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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. 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* (see Editor's Notes, July, 1966 issue) 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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We thank the San Diego Zoo for permission
to reproduce the cover photograph
of a proboscis monkey (*Nasalis larvatus*)

Managing Editor: Helen Janis Shuman

CONTENTS

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PRIMATE RESOURCES OF BANGLADESH

K. M. Green

National Zoological Park

This paper presents preliminary information on the status of primate populations in Bangladesh. The nonhuman primates found in Bangladesh are *Nycticebus coucang, Macaca mulatta, M. assamensis, Presbytis pileata, P. phayrei,* and *Hylobates hoolock*. With the exception of *Macaca mulatta,* the rhesus macaque, these animals are primarily forest dwellers. Although there is no record of *M. arctoides* nor *M. nemestrina* from Bangladesh, these two species are found in bordering regions of Burma and India (Fooden, 1975, 1976). It is likely that both of these species occur in the Chittagong Hill Tracts, which lie on the Bangladesh-Burma border.

South Asia is a major source of rhesus monkeys for the biomedical and research institutions in the United States and Europe. The recent decrease of rhesus monkey exports from India has acted as a catalyst for exploration of an alternate source of supply.

Bangladesh, formerly East Pakistan, had officially prohibited export of endemic primate species, including the rhesus, under provisions of the Bangladesh Wild Life Preservation Order of 1973. However, a recent 1975 amendment to this legislation permits a quota for *M. mulatta,* under supervision of the Ministry of Forest, Fisheries, and Livestock. Official U. S. Department of Commerce statistics indicate, nonetheless, that Bangladesh has supplied the following numbers of primates to the U. S.: 50 in 1972, 315 in 1973, 340 in 1974, 53 in 1975, and 1,071 in 1976 (Muckenhirn, 1977).

Methods

Survey data reported here were collected over a five-month period, from July to November, 1976. Several modes of transportation were utilized varying with the habitat observed. Habitat consisted of three ecological types: rural cultivation, tea plantation, and forest.

The roadside survey, employing a technique described in Southwick *et al.* (1964), was used in all habitats. Forest areas were also surveyed on foot as well as by car. The procedure for conducting a census was to walk slowly, with minimal noise, and wait five minutes every several hundred meters. This "transect" method was accomplished both alone or accompanied by one guide. Existing trails and creek beds were used to

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transverse the forest.

Results

Primate groups were sighted on 54 instances during the 299 hours of field work. This included 92 hours of transversing forest, 15 hours in tea plantations, and 116 hours censusing cultivated rural areas. Approximately 40 percent of the census hours were conducted in forest habitat, although this represented less than 10 percent of the miles travelled. Travel covered 4,096 km by boat, vehicle, and foot. All sightings of primates were restricted to forest areas. The primate distribution by species in Bangladesh based on personal sightings, information in the literature, and unconfirmed, local reports is presented in Figure 1.

P. pileata was observed most frequently during this survey primarily as a result of its abundance in the Madhupur forest tract. This sal (*Shorea robusta*) forest is located 70 km northeast of Dacca. This species was also observed in the primary forests of Sylhet, which is in the northeastern part of Bangladesh, as well as Chittagong and Cox's Bazar which are on the southeastern peninsula on the Bay of Bengal.

M. mulatta were seen infrequently in the sal forest of Madhupur and on all occasions during this survey. However, they were sighted in Dhamrei village, 20 km northeast of Dacca, and urban animals of this species were sighted on several occasions in Dacca city. These sightings were not made during regular census episodes and are therefore excluded from the data.

During interviews of local people, I was informed that rhesus monkeys raided the "aman," or winter rice crop, particularly during the latter stages of crop maturity. Although I visited many paddy fields during the survey, including the last month of rice maturity, rhesus were never sighted.

In the Madhupur forest local people molested the monkeys by throwing debris and yelling. Yet, under such circumstances, *P. pileata* show little concern and tolerate exceptional abuse. These langurs were easy to observe at close quarters for long periods. However, the macaques would never remain in sight and without exception would scatter and run off when I approached, prohibiting accurate group counts. The precise factors contributing to this different behavioral response between the langur and macaque is difficult to evaluate. But I suspect that hunting pressure, even though minimal, is important, and that the langurs, totally restricted to the forest, are not "pest" problems and are persecuted less.

H. hoolock clearly preferred the less disturbed primary forest. The two sightings of gibbons occurred in the Kalacherra and Lawachera Reserve Forests. Both areas contained human settlements and patches

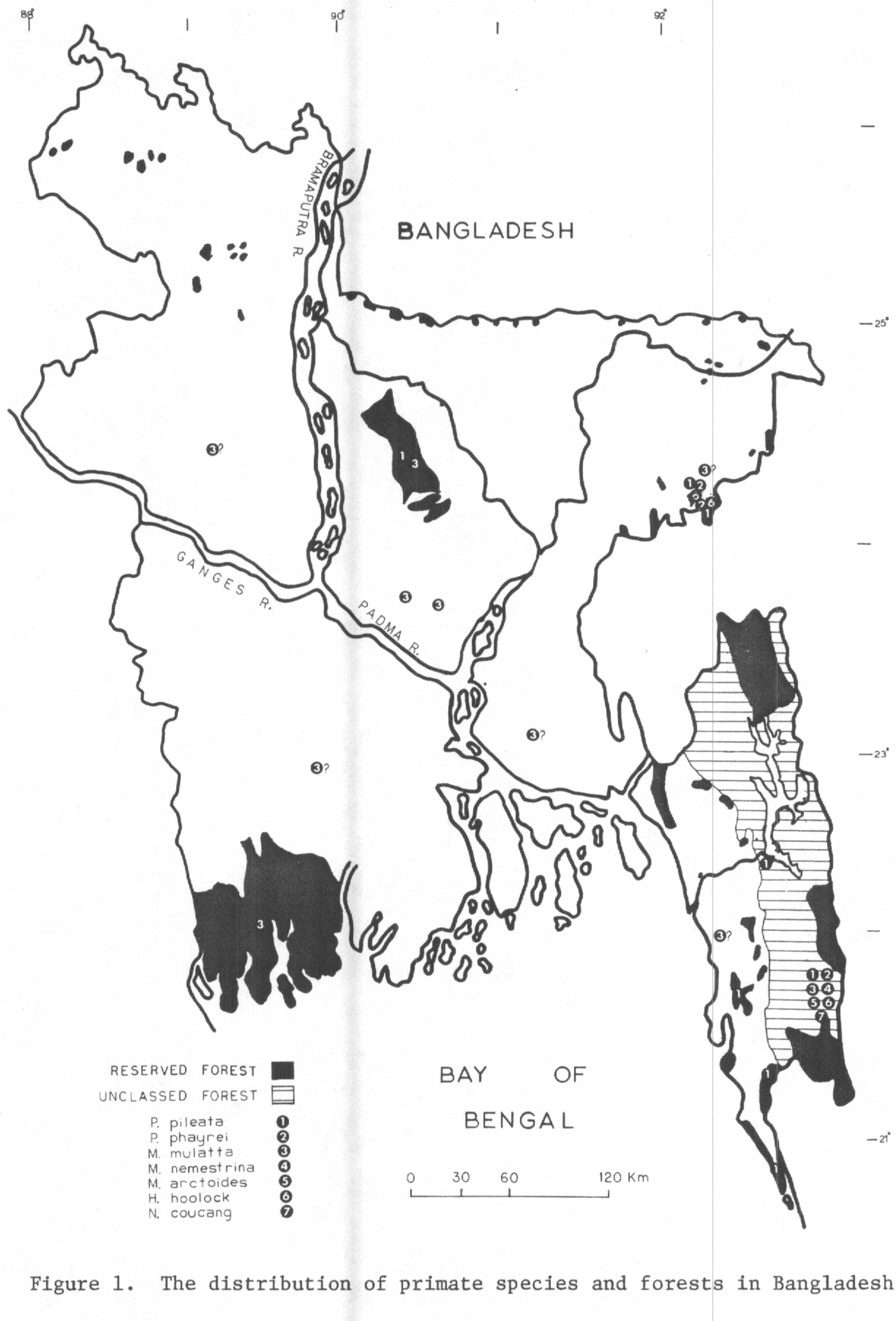

Figure 1. The distribution of primate species and forests in Bangladesh.

of agricultural fields. Adult males, completely black with white eyebrow patches, adult, silver-grey females, and all black juveniles were sighted. Contrary to expectation, certain individuals remained in close proximity for extended periods, permitting excellent observations. In addition to the group sighted in the Kalacherra Reserve, three other groups were heard calling during the same day. These groups, however, are not included in the density estimates.

