— Note —

Genetic Variations in Albumin and Transferrin as Species Markers in Plasma of *Callithricidae*

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Albumin (Alb) and transferrin (Tf) polymorphism in plasma of *Callithricidae* was investigated by means of starch gel electrophoresis. In 52 blood samples of three species (*Saguinus mystax*, *S. oedipus* and *S. labiatus*), four Alb phenotypes (Alb 1, Alb 2, Alb 3 and Alb 2-3) and two Tf phenotypes (Tf 1 and Tf 2) were observed. No Alb variant was found in *S. oedipus* and *S. mystax*.

Ecological, morphological and taxonomical studies of *Callithricidae* have been reported by many authors [3, 7].

Recently, taxonomical relationships in this genus were studied by using genetic variations in blood proteins. Those genetic variations were examined by means of gel electrophoresis and immunological technique. Genetic variations in plasma proteins of non-human primates have also been observed and applied to taxonomy; for example, macaques, chimpanzee and others [4, 5, 6, 9, 11, 12, 13].

The taxonomical relationship among species (*Saguinus oedipus*, *Saguinus mystax* etc.) of *Callithricidae* has received a little study by electrophoretic and immunological techniques [1, 2]. We also have investigated, by means of electrophoresis, the taxonomical relationships among *S. mystax*, *S. oedipus* and *S. labiatus* by using the genetic variations in blood proteins as genetic markers.

This paper describes the distinctive electrophoretic patterns of plasma albumin

(Alb) and transferrin (Tf) in each species.

Fifty-two blood samples (10 of *S. mystax*, 16 of *S. oedipus* and 26 of *S. labiatus* from the Tokyo Metropolitan Institute of Medical Science) were cted from colonies at the Institute of Animal Serology, Tokyo University of Agriculture. Starchgel electrophoresis of plasma proteins (Alb, Tf) was performed according to the method of Krishnamurthy et al. (1974).

The electrophoretic patterns of Alb and Tf are shown in Fig. 1. Four phenotypes were observed in Alb (Fig. 1). In *S. oedipus*, no variant was observed. There was one phenotype, named Alb 1, consisting of the fastest-migrating band. In *S. mystax*, no variant was observed. Only one phenotype, named Alb 3, consisting of the slowest-migrating band, was observed. In *S. labiatus*, three phenotypes were observed and named Alb 2, Alb 3 and Alb 2-3. The most common phenotype was Alb 2-3 which consisted of two bands, Alb 2 and Alb 3. The rarest phenotype was Alb 2 which consisted of

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Fig. 1. Starchgel electrophoretic patterns of albumin and transferrin in the sera of the three species of *Saguinus*

Table 1. Distribuion of plasma albumin (Alb) phenotypes in the three species of *Saguinus*

Species	No. of samples	Alb phenotype			
		Alb 1	Alb 2	Alb 2-3	Alb 3
<i>Saguinus mystax</i>	10	0	0	0	10
<i>Saguinus oedipus</i>	16	16	0	0	0
<i>Saguinus labiatus</i>	26	0	7	11	8
Total	52	16	7	11	18

Table 2. Observed and expected values of albumin (Alb) phenotypes of *Saguinus labiatus*

Species	Alb phenotype			D. F.	χ^2	P
	Alb 2	Alb 2-3	Alb 3			
<i>Saguinus labiatus</i>	7 (6.01)	11 (12.98)	8 (7.01)	2.058	0.623	P > 0.05

Figures in parentheses are expected values.

Table 3. Distribution of plasma transferrin (Tf) phenotypes in the three species of *Saguinus*

Species	No. of samples	Tf Phenotype	
		Tf 1	Tf 2
<i>Saguinus mystax</i>	10	0	10
<i>Saguinus oedipus</i>	16	16	0
<i>Saguinus labiatus</i>	26	0	26
Total	52	16	36

one band intermediate between Alb 1 and Alb 3. The third phenotype was Alb 3 which was the same as the one in *S. mystax*. The number of Alb variants found in the present work was highest in *S. labiatus* (Table 1). Genotypes and gene frequencies were estimated by the direct counting method and the assumption of Hardy-Weinberg equilibrium decided by means of Nass's (1959) χ^2 test for small samples. The results agree with the hypothesis that Alb polymorphism is controlled by two codominant genes, *Alb²* and *Alb³* ($p > 0.05$) (Table 2). Therefore, this Alb variation will be useful for the study of population genetics.

