem to be more heavily infected than others. Nine cases have also occurred in the canyon of Rock Creek, about 10 miles south of Bonito and 20 miles east of the Bitter Root.

This year information was obtained from Dr. L. A. Gates, of Bridger, Mont., about 400 miles east of the Bitter Root, of the prevalence of the disease in that locality. A report of two cases described by him will be seen in the appendix.

Idaho.—The disease has also been known clinically in Idaho for many years, the first published description having been made by Dr. E. E. Maxey, in the Portland Medical Sentinel for October, 1899 (1). An unpublished symposium on the disease by various Idaho physicians was made by Maj. M. W. Wood, U. S. Army, 1898, to the Surgeon-General of the Army. In Idaho the disease prevails throughout almost the entire valley of the Snake River, its tributaries, and the foothills of the neighboring mountains.

Nevada.—I am informed by Maj. W. R. Kendall, U. S. Army, that the disease also prevails in the valley of the Quinn River in northern Nevada.

Wyoming.—Cases have been reported this spring at Cody and Meeteetse.

Oregon.—The mild form of the disease has been reported in eastern Oregon.

2. CLIMATE.

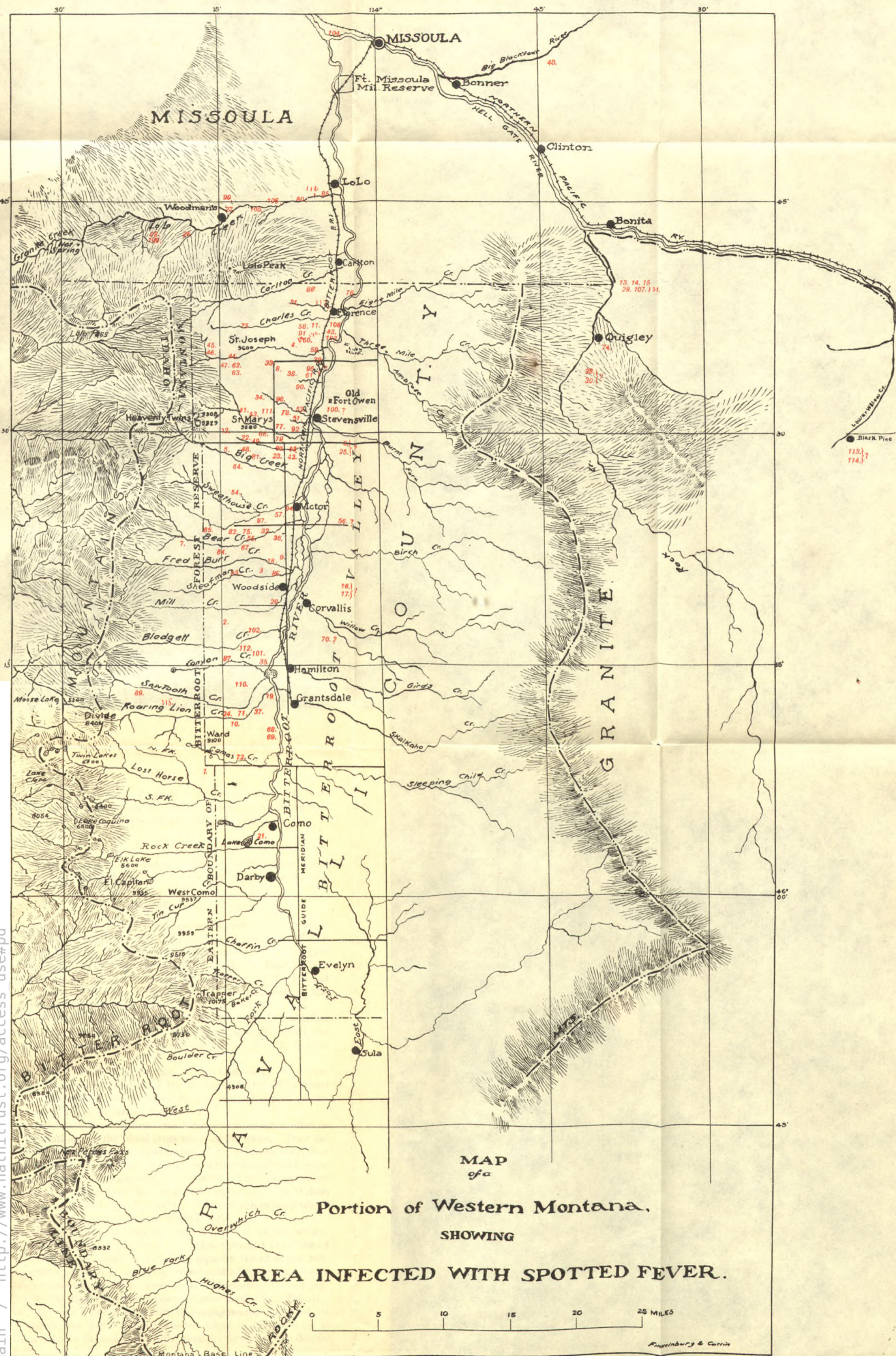
The disease does not prevail south of 40° or north of 47°. It prevails at an average elevation of about 3,000 to 4,000 feet above sea level.

3. SEASON.

The disease prevails exclusively in the spring and early summer. In the Bitter Root cases the earliest was March 17 and the latest July 20.

4. OCCUPATION.

All occupations that cause the person to be exposed to the bite of ticks, such as stockmen, and especially sheep herders, miners, prospectors, lumbermen, ranchmen, and those whose duties take them into the brush, are subject to the disease.



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5. AGE.

Persons from 15 to 50 years of age more often contract the disease, as during that period they are more actively engaged in outdoor work. The youngest case was 18 months and the eldest 74 years old.

6. SEX.

In 121 cases, 76 were males and 45 females, the difference being probably due to the greater liability to exposure of men on account of occupation.

7. THE PARASITE.

In the spring of 1902 Dr. A. F. Longeway, secretary of the Montana State Board of Health, engaged the services of Drs. L. B. Wilson and W. M. Chowning, of the University of Minnesota, to investigate the "spotted (tick) fever" then prevailing in the Bitter Root Valley. These gentlemen published the results of their work in the *Journal of the American Medical Association* July 19, 1902, and in the report of the Montana State Board of Health for 1901-2.

Surgeon-General Wyman, of the Marine-Hospital Service, detailed Surg. J. O. Cobb to also investigate the disease, and his report was published in the *Public Health Reports*, volume 17, No. 33, August 15, 1902.

The same year Dr. F. F. Wesbrook, of the University of Minnesota, visited Missoula and confirmed the findings of Drs. Wilson and Chowning. His report will be found in the biennial report of the Minnesota State Board of Health for 1901-2.

Wilson and Chowning noticed ovoid intracorpuseular bodies in stained preparations of the blood from their earlier cases. They did not determine the character or significance of these bodies until they examined the fresh blood of case No. 94, when they found ovoid intracorpuseular bodies showing amoeboid movements. These observations they confirmed in all the later cases which they examined. To Wilson and Chowning, then, belongs the credit of discovering a parasite which is very *probably* the cause of spotted (tick) fever.

Parasites in the red-blood cells are rather common in the animal kingdom. The two which I desire to mention especially are those of malaria and of Texas cattle fever. The parasite found in the red-blood corpuscles of persons suffering from spotted fever apparently lies between these two. Unlike most malarial parasites, it is not pigmented, but, like them, it shows amoeboid movements, thus differing from the *Pyrosoma bigeminum*, which is nonpigmented and without motion. Again, one form of the parasite found in spotted fever is arranged in pairs in the red-blood cells, closely resembling the double form of *Pyrosoma bigeminum*.

In my studies upon the cause of spotted (tick) fever I had the opportunity of examining the blood, both fresh and stained, in a number of cases. Two cases were in hospital in Missoula, and daily examinations were made. In the fresh blood a few cells were found to contain parasites. Three forms were seen. The most common was a single ovoid body, refractile, situated within the cell, usually near its edge. When the slide is warmed this body possesses the power of projecting quite rapidly pseudopodia and a slight change of position. This form, which is apparently an early or young form, is about 1.5 to 2 micra in length, and 0.5 to 1 micron in width at its widest part. It closely resembles the earliest intracorpuscular parasites of æstivo-autumnal malaria. (See Pl. II, figs. 4, 5.)

Another form, not so common, was larger, being about 2 to 2.5 by 1 to 1.5 micra, larger at one end and showing in the larger end a dark granular spot; this was also amoeboid. (See Pl. II, fig. 6.)

The third form noted was arranged in pairs, distinctly pyriform, with the smaller end approaching, and in two cases a fine thread uniting the small ends was seen. Motion was not observed in this form, but the spot mentioned in the second form was seen. (See Pl. II, fig. 9.)

Great difficulty was experienced in staining the organism. A number of stains were used, but the most satisfactory results were obtained by the use of Wright's stain, followed by Loeffler's blue. Carbolized Unna's polychrome methylene blue also gave fair results, heat fixation at 120° C. for twenty minutes being used. I was unable to find the paired forms in stained preparations, though Drs. Wilson and Chowning informed me that they had no difficulty in doing so. By a reference to Pl. I, figs. 1 and 2, it will be seen that the parasite takes the stain more deeply at one end and is only faintly outlined in its periphery. Sometimes it has only a central stained spot surrounded by a clear unstained space. (See Pl. I, fig. 3.)

The parasites are never found in very large numbers, it being usually necessary to search several fields of the slide to find one. Sometimes they occur in groups, two or three infected cells being found in one field. In both fresh and stained preparations extracorpuscular bodies closely resembling the small single intracorpuscular form were seen. I was unable to definitely decide the character of these bodies, but am strongly inclined to think that they are the young form of the parasite which has not yet invaded the red cells.

I had the opportunity to examine the fresh and stained blood from cases in the Bitter Root Valley of smallpox, typhoid fever, measles, scarlet fever, rheumatic fever, pneumonia, pernicious anæmia, some surgical cases, and from healthy persons, but did not note in any of them any bodies, either intra or extra corpuscular, resembling in any

way the bodies above described as being found in the fresh and stained blood of persons suffering from spotted (tick) fever.

In the cases of spotted (tick) fever which I had the opportunity of examining I had no great difficulty in finding both in fresh and stained preparations the bodies above described. Their constancy in the blood of persons suffering with spotted fever, their persistence for some time in the blood of these persons after recovery, their absence from the blood of persons suffering from other diseases and of healthy persons makes it very probable that they are the cause of the disease, and that one more has been added to the rapidly growing list of diseases of man due to animal parasites.

Cultures were made by Wilson and Chowning and by myself from the blood of patients during life and from the organs and tissues at autopsy, and the only bacterial growth obtained was *Staphylococcus epidermidis albus*, *Staphylococcus pyogenes aureus* and *albus*, *Bacillus coli*, and in one case an anærobic spore-bearing organism was obtained from the spleen. No one organism was constant, and from some cases no growth at all was obtained.

In the table which follows is gathered a complete collection of all the cases which have been reported by the physicians of western Montana since 1885, when the disease first attracted attention. Cases 1 to 114 were compiled by Wilson and Chowning and the remaining cases by myself.

