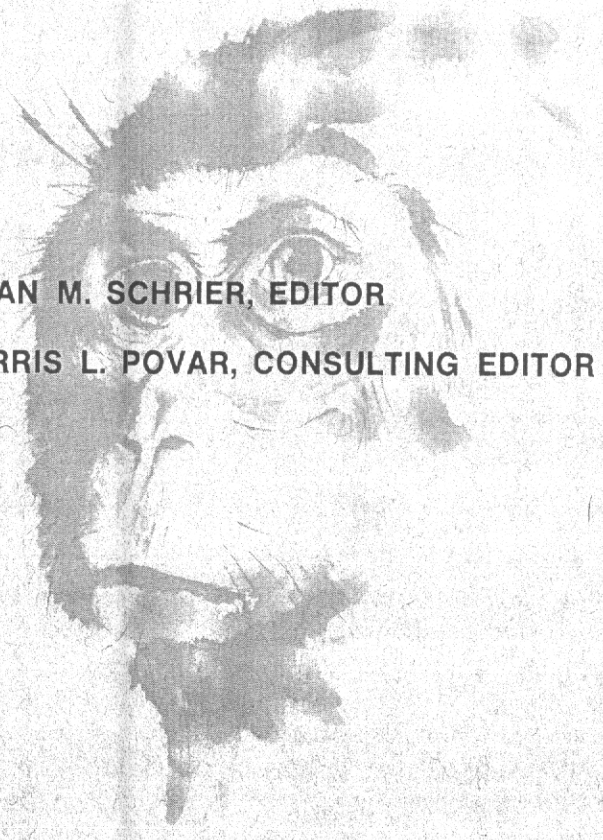
LABORATORY PRIMATE NEWSLETTER

Volume 13, Number 4 October, 1974



ALLAN M. SCHRIER, EDITOR

MORRIS L. POVAR, CONSULTING EDITOR

Published Quarterly by the Primate Behavior Laboratory
Psychology Department, Brown University
Providence, Rhode Island

CONTENTS

CALIFORNIA PRIMATE RESEARCH CENTER. Carmen D. Morrissey and Lloyd J. Neurauter..... 1

RESEARCH VACANCIES AT THE INSTITUTE OF AFRICAN PRIMATOLOGY, KENYA. 7

CURRENT STATUS OR PRIMATE BREEDING IN THE UNITED STATES. William J. Goodwin..... 8

INDIA PLANNING TO FURTHER REDUCE RHESUS EXPORT 11

NIH PRIMATE BREEDING PROGRAM FOR INTRAMURAL RESEARCH 12

TWO RHESUS BREEDING PROGRAMS INITIATED FOR EXTRAMURAL NIH RESEARCHERS 13

PAPIO HAMADRYAS WANTED 14

THE NONHUMAN PRIMATE AS A MODEL FOR HUMAN TWINNING. David E. Wildt and W. Richard Dukelow.....15

PROPOSAL FOR A PRIMATE CENTER LIBRARY AVAILABLE 18

REPORT ON PRIMATE CONSERVATION GROUP. Richard K. Thorington, Jr. 19

AUDIO-VISUAL KIT FOR TRAINING ANIMAL CARE TECHNICIANS 22

BREEDING OR PREGNANT RHESUS WANTED 22

MORE EFFECTIVE PREGNANCY TEST FOR MACAQUES AND BABOONS 23

NEW PRODUCTS AND SERVICES: *CEBUS APELLA* CAN BE SUPPLIED 23

RECENT BOOKS AND ARTICLES 24

COPIES OF CHIMPANZEE BIBLIOGRAPHY AVAILABLE 31

LAGOTHRIX LAGOTHRICHA WANTED.....31

ADDRESS CHANGES 32

CALIFORNIA PRIMATE RESEARCH CENTER

Carmen D. Morrissey and Lloyd J. Neurauter

California Primate Research Center

The California Primate Research Center (CPRC) was established in June, 1962, on a 300-acre tract about three miles from the center of the campus at the University of California at Davis. It was the last of seven Primate Centers organized by the National Heart Institute of the National Institutes of Health. The first six Centers were located on a regional basis in order to best serve the general scientific community. The seventh Center, then known as the National Center for Primate Biology, was designated as a national facility in order to explore areas vital to the activities of all the Regional Centers. It was subsequently renamed the California Primate Research Center. This Center was originally dedicated to studies relating to housing, breeding, and husbandry of diverse species of nonhuman primates, and to interdisciplinary investigations of the broad biologic features of these species.

During the next 10 years, these studies enabled the Center to establish procedures and guidelines for the efficient and economic maintenance of nonhuman primates in a research environment. Methods developed for outdoor caging have served as models for housing not only at the other Regional Primate Research Centers, but also at other major primate research centers throughout the world. The development of improved breeding techniques and procedures has resulted in the establishment of a major breeding colony at the Center, funded by the National Institute of Child Health and Human Development (NICHD), to provide animals and materials for grantees of their institute.

In 1971 the broad objectives of the Primate Center were re-evaluated and identified as:

1. To develop selected team research programs of scientific excellence in areas of human health oriented research where nonhuman primates are the animal of choice, and to provide suitable intellectual and physical research environments.

2. To provide a focus of competence and leadership in the use of primates in biomedical research, and to encourage member scientists to expand links with other scientists and research agencies.

3. To continue research in primatology as necessary to serve needs of primary research goals.

Authors' address: California Primate Research Center, Davis, California 95616.

4. To conduct small breeding operations for maintenance of research programs, with constant re-evaluation of global supply of primates relative to their availability for biomedical research generally.

Since that time, our research mission has been revised to follow a program which is more directed to human health related problems. This led to the development of human health related research teams in four major areas--behavioral biology, infectious diseases and immunology, perinatal biology and reproduction, and respiratory diseases--having as a common theme the effect of environmental influences. In addition, studies are continuing relating to care, maintenance, breeding, and health problems of the nonhuman primate in a research environment. Below are brief descriptions of the Center's present core research areas.

Behavioral Biology

Dr. William A. Mason, Unit Leader. This unit provides the cohesive nucleus for the Center and campus primate behavioral studies. The research aims encompass three closely related and complementary areas: psychosocial development, environmental influences (including socioecological), and the use of nonhuman primates as models in the study of conditions having particular relevance to man. The efforts of the Behavioral Biology unit include studies of the development and transfer of social attachments in young and adult primates, investigations of the effects of different rearing environments on social competence and the development of abnormal behavior patterns, research on various aspects of reproduction behavior, and studies of social organization in different primate species.

The Behavioral Biology unit derives its principal support from extramural grants and contracts. Center base grant funds are used primarily for the support of key academic and staff personnel and essential facilities. In addition to collaborative work with the School of Medicine and the College of Letters and Science, this unit has cooperative studies with other Center research units, including the Primate Medicine unit concerning behavioral aspects of various indoor and outdoor caging configurations, with the Perinatal Biology and Reproduction unit concerning behavioral aspects of reproduction, and with the Respiratory Diseases unit concerning behavioral aspects of air pollution exposure.

Infectious Diseases and Immunology

Dr. Bennie I. Osburn, Unit Leader. This unit provides a strong interdisciplinary approach for defining and studying models of human infectious diseases in nonhuman primates. In the area of parasitology, emphasis is placed on detection and host response in occult filariasis, soil amoebae infections, toxoplasmosis, hydatid disease, trichinosis, and pinworm infections in the nonhuman primate models. The microbiology

program concentrates on the host response to *Shigella flexneri* infection. In the virology program, etiological, pathogenetic, and immunologic mechanisms are being studied in the lymphoma outbreak in the rhesus population, in the different species inoculated with slow viruses, and in animals infected with the simian hemorrhagic fever agent. Studies in the fetal animal concentrate on establishing congenital disease models in nonhuman primates and defining the development of some host defense factors in the fetal rhesus. The combining of these various disciplines into a single unit provides a central setting through which information exchange may readily take place.

Also included in this broad research unit is the Primate Parasite Registry. The Registry provides a consultation service on taxonomic and other problems related to primate parasites, and serves as a national and international repository for primate parasitic materials so that a centralized reference collection will be available. The Registry also constructs sets of parasitological material composed of living and preserved tissue sections and photographed specimens for use in research projects, training programs, seminars, and other instructional purposes, including those at other institutions. The Registry collects basic reference literature pertaining to the study of taxonomy and compiles host-parasite checklists. In addition, parasitologists who are concerned with a particular parasitological problem or with advanced studies of primate parasites can use the Registry as a reference facility.

Perinatal Biology and Reproduction

Dr. Andrew G. Hendrickx, Unit Leader. The primary concern of this unit is research relating to the effects of environmental factors, especially chemicals, during pregnancy. Special attention is given to agents which are taken by women during pregnancy and which are suspected of being harmful, particularly during the embryonic and fetal period. These agents are being evaluated for their general teratogenicity, their teratogenic mechanisms, and their specific effects on cell division, cell differentiation, cell movement, and cell interaction. A preliminary study is underway to determine the possible relationship of teratogenesis and carcinogenesis during the prenatal period. In addition to the major thrust into developmental biology and teratology, the influence of environmental factors on reproduction and the mechanisms controlling parturition are being studied.