Density Estimates

Linear distance covered by walking and vehicular travel in forest was converted into square kilometer equivalents. The highest estimated primate density was seen in the Madhupur sal forest with 37.9 individuals and 5.1 groups per sq km (Table 1). *P. pileata* is the most abundant monkey with 31.1 individuals per sq km. The estimated number of groups per sq km is 4.4. *M. mulatta* constituted about 18 percent of the primate fauna in this ecosytem, with 6.8 individuals and 0.7 groups per sq km.

Table 1. Primate Density by Forest Type

	Sal		Secondary		Primary	
Species	I/km^2	G/km^2	I/km^2	G/km^2	I/km^2	G/km^2
Presbytis pileata	31.1	4.4	1.5	0.3	6.0	0.9
Presbytis phayrei	0	0	6.8	1.2	2.1	0.3
Macaca mulatta	6.8	0.7	0	0	0	0
Hylobates hoolock	0	0	0	0	1.6	0.3
Total	37.9	5.1	8.3	1.5	9.7	1.5

Note: I=Individuals. G=Groups

Primary forests surveyed had an estimated density of 9.7 individuals and 1.5 groups per sq km. This estimate is based on the most abundant species, *P. pileata*, having an estimated density of 6.0 individuals and 0.9 groups per sq km, comprising 62 percent of the primate fauna. The lowest estimated primate density was observed in secondary forests with 8.3 individuals and 1.5 groups per sq km. *P. phayrei* were the most frequent animals, with 6.8 individuals and 1.2 groups per sq km.

Discussion

Most sources quote the forest area of Bangladesh to be about 21,756 sq km or 16 percent of the country (Ahmed, 1968; Anon., 1976), but the actual amount of forest is considerably less. Forest Department statistics and reports (Anon., 1969, 1970, 1973, 1974, 1976; Baten, 1969; Chaudhury, 1969; Chowdhury, 1968, 1973) indicate that forest covers 20,580 sq km. Today, forest areas are restricted to the lowland mangrove Sundarban forests in the southwest and higher land areas in Sylhet, Madhupur, the Chittagong Hill Tracts, and Cox's Bazar.

Because of the great land demand for agricultural production, most of the original reed swamp vegetation in the fertile alluvial plain had been removed long ago and today yields to endless paddy fields, dotted with thousands of human settlements. Evidence indicates that forest never existed throughout most of these floodplains (UNDP-FAO, 1971).

During my travels, I noted that many reserve forest areas contained teak or sal monoculture plantations, extensive cleared plots, or poor secondary forest. For example, much of the reserve forest lands in the Chittagong division lack actual forest cover. Hence, of 847 sq km of forest reserve listed for this region, I estimate that only 50% actually contains forest.

Using the available information from published reports and personal observations, I have determined the "equivalent forest habitat" of Bangladesh to be 13,788 sq km or 30 percent less than the official estimates. From this information and the results of my primate survey, I can estimate the forest primate population of Bangladesh.

Primate populations were computed from densities in the following manner. The estimated Madhupur sal forest primate density, 37.8 individuals per sq km, is used to estimate the sal forest primate population in the Mymingsingh-Sylhet region. The primate population in the Sudarbans is calculated from Hendrichs (1975). Population size of the remaining 9,549 sq km of equivalent forest habitat is determined by using 9.7 individuals per sq km, which is the estimated primate forest density. Using the estimated forest primate density survey data for calculating the Hill Tracts primate population yields only an approximation since this region was not surveyed. Nonetheless, by this method of primate population estimation, I estimate a minimum population of about 140,000 animals for Bangladesh. Further field work, particularly in the Hill Tracts, is required for more accurate primate population estimates.

A major surprise of this survey confirmed by interviews with local people is the low numbers of primates. The paucity of *M. mulatta* populations in all habitats is noteworthy. Southwick and colleagues

(1964) also found low densities of these monkeys in central and southern West Bengal, India. This seemed surprising to these investigators since factors attributable to low primate detection were absent. Resources, such as long rows of large well spaced trees along many roadsides, readily available water in roadside irrigation ditches and ponds, and adjacent agricultural crops, which Southwick *et al.* (1964) considered important for supporting primate populations, were found throughout the region.

The same favorable resources and conditions for detecting primates in West Bengal are also found throughout neighboring Bangladesh. However, East Bengal is a more extensive seasonal flood plain, and has potentially less usable dry land than West Bengal during the wet season.

Hindus, unlike Muslims, provision monkeys in many villages, cities, and temple sites throughout the subcontinent. Therefore, during my survey I made special inquiry at Hindu settlements. With several exceptions, I was told that no monkeys presently existed. Upon further questioning it became evident that at some previous time monkeys had inhabited some areas but had disappeared. Attempts to determine the nature of such disappearances proved futile.

Possibly the low density of macaque populations throughout the areas visited in Bangladesh is a result of previous trapping pressures during the last decade. Another explanation, which I propose, is that the original alluvial flood plain habitat and seasonal flooding conditions never permitted the macaque to colonize this region. The argument that macaques are abundant in the Sundarbans does not preclude this assumption since mangrove forests are known to support extensive primate populations (Southwick & Cadigan, 1972), but treeless reed swamp is not a favorable habitat to support macaques. I suspect, because of the close association between Hindu and monkey, that these macaques were introduced from adjoining forest regions into the flood plains.

My inability to enter the two major forest regions of Bangladesh, the Sundarbans and Chittagong Hill Tracts, reduces the effectiveness of this survey but certain trends and problems are still evident. For all primate species, the status of forest habitat remains critical. Earlier comments pertaining to both the high human population density and expected continued high population growth rate project a pessimistic outlook. Increasing numbers of people will result in greater demand for fuel and house construction material. With the exception of cow dung, dead leaves, and jute stalks, the primary source of cooking fuel throughout regions adjacent to forest is fire-wood. In all forest areas visited, poaching of lumber was observed although prohibited. This poaching, due in part to the lack of sufficient forest department manpower and logistical problems in providing adequate protection, is expected to continue and probably increase.

Besides the human pressures, operating for example on the Madhupur sal forest, forest management practices of converting mature forests into sal or teak plantations is detrimental for primates. Personal observations of the author indicate that sal does not appear to contribute significantly to primate diets. Teak is reported to be highly non-palatable to numerous wildlife species (Berwick, 1976), and I never observed any primate species feeding in teak. However, *P. pileata* was seen travelling through a teak plantation to reach an adjacent forest patch.

The tea producing area of Sylhet contains numerous forest refugia varying in size and status. The amount of these forest areas is declining because of expanding tea production and lumber poaching. Perhaps more important is the patchiness of these forest islands which prohibits arboreal primate migration and genetic interchange.

With the exception of rhesus macaques, all primates in Bangladesh require forest habitat for survival. Forest destruction and alteration is projected to continue and possibly accelerate with the high human population growth rate in Bangladesh. Within this context, caution is urged when considering Bangladesh as a primate supply source for the biomedical and research community. If there is no guarantee that such endeavors will concomitantly include long term scientific evaluation of the effect upon primate population dynamics, such exploitation should not proceed. Furthermore, as indicated in this report, several diverse forest ecosystems are in the process of being altered and steps should be taken by the Bangladesh government to actively preserve such habitats.

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SECOND GENERATION BIRTH OF AN *AOTUS* MONKEY

Robert D. Hall

Walter Reed Army Medical Center

On May 25, 1977, a pair of *Aotus* monkeys *(Aotus trivirgatus)* which were born and raised at the Walter Reed Army Institute of Research gave birth to a 92 g female infant. This infant, the 23rd *Aotus* monkey born into our colony during 1977, is the second known second-generation monkey of this species born in captivity. The first such birth occurred at the Lincoln Park Zoological Gardens, Chicago, on February 1, 1977 (Meritt, 1977; see also article by Meritt on p. 11 of this issue).

The parents were born a week apart in April, 1974, during early attempts to breed *Aotus* monkeys in the laboratory. These monkeys were separated from their patents at 8 months of age and have been caged together since then. Both have the phenotype and karyotype (Type I, 2n = 54) reported for *Aotus* monkeys originating from Brazil (Ma, Jones, Miller, Morgan, & Adams, 1976).

