

For intestinal trouble, dry warm wraps round the abdomen are applied, and small doses of calomel with opium may also be administered with advantage.

When sequelæ set in they, of course, require special treatment.

THE TREATMENT OF REDWATER IN CATTLE (BOVINE PIROPLASMOSIS) WITH TRYPANBLUE.

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IN *Parasitology*, Vol. II., Nos. 1 and 2, May 1909, Nuttall and Hadwen published the results of an investigation into the treatment of canine piroplasmosis with trypanblue. The results were certainly very encouraging. In the same journal, Vol. II., No. 3, September 1909, these authors made a further communication on the treatment of bovine piroplasmosis with the drug above mentioned. They concluded, *inter alia*, that trypanblue promises to be an efficient remedy, since it exerts an obvious and direct effect upon the parasites. The conclusion was arrived at after treating nine cases of inoculated piroplasmosis.

The observations in connection with the treatment of bovine piroplasmosis were conducted at the laboratory of the Board of Agriculture and Fisheries on animals which I had infected. The history of the virus which I used for the animals on which Nuttall and Hadwen made their observations is given in their paper, and it may be described as an active virus. For the information of those who have not experimented on a large scale with redwater virus it is perhaps necessary to explain what the writer of the present article means by active virus. If one inoculates the blood of an animal more or less recently recovered from redwater into a series of other animals, the reactions obtained in the latter may be most irregular. Some of the animals after an incubative period of from five to ten days may show nothing more than a slight rise of temperature, accompanied by the appearance of piroplasms in a small proportion of the red blood cells, others may become more or less ill and recover, and some may even die of the disease inoculated.

During the last three years I have inoculated about 100 bovine animals with the virus of redwater, in most cases for the purpose of giving them some degree of immunity before they were shipped to colonies in which the pastures are infected with piroplasmosis, and I have found that the behaviour of one group of animals towards a certain virus was seldom a good guide to what its effect might be on the next group submitted to the immunisation process. In some of the groups there would be hardly one severe reaction, whilst in others the majority of the animals would suffer severely. I have even had to record one or two fatalities. I would describe, then, an active virus as one which has been known to produce a severe reaction

in a considerable number of cases, but I would not designate a virus as weak simply because it had caused only a slight reaction in a few cases. The reaction obtained with a special virus seems to depend to a great extent on the individual susceptibility of the animal operated upon,—a factor the existence of which one cannot initially even suspect. There are other factors, however, which appear to have some influence on the activity of a virus, but it is not my intention at present to discuss this subject, as I hope to do so in a future paper.

The death-rate from inoculated piroplasmosis in bovines is not high, probably 5 per cent. would be a high figure to put it at if a large number of animals are operated upon; but, of course, one may for some reason or another obtain the greater number of the total fatalities in one special group of animals.

It will be apparent from the above remarks that in estimating the value of a therapeutic agent for the treatment of bovine piroplasmosis one would not be in a position to form a definite opinion, based on a decided difference in the rate of mortality amongst the treated and the untreated, unless the observations were conducted on a large number of animals—such a number as would be impossible in an experiment. In practice it is also the case that the death-rate in cattle from uncomplicated piroplasmosis naturally contracted is not high when it is possible to apply treatment to the animals, although the disease indirectly accounts for a very considerable number of deaths.

I do not claim for the observations about to be recorded that they will particularly help anyone to come to a conclusion regarding the value of the trypanblue treatment of bovine piroplasmosis introduced by Nuttall and Hadwen, but rather that they further the view that the value can only be properly estimated after extensive trials in practice.

SERIES I.

The animals in this series were inoculated for another purpose, but it was found possible to put them under trypanblue treatment. They each received the same dose, namely, 10 cc. of the same virus, which, in the sense alluded to above, may be described as active. The treated animals, according to size, received 1 to 1½ grammes of trypanblue in 100-150 cc. of water.

HEIFER 17 P.

The reaction began on the sixth day, when the temperature rose to 105° F. and a few piroplasms were found in the blood.

Day of Reaction.	Temperature.		Number of Piroplasms.		Condition of Blood.	Condition of Urine.	General Remarks. ¹
	A.M. °	P.M. °	A.M.	P.M.			
1st	102	105	None	Few	—	—	—
2nd	105	104.4	Few	Few	—	—	—
3rd	*105	†105.2	Many	Many	—	—	*Mainly R. †Mainly B.
4th	106.2	105	Few	None	—	Red coloured	—
5th	101.2	103.4	None	None	—	Clearer	—
6th	101	101.4	—	—	Many distorted red cells	Clear	—
7th	102	102	—	—	Few basophiles	—	—
8th	102	102.4	—	—	Basophiles	—	—
9th	102.2	102	—	—	Basophiles	—	—
10th	102	101.6	—	—	Basophiles	—	—
11th	102	103.6	No slides		—	—	—
12th	102	102.4	—	—	—	—	—
13th	101.2	101.8	—	—	—	—	—
14th	102	102	—	—	—	—	—
15th	102	102	—	—	—	—	—
16th	101.4	102.4	—	—	—	—	—
17th	102	102	—	—	—	—	—
18th	101.8	101.8	—	—	—	—	—
19th	102	—	—	—	—	—	—

HEIFER 19 P.

The reaction began on the fifth day after inoculation, when the temperature rose to 104° F. morning and 105° F. evening, but piroplasms were not found in the blood cells until the evening.

Day of Reaction.	Temperature.		Number of Piroplasms.		Condition of Blood.	Condition of Urine.	General Remarks.
	A.M. °	P.M. °	A.M.	P.M.			
1st	104	105	None	Few	—	—	—
2nd	102	103.4	Few	Few	—	—	—
3rd	104	106	A few	Fair	—	—	—
4th	105	107.2	Fair	Fair	—	Red	—
5th	101.8	104	None	None	Red cells cre-nated	Red	—
6th	102.8	102	—	—	Same	Clearer	—
7th	104	103.6	—	—	Basophiles	Probably clear	—
8th	103.8	104	—	—	Same	—	—
9th	104.8	105	—	—	Same	—	—
10th	104.6	104.8	—	—	Many basophiles	—	—
11th	103.2	103.6	—	—	Same	—	—
12th	103.2	105	—	—	Same	—	—
13th	103.8	105	—	—	Basophiles	—	—
14th	102.2	102.6	—	—	Same	—	—
15th	102	102.8	—	—	Same	—	—
16th	102.2	102.4	—	—	Few basophiles	—	—
17th	102.8	102	—	—	Blood improving	—	—
18th	102.4	103	—	—	—	—	—
19th	102.6	102.4	—	—	—	—	—

¹ In this and the remaining Tables the letters B. and R. in the last column mean respectively "bigemina" or twin piroplasms, and "round" piroplasms.

