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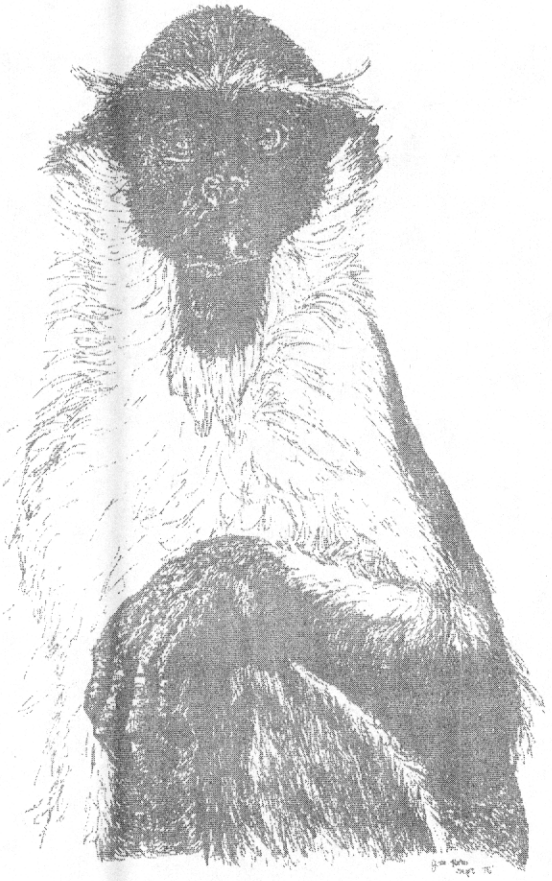

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POLICY STATEMENT

The purpose of the *Laboratory Primate Newsletter* is (1) to provide information on care, breeding, and procurement of nonhuman primates for laboratory research, (2) to disseminate general information about the world of primate research (such as announcements of meetings, research projects, nomenclature changes), (3) to help meet the special research needs of individual investigators by publishing requests for research material or for information related to specific research problems, and (4) to serve the cause of conservation of nonhuman primates by publishing information on that topic. As a rule, the only research articles or summaries that will be accepted for the *Newsletter* are those that have some practical implications or that provide general information likely to be of interest to investigators in a variety of areas of primate research. However, special consideration will be given to articles containing data on primates not conveniently publishable elsewhere. General descriptions of current research projects on primates will also be welcome.

The *Newsletter* appears quarterly and is intended primarily for persons doing research with nonhuman primates. New issues are mailed free of charge in the United States. Persons outside of the U. S. A. are requested to pay $1.50 per year to cover the additional cost of mailing. Back issues may be purchased for $1.00 each. (Please make checks payable to Brown University.)

The publication lag is typically no longer than the 3 months between issues and can be as short as a few weeks. The deadline for inclusion of a note or article in any given issue of the *Newsletter* has in practice been somewhat flexible, but is technically the fifteenth of December, March, June, or September, depending on which issue is scheduled to appear next. Reprints will not be supplied under any circumstances.

PREPARATION OF ARTICLES FOR THE *NEWSLETTER*. Articles and notes should be submitted in duplicate and all copy should be double spaced. Articles in the References section should be referred to in the text by author(s) and date of publications, as for example: Smith (1960) or (Smith & Jones, 1962). Names of journals should be spelled out completely in the References section. Technical names of monkeys should be indicated at least once in each note and article. In general, to avoid inconsistencies within the *Newsletter* the scientific names used will be those of Napier and Napier [*A Handbook of Living Primates*. New York: Academic Press, 1967].

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Ministerio de Agricultura, Lima, Peru

Until their recent embargos, Peru and Colombia were the principal South American exporters of primates to the United States (Thorington, 1972), and such Peruvian species as *Saimiri sciurius, Aotus trivirgatus, Saguinus fuscicollis, S. mystax, Cebus* spp., and *Ateles* spp. have been important in biomedical research (Thorington, 1971). Concern for the conservation of these animals and the continuance of research led to contracts from the United States Government to the National Academy of Sciences, whose Committee on Primate Conservation (of the Institute of Laboratory Animal Resources) subcontracted a project through the Pan American Health Organization (PAHO), which administered censuses in both Colombia and Peru. Neville and Freese were the successive PAHO field directors in Peru from December, 1972 to December, 1974, with Freese conducting most of the field expeditions. R. Castro cooperated during the PAHO phase of the project and is the Peruvian scientist directing its continuation under national administration. The project in Peru has not only been concerned with obtaining census data on the various primate

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Paper presented at the 44th Annual Meeting of the American Association of Physical Anthropologists, Denver, Colorado, April 9-12, 1975.

We wish to thank the many Peruvian and PAHO officials and friends who aided our project. Our special thanks to Marge Freese, Andrés Mármol, Marleini Ramirez, and Juan Revilla for participation in the collection of data, and to Pekka Soini and Warren Kinzey and his team for further advice and data. The project was carried out with the cooperation of the Peruvian Ministry of Health with support provided by the National Academy of Sciences through Contracts PH 43-64-44 (T.O.12) with the National Institutes of Health and DADA 17-71-C-1117 with the U.S. Army Medical Research and Development Command under terms of the sub-contract BA 22/23-72-30 with the Pan American Health Organization.

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species, evaluating factors which influence population levels, and making recommendations concerning management and conservation, but also with establishing the groundwork for continuing investigation into basic ecological and behavioral problems in the Peruvian forests. We were based at Iquitos because of its prominence in the exportation of monkeys.

The census technique which produced most of our data is the "transect census", a modification by Freese (1975) of the strip-census technique used by Southwick & Cadigan (1972) in West Malaysia. During the transect census the observers progress slowly through the forest either single file on foot (usually along a trail) or by canoe. The area censused is calculated by the following formula: Area = (Linear Distance Travelled) × ("Auditory/Visual Field"). The last term represents the estimated average distance from both sides of the path in which the observer is able to detect a species either auditorally or visually. See Southwick & Cadigan (1972), Freese (1975), and Neville *et al.* (in press) for a discussion of the technique. "Auditory" does not refer to the specialized spacing vocalizations of *Alouatta* or *Callicebus* but rather to the intragroup social vocalizations and noises from movement that can reveal a species. The estimated auditory/visual fields for the species range from 40 m for *Callicebus* and *Alouatta* to 100 m for *Saimiri* (i.e., *Saimiri* on the average can be detected when within 50 m of the observer's path; (Freese, 1975). *Cebuella* and *Aotus* present special problems, and are dealt with separately from the census data.

We also recorded sightings of monkeys during the progress of the project's 10-meter boat along waterways. Repeats of these motorboat censuses produced highly variable data; these censuses were chiefly useful in indicating seasonal riverside floral changes, related changes in exploitation by monkeys, and the amount of hunting. Data from motorboat censuses are not used in the density calculations.

A third method has been to establish a field station (Camp Callicebus) about 35 air-kilometers--three hours by a combination of speedboat and trail--from Iquitos. This station is permitting us to gradually obtain more precise data on ecological relationships and population levels and provides a site for intensive studies on special aspects of behavior and ecology. Examples of such study have been the work by Kinzey (Note 1, Note 2) on *Callicebus torquatus* and Ramirez *et al.* (Note 3) on *Cebuella*.

A system of trails was also established in Maldonado Peninsula--a forest surrounded by an ox-bow lake in the Samiria River Basin--to permit repeat censuses in a relatively undisturbed area, though logistics have not permitted the establishment of a field station there.

A summary of our findings in the areas that we censused follows (Figure 1 & Table 1).

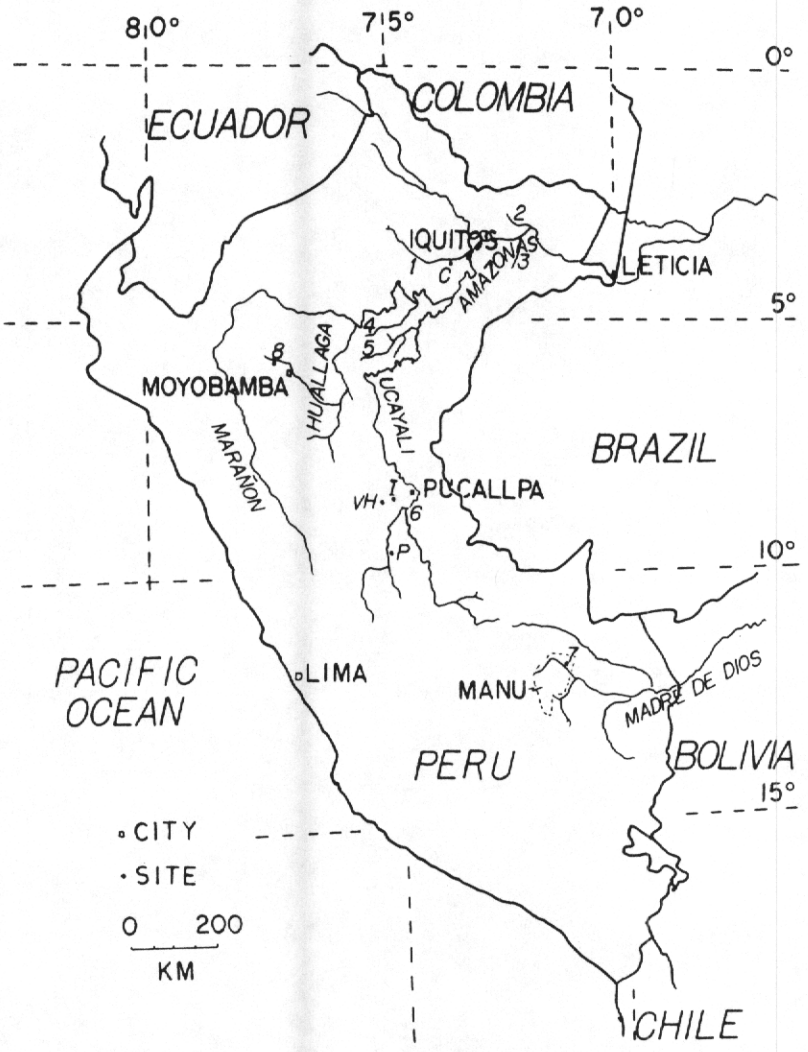

Figure 1. Surveyed localities covered in the text. (1) Nanay River and Iquitos. *C* is the location of the project's Camp Callicebus. (2) Ampiyacu River Basin. (3) Orosa River Basin. (4) Samiria River Basin. (5) Pacaya River Basin. (6) Pucallpa area. *P* indicates the field station Panguana on a tributary of the Pachitea, *I* indicates the IVITA field station near the Lima-Pucallpa road, and *VH* indicates von Humboldt National Forest. (7) Cocha Cashu Biological Station, in Manú National Park. (8) Mayo River site in the Moyobamba area.

