

A STUDY OF THE SERUM PROTEIN FRACTIONS OF LOWER MONKEYS BY FREE ELECTROPHORESIS

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Details of the blood serum protein fractions of the lower monkeys given by different authors vary considerably, more especially in relation to the number of globulin fractions detected. Using paper electrophoresis, some authors [1] found 4 globulin fractions in the serum of Macacus rhesus, and others [2] found six.

In the present study the serum protein fractions of several species of monkeys were investigated by the method of free electrophoresis.

EXPERIMENTAL METHOD

Samples of the blood serum of eight healthy adult animals belonging to five species of lower monkeys—baboons (hamadryad and mandrill) and macaques (rhesus, brown, and lapunder)—were analyzed in a Tiselius–Svensson apparatus using a diethylbarbiturate buffer (pH 8.6, ionic strength 0.07). Blood was taken from the cubital vein of the fasting monkeys. Before analysis the serum was dialyzed in the cold against the buffer overnight. To obtain comparable results of electrophoresis, some samples of the sera were also tested by electrophoresis on paper in diethylbarbiturate buffer (pH 8.6), followed by staining for protein with bromphenol blue and for glycoprotein with the periodic acid–Schiff reagent.

EXPERIMENTAL RESULTS

The composition of the serum fractions in monkeys is very variable. The number of peaks obtained during electrophoresis differed even among members of the same species. The largest number of fractions (11) was found in the lapunder.

Altogether 13 fractions with different electrophoretic mobilities were found (see table).

In one animal no fewer than 2 and no more than 3 α -fractions were found. The number of β -fractions varied from 1 to 3. The fractions from the different animals corresponded fairly closely in mobility. In 6 of 8 sera studied a peak for the γ_1 -globulins was present (Fig. 1), situated nearer to the β -globulins than to the γ_2 -globulins. During electrophoresis on paper this peak often merged with the γ_2 -globulins into a single fraction (Fig. 2).

Prealbumins were absent from all the baboons, and the β -globulins were sometimes represented by a single electrophoretic fraction. On the other hand, prealbumins were found in all three species of macaques, and the β -globulins consisted of no less than 2 fractions. Individually, the macaques of the same species differed in the number and mobility of the peaks of the prealbumins, and the α - and β -globulins, partly on account of an inherited polymorphism of these proteins [5, 7, 8, 10, 12]. The results obtained thus confirmed the earlier conclusion based on the results of paper electrophoresis, that the serum proteins of the lower monkeys exhibit high variability. The greatest differences in the relative protein content were observed in the fractions of the α - and β -globulins.

Comparison of the results of electrophoretic analysis of the sera of the hamadryads Nos. 989 and 990 showed (Fig. 1) that the α_2 - and α_3 -globulin fractions were poorly differentiated on the paper. Maximal

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Electrophoretic Analysis of Blood Serum of Lower Monkeys

Fraction	Limits of mobility of peaks	Baboons			Macaques				Mean results	
		hamadryad	man-drill		rhesus	brown	lap-under		monkeys	
									mobility	content
Prealbumins										
1	8,0—8,2	—	—	0	1,1	2,2	0	0	0,6	8,1
2	7,5—7,8			0	1,5	0		3,9	0,8	7,7
Albumins	7,0—7,1	56,5	60,4	58,4	60,0	55,3	54,2	51,0	58,6	7,0
										57,0
Globulins										
α_1	5,8—6,0	1,6	2,3	0	5,3	2,5	3,0	2,7	2,2	5,9
α_2	5,4—5,6	4,0	4,4	5,7		0	0	0	4,4	5,5
α_3	5,1—5,2	0	0	0	4,1	7,5	6,8	6,0	2,8	5,1
α_3	4,9	8,6	6,9	5,8	0	0	0	0	0	4,9
Total		14,2	13,6	11,5	9,4	10,0	9,8	8,7	9,4	11,0
β_1	4,5—4,7	0	0	5,9	4,5	5,6	5,8	4,7	6,1	4,6
β_1	4,2—4,3	7,5	7,7	0	0	0	4,9	0	0	4,2
β_2	3,9—4,0	0	0	0	6,8	6,6	0	0	3,8	4,0
β_2	3,6—3,8	0	0	6,5	0	0	5,3	8,2	0	3,7
Total		7,5	7,7	12,4	11,3	12,2	16,0	12,9	9,9	11,0
γ_1	3,1—3,3	5,6	5,2	—	2,4	2,5	2,5	0	4,7	3,2
γ_2	1,6—1,8	16,2	13,1	17,7	14,3	17,8	17,5	23,5	16,0	1,7
Total		21,8	18,3	17,7	16,7	20,3	20,0	23,5	20,7	21,0

Note. Diethylbarbiturate buffer, pH 8.6; 0.07, 0°; ascending boundary; mobility of fractions in $\text{cm}^2 \cdot \text{sec}^{-1} \cdot \text{V}^{-1} \cdot 10^5$; protein content in fractions in % of total protein