² Trypanblue injected into jugular vein.

HEIFER 20 P.

The reaction began on the sixth day, when the temperature rose to 104° F. and 104.6° F. in the evening, and piroplasms were present in the blood cells both morning and evening.

Day of Reaction.	Temperature.		Number of Piroplasms.		Condition of Blood.	Condition of Urine.	General Remarks.
	A.M.	P.M.	A.M.	P.M.			
1st	104	104.6	A few	Few	—	—	R. and B.
2nd	106	105.2	A few	Many	—	—	Mainly B.
3rd	106.4	107	Fair	Fair	—	Red	—
4th	104.4 ¹	102.4	Fewer	None	Red cells distorted	Red	Mainly B.
5th	103	102	None	None	Red; few basophiles	Clearer	—
6th	102.8	106	—	—	Basophiles	Probably clear	—
7th	101.2	103.8	—	—	Same	—	—
8th	104.4	105	—	—	Same	—	—
9th	103.2	105	—	—	Many basophiles and some normoblasts	—	—
10th	103.8	104	—	—	Same	—	—
11th	103	102.6	—	—	Basophiles	—	—
12th	102.6	103.2	—	—	Same	—	—
13th	102.2	102.6	—	—	Same	—	—
14th	102	102.6	—	—	Fewer basophiles	—	—
15th	102.2	102.8	—	—	Improving	—	—
16th	102.4	103.2	—	—	—	—	—
17th	103	102.8	—	—	—	—	—
18th	102.4	—	—	—	—	—	—
19th	—	—	—	—	—	—	—

HEIFER 21 P.

The reaction began on the sixth day after inoculation, when the temperature rose to 104.4° F. in the evening and a few piroplasms were found in the blood cells.

Day of Reaction.	Temperature.		Number of Piroplasms.		Condition of Blood.	Condition of Urine.	General Remarks.
	A.M.	P.M.	A.M.	P.M.			
1st	101.8	104.4	None	A few	—	—	Only B.
2nd ²	106	104	Many	Many	—	—	Mainly B.
3rd	106.2	104.1	—	Same	—	Black	In this case redwater persisted longer than I have ever seen it before
4th	101	101.2	None	None	Red cells crenated	Red	
5th	102	101.2	—	—	Many distorted red cells	Same	
6th	101.8	102	—	—	Few basophiles	Same	
7th	102	104	—	—	Basophiles	Same	
8th	102	102	—	—	Same	Same	
9th	102	102.4	—	—	Many basophiles	Same	
10th	102	105	—	—	Basophiles and normoblasts	Same	
11th	104.8	106.2	—	—	Same	Clear	
12th	103.6	105	—	—	Same	—	
13th	105	105.4	—	—	Fewer basophiles; red cells distorted	—	—
14th	103.8	105	—	—	Same	—	—
15th	102.4	104	—	—	Same	—	—
16th	102	103	—	—	Same	—	—
17th	103	103.4	—	—	Improving	—	—
18th	102.4	103	—	—	—	—	—
19th	103.2	—	—	—	—	—	—

¹ Trypanblue injected into jugular vein.² Temperature was 107° F. at noon..

HEIFER 22 P.

The reaction began on the evening of the seventh day after inoculation, when the temperature rose to 104° F. and a few piroplasms were found in the red cells.

Day of Reaction.	Temperature.		Number of Piroplasms.		Condition of Blood.	Condition of Urine.	General Remarks.
	A.M.	P.M.	A.M.	P.M.			
1st	102	104	A few	A few	—	—	R. and B.
2nd ¹	106	105 ²	Fair	Fair	—	Black	—
3rd	101'2	101'2	None	None	—		—
4th	101'4	101		—	—		—
5th	101'4	101		—	—		—
6th	101'6	101'4		—	Red cells crenated		—
7th	102'2	102		—	Same		—
8th	101'6	102'2		—	Same		—
9th	102'2	102		—	Same		—
10th	101	104	No smears		—		—
11th	102	102'6		—	—		—
12th	102	102		—	—		—
13th	102	102'4		—	—		—
14th	102	102'8		—	—		—
15th	102'2	102		—	—		—
16th	102	102'4		—	—		—
17th	101'4	102		—	—		—
18th	102	101'8		—	—		—
19th	102	—		—	—		—

HEIFER 23 P.

The reaction began on the evening of the fifth day, when the temperature rose to 105° F. and a few piroplasms were found in the blood cells.

Day of Reaction.	Temperature.		Number of Piroplasms.		Condition of Blood.	Condition of Urine.	General Remarks.
	A.M.	P.M.	A.M.	P.M.			
1st	102'4	105	None	A few	—	—	R. and B.
2nd	104	106	Many	Very many	—	Red	R. and B.
3rd	104	106'2	Very many	Very many	—	Same	—
4th	106'6	105'2 ²	Fewer	Few	—	Same	Temperature falling
5th	101	101	None	None	Red cells distorted; some basophiles		—
6th	101	100'8		—	Same		—
7th	101'2	101'4		—	Basophiles		—
8th	101'6	102'4		—	Same		—
9th	102	103'2		—	Many basophiles		—
10th	103'6	104		—	Same		—
11th	105	105		—	Same		—
12th	104	105'2		—	Basophiles and normoblasts		—
13th	104'2	103'2		—	Same		—
14th	104	105		—	Basophiles		—
15th	103'2	104		—	Same		—
16th	102'4	102'8		—	Basophiles fewer; improving		—
17th	103	103	No smears		—		—
18th	102'8	103		—	—		—
19th	102	101'6		—	—		—

¹ Temperature was 106'4° at noon and was falling.

² Trypanblue injected into jugular vein.