Nanay River/Iquitos (Area 1). Work was conducted in various localities along the river and close to Iquitos. The sub-areas around Iquitos are the most heavily utilized by humans of any we investigated, and apart

Table 1. Monkey density estimates from C. Freese's transect censuses.

Taxon	Estimated average group size	Density estimates at locations (monkeys/sq km) Nanay-Iquitos	Ampiyacu	Orosa	Samiria	Pucallpa	Cocha Cashu Manú N.P.
Small monkeys: adult generally under 1 kg.							
Saimiri sciureus	40	15.6(3)	s.	36.0(2)	72.0(9)	16.0(5)	84.0(6)
Saguinus fuscicollis	6	16.0(14)	n.s.	9.0(2)	15.0(6)	8.4(5)	10.8(3)
nigricollis	6	n.s.	19.2(5)[a]	n.s.	n.s.	n.s.	n.s.
imperator	3	n.s.	n.s.	n.s.	n.s.	n.s.	5.4(3)
Callicebus moloch	3	9.6(12)[a]	n.s.	13.5(4)	n.s.	2.7(2)	2.1(1)
torquatus	3.5	0.7(1)	13.3(4)[b]	n.s.	n.s.	n.s.	n.s.
Medium-sized monkeys: adult 1-3.5 kg.							
Pithecia monachus	5	8.5(7)	n.s.	4.5(1)	9.0(4)	2.5(1)	n.s.
Cebus albifrons	10	2.0(1)	n.s.	n.s.	2.0(1)[b]	4.0(4)[b]	24.0(4)
apella	10	2.0(1)	6.0(1)[c]	17.0(3)	24.0(9)	n.s.	36.0(8)
Large monkeys: adult generally 3.5-7.5 kg. or more.							
Alouatta seniculus	5	n.s.	n.s.	n.s.	29.5(9)	s.	24.0(6)
Lagothrix lagotricha	10	n.s.	n.s.	n.s.	7.0(2)	n.s.	n.s.
Ateles paniscus	7	n.s.	n.s.	n.s.	n.s.	n.s.	22.4(9)
All species	--	54.4(39)[d]	38.5(10)	80.0(12)	158.5(40)	33.6(17)	208.7(40)[e]

Note. Assembled from Freese, 1975, Tables 2, 3, & 5. The number of groups seen during transect censuses only is given in parenthesis; this gives an idea of the sample base. n.s.= not seen during transect censusing; s.= seen in field, but not during transect censusing. Weight ranges are crude and are related to descriptions in Napier & Napier (1967). Density calculations are based on the number of groups seen multiplied by the presumed average group size divided by the area swept by the transect. From the number of groups seen, the estimated average group size, and the density, one can work back to the area covered in transect work at each location.

[a] Includes two questionably identified groups.

[b] Includes one questionably identified group.

[c] Identification of genus and species probable but not positive.

[d] Does not include three unidentified groups.

[e] Does not inlcude one unidentified group.

from possible isolated groups and individuals, only the small monkeys, *Saimiri* and *Saguinus fuscicollis*, can be found commonly near Iquitos. The Nanay itself is a black-water river and most of the forest along it is inundated annually. As with other Amazon tributaries, forest alteration for lumbering and farming and hunting pressure from resident human populations drops off as one progresses upstream. The most frequently seen species during our expeditions along the river were *Saimiri*, *Saguinus fuscicollis* and *Callicebus moloch* (Freese, 1975, Table 2; N. Castro, Note 4).

The field station, Camp Callicebus, is situated in low rolling hills, an hour's walk from the river and is not seasonally inundated. It has been relatively free of hunting pressure since its foundation in August, 1973. Most frequently seen were *Callicebus moloch*, *C. torquatus*, *Saguinus fuscicollis*, and *Saimiri*. Overall, for Area 1, Freese's transect and motorboat censuses indicate the highest densities for *Saguinus fuscicollis* and *Saimiri*.

Ampiyacu River Basis (Area 2). The Ampiyacu is a left-bank tributary opening into the Amazon about 170 km downstream from Iquitos and appears intermediate between a black-water and white-water river. Most of the inundatable forests and human population occur along the lower part of the river. The most frequently seen species were *Saguinus nigricollis* and *Callicebus torquatus*.

Orosa River Basin (Area 3). The Orosa is a right-bank tributary emptying into the Amazon about 120 km downstream from Iquitos. The Orosa is similar generally to the nearby Ampiyacu, but has more inundatable forest near the headwaters. The most frequently seen species included *Saguinus fuscicollis*, *Saimiri*, *Callicebus moloch*, and *Cebus apella*.

Samiria River Basin (Area 4). The Samiria is a black-water tributary of the lower Marañón River and, together with the Pacaya River, drains the area between the Marañón/Huallaga Rivers and the Ucayali River. The Samiria and Pacaya are under the protection of a government fishing agency (Empresa Publica de Servicios Pesqueros), which has considerably reduced human settlements and hunting pressure; however, both were occupied by various companies engaged in the search for petroleum reserves. The river basins are almost totally inundated seasonally, the Pacaya reportedly more extensively than the Samiria. Four expeditions were made to the Samiria. The most abundant monkeys appear to be *Saimiri*, *Alouatta seniculus*, *Cebus apella*, and *Saguinus fuscicollis*, though *Pithecia monachus* and *Lagothrix lagotricha* were locally abundant (Freese, 1975, Tables 2 & 3; Neville *et al.*, in press, Tables 4 & 6). At transect localities Freese estimated an average total of 159 monkeys/sq km, with a density of 260/sq km for the special work area of Maldonado Peninsula (Freese, 1975, Table 3). Freese's estimates for Maldonado Peninsula are roughly equivalent to independent calculations by Neville (Note 5, Table 3).

Pacaya River Basin (Area 5). The Pacaya, mentioned above, is a

black-water tributary of the lower Ucayali. Most commonly seen species were *Saimiri*, *Alouatta*, and *Pithecia*, and densities are probably broadly similar to those on the Samiria (Neville *et al.*, in press).

Pucallpa (Area 6). Censuses were performed in and near two biological field stations (Panguana on the Llullapichis River, an affluent of the Pachitea; and a station of the Instituto Veterinario de Investigaciones Tropicales y de Altura, near the Lima-Pucallpa road) and in von Humboldt National Forest. *Saimiri* had the highest density and *Saguinus fuscicollis* the next highest, but overall density was lower in any of the previous areas. Interestingly, *C. apella* is absent, but *C. albifrons* somewhat common, over a large area east of the Pachitea, including Panguana (Freese, 1975).

Cocha Cashu Biological Station in Manú National Park, Madre de Diós Department (Area 7). Manú is a 14,000 sq km park protected by inaccessibility both before and after its establishment in 1969. The Cocha Cashu trail system encloses ca. 1.2 sq km and is on the northeast bank of the white-water Manú River. This was the most productive census area other than the site of Maldonado Peninsula on the Samiria. The primate abundance at Cocha Cashu seems to be indicative of the general faunal richness of Manú, though individual species vary locally. Freese's estimate for *Saimiri* exceeds *total* monkey densities in all other areas except the Samiria River. *Cebus apella, C. Albifrons, Alouatta,* and *Ateles paniscus* all are estimated over 20/sq km. *Saguinus imperator,* of special interest because of its small geographical range, was found at low numbers in the park.

Moyobamba (Area 8). Freese conducted a brief search in forest on the Mayo River at approximately 1000 m elevation in northern San Martín Department. The upper Mayo area is the first definite locality for *Lagothrix flavicauda* (Fooden, 1963), but no monkeys of any species were observed in the wild, and questioning of locals strongly indicated that *L. flavicauda* is, at best, extremely rare in the region.

Over 250,000 *Saimiri* and over 16,000 for each of the three genera *Cebus, Saguinus,* and *Lagothrix* were reported exported from Amazonian Peru during the period January, 1962 to April, 1971 (Soini, 1972, Table 1). The Peruvian government placed a moratorium on primate commerce in October, 1973 (Supreme Decree 934-73-AG) to allow time for consideration of the best means for management and conservation of these and many other forest species; since January, 1974 export has been essentially nill. Even before the moratorium, however, consumption of monkeys as food in Iquitos alone was probably a more significant factor than export for *Lagothrix, Alouatta, Ateles,* and *Pithecia* (Castro *et al.*, in press; Neville, Note 6).

Overall, the most important factor affecting Peruvian primates is hunting for food. This can be seen from both density figures and composition in the Samiria, Pacaya, and Manú, where hunting is greatly re-

duced. Habitat destruction is probably critical only in parts of the Andean montane and foothill forests, and in inundatable riverside forests.

The large monkeys, *Ateles*, *Lagothrix*, and *Alouatta* in that order, are the first to disappear from a region because of hunting (see Table 1). The situation of the first two genera is critical over probably most of their range. The recently rediscovered *Lagothrix flavicauda* (by Tony Luscombe, Hernando de Macedo, and Russell Mittermeier, as reported in *La Prensa*, Supplement, 19 May 1974) is probably restricted to a small area which is now being colonized, and its survival should be regarded as precarious until proven otherwise. Intermediate-sized primates such as *Callicebus* spp. and *Pithecia* become prime targets once the bigger monkeys have disappeared, but their size and effective evasive behavior often serve to maintain populations in moderately hunted areas. The two *Cebus* species and *Saimiri* appear more susceptible; however, even a greatly reduced *Saimiri* population is usually abundant relative to other species. It appears that *Saguinus fuscicollis* and *S. nigricollis* can maintain near-natural numbers in areas of heavy hunting and forest degradation. They themselves are rarely hunted heavily. We cannot yet judge *S. mystax* and *S. imperator* tolerance of human disturbance, although Castro and Soini (Note 7) recently found a high density of *S. mystax* in an area near Iquitos.

Nocturnal *Aotus* and the diminutive *Cebuella pygmaea* are very difficult to see in the wild. Locals reported that *Aotus* were present and usually common in all areas surveyed. From reports and observations of *Cebuella*, as well as sighting of their marks on trees from which they eat exudate, they apparently occur along most of the Amazon's tributaries in Peru, but density data are unavailable. A guide's report and a communication from Charles Janson to Freese placed *Cebuella* at Moyobamba and Manú respectively, far to the west and south of its previously known range (Freese, 1975). We have almost no information on *Cacajao calvus rubicundus;* they were reported to occur along the Orosa. *Cebuella* and *Cacajao* have been protected since 1970 (Soini, 1972). The enigmatic *Callimico goeldii* is probably present in only low numbers throughout most of its poorly known range.