Since 1974, *Aotus* monkeys have been difficult to obtain for research due to export restrictions imposed by the governments of South American countries. Early attempts to breed *Aotus* monkeys in captivity have met with variable success (Cicmanec & Campbell, 1974; Renquist, Wyckoff, & Toigo, 1974; and Elliott, Sehgal, & Chalifoux, 1976). The Walter Reed colony, which was recently expanded to over 200 adult monkeys, has had 47 live births and 4 still births from May of 1976 to May, 1977. The occurrence of a second-generation offspring marks an important milestone in the development of a breeding colony of *Aotus*.

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PAIRED SKELETAL PARTS NEEDED

I need access to the following paired skeletal parts of any pongids and cercopithecoids that have weight figures and sex determinations: (1) dentition (maxillary and mandibular). (2) mandible (complete). (3) either right or left femur (complete). Contact: Carlos M. Medina, Department of Anthropology, Columbia University, 452 Schermerhorn Hall, New York, NY 10027)

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VIIth CONGRESS OF THE INTERNATIONAL PRIMATOLOGICAL SOCIETY

First announcement: The VIIth Congress of the International Primatological Society will be held in New Delhi, India, January 1-5, 1979. For details please contact: Dr. T. C. Anand Kumar, Secretary for Asia, International Primatological Society, Department of Anatomy, All India Institute of Medical Sciences, New Delhi, 110016, India.

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SET OF BACK VOLUMES OF NEWSLETTER AVAILABLE

Set of the *Laboratory Primate Newsletter* back to Volume 3 available as a donation to an educational or research institution. Contact: G. A. Sacher, Division of Biological and Medical Research, Argonne National Laboratory, 9700 South Cass Av., Argonne, IL 60439.

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REPRODUCTIVE RECORD OF OWL MONKEYS (*AOTUS TRIVIRGATUS*) AT LINCOLN PARK ZOOLOGICAL GARDENS

Dennis A. Meritt Jr.

Lincoln Park Zoological Gardens

Between 1969 and 1977, more than 24 owl monkeys (*Aotus trivirgatus*) have been born at the zoological gardens to 5 pairs of breeders. The most prolific pair, both of Colombian origin, produced 10 single offspring between 1969 and 1975. This pair was formed in 1969 and continued until the death of the male in 1975. Offspring produced and birth dates are given in Table 1.

Table 1. Births Between 1969 and 1975 to One Pair of Colombian Origin Owl Monkeys

Birth Date	Sex	Birth Date	Sex
August 18, 1969	Male	March 9, 1973	Female
March 18, 1970	Male	August 12, 1973	Male
January 31, 1971	Female	March 25, 1974	Male
October 14, 1971	Male	November 23, 1974	Male
May 19, 1972	Female	June 5, 1975	Female

The female was paired with a new male in December of 1976 and this new pair bond produced a single infanc on June 1, 1977. The remarkable part of this birth is the age of the female. She was received from Colombia as an adult in early 1964. At the present time she is over 13 years of age and is still able to reproduce. The current breeding male of this pair is himself over 11 years of age.

All births to this species at the zoological gardens have been single offspring. Each nursed within eight hours of birth and was observed on the male parent within 12 hours of birth (maximums). *Aotus* at our facility are maintained as pairs or pairs with their most recent offspring. Large groupings have always resulted in fighting and decreased reproduction, regardless of sexual composition or behavioral assessment.

Behavioral observations, nutritional needs, and management techniques have been recorded for the past nine years (Meritt, 1977, in press).

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Pairs of family groups of *Aotus* from Colombia, Bolivia, Brazil, and the Republic of Panama are now in the breeding project, and additional animals are being sought. With an increase in the number of sexually mature, compatible breeding pairs, the potential number of owl monkeys that can be bred at the zoological gardens is greater than it has been. A full second generation offspring was produced earlier this year (also see article by Hall on p. 9 of this issue).

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THREE SPECIES OF MARMOSETS UNDER REVIEW

The cottontop (*Saguinus oedipus*), pied (*S. bicolor*), and white-footed tamarins (*S. leucopus*) are being reviewed by the U. S. Fish and Wildlife Service to determine whether they should be listed as Threatened or Endangered under the Endangered Species Act of 1973 (see article on pp. 5-7 of April, 1977 issue of the *Laboratory Primate Newsletter*). Notice of this review was published in the *Federal Register* on Aug. 11, 1977. Those wishing to provide information to the Fish and Wildlife Service on these species should do so before Jan. 1, 1978. Comments should be addressed to the Director, (FWS/OES), U. S. Fish and Wildlife Service, U. S. Department of the Interior, Washington, DC 20240. For further information contact Mr. Keith M. Schreiner, Associate Director, Federal Assistance, Fish and Wildlife Service, U. S. Department of the Interior, Washington, DC 20240, (202) 343-4646.

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MACAQUES FOR SALE

The following are available: Three stumptailed monkeys (*Macaca arctoides*), 2 males and 1 female, all about 15 years old; and 10 rhesus monkeys (*M. mulatta*), all females about 7 years old. All animals are jungle born and have been used in behavioral studies. They have been members of a colony for the past four years. Purchaser must incur cost of animals, transportation, and must provide transport cages. Contact: James P. Motiff, Department of Psychology, Hope College, Holland, MI 49423 (Phone 616-392-5111).

* * *

McPHERSON RECEIVES PHS HONOR AWARD

Charles W. McPherson, D.V.M., was awarded the Public Health Service (PHS) Commendation Medal for outstanding service as Director of the Animal Resources Program of the Division of Research Resources, National Institutes of Health. The PHS honor award is presented to individuals demonstrating outstanding service and leadership in the performance of their duties as Commissioned Officers in the Public Health Service of the Department of Health, Education, and Welfare.

A commissioned officer of the PHS since 1956, Dr. McPherson received both his Sc.B. and D.V.M. degrees at the University of Minnesota. He earned a masters degree in Public Health at the University of California, Berkeley. He became associated with the National Institutes of Health (NIH) in 1956, and now heads the Animal Resources Program which is administered by NIH's Division of Research Resources. The program, with an approximate annual budget of $20 million, supports projects that enable biomedical scientists to effectively use animals in human-related research.

In receiving the PHS Commendation Medal June 27, 1977, Dr. McPherson was cited for his exceptional leadership and initiative in the field of veterinary science which has significantly added to the overall biomedical research effort of the National Institutes of Health.

Specifically, Dr. McPherson has been responsible for the development of the DHEW Guide for the Care and Use of Laboratory Animals; the development of a Cost Analysis and Rate Setting Manual for Animal Resources facilities; implementation of the NIH program for the institutional response to the Animal Welfare legislation of 1970 and 1972; and initiation of studies leading to the identification of and plans for the alleviation of the severe shortages of nonhuman primates for biomedical research purposes.

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RHESUS MONKEYS AVAILABLE

We have rhesus monkeys that have been free of T.B., parasites, and nutritional deficiencies for over 5 years and are currently in excellent health. These animals are now available for use in our facility or are for sale. Most have been born in our facility, have not been used for testing, and have exact birth dates and medical histories. Animals of either sex are available in most age ranges. Contact: Dr. G. N. Rao, Endocrine Laboratories, P.O. Box 7546, 3301 Kinsman Blvd., Madison, WI 53704. (Telephone: 608-241-4108)

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LABORATORY PRIMATE NEWSLETTER QUARTERLY SURVEY: FOURTH QUARTER 1976 AND FIRST QUARTER 1977

The present report is one of a series summarizing data from the quarterly surveys being conducted by the *Laboratory Primate Newsletter*. The data in Tables 1 and 2 are based on reports from the following facilities: California, Delta, New England, Oregon, Washington (including the Field Station), Wisconsin and Yerkes Regional Primate Research Centers, Laboratory for Experimental Medicine and Surgery in Primates (LEMSIP). National Institutes of Health, and the Southwest Foundation for Research and Education. NIH reports include both the Primate Quarantine Unit and the Primate Research Units. The data in Tables 3 and 4 are based on reports from all the above except the New England Center and LEMSIP. (See the April, 1977 issue for the previous survey report.)