The Perinatal Biology unit is responsible for the scientific direction of all breeding programs at the Center, including that for the NICHD and the Center Breeding Colony.

Respiratory Diseases

Dr. Donald L. Dungworth, Unit Leader. The Center has become the focal point for the large interdisciplinary pulmonary research team which has been in existence on the Davis campus for more than two years.

The major concern of this unit is to pursue interdisciplinary studies of spontaneous and experimentally induced respiratory diseases in non-human primates to obtain information relating to the cause, pathogenesis and, ultimately, prevention and/or cure of respiratory disease in man. Minor programs concern structural and functional analyses of lungs of several species of primates and man, bacterial pneumonias, and a search for spontaneous respiratory disease models in primates. Plans are being made to investigate immunologic mechanisms of pulmonary injury and pathogenesis of chronic interstitial lung disease. In addition to cooperative research with other Center units, Respiratory Diseases has collaborative efforts with several investigators from other institutions.

Primate Medicine/Colony

Dr. Roy V. Henrickson, Unit Leader. While it does not have a primary research function, a high level of performance by this team is vital to the success of all the research units. The Colony personnel provide day-to-day care and maintenance of all Center animals. The Primate Medicine personnel provide an effective and efficient medical care program for Center animals and the animals on discrete studies being carried out by Center staff. The program places emphasis on preventive medicine, including the daily observation of all animals and routinely scheduled physical examinations. The more sophisticated research programs which have been established also require specialized support in surgery, therapeutics, radiology, and specialized medical procedures.

Dr. Henrickson, the Senior Primate Veterinarian, has assembled a health care team of board eligible veterinarians including an epidemiologist, a clinical pathologist, a radiologist, a pathologist, an anesthesiologist, a virologist, and specialists in laboratory animal medicine. This team, along with members of the supporting medicine/colony staff, meets weekly to review the disease status of the colony, case reports, and colony management. They conduct a limited amount of clinical research related to health problems in our colony and participate in appropriate research projects, as well as provide many services to research teams. In cooperation with the Center Data Services unit, health and demographic data are also collected and collated. This information is made readily available to the health care team. The result is a healthier colony, improved animal and colony management, ongoing clinical research including epidemiologic studies, and greater participation in and services to the research units.

Research Support Services

The Center staff receives research support services from the Diagnostic and Laboratory Services, the Reference Services, Central Supply and Services, and the Electron Microscopy Facility.

The Diagnostic and Laboratory Services offer support by providing

the resources and facilities necessary for the medical surveillance and diagnosis of diseases within the animal colony. These laboratories also support specific research needs of the Center staff. Individual laboratories in this support unit include bacteriology, biochemistry, hematology, parasitology, pathology, and virology.

The Reference Services provide the source for information needed by the Center staff in conducting their research. The acquisition, cataloging, circulation, and binding of our Center library collection is handled through this unit. Since a minimal collection of the essential items is maintained at the Center, a liaison is sustained with the Health Sciences Library and the Main Library on campus. Through these two libraries, staff members have quick access to a large collection of monographs and periodicals, interlibrary loan services all over the world, a Medline terminal for bibliographic searches on all aspects of medical research, and many other useful services at no charge.

The Data Services unit provides timely, accurate information on the entire colony for clinical, research, and administrative purposes. It provides periodic statistical reports and analyses of research and/or clinical data for efficient colony management and Center research projects. Retrieval and analysis services are also provided for non-Center investigators on a recharge basis as workloads permit. Data Services furnishes the Center Business Office with detailed and summarized data on colony activities for billing purposes.

The Central Supply and Services unit combines a number of related support activities, including receiving and stores, vehicles, Center maintenance, and glassware and sterilization.

The Electron Microscopy Facility has recently been established to provide all research units at the Center with the opportunity to use the Zeiss EM-10 transmission electron microscope and the ETEC scanning electron microscope. Both microscopes are fully operational, and supporting services for tissue preparation and film developing and printing are available both at the Center and on the main campus.

Administration of the research programs is the direct responsibility of the individual research unit leaders. The unit leaders function as members of the Research Coordinating Committee which is chaired by the Director. Additional members of the Committee include the Associate Director, the Epidemiologist, and the Primate Pathologist. This Committee reviews all research projects, requests for animals, space requests, policy statements, and budget requests of individuals related to the Center base grant, and makes recommendations to the Director, who has the responsibility for the final decision on these matters. The Committee is consulted on all research protocols, policies, or grant requests which potentially have a direct influence on the Center or the Health of the colony. The Committee meets biweekly, and the minutes are posted for

the information of the faculty and staff.

Close ties with the general campus are maintained by the Center faculty's participation in teaching, research and administrative units, and committees. Many of the Center faculty have part-time academic appointments or affiliations with appropriate departments on campus. This is necessary both for effective maintenance of intellectual awareness and as an aid to recruitment. Also, approximately 25-30 non-Center scientists from this and other campuses collaborate in research at the Center. Partial support is provided for eight graduate students and part-time employment of several undergraduate students. In addition, facilities and resources of the Center are available for graduate students from the Davis campus and other institutions of higher learning. Approximately 20 graduate students utilize these resources for portions of their research programs leading to a master's or a doctoral degree. Graduate students are an extremely important way of amplifying research productivity and the Center encourages their participation in its activities. The Center also plays a major role in the School of Veterinary Medicine developing undergraduate and graduate programs in primate, laboratory, and zoo medicine.

Professional Staff

The listing below incorporates core faculty, including those with joint appointments in other UCD departments, as well as those campus faculty who have nonsalaried appointments with the Center.

Administration

Dr. William R. Pritchard, Dean, School of Veterinary Medicine, and Principal Investigator; Dr. Walter S. Tyler, Director; Dr. Lloyd J. Neurauter, Associate Director.

Behavioral Biology

Dr. William A. Mason, Dr. Clark O. Anderson, Dr. Ethelda N. Sassenrath, Dr. Gary D. Mitchell, Dr. Peter S. Rodman, Dr. Loring F. Chapman.

Infectious Diseases and Immunology

Immunology: Dr. Bennie I. Osburn, Dr. Robert Schneider, Dr. Allan Lock, Dr. Dwight Hirsh, Dr. JaRue S. Manning.
Virology: Dr. Carlos D. Espana, Dr. Charles F. Abildgaard.
Parasitology: Dr. Ming M. Wong, Dr. Wieslaw J. Kozek.
Primate Parasite Registry: Mrs. MayBelle H. Chitwood.

Perinatal Biology and Reproduction

Dr. Andres G. Hendrickx, Dr. Roger H. Sawyer, Dr. George Stabenfeldt, Dr. Allen C. Andersen, Dr. Mack I. Johnson, Dr. Michel H. Momeni.

Respiratory Diseases

Dr. Donald L. Dungworth, Dr. Walter S. Tyler, Dr. Lester W. Schwartz, Dr. Neal F. Peek, Dr. Elliot Goldstein, Dr. Jerry Gillespie, Dr. Carroll Cross, Dr. Mohammad Mustafa, Dr. Eugene Steffey, Dr. Norris J. Parks, Dr. Paul Mellick, Dr. Charles G. Plopper, Dr. M. Zamirul Hussain, Dr. Ching K. Chow, Dr. Rafael Loures, Dr. Krishna Reddy, Dr. Franklyn Jagdis.

Primate Medicine and Primate Colony

Dr. Roy V. Henrickson, Dr. John Anderson, Dr. David Sesline, Dr. Ann Wisloh, Dr. Sam Silverman, Mr. Richard A. Hoffmann.

Diagnostic and Laboratory Services

Dr. Roy V. Henrickson, Dr. David Gribble, Dr. James Armstrong, Dr. Jiro J. Kaneko, Ms. Bessie D. May, Mr. Roger Sullivan.

* * *

RESEARCH VACANCIES AT THE INSTITUTE OF AFRICAN PRIMATOLOGY, KENYA

The Institute of African Primatology, Limuru, Kenya, currently has vacancies for post-graduate research students or research workers in the fields of Primate Behavior, Nutrition, and Physiology/Endocrinology. Applicants must be completely self-supporting financially (i.e., obtain their own maintenance, travel and special equipment grants) and will be required to pay a modest fee for use of the Institute's facilities. Limited accommodation is available at the Institute.

The following species are currently housed at the Institute: a) *Cercopithecus* spp. (vervets, blues, sykes, de brazzas and coppertails), b) *Cercocebus* spp. (grey and grey-cheeked mangabeys), c) *Colobus* (two races of black and white colobus), d) *Erythrocebus patas*.

Most of these animals are housed in one-male 'family' groups in outdoor cages of varying sizes. In addition, feral groups of colobus, sykes, and vervets occur locally.