Clearly, much more research on the status and population ecology of Peru's monkeys is needed. In fact, no more than preliminary data exist on the population ecology of *any* nonhuman primate species in South America. Only after data from long-term studies become available can Peru, and other South American countries, confidently establish proper management guidelines for their primate populations.

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* * *

CONFERENCE ON MARMOSETS PLANNED IN OAK RIDGE

A conference on "Marmosets in Experimental Medicine" is to be held at Oak Ridge Associated Universities, Oak Ridge, Tennessee, in March, 1977. The primary aim of the meeting will be to identify the scientific community's future need for the marmoset, a question which is particularly relevant today in view of the events of the past few years concerning supply limitations. In addition to highlighting the already well documented value of these animals in viral oncology, infectious hepatitis, and transplantation immunology, we hope the conference will reveal other uses for which the marmoset might be most appropriately and uniquely suited. The future of this species as a laboratory animal model will also necessitate discussions on the current status of conservation efforts being made here and in South American countries and an up-to-date, objective evaluation of the breeding potential of various marmoset species in a colony environment.

The organizers of the conference, Dr. N. Gengozian (Oak Ridge Associated Universities) and Dr. F. Deinhardt (Rush-Presbyterian-St. Luke's Medical Center, Chicago, IL) welcome all participants and encourage contributions by investigators for formal presentations on topics related to the utilization of the marmoset in various biomedical disciplines, the supply status and conservation of this species, and breeding in a colony environment. Thus, in addition to invited speakers on these selected topics, active participation by individuals working with marmosets is desired. The full details of the conference and program format have yet to be determined and in part will be dependent upon the response received. Those interested in participating and presenting papers should contact Dr. N. Gengozian, Medical and Health Sciences Division, Oak Ridge Associated Universities, Oak Ridge, Tennessee 37830.

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PRIMATE BLOOD GROUP REFERENCE LABORATORY AT THE WHO COLLABORATING CENTRE FOR PRIMATE HEMATOLOGY

J. Moor-Jankowski, A. S. Wiener and W. W. Socha

Laboratory for Experimental Medicine and Surgery in Primates
New York University Medical Center

The Primate Blood Group Reference Laboratory at LEMSIP was established in 1965 and since that time has tested thousands of blood specimens from apes and monkeys submitted by investigators throughout the world. The laboratory was awarded the status of World Health Organization Collaborating Centre for Primate Hematology early in 1975. A review of 10 years of activity reveals primate blood grouping to be of interest mainly for the following areas of investigation: (1) experimental surgery, gynecology, and obstetrics; (2) experimental immunology, comparative immunogenetics and experimental blood grouping; (3) heterotransplantation of primate animal organs to man and cross-circulation of patients in hepatic failure; (4) transfusion therapy in primate animal colonies; (5) determination of parentage in primate populations in their countries of origin.

During the existence of the Laboratory, blood samples of laboratory housed animals were tested for numerous investigators in the United States and most European countries. In addition, blood tests were performed on animals in the field in various regions of Africa and South America and on troops of animals maintained in open enclosures in this country and in South Africa. All the studies in this country and abroad concerned with experimental primate organ transplantation to man and with cross-circulation relied on tests performed in our laboratory or on our published techniques. Methods for freeze preservation of primate blood were developed in 1967 in collaboration with Arthur Rowe, New York Blood Center, and the frozen and thawed reconstituted red cells were shown to have normal survival time *in vivo*. These studies demonstrated that the red cells of chimpanzees, gibbons, baboons, and rhesus monkeys have only about half the life-span of human red cells. At present, tests for the blood group systems and blood factors listed in Table 1 can be carried out at the Laboratory.

It should be noted that the "naturally" occurring isoantibodies (directed against the red cells of the same species) were observed by us in numerous chimpanzees, baboons, and rhesus, bonnet and cynomolgus monkeys. Erythroblastosis fetalis similar to the disease caused in man by the Rh-factor incompatibility of parents was observed by us in chimpanzees and contributed to a stillbirth and the death of a newborn.

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Table 1. Blood Typing Tests That Can Be Carried Out at Primate Blood Group Reference Laboratory

Species	Human-type Systems	Human-type Blood Factors	Simian-type Systems	Simian-type Blood Factors
Chimpanzee (*Pan troglodytes* and *Pan paniscus*	A-B-O	A, A_1, H	V-A-B	V^c, A^c, B^c, D^c,
		Secretor type		X^c, Y^c
	M-N		C-E-F	C^c, C^c, E^c, F^c,
	Rh-Hr	Rh_o, hr'		G^c, H^c, K^c, L^c,
				N^c, O^c, P^c
Gibbon (*Hylobates* sp.)	A-B-O	A, A_1, B, H		A^g, B^g, C^g and 3 unnamed factors
		Secretor type		
	M-N			
	Rh-Hr	hr'		
Orangutans (*Pongo pygmaeus*)	A-B-O	A, A_1, B, H		
		Secretor type		
Gorilla (*Gorilla gorilla gorilla* and *G. g. beringei*)	A-B-O	B	Cross reacts selectively with chimpanzee C-E-F reagents	
		Secretor type		
	M-N			
	Rh-Hr	Rh_o, hr'		
Baboons (*Papio* sp.)	A-B-O	A-B-H		A^P, B^P, C^P, D^P,
		Secretor type		G^P, H^P, N^P, Q^P,
				Y^P, Z^P, ca, hu and 11 unnamed factors
Geladas (*Theropithecus gelada*)	A-B-O	Secretor type		3 unnamed factors
Rhesus and Cynomologus macaques (*Macaca mulatta* and *M. fascicularis*)[a]	A-B-O	Secretor type		A^{rh}, B^{rh}, C^{rh}, D^{rh},
				D_1^{rh}, D_2^{rh}, E^{rh}, F^{rh},
				G^{rh}, H^{rh}, I^{rh}, X^{rh},
				Y^{rh}, Z^{rh}, R^J, J^{rh},
				L^{rh}, M^{rh}, N^{rh} and
				5 unnamed factors
Other Old World Monkeys	Human-types			

[a]Antisera detecting all 24 factors were produced by immunization of rhesus monkeys and show polymorphism in both rhesus and cynomolgus macaques.

The isoantibodies occurring in primate animals make imperative their blood typing and cross-matching prior to transfusions, transplantation experiments, etc. Blood grouping for determination of parentage and for future selection of desirable breeding stock should be performed in all breeding colonies of primate animals.

All blood grouping tests at the WHO Collaborating Centre are performed by the same methods as used by us for the blood typing of human subjects in our clinical work and for the Office of the Chief Medical Examiner of New York City. Tests are performed by saline agglutination of unmodified or ficinated red cells, followed by the antiglobulin test using anti-primate animal globulin prepared in rabbits. Readings are all taken blindly by two independent observers. No reagents are used for typing unless they have a minimum titer of 16 units.

Scientists interested in availing themselves of the services provided by the Centre should contact: W. W. Socha, M. D., Laboratory for Experimental Medicine and Surgery in Primates (LEMSIP), P. O. Box #575, Tuxedo, New York 10987 (Phone: 914-351-2922).

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POSITIONS AVAILABLE: NEUROANATOMIST-NEUROENDOCRINOLOGIST AND NEUROCHEMIST

The University of Wisconsin Regional Primate Research Center (An Equal Employment Educational Institution--Title IX, Title VI) has two openings for full-time researchers at the level of Assistant or Associate Scientist beginning as soon as possible. One is for a Neuroanatomist-Neuroendocrinologist having expertise in neural ultrastructure and an interest in neuroendocrine phenomena, and the other is for a Neurochemist having expertise and current research interests in the chemistry of neurotransmitters and in immunochemistry.

The overall mission of the Center is to conduct basic research in the areas of neural systems, endocrine physiology, behavior, and pathology, especially as related to reproduction. Applicants interested in brain-endocrine interactions are preferred, to take advantage of major opportunities for collaboration with other Center scientists. The Ph.D. or equivalent degree is required. Salary will be commensurate with training and experience. Interested and qualified candidates should send their curriculum vitae, bibliography, and names of three references by September 1, 1976, to: Search Committee, Wisconsin Regional Primate Research Center, 1223 Capitol Court, Madison, Wisconsin 53706.

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BLOOD TRANSFUSION THERAPY FOR LEUKEMIC CHIMPANZEE

Elizabeth Muchmore and W. W. Socha

Laboratory for Experimental Medicine and Surgery in Primates
New York University Medical Center

The resources of the Primate Blood Group Reference Laboratory and the WHO Collaborating Centre for Primate Hematology at the Laboratory for Experimental Medicine and Surgery in Primates (LEMSIP) were called into play when the need arose for blood transfusion support of the first reported case of spontaneous leukemia in a chimpanzee.

In late August, 1976, Pili, a two-year-old male chimpanzee learning to communicate in American Sign Language (Ameslan), in a study by Drs. Beatrice and Allen Gardner at the University of Nevada in Reno, was diagnosed as having chronic lymphocytic leukemia. Although prognosis was guarded, there was hope of remission with chemotherapy and adequate blood transfusion support. Dr. Elizabeth Muchmore, at LEMSIP, was contacted and served as coordinator of the blood transfusion supply for Pili. Dr. Robert Silber, Professor of Medicine and Director, Division of Hematology, New York University Medical Center, accepted the responsibility for therapy and hematological follow-up of the chimpanzee.