Table showing cases of spotted (tick) fever

Case No.	Physician's name and address.	Year.	Date of onset of symptoms.	Patient's initials.	Sex.	Age.	Occupation.
1	J. F. Coughenour, Corvallis.	1885	June 25	J. M	Male ...	36	Prospector.....
2	.....do.....	1886	May 3	H. T .....	.....do ...	30	Lumberman
3	.....do.....	1888	May 7	Mrs. W.....	Female..	37	Housekeeper
4	R. Gwinn, Missoula.....	1888	Spring..	F	Male ...	35	.....do.....
5	.....do.....	1888	.....do ..	.....do ..	.....do ...	25	Laborer
6	.....do.....	1889	.....do ..	Half-breed .....	.....do ...	20	.....do.....
7	.....do.....	1889	.....do ..	.....do ..	Female..	6	.....do.....
8	.....do.....	1889	.....do ..	.....do ..	Male ...	12	.....do.....
9	J. F. Coughenour, Corvallis.	1890	June 22	W. J .....	.....do ...	30	Laborer
10	.....do.....	1891	June 17	D. S .....	.....do ...	40	Farmer
11	E. A. Crain, Missoula	1891	.....do ..	L. D	Female..	a 17	Farmer's daughter.
12	W. B. Parsons, Missoula....	1891	May	Z. H	Male ...	35	Hotel
13	.....do.....	1891	May 20	F. C .....	.....do ...	48	Trapper
14	.....do.....	1891	May 26	C. M .....	.....do ...	51	.....do.....
15	.....do.....	1891	July 20	L. P .....	.....do ...	10	.....do.....
16	J. F. Coughenour, Corvallis.	1892	Apr. 27	Mrs. J. C.....	Female..	26	Housekeeper
17	.....do.....	1892	June 2	Mrs. C.'s babe.	Male ...	2d	.....do.....
18	E. A. Crain, Missoula .....	.....	.....do ..	Name forgotten.	.....do ...	a 30	Laborer
19	.....do.....	.....	.....do ..	Mrs. M. G	Female..	a 28	Housewife.....
20	Geo. McGrath, Hamilton	1893	June ....	.....do ..	Male ...	a 11	.....do.....
21	.....do.....	1893	May ....	.....do ..	.....do ...	a 40	Laborer
22	J. T. Brice, Stevensville	1895	.....do ..	O. O .....	.....do ...	45	Farmer
23	.....do.....	1895	.....do ..	Mrs. A. A.....	Female..	40	Housewife.....
24	Geo. McGrath, Hamilton	1895	.....do ..	.....do ..	Male ...	a 8	.....do.....
25	J. T. Brice, Stevensville	1896	.....do ..	J. S .....	.....do ...	44	.....do.....
26	J. J. Buckley, Missoula	1896	June ....	.....do ..	.....do ...	26	Lumberman
27	G. T. McCullough, Missoula	1896	May 1	Ed. W .....	.....do ...	26	Ranchman
28	W. B. Parsons, Missoula	1896	May	G. B .....	.....do ...	32	.....do.....
29	.....do.....	1896	.....do ..	F. L	Female..	18	.....do.....
30	.....do.....	1896	.....do ..	— P	Male ...	.....	.....do.....
31	J. T. Brice, Stevensville	1897	.....do ..	J. F. W .....	.....do ...	60	Farmer
32	.....do.....	1897	.....do ..	J. N .....	.....do ...	a 60	.....do.....
33	.....do.....	1897	Apr.	R. C .....	.....do ...	21	.....do.....
34	.....do.....	1897	June	Mrs. C. M.....	Female..	40	Housewife.....
35	J. J. Buckley, Missoula	1897	Spring ..	.....do ..	Male ...	39	Lumberman
36	.....do.....	1897	.....do ..	J. H .....	.....do ...	27	Farmer
37	J. W. Howard, Hamilton ..	1898	June 27	A. D .....	.....do ...	43	.....do.....
38	J. T. Brice, Stevensville.....	1899	May 19	D. M .....	.....do ...	14	Schoolboy
39	.....do.....	1899	June	W. H .....	.....do ...	30	Farmer
40	C. A. Crain, Missoula	1899	.....do ..	H. M	Female..	12	.....do.....

a About.

reported by physicians of western Montana.

About what day of illness did spots appear.	Death on what day of disease, or convalescence beginning about what day.	Remarks.	
Fifth	Died eleventh day	Made 3 visits—July 2, 3, 4, 1885. Spots present at my first visit. Diagnosed case "typhoid fever."	
Fourth .....	.....do	
Sixth	Beginning of lysis on fifteenth day.	This case occurred in a year when there were many deaths from spotted fever from Carlton to Corvallis. It was then called by the valley physicians "black measles."	
Third	Died sixth day		
Third or fourth	Convalesced eighteenth day.		
Third	Died fifth day		
.....do	Died seventh day		
.....do .....	.....do	
Fifth	Died eleventh day		
Fourth	Died tenth day		
No record	Recovered		
Third	Died sixth day		This man lived in Stevensville. A short time before he was taken sick he was on the west side of the river and slept out in the mountains.
.....do	Died seventh day	Mrs. C. had been delivered of male babe 4 days before her death. Early in the second morning after birth the babe's grandmother called my attention to the child's fever and jaundiced appearance.	
.....do	Died sixth day		
.....do	2 or 3 weeks		
.....do	Died eighth day		
Had but little eruption.	Began to get better on ninth or tenth day.	Had but few spots; began to get better on ninth or tenth day of his sickness.	
No record	Recovered	I can give no good account of them. The man, as near as I can remember, was under my care for about 3 weeks, then went to his relations at Wausau, Wis. The case of the female was slight.	
.....do .....	.....do	
Third	Died about thirteenth day.	Considerable swelling of legs and face last day or two.	
.....do	Died twelfth day		
.....do	Died eighth day		
.....do	Died twelfth day		
Don't remember.	Died about eleventh day.		
Fourth	Died tenth day		
Can not say	Died about eighth day		
Fourth	Died eighth day		Impossible to find any records in this case in St. Patrick's Hospital records.
About third day	Died in a few days		
.....dodo		Case came from Hamilton and taken to St. Patrick's Hospital; only lived 2 days. Was broken out thoroughly on arrival; could get no history from him. A post-mortem held; only thing apparently abnormal was spleen largely increased in size.
.....do .....	.....do	
Third	Died ninth day		
.....do	Died eighth day		
.....do	Died tenth day		
.....do	Died eighth day		
.....do .....	.....do	
Fourth	Recovery	This man was seen by me in consultation with the late Dr. G. F. Mills, who had charge of the case. It presented the usual type. He had marked delirium, was abundantly "spotted," but made a good recovery.	
About fourth	Recovered at the end of the fourth week after attack. Dismissed at end of five and a half weeks from date of attack.	Was called to see this case on July 9, he having been attended by others prior to this. Found him entirely comatose and learned that had existed for 3 days prior. Respirations hurried. Temperature but slightly above normal and the petechic abundant, many of which, by their coalescence, made a spot as large as 1 inch in width and 2 or 3 in length, all of which, later on, formed dry gangrene and sloughed to a depth including deep fascia.	
Third	Recovered.	Child from "Big Blackfoot" country, after disease was well developed. The spots were not as general as in the cases I had before, and were only general in distribution over the region of shoulders and spine.	
Fourth	Died tenth day.		
No record	Recovered after about 3 weeks treatment.		

Table showing cases of spotted (tick) fever reported

Case No.	Physician's name and address.	Year.	Date of onset of symptoms.	Patient's initials.	Sex.	Age.	Occupation.
41	R. Gwinn, Missoula.....	1899	June....	M.....	Male...	30	Farmer.....
42	do.....	1899	do....	W., Mrs.	Female.	39	Housewife.....
43	do.....	1899	do....	B.....	Male...	18	Farmer.....
44	do.....	1899	do....	F.....	do....	45	do.....
45	do.....	1899	do....	T. (2 children)	Male and female.	3, 5	do.....
46	do.....	1899	do....	J. T.....	Male...	50	Prospector.....
47	do.....	1899	do....	Mrs. J. A.....	Female.	40	Housewife.....
48	do.....	1899	do....	Mrs. S.....	do....	45	do.....
49	do.....	1899	do....	M. V.....	do....	9	do.....
50	do.....	1899	do....	do.....	Male...	30	Lumberman.....
51	do.....	1899	do....	do.....	do....	30	do.....
52	do.....	1899	do....	do.....	do....	33	do.....
53	do.....	1899	do....	do.....	Female.	12	Schoolgirl.....
54	T. H. Hanbridge, Victor...	1899	Apr. 24	L. W.....	do....	18	Housekeeper.....
55	do.....	1899	May 4	Mrs. B. W.....	do....		
56	J. W. Howard, Hamilton ..	1899	July....	— J.....	Male...	24	
57	do.....	1899	do....	H. M.....	do....	24	
58	do.....	1899	June 25		do....	35	Sawmill man.....
59	J. T. Brice, Stevensville....	1899	May....	B. R.....	Female.	3	None.....
60	do.....	1899	Apr....	Mrs. J. W.....	do....	22	Housekeeper.....
61	R. Gwinn, Missoula.....	1900	June....	F. T.....	Male...	70	Farmer.....
62	do.....	1900	do....	Mrs. L.....	Female.	35	Housekeeper.....
63	do.....	1900	do....	do.....	Male...	30	Laborer.....
64	T. H. Hanbridge, Victor...	1900	Apr. 30	Mrs. A.....	Female.	42	Housekeeper.....
65	do.....	1900	May 13	K.....	Male...	4	do.....
66	do.....	1900	May 18	Baby.....	Female.	1½	do.....
67	do.....	1900	Apr. 15	R. B.....	Male...	40	Stone mason.....
68	Geo. McGrath, Hamilton ..	1900	May 2	T.....	do....	a 9	do.....
69	do.....	1900	May 8	B.....	do....	a 24	do.....
70	do.....	1900	May 6	H.....	Female.	a 10	do.....
71	do.....	1900	Apr....	Mrs. W.....	do....	a 40	Housewife.....
72	do.....	1900	Apr. 16	Mrs. M.....	do....	a 55	do.....
73	do.....	1900	June....	— N.....	Male...	a 17	do.....
74	Geo. Putney, Missoula.....	1900	Mar. 30	F. L.....	Female.	a 20	None.....
75	H. F. Brethnour, Hamilton.	1901	May 6	S.....	Male...	25	Lumber jack.....
76	J. T. Brice, Stevensville....	1901	May —	B.....	Female.	3	None.....
77	do.....	1901	May —	J. P.....	Male...	25	Laborer.....
78	do.....	1901	May 24	— R.....	do....	12	Schoolboy.....

a About.

by physicians of western Montana—Continued.