TABLE 1: MORTALITY SUMMARY BY SYSTEM: OCTOBER 1-DECEMBER 31, 1976

SPECIES	Generalized	Integumentary	Musculoskeletal	Respiratory	Cardiovascular	Digestive	Urogenital	Nervous	Endocrine	Neoplasia	Trauma	Unspecified
Pan troglodytes					1							1[d]
Pongo pygmaeus	1					1						
Macaca arctoides	4					6	1		1		3	1
M. fascicularis	3	1		3		3					3	5
M. mulatta	28		1	32[c]	3	24	8			1	26	18
M. nemestrina	3			15		18	2	1			10	
M. nigra[a]	2					4					1	
M. radiata	1											1
M. hybrids						2					1	
Erythrocebus patas	3							1			1	1
Cercopithecus aethiops	4											4
Papio anubis				1								
P. spp.	12			6		10	3				4	12
Theropithecus gelada						1						
Saimiri sciureus	24			3		3					1	18
Cebus albifrons	1											1
C. apella	1			3								
Aotus trivirgatus	14			2	1	2	2					6
Callithrix jacchus	1						1					
Saguinus mystax	8			2								
S. nigricollis				1		1					2	1
S. oedipus	34[b]		1[b]	14[b]	1[b]	32[b]		2[b]	2[b]			24[b]
Galago crassicaudatus							2				1	1
Lemur catta											1	
L. fulvis											1	
L. macaco				1			1					
TOTALS	144	1	2	73	6	107	20	4	3	1	53	94

[a]Also referred to as *Cynopithecus niger*.

[b]Thirty marmosets were received from a commercial importer with twenty-six showing seveve emaciation and five being prostrate on arrival. Within three weeks, with most deaths within the first week, twenty-four had died with the following specific causes: Inanition-nutritional wasting and pneumonia-klebsiella, 16; ear infection, 1; dysentery, 1; intestinal obstruction, 1; liver flukes, 2; meningitis, 1; candidiasis, 1; filariasis, 1 (Total, 24).

[c]Includes 7 cases tuberculosis.

[d]Study related.

TABLE 2. CENSUS, NUMBER OF BIRTHS, AND MORBIDITY SUMMARY BY SYSTEM
OCTOBER 1-DECEMBER 31, 1976

SPECIES	Census	Births	Generalized	Integumentary	Musculoskeletal	Respiratory	Cardiovascular	Digestive	Urogenital	Nervous	Endocrine	Neoplasia	Trauma	Unspecified
Gorilla gorilla						1		1						
Pan troglodytes	389	13	6	2	2	7		75	3	1			4	8
Pongo pygmaeus	33	1				3	3	12	1				1	
Macaca arctoides	271	9		5	2	3	9	24	2	4			6	9
M. assemensis			1					1						
M. cyclopis	86													1
M. fascicularis	539	15	3	5		1		2	1				5	1
M. mulatta	7762	123	27	143	45	87	39	729[c]	51	7		1	73	80
M. nemestrina	1179	69	7	1		7		73	11				15	
M. nigra[a]	83	5	1						1					
M. radiata	288	3		12	8	2		48	8	2			2	2
M. hybrids	29													
Erythrocebus patas	118		2										2	1
Cercocebus atys	49													
Cercopithecus aethiops	52	1							1				9	
Papio anubis	38	2											1	
P. cynocephalus	107			8	5		1	2	3					
P. papio	56	3		7				17						1
P. spp.	1311	59	10	1				16	1				139	30
Saimiri sciureus	925	4	7	1		2		3	2	1			7	
Ateles geoffroyi		2												
Cebus apella	86												2	
C. spp.	39													
Aotus trivirgatus	273			1		3	6	4	1				1	1
Saguinus mystax	108													
S. nigricollis	32	1		2				17			1			1
S. oedipus	210	4	27[b]	1	1	9		16					2	1
S. spp.	30													
Galago argentatus	29													
G. crassicaudatus	104	4												
Lemur catta	83		3					1						
L. fulvis	90	3												
TOTALS	15,399	321	94	189	66	125	58	1038	86	15	1	1	269	136

[a]Also referred to as *Cynopithecus niger*.
[b]See (b) under Mortality table.
[c]Includes 2 *Salmonella*, 13 *Shigella*.

TABLE 3: MORTALITY SUMMARY BY SYSTEM: JANUARY 1-MARCH 31, 1977

SPECIES	Generalized	Integumentary	Musculoskeletal	Respiratory	Cardiovascular	Digestive	Urogenital	Nervous	Endocrine	Neoplasia	Trauma	Unspecified
Pan troglodytes	2			2		1					1	
Pongo pygmaeus				1		1						
Macaca arctoides	1			1		2					3	2
M. fascicularis		1		1		1					1	
M. fuscata					1							
M. mulatta	29		2	17	2	30	6	1	1	1	10	29
M. nemestrina	4			6		24	1	1		1	5	1
M. nigra[a]						1						1
M. radiata	3			1	1	4					1	1
M. hybrids	1	1						1			1	
Erythrocebus patas	1											
Cercocebus atys												1
Cercopithecus aethiops						1						
Papio anubis											1	
P. cynocephalus				1								
P. spp.	6			7		11	1				2	13
Theropithecus gelada	1						2					4
Saimiri sciureus	8							1				19
Saguinus mystax	1			1								
S. nigricollis	1					2						
S. oedipus	3			2		2					1	
Galago crassicaudatus						2		1			2	
Lemur macaco			1					1				
TOTALS	61	2	3	40	4	82	10	5	1	2	26	71

[a]Also referred to as *Cynopithecus niger*.

TABLE 4. CENSUS, NUMBER OF BIRTHS, AND MORBIDITY SUMMARY BY SYSTEM
JANUARY 1-MARCH 31, 1977

SPECIES	Census	Births	Generalized	Integumentary	Musculoskeletal	Respiratory	Cardiovascular	Digestive	Urogenital	Nervous	Endocrine	Neoplasia	Trauma	Unspecified
Gorilla gorilla			2	1		2		3			3			
Pan troglodytes	240	6	3	3	5	30	2	33	2	2				
Pongo pygmaeus	33			1		6	1	9						
Macaca arctoides	209	4	2	3		2	3	19					9	2
M. fascicularis	344	12	1	2	1	32		19	1				5	
M. fuscata	223	12												
M. mulatta	7785	271	21	81	108	36		529	46	7	2		102	18
M. nemestrina	1024	75	11	3	1	9		92	16				37	13
M. nigra[a]	129	3			1	2		1	1				1	
M. radiata	283	19		6	4	4	4	33	17	2			2	8
M. hybrids	33	3			1					1			1	
Erythrocebus patas	116	1												
Cercopithecus aethiops	50	1											1	
Papio anubis	38	4	1										1	
P. cynocephalus	68		1	2				1		1			6	5
P. papio	57	1		6	1			10						
P. spp.	1160	41	31	1				29					187	9
Saimiri sciureus	752	4	9		4			1	1				4	
Cebus apella	85		1											
Saguinus mystax	112													
S. nigricollis	25				2			7						1
S. oedipus	71	2	1											
Galago argentatus	29	2												
G. crassicaudatus	104	1												
Nictocebus coucang								1					1	
Lemur catta	82			4				2					4	
L. fulvis	93	6												
L. macaco	25				1									
TOTALS	13,170	468	84	113	129	123	10	789	84	13	5	0	361	56

[a]Also referred to as *Cynopithecus niger* .