On September 8, 1975, blood samples for Pili were flown to LEMSIP where Dr. W. W. Socha, of the Primate Blood Group Reference Laboratory, determined his human-type and simian-type blood groups. Pili was found to be human-type A, MN; simian-type V.D, CceF, G^c, H^c, K^c, L^c, N^c. Since the simian-type V.D is relatively uncommon (population studies on 113 chimpanzees revealed this blood group in only 2.6 percent of animals tested (Wiener *et al.*, 1974), the chances of finding a donor with identical V-A-B type were low. In fact, none among the 54 chimpanzees at LEMSIP available for blood transfusion were in this particular blood group. There were, however, three chimpanzees of the type V.0 (genotype *VV* or *Vv*) which can be considered compatible for a V.D recipient. These potential donors were: Ch-13 Edgar, human-type A, MN; simian-type V.0, cef, G^c, h^c, L^c, K^c, n^c; Ch-647 Gillian, human-type A, MN; simian-type V.0, cef, g^c, h^c, 1^c, K^c, n^c and Ch-336 Stu, human-type A, MN; simian-type V.0, cef, G^c, h^c, 1^c, K^c, n^c. Of these three, only two were suitable to be donors because the third had been immunized to produce antisera against chimpanzee red cells. The two potential chimpanzee donors were cross-matched with Pili and were found to be compatible. When the first call for blood came on September 11, 1975, Ch-13 Edgar was bled for 400 ml of whole blood in ACD, which was sent as two, 200 ml aliquots in plastic transfusion bags on wet ice. (The blood was drawn in 200 ml ali-

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quots because this was the amount prescribed for each transfusion by Dr. Silber.) United Airlines Special Small Package Service provided optimal predictable transport so that fresh blood[1] could be transfused in the evening of the day it was drawn. Subsequent transfusion blood was accompanied by pilot tubes so that cross-matches could be done by Western Clinical Laboratory at Reno immediately prior to transfusion to detect whether Pili had developed antibodies against the red cells of the donors.

On September 23, 1975, another 400 ml of blood from Ch-13 Edgar was sent to Reno, and on October 10, 1975, 400 ml from Ch-647 Gillian.

Since these two donors now needed a rest, Dr. Brent Swenson at Yerkes Regional Primate Research Center was contacted. The majority of chimpanzees in the Yerkes colony had previously been blood grouped by the Primate Blood Group Reference Laboratory at LEMSIP, so it was possible to select potential donors from the published lists (Wiener *et al.*, 1972b, 1974, 1975). There was only one donor readily available at Yerkes; Hep, human-type A; simian-type V.O, CceF, G^c, H^c, L^c. After he had contributed 600 ml of blood, Dr. Muchmore contacted Dr. S. S. Kalter at the Southwest Foundation for Research and Education (SFRE), San Antonio, Texas. Since none of their sizeable chimpanzee colony had been blood typed, Dr. R. Cummins from SFRE sent blood samples from 16 chimpanzees for screening. There were four potential donors among this group and Pili had received a transfusion from one of them prior to his death on October 20, 1975.

Although the attempt to save this life was unsuccessful, the fact that it was sustained for two months in the face of a rapidly progressing disease by nine transfusions demonstrated the importance of having specific and detailed blood grouping capabilities available to the primate research community for instances such as this when multiple transfusions are necessary.

If Pili had been transfused on the basis of human-type A-B-O grouping alone, almost all chimpanzees would have been considered suitable, since 85% of them are type A (Wiener & Moor-Jankowski, 1972a). On the other hand, the chances of simian blood group incompatibility would have been high, and in the course of therapy with multiple transfusions, there would have been considerable risk of developing antibodies against unmatched donors and subsequent transfusion reactions.

References

Wiener, A. S., Socha, W. W., Moor-Jankowski, J., & Gordon, E. B. Family studies on the simian-type blood groups of chimpanzees. *Journal of Medical Primatology*, 1975, *4*, 45-50.

[1]Transfusion of fresh blood is important for platelet activity; moreover, the red cells of chimpanzees have only half the life span of human red cells.

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Wiener, A. S. & Moor-Jankowski, J. Blood groups of chimpanzees. In C. Kratochvil (Ed.), *Primates in medicine*. Vol. 6. *Chimpanzee: Immunological specificities of blood*. Basel: Karger, 1972. Pp. 115-144. (a)

Wiener, A. S., Gordon, E. G., Socha, W. W., & Moor-Jankowski, J. Population genetics of chimpanzee blood groups. *American Journal of Physical Anthropology*, 1972, *37*, 301-310. (b)

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WORKSHOP ON SIMIAN VIRUSES TO BE HELD

The NIH/WHO Collaborating Center for Reference and Research in Simian Viruses will hold its Second Workshop on Diagnosis of Virus Diseases of Nonhuman Primates on January 17-19, 1977. This Workshop is intended principally for veterinarians and supervisors of nonhuman primate colonies and will be limited to 15-20 individuals. Registration fees are not required for this Workshop.

The topics to be covered in this 2-1/2 day Workshop will include: Collection and Handling of Primate Specimens, Practical Demonstrations of Specimen Collecting, Proper Packaging and Shipping of Specimens, Receipt of Specimens and Their Handling, Current Laboratory Procedures (Virus Isolations, Serology, Newer Diagnostic Procedures--Immunofluorescence, Radio Immunoassay), Necropsy (Appropriate Collection of Specimens), Cytopathology (Differentiation of Virus Groups), Biohazards Associated with Simian Viruses, and Practical Applications and Discussions on Virus Diseases of Primates (including Significance of C-type Endogenous Primate Viruses).--Applicants or inquiries should be addressed to: Dr. S. S. Kalter, Director, Microbiology and Infectious Diseases, Southwest Foundation for Research and Education, P. O. Box 28147, San Antonio, Texas 78284.

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AGILE (DARK-HANDED) GIBBON WANTED

One male agile or dark-handed gibbon (*Hylobates agilis*) is needed to complete a long-term breeding group. A young adult is preferred.--Alan H. Shoemaker, Columbia Zoological Park, P. O. Box 1143, Columbia, South Carolina 29202.

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CONFERENCE ON THE BIOLOGY AND CONSERVATION OF THE CALLITRICHIDAE

Russell A. Mittermeier

Harvard University

Adelmar F. Coimbra-Filho

Department of Environmental Conservation, Brazil

Rogerio Castro Coronado

Peruvian Primate Project, Peru

The New World primate family Callitrichidae is composed of four genera of small monkeys (*Callithrix, Cebuella, Saguinus, Leontopithecus*) commonly known as marmosets and tamarins. In the past few years, these animals have attracted much international attention because of their importance in biomedical research and because the most spectacular callitrichid, the golden lion tamarin[1] (*L. rosalia rosalia*) is rapidly nearing extinction. In February, 1972, a special Golden Marmoset Conference was held at the National Zoological Park in Washington, D. C. and the proceedings published (Hampton, 1972; Bridgwater, 1972). The purpose of this conference was to bring together callitrichid specialists and try to develop measures to ensure the survival of the lion tamarins in the wild and in captivity. Since that time, interest in all callitrichids has increased rapidly. As a result, a conference on the biology and conservation of the Callitrichidae was held from August 18-20, 1975 at the National Zoological Park's Conservation and Research Center at Front Royal, Virginia.[2] This conference, which brought together some 50 scientists from the United States, South America, and Europe, served as a follow-up to the February, 1972 conference and promoted the exchange

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[1]The vernacular names "marmoset" and "tamarin" may cause some confusion. The Callitrichidae can be divided into two major groups on the basis of lower canine to lower incisor relationships and some authors (e.g., Napier & Napier, 1967) use this difference to assign vernacular names. *Cebuella* and *Callithrix*, with short lower canines and elongate lower incisors, are referred to as marmosets, whereas *Leontopithecus* and *Saguinus*, with long lower canines and short lower incisors, are called tamarins. However, many other researchers, especially those in biomedical fields, refer to all callitrichids as marmosets. In this report, we use the name tamarin for *Saguinus* and *Leontopithecus* since we find it useful to distinguish between the two major groups of the Callitrichidae by the vernacular names.

[2]A brief description of the conference by its organizer, Devra C. Kleiman, appeared in the January, 1976 issue of this Newsletter.

of new data and ideas within the diverse group of researchers working with callitrichids. The Front Royal conference clearly demonstrated that the study of callitrichid biology has come a long way in the three short years since the 1972 conference. Furthermore, in spite of the wide variety of interests of the participants, it was clear that everyone recognized the need for sound conservation measures and captive breeding programs to ensure a continued supply of callitrichids for research.

The papers presented at the conference fell into three major categories: behavior, ecology, and conservation status of wild populations, reproduction and social behavior of captive callitrichids, and management and status of captive breeding colonies. John F. Eisenberg (National Zoological Park, Office of Zoological Research) opened the conference with an overview of the comparative ecology and reproduction of New World monkeys. He stressed the difference in reproduction rates in cebids and callitrichids and suggested that the high reproductive rate of callitrichids (which twin and occasionally produce triplets) made them amenable to cropping and to laboratory breeding programs. Following this were a number of papers on the behavior and ecology of wild callitrichids in Panama, Colombia, Peru, and Brazil. The studies of Panamanian *S. oedipus geoffroyi* by Gary Dawson (Michigan State University) and Colombian *S. o. oedipus* by Patricia Neyman-Warner (University of California, Berkeley) represented the first long term investigations of callitrichid behavior and ecology. Both studies supported the laboratory findings that callitrichids are monogamous and live in family groups, a discovery inadvertently made on captive marmosets and tamarins because only one pair per group ever reproduced. A paper on *S. mystax* and *S. fuscicollis* by Rogerio Castro and Pekka Soini of the Peruvian Primate Project provided some preliminary field data on two of the major species used in biomedical research. Marleni Ramirez (Peruvian Primate Project), Juan Revilla (Universidad Nacional Mayor de San Marcos, Lima, Peru) and Curtis Freese (Johns Hopkins University) in one paper and Adelmar F. Coimbra-Filho (Department of Environmental Conservation, FEEMA, Rio de Janeiro, Brazil) and Russell A. Mittermeier (Harvard University) in another discussed the use of the lower anterior dentition in *Cebuella* and *Callithrix*. These teeth are used to gouge holes into trees and elicit the flow of gums, an important food source. In another paper, Coimbra-Filho reported that *Leontopithecus* apparently depend on tree holes as nocturnal sleeping sites and discussed the relevance of this for management of severely diminished wild stocks of these endangered animals.

The conservation status of callitrichids in the vast Amazon region was reviewed in one paper on Amazonian Peru by Curtis and Margaret Freese (Johns Hopkins University) and a second on the Brazilian Amazon, Surinam, and French Guiana by Mittermeier, Robert C. Bailey (Harvard University), and Coimbra-Filho. These studies concluded that, on the basis of available data, no Amazonian callitrichids are in immediate danger of extinction, but that several are restricted in range and could be adversely

affected by an upsurge in habitat destruction or heavy trapping for export. Amazonian callitrichids are rarely hunted for food because of their small size.