About what day of illness did spots appear.	Death on what day of disease, or convalescence beginning about what day.	Remarks.
Third.....	Died tenth day.....	Complicated with pneumonia.
.....do.....	Died eighth day.....	
Second.....	Died fourth day.....	
Third.....	Died seventh day.....	
.....do.....	.....do.....	
Second.....	Died third day.....	Very violent attack after exposure.
Third.....	Convalescent twenty-first.....	
.....do.....	.....do.....	Mild and prolonged attack.
Fourth.....	Convalescent forty-second.....	
Third.....	Died sixth day.....	
.....do.....	.....do.....	Relapsed after abortive treatment.
Third.....	Died fifth day.....	
Second.....	Died sixth day.....	
Fourth.....	Convalescence set in on twelfth day. Fever dropped entirely out twenty-second day.	
Fourth or fifth.....	Recovered. Convalescence began ten days after coming under my observation and was dismissed at the end of three and a half weeks.	Temperature about 103; pulse exceedingly rapid; respiration between 40 and 50; petechia well defined and abundant; extreme prostration and marked jactitation. The foregoing symptoms continued until beginning convalescence.
Do not know.....	Recovered. Convalescence began at about the end of third week after attack, but not dismissed for about four and a half weeks from the date of attack.	Symptoms same as case No. 56, but in a more advanced stage, with a correspondingly increased state of petechia.
Third or fourth.....	Died. Saw patient first at about 9 p. m., and he died at about 8 the next a. m.	
Third.....	Died ninth day.....	Sent to Sister's Hospital, Missoula. Sick about 24 days, 2 months before recovery was complete. Treated by Dr. W. P. Mills at hospital. Had a low fever record; eruption well marked.
.....do.....	Recovered.....	
Seventh.....	Died about seventh day.	Complicated by gangrene.
Third.....	Died about fourteenth day.	
.....do.....	Died about seventh day.	No. 66 is a niece of No. 82 and died the year before.
.....do.....	Died eleventh day.....	
Second.....	Died sixth day.....	
Third.....	Died eighth day.....	Recovered.
Fourth.....	Died seventh day.....	Do.
Third.....	Last visit May 25, 1899 ..	Do.
Can not tell at first visit.	Last visit May 20	First and last visit the morning of day she died.
About fifth day.....	Last visit May 23, 1902 ..	Considerable swelling of legs and face the last 2 or 3 days.
Third, so says husband.	Died on third day of eruption.	
Fourth, so says her son.	Died on tenth day of disease.	In this case the symptoms were about 3 days in reaching their height. She became slightly more ill with malarial fever, etc., each day, very much as a very malignant case of typhoid would do. Delirium about fourth day. Hypostatic pneumonia beginning at this time. I saw her first at the end of the first week, when she had been delirious for 3 days. She is supposed to have contracted the disease at Quigley, where she was visiting just previous to her illness.
Do not know.....	Died about thirteenth day.	
About one week after first symptoms appeared, but the symptoms came on gradually and I did not see her during first 6 or 7 days, so I can not say definitely.	Died on eleventh day ..	Complicated with pneumonia; patient especially rugged.
Sixth.....	Convalescent sixteenth day.	Sick 23 days when convalescence began. Disease taken regular course from onset. First symptom same as other cases of same disease.
Third.....	Died tenth day.....	
.....do.....	Died ninth day.....	
.....do.....	Recovered.....	

Table showing cases of spotted (tick) fever reported

Case No.	Physician's name and address.	Year.	Date of onset of symptoms.	Patient's initials.	Sex.	Age.	Occupation.
79	J. T. Brice, Stevensville	1901	May —	R.....	Female.	13	Schoolgirl.....
80	J. J. Buckley, Missoula	1901	May 17	A. H.....	do	18	Attending school.
81	T. H. Hanbridge, Victor	1901	Apr. 20	R. C.....	Male	62	Laborer.....
82	do	1901	Apr. 2	G. B.....	do	35	do
83	do	1901	May 4	Mrs. R.....	Female.	62	Housekeeper.....
84	do	1901	July 12	M. B.....	do	7	do
85	G. T. McCullough, Missoula.	1901	Mar. 27	B. R.....	do	3	do
86	do	1901	Mar. 20	J. F.....	Male	34	Lumberman
87	Geo. McGrath, Hamilton	1901	July 1	Mrs. M. H.....	Female.	α37.	Nurse
88	W. B. Parsons, Missoula	1901	June —	J. H.....	Male	35	Lumber jack
89	N. F. Brethnour, Hamilton	1902	May 13	Mrs. J. D.....	Female.	33	Housewife
90	J. T. Brice, Stevensville	1902	Apr. 20	Mrs. E. B.....	do	α40	Housekeeper
91	do	1902	May 18	A. G.....	Male	22	Farmer
92	do	1902	Apr. 27	Mr. E.....	do	74	do
93	do	1902	May 24	J. A. P.....	do	α23	Laborer
94	do	1902	May 25	A. R.....	Female.	α6	None
95	do	1902	June 3	J. O., jr.....	Male	2	do
96	do	1902	June 17	D. McD.....	do	34	Lumberman
97	J. C. Burton (D. O.), Missoula	1902	May 23	Mrs. V. R. W.....	Female.	65	Wife of farmer
98	R. Gwinn, Missoula	1902	June 1	B. J. H.....	Male	38	Timber inspector.
99	do	1902	Apr. 22	McN.....	Female.	30	Housekeeper
100	do	1902	Apr. 8	B. J.....	Male	45	Common laborer
101	Geo. McGrath, Hamilton	1902	Mar. 17	A. M.....	Female.	12	Schoolgirl
102	do	1902	Apr. 13	W. E.....	Male	9	Schoolboy
103	do	1902	Apr. 16	A. F.....	do	35	Laborer
104	G. T. McCullough, Missoula.	1902	Apr. 20	C. D.....	do	20	Teamster
105	do	1902	Apr. 10	P. W.....	do	9	do
106	Dr. W. B. Parsons, Missoula.	1902	Apr. 12	McG.....	Female.	4	None
107	do	1902	May 10	H. M.....	Male	9	do
108	do	1902	May 25	G. R.....	do	52	Farmer
109	E. W. Spottswood, Missoula.	1902	May 6	J. W.....	do	40	Lumber cruiser
110	Dr. Owen, Hamilton	1892	Apr. 16	Mrs. S.....	Female.	55	Housewife
111	do	1898	May 25	R. McF.....	Male	30	do
112	do	1898	June 10	Mrs. J. H.....	Female.	24	Housewife
113	T. G. Heine, Butte	1893	(b)	W. H.....	Male	α34	Miner
114	do	1893	(c)	Mrs. W. H.....	Female.	α30	Housewife
115	Dr. McGrath, Hamilton	1903	Apr. 7	O. G.....	do	8	Child
116	Dr. McCullough, Missoula	1903	Apr. 19	Mrs. F. D.....	do	18	Housewife

α About.

b Early in March.

c Ten days later than husband.

by physicians of western Montana—Continued.

About what day of illness did spots appear.	Death on what day of disease, or convalescence beginning about what day.	Remarks.
Third..... Fifth.....	Died eighth day..... Recovered.....	This patient made a good recovery though a very severe case and remarkably well spotted. This patient drank no water during the season.
Third..... Fourth..... .....do..... .....do.....	Died fifth day..... Died seventh day..... Died eleventh day..... Died eighth day.....	
About fourth..... About fifth..... Third..... .....do..... .....do.....	Died seventh day..... Died tenth day..... Recovered twenty-first day..... Died sixth day..... Died eleventh day.....	This is a daughter of No. 82, but was not living on the same ranch. Very typical case. Patient conscious until hour or two before death. Full report obtained before. Saw patient first in my office on second day of illness complained of. Pains in head, back upper and lower limbs, soreness of muscles in all parts of body. Temperature, 102; pulse, 90; respiration, 24. Temperature did not raise above 103; was normal 24 hours before death.
.....do.....	Died ninth day.....	
Fourth..... Unknown.....	Died eighth day..... Died about ninth day.....	Saw him first about 3 hours before death. Had been alone most all the time; could get no history. Spots well defined.
Third..... Second..... Third..... .....do.....	Died seventh day..... Died eleventh day..... Died eighteenth day..... Died thirteenth day.....	
About fifth day.....	Died sixth day.....	Saw him first 33 hours after onset of disease. History same as above. Temperature, 103; pulse, 90; respiration, 24. Taken regular course of disease. Died on thirteenth day. Began with chills and vomiting, with a rapid rise of temperature. Bowels were loose from onset of disease; urine scanty and highly colored. At first visit, two days after onset of disease, found temperature 105; pulse rate 104, and respiration 32. The temperature was kept under 103 by the use of baths, the pulse rate did not vary materially, and the respirations gradually increased to 45 per minute. Ten hours before death occurred temperature fell to 95 and the spots all became darker.
A few third day..... Ninth..... .....do.....	Convalescent eighth day..... Convalescent tenth day..... Convalescent ninth day.....	
About fourth..... .....do.....	Recovery twenty-first day..... Died Apr. 23, tenth day.....	Abortive treatment; blood showed protozoon. Abortive treatment used by patient at first attack. Abortive treatment; threatened gangrene of right toes. Circulation quite rapid at end of two months. Delirious much of the time after Apr. 17 until death.
Fourth..... About fifth.....	Died about twelfth day..... Recovered.....	
About third..... Third..... .....do..... .....do..... .....do..... Fourth.....	Died ninth day..... Died sixth day..... .....do..... Recovered in three weeks..... Died ninth day..... Convalescence began about eighteenth day; last medicine given 5 weeks after onset of disease.....	Convalescence beginning about twelfth day of disease. No. 108 is the only one which recovered. He had been bitten by two ticks a few days before taken sick.
Death on eighth day..... Death on ninth day..... This I am not certain, but I think about 8 or 10 days..... About 8 or 10 days.....	Convalescent about fourth week..... Little earlier than husband.....	
Third.....do.....	About fifteenth day..... Eighth day.....	Systematic treatment with quinine; parasites in blood. Blood showed parasites.

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Table showing cases of spotted (tick) fever reported

Case No.	Physician's name and address.	Year.	Date of onset of symptoms.	Patient's initials.	Sex.	Age.	Occupation.
117	Dr. Brooke, Stevensville...	1903	Apr. 20	J. H. D	Male....	34	Farmer
118	Dr. Bryce, Stevensville	1903	...do ...	C. F .....	...do ...	48	Lumberman
119	.....do	1903	Apr. 25	R. S.	Female.	5	Child
120	Dr. Mills, Missoula	1903	Apr. 28	C. W.	Male....	28	Ranch hand
121	Drs. Parson and Brown, Missoula.	1903	May 11	Mrs. L. M.	Female.	30	Housewife

by physicians of western Montana—Continued.

About what day of illness did spots appear.	Death on what day of disease, or convalescence beginning about what day.	Remarks.
Fourth	Eighth day	Blood showed Parasites.
Third	Convalescence began	Blood showed parasites. Systematic treatment
.....do	about eighteenth day.	with quinine.
.....do	Convalescence began	Blood examination not permitted. Quinine
Seventh	twelfth day.	treatment.
Third	Died fourteenth day....	Blood showed parasites. No quinine.
Third	Convalescent fifteenth	Blood showed parasites. Quinine treatment.
	day.	

8.—METHOD OF INFECTION.