Two Tf phenotypes were observed in this investigation (Fig. 1), but no variant was found. In *S. oedipus*, however there was one phenotype, named Tf 1, consisting of a fast-migrating band. In the other two species, a phenotype which consisted of the slow-migrating band was observed and named Tf 2 (Table 3). Electrophoretic patterns of Alb and Tf show that *S. mystax* is taxonomically similar to *S. labiatus* and that both are distinct from *S. oedipus*.

Cronin and Sarich (1978) postulated that *S. mystax* is appreciably distant from *S. oedipus* in evolutionary units.

However the taxonomical relationship between *S. labiatus* and *S. mystax* or *S. oedipus* remains unknown.

Hershkovitz (1977) reported that genus *Saguinus* is divided into six groups (*S. nigricollis*, *S. mystax*, *S. bicolor*, *S. midas*, *S. inustus* and *S. oedipus*) in three sections (Hairly, Mottle and Bare-face tamarin) from the morphological point of view.

We postulate that *S. mystax* and *S.*

labiatus have a very similar evolutionary unit of relatively recent origin and support the concept that *S. labiatus* and *S. mystax* belong to the *S. mystax* group which was postulated from a morphological point of view by Hershkovitz (1977).

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References

- [1] Cronin, J. E., and Sarich V. M. (1975). *J. hum. Evol.*, **4**, 357-375.
- [2] Cronin, J. E., and Sarich V. M. (1978). *Prim. Med.*, **10**, 12-16.
- [3] Hershkovitz, P. (1977). *The Living New World Monkeys*. The University of Chicago press, Chicago.
- [4] Ishimoto, G. (1972a). *J. Anthrop. Soc. Nippon*, **80**, 250-274.
- [5] Ishimoto, G. (1972b). *J. Anthrop. Soc. Nippon*, **80**, 337-350.
- [6] Ishimoto, G. (1973). *J. Anthrop. Soc. Nippon*, **81**, 1-13.
- [7] Kleiman, D. G. (1977). *The Biology and Conservation of the Callithricidae*. Smithsonian Institution Press, Washington.
- [8] Krishnamurthy, U. S., Bhuvanakumar, C. K., and Rathnasabapathy, U. (1974). *Anim. Blood Grps. Biochem. Genet.*, **5**, 125-127.
- [9] Moor-Jankowski, J., and Socha, W. W. (1980). *Development.*, **45**, 35-45.
- [10] Nass, C. A. G. (1959). *Biometrika*, **46**, 365-386.
- [11] Nozawa, K., Shotake, T., Ohkura, Y., and Tanabe, Y. (1977). *Japan J. Genet.*, **52**, 12-30.
- [12] Shotake, T. (1979). Serum albumin and erythrocyte adenosine deaminase polymorphisms in Asian macaques with special reference to relationships among *Macaca assamensis*, *M. radiata* and *M. mulatta*.
- [13] Socha, W. W., and Moor-Jankowski, J. (1980). *Folia Primatol.*, **33**, 172-188.

Callithricidae における種の標識としての血漿アルブミン およびトランスフェリンの遺伝的変異

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デンプンゲル電気泳動法を用いて、*Callithricidae* における血漿アルブミンおよびトランスフェリンの多型現象の有無について調査した。調査した個体は、*S. mystax*, *S. oedipus* および *S. labiatus* の3種計52例であり、アルブミンにおいては Alb 1, Alb 2, Alb 3 およ

び Alb 2-3 型の4つの表現型そしてトランスフェリンにおいては Tf 1 および Tf 2 型の2つの表現型を確認した。また、アルブミンにおいては *S. oedipus* および *S. mystax* は、変異型が確認されなかった。