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

Books

Primate Bio-Social Development: Biological, Social, and Ecological Determinants. Susanne Chevalier-Skolnikoff & Frank E. Poirier (Eds.) New York: Garland. 550 pp. [Price: $45]

This volume contains original articles on primate socialization based on both laboratory and field research by researchers in the fields of anthropology, psychology, ethology, and zoology. Contents: 1. Introduction, by F. E. Poirier. Part One. BIOLOGICAL DETERMINANTS OF SOCIALIZATION. 2. Piaget's sensorimotor series in an infant macaque: A model for comparing unstereotyped behavior and intelligence in human and nonhuman primates, by S. T. Parker. 3. Brain structure and intelligence in macaques and human infants from a Piagetian perspective, by K. R. Gibson. 4. A Piagetian model for describing and comparing socialization in monkey, ape, and human infants, by S. Chevalier-Skolnikoff. 5. The social ecology of defects in primates, by G. Berkson. 6. The social development of a handicapped infant in a free-living troop of Japanese monkeys, by L. M. Fedigan & L. Fedigan. Part Two. SOCIAL INFLUENCES AND SOCIALIZATION. 7. Perceptual properties of attachment in surrogate-reared and mother-reared squirrel monkeys, by J. Kaplan. 8. A preliminary report on weaning among chimpanzees of the Gombe National Park, Tanzania, by C. B. Clark. 9. Socialization and object manipulation of wild chimpanzees, by W. C. McGrew. 10. Orang-utan maturation: Growing up in a female world, by D. A. Horr. 11. Incest avoidance among human and nonhuman primates, by W. J. Demarest. 12. The role of learning phenomena in the ontogeny of exploration and play, by J. D. Baldwin & J. I. Baldwin. 13. The effects of social isolation on sexual behavior in *Macaca fascicularis*, by T. J. Testa & D. Mack. 14. Foot clasp mounting in the prepubertal rhesus monkey: Social and hormonal influences, by K. Wallen, C. Bielert, & J. Slimp. 15. Response to mother and stranger: A first step in socialization, by L. A. Rosenblum & S. Alpert. 16. The influence of social structure on squirrel monkey socialization, by L. A. Rosenblum & C. L. Coe. 17. Some behavioral observations of surrogate- and mother-reared squirrel monkeys, by J. Kaplan. Part Three. ECOLOGICAL DETERMINANTS OF SOCIALIZATION. 18. Socialization, social structure, and ecology

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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 SJ-50, University of Washington, Seattle, WA 98195. 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.

of two sympatric species of lemur, by R. W. Sussman. 19. A comparison of early behavioral development in wild and captive chimpanzees, by N. A. Nicolson. Part Four. EVOLUTIONARY PERSPECTIVE. 20. Bio-social approach to human development, by R. C. Savin-Williams & D. G. Freedman. 21. Socialization in mammals with an emphasis on nonprimates, by M. Bekoff.

Behavioral Primatology: Advances in Research and Theory (Vol. 1). Allan M. Schrier (Ed.) Hillsdale, NJ: Lawrence Erlbaum Associates, 1977. (Distributed by Halsted Press Division of John Wiley.) 194 pp. [Price: $14.95]

The first volume in a new series whose purpose is to provide chapters which are primarily critical summaries or syntheses of selected lines or areas of behavioral research on nonhuman primates. Contents: 1. Use of common and scientific nomenclature to designate laboratory primates, by M. W. Terry. 2. Information processing and discrimination learning set, by D. L. Medin. 3. Interactions between sensory modalities in nonhuman primates, by G. Ettlinger. 4. Language behavior of apes, by D. M. Rumbaugh. 5. Sociosexual behaviors of nonhuman primates during development and maturity: Social and hormonal relationships, by D. A. Goldfoot.

Molecular Anthropology: Genes and Proteins in the Evolutionary Ascent of the Primates. Morris Goodman & Richard E. Tashian (Eds.) New York: Plenum, 1976. 466 pp. [Price: $35]

The purpose of this volume is to explore the present state of knowledge in molecular anthropology, a discipline which is concerned with the study of primate phylogeny and human evolution through the analysis of genetic information contained in proteins and polynucleotides. The data are examined especially as they relate to the phyletic position of man and to the trends that shaped the direction of his evolution. Authors are from the fields of protein and nucleotide chemistry, genetics, statistics, paleontology, and physical anthropology. Contents: I. BACKGROUND TO SOME KEY ISSUES. 1. What is molecular anthropology? by G. W. Lasker. 2. Mutation and molecular evolution, by F. Vogel, M. Kopun, & R. Rathenberg. 3. The fossil record of primate phylogeny, by E. L. Simons. 4. Splitting times among hominoids deduced from the fossil record, by A. Walker. II. MOLECULAR EVOLUTION AS INTERPRETED BY MATHEMATICAL MODELS. 5. Information theory, molecular evolution, and the concepts of von Neumann, by L. L. Gatlin. 6. Random and nonrandom processes in the molecular evolution of higher organisms, by R. Holmquist. 7. Proof for the maximum parsimony ("Red King") algorithm, by G. W. Moore. III. PRIMATE PHYLOGENY AND THE MOLECULAR CLOCK CONTROVERSY. 8. Molecular systematics of the primates, by V. M. Sarich & J. E. Cronin. 9. Immunodiffusion evidence on the phylogeny of the primates, by H. T. Dene, M. Goodman, & W. Prychodko. 10. Evolutionary rates in proteins: Neutral mutations and the molecular clock, by W. M. Fitch & C. H. Langley. IV. PRIMATE EVOLUTION INFERRED FROM AMINO ACID SEQUENCE DATA. 11. Evolution of the primary structures of primate and other vertebrate hemoglobins, by G. Matsuda. 12. The hemoglobins of *Tarsius bancanus*, by J. M. Beard & M. Goodman. 13. Old World Monkey hemoglobins: Deciphering phylogeny from complex patterns of molecular evolution, by D. Hewett-Emmett, C. N. Cook, & N. A. Barnicot. 14. Structure and function of baboon hemoglobins, by B. Sullivan, J. Bonaventura, C. Bonaventura, & P. E. Nute. 15. Evolution of myoglobin amino acid sequences in primates and other vertebrates, by A. E. Romero-Herrera, H. Lehmann, K. A. Joysey, & A. E. Friday. 16. Evolution of carbonic anhydrase in primates and other mammals, by R. E. Tashian, M. Goodman, R. E. Ferrell, & R. J. Tanis. 17. Toward a genealogical description of the primates, by M. Goodman. V. MULTIGENE FAMILIES AND GENETIC REGULATION IN THE EVOLUTION OF MAN. 18. Comparative aspects of DNA in higher primates, by K. W. Jones. 19. Evolutionary origin of antibody specificity, by N. Hilschmann, H. Kratzin, P. Altevogt, E. Ruban, A. Kortt, C. Staroscik, R. Scholz, W. Palm, H. U. Barnikol, S. Barnikol-Watanabe, J. Bertram, J. Horn, M. Engelhard, M. Schneider, & L. Dreker. 20. Programs of gene action and progressive evolution, by E. Zuckerkandl.

The Great Apes: A Study of Anthropoid Life. Robert M. Yerkes & Ada W. Yerkes. New York: Johnson Reprint Corp., 1970. (Originally published by Yale University Press, 1929.) 652 pp. [Price: $38.50]

This was intended to serve as a handbook and critical evaluation of the literature on the life of the Great Apes. Contents: Part I. HISTORICAL. 1. Ancient knowledge of the anthropoid apes. 2. Knowledge of the anthropoids through the Middle Ages to the end of the seventeenth century. 3. Progress of acquaintance with the anthropoid apes during the eighteenth century. 4. The emergence of the gorilla. 5. Terms, types, and relations. Part II. GIBBON. 6. The habits and life history of gibbon. 7. Affectivity and its expressions in gibbon. 8. Receptivity and adaptivity in gibbon. Part III. ORANG-OUTAN. 9. Structural appearance, species, distribution, and habitat of orang-outan. 10. Mode of life of orang-outan. 11. Capture, life in captivity, and diseases of orang-outan. 12. Social relations and life history of orang-outan. 13. Affective behavior and speech in orang-outan. 14. Nervous system and receptivity of orang-outan. 15. Intelligence of orang-outan: Perception, endowment, and acquisition. 16. Intelligence of orang-outan: Experimental studies. Part IV. CHIMPANZEE. 17. Structural appearance, species, distribution, and habitat of chimpanzee. 18. Manner of life, locomotion, nesting, and capture of chimpanzee. 19. Habits of eating and drinking, hygiene, and care in captivity of chimpanzee. 20. Social relations of chimpanzee. 21. Life history of chimpanzee. 22. Affective behavior of chimpanzee: Temperament and expressivity. 23. Affective behavior of chimpanzee: Behavioral patterns of emotion. 24. Affective behavior of chimpanzee: Vocalization, speech, language, and intercommunication. 25. Nervous system and receptivity of chimpanzee. 26. Perceptual processes of chimpanzee. 27. Intelligence of chimpanzee: Opinions and methods of inquiry. 28. Intelligence of chimpanzee: Modes and conditions of behavioral adaptation. 29. Intelligence of chimpanzee: Adaptation of environment *versus* self-adaptation. 30. Intelligence of chimpanzee: Imaginal processes. Part V. GORILLA. 31. Structural appearance, races, distribution, and habitat of gorilla. 32. Mode of life, locomotion, and handedness of gorilla. 33. Nesting and feeding activities in gorilla. 34. Hygiene, health, and care in captivity of gorilla. 35. Social relations of gorilla. 36. Life history of gorilla. 37. Affective behavior of gorilla: Temperament and varieties of expression. 38. Affective behavior in gorilla: Varieties of emotional pattern, and motivation. 39. Nervous system and receptivity of gorilla. 40. Observational ability and perceptual processes in gorilla. 41. Opinions concerning intelligence of gorilla. 42. Methods of studying behavioral adaptivity in gorilla. 43. Concerning memory, insight, and foresight in gorilla. Part VI. COMPARISONS AND CONCLUSIONS. 44. Comparison of anthropoid types. 45. Comparison of primate types. 46. Anthropoid research in retrospect and prospect.