For further details please apply, sending full curriculum vitae, to: Dr. S. M. Richards, Director, Institute of African Primatology (National Museums of Kenya), P. O. Box 114, Limuru, Kenya.

CURRENT STATUS OF PRIMATE BREEDING IN THE UNITED STATES

William J. Goodwin

National Institutes of Health

Domestic breeding of primates was not a serious effort until recently. This development in the United States resulted from the need for better defined animals and the increasing difficulties in obtaining feral primates. The major breeding colonies in the United States as of 1972 have been described by Goodwin (in press), and it is not necessary to discuss them again. This paper will attempt to present the steps that have been taken during the past two years to evaluate the primate supply situation and to establish large breeding colonies.

The Primate Research Centers, sponsored by the National Institutes of Health (NIH), Division of Research Resources, and other major primate laboratories have devoted considerable effort to acquiring the basic biological baseline information and the husbandry methods required in the establishment of breeding colonies. Currently, this information is available for most commonly used primate species. During the past several years the Primate Research Centers have established significant breeding colonies of the species required in their research programs and have endeavored to become self-sufficient in the breeding of primates for their own use. There are currently over 3,200 primates in the breeding colonies of the seven Centers, and during 1973, a total of 1,110 infants were produced. This is more than 50 percent of their annual requirement for additional animals.

In 1973, the Directors of the Primate Research Centers met with members of the NIH Primate Research Centers Review Committee and several special consultants for a general discussion on biomedical research needs and the future availability of primates. This group agreed that we are facing a critical situation regarding primate availability, and the following courses of action have been recommended and adopted by the Primate Research Centers and the NIH:

a) Information already available on natural primate populations and on the use of primates in the United States should be review-

---

A longer, more detailed version of this note was presented at the Symposium on The Breeding of Simians and Their Uses in Developmental Biology, The Zoological Society of London, Nuffield Zoo, London, England, June 3-6, 1974, and will be published in the Proceedings of the Symposium.

Author's address: Animal Resources Branch, Division of Research Resources, National Institutes of Health, Bethesda, Maryland 20014.

ed, and a comprehensive report prepared. This report should highlight gaps in our present knowledge and would serve as a basis for selecting and designing field studies and for the selection of primate species to be bred in large numbers.

b) A number of carefully selected field surveys should be undertaken in order to estimate populations of medically important species worldwide.

c) Large breeding colonies of three to five species should be established as soon as possible. The rhesus monkey, the squirrel monkey, and the chimpanzee were the three species suggested. Federal agencies and private enterprises consuming large numbers of primates should be encouraged to support the establishment of breeding colonies to insure a future supply of animals for their needs.

d) Nuclear colonies of less commonly used species should be maintained to insure the survival of these species. It is essential to maintain such nuclear colonies because there is no way to predict which species will become significant for research on specific diseases.

Considerable progress has been made to implement these recommendations during the past year. Immediately following this meeting, the NIH negotiated with the Institute of Laboratory Animal Resources (ILAR) of the U. S. National Academy of Sciences to undertake the study mentioned above. This study will be published in August 1974, and will be the most comprehensive study ever undertaken to establish information on primate populations and the use of primates in biomedical research. Prepublication data has been made available to the writer[1] for purposes of this report. In 1973, ILAR conducted a survey of all the medical laboratories using primates. Significant breeding colonies (over 200 breeding females) were reported for seven species including *Macaca mulatta, Siamiri sciureus, Papio* spp., *M. nemestrina, M. fascicularis, M. arctoides,* and *Saguinus fuscicollis*. Only one species, *M. mulatta,* has more than 1,000 females in breeding colonies. There are only nine species listed as having more than 1,000 animals in colonies.

Currently, many of the infants produced in breeding colonies are used for various research purposes and are not being retained as future breeding stock. Data on the rhesus monkey breeding colonies for 1972, as compiled by ILAR, indicating the fate of over 1,100 conceptions, show the production of live births was only 32 percent; however, 26 percent of the pregnancies were terminated for experimental reasons. The percentage of live births reaching six months of age was 44, with another

---

[1]Personal Communication, 1974. Courtesy of Dr. Nancy Muckenhirn, Staff Officer, ILAR.

27 percent of the live births being terminated for experimental purposes. It is obvious from this data that breeding colonies must be established primarily for the production of infants to be retained for breeding stock if we are to assure a future supply of colony bred animals.

The current restrictions on the export of rhesus monkeys from India has increased our concern regarding the supply of this very important primate species. It has helped to stimulate plans for the establishment of several rather large breeding colonies. The Bureau of Biologics, Food and Drug Administration, has a requirement for several thousand juvenile rhesus monkeys for use in the testing of polio vaccine. Recently, this organization has supported the development of a free-ranging breeding colony of 1,000 rhesus monkeys on the off-shore Puerto Rican island of La Cueva. This 80-acre island is part of the Caribbean Primate Research Center and has had a colony of 300 free-ranging rhesus monkeys for a number of years. The Bureau of Biologics is also negotiating for another 1,000-monkey rhesus breeding colony with the Delta Primate Research Center. Breeding groups of 50 animals will be maintained in one-half acre corrals at this Center. The NIH is currently negotiating for large breeding colonies in order to assure a supply of rhesus for its research programs. Some colonies will provide infant monkeys for the intramural scientists at the NIH [see note on page 12 of this *Newsletter*.--Ed.] and others will supply animals to university scientists that are NIH grantees [see note on page 13 of this *Newsletter*.--Ed.]. It will require at least three years for these colonies to reach full production; however, they will have the potential of producing more than 2,500 infant rhesus monkeys annually.

The NIH and other Federal agencies are supporting the development of smaller breeding colonies of rhesus and several other species. A colony of some 350 rhesus monkeys has been developed at the California Primate Research Center to provide timed pregnancies and age-known neonates for the grantees of the National Institute of Child Health and Human Development. This colony has been very successful, and in 1973 the conception rate was 85 percent. Recently, the NIH obtained and is operating a primate facility at Perrine, Florida, which has capacity for 400 rhesus and squirrel monkeys. Breeding colonies of both the *mystax* marmoset and squirrel monkeys are being established at the Delta Primate Research Center for use in hepatitis A and cancer research. A breeding colony of some 60 chimpanzees has been established at the International Center for Environmental Safety, Holloman AFB, New Mexico, supported by three Federal agencies interested in hepatitis B research.

Several large commercial indoor breeding colonies have been in existence for some time in order to provide animals for special research needs. One commercial outdoor breeding colony of some 700 rhesus monkeys has been recently established by the Charles River Laboratories on an island in the Florida keys. This operation is partially supported by the NIH in order to investigate the commercial feasibility of producing rhesus monkeys under island conditions.

There are a number of smaller breeding colonies of several species; however, time does not permit a discussion of these colonies.

Nuclear colonies of many infrequently used primates have been maintained in the Primate Research Centers for some time. The Centers have accepted the responsibility of maintaining these colonies in order to provide the initial stock in the event it becomes necessary to develop breeding colonies of these species for research purposes. Colonies of these and other species are also being maintained in other laboratories and in zoos.

During the past two years there has been an increasing awareness on the part of Federal officials and research scientists regarding the supply of primates for research. In the United States, funds are being made available for primate population surveys, for establishing large breeding colonies of commonly used species, and for the maintaining of nuclear colonies of other species. These initial efforts must be continued and expanded significantly if we are to have an adequate supply of primates for future research needs. It is strongly urged that breeding colonies of medically important primates be established by all countries requiring primates in their research programs.

REFERENCES

Goodwin, William J. Primate research in the United States--Domestic needs and resources. Presented at the Conference on New Concepts in Primate Production, Battelle-Seattle Conference Center, Seattle, Washington, 1972 (in press).

* * *

INDIA PLANNING TO FURTHER REDUCE RHESUS EXPORT

The following is a statement by Dr. Charles McPherson, Animal Resources Branch, Division of Research Resources, National Institutes of Health: The government of India is planning to reduce the number of rhesus monkeys it will allow to be exported by approximately 40 percent for the period of April 1, 1974, to March 31, 1975. The exporters of primates plan to request that the quota be increased, but it is very possible that they will not be successful in this regard. We have been advised against a direct governmental appeal at this point in time. You are requested, therefore, to take all reasonable steps to reduce the use of rhesus monkeys. These steps might include: the best possible veterinary medical and husbandry care to reduce death losses; shared use of animals when possible; and when feasible, use of alternate species.

NIH does not, at this time, plan to restrict or allocate Certificates of Need for rhesus monkeys. Any organization, however, that increases its use of rhesus monkeys to a significant degree will be asked for special justification before the Certificates of Need will be signed.

NIH PRIMATE BREEDING PROGRAM FOR INTRAMURAL RESEARCH

Harem Breeding Colonies

To meet National Institutes of Health (NIH) intramural needs for primates and to improve the monkey as a model for researchers, the Veterinary Resources Branch (VRB), of the Division of Research Services, NIH, established breeding colonies of rhesus (*Macaca mulatta*) and squirrel monkeys (*Saimiri sciureus*) at the NIH Perrine Primate Center, Perrine, Florida, in November 1973. The 60-acre facility was previously occupied by an Environmental Protection Agency laboratory which recently moved to Research Triangle Park, North Carolina.