HEIFER 24 P.

The reaction began on the morning of the sixth day after inoculation, when the temperature rose to 104.4° F. and a few piroplasms were found in the blood cells.

Day of Reaction.	Temperature.		Number of Piroplasms.		Condition of Blood.	Condition of Urine.	General Remarks.
	A.M.	P.M.	A.M.	P.M.			
1st	104.4	104.8	A few	A few	—	—	—
2nd	104.2	105		Same	—	—	R. and B.
3rd	105.2	106.1	Fair	Fair	—	—	Mainly B.
4th	105.2	106.2	Many	Many	—	Red	—
5th	103	102.6	None	None	—	—	—
6th	101.6	101		—	—	Not noticed when first clear	—
7th	102	101.8		—	—		—
8th	102	102.8		—	Red cells distorted and basophiles		—
9th	102.4	102.4		—	Same		—
10th	105.8	106		—	Same		—
11th	105	105.2		—	Same		—
12th	105.2	105.4		—	Same		—
13th	103.6	104		—	Same		—
14th	103	103.6		—	Same		—
15th	102.8	103		—	Improving		—
16th	103	103.4		—	—		—
17th	103	104.2		—	—		—
18th	103.8	102.8		—	—		—
19th	103	—		—	—		—

HEIFER 25 P.

The reaction began on the morning of the sixth day after inoculation, when the temperature rose to 105° F., and a few piroplasms were found in the red cells on the seventh day.

Day of Reaction.	Temperature.		Number of Piroplasms.		Condition of Blood.	Condition of Urine.	General Remarks.
	A.M.	P.M.	A.M.	P.M.			
1st	105	105	None	None	—	—	—
2nd	105	103.4	Fair	Fair	—	—	R. and B.
3rd	105.2	105	Same	Same	—	—	Mainly B.
4th	105.8	106.2 ¹	Fair	Very few	—	Red	Mainly B.
5th	101	102.8	None	None	—	Less red	—
6th	101	101.4		—	Basophiles ; distorted red cells	Clear	—
7th	101.8	103.6		—	Same	—	—
8th	101.4	102.2		—	Same	—	—
9th	102.2	102		—	Same	—	—
10th	103	102		—	Same	—	—
11th	103	103.4		—	—	—	—
12th	102	102.4		—	—	—	—
13th	102	102	No smears		—	—	—
14th	101.6	102			—	—	—
15th	102	102.6			—	—	—
16th	102	102			—	—	—
17th	102	102		—	—	—	—
18th	101	101.4		—	—	—	—
19th	102.6	—		—	—	—	—

¹ Trypanblue injected subcutaneously.

HEIFER 26 P.

The reaction began on the evening of the fifth day, when the temperature rose to 103° F., but no piroplasms were found in the blood until the morning of the sixth day.

Day of Reaction.	Temperature.		Number of Piroplasms.		Condition of Blood.	Condition of Urine.	General Remarks.
	A.M. °	P.M. °	A.M.	P.M.			
1st	102	103	None	None	—	—	—
2nd	104.2	102.4	A few	A few	—	—	Mainly R.
3rd	102.2	104.3	Same		—	—	—
4th	106.2	106.3 ¹	Fair	Fewer	—	Black	—
5th	102	104	None	None	—	Clear	—
6th	101.2	102	—		—	—	—
7th	102.4	102	—		—	—	—
8th	102.2	102	—		Distorted red cells	—	—
9th	101.4	102.4	—		Same	—	—
10th	102	102	—		Same	—	—
11th	102	102	—		—	—	—
12th	102	103.6	—		—	—	—
13th	101.3	102.6	—		—	—	—
14th	102	102.4	—		—	—	—
15th	102	102	—		—	—	—
16th	102.2	102	—		—	—	—
17th	102.6	102.4	—		—	—	—
18th	102.2	102.4	—		—	—	—
19th	102.2	—	—		—	—	—

HEIFER 27 P.

The reaction began on the evening of the sixth day, when the temperature rose to 104.6 F. and a few piroplasms were found in the red cells.

Day of Reaction.	Temperature.		Number of Piroplasms.		Condition of Blood.	Condition of Urine.	General Remarks.
	A.M. °	P.M. °	A.M.	P.M.			
1st	102.2	104.6	None	A few	—	—	Mainly B.
2nd	103.4	103	A few	A few	—	—	—
3rd	105.8	106 ¹	Fair	Fair	—	Black	—
4th	101.8	101.6	None	None	—	Very red	—
5th	101	101.2	—		—	Red	—
6th	102	102	—		—	Clearer	—
7th	102	102	—		Basophiles	Clear	—
8th	102	102.3	—		Same	—	—
9th	102	103	—		Same	—	—
10th	103.8	103.4	—		Same	—	—
11th	102	105	No smears		—	—	—
12th	101.4	102.4	—		—	—	—
13th	102.2	102.2	—		—	—	—
14th	102.4	103	—		—	—	—
15th	102	102.4	—		—	—	—
16th	102.2	102.8	—		—	—	—
17th	102	102	—		—	—	—
18th	102.2	102.4	—		—	—	—
19th	102	—	—		—	—	—

¹ Trypanblue injected into jugular vein.

HEIFER 28 P.

The reaction began on the morning of the fifth day, when the temperature rose to 103° F., but piroplasms were not found until the evening.

Day of Reaction.	Temperature.		Number of Piroplasms.		Condition of Blood.	Condition of Urine.	General Remarks.
	A.M.	P.M.	A.M.	P.M.			
1st	103	105	None	A few	—	—	R. and B.
2nd	104.4	101.4	A few	A few	—	—	R. and B.
3rd	106	105.2	Fair	Fewer	—	Red	Mainly B.
4th	106.8	106.6 ¹	Fewer	Fewer	—	Black	—
5th	102.2	103.2	None	None	—	Red	—
6th	101.4	102.3	—	—	—	Clearer	—
7th	102.4	102	—	—	Basophiles	Clear	—
8th	103.2	103.3	—	—	Same	—	—
9th	103.2	104.8	—	—	Basophiles and normoblasts	—	—
10th	103	103.4	—	—	Fewer basophiles	—	—
11th	104	104	—	—	Basophiles	—	—
12th	102.8	103	No smears		—	—	—
13th	102	102.4	—	—	—	—	—
14th	102.6	103.8	—	—	—	—	—
15th	104	103.6	—	—	—	—	—
16th	102.4	102.8	—	—	—	—	—
17th	102.2	102.4	—	—	—	—	—
18th	102	101.2	—	—	—	—	—
19th	101.6	101.4	—	—	—	—	—

HEIFER 29 P.