The life history of the organisms of malaria and Texas fever naturally suggested that some insect was concerned in the transmission of the disease. On investigation it was found that the ticks appeared in the valley about the last of February, but were inactive until the middle of March or first of April, the first cases of fever appearing about the last of March. The ticks begin to diminish greatly in number from about June 1, and after the middle of July very few are seen; the cases of fever also begin to diminish about June 1, the latest date on which the disease has been known to occur being July 20.

Mosquitoes do not appear in the valley until after the first cases of fever develop, and remain some time after the last cases appear. Bedbugs and other house insects, I think, were well excluded, by the fact that there has never been known an instance in which two cases occurred the same year in the same house.

On a closer study of the cases of spotted (tick) fever it was always found that there was a history of tick bites about one week before the onset. In four cases there was a history of a single bite two, three, five, and seven days, respectively, before the initial symptoms. The usual time between the bite and the onset of the fever is about seven days. If the tick transmits the disease, it may be asked, Why do not more persons become infected, and why is the infection confined to the west bank of the Bitter Root River? I think this may be answered by the very obvious fact that the tick is unable to travel any great distance, unless carried on some person or object. Again, it is very unusual for a tick to bite a person and not be discovered in a short while, and the result is the death of the tick. If, as in Texas fever, the development of the parasite takes place in the female tick and the young ticks transmit the infection, the very small number of ticks which escape detection on persons explains the small number of infected ticks. Where do the female ticks get their infection? I examined a recovered case twenty-four days after discharge by the physician and had no trouble in finding the parasite in the fresh blood. This child had been out of doors for over two weeks, and if a female tick (ticks were quite numerous near the house) had bitten her and escaped destruction the parasites in the blood taken in by the tick would have undergone development and the young ticks, when hatched out, would be ready to infect prospective victims.

While the above facts and conclusions tend strongly to the belief that the ticks are necessary for the transmission of the disease, the actual fact can not be proved scientifically until carefully controlled experiments are made on nonimmune persons.

TICKS.

As many ticks as it was possible to obtain were collected in the Bitter Root Valley; twenty-four, representing what were thought to be different species, were sent to the Hygienic Laboratory of the Service in Washington, D. C., for classification. They were referred by the Director to Dr. Ch. Wardell Stiles, Zoologist of the Laboratory, for determination, and he reports that—

All of these specimens belong to the genus *Dermacentor*. There is considerable variation among them, but so far as I have been able to make out, this variation does not extend beyond the limits usually found in one and the same species in this group. Most of the material is not in the best condition for determination, but so far as I am able to discover, I can recognize as yet no specific difference between these specimens and *Dermacentor reticulatus*. I would therefore make the provisional diagnosis of *Dermacentor reticulatus*.

The ticks in box No. 1 have laid numerous eggs, and I have developed the six-legged stage from them. I have now made arrangements to place these young ticks on cattle and develop all of the various stages. With fresh material of this kind I shall be able to determine whether the variations noticed extend beyond the limits of specific value, and also whether there is any reason for me to change my opinion that these represent the species known to zoologists as *Dermacentor reticulatus*.

SYMPTOMS.

INCUBATION.

This is from three to ten days, usually about seven. For a few days the patient may have chilly sensations, malaise, and nausea; finally there is a distinct chill, and the person takes to bed. There is some pain in the back and head; soreness of the muscles and bones, causing a sensation as if the limbs were in a vise; bowels constipated; tongue with heavy white coat, red edge and tip; conjunctivæ congested, becoming yellowish; urine usually small in amount, with albumin and a few casts; slight bronchitis after a few days; nose bleed, sometimes quite severe, is always present.

FEVER.

Before the distinct chill there is little or no fever in the morning, with a slight rise in the afternoon. After the chill there is an abrupt rise, and from then on the fever gradually rises in the evening, with a slight morning remission. The maximum is usually reached on the eighth to the twelfth day; then, in a favorable case, gradually falls, becoming normal about the fourteenth to the eighteenth day, usually going to subnormal for a few days. In fatal cases the fever remains high, from 104° to 105° or 106° , and the morning remissions are very slight or not present.

CIRCULATORY SYSTEM.

The pulse appears out of all proportion to the temperature, usually running from 110 to 140, a pulse of 120 being not unusual with a temperature of 102°. It is rather thready, though sometimes full and strong, occasionally dicrotic in the first week. Red blood counts show a progressive decrease in red cells, but as soon as the temperature becomes normal an increase begins. The white blood corpuscles are increased in number, varying from 8,000 to 12,000. A differential count in two cases gave an average of—

	Per cent.
Polymorphonuclear leucocytes	77.7
Large mononuclear leucocytes	11.4
Small lymphocytes	10.0
Eosinophiles .....	.9
Total	100.0

This shows as its most interesting feature an increase in the large mononuclears.

There was a steady, but never very rapid, decrease in the percentage of hemoglobin, one case going as low as 50 per cent.

The blood failed at all times to agglutinate *bacillus typhosus*.

Fresh and stained blood showed the three forms of parasites described under etiology.^a

THE ERUPTION.

The eruption appears usually on the third day, first on the wrists and ankles, then on arms, legs, forehead, back, chest, and, last and least, on the abdomen. It is never very abundant on the abdomen, but the other portions of the body in some cases are literally covered by the eruption.

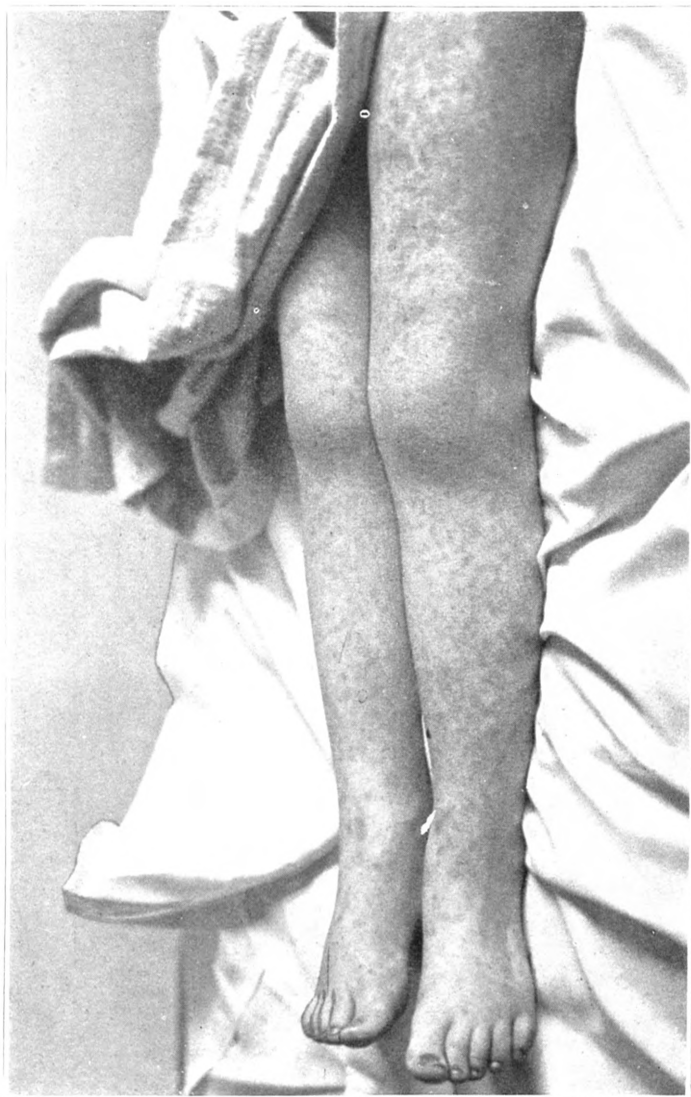
At first the spots are of a bright-red color, macular at all times, from a pin point to a split pea in size. At first they disappear readily on pressure and return quickly, but if the case is a severe one they soon become darker and in some cases are almost purple. From about the sixth to the tenth day of the disease they fail to disappear on pressure and are distinctly petechial in character. In favorable cases, about the fourteenth day they begin to lose their petechial character and disappear slowly on pressure. In some cases the eruption consists of small, brownish spots, giving a turkey-egg appearance, well shown by the photographs on pages 22 and 23.

As the fever declines the eruption begins to fade; but a slight return of fever or a free perspiration will cause it to show distinctly. I am informed that, following a warm bath in a case ten months recov-

^a The average normal red blood count at this elevation (3,500 feet) gives over 5,500,000.



ERUPTION TICK FEVER; TWO HOURS AFTER DEATH.



ERUPTION TICK FEVER; TWO HOURS AFTER DEATH.

ered, the spots showed distinctly. I have seen them in a case twenty-four days after discharge.

When convalescence is well advanced desquamation begins and extends over the entire body. In very severe cases there may be gangrene of the fingers or toes, and still more frequently of the skin of the scrotum and penis. The skin is always jaundiced to a greater or less degree. This is usually first noticed in the conjunctivæ, the vessels of which are congested from the outset.

DIGESTIVE SYSTEM.

The tongue at first has a heavy whitish coat, with red edge and tip; later the coat becomes dark brown and the teeth are covered with sordes. At first there may be a little nausea, but the appetite is often good throughout the first week. In fatal cases nausea becomes more persistent during the second week and lasts until the end. Constipation is present throughout the course of the attack. Tympanites is never excessive; gurgling in right iliac fossa occasionally. The liver is usually moderately enlarged. The spleen is enlarged early and may extend 1 or 2 inches below the costal margin.

URINARY SYSTEM.

The urine is decreased to about one-half its normal amount for the twenty-four hours; small amount of albumin in all cases examined; granular, hyaline, and epithelial casts.

RESPIRATORY SYSTEM.

The respiratory rate is always increased, usually varying from 26 to 40 per minute, in some cases reaching 50 to 60; regular, but often shallow. In the second week there is always a slight bronchitis. Lobar pneumonia is a frequent complication in fatal cases. Epistaxis is usually seen from the end of the first week.

NERVOUS SYSTEM.

Pain in head and back is usually severe during the first week. Soreness of the muscles and bones causes the patient to change position often in the endeavor to find a comfortable posture. The muscular soreness is often very severe, even in mild cases, and lasts until recovery. The mind is usually clear, even in severe cases, until within a few hours of the end. Pupils react normally to light and distance; no opisthotomus or other irritative symptoms.

HISTORY OF CASES.

CASE 115, 1903.

O. C., age 8 years, residence about 3 miles west and 1 mile south of Hamilton, about 1 mile east of case Mrs. J. D., case 89, 1902. (See map, p. 8.)

About April 1 two ticks were removed from right side of head, near middle line. The wounds became quite sore on the following day and the child complained of headache during the ensuing week. April 7 or 8 the child complained, in addition to headache, of soreness from site of bite down the side of head behind right ear and neck to shoulder. The post-cervical glands were enlarged, particularly on right side. At this time she complained of being chilly, though she did not have a marked rigor. She was feverish April 8, 9, and 10. On April 10 spots began to appear, first on the extremities.

She was first seen by Dr. G. B. McGrath, of Hamilton, on April 13.