The NIH Perrine Primate Center can house 800 rhesus and 200 squirrel monkeys in 120 run-type enclosures in 10 buildings with ample support facilities. Eighty-five percent of the juvenile offspring will be supplied each year to intramural investigators. The remaining 15 percent will replace retired breeders enabling the colony to eventually be self-sustaining.

To further supplement requirements for domestically-bred monkeys resulting from reduced rhesus monkey exportation from India, VRB has also contracted with Gulf South Research Institute, New Iberia, Louisiana and Hazleton Laboratories, Inc., Vienna, Virginia, to establish additional colonies of this species. Together these contracts will amount to approximately 1.3 million dollars over a five-year period and will provide for a breeding program capable of supplying a minimum of 500 juvenile rhesus monkeys each year by 1978. It is anticipated that approximately 700 female and 70 adult male breeders will be supplied to the contractors by the VRB during the next 18-24 months. The Perrine operation and the two contracts for harem breeding, with Hazleton and with Gulf South, are being managed by Dr. A. E. New, Assistant Branch Chief, VRB.

Altogether the three harem breeding colonies are expected to yield 1,000 rhesus juveniles and 100 infant squirrel monkeys each year by 1978. These primates should supply about one-half of the NIH intramural research needs.

Timed Pregnant Nonhuman Primates

The VRB currently issues to the NIH intramural research program approximately 170 timed pregnant rhesus monkeys and 50 timed pregnant baboons per year. These animals come from highly selected breeding stock mated under controlled conditions in which the time of conception is known within a 72-hour period. They are used by investigators who need to know the stage of fetal development and date of parturition for their studies.

A VRB rhesus breeding colony in Bethesda of approximately 160 females and 20 males currently supplies approximately 100 timed preg-

nancies per year. In addition, a contract with Gulf South Research Institute provides an additional 70 timed pregnancies per year.

Fifty timed pregnant baboons will also be obtained by contracts with the Southwest Foundation for Research and Education, the Washington Regional Primate Research Center, and the Laboratory for Experimental Medicine and Surgery in Primates during the 1975 fiscal year. An intramural timed pregnant baboon colony of 50 breeders is planned with first deliveries scheduled for summer 1975.

The timed pregnancy colonies are being managed by Dr. David K. Johnson, Chief, Veterinary Medicine and Surgery Section, VRB.

Current research requiring timed pregnant primates includes: (a) neonatal jaundice: deficiencies in glucuronyl transferase; (b) induced diabetes during pregnancy and effects on fetal development; (c) amblyomma and other neonatal ocular defects; (d) endocrinology relationships between mother, fetus, and placenta; (e) circadian cycles of estrogen and estrogen precursors with development of diagnostic tools for early detection of abortion and physiological labor; (f) improved diagnostic methods of early pregnancies; (g) toxicological studies with respect to fetal development.

With reductions in the available supplies of wild-trapped rhesus monkeys and increased demands for high quality, domestically reared primates, the colony of timed pregnant rhesus monkeys is an important resource for gaining knowledge of primate reproductive endocrinology and physiology. This information will be necessary in developing domestic breeding colonies to produce the highly specialized models needed in NIH research programs.

* * *

TWO RHESUS BREEDING PROGRAMS INITIATED FOR EXTRAMURAL NIH RESEARCHERS

Two domestic monkey-breeding contracts have been awarded by the Animal Resources Branch, Division of Research Resources, National Institutes of Health, in the effort to bolster the anticipated dwindling supply of rhesus monkeys and other primates for biomedical research.

As part of the recently implemented NIH National Plan for Rhesus Monkey Supply, Litton-Bionetics, Inc. and Hazleton Laboratories, Inc. have been contracted to develop rhesus monkey breeding colonies.

Hazleton Laboratories, Inc., recipient of a first-year contract for $289,000, will establish a breeding colony near Edinburg, Texas, with anticipated annual production of 500 infant rhesus monkeys after the fourth and fifth years.

Litton-Bionetics, Inc. received an 11-month initial contract in the amount of $191,000 to provide a sufficient number of breeding animals to produce 400 infant rhesus monkeys annually after four or five years at Yemassee, South Carolina.

In anticipation of severe shortages in rhesus monkey supply in the next five years, the Animal Resources Branch has vigorously taken the initiative in assuring that extramural NIH researchers will have an adequate number of animals to continue their work.

India, the main source of supply for rhesus monkeys, has indicated constriction of export quotas in the next several years. Heretofore, India was exporting 50,000 to the world. In the past year this figure was cut to 30,000.

The 28,000 rhesus monkeys imported annually in this country represent about 50 percent of all nonhuman primates acquired for all biomedical activities. Approximately 13,000 are used by the pharmaceutical industry for the development, production, and testing of pharmaceuticals and biologics; 9,000 by non-governmental medical research organizations; 3,000 by intramural NIH, including the Bureau of Biologics, Food and Drug Administration; and 3,000 by other governmental agencies.

Approximately two-thirds of the animals used by non-government medical research organizations are on NIH-supported biomedical research projects, representing some 1,187 studies. Between 600 and 700 of these projects use rhesus monkeys.

International concern over the rhesus monkey situation was expressed at a symposium of the Zoological Society of London held in early June 1974 and attended by over 100 leading primatologists from the United Kingdom, Europe, and the United States. At this symposium, Dr. William J. Goodwin, director of NIH's Primate Research Centers Program, reported on the current state of primate breeding in the United States [see note on page 8 of this *Newsletter*.-- Ed.].

* * *

PAPIO HAMADRYAS WANTED

The Laboratory for Experimental Medicine & Surgery in Primates (LEMSIP), New York University Medical Center, would like to purchase two (2) female *Papio hamadryas* baboons, 4-6 years old. Contact: Mr. David Armstrong, LEMSIP, N.Y.U. Medical Center, 550 First Avenue, New York, N.Y. (Telephone: 212-679-3200 ext. 266.)

THE NONHUMAN PRIMATE AS A MODEL FOR HUMAN TWINNING

David E. Wildt and W. Richard Dukelow

Michigan State University

The incidence of twin births in the human is known to be approximately one in 86 or 1.2%. For studying the twin relationship in a research environment it is, of course, more convenient in certain types of studies to utilize a nonhuman primate with a similar incidence of multiple births. A model for human twinning would be advantageous in studies of the genetic expression of this characteristic or in certain physiological research problems such as maternal nutritive support of twins vs. singletons. Obviously, especially for the former study, a nonhuman primate physically related as closely to man as possible is necessary as well as the similar occurrence of the twinning phenomenon. The purpose of this note is to discuss briefly the occurrence of twinning in the different primate genera and to speculate on the particular species most closely related to the human in this characteristic. Since twinning is relatively rare in primates, some general observations on multiple births will also be noted. In addition, in order to keep this paper brief, it will not be concerned with the numerous complex variables such as cost, supply, or species endangerment associated with choosing a primate model.

The Great Apes and Old World monkeys are normally monotocous and consequently there are only a few reports on multiple births in these primate classifications, especially the former. In May, 1967, gorilla twins were born at the Frankfurt zoo, the only report of twinning in this species in captivity. The only other record of twins in the gorilla was recorded in Kansas City where twins were aborted in 1967. There are no records of gorilla females nursing twins in the wild although it was reported in January of 1966 that a native hunter in the southwest section of the Cameroons found two very small identical male gorillas clinging to the body of their dead mother (Kirchshofer *et al.*, 1968).

There are only seven recordings of twin births for chimpanzees, and one exceptional record of a triple birth, all occurring in captivity at the Yerkes Regional Primate Research Center (Kirchshofer *et al.*, 1968). A general observation in all Great Ape multiple births seems to be an inability of the mother to feed and care for twins, thus making it necessary to hand rear the infants (Hendrickx & Nelson, 1971).

The reported incidence of twinning in Old World monkeys varies

---

Authors' address: Endocrine Research Unit, Michigan State University, East Lansing, Michigan 48823.

between species and colonies. Multiple births occur only occasionally in the baboon. Schultz (1956) has reported six multiple births for baboons in the wild. Four sets of twins in 730 deliveries have been recorded at the Southwest Foundation for Research and Education baboon colony in San Antonio (Hendrickx *et al.*, 1968) and two sets of twins in 837 deliveries have been recorded at the Sukhumi, U.S.S.R. colony (Lapin & Yakovleva, 1963). Combining these results shows that the twinning rate in the baboon is only 0.38%, much less than the human.