The reaction began on the evening of the sixth day, when the temperature rose to 103.6° F. and a few piroplasms were found in red cells.

Day of Reaction.	Temperature.		Number of Piroplasms.		Condition of Blood.	Condition of Urine.	General Remarks.
	A.M.	P.M.	A.M.	P.M.			
1st	102.2	103.6	None	A few	—	—	—
2nd	105	105.2	A few	Many	—	—	A few R. but mainly B.
3rd	106.6	106.2 ¹	Many	Many	—	Black	Many R.
4th	101.4	101.2	None	None	Distorted & crenated red cells	Black	—
5th	101	102.2	—	—	Same	Red	—
6th	103	103.2	—	—	Basophiles; distorted red cells	Clearer	—
7th	105	105	—	—	Same	Red	—
8th	101.8	102.2	—	—	Same	Clear	—
9th	102.2	102	—	—	Same	—	—
10th	103.2	104	—	—	Same	—	—
11th	104.4	106	—	—	Same	—	—
12th	103.2	103.8	—	—	Same	—	—
13th	104	104.2	—	—	Improving	—	—
14th	103	103.6	—	—	—	—	—
15th	102.2	103.2	—	—	—	—	—
16th	102	102	—	—	—	—	—
17th	102.6	103	—	—	—	—	—
18th	102.8	102.6	—	—	—	—	—
19th	102.2	—	—	—	—	—	—

¹ Trypanblue injected into jugular vein.

HEIFER 30 P.

The reaction began on the morning of the seventh day, when the temperature rose to 104.4° F. and a few piroplasms were found in the red cells.

<i>Day of Reaction.</i>	<i>Temperature.</i>		<i>Number of Piroplasms.</i>		<i>Condition of Blood.</i>	<i>Condition of Urine.</i>	<i>General Remarks.</i>
	A.M.	P.M.	A.M.	P.M.			
1st	104.4	104.8	A few	A few	—	—	Mainly B.
2nd	104	107.6 ¹	Fair	Fair	—	Black	R. and B.
3rd	101	104	None	None	—	Clearing	—
4th	103	103.8	—	—	—	Clear	—
5th	103	103	—	—	Red cells distorted and crenated	—	—
6th	101.8	102	—	—	Same	—	—
7th	101.6	102.4	—	—	—	—	—
8th	102	102.6	—	—	—	—	—
9th	103.2	103	—	—	—	—	—
10th	102.2	103	—	—	—	—	—
11th	101.8	102.4	—	—	—	—	—
12th	102.2	102	—	—	—	—	—
13th	102	102.2	—	—	—	—	—
14th	102.2	102.6	—	—	—	—	—
15th	102	102.8	—	—	—	—	—
16th	102	102.2	—	—	—	—	—
17th	101.4	102	—	—	—	—	—
18th	102	—	—	—	—	—	—

HEIFER 31 P.

The reaction began on the morning of the sixth day, when the temperature rose to 106° F. and a few piroplasms, mainly round forms, were found in the blood cells.

<i>Day of Reaction.</i>	<i>Temperature.</i>		<i>Number of Piroplasms.</i>		<i>Condition of Blood.</i>	<i>Condition of Urine.</i>	<i>General Remarks.</i>
	A.M.	P.M.	A.M.	P.M.			
1st	106	102.8	Few	Few	—	—	R. mainly
2nd	102.2	105.6	Few	Few	—	—	R. and B.
3rd	105	105	Few	Few	—	—	R. and B.
4th	107	107 ²	Very few	Very few	—	Red	—
5th	101	100.4	None	None	—	Red	—
6th	101	101	—	—	—	Clear	—
7th	101.8	101.4	—	—	Red cells distorted	—	—
8th	101.6	102.4	—	—	Basophiles	—	—
9th	102	104	—	—	Same	—	—
10th	102.2	102.8	—	—	Many basophiles and normoblasts; punctate degeneration	—	—
11th	103	105.4	—	—	Same	—	—
12th	103	104	—	—	Basophiles	—	—
13th	101.6	103	—	—	Same	—	—
14th	103	103	—	—	Same	—	—
15th	103	103	—	—	Fewer basophiles	—	—
16th	102.6	103	—	—	Improving	—	—
17th	102.2	102.2	—	—	Same	—	—
18th	102.4	102.2	—	—	Same	—	—
19th	102	—	—	—	Same	—	—

¹ Trypanblue injected into jugular vein.² Trypanblue injected subcutaneously.

HEIFER 32 P.

The reaction began on the morning of the seventh day, when the temperature rose to 103°2 F. and a few piroplasms were found in the blood cells.

Day of Reaction.	Temperature.		Number of Piroplasms.		Condition of Blood.	Condition of Urine.	General Remarks.
	A.M. °	P.M. °	A.M.	P.M.			
1st	103°2	103°4	Few	Few	—	—	R. and B.
2nd	105°6	107	Fair	Fair	—	—	R. and B.
3rd	103 ¹	102	Few	None	—	Red	R. and B.
4th	100	100°6	None	None	—		—
5th	101°2	101	—	—	Few basophiles		—
6th	101°8	101°6	—	—	Basophiles		—
7th	102	103	—	—	Basophiles		—
8th	102°8	102°6	—	—	Punctate degeneration and many basophiles		—
9th	104	104	—	—	Many basophiles and punctate degeneration and normoblasts		—
10th	103	105	—	—	Same		—
11th	102°2	103	—	—	Fewer basophiles		—
12th	102	103	—	—	Improving		—
13th	102	102°2	—	—	—		—
14th	102	102°8	—	—	—		—
15th	102	102°8	—	—	—		—
16th	102	102	—	—	—		—
17th	102	102°4	—	—	—		—
18th	102	102°2	—	—	—		—

BULL 36 P.