Patient was seen by Drs. McGrath and Wilson April 24. Child seemed pale, weak, and easily tired, but otherwise well and able to play outdoors. Over the forearms, legs, thighs, and back there was a distinct mottling of the skin. Pressure over these areas increased the distinctness of the spots. Examination of fresh blood showed a few ovoidal bodies within red blood cells. Count showed—

Red blood corpuscles.....	4,720,000
Leucocytes	4,500
Hemoglobin (Tallquist).....per cent..	80

Post-cervical glands on right side still enlarged.

Patient examined again May 5 by Drs. Anderson, Hanbidge, and Wilson. Feeling much better, not as pale as on previous examination, and able to play longer without tiring. Pulse, 112; temperature normal.

Red blood corpuscles.....	4,824,000
Leucocytes	4,450
Hemoglobin (Tallquist).....per cent..	90

Fresh blood showed a few red blood corpuscles which contained the ovoidal bodies similar to those seen at first examination.

CASE 116, 1903.

Mrs. F. D., age 18 years, married one and one-half years, mother of 7-months-old child. Residence on left bank of Lolo Creek, 1 mile west of Lolo store. (See map, p. 8.)

On April 12 or 13 Mrs. D. was with her husband with team in grove of small poplars 300 yards north of residence. On this day she was perhaps also across Lolo Creek, south of house; accurate information on this point could not be gained. Certainly the horse



ERUPTION TICK FEVER; TWELFTH DAY.

On April 19 the soreness became much worse, and shooting pains began radiating from the axilla through the shoulder, down the arm and side of the body. Patient had a severe chill, followed by high temperature and aching pains in back. These gradually extended to the whole body. Patient felt better on April 20 and 21 in the morning, but was worse again in the afternoon.

On April 22 she was brought to St. Patrick's Hospital, Missoula, and placed under the care of Dr. McCollough. On the evening of April 22 spots began to appear first on the wrist and ankles. On the morning of April 24 spots were well developed all over body, being of the small petechial type and quite rosy in appearance. Patient's mind at this time was quite clear (except for slight wandering immediately after awakening) and remained so until a few hours before death.

Patient examined April 24, 9 a. m., by Drs. McCollough, Gwinn, Spottswood, and Wilson. Fresh blood showed a few red cells which contained ovoidal bodies with amœboid movements (an alcohol lamp was in front of concave mirror). Count showed—

Red blood corpuscles	4,920,000
Leucocytes	7,400
Hemoglobin	per cent. 100

Cultures with blood taken from the ear were made on agar and serum. These showed no growth after three days in the incubator.

Patient was examined again April 26 by Dr. Wilson. Condition was apparently the same as when last seen except the patient was more restless. Fresh blood showed many more infected cells than that collected April 24. Count showed—

Red blood corpuscles	4,600,000
Leucocytes	7,600
Hemoglobin	per cent. 80

Patient died at 10 a. m., April 27. (For temperature, pulse, etc., see accompanying chart.)

On the afternoon of April 24 Dr. Wilson, in company with Mr. D., examined the latter's ranch and searched for ticks in the locality where Mrs. D. was supposed to have gotten her infection. No ticks were found.

CASE 117, 1903.

J. H. D., age 34, residence one-half mile north and one-fourth mile west of Florence. (See map, p. 8.)

Was bitten on top of the head and on left arm by ticks on Thursday, April 16. Ticks, when removed on this date, were partially filled with blood, having evidently been in place for some time. Wounds were sore before removal of ticks and continued so until disease was well developed. On April 20 soreness of wound on head

extended over side of head and down neck with shooting pains to shoulder, arm, and hand. Patient had marked chill, followed by fever.

On April 20 spots appeared on hands and feet, extending up forearms and legs and appearing on back in a few hours. Patient was seen on this day by Dr. Brooke, of Stevensville. No record of pulse, etc., was kept, but the following figures were obtained from nurse after death of patient:

Temperature.

April 20.....	105.0	April 24.....	103.0
April 21.....	101.0	April 25.....	100.2
April 22.....	99.0	April 26.....	100.0
April 23.....	105.0	April 27.....	98.0

Pulse ran from 90 to 120 throughout the disease, until the last twenty-four hours. Respiration normal at first, became more rapid and labored until a few hours before death, then gradually grew weaker. Mind was clear throughout the course of the disease until a few hours before death. After initial constipation bowels were regular without medicine. Tongue was coated throughout course of disease.

Patient was examined April 27, at 2 p. m., by Drs. Brooke and Wilson. Temperature normal, pulse 108, respiration 30 and labored. Face and limbs much swollen. Mind fairly clear, but some stupor. Skin over whole of body, and especially of dependent portions, showed spots of dark red to purple in color and from 1 mm. to 3 cm. in diameter. Over the legs and forearms a marked marbled appearance was produced. Fresh blood showed relatively large numbers of red blood cells which contained parasites. Count showed—

Red blood corpuscles.....	4,368,000
Leucocytes.....	7,800
Hemoglobin.....per cent..	60

Patient died on April 28, 4 a. m. No autopsy was performed.

CASE 118, 1903.

E. F., age 48 years, residence 4 miles north of Stevensville, on main road. (See map, p. 8.) Had been bitten many times by ticks during the spring of 1903. Had no remembrance of any single severe bite shortly before illness. Was not feeling well on Sunday, April 19. Had a chill on April 20, followed by fever with morning remissions during the next two days. Spots began to appear April 22, first on extremities. Were well marked April 23, when patient was first seen by Dr. Bryce, of Stevensville. Patient at this time presented the usual symptoms of headache, fever (temperature 103), aching pains in back and limbs, and constipation. Patient was given calomel 10 grains and quinine sulphate 40 grains by the mouth. Patient examined

April 27, at 11 a. m., by Drs. Bryce and Wilson. Spots were numerous, large, and covering entire body, were rosy in appearance except on dependent portions, where they were somewhat darker in color. Temperature 101, pulse 104, respiration 26. Fresh blood showed a few red cells containing organisms. Count showed—

Red blood corpuscles	4,576,000
White blood corpuscles	7,300
Hemoglobin.....per cent..	70

At Dr. Wilson's suggestion, the patient's room was darkened, with apparent good results in allaying restlessness.

Patient examined again April 29 by Drs. Bryce, Johnson, and Wilson. Examinations of fresh blood showed many red blood cells containing organisms. Count showed—

Red blood corpuscles	3,820,000
Leucocytes.....	8,000
Hemoglobin.....per cent..	50

Patient examined again May 2 by Drs. Bryce, Anderson, and Wilson. Patient very weak; condition otherwise much as before. Spots somewhat darker on dependent portions, but more rosy over remainder of body. Temperature 102.5, pulse 120, respiration 28. Patient had had only strychnine for the last twenty-four hours. Given subcutaneous injection of quinine hydrochlorate 20 grains at time of visit. Examination of fresh blood showed a few organisms in red cells. Count gave—

Red blood corpuscles	3,920,000
Leucocytes.....	8,500
Hemoglobin.....per cent..	60

(Specimen taken from same point as that of April 27.)

Patient passed into a state of semiconsciousness, gradually increasing to total unconsciousness, which gradually passed away, having lasted seventy-two hours.

Pulse about 120, temperature ran between 102.5 in the morning to 103.5 in the afternoon until May 9, then it dropped to subnormal. The spots remained dark until about the 14th, when they became much lighter, gradually disappearing, first from the extremities and back. Recovered.

Treatment: Bowels kept open with calomel. Quinine sulphate 2.6 grams by mouth every twenty-four hours, and quinine hydrochlorate in gradually increasing doses up to 3.3 grams every twenty-four hours hypodermically until improvement began, then gradually decreased. Patient was frequently given hot sponge baths, which allayed the restlessness and lessened the congestion of the skin, causing spots to change from dark red to rosy red.

CASE 119, 1903.

R. S., female, age 5 years, residence 1 mile north of Florence and about one-eighth mile south of O. G.'s residence. (Map, p. 8, case No. 91, 1902.) Child's two sisters and brother had been frequently bitten by ticks during the spring of 1903. This child had, however, been in Missoula during most of the spring until three weeks before sickness began. The wound remained sore and some pain and swelling was present, extending down side of head behind ear and to right neck.

April 25 patient appeared dull and feverish. On April 27 spots began to appear first on back and thighs (child had been in bed since April 25). Dr. Bryce, of Stevensville, saw patient on this day (April 27). Temperature 102. Quinine hydrochlorate was given by mouth and room darkened. Patient seen April 29, 12 m., by Drs. Bryce, Johnson, and Wilson. Child feeling well; mind clear. Spots consisted of fine petechiæ. Temperature 101, pulse 120, strong and regular. No examination of blood permitted.

Patient examined May 2 by Drs. Bryce, Anderson, and Wilson. Child weaker and more restless than on April 29, otherwise condition much the same. Pulse 120, temperature 101.4. Quinine hydrochlorate was given in 10-grain doses twice daily, at first by rectum. Temperature remained about 102°

On May 5 gradually became unconscious and remained so for about five days, and then gradual improvement began, which was interrupted by an attack of acute indigestion on the 14th, which gradually passed off. Spots remained dark red until about the 12th, and then began to fade. Recovery.

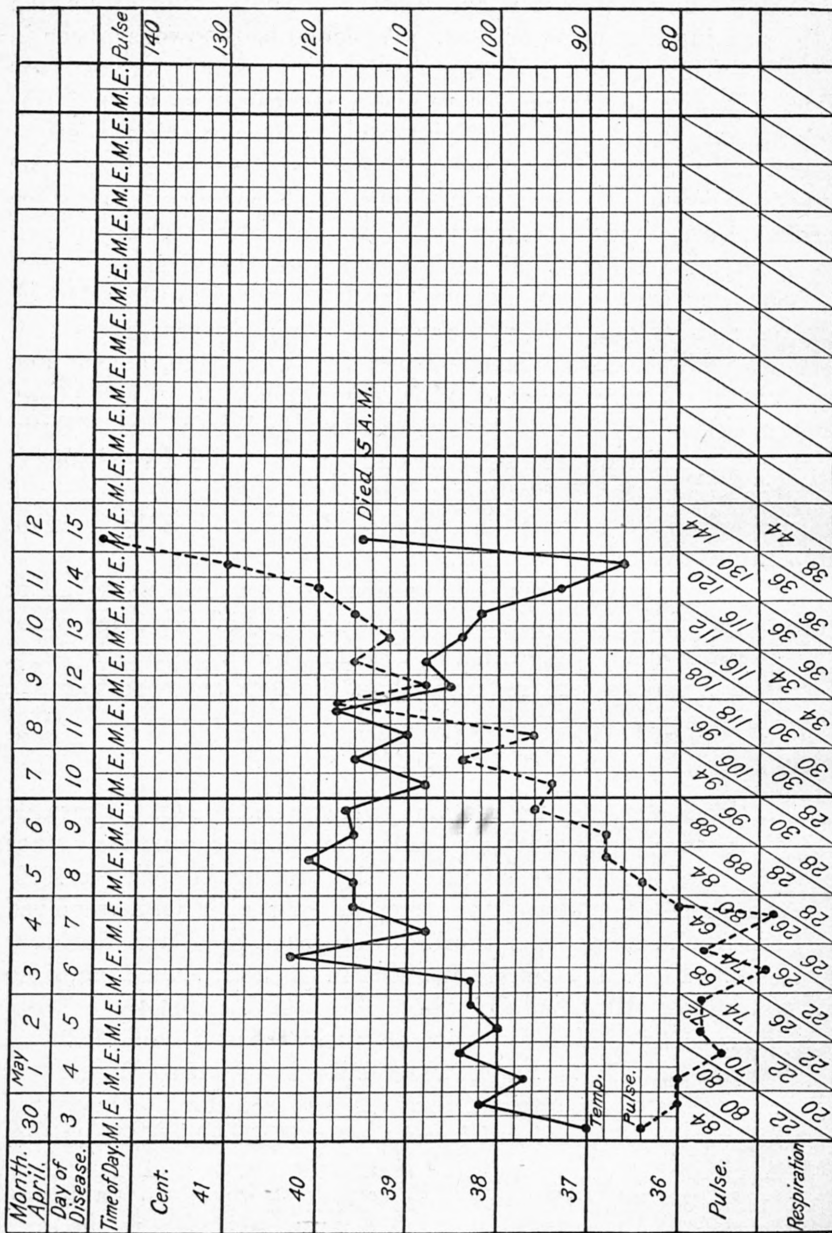
CASE 120, 1903.