Lapin and Yakovleva (1963) reported the incidence of multiple births in rhesus monkeys (*Macaca mulatta*) to be near 1.0% and van Wagenen and Asling (1964) confirmed this value by reporting the twinning rate to be near that of man or 0.96%. However, other colonies report conflicting results. From 1956 to 1963, records were kept on 1003 rhesus monkeys born in the free-ranging colonies of Puerto Rico and in the caged colonies in San Juan. All births were singles with one exception of an old female confined in a cage bearing twin males (Koford *et al.*, 1966). Hendrickx *et al.* (1968) reported one pair of twins in 56 births (1.8%) for sooty mangabey's (*Cercocebus atys*), none in 269 births (0.0%) for cynomolgus monkeys (*Macaca fascicularis*), 4 pairs in 840 births (0.5%) for rhesus monkeys, and one pair in 82 (1.2%) births for stumptailed monkeys (*M. arctoides*).

Multiple births are more common in New World monkeys especially in the Callithricidae family. Tamarins are reported normally to twin in the wild, but in captive conditions single young are common (Napier & Napier, 1968). Marmosets normally have two young at birth and occasionally three (Hendrickx & Kraemer, 1970). Of the primates composing the Cebidae family of the New World monkeys, only the capuchin monkey (*Cebus*) and the howler monkey (*Alouatta*) have been found to twin and then only very rarely (Napier & Napier, 1968).

The highest incidence of multiple deliveries is in the prosimians. Doyle *et al.* (1967) reported that of eight births of bushbabies (*Galago senegalensis moholi*) in four different females, five had been twin births and one a triplet (75%). Both of the single births were to primiparous females one of which subsequently gave birth three times to twins and once to triplets. This high rate confirms Lowther's (1940) findings for this species. Surprisingly, Butler (1959), observing *G. s. senegalensis*, and Doyle *et al.* (1967), examining *G. s. braccalus*, noted only single births with rare instances of twinning. Lemurs and lorises are known to give birth normally to single young but twinning is not uncommon (8 of 65 or 12.3%) in the loris (Napier & Napier, 1968). The tree shrews definitely have the most consistent multiple birth rate with a range of one to four and an average of two (Napier & Napier, 1968). Although the Great Apes are more closely related to man than other nonhuman primates, the incidence of multiple births, as discussed, is very rare. At the other extreme are the prosimians, in which twinning is quite common, much more so than in humans. However, most of these animals bear no more physical

resemblance to man than nonprimate species, some of which (e.g., the sheep) demonstrate a consistent genetic ability for multiple births. Most of the members of this nonhuman primate classification, then, would not be ideal candidates for a human model.

Because information on the exact twinning incidence is scarce in most New World species, members of the Old World classification, due to their physical and reproductive similarities to man (e.g. menstruation), would most likely be utilized as models for multiple births. Within this family, the baboon, cynomolgus, and bonnet monkeys (*M. radiata*) would be excluded due to the low incidence of twinning observed in the records to date. Finally, based on the data known, it could be concluded that rhesus monkeys (0.5-1.0% twinning) or, more ideally, stumptailed monkeys (1.2%) would represent most closely the human incidence of multiple births. Present breeding colonies should be aware of this possible use of these species and births of twins should be announced for their possible inclusion in research projects requiring identical twins. Finally, it might also be mentioned that, in cattle, a set of identical twins for experimental-control purposes in research is considered equivalent to 22 unrelated animals under experimentation. This resource, although rare, could provide valuable information on a variety of biomedical problems.

REFERENCES

Butler, H. The breeding cycle of the Senegal Galago, *Galago senegalensis senegalensis*. *Proceedings of Zoological Society of London*, 1959, *129*, 147-149.

Doyle, G. A., Pelletier, A., & Bekker, T. Courtship, mating, and parturition in the lesser bushbaby (*Galago senegalensis moholi*) under semi-natural conditions. *Folia Primatologica*, 1967, *7*, 169-197.

Hendrickx, A. G. *Embryology of the baboon*. London: The University of Chicago Press, Ltd., 1971, p. 28.

Hendrickx, A. G., Houston, M. L., & Kraemer, D. C. Observations on twin baboon embryos (*Papio* sp.). *Anatomical Record*, 1968, *160*, 181-186.

Hendrickx, A. G., & Kraemer, D. C. Primates. In E. S. E. Hafez (Ed.), *Reproduction and breeding techniques in laboratory animals*. Springfield: Charles C. Thomas Co., 1970. Pp. 316-335.

Hendrickx, A. G. & Nelson, V. G. Reproduction Failure. In E. S. E. Hafez (Ed.), *Comparative reproduction of nonhuman primates*. Springfield: Charles C. Thomas Co., 1971. Pp. 417-418.

Kirchshofer, R., Weisse, K., Berenz, K., & Klose, H. and I. A preliminary account of the physical and behavioral development during the first 10 weeks of the hand-reared gorilla twins born in the Frankfurt Zoo.

In C. Jarvis (Ed.), *International Zoo Yearbook*. Scotland: Aberdeen University Press, 1968. Pp. 121-128.

Koford, C. B., Farber, P. A., & Windle, W. F. Twins and teratisms in rhesus monkeys. *Folia Primatologica*, 1966, *4*, 221-226.

Lapin, B. A., & Yakovleva, L. A. *Comparative pathology in monkeys*. (U. S. Joint Publication Research Service, transl.) Springfield: Charles C. Thomas Co., 1963. Pp. 209-229.

Lowther, F. A study of the activities of a pair of *Galago senegalensis moholi* in captivity including the birth and postnatal development of twins. *Zoologica*, 1940, *25*, 433-459.

Napier, J. R. & Napier, P. H. *A handbook of living primates*. London/New York: Academic Press, 1968.

Schultz, A. H. The occurrence and frequency of pathological and teratological conditions and of twinning among nonhuman primates. In Hoffer, H., Schultz, A. H. and Starch, D. *Primatologica*. Vol. 1. Basel: Karger, 1956. Pp. 965-1014.

Wagenen, G. van. Vital statistics from a breeding colony: Reproduction and pregnancy outcome in *Macaca mulatta*. *Journal of Medical Primatology*, 1972, *1*, 3-28.

Wagenen, G. van, & Asling, C. W. Ossification in the fetal monkey (*Macaca mulatta*). Estimation of age and progress of gestation by roentgenography. *American Journal of Anatomy*, 1964, *114*, 107-132.

* * *

PROPOSAL FOR A PRIMATE CENTER LIBRARY AVAILABLE

A class in Administration of Special Libraries at the Graduate School of Library Science, Louisiana State University, completed a project that was concerned with establishing a theoretical primate center library. The instructor of the class was Ms. Katherine Haas. A survey of existing primate center libraries was carried out as part of the project. The survey and research for the project resulted in the compilation of a large, detailed manual entitled "A Proposal for a Regional Primate Laboratory Library," which could be very helpful to anyone interested in such a library. A few copies are still available by writing to: Ms. Katherine Haas, Graduate School of Library Science, Louisiana State University, Baton Rouge, Louisiana 70803.

REPORT ON PRIMATE CONSERVATION GROUP

Richard K. Thorington, Jr.

Smithsonian Institution

Primate Conservation

The Primate Conservation Group of the International Primatological Society (I.P.S.) and the International Union for the Conservation of Nature (I.U.C.N.) has been constituted by Dr. Hans Kummer. Each member has been assigned a particular area of responsibility. The group members and their responsibilities are listed below:

Name	Responsibility
Thorington, R. W., Jr., Washington, D. C.	Chairman and Latin America
Kummer, H., H., Zurich	I.U.C.N. Liaison
Gartlan, J. S., Madison, Wisconsin	Gorilla
Hobbs, K. R., Bicester, UK	Breeding programs and primate export
Itani, J., Kyoto, Japan	Chimpanzee
Kurup, G. U., Mylapore, India	India and Ceylon
MacKinnon, J., Oxford, UK	Orang-Utan
Medway, G., Saxmundham, UK	Southeast Asia, Philippines, Taiwan
Petter, J. J., Brunoy, France	Madagascar
Struhsaker, Bronx, N. Y.	Africa
Wolfheim, J. H., Washington, D. C.	Information

These persons are expected to solicit the help of a number of consultants in their area of responsibility. They will promote and review conservation projects, which will then be submitted to the I.U.C.N. for funding by the World Wildlife Fund.

In November, 1973, most members of the group met at Carshalton, England and discussed priorities. It was agreed that our highest priority is conservation of habitat. A second priority is given to efforts to control hunting, trapping, trade, and export. Isolated measures for the protection of particular species of primates rank third in priority. We further concurred that our efforts should not be scattered, but rather should be concentrated on certain habitats and areas. We propose to concentrate on forest ecosystems containing primates with special emphasis on Great Apes. These are the priorities which will be considered by the group when reviewing proposals.

Author's address: NMH 399, Smithsonian Institution, Washington, D. C. 20560.

It should be noted that many subjects of relevance to conservation are not listed in the priorities. It was our consensus that conservation dollars should not be spent for research, but should be used specifically for the establishment and protection of reserves and parks. Our mandate from the I.P.S. was to do something, not just to study the situation. We encourage surveys and ecological studies, but we are not in the position of being able to finance them with conservation funds unless they are tied to habitat protection.