Papers on reproduction of captive callitrichids included behavior of *L. r. rosalia* during the reproductive cycle (Devra G. Kleiman), pair formation and response to intruders by *S. fuscicollis* (Gisela Epple, Monell Chemical Senses Center, Philadelphia, Penn.), parturition in *C. jacchus* (Hartmut Rothe, University of Göttingen, West Germany), length of gestation period in *L. r. rosalia* (Charles Wilson, Little Rock Zoo, Little Rock, Arkansas), reproductive endocrinology in *C. jacchus* (John Hearn, MRC Reproductive Biology Unit, Edinburgh, Scotland), and detection of estrous cycle and pregnancy in marmosets (Suzanne H. Hampton, New York College, CUNY, New York). The papers by Hearn, Hampton, and Kleiman provided hormonal and behavioral evidence for the existence of an estrous cycle of just over two weeks in the callitrichids studied. Wilson and Kleiman indicated that the gestation period of *Leontopithecus* averaged approximately 128 days, whereas Rothe and Hearn obtained figures of 144-146 and 148 days for *C. jacchus*.

The session on social behavior and development of captive callitrichids included studies of parent-infant interactions, social relations in family groups, and vocalizations. Robert Hoage's (University of Pittsburgh) study of parental care and carrying behavior in *L. r. rosalia* indicated that juveniles require a minimum exposure time to infant siblings if they are later to become successful primiparous parents. Both Hoage's study and another by Jennifer Ingram (University of Bristol) on parent-infant interactions and development of the infant in *C. jacchus* indicated that parents react differently to male and female infants. Hilary Box (University of Reading) discussed social interactions in family groups of *C. jacchus*, with special emphasis on social play, allogrooming and scent marking. A. G. Pook's (Jersey Wildlife Preservation Trust) paper on the vocal repertoire of *C. jacchus* and *S. fuscicollis* showed that contact calls were the most frequently used vocal signals in both species. Kenneth Green and Elizabeth McLanahan's (National Zoological Park) analysis of the *L. r. rosalia* repertoire showed that males vocalized more often than females and that the greatest percentage of vocalizations were associated with vigilant behavior.

Several investigators with considerable experience in callitrichid husbandry presented papers on captive breeding and management. Nazareth Gengozian (Medical Division, Oak Ridge Associated Universities) described the breeding program at Oak Ridge, Tennessee, W. R. Kingston (Loughborough, Leicester, England) discussed the cost of developing and managing callitrichid colonies. John Cicmanec (Litton Bionetics) reviewed the medical problems encountered in colonies, and Jeremy Mallinson (Jersey Wildlife Preservation Trust) described maintenance techniques and a new marmoset complex at the Jersey Zoo. Devra Kleiman and Marvin Jones covered the current status of *L. r. rosalia* in captivity, with special attention

given to breeding success in the National Zoological Park. James Porter (South American Primates, Inc.) presented the viewpoint of the primate dealer and discussed plans for a captive breeding program in South America.

Round table discussions were held following each day's papers. The first day's discussion, chaired by Richard W. Thorington (Museum of Natural History, Smithsonian Institution), dealt with callitrichid conservation. It was concerned with the usefulness of currently-employed primate survey techniques and the applicability of findings from such surveys to conservation. Although the transect methods used in recent primate censuses conducted in South America have a number of shortcomings, they provide reasonable estimates of absolute densities. They are also good indicators of relative primate abundance in different areas, which is especially helpful in determining priorities for the establishment of national parks and reserves.

The round table of the second day, chaired by K. Hobbs (Bicester, England), attempted to iron out some of the differences among conservationists, exporting countries and primate consumers. Now that the major exporting countries in South America (Peru, Colombia, Brazil) have ended primate exports, more attention is being directed to captive breeding of callitrichids needed in research. Large scale captive breeding unfortunately did not receive sufficient attention prior to the curtailment of the trade, in spite of warnings from conservationists and governments of exporting countries. The National Institutes of Health and the Pan American Health Organization have now realized that the demand for primates will not abate and have taken steps to encourage research and development of breeding facilities within exporting countries. Plans are now underway to establish a primate breeding center in Peru and centers in other countries may follow.

The third of the round tables, chaired by Warren Thomas (Los Angeles Zoo), dealt with reproduction in small colonies of endangered callitrichids. Among the problems discussed were possible consequences of inbreeding with very small numbers of rare animals. The major contribution of this round table was the decision to initiate a studbook for the cotton-top tamarin (*S. o. oedipus*), a species which was originally one of the most common in zoos and research institutions but is now endangered.

At the end of the conference, a committee, chaired by John Hearn and including Nazareth Gengozian, Devra G. Kleiman, Russell A. Mittermeier, Richard W. Thorington, Jr., Warren Thomas, and Charles Wilson, drew up a statement that was subsequently adopted by the conference participants. The statement expressed concern for two categories of callitrichids: The endangered species and the species widely used in research. The endangered species, including the three subspecies of lion tamarin (*L. r. rosalia, L. r. chrysomelas, L. r. chrysopygus*), the buff-headed marmoset (*C. flaviceps*), the white-eared marmoset (*C. aurita*) and

the cotton-top tamarin (*S. o. oedipus*) are in urgent need of help. The lion tamarins and the two marmosets are threatened by large scale habitat destruction in southern Brazil. Only a small fraction of their original habitat remains (Fig. 1). The cotton-top tamarin, endemic to northwestern Colombia, has been heavyly exploited in the past 10-15 years (an estimated 30,000-40,000 were exported during this period; Hernandez-Camacho & Cooper, Note 1) and is also threatened by widespread habitat destruction within its limited range. Reserves are urgently needed for these species and detailed studies of their behavior and ecology should be initiated as soon as possible. Failure to apply protective measures for them will result in their extinction in the near future.

The major callitrichid species used in research are the common marmoset (*C. jacchus*), the saddle-backed tamarin (*S. fuscicollis* spp.) and the moustached tamarin (*S. mystax mystax*). These animals are very important in research since they allow the study of naturally occurring human diseases such as hepatitis and serve as excellent models in human-oriented research in immunology, virology, reproduction, contraception. and teratology. Their potential is only beginning to be realized. They are in no immediate danger of extinction, but could be decimated by habitat destruction and by overexploitation. Of special concern are the high losses during capture, transport, and holding, which have increased with the illegal shipments made since the initiation of export bans. To improve the situation, it was recommended that carefully managed breeding centers be developed in exporting and user countries, that rigorous control of export quotas and holding and shipping conditions be exercised, and that long term field studies of these species be conducted.

The only really disappointing note at the Front Royal conference was that the situation of the lion tamarins, which was the main focus of the 1972 conference and a major concern in 1975, was worse than ever before. Although the Tijuca Biological Bank[3] in Rio de Janeiro has been established and is functioning smoothly, the future of wild populations of *Leontopithecus* looks very bleak. The wild population of the golden lion tamarin (*L. r. rosalia*) is estimated to be 100-200 individuals, whereas the other two subspecies, the golden-headed lion tamarin (*L. r. chrysomelas*) and the golden-rumped lion tamarin (*L. r. chrysopygus*), are down to approximately 200 animals each. The captive population of the golden lion tamarin does not exceed 125 animals worldwide. In spite

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[3]The Tijuca Biological Bank is a special captive *Leontopithecus* colony located at the edge of Tijuca National Park in Rio de Janeiro. It was financed by the World Wildlife Fund, the Brazilian Forestry Development Institute, and the Brazilian Academy of Sciences. It is intended to serve as a breeding colony for *Leontopithecus* and also a holding site for animals translocated from areas where habitat destruction is inevitable and those confiscated from illegal dealers. If adequate reserves are created, animals from the Tijuca Bank will be used for restocking programs. At the present time, the Bank houses 31 *L. r. rosalia*, 9 *L. r. chrysopygus*, and 8 *L. r. chrysomelas*.

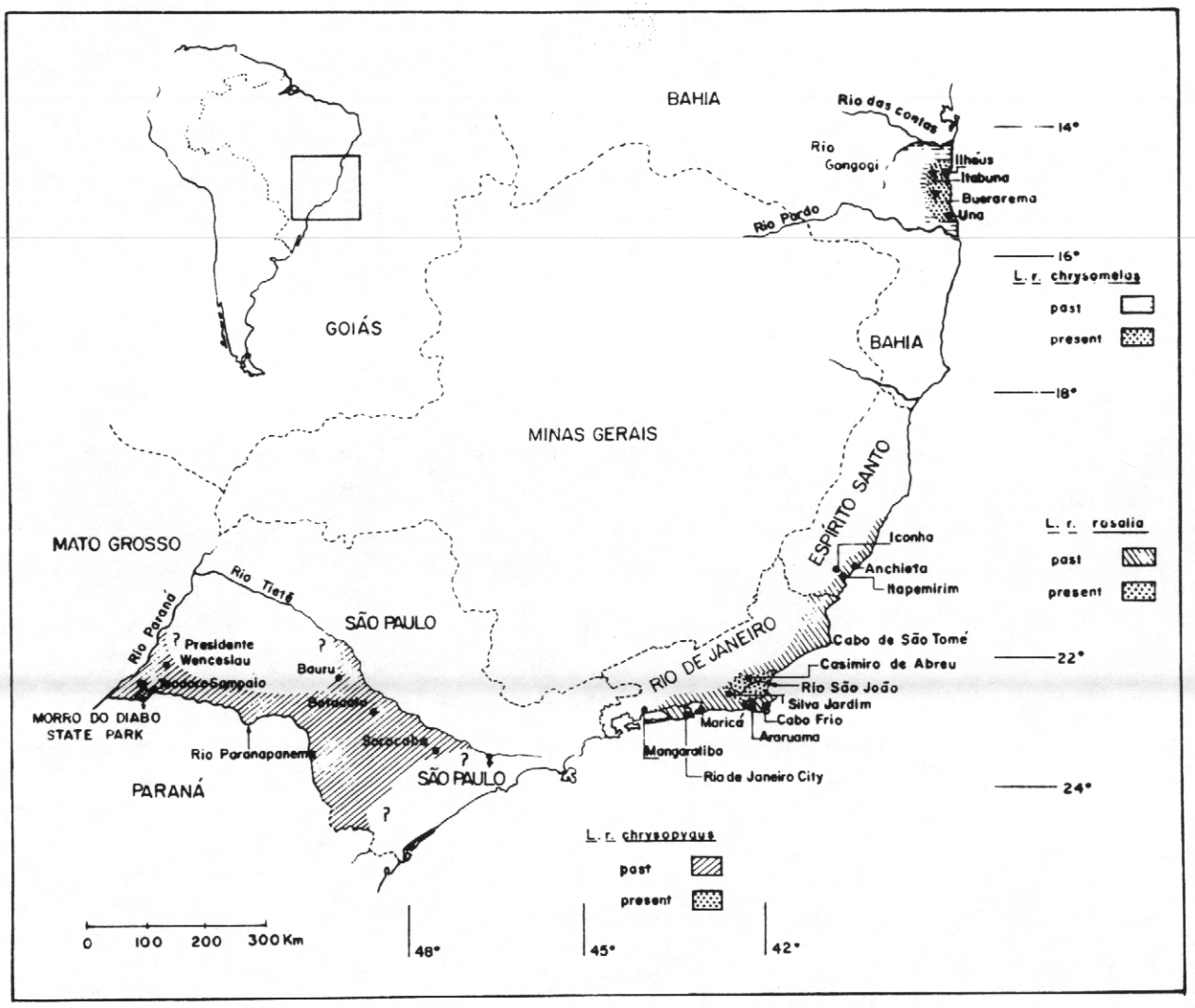

Figure 1. Map showing the past and present distribution of the three members of the genus Leontopithecus in Brazil.

of recent advances in callitrichid husbandry, it is by no means certain that this small nucleus can perpetuate the species if attempts to save wild populations fail. The other two subspecies are represented by a total of only 17 captive individuals, all of them in the Tijuca Bank.