E. M., Finlander, age 28, resident of cottage where O. G., case 91, 1902, died; about 1 mile south and 1 mile west of Florence station. (See map, p. 8.) Had not often been bitten by ticks during the spring of 1903; in fact, does not remember having been bitten at all until he removed two ticks April 28, one from over left breast and the other from over left biceps. These ticks must have been in place for some time, since both were filled with blood.

On the evening of Monday, April 28, patient had a chill, followed by fever and pains in back and limbs. Pains and fever continued next day and patient walked to a friend's $1\frac{1}{4}$ miles distant. On arrival there he examined himself and found the two ticks above mentioned.

On April 29, 3 p. m., patient first seen by Dr. Bryce. Temperature 102.5, pulse 108, furred tongue, peculiar, sweetish odor of breath, circulation on compressed areas and extremities feeble. Mottling of skin over palms of hands, especially thumbs. Patient showed considerable mental dullness and complained of headache, pains in back

and limbs, and bad taste in mouth. Diagnosis of beginning spotted fever was made. Patient given 15 grains of blue mass and 40 grains of quinine hydrochlorate by mouth.



Name, E. M.; case, 120; age, 28; disease, tick fever.

On the morning of April 30 patient was brought to St. Patrick's Hospital and placed under the care of Dr. Mills. (For temperature, pulse, respiration, etc., from this time see chart.)

Symptoms as noted by Dr. Bryce continued after initial slight abatement until May 4, when patient felt worse. On the morning of May 5 Dr. Mills observed small red spots on right side over region of liver; more spots on back and on wrists in the afternoon. On the morning of May 6 spots were quite abundant over regions noted above and also over thighs and forearms. Specimens of blood taken, fixed, and stained by Dr. Charles Pixley showed a few intracellular bodies.

At 3 p. m., May 6, patient was examined by Drs. Mills, Pixley, Ashburn, Merritt, Anderson, and Wilson. Patient apathetic; tongue with heavy, white coat, red margins and tip. Spots were numerous on extremities and back; few or almost absent over abdomen; scattered, but larger and more plentiful, over chest; obscured on face by tan, beard, and pockmarks. Spots were 2 to 5 mm. in diameter, rosy in color, not elevated, and disappeared readily on pressure, also readily reappeared when pressure was removed. Spleen much enlarged; liver normal. Considerable gurgling and tenderness in right iliac fossa. Fresh blood showed a very few organisms in red cells, mostly of small type. Count gave—

Red blood corpuscles	4,744,000
Leucocytes	4,800
Hemoglobin	per cent.. 90

Examined again 10.30 a. m. May 7, 1903, by Drs. Mills, Pixley, Bryce, Anderson, and Wilson. Spots more general over body, but somewhat lighter in color than on previous day. Patient feeling better. Spleen and liver as on previous day. Gurgling in right iliac fossa still present; no tenderness. Fresh blood showed a few organisms, mostly of small type.

Red blood corpuscles	4,722,000
Leucocytes	6,900
Hemoglobin	per cent.. 87

Patient seen on the 8th of May, 10 a. m., by Drs. Mills and Anderson. Patient sleeping, having had sulphonal, grains 40, the night before. Conjunctivæ much injected. Spots bright red, very numerous on back, plentiful on legs, thighs, arms, and especially on forearms; disappear very slowly on pressure and return slowly. Spleen and liver as yesterday; pulse of fair volume.

Red blood corpuscles	4,721,000
Hemoglobin	per cent.. 85

Very few intracellular bodies seen in fresh blood preparations. Small amount of albumin in urine, heavy deposit phosphates; no casts or red blood cells.

May 9, 1903, patient seen by Drs. Mills, Wilson, and Anderson. Apparently not as well as yesterday. Conjunctivæ much injected.

Spots on back bright red, do not disappear on pressure; on arms and lower limbs disappear very slowly and return slowly.

Red blood corpuscles.....	4,458,000
Hemoglobin	per cent.. 82

Few intracellular bodies seen in fresh blood in red cells. Paired organisms, united by fine threads in two cells, seen for the first time. Albumin present; granular and epithelial casts.

May 10, 1903, 11 a. m., patient seen by Drs. Mills, Wilson, and Anderson. Much weaker than yesterday. Had nosebleed during night. Pulse about 102 and of poor volume. Spots on back of a petechial character and do not disappear on pressure; on hands and legs disappear very slowly.

Red blood corpuscles.....	3,858,000
Hemoglobin	per cent.. 77

Many intracellular bodies seen in fresh preparations. A few paired ones united by fine thread.

May 10, 1903, 8 p. m., patient seen by Drs. Mills and Anderson. Pulse stronger and fuller than this morning. Had nosebleed for about thirty minutes in afternoon and morning.

May 11, 1903, patient seen by Drs. Mills, Wilson, and Anderson. Very much weaker. The conjunctivæ much injected and jaundiced. Pulse about 120; very poor volume. Spots on back distinctly petechial and dark purple; on hands and lower limbs petechial in character; dark spots on hands; skin distinctly yellow.

Red blood corpuscles.....	3,672,000
Hemoglobin.....	per cent.. 75

Albumin present in urine; granular and epithelial casts; no red cells. Blood taken on the 12th day of the disease did not give positive widal reaction with *B. typhosus* in a dilution of 1:20.

Patient died May 12 at 5 a. m. At 6 a. m. was removed to undertaking rooms, surface of body cleaned and sponged with embalming fluid (formaldehyde). Autopsy at 2 p. m. by Drs. Anderson and Wilson, in presence of Drs. Mills, Pixley, Gwinn, Spottswood, and Olson.

Body that of a well-nourished man. Panniculus adiposus about normal. Some edema about ankles, hands, and face. Rigor mortis not intense. Small to large petechial hemorrhages covering body, somewhat obscured by tan on face and hands, and by thickened skin of hands and feet. Petechial spots over chest and abdomen from pin point to 5 mm. in diameter. Over dependent portions of elbows, thighs, and back areas are largest, being from 1 to 3 cm. in diameter. Over inner aspect of arm and forearm petechial spots are very thick-

set, but not coalescent. The epidermis over the scrotum was sloughed off from area about 2 to 5 cm. in diameter. On the left chest 3 cm. from middle line and just above the left biceps were two small recent scars. (See history of tick bite.)

Post mortem lividity on dependent portions of skin and thighs. Entire skin deeply jaundiced.

Lungs: There was no adhesion of the pleura. Lungs were normally inflated, containing no consolidated areas except a very few points resembling emboli.

Pericardium: Normal; cavity contained about two ounces of fluid. Right heart half filled with blood; left contracted. Small chicken-fat clots in auricles. A few small hemorrhages over left ventricle near inter-ventricular groove under the pericardium. Myocardium somewhat pale and flabby.

Endocardium apparently normal.

Spleen: Greatly enlarged (weight, 20 ounces) one hour after removal; very soft, dark, and diffuent.

Stomach: Apparently normal, except hypostatic congestion over dorsal surface of fundus.

Small intestine: Empty and showing no inflammation or congestion except hypostatic. Peyer's patches pale and not congested.

Mesenteric and retroperitoneal glands pale and not enlarged.

Liver: Enlarged (weight, 92½ ounces) one hour after removal. Pale, fatty in appearance, and in some areas outlined by engorged bile ducts.

Pancreas: Normal in appearance, except enlargement (weight 5 ounces), one hour after removal.

Kidneys: Enlarged. Weight of left 10 ounces one hour after removal. Capsule adherent; minute subcapsular hemorrhages, especially over greater curvature. On section, cortex congested; pyramids well outlined. Small hemorrhages about 1 mm. in diameter in pelves.

Bladder wall: Apparently normal; cavity contained about 4 ounces of urine.

Cultures in broth and on Löffler's serum were made from pericardial fluid, heart's blood, spleen pulp, liver and kidney substance. Smear preparations were made from lung substance, heart wall, spleen pulp, liver and kidney substance, and red marrow of rib. Portions of skin, lung, heart wall, spleen, liver, small intestine (including Peyer's patches), pancreas, and kidneys were preserved in Zenker's fluid, 95 per cent alcohol and 10 per cent formalin. Portions of rib were fixed in picro-sulphuric and nitro-sulphuric acid solutions.

Cultures.—After forty-eight hours in the incubator all cultures remained sterile, except one from the liver and one from the kidney. The serum culture from the liver developed one colony of a staphylococcus, which remained white after seventy-two hours' growth (presumably *Staphylococcus pyogenes albus*).

On the serum culture from the kidney there developed a few colonies of a small bacillus which in broth, on serum, plain agar, and in and on litmus dextrose agar gave the appearance and the reaction of *Bacillus coli. c.*

CASE 121, 1903.

Mrs. L. M., age 30, born in Germany, residence near Rock Creek clubhouse. (See map, p. 8.) Mother of child H. M., case 107, 1902.

Had not been away from home since October, 1902, and there had been no visitors at the house since last fall; husband had not been to Missoula since winter. These details are mentioned to show the isolation of the locality and the impossibility of infection from the Bitter Root Valley.

Two months pregnant. Had been in good health for past year and spent considerable time shooting near home and clubhouse during the spring. All the members of family had been frequently bitten by ticks during spring of 1903. As soon as ticks were discovered they were removed by ammonia or whisky, and lately by applying carbolic acid.

On May 3 a tick was removed from patient over left breast and another over left scapula; ammonia only was used.

On May 10 she complained of headache, backache, and nausea; went to bed for a few hours.

May 11, had a distinct chill, followed by considerable fever.

May 12 and 13, felt better in morning but worse in evening.