At the November, 1973 meeting a number of proposals were reviewed and ranked. The highest ranking project was for the establishment of two rain forest parks in the Cameroons. This project, under the direction of Dr. Gartlan, has received funding from the World Wildlife Fund and assistance from other members of the committee. It serves as an example of the type of proposal which the primate group seeks to encourage. Dr. Gartlan has been working closely with the government and people of the Cameroons to establish the parks, to obtain their protection, and to assure their economic importance to the Cameroons by carefully developing tourist facilities.

Requests for Help

Primatologists are urged to contact and to assist the members of the conservation group. We will receive financial support from the World Wildlife Fund for primate conservation only in proportion to our efforts, enthusiasm, and the numbers of good proposals we submit.

At the I.P.S. meeting in Japan, in August, 1974, several requests were directed to primatologists by the I.P.S. Conservation Group. We are particularly interested in data and ideas about the minimal size of area needed for long-term maintenance of wild primate populations. How much genetic heterogeneity should be maintained in different species, how large must the populations be, and how large are the areas which are therefore required? We invite debate of these issues in the scientific literature.

In almost all areas of the tropics there is need for more information on the present distribution and abundance of wild primate populations. In compiling information on these subjects, Ms. Jaclyn Wolfheim noted particular gaps and requested information as follows:

"For some species, almost no recent information could be located. African primates in this category include *Cercopithecus erythrogaster, C. hamlyni, C. diana, Allenopithecus nigroviridis, Procolobus verus,* and *Pan paniscus*. In Asia, there is a lack of recent data concerning *Macaca assamensis, M. cyclopsis, M. nigra,* and *M. radiata; Presbytis francoisi, P. frontata, P. geei, P. phayrei, P. pileatus,* and *P. rubicundus; Nasalis larvatus, Pygathrix nemaeus, Rhinopithecus avunculus, R. roxellanae, Hylobates concolor,* and *H. hoolock*. Among the Latin American species

almost nothing could be learned about the present status of *Aloutta belzebul, A. caraya, A. fusca,* and *A. pigra; Cacajao calvus* and *C. melanocephalus; Callicebus personatus* and *Callimico goeldii; Callithrix argentata, C. humeralifer,* and *C. jacchus; Cebus albifrons* and *C. nigrivittatus; Chiropotes albinasus* and *C. satanas; Logothrix flavicauda; Saguinus bicolor, S. fuscicollis, S. imperator, S. inustus, S. labiatus, S. leucopus,* and *S. nigricollis.* If any of you have any information regarding any of these species, or know of someone else who has such data, please notify me.

"Moreover, the information regarding those species not listed above is far from complete. Many species have been studied in only one area and remain unstudied in the majority of their range. In certain countries, no recent surveys of the primate fauna or of the condition of habitats are available. In Africa, these countries include: Congo Brazzaville, Zaire, Central African Republic, Guinea, Portuguese Guinea, Sierra Leone, Ghana, Liberia, Dahomey, Niger, Chad, and Malawi.

"In Asia, almost nothing was learned regarding primate populations in the Peoples Republic of China, North Viet Nam, South Viet Nam, Cambodia, Laos, Burma, West Pakistan, Bangladesh, Java, interior Kalimantan, Bali and Celebese (Indonesia), the Philippines, or Taiwan.

"I found very little recent data concerning the primates in the Latin American countries of Ecuador, Guatemala, British Honduras, Nicaragua, El Salvador, Honduras, Guyana, Bolivia, Argentina, or Paraguay. Thus, if any of you have access to these countries or to others who have been there you may be able to supply some of the needed information."

Steve Gartlan requested information on the export-import trade in gorillas. The writer reiterated Jaclyn Wolfheim's request for information on habitat destruction and on population densities of primates in Latin America. Hans Kummer requested information on the usefulness of second growth as primate habitat, since areas which have already been logged are less valuable and easier to establish as reserves. Tom Struhsaker is particularly interested in the effect of the lumber industry in Africa and the uses made of the lumber in different countries.

We wish to remind our colleagues that the I.P.S. Conservation Group was constituted on your behalf. We need your help and your enthusiasm. We will succeed only to the degree that others work with us on the very large problems of primate conservation.

AUDIO-VISUAL KIT FOR TRAINING ANIMAL CARE TECHNICIANS

A new comprehensive audio-visual training course, designed specifically to upgrade entry-level animal care technicians, has just been released. The course was developed for laboratory animal facilities by Dr. Joseph S. Spinelli, director of the Animal Care Facility of the University of California, San Francisco, under contract from the Animal Resources Branch, Division of Research Resources, National Institutes of Health. It is intended to upgrade animal care technicians' skills and improve employee productivity in laboratory animal facilities throughout the country. The course is also geared to train the supervisor in teaching techniques.

"Laboratory Animal Care" consists of 30 visualized lessons in 12 film-and-tape cartridges. Also included in the basic kit are a training manual with practice and mastery exercises for each lesson, a pretraining manual for supervisors, three animal identification wallcharts, and a certificate of completion. The course is performance-oriented; designed to teach animal technicians to carry out their actual duties proficiently. Because of its audio-visual format, the successful comprehension of the course does not depend upon the ability of the animal technician to deal with written material.

The lessons are progressive, allowing the individual to proceed at his or her own rate of speed. Practice and mastery lessons allow the student actually to perform the tasks outlined in the lessons. The individual lessons include those related to identification of animal species, how to sex animals, how to recognize various types of equipment and supplies, how to restrain animals for procedures, how to clean and water the various species, how to prepare the animals for surgery, how to give injections, how to better understand environmental conditions, and many other topics.

The basic "Laboratory Animal Care" audio-visual course, training manuals, and other materials are available through the American Association for Laboratory Animal Science, 2317 W. Jefferson St., Joliet, Ill. 60435. The cost of the basic course is $205.00. The film-and-tape cartridges are designed specifically for the Bell & Howell Filmosound Projector Model 756-A. This unit can be secured for $249.00 if ordered with the basic kit.

* * *

BREEDING OR PREGNANT RHESUS WANTED

We would like to purchase approximately 12 young breeding female rhesus (*Macaca mulatta*) or pregnant female rhesus.--Dr. David Strobel, Department of Psychology, University of Montana, Missoula, Montana 59801. Telephone (406) 243-2091 or 243-2484.

MORE EFFECTIVE PREGNANCY TEST FOR MACAQUES AND BABOONS

A new diagnostic test, developed by Drs. Gary Hodgen and Griff Ross of the Reproduction Research Branch, National Institute of Child Health and Human Development, permits the rapid identification of early pregnancies in macaques and baboons. The tests extend the investigational use of these primates when the earliest possible diagnosis of pregnancy is desired.

This discovery increases the animals' usefulness in the study of teratogenic effects of infectious diseases or drugs, since the developing embryo may be vulnerable to such external factors only during very early pregnancy. Secondly, an early definitive test result is vital in evaluating most types of fertility control.

Because of new restrictions on the importation of laboratory primates, large scale domestic breeding is necessary. The new test will facilitate maximum breeding efficiency by early differentiation between females who have conceived and those requiring remating.

The hemagglutination inhibition test is rapid, simple, inexpensive, and yields a definitive diagnosis of pregnancy by the 18th day after fertilization, fully three weeks earlier than conventional pregnancy diagnosis. The test is reliable in that the frequency of false negative or false positive results is less than one percent.

Kits containing reagents for the diagnostic test will be available by the end of the year. Application should be made to the Hormone Distribution Officer, Office of the Director, National Institute of Arthritis, Metabolism and Digestive Diseases, Building 31, Room 9A-47, Bethesda, Md. 20014. (From *National Society For Medical Research Bulletin*, June, 1974.)

* * *

NEW PRODUCTS AND SERVICES

Cebus Apella Can Be Supplied

All countries that produce squirrel monkeys have imposed a ban on them and have refused to honor any requisitions for them. Those wishing to continue to use South American monkeys may be interested to learn that primate hunters from Peru who were sent by us to Paraguay have opened a vast new area for the supply of *Cebus apella* and have been teaching the native hunters the value of these desirable primates for research. Names of primate suppliers who are offering specimens from new areas may be had by writing: The Blue Ribbon Pet Farm, 14300 S.W. 86th Ave., Miami, Florida 33158.

RECENT BOOKS AND ARTICLES*

(Addresses are those of first authors)

Books

Behavior of Nonhuman Primates. Vol. 5. A. M. Schrier and F. Stollnitz (Eds.) New York/London: Academic Press, 1974. [Price: $22.50]

Contents: Memory, by D. L. Medin and R. T. Davis; Identification, Discrimination and Retention of Visual Stimuli, by M. Wilson; A Group of Young Chimpanzees in a One-Acre Field, by E. W. Menzel, Jr.; Behavior of Prosimians, by G. A. Doyle.