A paper by Alceo Magnanini (Tijuca National Park, Rio de Janeiro), presented in his absence by Coimbra-Filho, discussed the current status of the Poço das Antas Biological Reserve for the golden lion tamarin. Efforts to establish this reserve were initiated in 1971. However, in spite of considerable international interest, including a special letter sent to the President of Brazil by participants in the 1972 conference, the reserve was not signed into law until March, 1974. Forest destruction (for charcoal and to make way for agricultural and pasture land) was rampant before the official creation of the reserve and continues even now. A recent survey revealed that a substantial portion of the 3,000 hectare reserve is no longer suitable tamarin habitat. The latest plan is to drop the most degraded sections and add 2,500 hectares of new land, bringing the total reserve area to some 5,000 hectares. A proposal for the extension of the reserve boundaries has now been prepared. If the new addition is not rapidly approved and adequate enforcement of existing protective measures not immediately put into effect, the golden lion tamarin will be extinct in the wild within a few years. The entire valley of the Rio São João, which contains the last populations of this animal, has been slated for an enormous agricultural project which will ensure the destruction of all remaining natural habitat.

The golden-headed lion tamarin occurs in only a few forested areas in the southern part of the Brazilian state of Bahia. Forests in this region contain valuable lumber (e.g., Brazilian rosewood, *Dalbergia nigra, Leguminosae)* and are being cleared to make way for cocoa and rubber plantations. A site for a reserve has been selected, but thus far governmental authorities have done nothing to expropriate the land and provide protection against exploitation. The golden-rumped lion tamarin once ranged widely in the Brazilian state of São Paulo, but habitat destruction has been so widespread that the animal is now found in only one area, the Morro do Diablo State Park in the extreme western part of the state (Fig. 1). Nonetheless, *L. r. chrysopygus* is probably safer than its two relatives because it occurs in an already established park.

As far as the lion tamarins are concerned, we can only end with the same message that concluded the 1972 conference: If something is not done quickly, several unique and beautiful animals will disappear from the face of the earth. The only difference is that in 1975 the message is more urgent than ever.

Reference Notes

1. Hernandez-Camacho, J. & Cooper, R. W. The nonhuman primates of Colombia. Paper presented at the ILAR Conference on Distribution

and Abundance of Neotropical Primates, August, 1972

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Hampton, S. H. Golden Lion Marmoset Conference. *Science,* 1972, *177,* 86-87.

Napier, J. R. & Napier, P. *A Handbook of Living Primates,* New York: Academic Press, 1967.

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INTERNATIONAL PRIMATOLOGICAL SOCIETY NOTES: ELECTION OF OFFICERS

The four year term of International Primatology Society Officers expires at the Cambridge conference. Some officers will not be available for re-election. These include: the President, Dr. Hans Kummer; the Secretary for U.S., Dr. D. Rumbaugh; the Membership Secretary, and Secretary for Europe, Dr. H. Preuschoft; the Secretary-General, Dr. G. Bourne; the Secretary for Asia; Dr. Shiro Kondo and one Vice President, Dr. K. Imanishi.

The Treasurer, Dr. R. Schneider, and Vice President, Dr. Richard Thorington will be available for re-election.

Nominations for the above positions can be received by the Secretary-General in writing or made from the floor at the annual business meeting. In each case, the nominators should have the written consent of the nominee.

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STEREOTAXIC ATLASES NEEDED

I am in need of one or both of the following stereotaxic atlases which are no longer available from the respective publishers: (1) R. S. Snider and J. C. Lee, *A Stereotaxic Atlas of the Monkey Brain,* The University of Chicago Press, 1961. (2) J. Olszewski, *The Thalamus of the Macaca Mulatta: An Atlas for Use With the Stereotaxic Instrument,* Basel: Karger, 1952.--Contact James R. Augustine, Ph.D., Department of Anatomy, USC--School of Medicine, Columbia, SC 29208 (Phone: 803-777-7000).

MONKEYPOX SURVEILLANCE

During the last seven years, no monkeypox outbreaks have been reported from laboratories with captive monkey colonies. The first monkeypox outbreak was recognized at the Statens Serum Institute, Copenhagen in 1958 (Magnus *et al.*, 1959). Since then, nine outbreaks in captive monkey colonies were reported up to 1968 (Arita *et al.*, 1972). The last known outbreak occurred in Paris in chimpanzees shipped from Sierra Leone (Milhaud *et al.*, 1969). No naturally occurring outbreak in wild monkeys has been reported, but, from 1970 to the present, 20 human monkeypox cases were reported from West and Central Africa (Anonymous, 1976). Monkeypox virus is an orthopox virus and causes smallpox-like disease in monkeys and man. However, the disease has rarely been transmitted from man to man. The animal reservoirs have not been determined but monkeys and rodents are suspected.

The finding that since 1968 there has been no reported monkeypox outbreak in laboratories is puzzling, since many laboratories have been receiving monkeys originating from West and Central Africa. As indicated by the occurrence of human monkeypox cases, reservoirs are certainly present.

We would be grateful if any laboratory which has heard any rumor or has had experience of monkeypox outbreaks or poxvirus infection in monkeys during the last 5 years (or in the future) would report such findings to the following address: Chief, Smallpox Eradication Unit, World Health Organization, Avenue Appia, 1211 Geneva 27, Switzerland.

The problem is closely related to the smallpox eradication program since monkeypox virus causes smallpox-like disease in man which can only be identified by laboratory testing.

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Anonymous. Smallpox Surveillance. *WHO Weekly Epidemiological Record.* 1976. No. 3, 16-17.

Arita, I., Gispen, R., Kalter, S. S., Lim Teong Wah, Marennikova, S. S., Netter, R., & Tagaya, I. Outbreaks of monkeypox and serological surveys in nonhuman primates. *Bulletin of the World Health Organization,* 1972, *46*, 625-631.

Milhaud, C., Klein, M., & Virat, J. Analyse d'un cas de variole du singe (monkey-pox) chez le chimpanzé (*Pan troglodytes*). *Expérimentation animale,* 1969, *2*, 121-135.

von Magnus, P., Andersen, E. K., Petersen, K. B., & Birch-Andersen, A. A pox-like disease in cynomolgus monkeys. *Acta Pathologica et Microbiologica Scandinavica,* 1959, *46*, 156-176.

RECENT BOOKS AND ARTICLES
(Addresses are those of first authors)

Books

Laboratory Animal Handbooks, Vol. 6. *Breeding Simians For Developmental Biology*. F. J. Perkins and P. N. O'Donoghue (Eds.). London: Laboratory Animals Ltd. (7 Warwick Ct., London, WC1R 5DP), 1975. 353 pp. [Price: $30.00]

A collection of papers presented at an International Association of Biological Standardization Symposium, held at the Zoological Society of London, June 3-5, 1974. Contents: Introductory remarks, by D. G. Davey. The need for primate breeding programmes in relation to general supply and specific research requirements, by K. R. Hobbs. Statement on ICLA inquiry, by A. Spiegel. Economic and other aspects of breeding macaques in indoor cages, by H. Weber & W. Brühl. Breeding rhesus monkeys and chimpanzees at the Primate Center TNO, by H. Balner. The establishment of non-human primate breeding colonies at the Southwest Foundation for Research and Education, by D. C. Kraemer, S. S. Kalter, & G. T. Moore. Experiences in the laboratory breeding of non-human primates, by D. A. Valerio & D. W. Dalgard. Breeding anthropoid apes and rhesus monkeys at the Yerkes Primate Center, by G. H. Bourne, M. E. Keeling, & M. N. Golarz de Bourne. Breeding macaques in Münster, by R. Korte. Breeding *Macaca fascicularis* under laboratory conditions, by E. Weinmann & R. Mauler. Establishment of an island breeding colony of Japanese monkeys as a laboratory animal, by S. Kotera, T. Tanaka, Y. Tajima, & T. Nomura. Establishment of a free-ranging rhesus monkey breeding colony on Key Lois Island, Florida, by H. L. Foster. Ovulation induction in primates, by C. R. Austin. The accuracy of bimanual rectal palpation for determining the time of ovulation and conception in the rhesus monkey (*Macaca mulatta*), by C. J. Mahoney. The breeding stock of tupaias at the Battelle-Institut, by A. Schwaier. Current Status of primate breeding in the United States, by W. J. Goodwin. The comparison of perinatal steroid endocrinology in simians with a view to finding a suitable animal model to study human problems, by C. H. L. Shackleton & F. L. Mitchell. Evaluation of fertility in male baboons (*Papio cynocephalus*), by R. E. Lister. The reproductive biology of the marmoset monkey, *Callithrix jacchus*, by J. P. Hearn & S. F. Lunn. Comparison of embryonic and foetal development in man and

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In many cases, the original source of references in this section has been the Current Primate References prepared by The Primate Information Center, Regional Primate Research Center, University of Washington. Because of this excellent source of references, the present section is devoted primarily to presentation of abstracts of articles of practical or of general interest. In most cases, abstracts are those of the authors. Any author wishing to have a published paper abstracted in this section may do so by sending the Editor a copy of the reprint with a summary or abstract and indicating his desire on the reprint.

rhesus monkey, by T. Tanimura & Y. Tanioka. Some expected and unexpected characteristics of reproduction in callithricidae, by J. K. Hampton Jr. & S. H. Hampton. Aberrant menstrual cycles in *Macaca mulatta* and *M. fascicularis*, by C. J. Mahoney. Chronology of the development of embryo and placenta in *Tupaia belangeri*, by A. Schwaier and H.-J. Kuhn. Practical aspects of determining early pregnancy, state of foetal development, and imminent parturition in the monkey (*Macaca fascicularis*), by C. J. Mahoney. The use of pregnant and neonatal simians for microbiological studies, by C. R. Coid & W. H. Bowen. Macaque and marmoset monkeys as animal models for the study of birth defects, by I. R. Phillips. Comparison of developmental stages in primates with a note on the detection of ovulation, by A. G. Hendrickx, R. H. Sawyer, B. L. Lasley & R. D. Barnes. Studies on neonatal growth and nutrition, by J. S. Garrow & S. F. Stalley. A study of wound healing in the foetal tissues of the cynomolgus monkey, by D. Sopher. The possibilities of using *Macaca arctoides* in teratological experiments, by S. Brüggemann & J. Grauwiler. Vaccines to prevent disease in simians, by F. T. Perkins.