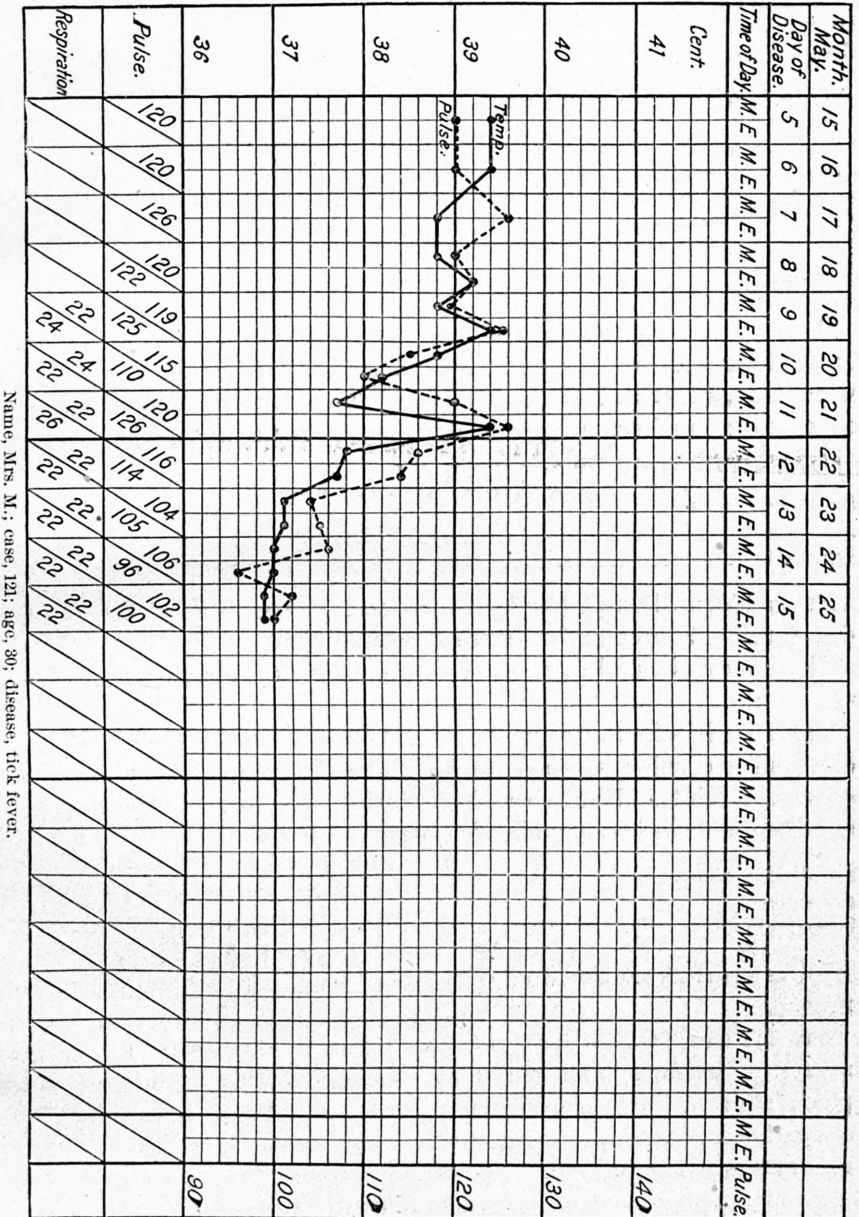
May 14, confined to bed and Dr. Parson called, but he was unable to go, and Dr. Brown went on the 15th. He found the patient with temperature of 103°, pulse 120, suffering with severe pain in back and limbs, tongue with a heavy white coat; nausea. A few small red spots were noticed on ankles, legs, and knees; none on face or chest; few on anterior aspect of wrists.

May 16, temperature 103°, pulse 120, spots beginning to appear on back and arms.

May 17, patient brought to Missoula and placed in Dr. Parson's private hospital. Seen at 8 p. m. by Drs. Brown, Wilson, and Anderson. Temperature 102°, pulse 126, full and strong. Headache, backache, soreness of muscles of legs and arms. Tongue with white coat in center and red tip and edges. Small scattered red spots, most plentiful on thighs and back; none on face, few on chest, a very few

on abdomen, some on forearm, wrists, and ankles; all disappear readily on pressure and return quickly when pressure is removed.

May 18, seen at 9 a. m. by Drs. Brown, Wilson, and Anderson.



Had morphine sulphate, one-fourth grain, during night. Condition much as yesterday. Spleen enlarged and easily palpable; liver not enlarged. Spots bright red in color, and more distinct than before;

no increase in number. Conjunctivæ injected. No Kopliks spots. Fresh blood showed few amœboid oval bodies in red blood cells. Count gave—

Red blood corpuscles	4,380,000
Leucocytes.....	7,000
Hemoglobin.....per cent..	75

Differential white count gave—

	Per cent.
Polymorphonuclear leucocytes	78.7
Large mononuclear leucocytes	10.6
Small lymphocytes	9.9
Eosinophiles .....	.8
Total	100.0

May 19, seen at 9 a. m. by Drs. Brown, Wilson, and Anderson. Dull aching pains in head and back; muscular soreness more marked. Mind clear, slight nausea, constipated. Spots darker in color, but not increased in number; disappear slowly on pressure and return slowly when pressure is removed.

Red blood corpuscles	4,723,000 (?)
Leucocytes	10,400
Hemoglobin	per cent.. 70

Fresh blood shows a few intracorpuseular organisms of the single oval form. A preparation stained with Wright's stain, followed by Löffler's methylene blue, showed a large single oval parasite in a red cell.

May 20, visited at 9 a. m. by Drs. Anderson and Wilson. Headache and muscular soreness more intense. Complains of pain in bones and joints. Had nose bleed during the night. Conjunctivæ congested and slightly jaundiced. Mind clear.

Red blood corpuscles	4,452,000
Leucocytes.....	8,400
Hemoglobin.....per cent..	66

Not as many organisms found in fresh blood. No albumin or casts in urine.

May 21, seen by Drs. Anderson and Brown. Complains of ringing in ears. Headache and muscular soreness. Pulse good volume. Spleen about 1 inch below lower border of ribs. Liver slightly enlarged. Spots rather brighter in color than yesterday. Blood examination not permitted. No albumin or casts in urine.

May 22, visited at 9 a. m. by Drs. Brown, Chowning, and Anderson. Had slept fairly well during night. Felt better. Temperature lower. Conjunctivæ more congested and jaundiced. Nosebleed for

short time during the night. Spots brighter in color. Pulse good volume.

Red blood corpuscles	4,220,000
Hemoglobin.....per cent..	60

No albumin in urine.

May 23, seen at 9 a. m. by Drs. Brown and Anderson. Says she feels much better; slept well; wants to eat. Bowels moved naturally during night. No pain in head or back. Spots bright, but still do not disappear on pressure. Temperature 99°, pulse 104.

Red blood corpuscles	3,772,000
Hemoglobin.....per cent..	62

No albumin in urine.

May 24, visited at 9 a. m. by Drs. Brown, Anderson, and Chowning. Says she feels all right. Spots bright red and a few disappear slowly on pressure. On account of disappearance of tan on face a few were noticed there for the first time. Conjunctivæ still jaundiced.

May 25, seen at 9 a. m. by Drs. Brown and Anderson. Says she is hungry; feels stronger; slept well. Normal temperature for first time.

Red blood corpuscles	4,200,600
Hemoglobin.....per cent..	62

Spots beginning to fade. Patient was visited by Drs. Brown and Anderson until May 30, but other than the gradual return of strength and slow disappearance of the spots and jaundice, nothing was noted.

No further blood examinations were permitted after the 25th. Blood taken on the seventh and twelfth days of the illness did not give positive Widal reaction in a dilution of 1:20.

Treatment: On admission a cathartic was given and bowels were kept open each day with medicine or enema. On May 17 treatment was given of calcium sulphide, and, at the suggestion of Drs. Anderson and Wilson, quinine sulphate (2.6 grams) every twenty-four hours was given and continued until recovery. The room was kept dark and warm sponge baths given about three times daily. These seemed to act especially well in relieving the congestion of the skin and allaying restlessness, and after each bath it was noted that the spots lost their dark appearance and became much brighter. The patient was allowed milk, broths, egg-nogs, and occasionally soft toast.

MORBID ANATOMY.

The following summary of the post-mortem appearances of the disease are based on the findings in seven cases from the Bitter Root Valley.

Rigor mortis.—Usually intense and appears early.

Skin.—Jaundiced, sometimes deeply. One or more wounds apparently caused by tick bites usually present. The skin has a marbled appearance, well shown by the cut on page 23. On the non-dependent parts of the body spots, petechial in character, from bright red to dark purple in color and from 1 to 3 cm. in diameter; most abundant on wrists, ankles, arms, and back. The capillaries are congested; minute extravasation in the rete extending into the stratum mucosum.

Nervous system.—The cerebral and spinal meninges are normal except for slight hypostatic congestion. No increase in fluid. The brain and spinal substance normal.

Respiratory organs.—Pleuræ normal and do not contain excess of fluid. Lungs show hypostatic congestion; occasionally pneumonia.

Circulatory system.—Pericardium normal. A few small petechial hemorrhages under the epicardium over left ventricle were constantly found. The heart muscle is flabby, softened, and pale. Right heart full of blood; left, contracted and empty. The nuclei are faintly stained; fibers granular and fragmented.

Digestive organs.—Stomach normal. Small and large intestines normal in appearance throughout; Peyer's patches rather pale in color. Mesenteric and retroperitoneal glands not enlarged. Spleen usually dark purple in color, soft, diffuent, and from three to four times its normal weight; vessels engorged with blood; many mononuclear leucocytes containing from one to four red corpuscles; no free pigment. Liver enlarged, fatty, and in portions areas outlined by bile pigment; sections usually show an advanced degree of fatty infiltration; bile capillaries full. Pancreas about twice its normal weight.

Kidneys.—Enlarged; capsule usually not adherent. Small subcapsular hemorrhages on ventral surface. On section, congested and swollen cortex; pyramids well outlined and deep red color. Small hemorrhages in pelvis. Microscopically there are minute extravasations of blood in cortex and under the capsule; veins filled with blood. Nuclei of the convoluted tubules stain poorly; cells granular and in some places detached; newly formed casts in tubules. Bladder normal and usually with small amount of dark urine.

PROGNOSIS.

Of 121 cases which have occurred in or near the Bitter Root Valley, 84 died, giving a case mortality of about 70 per cent. The mortality varies within narrow limits from year to year, some years as many as

90 per cent of those attacked dying. The cases which have occurred near Bridger, Mont., show about the same mortality. Death usually occurs between the sixth and the twelfth day. The abundance of the eruption apparently bears no relation to the severity of the disease. The disease in Nevada and Idaho is not nearly as fatal as in Montana. Dr. Maxey says of the Idaho cases:

The prognosis in spotted fever is, as a rule, very favorable if the patient is transferred to the lower valleys where he can have home comforts and proper care. The disease seems to be more malignant in some localities than it is in others, and in one year than in another.

DIAGNOSIS.

