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Electrophoresis as an Aid in Detecting Pathological Conditions in Wild Mammals[1]

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ABSTRACT

Changes in the electrophoretic distribution of plasma proteins were noted in wild animals with a variety of parasitic and infectious diseases. This technique may be useful in screening for disease before death or sacrifice of animals.

INTRODUCTION

Alterations in the electrophoretic distributions of plasma and serum proteins have been described in various animals both in spontaneous diseases[2 3 5] and in the screening of experimental animals[1]. The alterations in normal plasma protein distribution following disease are largely nonspecific consisting of an increase in the globulin fractions and a decrease in the albumin component.

During studies of the plasma protein patterns of wild mammals of the USAEC Oak Ridge Reservation, electrophoretic patterns of some diseased mammals differed markedly from the normal distribution for the particular species. Further studies were carried out to determine the disease present, the plasma protein pattern, and the possible relationship between the two.

MATERIALS AND METHODS

Blood coagulation was prevented by EDTA, and 6-12 μl samples of plasma were analyzed for proteins using the Spinco Model R paper electrophoresis system, staining with bromphenol blue, and scan-tracing the protein fractions with a Spinco Model R Analytrol. Calculations of protein fractions and albumin-to-globulin ratios (A/G) were made from the scan-tracing of each sample.

RESULTS AND DISCUSSION

The effects of several pathological conditions upon plasma protein distribution are summarized in Table 1. With the exception of the fox with uncomplicated rabies, all of the diseased animals showed a marked depression in the A/G. This is the result of concurrent albumin decrease and variable increases in alpha$_1$, beta$_1$, and beta$_2$ globulins. In myiasis and mite infestations of rabbits and skunks, where the number of parasites was high, inflammation with serous exudate was observed and involved approximately two to twenty percent of the hosts' total body surface area. Increased vascular permeability associated with the inflammatory process may have resulted in some loss of albumin from the circulation. Inflammation was associated with the response to *Cuterebra* infestation in chip-

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munks and white-footed mice where purulent exudate and/or abscess formation was observed. The presence of pneumonia with the associated extensive tissue involvement in one rabid fox may account for the depression in A/G in this animal when compared to the one with rabies alone.

Since variations in plasma protein patterns appear to accompany many abnormal conditions, the use of this technique in experimental and wild animals is worthwhile. The small size of the blood serum sample (.006 - .012 ml) required and the relative simplicity of the procedure make it suitable for establishing basic blood parameters and detecting responses of the host to injurious agents in a wide range of pathological conditions.

Table 1. *Percent plasma protein distribution in wild mammals with and without disease.*

Species	Common name	Number animals	Disease				
			Globulins				
Albumin	α_1	α_2	β_1	β_2	γ	A/G
Oryctolague cuniculus (domestic rabbit), five animals, no disease.						
61.8±1.77*	7.2±0.21	5.8±0.25	8.8±0.60		16.4±1.31	1.640±0.122
O. cuniculus, five animals, caliphorid myiasis and acarine mange.						
53.4±0.75	7.9±0.39	6.7±0.45	8.6±0.54		23.3±0.70	1.154±0.057
Tamias striatus (eastern chipmunk), seven animals, no disease.						
23.6±1.06	9.5±1.69	18.8±2.48	8.2±0.71	15.1±3.05	10.0±2.68	0.656±0.098
T. striatus, two animals, myiasis, *Cutebra* sp.						
13.8±2.95	12.9±3.15	16.9±1.80	10.3±2.7	20.5±1.10	17.5±5.70	0.284±0.075
Peromyscus leucopus (white-footed mouse) fifteen animals, no disease.						
47.4±1.0	8.9±0.7	10.7±1.0	21.3±0.6		11.8±0.8	0.899±0.034
P. leucopus, thirteen animals, myiasis, *Cuterebra angustifrons*.**						
32.9±1.5	8.2±0.5	15.6±1.0	32.0±1.5		11.3±0.9	0.490±0.032
Sigmodon hispidus, (Cotton rat) two animals, no disease.						
43.9±0.54	22.3±1.03		13.8±0.62		19.9±0.96	0.805±0.001
S. hispidus, two animals, filariasis, *Litomosoides* sp.						
36.9±1.31	27.2±0.85		19.2±1.72		16.8±0.40	0.585±0.035
Urocyon cinereoargenteus, (gray fox), one animal, no disease.						
37.4	5.0	6.8	13.9	22.9	14.0	0.597
U. cinereoargenteus, one animal, rabies.						
37.5	13.6	7.8	28.0	6.5	6.6	0.600
U. cinereargenteus, one animal, rabies and pneumonia						
30.2	9.4	5.7	20.8	25.3	8.6	0.433
Mephatis mephitis, (striped skunk), five animals, no disease.						
38.7±0.04	16.7±0.02		13.3±0.02	17.7±0.008	13.2±0.02	0.658±0.107
M. mephitis, one animal, acarine mange.						
22.2	16.7		20.4	27.6	13.1	0.285

* Mean ± standard error of the mean.

** Data from Payne *et al.*[4]

NOTE: Pre-albumin determinations for normal chipmunks were 14.8±3.04, and for diseased chipmunks, 8.1±0.937.

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