The Rhesus Monkey. Vol. 1. *Anatomy and Physiology*. Geoffrey H. Bourne (Ed.). New York: Academic Press, 1975.

This volume, one of two, attempts to summarize in one place the great amount of information collected on the monkey that has been most widely used in biomedical and psychological studies. Contents: 1. Collected Anatomical and Physiological Data from the Rhesus Monkey, by G. H. Bourne. 2. Cerebral Angiography, by K. G. Ryan. 3. The Electrocardiogram (ECG) and Vectorcardiogram (VCG) of the Rhesus Monkey, by M. R. Malinow. 4. Structure and Function of the Rhesus Kidney, by C. C. Tisher. 5. Development and Eruption of Teeth in Rhesus, by E. B. Kenney. 6. The Histology and Histochemistry of the Rhesus Monkey, by M. N. Golarz de Bourne and G. H. Bourne. 7. The Learning Skills of the Rhesus Monkey, by D. M. Rumbaugh and T. V. Gill. 8. Behavior of Free-Ranging Adult Rhesus Macaques: A Review, by M. E. Agar and G. Mitchell. 9. Perception and Learning in Infant Rhesus Monkeys, by R. Boothe and G. Sackett. 10. Rhesus Monkey Vocal Sounds, by J. Erwin. 11. The Neural Bases of Aggression and Sexual Behavior in the Rhesus Monkey, by A. A. Perachio and M. Alexander.

The Rhesus Monkey. Vol. 2. *Management, Reproduction, and Pathology*. G. H. Bourne (Ed.). New York: Academic Press, 1975.

Contents: 1. Conditioning Wild Rhesus for Biomedical Research, by M. A. Nolan. 2. Medical Management of the Rhesus Monkey, by M. E. Keeling and R. H. Wolf. 3. Nutrition of the Rhesus Monkey, by G. H. Bourne. 4. Reproduction in the Rhesus Monkey, *Macaca mulatta*, by H. R. Catchpole and G. van Wagenen. 5. Embryology of the Rhesus Monkey, by A. G. Hendrickx and R. H. Sawyer. 6. Pregnancy in the Rhesus Monkey, by L. A. M. Stolte. 7. Behavior of the Female Rhesus Monkey during Birth, by G. Mitchell and E. M. Brandt. 8. The Assessment of Skeletal Development in the Rhesus Monkey (*Macaca mulatta*) and its Relationship to Growth and Sexual Maturity, by E. S. Watts.

9. Breeding Monkeys for Biomedical Research, by G. H. Bourne and M. N. Golarz de Bourne. 10. Circadian Rhythms of the Rhesus Monkey, by C. M. Winget. 11. Immunogenetic Studies of Rhesus, by W. H. Stone. 12. Pathology of the Rhesus Monkey, by H. M. McClure. 13. Neoplasia in Rhesus Monkeys, by H. M. McClure. 14. Cytogenetics of the Rhesus, by H. M. McClure. 15. Hematologic, Blood Chemistry, and Cerebrospinal Fluid Data for the Rhesus Monkey, by H. M. McClure.

Contributions to Primatology. Vol. 5. *Approaches to Primate Paleobiology.* F. S. Szalay (Vol. Ed.). Basel: Karger, 1975. Soft cover. 340 pp. [Price: Approx. $55]

The volume is designed to demonstrate the varied nature of paleobiology, using the Primates as a point of focus. Paleobiology is a discipline concerned with answering questions related to past biological entities; it is closely involved with but not identical to paleontology. The papers are organized into three sections as follows: I. TIME AND PALEOECOLOGY. Cenozoic - The Primate Episode, by D. E. Savage. Paleoecology of the Paleocene-Eocene Transition in Europe, by D. E. Russel. Paleoenvironments in the East African Miocene, by P. Andrews & J. A. H. van Couvering. II. TAXONOMY AND PHYLOGENY. Using Polar Coordinates to Measure Variability in Samples of Phenacolemur: A Method of Approach, by P. Ramaekers. Phylogenetic Relationships of Plesiadapis - Postcranial Evidence, by F. S. Szalay, I. Tattersall, & R. L. Decker. Evolutionary History of the Cercopithecidae, by E. Delson. Evolutionary Models, Phylogenetic Reconstruction, and Another Look at Hominid Phylogeny, by N. Eldredge & I. Tattersall. III. EVOLUTIONARY MORPHOLOGY. Allometry in Primates, with Emphasis on Scaling and the Evolution of the Brain, by S. J. Gould. Significance of Tooth Sharpness for Mammalian, Especially Primate, Evolution, by R. G. Every.

Contributions to Primatology. Vol. 6. *Social Dynamics of Gelada Baboons.* R. Dunbar and P. Dunbar. Basel: Karger, 1975. Soft cover, 165 pp. [Price: Approx. $37]

This volume contains the results of a field study of the social organization of the gelada baboon, *Theropithecus gelada.* Although baboons have been extensively studied in Africa during the past 2 decades, relatively little attention has been paid to this species. The aim of the study was to provide a detailed description of the gelada's social structure and dynamics. The guidelines for the research lay in seeking answers to four broad questions: 1. Into what kinds of social groups is the population divided? 2. How do the individual members of these groups relate to each other? 3. How do the members of one group relate to members of other groups? 4. How do males acquire females with whom to mate and rear offspring? The chapters are organized as follows in an attempt to answer these questions. In chapter II, the structure of the main study population is outlined through an analysis of numerical data on group size and com-

position, together with a brief discussion of population dynamics. Chapters III and IV are concerned with the structure and dynamics of the basic social units, the reproductive and all-male groups. In chapter V, a broader description of the relationships among the age-sex classes is undertaken. In chapter VI, the behavior and grouping tendencies of juveniles are examined, while chapter VII is concerned with the processes of group ontogeny and the life-cycle of reproductive units. The structure and dynamics of the higher units of population, bands and herds, are examined in chapter VIII and, finally, in chapter IX the adaptive significance of gelada social organization is briefly discussed. The authors state that their "purpose here is simply to provide a broad 'anatomical' description of the social organization of gelada baboons and of the kinds of social processes that occur. The 'physiological' details of how this system works are the subject of [their] current field study."

Contributions to Primatology. Vol. 7. *Dominance and Reproduction in Baboons* (Papio Cynocephalus): *A Quantitative Analysis.* Glenn Hausfater. Basel: Karger, 1975. Soft cover, 157 pp. [Price: Approx. $33]

This monograph reports on a 14-month study of yellow baboons (*Papio cynocephalus*) in the Masai-Amboseli Game Reserve, Kenya. The study was an attempt to determine the relationship between agonistic dominance and reproductive success in male baboons and centered around testing a priority-of-access model of mating behavior. Explicit criteria for determining dominance in baboons are presented and the consistency of dominance relationships through time is analyzed for all classes of individuals. Related data on reproductive cycle length, perineal and behavioral indications of the optimal day for mating, changes in female behavior during estrous, and effects of the presence of estrous females on group organization are also included. The work emphasized the use of systematic behavior sampling techniques in the field and quantitative models in the study of primate social behavior.

The Red Colobus Monkey. Thomas T. Struhsaker. Chicago, IL: Univ. of Chicago Press, 1976. 325 pp. [Price: $25]

There have been few field studies of primates living in tropical rain forests and of representatives of the Colobinae (the leaf-eating monkeys) in general. The purpose of this book is to provide a detailed account of the behavior and ecology of one species of the Colobinae (which is a subfamily of the Cerocopithecidae), the red colobus monkey (*Colobus badius tephrosceles*). This species inhabits tropical rain forests in Africa and Struhsaker's work was conducted in the Kibale Forest of Western Uganda. The contents of the volume are as follows: 1. Red Colobus: General Description and Survey Techniques. (The survey. The Intensive study. Techniques.) 2. Social Structure. (Methods. Group size and composition. Dynamics of group membership for *C. b. tephrosceles*. Solitary *C. b. tephrosceles*. Intergroup relations of *C. b. tephrosceles*. Intergroup relations of other subspecies. Comparison with other studies.) 3. Social Behavior and

Intragroup Social Structure. (Methods. Resumé of prominent aspects of intragroup social structure. Agonistic behavior. Grooming behavior. Heterosexual behavior. Births. Infant ontogeny. Miscellaneous social behavior. Intragroup dispersion.) 4. Vocalizations. (Methods. Definition of terms. Vocal repertoire of *C. b. tephrosceles*. Vocal roles of *C. b. tephrosceles*. Frequency data on vocalization of *C. b. tephrosceles*. Vocalizations and group progressions. Vocal repertoire of *C. b. temminckii*. Vocal repertoire of *C. b. badius*. Vocal repertoire of *C. b. preussi*. Vocal repertoire of *C. b. rufomitratus*. Discussion of vocalizations.) 5. Ecology. (The Kibale Forest. The major study area--compartment 30 of the Kibale Forest. Food habits of *C. b. tephrosceles*. Ranging patterns of *C. b. tephrosceles*. Temporal distribution of activities of *C. b. tephrosceles*. Vertical distribution of activities of *C. b. tephrosceles*. Censuses of anthropoid primates in the Kibale Forest. Interspecific relations. Mortality. Habitat destruction and conservation.) 6. Concluding remarks and speculations.

Disease

Recovery of Herpes simiae (B-virus) from both primary and latent infections in rhesus monkeys. Vizoso, A. D. (Unit of Invertebrate Virology, Commonwealth Forestry Institute, South Parks Road, Oxford, OX1 3RB, England) *British Journal of Experimental Pathology*, 1975, *56*, 485-488.