Cases occurring in the infected localities and presenting a history of tick bites, chill, pain in head and back, muscular soreness, constipation, macular eruption, first on the wrists and ankles, appearing on the third day of illness, becoming petechial in character, do not present much difficulty in diagnosing spotted (tick) fever. A blood examination should be made in all suspicious cases. There are five diseases which might cause some difficulty in differentiating them from spotted fever.

DENGUE.

This is a disease of tropical and subtropical countries, whereas spotted fever occurs at an elevation of from 3,000 to 4,000 feet above sea level. The swollen joints, pleomorphic eruption over the joints, never petechial, apyretic period, and short course of the disease would differentiate it from spotted fever.

CEREBRO-SPINAL MENINGITIS.

The stiffness of the muscles of the neck, photophobia, sensitiveness to sudden noises, headache, and rigidity of the muscles of the back and neck, with the not altogether constant irregularly situated rash, should not cause much trouble.

PELLOSIS RHEUMATICA.

In this disease the sore throat, multiple arthritis with purpura and urticaria, and comparative rarity of the disease, offer a sufficiently distinct clinical picture.

TYPHOID FEVER.

Clinically this disease closely resembles spotted fever, but the rose spots appearing first on the abdomen—papular in character—diarrhea, Widal reaction, and presence of the typhoid bacilli in cultures from the blood of typhoid fever, and the presence of parasites in the red blood cells of spotted fever, suffice to separate distinctly the two diseases.

TYPHUS FEVER.

Spotted (tick) fever, I think, more closely resembles typhus fever than any other disease, and cases of typhus fever occurring in a locality in which spotted fever prevails would, without a blood examination and close bedside observation, cause much trouble in diagnosis. In typhus we have the longer period of incubation, absence of a history of tick bites, the eruption which first appears on the abdomen and chest, its intensely contagious character, especially prevalent in the winter months, not limited to a short time in the spring, and marked nervous symptoms. As before mentioned, two cases of spotted fever have never been known to occur in the same family the same season, thus conclusively showing the noncontagious character of the disease.

TREATMENT.

Until the past season the treatment of the disease has been purely symptomatic, but after the discovery of the parasite Dr. Wilson and the writer suggested the use of quinine in large doses, preferably hypodermatically. In five cases in which it was used systematically and in large doses the results were most happy, all recovering. Five cases which did not have the treatment died. Of course, 10 cases is too small a number on which to base very positive conclusions, but I hope that the use of quinine will be followed in the future treatment of the disease.

Quinine bimuriate, 1 gram, should be given hypodermatically every six hours. If there is great objection to the use of the needle, the sulphate, 1 gram, every four hours may be given by mouth; but the irritable condition of the stomach at times may prevent. The use of quinine should be begun as soon as the diagnosis is made and persisted with in decreasing doses as convalescence begins.

Some of the valley physicians seemed to fear that quinine depressed the heart and caused nervous symptoms; but I am of the opinion that the great good the drug does more than counterbalances these effects. I strongly advise the early and continuous use of large doses of quinine.

Some physicians speak well of calcium sulphide, and others of creosote.

The heart should be supported with strychnine, whisky, or other appropriate cardiac stimulants.

For the severe pain in the head and back during the first week Dover's powders or morphine sulphate may be used. The patient should be encouraged to drink large quantities of water to flush out the kidneys. For the fever, warm sponge baths or packs are useful and refreshing to the patient. After a bath the spots lose their dark

color and become much brighter. The room should be kept dark and as free from noise as possible.

Milk, buttermilk, broths, soft eggs, and soft toast may all be allowed. The whisky may be administered in an eggnog.

As soon as a person is bitten by a tick the insect should be removed and the place cauterized with 95 per cent carbolic acid. There is sometimes difficulty in removing the tick; but by applying ammonia, turpentine, kerosene, or carbolized vaseline it can usually be detached without trouble.

The disease, considered from a public-health standpoint, is of much greater importance than was thought until recently. On account of its high mortality in the Bitter Root district attention has been focused there, but on investigation the disease was found to be spread over a large area. The mortality, for some unknown reason, is greatly higher in Montana than in the other States. The disease is not much dreaded in Idaho or in Nevada, but the terror it excites in the Bitter Root Valley is great. If, as seems very probable and almost proved, the tick is the means by which the disease is spread, the question of the prevention of the disease resolves itself into the destruction of the ticks. This is an almost impossible task over such a large area, especially of such varied topography. When conditions will permit, burning the undergrowth and stubble will be an effective method for the destruction of ticks. This may be done either in the early fall or preferably in the early spring, when the ticks are just beginning to move about.

PLATE I.

Drawn with Abbe drawing camera. Stained with Wright's stain, followed by Loeffler's blue. $\times 750$.

Fig. 1. Small form of the parasite found in one field.

Fig. 2. The same, another field.

Fig. 3. Showing parasite with central stained spot surrounded by vacuole.

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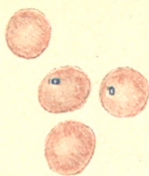


Fig. 1.

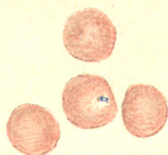


Fig. 2.



Fig. 3.

PLATE II.

Fresh blood drawn with Abbe drawing camera.

Figs. 4 and 5. Small form of the parasite. $\times 665$.

Fig. 6. Large form. $\times 665$.

Figs. 7 and 8. Single form of the parasite. $\times 1,000$.

Fig. 9. Double form of the parasite. $\times 1,000$.

Fig. 10. One field showing two infected corpuscles. $\times 665$.

Fig. 11. One field showing a corpuscle with a large and small parasite. $\times 1,000$.



Fig. 4.



Fig. 5.



Fig. 6.



Fig. 7.



Fig. 8.



Fig. 9.

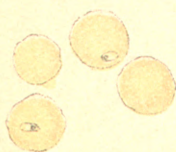


Fig. 10.



Fig. 11.

APPENDIX.

A REPORT OF TWO CASES OF "SPOTTED FEVER."

By Dr. G. A. GATES,
Bridger, Mont.

CASE I.

On May 29, 1898, I was called to see L. M., at Thermopolis, Wyo. Patient was a male, white, aged 23 years, sandy or red hair, rather spare built; had come from Iowa about three months previous to present attack. He became ill while traveling overland from Lander to Thermopolis, Wyo. Having camped out several nights during the journey, on one or two occasions his bedding became thoroughly wet from the heavy rains of that season.

When first seen patient's face was deeply flushed, eyes bright, skin hot and dry, with a beginning petechia on the forehead, back of hands, wrists, and ankles. Headache, thirst, slightly sore throat, and a soreness of muscles and aching throughout the body were complained of by the patient. Temperature 104° F., pulse 120, urine highly colored, no albumin. Complete loss of appetite; no other gastro-intestinal symptoms.

Patient was given small doses of aconite and spirit of nitrous ether and small doses of alcohol until fever was reduced and bowels moved freely.

This was followed by a prescription containing salol, hydrate of chloral, with soda bicarbonate, caffein citrate, and pepsin, combined in a powder and given every four or six hours. Patient was sponged with cool or cold water, as needed for high temperature, and placed on a diet of milk, gruel, raw eggs, and whisky.

The fever ran an irregular course, with great variation, reaching at times a temperature of 104.5° F. and again sinking to 97° F. This low temperature was observed during the last of the first week of the disease, at which time patient was in a state of collapse, being almost pulseless and having a hard chill at the time.

Slight albuminuria appeared during the second week.

Delirium was very slight; patient could be aroused at any time.

Fever gradually subsided after eighteen days.



ERUPTION OF TICK FEVER.

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The petechiæ increased in size and number very rapidly during the first two weeks, forming large, irregularly shaped spots from the size of a little finger nail to spots one-half by one-half inch in size. These spots darkened in color, becoming bluish, with a surrounding yellow tinge. The spots were slow in disappearing, some traces of them being visible seven months after recovery.

CASE 8.

Mrs. H., white, aged 67 years, was bitten by a tick May 4 and 8, the tick being removed from the left thigh on May 8, 1903. The species of ticks to which this one belonged is said to have been brought to this section of country by sheep from Bozeman or vicinity. This tick is recognized by having a grayish or whitish spot on the back of the head. The tick which bit patient came from near the mouth of Dry Creek, on the west side of the Clarke Fork River, 7 miles south of Bridger.

Patient first complained of feeling ill on May 9. She complained of headache, tired feeling, general soreness of the muscles, and loss of appetite.

I saw patient first May 11. Temperature 103, pulse 104, cheeks flushed, tongue white coat on sides, rather dry. Quite severe headache and tired feeling were the only subjective symptoms. Urine dark; on examination showed slight amount of albumin and some hyaline and granular blood casts and numerous bacteria; the quantity for following twenty-four hours was 32 ounces; the quantity gradually diminished from this time until two days before death, when there was complete anuria. Red and white blood cells, with an enormous number of granular, blood, and epithelial casts, were present in last samples of urine obtained.

During the 12th and 13th temperature varied from 101 to 103.5 F. On the 14th it rose to 104.4, slowly dropping to 101 on the morning of the 17th, where it remained until death.

Food and medicine were taken well until the last thirty-six hours. Vomiting occurred once. A number of watery evacuations were produced by the action of elaterium.

Rectal and subcutaneous injections of normal saline solution were given. The combined use of the above and hot packs, together with hot elder water and liquor ammonii acetatis internally, produced only slight diaphoresis, and that mostly about the head.

On the 15th petechial eruption began to make its appearance upon the buttocks, back, and thighs. These increased in number and size until every portion of the body was covered, though but little showing on the face. They seemed to be subcutaneous or intracutaneous extravasations of blood, rapidly darkening in color.

There seemed to be a profound impression on the nervous system from the very first symptoms of the disease. Muttering delirium, and a semicomatose condition, from which the patient could be roused only with much effort, were early and prominent symptoms.

Respiration varied from 30 to 40 per minute throughout the course of the disease and continued until after all signs of heart action had ceased.

Highest pulse rate observed was 186 per minute.

Patient died on the morning of May 19 about 1 a. m.

This case was also seen by Dr. Johnson, of this place, and Dr. Lutz, of Red Lodge, in consultation with me.

○

(Continued from second page of cover.)

No. 19.—A method for inoculating animals with precise amounts. By M. J. Rosenau.

No. 20.—A zoological investigation into the cause, transmission, and source of Rocky Mountain "spotted fever." By Ch. Wardell Stiles.

No. 21.—The immunity unit for standardizing diphtheria antitoxin (based on Ehrlich's normal serum). Official standard prepared under the act approved July 1, 1902. By M. J. Rosenau.

No. 22.—Chloride of zinc as a deodorant, antiseptic, and germicide. By T. B. McClintic.

No. 23.—Changes in the Pharmacopœia of the United States of America. Eighth Decennial Revision. By Reid Hunt and Murray Galt Motter.

No. 24.—The International Code of Zoological Nomenclature as applied to medicine. By Ch. Wardell Stiles.

In citing these bulletins, beginning with No. 8, bibliographers and authors are requested to adopt the following abbreviations: Bull. No. —, Hyg. Lab., U. S. Pub. Health & Mar.-Hosp. Serv., Wash., pp. —.

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