The Ontogeny of Communication in the Stumptail Macaque (Macaca arctoides). Contributions to Primatology, Vol. 2. S. Chevalier-Skolnikoff. Basel: Karger, 1974. [Price: $27.00]

Contents: Ch. 1. Introduction: I. Purpose of the Study, II. The Animals, III. The Setting, IV. Methods. Ch. 2. Communicative Repertoire of *Macaca arctoides*: I. Communication Defined, II. Communicative Act, III. Adult Communicative Repertoire, IV. Comparison with Other Primates. Ch. 3. Communication between Mothers and Infants: I. The Reflexive Nature of Neonatal Behavior, II. The Reflexive Nature of Early Infantile Communication, III. Sensory Modes Employed in Communication, IV. Comparison with Other Primates, V. Implications of Mother-Infant Interaction for Socialization in *Macaca arctoides*. Ch. 4. Ontogeny of Communication: I. Age of Appearance of Behaviors, II. Development of the Adult Communication System. Ch. 5. Determinants of Ontogeny of Communicative Behavior: I. Functions of Behaviors, II. Determinants of Ontogeny of Communicative Behaviors. Ch. 6. Conclusion. Appendix A. Descriptions of Observed Repertoire of Communicative Behaviors. Appendix B. Sample Facial Expression Checklist.

Social Communication and Movement: Studies of Interaction and Expression in Man and Chimpanzee (European Monographis in Social Psychology 4). M. von Cranach & I. Vine (Eds.) New York/London: Academic Press, 1974. [Price: $24.00]

Contents: I. Introduction, by M. von Cranach and I. Vine. II. Behaviour Patterns and Communicative Consequences. The role of visible behaviour in the organization of social interaction, by A. Kendon; A structural analysis of the social behaviour of a semi-captive

---

*In many cases, the original source of references in the following 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.

group of chimpanzees, by J. A. R. A. M. van Hooff; The expressive behaviour of the deaf-and-blind-born, by I. Eibl-Eibesfeldt; The role of facial-visual signalling in early social development, by I. Vine; Eyes, eye-spots and pupil dilation in nonverbal communication, by I. Hindmarch. III. Structural Analysis of Facial Expressions. The relation between emotion and expression, by N. H. Frijda; Do dimensions have face validity? by P. H. Stringer. IV. Concepts, Strategies and Methods. A method for the assessment of body movement variability, by S. Frey & M. von Cranach; Problems in the recognition of gaze direction, by M. von Cranach & J. H. Ellgring; Some nonverbal and paralinguistic cues as mediators of experimenter expectancy effects, by E. Timaeus.

Disease

Isospora Callimico N Sp, (Coccidia: Eimeriidae) from Goeldi's marmoset (*Callimico Goeldii*). Hsu, C-K. & Melby, E. C., Jr. (Div. of Lab. Animal Med., Sch. of Med., The Johns Hopkins Univ., Baltimore, Md. 21205) *Laboratory Animal Science*, 1974, *24*, 476-79.

Parasitism is one of the most common problems in monkeys. Very few reports on coccidia in nonhuman primates appear in the literature. A new coccidian species, *Isospora callimico*, was obtained from feces of a Goeldi's marmoset (*Callimico goeldii*). Its sporulated oocysts were either ellipsoidal or ovoid, 13.2-20.6 by 11.5-17.4 μ with a mean of 16.9 by 14.9 μ. The sporulation time was 48 hr. at 26°C. Micropyle, polar granule, and oocyst residium were absent. Its sporocysts were ellipsoidal without a Stieda body, 10.2-12.6 by 6.6-9.0 μ with a mean of 11.3 by 7.5 μ.

Serologic testing of various primate species maintained in a single outdoor breeding colony. Kalter, S. S., Heberling, R. L. & Cooper, R. W. (Dept. of Microbiol. & Inf. Dis., Southwest Found. for Res. & Educ., San Antonio, Tx. 78284) *Laboratory Animal Science*, 1974, *24*, 636-645.

Sera from 3 species of monkeys, a marmoset species, a prosimian species, and human contacts in an isolated outdoor colony were surveyed for antibody to a variety of infectious viral agents. The serologic data suggest a variation in species' viral susceptibility and frequent infection of simians with certain human viruses in captivity and demonstrate the biological impossibility of keeping a captive colony of primates free from their natural viral associations as well as from many opportunistic agents.

Studies on the biology of the lung mite, *Pneumonyssus simicola* banks (Acarina: Halarachnidae) and diagnosis of infestation in macaques. Furman, D. F., Bonasch, H., Springsteen, R., Stiller, D. & Rahlmann, F. (Div. of Entomology & Parasitology, Univ. of Ca., Berkeley, Ca. 94720) *Laboratory Animal Science*, 1974, *24*, 622-629.

A tracheo-bronchial swab-irrigation technic for diagnosis of lung mite infestation in macaques was described and evaluated. Diag-

nostic effectiveness was over 78%. Larvae of *Pneumonyssus simicola* were reared *in vitro* to adults of both sexes. Tachygenesis was evident in that protonymphal and deutonymphal instars were evanescent, non-feeding, immobile forms. The motility and behavior of the various stages were discussed with relation to the hypothesis that host-to-host transfer is actively accomplished by the larvae.

Distribution and life cycle stages of lung mites (*Pneumonyssus* spp). Kim, J. C. S. (Dept. of Pathobiology, Sch. of Hygiene & Public Hlth., Johns Hopkins Univ., Baltimore, Md. 21205) *Journal of Medical Primatology*, 1974, *3*, 105-119.

Distribution and life cycle stages of lung mites, *Pneumonyssus* spp., in rhesus monkeys and baboons were studied. Fertile female mites accounted for more than 80% of the total population which were recovered from the lung lesions observed. The possible vector role of this internal parasite has also been investigated by electron microscopy.

Klebsiella air sacculitis in the owl monkey (*Aotus trivirgatus*). Giles, R. C., Jr., Hildebrandt, P. K. & Tate, C. (Div. of Pathology, Walter Reed Army Inst. of Res., Walter Reed Army Med. Ctr., Washington, D. C. 20012) *Laboratory Animal Science*, 1974, *24*, 610-616.

Klebsiella pneumoniae was isolated from the laryngeal air sacs of 11 of 12 owl monkeys with air sac infection. The pathologic changes consisted of an acute thromboembolic air sacculitis in 5 animals and a subacute suppurative air sacculitis in 6 animals. The report recognized *Klebsiella pneumoniae* as an organism of high pathogenicity in the owl monkey. The laryngeal air sacs were presented as potential primary sites for infection.

Semen matrix calculi in a rhesus monkey (*Macaca mulatta*). Frisk, C. S., Manning, P. J. & Wagner, J. E. (Sinclair Comp. Med. Res. Farm & Dept. of Pathol., Sch. of Vet. Med., Univ. of Missouri, Columbia, Mo. 65201) *Laboratory Animal Science*, 1974, *24*, 679-681.

An 8.5 year old male rhesus monkey (*Macaca mulatta* died unexpectedly from *Streptococcus pneumoniae* septicemia. At necropsy the animal had severe ulcerative cystitis, and a rent in the bladder wall resulted in leakage of urine into the abdominal cavity. Seven soft calculi were loosely attached to the mucosa of the urinary bladder. The calculi were resilient, cylindrical, 1-1.5 cm long, 0.5 cm wide, and brown-green. Microscopically, they consisted of a bright eosinophilic hyaline matrix that contained spermatozoa. The matrix calculi probably resulted from coagulation of semen after retrograde ejaculation into the urinary bladder. A chronic penile urethritis appeared to be responsible for retrograde ejaculation.

Problems of rickets in monkeys and apes. Fiennes, R. N. T-W-. (Dept. of Path., Nuffield Inst. of Comp. Med., London NW1 4RY, England) *Pro-*

ceedings of the Royal Society of Medicine, 1974, *67*, 309-314.

The article is the presidential address to the Section on Comparative Medicine of the Royal Society. The writer reviews studies concerned with bone disease in primates and concludes that a new perspective on the problem has emerged on the basis of more recent research. Monkey rickets is evidently not primarily rickets, but a condition that covers a great deal more than at first appears. Monkeys do not have an exceptionally high requirement of vitamin D. One has learned also that it is dangerous to extrapolate from one species to another.

Physiology

Hematology of laboratory baboons in Kenya. Newson, J. & Davies, J. D. G. (Wellcome Trust Res. Lab., Nairobi) *Journal of Medical Primatology*, 1974, *3*, 95-104.

Most published reports of normal hematological values for baboons are unsatisfactory in that data on different subspecies, sexes and age groups are pooled indiscriminately. Our baboons are trapped and maintained in Kenya, where they are utilized for nutritional anemia studies. They show certain differences in their hematological values compared with published data, most of which refer to animals in the USA. The obvious environmental aspects of climate, altitude and diet may account for this. The present paper demonstrates some alterations in hematological and biochemical parameters which appear under two dissimilar, yet supposedly normal, dietary regimes. It provides evidence also of consistent differences between the yellow and olive baboons, the two subspecies most frequently kept as laboratory animals.