Chimpanzees: A Laboratory Colony. Robert M. Yerkes. New York: Johnson Reprint Corp., 1971. (Originally published by Yale University Press, 1943.) 321 pp. [Price: $21]

In this volume, Yerkes presented his personal observations on the behavior, care, and handling of chimpanzees. Contents: PROLOGUE. Servants of science. GENERAL DESCRIPTION. From jungle to laboratory. Good tempers and bad. Social behavior. Life's cycles. Male and female. MENTALITY. The world of the chimpanzee. Looking toward intelligence. Experience the teacher. Memory, foresight, and insight. Language and symbolism. CARE AND HANDLING. House and home. Feeding chimpanzees. Breeding and rearing. An ounce of prevention. EPILOGUE. The story of an idea. References and selected bibliography.

Directories

Animal Resources: A Research Resources Directory. Bethesda, MD: U. S. Dept. Health, Education, and Welfare, 1977. (DHEW Publication No. (NIH) 77-1431.)

This 56-page directory describes the animal research resources of NIH's Division of Research Resources (DRR). In addition to a complete listing of NIH's major Primate Research Centers, the directory identifies animal diagnostic laboratories, animal information projects, animal reference centers, and special colony and model study centers currently supported by DRR. The Directory indicates the services provided, areas of research interest, principal investigators or directors, addresses, and telephone numbers. A contact person is identified for each resource. A geographic index is included, listing resources by state, and within each state. A map shows the locations of the Primate Research Centers and animal diagnostic laboratories throughout the country. A single free copy of this directory may be secured by writing to the Research Resources Information Center, 1776 East Jefferson St., Rockville, MD 20852, or by request from the Office of Science and Health Reports, Division of

Research Resources, National Institutes of Health, Bethesda, MD 20014.

Biotechnology Resources: A Research Resources Directory. Bethesda, MD: U. S. Dept. Health, Education, and Welfare, 1977. (DHEW Publication No. (NIH) 77-1430.)

This 56-page directory describes NIH's Division of Research Resources' grantee facilities which may be used by biomedical researchers. Facilities supported by the Biotechnology Resources Program include large-scale and mini-computer systems, biochemical and biophysical instruments, million-volt electron microscopes, electron microprobes, biomedical engineering technologies, and production of biochemical and cellular materials. The Directory details the instruments, services, and current research applications at the 56 individual resources listed. Complete names, addresses, and phone numbers of the Principal Investigators and User Contact Persons are also included. Information for obtaining this directory is the same as in the previous reference.

Bibliographies

Recent Books on Primatology and Research with Primates. Seattle: Primate Information Center, 1977. 105 Citations. [Price: $2.00. Send orders to: Primate Information Center, Regional Primate Research Center (SJ-50), University of Washington, Seattle, WA 98195]

The Use of Marihuana and Its Components in Nonhuman Primates. Benella Caminiti & Jean Balch Williams. Seattle: Primate Information Center, 1977. 92 Citations with Species Index. [Price: $1.50. Order address same as in the previous reference.]

Disease

Pulmonary acariasis in Old World monkeys. Kim, J. C. S. (Dept. of Pathology, Michigan State Univ., East Lansing, MI 48824) *Veterinary Bulletin*, 1977, *47*, 249-255.

It is likely that infection with respiratory mites may predispose to other respiratory infections which contribute to the high mortality of monkeys caught in the wild. It is also evident that no clear interpretation can be made of the results of experimental pathology and physiology in studies of respiratory diseases in animals which are already infected with mites. The projected use of nonhuman primates in the "Cancer Conquering Program" initiated by the National Institutes of Health emphasizes the need for more thorough knowledge concerning the spontaneously arising diseases of monkeys. Despite the demonstrated high incidence of lung mite infection in Old World monkeys, this review indicates that almost nothing is known of the life history and physiology of the parasite or of the pathogenesis or the ecology of the disease. Increased knowledge in these areas is required for the efficient control of mite infection in research populations. The ability of a parasite to survive in a particular host depends on several factors. Ecology, social behavior patterns of primates, and host immunity may all play a role in maintaining this internal parasite among susceptible primate populations. Since biomedical research on national health problems is directed toward obtaining models for human studies, it is concluded that further investigations on this neglected primate disease should be carried out.

Viral infections of the captive Kenya baboon (*Papio cynocephalus*): A five-year epidemiologic study of an outdoor colony. Rodriguez, A. R., Kalter, S. S., Heberling, R. L., Helmke, R. J., & Guajardo, J. E. (Southwest Foundation for Research and Education, PO Box 28147, San Antonio, TX 78284) *Laboratory Animal Science*, 1977, *27*, 356-371.

Rectal swabs, throat swabs, fecal samples, tissues, and sera were collected from 334 adult and infant Kenya baboons in captivity over a 5-year period. A total of 4,893 specimens were collected, resulting in the isolation of 582 viral isolates (11.9%). The month of November yielded the lowest isolation rate, while the month of January produced the highest rate. The most commonly isolated viruses in adults and infants were SV6 and SV23, followed by N125, SV15, and SV17 in that order in adults, and SA7, N125, SV15, V340, and SV17 in that order in infants. Nine serotypes, namely enteroviruses SV19, SV42, SA5, A13, and N203, as well as adenoviruses SV15, SV20, SV31, and SV37, were isolated only from adults. Two adenovirus serotypes, SA7 and V340, were recovered predominantly from infants.

Monkey models in dental research. Dreizen, S., & Levy, B. M. (University of Texas, Dental Science Institute, PO Box 20068, Houston, TX 77025) *Journal of Medical Primatology*, 1977, *6*, 133-144.

There has been a striking increase in the use of nonhuman primate models in all major areas of dental research since this subject was last reviewed in 1970. The search for a suitable simian surrogate for man in which to investigate simulated human oral diseases has encompassed primate species ranging from the marmoset to the chimpanzee. Old and New World monkeys have been shown to be superior to laboratory rodents and small mammals for probes into the pathogenesis and prevention of periodontal disease. Monkeys are also proving invaluable as experimental models in dental caries, oral cancer, cleft palate, surgical orthodontic and oral implant research.

Elimination of the *Shigella* carrier state in rhesus monkeys (*Macaca mulatta*) by trimethoprim-sulfamethoxazole. Pucak, G. J., Orcutt, R. P., Judge, R. J., & Rendon, F. (The Charles River Breeding Laboratories, 251 Ballardvale St., Wilmington, MA 01887) *Journal of Medical Primatology*, 1977, *6*, 127-132.

The *Shigella* carrier state was eliminated from its nonhuman primate host, *Macaca mulatta*. Each of 31 animals was treated twice a day for 10 consecutive days with 16 mg trimethoprim and 80 mg sulfamethoxazole delivered via stomach tube. Fresh rectal swab and stool enrichment cultures were taken for seven consecutive days as well as the 35th and 78th days after treatment, and all were negative for shigellae. In addition, no clinical signs of shigellosis were observed during or following an extensive period of stress.

Physiology

Assessment of obesity in pigtailed monkeys (*Macaca nemestrina*). Walike, B. C., Goodner, C. J., Koerker, D. J., Chideckel, E. W., & Kalnasy, L. W. (Regional Primate Research Center, University of Washington, Seattle, WA 98195) *Journal of Medical Primatology*, 1977, *6*, 151-162.

Obesity was studied in a colony of 873 *Macaca nemestrina* to establish tools for epidemiologic studies, to examine a genetic form of obesity, to document age/sex relationships to obesity, and to compare metabolic profiles of obese and normal monkeys. Age/weight growth curves were analyzed to select the most obese monkeys and age- and sex-matched normal controls. Degree of adiposity was determined using tritiated water for estimation of lean body mass. Body weight, anterior trunk height, and abdominal and triceps skinfolds were measured. Fasting insulin, fasting free fatty acids, and glucose disappearance rate were determined. The results give evidence of similarities between macaque and human obesity.