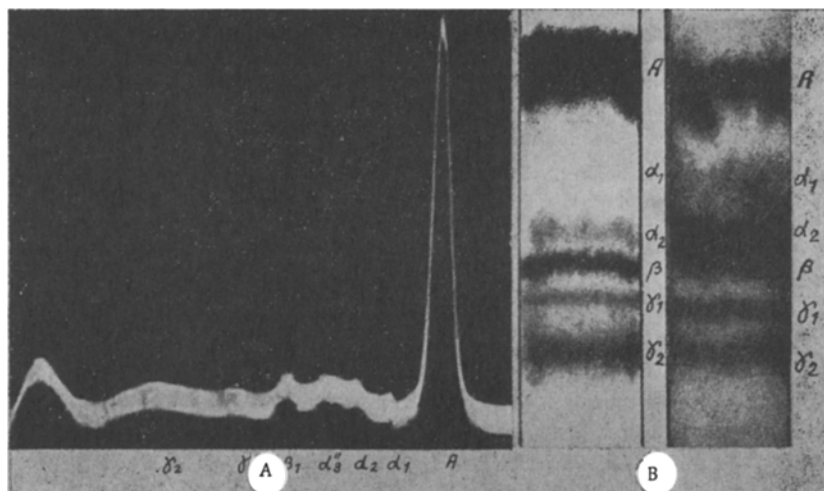


Fig. 1. Electrophoresis of blood serum proteins of hamadryad No. 989. A) free electrophoresis; B) electrophoresis on paper (on the left—staining for proteins, on the right—for glycoproteins).

intensity of staining for glycoproteins characteristically coincided with this combined fraction. Both on paper and during free electrophoresis, the β -, γ_1 -, and γ_2 -globulin fractions were clearly detected. After electrophoresis of the serum of the macaques on paper, as a rule the band staining most intensively for protein was that corresponding to the β -globulins, and for glycoproteins—the α_2 -globulin fraction. The number of fractions during parallel analyses in the Tiselius apparatus and on paper did not always agree,

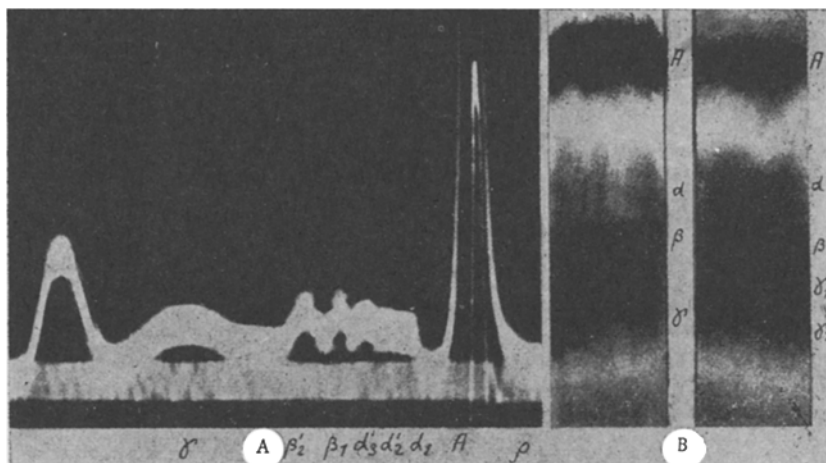


Fig. 2. Electrophoresis of the blood serum proteins of the rhesus macaque No. 6030. Legend as in Fig. 1.

mainly because of incomplete resolution of zones of closely similar mobility on the paper. Most frequently during analysis on paper the α_2 - and α_3 -globulins were not separated, less frequently the β_1 - and β_2 - or the γ_2 -globulins. Sometimes cases of superposition of the α_3 - and β_2 -globulins were found, in which case the maximum for the glycoproteins appeared to be in the β -zone (Fig. 2).

The mean values of the relative albumin content and the combined α -, β -, and γ -globulin fractions in the lower monkeys were close to the corresponding mean values in man obtained in the same conditions. The mobility of the α_2 -, β -, and γ -globulins was higher.

When these results are compared with those reported in the literature it must be remembered that the observations of Moor [11] and Greenberg [9] were made in different conditions of electrophoresis. The present results obtained with M. rhesus are in good agreement with those of Deutsch and Goodloe [6], and those obtained with the hamadryad—with the observations of Anderson and co-workers [3]. The slightly higher values obtained in the present experiments on the rhesus macaques may be attributed to the fact that the results were read at the ascending boundary and not at the descending, as in Deutsch's experiments. It should also be borne in mind that in accordance with the nomenclature adopted by the present authors (uniform for all 5 species), and fraction identified by Deutsch from its mobility as α_3 -globulin evidently fell into the category of β -globulin corresponded to β_2 -globulin in the present case.

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