The reaction began on the morning of the seventh day, when the temperature rose to 103°2° F. and a few piroplasms were found in the blood cells.

Day of Reaction.	Temperature.		Number of Piroplasms.		Condition of Blood.	Condition of Urine.	General Remarks.
	A.M. °	P.M. °	A.M.	P.M.			
1st	103°2	106	Very few	Very few	—	—	—
2nd	105°2	106	Few	Few	Red cells distorted	—	—
3rd	107°2	107°4 ²	Many	Many	—	Red	Mainly B.
4th	102°4	102°2	Very few	None	—	Red	—
5th	102°4	102°8	None	None	—	Red	—
6th	102	101°6	—	—	—	Red	—
7th	102°4	103	—	—	Basophiles	Red	—
8th	103	102°4	—	—	Basophiles	Clearing	—
9th	103°4	103	—	—	Many basophiles and punctate degeneration	—	—
10th	102°2	103°2	—	—	Same	—	—
11th	103	103	—	—	Same	Cleared	—
12th	102	102°8	—	—	Same	—	—
13th	103°2	104°6	—	—	No basophiles	—	—
14th	103°2	103	—	—	Improving	—	—
15th	102	102	—	—	—	—	—
16th	101°8	102°6	—	—	—	—	—
17th	101°8	101°6	—	—	—	—	—
18th	102°2	—	—	—	—	—	—

¹ Trypanblue injected into jugular vein.² Trypanblue injected subcutaneously.

BULL 34 P.

The reaction began on the morning of the fourth day, but no piroplasms were found in the blood cells until the morning of the fifth day. The temperature rose on the morning of the fourth day to 106° F.

Day of Reaction.	Temperature.		Number of Piroplasms.		Condition of Blood.	Condition of Urine.	General Remarks.
	A.M.	P.M.	A.M.	P.M.			
1st	106	105.6	None	None	—	—	—
2nd	105	105.8	Few	Few	—	—	R. and B.
3rd	106	107	Fair	Fair	—	—	B. and R., mainly latter
4th	107	107.2	Many	Many	—	—	B. and R.
5th	106.2	108 ¹	Fewer	Fewer	—	Black	B. and R.
6th	103.2	106.8	None	None	—	Red	—
7th	104.2	105.2	—	—	—	Blue (from drug)	—
8th	104.6	105	—	—	—	Same	—
9th	103.2	103	—	—	—	Same	—
10th	103	105	—	—	—	Same	—
11th	103	105	—	—	—	—	—
12th	104	104.4	—	—	Red cells much distorted	—	Between the 19th and 37th days the temperature varied from 102° F. to 105.6° F., after which it became normal
13th	104	106.2	—	—	Same	—	
14th	105.2	105	—	—	Same	—	
15th	104.2	104.4	—	—	—	—	
16th	103.6	103.4	—	—	—	—	
17th	103	104	—	—	—	—	
18th	104.4	104	—	—	—	—	
19th	101.6	103	—	—	—	—	

HEIFER 18 P.

The reaction began on the evening of the fifth day, when the temperature rose to 103° F., but piroplasms were not found until the seventh day. This heifer was not treated.

Day of Reaction.	Temperature.		Number of Piroplasms.		Condition of Blood.	Condition of Urine.	General Remarks.
	A.M.	P.M.	A.M.	P.M.			
1st	102	103	—	—	—	—	—
2nd	103	103.2	—	—	—	—	—
3rd	102	103	Few	Few	—	—	—
4th	102.6	104	A few	Few	—	—	Mainly B.
5th	102	102.6	A few	A few	—	—	B. and R.
6th	102	102	Very few	Very few	—	—	Mainly R.
7th	102	102.8	Very few	Very few	Red cells distorted	No alterations	—
8th	102	102.4	Very few	Very few	—		Mainly B.
9th	102	102.2	None	None	—		—
10th	102	102.8	None	None	—		—
11th	102	102	None	None	—		—
12th	103	103	No smears		—		—
13th	102	102	—	—	—		—
14th	102	102	—	—	—		—
15th	Did not rise above 102.6° F. up to the 19th day	—	—	—	—		—
16th		—	—	—	—		—
17th		—	—	—	—		—
18th		—	—	—	—		—
19th		—	—	—	—		—

¹ Trypanblue injected into jugular vein.

BULL 33 P.

This animal was not treated. The reaction began on the evening of the fourth day, when the temperature rose to 103° F. No piroplasms were found in the blood cells until the third day.

Day of Reaction.	Temperature.		Number of Piroplasms.		Condition of Blood.	Condition of Urine.	General Remarks.
	A.M. °	P.M. °	A.M.	P.M.			
1st	101.4	103	None	None	—		—
2nd	103	104	None	None	—		—
3rd	104.8	104.4	Few	Few	—		—
4th	104.8	105.4	Few	Few	—		Mainly B.
5th	103.2	105	Few	Few	—		B.
6th	104.4	102.2	Very few	Very few	—		—
7th	102.4	102.8	Very few	Very few	—		—
8th	104	103.6	None	None	—		—
9th	103.2	104.2			—		—
10th	102	103.4			—		—
11th	104	102.2			—		—
12th	102.8	103.2			Few basophiles	No alterations	—
13th	103.8	103.2			Improving		—
14th	103.8	103.4			Appeared normal		—
15th	103.4	103			—		—
16th	104.2	104.2			—		—
17th	103	104.8			—		—
18th	104	103.4			—		—
19th	103.8	102.2			—		—
20th	102	103			—		—

BULL 35 P.

This animal was not treated. The reaction began on the morning of the ninth day, when the temperature rose to 103° F., but no piroplasms were found until the evening.

<i>Day of Reaction.</i>	<i>Temperature.</i>		<i>Number of Piroplasms.</i>		<i>Condition of Blood.</i>	<i>Condition of Urine.</i>	<i>General Remarks.</i>
	A.M. °	P.M. °	A.M.	P.M.			
1st	103	104.2	None	Few	No changes	No alterations	B.
2nd	105	105	Few	Few			B.
3rd	104	104.8	Few	Few			R. and B.
4th	104.2	105	Same				Same
5th	103.6	104	None	None			—
6th	103	102.6	—				—
7th	102	103	—				—
8th	101.4	103.8	—				—
9th	102.4	103	—				—
10th	102.4	102.6	No smears				—
11th	102.2	102	—				—
12th	102	102.6	—				—
13th	102	102.6	—				—
14th	102.2	101.6	—				—
15th	102	101.6	—				—
16th	102	—	—				—

BULL 37 P.