Heart rate in caged *Macaca fascicularis:* Effects of short-term physical exercise. Malinow, M. R., Hill, J. D., & Ochsner, A. J., III. (Oregon Regional Primate Research Center, Beaverton, OR 97005) *Journal of Medical Primatology*, 1977, *6*, 69-75.

Electrocardiograms were recorded hourly for five days in 16 caged *Macaca fascicularis* by means of a miniaturized ECG transmitter connected to two chest leads. The lowest heart rates were 135 ± 35 (mean $\pm$ SD, $n = 31$) beats/min at 5 a.m., and the highest were 192 ± 22 ($n = 29$) beats/min at 3 p.m. Sinus arrhythmia was common. Eight of the animals were trained to exercise in a specially designed enclosed treadmill; their heart rates were recorded daily during two 10-min periods of running at 3.4 km/h. Transfer of the monkeys ($n = 40$) to the treadmill increased heart rate from 186 ± 24 to 228 ± 23 beats/min; exercise further increased it to 271 ± 8 beats/min.

Normal acid-base status of arterial blood from the conscious, chair-restrained squirrel monkey. Horstman, D. H., & Banderet, L. E. (US Army Research Institute of Environmental Medicine, Natick, MA 01760) *Journal of Medical Primatology*, 1977, *6*, 176-180.

Normal acid-base status of arterial blood ($pH_a = 7.40$, $P_aCO_2 = 38.1$ (Torr) was demonstrated for conscious, restrained squirrel monkeys when environmental stimuli were minimized and monkeys were habituated to experimental procedures. These results indicate the potential for using squirrel monkeys in experiments in which normal acid-base status is a significant factor.

Blood groups of crab-eating macaques (*Macaca fascicularis*) demonstrated by isoimmune rhesus monkey (*Macaca mulatta*) sera. Moor-Jankowski, J., Wiener, A. S., Socha, W. W., & Valerio, D. A. (Laboratory for Experimental Medicine and Surgery in Primates (LEMSIP), New York University Medical Center, 550 1st Ave., New York, NY 10016) *Journal of Medical Primatology*, 1977, *6*, 76-86.

Twenty-one isoimmune sera produced in rhesus monkey containing type-specific antibodies for simian-type red cell antigens were tested for their cross-reactivity with red cells from crab-eating macaques. The majority of the antisera gave cross-reactions determining polymorphisms in the red cells of crab-eating macaques, homologous to those of rhesus monkeys. These results attest to the close taxonomic relationship between the two species of macaques, and have the practical implication that isoimmune sera produced for blood typing can also be used for typing red cells from related species, as has been also observed in studies on apes.

Immunogenetic studies on the rhesus monkey (*Macaca mulatta*): XI. Use of blood groups in problems of parentage. Sullivan, P. T., Blystad, C., & Stone, W. H. (Reprint requests to W. H. Stone, Laboratory of Genetics, University of Wisconsin, Madison, WI 53706) *Laboratory Animal Science*, 1977, *27*, 348-451.

A battery of 21 alloimmune blood typing reagents was developed and used for resolving cases of disputed patentage in the rhesus monkey. Using these reagents, the breeding records of a large colony of rhesus monkeys were monitored. Among 1,263 complete families typed, 46 (3.6%) disputed parentage cases were discovered by excluding an assigned parent. Of these disputed parentage cases, 76% were resolved and the most probable parents assigned. In addition, the paternity of 63% of the infants born into a man-made troop which included several unrelated adult males was determined. The probability of excluding an incorrectly assigned (randomly chosen) male as a father was calculated as 73% when all 21 reagents are employed.

Behavior

New data and a discussion of infant killing in Old World monkeys and apes. Angst, W., & Thommen, D. (Zoological Institute of Basel University, Basel, Switzerland) *Folia primatologica*, 1977, *27*, 198-229.

Information on infant killing by males is reviewed and extended by personal communications and observations. Most cases of infant killing reported occurred during periods when a new alpha male was establishing himself and during arranged encounters of strangers or unfamiliar individuals in captivity. There seems to be no specific releasing stimuli for infant killing, but rather the lack of familiarity between male and females, their nonacceptance of him in the whole set of roles tied to the alpha status, and his special motivational condition as new alpha lead him to a state, in which attacks on infants may result. Infant killing is considered to have a selection advantage by increasing one's own reproduction success while reducing the one of other males.

Factors influencing aggressive behavior and risk of trauma in the pigtail macaque (*Macaca nemestrina*). Erwin, J. (Comparative Dev. Lab., Box 154, IMRID, George Peabody College, Nashville, TN 37203) *Laboratory Animal Science*, 1977, *27*, 541-547.

Several experiments and surveys were conducted in a large colony of pigtail macaques to determine some of the influences of spatial and social factors on aggressive behavior and risk of trauma. Female subjects exhibited more aggression when they had access to two-room suites than when they had access to single rooms. The frequency of aggressive interactions among females was positively related to the number of females per group. The presence of one or more males in groups inhibited aggressive interaction among females. Less aggression occurred among females in groups containing infants than in groups containing no infants. Provision of cover by introduction of concrete cylinders into rooms reduced aggression among members of stable groups. Subjects in newly-formed groups composed of unfamiliar animals sustained fewer injuries than did those in groups formed by merger of groups or subgroups of familiar animals.

Facilities, Care, and Handling

Primates. Bowen, W. H., Coid, C. R., T-W-Fiennes, R. N., & Mahoney, C. J. (Nat. Inst. of Dental Res., Westwood Bldg., Rm. 532, Bethesda, MD 20014) In *The UFAW handbook on the care and management of laboratory animals* (5th ed.). Edinburgh: Churchill Livingstone, 1976. Pp. 377-427.

This edition of the handbook of the Universities Federation for Animal Welfare includes a chapter entitled "Primates" which consists of the following sections: General, by R. N. T-W-Fiennes which is a general introduction to the primates; Feeding, by the same author; Husbandry, by C. R. Coid; Breeding, by C. J. Mahoney; Laboratory procedures, by W. H. Bowen; and Disease Control, by R. N. T-W-Fiennes.

Breeding

Progesterone levels in the Japanese monkey (*Macaca fuscata fuscata*) during the breeding and nonbreeding season and pregnancy. Oshima, K., Hayashi, M., & Matsubayashi, K. (Department of Physiology, Primate Research Institute, Kyoto University, Inuyama, Aichi, Japan) *Journal of Medical Primatology*, 1977, *6*, 99-107.

Progesterone levels were determined in the peripheral blood of the Japanese monkey during the menstrual cycle, breeding season, nonbreeding season, and gestation. Progesterone levels averaged less than 0.3 ng/ml in the earlier follicular phase, rose to maximum values of 3.8 ng/ml approximately eight days before menses, and declined to less than 1.0 ng/ml before menstruation. Progesterone levels during the nonbreeding season were comparable with those during the early follicular phase. In pregnant animals circulating progesterone either continued to rise around day 20, or fell as in the infertile cycle, then rose again. Progesterone levels declined between days 35 and 60 and were variable until about day 130 of gestation.

Rearing conditions which support or inhibit later sexual potential of laboratory-born rhesus monkeys: Hypotheses and diagnostic behaviors. Goldfoot, D. A. (Wisconsin Regional Primate Res. Ctr., Madison, WI 53706) *Laboratory Animal Science*, 1977, *27*, 548-556.

Sexual behaviors of adult rhesus monkeys reared in infancy under severe, moderate, or minimal social deprivation conditions have been studied at several laboratories. With severe deprivation conditions (weaning at birth; no peer contact) reproductive success for both sexes was very low, and rehabilitation efforts did not appear to be promising. Moderate deprivation conditions (weaning at 3-6 months; limited daily contact with peers) eliminated many of the neurotic behaviors associated with severe social deprivation, but reproductive success was still quite poor (25-40% male copulators; females poor mothers). Rehabilitation was possible in some instances. Minimal laboratory deprivation conditions (mother-infant rearing in penned groups; weaning at 8-12 months with further peer group socialization) resulted in high copulatory probabilities of the offspring. It was hypothesized that for eventual reproductive potential to develop, rhesus infants needed complex social environments in which aggression and fear among peers occurred only at low levels, and that the closer one came to duplicating the naturalistic social environment of the monkey, the better chance one had of producing reproductively capable animals. Diagnostic behavioral categories were given to help researchers assess the psychosocial development of the rhesus infant. It was suggested, in particular, that weaning not be carried out until the development of the foot clasp mount in the infant male was a regular part of the behavioral repertoire.

