

Eperythrozoon parvum, a Filterable Blood Parasite of Swine

INFORMATION relative to the filterability of species of the genus *Eperythrozoon* apparently has not been published previously¹. These blood parasites are classified¹ in the order Rickettsiales, a group which includes numerous filterable agents. It is apparent that passage or retention of *Eperythrozoon* by the usual bacteriological filters would not serve as any criterion for altering their present classification.

Foote *et al.*² reported that the parasites of swine, *Eperythrozoon suis* Splitter and *Eperythrozoon parvum* Splitter, were both filterable through 12-lb. Mandler and possibly finer filters. This observation was made in connexion with studies on a condition of swine termed by these workers "virus anemia". However, the infectious nature of eperythrozoa was not recognized and these parasites were referred to as "artefacts" or "reactionary bodies".

A study was made of the filterability of *E. suis* and *E. parvum* in swine blood serum. Details of the filtration procedures are given in a report of this work³. At negative pressures not exceeding 100 mm. of mercury, *E. parvum* was found capable of traversing the 8-, 12- and 14-lb. Mandler candles. Passage was also effected through the medium (*N*) and fine (*W*) Berkefeld candles, and the Seitz *EK*. The parasite was also recovered on double filtration through two 8-lb. Mandler candles in one instance, and two 12-lb. Mandlers in another. Complete retention was obtained on double filtration with the Seitz *EK*. These filters

completely retained *Serratia marcescens* in saline (300 million bacteria per c.c.) adjusted to the approximate pH of swine serum (pH 7.4).

In one instance *E. suis* passed the *N*-Berkefeld, but was retained by the Seitz *EK*. In another experiment, passage was effected through the 8-lb. Mandler, but not the 14-lb. Mandler, the *W*-Berkefeld, or the Seitz *EK*. In an additional trial, the parasite traversed the 8- and 14-lb. Mandlers, but was retained by the *W*-Berkefeld and the Seitz *EK*. *E. suis* was not recovered in nine other filtration experiments from serum or serum filtrates of known carriers or acute experimental cases.

E. parvum was repeatedly separated from *E. suis* and established in a pure, uncomplicated infection by filtering the serum portion of blood known to contain both species. In several experiments involving microscopically negative carriers, eperythrozoa were recovered from the cellular portion of blood only; the unfiltered serum was not infectious. This is regarded as additional evidence of the infectious nature of the *Eperythrozoon* structure, since these blood forms possess a distinct affinity for the erythrocyte.

As a result of these studies, additional information has been compiled relative to the differentiation of *E. suis* from *E. parvum*. This is summarized in the accompanying table.

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DIFFERENTIATION OF *Eperythrozoon suis* AND *Eperythrozoon parvum*

	<i>E. suis</i>	<i>E. parvum</i>
Morphology	Large rings (0.8-1.0 μ) with much chromatin. Discoid forms and very large irregular rings (2-3 μ) may be present	Small rings (0.5-0.8 μ) with numerous coccus forms of considerably smaller size. Often found in large numbers on single erythrocytes when organisms are rare in blood
Pathogenicity	Consistently pathogenic in heavy infections in splenectomized or non-splenectomized pigs. Etiological agent of acute eperythrozoonosis of swine in the field	Relatively non-pathogenic. May produce mild to severe anaemia in some experimental cases. Not known to produce acute eperythrozoonosis in the field
Prepatent period	6.1 days (average of 43 initial attacks)	13.1 days (average of 21 initial attacks)
Patent rise of infection	3.3 days (average of 43 initial attacks)	7.0 days (average of 21 initial attacks)
Incubation period	9.7 days (average of 43 experimental cases)	26.6 days (average of 3 experimental cases)
Susceptibility to Neosarsphenamine	Highly susceptible to doses of 15 mgm./kgm. or greater	Relatively resistant. Doses of 40-45 mgm./kgm. are effective irregularly
Cross immunity	Pigs pre-mune with <i>E. suis</i> are readily infected with <i>E. parvum</i>	Pigs pre-mune with <i>E. parvum</i> are readily susceptible to acute and fatal infection with <i>E. suis</i>
Interference	<i>E. suis</i> displaces <i>E. parvum</i> when infection is superimposed	<i>E. parvum</i> is suppressed in initial mixed infections with <i>E. suis</i>
Filterability	Usually retained by the fine diatomaceous earth filters and the Seitz <i>EK</i> at negative pressures of 100 mm. mercury	Readily passes the fine diatomaceous earth filters and the Seitz <i>EK</i> . Uncomplicated strain may be established by filtration of serum containing the two species

¹ Breed, R. S., Murray, E. G. D., Hitchens, A. P., and the Society of American Bacteriologists, "Bergey's Manual of Determinative Bacteriology", 1111 (Williams and Wilkins Co., 6th edit., 1948).

² Foote, L. E., Brock, W. E., and Gallaher, B., *North Amer. Vet.*, **32**, 17 (1951).

³ Splitter, E. J., *Amer. J. Vet. Res.*, **13**, 290 (1952).

Reversal of the Heart-beat in Tunicates

THE periodic reversal of the heart-beat in Tunicates has been considered by us¹ on the basis of the back-pressure theory originally propounded by Lahille². Recently, Millar³ has concluded from experiments on isolated hearts of *Ciona intestinalis* that the back-pressure theory is untenable.

Although we failed to observe reversals in isolated hearts of *Ascididella aspersa*, we stated that we saw no reason to suppose that they should not occur. We would not, however, expect them to be regular, and in fact the results quoted by Millar give periods ranging from 1½ to 18½ minutes between reversals. These reversals occurred after several hours of one-way beating, a fact which is in agreement with the back-pressure theory, and only when the heart is very abnormal does the reversal effect become apparent.

It is important to realize the scope of the back-pressure theory. As we have pointed out¹, it merely gives a reason for the stopping of the beat in a particular direction. How the opposite beat afterwards takes over is not explainable in terms of the theory, nor in fact is the mechanism by means of which successive beats one way dominate until reversal.