This animal was not treated. The reaction began on the evening of the fourth day, when the temperature rose to 104°6' F., but no piroplasms were found until the morning of the fifth day.

Day of Reaction.	Temperature.		Number of Piroplasms.		Condition of Blood.	Condition of Urine.	General Remarks.
	A.M. °	P.M. °	A.M.	P.M.			
1st	102°6	104°6	None	None	No alterations	No alterations	—
2nd	104	103°4	Few	Few			Mainly R.
3rd	105°4	106	Few	Few			Mainly R, some B.
4th	104°8	105	Few	Few			R. and B.
5th	104	105	Fair	Fewer			Mainly B.
6th	102	102°2	Very few	Very few			Mainly R.
7th	102°4	102°2	Very few	Very few			Mainly B.
8th	102	102°2	None	None			—
9th	102	103	Very few	Very few			Mainly B.
10th	102°4	102°2	Same				Same
11th	102	102	None	None			—
12th	101°2	102	None	None			—
13th	101°8	102°4	None	None			—
14th	102	102°2	No smears				—
15th	101°2	102°6	—				—
16th	102°2	102°2	—				—
17th	101°4	102°2	—				—
18th	102	101°2	—				—
19th	102	102°4	—				—

Since the "live or die" test is not applicable except in the case of a very large number of animals, one might try to arrive at a conclusion by comparing in the treated and untreated (*a*) the duration of the temperature reaction; (*b*) the duration of the redwater; (*c*) the presence of serious blood changes; and (*d*) the time at which the piroplasms disappeared from the cells in the peripheral blood stream.

Duration of the Temperature Reaction.

	Ten Days and Under.	Ten to Fifteen Days.	Above Fifteen Days.
Treated (17)	(3) Heifers 30 (9), 22 (9), and 7 (5 days)	(7) Heifers 36 (14), 32 (12), 27 (11), 25 (11), 29 (15), 28 (15), and 31 (16 days)	(7) Heifers 31 (16), 34 (25), 24 (19), 23 (18), 21 (19), 20 (17), and 19 (18 days).
Untreated (4)	(2) Nos. 37 (9) and 35 (9 days)	(1) No. 18 (12 days)	(1) No. 33 (20 days).
Compare also untreated in Series II.	Nos. 22 T (8) and 16 T (6 days)	No. 14 T (14 days)	—

A temperature of 103° F. and above is reckoned as distinctly above the normal. It is to be noted that the administration of the drug was often followed by a more or less temporary fall to about normal.

Duration of the Redwater.

Records were available in fourteen of the treated cases.

No. of days	1	2	3	4	5	6	7	8
Treated cases (14)	1	5	3	2	1	1	—	1
Compare Series II. and III., untreated	—	1	1	1	—	—	—	—

It should be noted that all the animals put under treatment were on the point of passing red urine, had just begun to pass it, or had been passing it for a short time, before the trypanblue was injected. Treatment was begun on No. 24 the day before red urine appeared. To apply treatment after a disease has well established itself must be considered a severe test of remedial agents or methods. Nevertheless, the practitioner is seldom or never called to treat a case unless redwater has shown itself. A very large number of cases of bovine piroplasmosis pass unnoticed by the farmers on account of the absence of red urine, and nothing is ever heard of them. Indeed, it would be practically correct to say that veterinary surgeons are only asked to treat cases of actual redwater. In this sense, then, the test is not too severe for the purpose of comparison with other methods.

It has also to be noted that none of the five animals left untreated developed redwater, which in the experimental sense is unfortunate, since it must to some extent reduce the value of a comparison. The reason for this was that the most expensive animals (few of them had cost less than £30, and some more) developed redwater at an early date, and during my absence on the Continent my assistant did not care to take the responsibility of leaving them untreated. For comparison, however, three cases of redwater from another group are inserted in Series II.

It is to be noted that when red urine appears as the result of inoculation this symptom seldom lasts longer than two or three days.

Presence of Serious Blood Changes.—The appearance of basophile cells, cells showing punctate degeneration, and nucleated red cells is generally looked upon as evidence that the animal is severely affected. Of the seventeen animals treated thirteen showed serious blood lesions after treatment, and of the four untreated one showed such lesions. It would be better, however, for purposes of comparison, to refer to Heifer 22 T (Series III.), which developed redwater and was not treated. Blood lesions appeared in this animal, but they were no more severe than in the treated animals.

Duration of Piroplasms in the Peripheral Blood Stream.

No. of days	3	4	5	6	7	8	9	10	11
Treated (17)	3	3	10	1	—	—	—	—	—
Untreated (4)	—	—	1	—	—	2	—	—	1

There is no rule regarding the persistence of piroplasms in the red cells of the peripheral blood stream. They may be present more or less throughout the reaction, or they may disappear after the first few days, returning or not as the case may be. Their disappearance not infrequently follows the appearance of red urine (consult Heifer 22 T, Series III.). An important point to be noted, however, in connection with the treated animals is that, except in the cases of Nos. 24 and 36, the piroplasms disappeared from the red cells in the peripheral blood stream a few hours after the drug had been injected. Nuttall and Hadwen drew attention to the early disappearance of the piroplasms after treatment, and it is practically on this action of trypanblue that they believe that it promises to be an efficient remedy. Since, however, the temperature reaction and other symptoms persisted in many of the above treated cases for the usual time, it seems probable that the action of the drug is to confine the parasites to the internal organs, as in the case of some of the agents used for the treatment of trypanosomiasis. One should not lose sight of the possibility that had a second dose of trypanblue been given to each animal the effect of the drug might have been greater. This was only tried on Bull 34 (*see* Chart). In two animals of another group which were slaughtered nearly a fortnight after treatment the subcutaneous and other tissues were found to be deeply stained with blue. At first sight it might appear that since the dye is available in the tissues during this long period a second dose is unnecessary. On the other hand, it is quite possible that the colouring matter left is not the active part of the drug, and that the piroplasmicide was used up at a comparatively early date.