The suspected ability of herpes simiae (B virus) to persist in a latent form has been confirmed in rhesus monkeys. The virus was recovered from primary oral lesions of 2 young monkeys and again, 6 months after disappearance of symptoms, from cultures of Gasserian ganglia taken from the same individuals. B virus was identified by its effects *in vivo* and *in vitro* and in cross neutralization tests with antisera to reference B virus and herpes simplex virus. Tests showed that the same virus was present in oral lesions and in ganglia. The one-way immunological relationship between herpes simplex virus and B virus was clearly shown in results of cross neutralization tests.

A comparison of several intradermal tuberculins in *Macaca mulatta* during an epizootic of tuberculosis. McLaughlin, R. M., Thoenig, J. R., & Marrs, J. R., Jr. (Vet. Med. Div., US Army Biomedical Lab., Aberdeen Proving Grounds, MD 21010) *Laboratory Animal Science*, 1976, *26*, 44-50.

During an epizootic of tuberculosis in rhesus monkeys, several intradermal test reagents were compared for accuracy in detecting tuberculosis and for strength of reaction elicited. A purified protein derivative of *Mycobacterium bovis*, similar to one which will probably by approved for official veterinary testing and thus eliminate tuberculin-mammalian intradermic from commercial production, was among those evaluated. None of the reagents was found to be superior to tuberculin-mammalian intradermic. Significant differences were not found in reaction strength between abdominal and palpebral test sites, but both together were about 10% more sensitive than either alone. *Mycobacterium bovis* and *Mycobacterium tuberculosis* were both cultured and identified

from this epizootic.

Multiple testing for the detection of B virus antibody in specially handled rhesus monkeys after capture from virgin trapping grounds. Orcutt, R. P., Pucak, G. J., Foster, H. L., Kilcourse, J. T., & Ferrell, T. (Charles River Breeding Labs., Inc., Wilmington, MA 01887) *Laboratory Animal Science,* 1976, *26*, 70-74.

Eight groups of rhesus monkeys totaling over 1,000 animals were captured in the virgin trapping grounds of Jammu and Kashmir, India. Individual caging and special handling technics were utilized to prevent cross-contamination during capture, holding, and subsequent shipment to quarantine facilities in the United States. Immediately following the arrival of the monkeys, 5 consecutive blood samples were obtained at approximately 2-wk intervals, and the sera were tested for neutralizing antibody against *Herpesvirus simiae*. In order to assure the greatest sensitivity possible, sera were not heat-inactivated and were tested against only 10 $TCID_{50}$ units of virus in addition to the more commonly used concentration of 100 $TCID_{50}$ units. The first test detected 80-90% of the positive animals within each group and only 1 seroconversion was noted after the second test. Seventy-three percent of the adults, 36.6% of the young adults, and 12.4% of the juvenile macaques were found to be antibody-positive. Considering the measures employed to prevent cross contamination, these percentages probably reflect the true prevalence of B virus infection in these rhesus monkeys at the time of their capture in the wild.

T-strain mycoplasma in the chimpanzee. Brown, W. J., Jacobs, N. F., Jr., Arum, E. S., & Arko, R. J. (Venereal Disease Res. Br., Ctr. for Dis. Control, Atlanta, GA 30333) *Laboratory Animal Science,* 1976, *26*, 81-83.

Specimens from 4 chimpanzees were cultured for T-strain mycoplasma and *Mycoplasma hominis*. T-strain mycoplasmas were recovered from the genital tract and throat of a male and the genital tract of his female cagemate; neither had clinical evidence of infection. Two other male chimpanzees were culturally negative for T-strain mycoplasmas. *M. hominis* was not isolated from any of the animals. The chimpanzee may serve as a suitable experimental model for studying the role of T-strain mycoplasmas in human urethritis and reproductive failure.

Subhuman primate-associated hepatitis. Pattison, C. P., Maynard, J. E., & Bryan, J. S. (Phoenix Labs., Ctr. for Dis. Control, Phoenix, AZ 85014) *Journal of Infectious Disease,* 1975, *132*, 478-479.

A brief summary of information about nonhuman primate-associated hepatitis, which was first recognized as an epidemiologic entity in 1961.

Increased fertility in rhesus monkeys by breeding after the preovulatory LH surge. Hobson, W., Dougherty, W., Lowry, J., Fuller, G., & Coulston, F. (International Ctr. of Env. Safety, Albany Med. Coll., Halloman AFB, NM 88330) *Laboratory Animal Science*, 1976, *26*, 63-65.

Fertility in a rhesus monkey breeding colony was significantly increased by caging females with males immediately after detection of the preovulatory luteinizing hormone (LH) surge. LH was measured in daily serum samples by a rapid (24-hr) radioimmunoassay which used iodinated ovine LH as tracer and an antiserum to human LH.

Some aspects related to conception of the Japanese monkey (*Macaca fuscata*), Nigi, H. (Japan Monkey Centre, 55 Kurisu, Inuyama-Shi, Aichi-ken, Japan) *Primates*, 1976, *17*, 81-87.

The season of birth, age of the first parturition, gestation period, and vaginal bleeding and mating after conception were surveyed in Japanese monkeys (*Macaca fuscata*). The analyses of the former two items were dependent on the birth records in the Ohirayama troop collected from 1957 to 1973, and the analyses of the latter two items were dependent on data obtained by a 48-hour mating in a laboratory. Birth in the Ohirayama troop converged into the months from March to July, especially from April to June. The age of the first parturition was 3 years and 11 months at the earliest, and 9 years and 2 months at the latest. Most of the monkeys observed (68.6%) gave birth for the first time at about the age of 5 with the range being about 4 to 6 years. The gestation period calculated from 17 cases, which was defined as the period from the first day of a 48-hour mating to the day before parturition, was 173 ± 6.9 days, ranging from 161 to 188 days. In 25 out of 28 cases, vaginal bleeding was observed after conception. It began slightly later (between 16 and 24 days after mating) than the forecasted time of the next menstrual hemorrhage, and usually lasted longer than bleeding of the usual menses. Each of three female monkeys caged together with a male monkey 30 days after conception was observed to have copulated, and the male was observed to have ejaculated.

Breeding performance of Great Apes in the U. K. Verstraete, A. P. (63 St. Peter's Road, Croydon, Surrey. CRO 1HS, England) *Ratel - Journal of the Association of British Wild Animal Keepers*, 1976, *2*, [4], 10-14.

This review covers the period from 1934 until October, 1975. Comparative data on menstrual cycle, oestrus period, gestation period and birth weights are given for Gorilla, Orangutan, and Chimpanzee. Includes brief details of physical and psychological changes that may occur during pregnancy and consequently be of value in pregnancy determination.

Self-feeding infant macaques. Chamove, A. S. (Dept. Psychol., Univ. Stirling, Stirling, Scotland) *The Simian*, 1975, *18*, 3-5.

The training of 30 stumptails separated from their mothers at 9 days of age is described using a continuously-available supply of milk.

Most infants are self-feeding within 24 hours after which they can be fed formula from a nipple-covered standard water bottle. Essential care is reduced to changing the milk every five hours three times during the day.

Instruments and Techniques

Subhuman primates. In *Techniques of veterinary radiography*. Morgan, J. P., Silverman, S., & Zontine, W. J. Davis, California: Veterinary Radiology Associates, 1975. Pp. 286-295.

A practical guide to radiographic procedures for nonhuman primates.

Ecology and Field Studies

Resource availability and population density in primates: A socio-bioenergetic analysis of the energy budgets of Guatemalan howler and spider monkeys. Coelho, A. M., Jr. (Southwest Foundation for Res. & Ed., San Antonio, TX 78228) *Primates*, 1976, *17*, 63-80.

This paper presents data on the food and energy utilization budgets of two sympatric species of nonhuman primates living in the quasi-rain forest of Tikal, Guatemala. Seven researchers working in teams obtained approximately 1,200 hours of animal-observer contact time, representing approximately 2,400 hours in the field. The following information is herein presented: (1) data on the estimated energy expenditure of the cebidae population living in the study site; (2) the nutritional composition of some foods eaten by Tikal's howler and spider population; (3) an estimate of the nutritional intake of howlers and spiders; and (4) an estimate of the carrying capacity of the habitat. The above types of data were combined in an attempt to answer the following question: To what extent are population density and size an indication of the carrying capacity of the habitat either in terms of food availability or quality? Data presented in this paper suggest that low population density and small group size are not necessarily the result of a nutritionally poor environment. The Tikal study site is capable of supporting 8,500 animal/km^2. In the absence of other comparable quantitative socio-bioenergetic surveys it is herein suggested that the concept of food resource limitation is largely a myth among primatologists.

Primates obtained in peninsular Thailand June-July, 1973, with notes on the distribution of continental southeast Asian leaf-monkeys (*Presbytis*). Fooden, J. (Field Museum of Natural History, Roosevelt Rd., Lake Shore Dr., Chicago, IL 60605) *Primates*, 1976, *17*, 95-118.

During five weeks of field work 50 specimens of seven species of primates were obtained in peninsular Thailand. For each of these species information is given concerning external measurements, habitats, troop size, reproductive biology, and stomach contents. Peninsular primate specimens are compared with specimens previously collected in west-central Thailand. The distribution of species of leaf-monkeys (*Presbytis*) in continental Southeast Asia is comprehensively surveyed

and mapped for the first time: the *Trachypithecus*-group of leaf-monkeys is widely distributed in continental Southeast Asia; the *Presbytis*-group is restricted to the Burmo-Thai-Malay Peninsula, where it is sympatric with the *Trachypithecus*-group; species in the *Trachypithecus*-group are largely allopatric.

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PATHOLOGY OF LABORATORY ANIMALS COURSE

The "Pathology of Laboratory Animals" course will be conducted at the Armed Forces Institute of Pathology on 13-17 September 1976. Military and federal service employees in the veterinary and other medical science fields are requested to consult respective agency regulations for appropriate application procedures. Civilian veterinarians and allied scientists are invited to apply and will be considered on a space available basis.

All applications must be received by 16 August 1976, and may be made by writing to: The Director, Armed Forces Institute of Pathology, Washington, D. C. 20306, Attn: AFIP-EDE. Upon application, non-federal civilians and foreign nationals are required to submit a $125 fee, payable to the Treasurer of the United States. (Telephone number of the Public Information Activities Office of the Armed Forces Institute of Pathology is 202-576-2901)

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