Breeding and rearing squirrel monkeys (*Saimiri sciureus*) in captivity. Kaplan, J. N. (Stanford Res. Inst., Menlo Park, CA 94025) *Laboratory Animal Science*, 1977, *27*, 557-567.

A breeding colony of squirrel monkeys was established to provide animals for behavioral research concerned with early development. The origin of the initial breeders was Peru, Colombia, and Bolivia. During the past 10 years, the colony has grown to 125 adult females, 20 adult males, and 120 immature animals of various ages. The annual conception rate for the last 5 years averaged 68%. This resulted in 84% viable births of which 82% survived past 6 months of age. The majority of the births (65%) occurred during June-August, and 87% during May-September. The most efficient and successful breeding strategy was to form mixed-sexed groups of 10-15 females and 2-3 males before the mating season began and to maintain the integrity of these groups with minimal interference. Progeny were reared apart from their natural mother without difficulty, and their growth and development were found to be similar to those of mother-reared monkeys.

Breeding the owl monkey (*Aotus trivirgatus*) in a laboratory environment.

Cicmanec, J. C., & Campbell, A. K. (Litton Bionetics, Inc., Dept. of Lab. Animal Med. & Sci., 5516 Nicholson Lane, Kensington, MD 20795) *Laboratory Animal Science*, 1977, *27*, 512-517.

A breeding colony of owl monkeys (*Aotus trivirgatus*) established in 1972 produced 35 live infants during the first 3 years from an average daily population of 30 monogamous pairs. Initial productivity was poor, but once the breeding pairs were set up by karyotypes, reproductive performance improved. No seasonal influence on births was observed and most births occurred during daylight hours. Uterine size during gestation ranged from about 1 cm in diameter at 30 days after conception to 7-8 cm (transverse diameter) × 18-20 cm (longitudinal diameter) at 115 days after conception. The fetal head was palpable at 85 days. A gestation period of 120-140 days was estimated from extrapolation of uterine palpation data and interbirth intervals. Vaginal swabs collected from six females during two separate 1-month periods did not consistently reveal estrous cycles. An analysis of owl monkey milk showed it to contain 88.2% water, 2.16% crude protein, 2.09% fat, 7.52% lactose, and 0.36% ash.

Correlation of perineal detumescence and ovulation in the pigtail macaque (*Macaca nemestrina*). Blakeley, G. A., Blaine, C. R., & Morton, W. R. (Medical Lake Field Station, Regional Primate Res. Ctr., Univ. of Washington, Medical Lake, WA 99022) *Laboratory Animal Science*, 1977, *27*, 352-355.

A study was made of the relationship between ovulation and perineal detumescence in the pigtail macaque. Daily laparoscopic examination of both ovaries was made beginning on the 9th day of the menstrual cycle. The appearance of the ovaries was recorded and photographs were taken of the perineum and ovaries. This procedure was repeated daily until the 5th day after ovulation or until the 20th day of the menstrual cycle for presumed anovulatory cycles. The time at which ovulation occurred was correlated with the first signs of detumescence, both events occurring within a 24-hour period.

Endocrine characterization of the menstrual cycle of the stumptailed monkey (*Macaca arctoides*). Wilks, J. W. (Fertility Research, The Upjohn Company, Kalamazoo, MI 49001) *Biology of Reproduction*, 1977, *16*, 474-478.

The serum concentrations of luteinizing hormone, estradiol-17β, and progesterone were determined on daily blood samples collected from five stumptailed monkeys during nine menstrual cycles. The serum concentrations and patterns of each hormone were similar to those observed in rhesus monkeys (*Macaca mulatta*) with the following exceptions: a) basal and peak concentrations of radioimmunoassayable LH in the stumptailed macaque were 40 percent of values observed in rhesus monkeys; b) the highest mean estradiol value occurred on the day preceding the LH peak in the stumptailed monkey, while the estradiol preovulatory peak of the rhesus monkey was coincident with the LH rise; c) a unique serum estradiol peak occurred on the third day after the LH surge in the stumptailed monkey and represented the highest mean estradiol value during the luteal phase; and d) the periovulatory decline in serum progesterone usually observed in the rhesus monkey was not noted in the stumptailed macaque.

Parturition in nonhuman primates. Lanman, J. T. (National Institute of Child Health and Human Development, National Institutes of Health, Bethesda, MD 20014) *Biology of Reproduction*, 1977, *16*, 28-38.

At present the sequence of events at parturition in nonhuman primates is less clear than in some other mammals. In at least the macaque, the best studied of the nonhuman primates, it appears likely that fetal participation in the onset of parturition occurs. Progesterone acts in its classical role of maintaining uterine quiescence; as term approaches its concentration in uterine venous effluent and therefore presumably in the myometrium declines. A prepartum estrogen rise occurs as in sheep, but there is conflicting evidence in macaques whether estrogen administration will either terminate pregnancy or cause a rise in $PGF_{2\alpha}$ levels as it does in sheep. There is some evidence that $PGF_{2\alpha}$ plays a role in normal parturition in the macaque, and that the declining influence of progesterone is at some point overridden by other events precipitating delivery. The "other events" are not well defined except by a hazardous extrapolation from other better-studied species. More information is needed in the macaque on the interrelationship of progesterone, estrogens, prostaglandins and perhaps on other agents not presently recognized as critical. If the purpose of pregnancy and parturition research among nonhuman primates is to improve understanding of the human counterparts, the macaque, at least as evidenced by the patterns of pregnancy hormones, does not appear to be the best animal. By these limited criteria, either the chimpanzee or marmoset is closer to the human. But mechanisms worked out in any animal can be reliably applied to humans only after their direct demonstration in human subjects.

Instruments and Techniques

Improvements on a radio-controlled stimulator system for primate studies. Spelman, F. A., & Maxim, P. E. (Regional Primate Research Ctr, SJ-50, Univ. of Washington, Seattle, WA 98195) *Physiology and Behavior*, 1977, *18*, 523-525.

A commercially available model airplane radio control transmitter-receiver system has been modified for nonhuman primate telestimulation studies. The circuit design has since been improved to decrease the size and weight and increase the performance of this system. The stimulator provides symmetrical, biphasic constant current pulses to electrodes implanted in the monkey brain.

Computer program for maintenance of individual animal records in a nonhuman primate colony. Kuehl, T. J., & Dukelow, W. R. (Endocrine Res. Unit, Michigan State Univ., East Lansing, MI 48824) *Laboratory Animal Science*, 1977, *27*, 391-395.

A computer program was developed to maintain animal records for a nonhuman primate colony used in research. The program was designed for use with an existing laboratory notebook system. The computer program identifies each notebook entry containing information about each animal and keeps other information, including animal name, sex, species, projects to which the animal is assigned, location of the animal, dates and body weights. The program is interactive and easy to use. Information stored in the system is readily accessible to all investigators using the animals. In 17 months of use, 1,382 master file entries were developed for 113 monkeys.

Two inexpensive manipulanda for use with monkeys or children. Borrebach, D. E. (John F. Kennedy Ctr. for Res. on Education and Human Dev., George Peabody College, Nashville, TN 37203) *Behaivor Research Methods & Instrumentation*, 1977, *9*, 391-392.

This report details steps for constructing two switches that have been used successfully in operant studies with both rhesus macaques and human infants. The bidirectional lever is for panel mounting; the chain response device is designed to be mounted in an overhead position. The lever was constructed because a commercially available omnidirectional lever failed to stand up to the rigors of experimentation with large primates, and it quickly became unreliable. The unit described is rugged and does not produce a spurious series of switch closures when given hard glancing blows. The chain response manipulandum was designed because of the lack of a suitable commercial device for primates. Both switches meet three design criteria: (1) ease of construction, (2) low cost, and (3) positive stop action.

A restraining device for the infant monkey. Caudill, D. (Procter & Gamble Co., Miami Valley Labs., PO Box 39175, Cincinnati, OH 45247) *Laboratory Animal Science*, 1977, *27*, 406.

A restrainer was constructed of acrylic plastic according to a design illustrated in the article. The device was used to restrain 48-hour-old rhesus monkeys.

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