SERIES II.

The three charts given below are of animals from other groups which were not treated. Two are examples of many which have gone through an attack of actual redwater after inoculation with an active virus. All three are examples taken from those inoculated animals which showed a sudden drop of temperature after it had reached its highest point, and two of them illustrate another not uncommonly observed feature of the disease, viz., that the sudden drop synchronises with the appearance of red urine.

HEIFER 16 T.

The reaction began on the fourth day, but piroplasms were not found until the fifth day. This heifer belongs to another series, and was not treated.

<i>Day of Reaction.</i>	<i>Temperature.</i>		<i>Number of Piroplasms.</i>		<i>Condition of Blood.</i>	<i>Condition of Urine.</i>	<i>General Remarks.</i>
	A.M.	P.M.	A.M.	P.M.			
1st	103	105.2	None	None	—	—	—
2nd	106.2	105.6	A few	A few	—	—	—
3rd	106.2	106	Same		—	—	—
4th	106.4	107	Fair	Fair	—	—	—
5th	106	107	Slides not available		—	—	—
6th	104	103.4	—		—	Red	—
7th	101.8	102	—		—	Red	—
8th	101.4	101.8	—		—	Light red	—
9th	101	101	—		—	Clear	—
10th	Never rose above 102° F. for a month afterwards						

HEIFER 10 P.

The reaction began on the morning of the tenth day, when the temperature rose to 104° F. and a few piroplasms were found in the blood cells. The animal was not treated.

<i>Day of Reaction.</i>	<i>Temperature.</i>		<i>Number of Piroplasms.</i>		<i>Condition of Blood.</i>	<i>Condition of Urine.</i>	<i>General Remarks.</i>
	A.M.	P.M.	A.M.	P.M.			
1st	104	106	Few		No alterations	No alterations.	—
2nd	101	102	Few				—
3rd	106	107	More numerous				—
4th	100	102	Few				—
5th	101'2	102	No further observations				—
6th	}	*					—
7th							—
8th							—
9th							—
10th							—

* Did not rise above 102° F. during the next month of observation.

HEIFER 14 T.

This animal was not treated. The reaction began on the fifth day, when the temperature rose to 105° F. and piroplasms were found in the red cells.

<i>Day of Reaction.</i>	<i>Temperature.</i>		<i>Number of Piroplasms.</i>		<i>Condition of Blood.</i>	<i>Condition of Urine.</i>	<i>General Remarks.</i>
	A.M. °	P.M. °	A.M.	P.M.	No particular alteration except distortion of red cells		
1st	102·2	105	None	Very few		—	—
2nd	106	103·6	A few	A few		—	—
3rd	105	106	Same			—	—
4th	105	107	No smears available			—	—
5th	102	101·8	—			Red Red, clearing Clear	—
6th	101·3	102	—				—
7th	101·4	102	—				—
8th	102	—	—			—	—
9th	102	—	—			—	—
10th	102	—	—			—	—
11th	102	—	—			—	—
12th	102	—	—			—	—
13th	102	—	—			—	—
14th	103	103·2	—			—	—
15th	102	—	—			—	—
16th	102	—	—			—	—
17th	102	—	—			—	—
18th	102	—	—		—	—	

SERIES III.

As a further opportunity presented itself, though on a smaller scale, of trying the effect of trypanblue, it was decided to vary the observations in such a way that the drug would have the opportunity of exerting its influence the moment the animals showed the first sign of reaction. This, of course, is not comparable to the conditions met with in practice, but it is calculated to supply further evidence relating to the action of the drug. The virus used was active. The animals each received subcutaneously 1½ grammes of trypanblue dissolved in 150 cc. of water, and it will be noted that in two of the three animals treated piroplasms had not appeared before the drug was injected.

HEIFER 22 T.

This animal was not treated. The reaction began on the morning of the tenth day, when the temperature rose to 103.2° F. A few piroplasms were found in the blood cells.

<i>Day of Reaction.</i>	<i>Temperature.</i>		<i>Number of Piroplasms.</i>		<i>Condition of Blood.</i>	<i>Condition of Urine.</i>	<i>General Remarks.</i>
	A.M. °	P.M. °	A.M.	P.M.			
1st	103.2	105	Few	Few	—	—	Mainly R., few B.
2nd	105.4	107.2	Fair		—	Red	R. and B.
3rd	104.2	104	Same		—	Red	R. and B.
4th	102.8	102.2	Very few	None	—	Red	R. and B.
5th	102.2	102.2	None	None	—	Clearing	—
6th	102	102.2	—		—	—	—
7th	102	102.8	—		Basophiles	—	—
8th	101.8	103.2	—		Basophiles and punctate degeneration	—	—
9th	101.2	102	—		Same	—	—
10th	102	102.2	—		Same	—	—
11th	102.2	—	A few		Same	—	R. and B.
12th	Animal had to go for shipment, but did not appear ill						

HEIFER 23 T.

The reaction began on the morning of the fifth day, when the temperature rose to 105° F. and one piroplasm was found in a smear.

Day of Reaction.	Temperature.		Number of Piroplasms.		Condition of Blood.	Condition of Urine.	General Remarks.
	A.M.	P.M.	A.M.	P.M.			
1st	105.1	106.6	Very few	Few	—	No alterations	—
2nd	104.2	105	None	None	—		—
3rd	104	103.4	—		—		—
4th	103.4	104.6	—		—		—
5th	104.2	105	—		—		—
6th	104	103.2	—		—		—
7th	102.4	103.6	—		—		—
8th	102.2	103	—		—		—
9th	103.6	103	—		—		—
10th	103	103	Few	Few	—		B. mainly
11th	102.6	103	Same		—		Same
12th	103	103	Same		—		R. mainly
13th	103.4	103	Same		—		R. mainly
14th	103	104.6	Very few	Very few	—		R. and B.
15th	103	105	None	None	—		—
16th	102.2	—	None	None	A few basophiles and punctate degeneration		—

¹ Trypanblue injected subcutaneously.

HEIFER 24 T.

The reaction began on the morning of the fifth day, when the temperature rose to 103° F., but no piroplasms were found in the blood cells.

<i>Day of Reaction.</i>	<i>Temperature.</i>		<i>Number of Piroplasms.</i>		<i>Condition of Blood.</i>	<i>Condition of Urine.</i>	<i>General Remarks.</i>
	A M	P M.	A M	P M			
1st	103°8	104°4	None		No alterations	No alterations	—
2nd	102°1	102°6	—				—
3rd	103	102°6	—				—
4th	101°4	102	—				—
5th	101°2	104	—				—
6th	103	102°2	—				—
7th	102°2	102°4	—				—
8th	102	102°6	—				—
9th	102°2	102°2	—				—
10th	102	102°2	—				—
11th	101°2	101°8	—				—
12th	101°2	101°6	A few	A few			Mainly B.
13th	101°2	101°8	Same				Same
14th	101	102	Same				B. and R.
15th	101°6	102	Very few	None			—
16th	102	—	A few	—			R. and B.

¹ Trypanblue injected subcutaneously.

HEIFER 25 T.

The reaction began on the evening of the fifth day, when the temperature rose to 103° F., but no piroplasms were found until the sixth day. This animal was not treated.

<i>Day of Reaction.</i>	<i>Temperature.</i>		<i>Number of Piroplasms.</i>		<i>Condition of Blood.</i>	<i>Condition of Urine.</i>	<i>General Remarks.</i>
	A M	P.M	A M	P M			
1st	101°4	103°8	None	None	No alterations	No alterations	—
2nd	103°2	104	A few	Very few			R. mainly.
3rd	101°8	101°2	A few	A few			R. and B.
4th	101°8	101°2	Very few	Very few			R. mainly.
5th	101°8	101°4	Same				—
6th	102	101°2	Same				B. mainly.
7th	102	102	Same				Same.
8th	101°8	102	A few	A few			—
9th	102	102	Very few	None			R. mainly.
10th	101°4	102	A few	A few			R. mainly.
11th	101°8	102	Same				B. mainly.
12th	101°8	102	Same				Same.
13th	101°6	102	None	A few			R. and B.
14th	102	102	A few	Very few			R. and B.
15th	101	101°4	None	None			—
16th	101°2	—	None	None			—
17th	Left for shipment						—

HEIFER 26 T.

The reaction began on the morning of the eighth day, but no piroplasms were found in the red cells. The temperature on the fifth day rose to 105° F.

Day of Reaction.	Temperature.		Number of Piroplasms.		Condition of Blood.	Condition of Urine.	General Remarks.
	A.M.	P.M.	A.M.	P.M.			
1st	105	105	None		No alterations	No alterations	—
2nd	102·6 ¹	102	—				—
3rd	102·2	102	—				—
4th	101·2	101·8	—				—
5th	101·2	101·2	—				—
6th	101	101	—				—
7th	101·4	102·2	—				—
8th	102	102·2	Very few	None			Mainly B.
9th	101·6	101·8	None				—
10th	101	101·6	—				—
11th	102	102	—				—
12th	102	102	None	Very few			Mainly B.
13th	101·4	101·6	None				—
14th	102	102	Very few	None			—
15th	101·2	102·2	None				—
16th	101·4	—	None				—
17th	Went for shipment						—

¹ Trypanblue injected subcutaneously.

The number of animals employed in the above series is, of course, very small.

Duration of Temperature Reaction.

	<i>Ten Days and Under.</i>	<i>Ten to Fifteen Days.</i>
Treated (3)	Nos. 26 ⁽²⁾ ₍₁₎ and 24 (6 days)	No. 23 ⁽¹⁾ _(15 days) .
Untreated (2)	Nos. 25 ⁽²⁾ ₍₂₎ and 22 (8 days)	—

Duration of Redwater.—None of the three treated developed redwater. One of the two untreated passed redwater for four days.

Duration of Piroplasms in the Peripheral Blood Stream.—Piroplasms did not appear at the usual time after inoculation in two of the treated animals, but a few were present in the third. In No. 24 they appeared, or one might almost say reappeared, on the twelfth, thirteenth, fourteenth, and fifteenth days of reaction. In No. 26 they appeared on the eighth, twelfth, and fourteenth days of reaction. In No. 23 they appeared on the first day of reaction, disappeared, and reappeared on the tenth, eleventh, twelfth, thirteenth, and fourteenth

days. In one of the untreated (No. 22) the piroplasms disappeared on the fourth day of the reaction, and reappeared on the eleventh day. In the other they persisted until the fifteenth day.

Presence of Blood Changes.—These were present in one of the three treated and in one of the two untreated.

The observations in Series III. furnish further evidence that the action of the drug is to confine the piroplasms for a time to the internal organs. It certainly does not appear to clear them completely out of the system, since they reappeared after an interval, as in the case of some of the untreated. Had the piroplasms not reappeared after treatment it was intended to test the virulence of the blood on another animal. I think there can be no reason to doubt, however, that the blood of an animal treated with trypanblue retains its virulence and can infect ticks, but on this point I hope at a future date to furnish further information.

The Actual Problem in Practice.—The demand in infected colonies is not so much for a remedy as for a preventive. The cattle in most cases wander over very extensive pastures, and might be very ill before they were observed, or they might never be noticed. Remedial measures can only be applied in the case of animals on a home farm or under cover, but, of course, there are many such both at home and abroad which run on infected pastures. Still, the fact remains that the necessity for treatment is seldom apparent until red water is being passed, that is to say, after the animal has been more or less severely damaged, and it is a question whether prevention of an acute attack by salting is not the preferable method of dealing with redwater, except in those cases in which eradication of infected ticks from the pastures seems a practicable proposition. It is possible, however, that trypanblue may help to make the process of immunisation more regularly mild.

I think the experiments described in this article support the conclusion of Nuttall and Hadwen that trypanblue has a marked effect on the bovine piroplasm—at least, I think, on those in the blood stream.

I do not think, however, that the advantages and disadvantages of the drug can ever be properly assessed by experiments carried out in the laboratory, but that these points must be decided by practitioners after extensive trials in the field.

EDITORIAL ARTICLE.

MILK-BORNE SCARLET FEVER.

THE report by Dr W. H. Hamer and Dr T. Henry Jones which is published at a later part of this number raises (p. 363) once more a question which the majority of people had thought to be settled,