Facilities and Care

Comparison of two early separation and weaning schedules of infant rhesus monkeys (*Macaca mulatta*). Southam, L. (50 Orchard Rd., Demarest, N. J. 07627) *Journal of Medical Primatology*, 1973, *2*, 302-307.

Two schedules for separation of infant rhesus monkeys from the mother and weaning from a milk substitute are presented. Body weight increased more rapidly in infants who were separated early from their mothers. The chief advantages of this method are the early resumption of menstrual cycles in the mature females and rapid adjustment to human handling and care in the infants.

The need for field-laboratory facilities for primate research. Snyder, D. R. & Pilbeam, D. R. (Sec. of Lab. Animal Science, Yale Univ. Sch. of Med., New Haven, Conn. 06510) *Journal of Medical Primatology*, 1973, *2*, 257-266.

Well planned and equipped field-laboratory facilities will permit primate behaviorists to investigate the environmental and social factors and neural mechanisms which interact so profoundly

in the ontogeny and regulation of communicative social behavior including aggression, individual spacing, play, sex, and affection. Furthermore, only in a field-laboratory is the investigator able to interactively manipulate the relationship between brain function and behavior by remote electrical, chemical, environmental, or social means.

Environments can be distributed along a continuum from the natural habitat at one end to a sterile isolation cage at the other. While it is true that the environment of a field-lab facility can only approach the natural condition, we are convinced that it would be superior in most features to solitary or group cages. In particular, social observations and experiments can be performed on individuals who are part of intact, ongoing social groups in a rich and essentially unrestricted habitat relative to their caged counterparts. With presently available telemetry, radio-stimulation, radio-injection, and activity monitoring equipment, we see no barrier to performing the most elegant, electronically sophisticated, physiological and social manipulative experiments at a field-laboratory facility--to which must be added the environmental advantage.

Breeding

Electroejaculation technique in *Macaca mulatta* (rhesus monkeys). Fordney Settlage, D. S. & Hendrickx, A. G. (Dept. of Obs. & Gyn., Univ. of So. Calif., Los Angeles, Calif., 90033) *Fertility and Sterility*, 1974, *25*, 157-159.

Ejaculates were collected from five rhesus monkeys by penile electrode stimulation over a 6-month period. The success of specimen collection was 97.4%, with all failures occurring in the first 3 weeks of the study. All animals showed a conditioning response to the procedure which included occasional or frequent ejaculation without the need for using electric current. In short periods of time, a capacity for multiple ejaculations was demonstrated for all animals. Early complications of the procedure included urine contamination with stimulation above 45 volts and small burns over 60 volts. Stimulation over 45 volts must, therefore, be avoided. This method is shown to be safe, practical, and effective in the collection of large numbers of ejaculates for use in insemination and laboratory studies.

Age of sexual maturity in laboratory-born pairs of rhesus monkeys (*Macaca mulatta*). Maple, T., Erwin, J. & Mitchell, G. (Dept. of Psychology, Univ. of Calif., Davis, Calif. 95616) *Primates*, 1973, *14*, 427-428.

Two pairs of laboratory born rhesus monkeys gave birth to healthy young at what was calculated to be approximately 3.30

years for the 2 males and 3.11 and 3.13 years for the 2 females, respectively. The generally accepted age for the onset of sexual maturity for this species has been 4.5 years for males and 3.5 years for females.

Birth of two second generation hybrid macaques. Bernstein, I. S. (Dept. of Psychology, Univ. of Georgia, Athens, Georgia 30602) *Journal of Human Evolution*, 1974, *3*, 205-206.

A male infant was born to hybrid female monkey (*Macaca mulatta* × *M. nemestrina*) on 24 May 1973. On 4 July 1973, a second hybrid female macaque (*M. nemestrina* × *M. nigra*) also produced a viable female infant. These were the twenty-seventh and twenty-eighth hybrid births in our program, but the first second generation births.

Reproduction in two species of spider monkeys, *Ateles fusciceps* and *Ateles geoffroyi*. Eisenberg, J. F. (Natl. Zool. Pk., Smithsonian Inst., Washington, D. C. 20009) *Journal of Mammalogy*, 1973, *54*, 955-957.

The author presents data on breeding history of 3 female *Ateles fusciceps robustus*. Normal gestation lies between 7 and 7.5 months. Breeding data for a free ranging population of *Ateles geoffroyi panamensis* on Barro Colorado Island. The writer contends that the larger New World primates exhibit reproductive characteristics that, when taken collectively, differ from those reported by Napier and Napier (1967) for the Old World macaques and baboons.

Taxonomy

Two distinctive types of owl monkeys (*Aotus*). Brunback, R. A. (Dept. of Neurology, Barnes Hospital, St. Louis, Missouri 63110) *Journal of Medical Primatology*, 1973, *2*, 284-289.

The South American owl monkeys, genus *Aotus*, are of two distinct types (*griseimembra* Elliot 1912 and *trivirgatus* Humboldt 1812) based upon differences in karyotype, geographic origin, and pelage. Investigators using these animals must carefully differentiate these two types and identify additional characteristics of each group.

New data on the taxonomy of the Brazilian marmosets of the genus *Callithrix* Erxleben, 1777. Coimbra-Filho, A. F. & Mittermeier, R. A. (Rua Artur Araripe 60/902, Gávea - 20.000, Guanabara, Brazil) *Folia Primatologica*, 1973, *20*, 241-264.

The taxonomy of the marmoset genus *Callithrix* is re-evaluated. The members of the *C. jacchus* group (*C. aurita, C. flaviceps, C. geoffroyi, C. jacchus, C. penicillata*) are considered good species. Although they produce hybrids and even double hybrids in captivity and are largely allopatric in nature, there is some

range overlap between them and natural hybrids are unknown. *C. aurita coelestis* and *C. penicillata jordani* are considered valid subspecies. *C. humeralifer* (including *C. h. humeralifer* and *C. h. chrysoleuca*) is probably more closely related to the *C. jacchus* group than to *C. argentata* (which includes *C. a. argentata, C. a. leucippe* and *C. a. melanura*).

Conservation

Orang-utan conservation and rehabilitation in Sumatra. Rijksen, H. D. (Nature Conservation Dept., Agric. Univ., Marijkeweg 15, Wageningen, The Netherlands) *Biological Conservation*, 1974, *6*, 20-25.

The orang-utan in Sumatra has long been under heavy hunting pressure, in order to supply foreign zoos, and notwithstanding protection by law. Since the author started his orang-utan survey in the Gunung Leuser Reserve and established a rehabilitation station for animals confiscated by nature conservation authorities, the situation has somewhat improved, at least in the areas visited by him from time to time. There is, however, another threat to the species--the destruction of its habitat, the rain-forest, either by the local people's shifting cultivation (ladang) or on account of large-scale logging by Indonesian or foreign timber companies. It is hoped that the Leuser, Langkat, and Kluët reserve complex can be kept inviolate. The rehabilitation project has proved a success, despite predation by a Clouded Leopard. Some of the sub-adult orang-utan have gone wild in the jungle surrounding the station in which wild specimens are seen regularly. The mode of life and behavior of both the wild and the rehabilitation station animals are being studied, the contrasts between the animals at the station and their wild counterparts being of great interest.

Evaluations of Primates for Research

Evaluation of the gibbon (*Hylobates lar lar*) as a laboratory primate--use of gibbons. Tanticharoenyos, P. (US Army Med. Component, SEATO, Bangkok, Thailand) *Experimental Animals (Tokyo)*, 1973, *22*, (Suppl.), 489-496.

In the animal colony of the Department of Veterinary Medicine, United States Medical Component, SEATO, gibbons are being studied for their suitability as a laboratory primate. The gibbon's normal reproductive biology as it may be practically related to laboratory breeding programs and its susceptibility to spontaneous or experimentally induced diseases are receiving particular attention. The white-handed gibbon (*H. lar lar*) which is widely distributed in Thailand can be a useful and perhaps a unique laboratory primate. The gibbon has been found to be susceptible to a number of infectious agents which include *Pseudo pseudomallei* and *Enterobacter cloacae, Herpesvirus hominis*, Dengue, and Influenza viruses, and various parasitic agents in-

cluding malaria, canine heartworms, cysticerciasis and gnathostomiasis. A number of deaths in this animal caused by either granulocytic or lymphocytic leukemia indicate this animal may be useful in oncogenic studies. Experimental infections with veneral disease agents have been attempted but have been unsuccessful.

* * *

COPIES OF CHIMPANZEE BIBLIOGRAPHY AVAILABLE

We have a limited number of extra copies of the following publications to give to qualified requestors in the U.S. Please address requests to: Barbara Iatropoulos, Librarian, The Albany Medical College, International Center of Environmental Safety, P. O. Box 1027, Holloman AFB, N. M. 88330.

Rohles, Frederick H., Jr. The chimpanzee: a topical bibliography. *Aeromedical Research Laboratory Technical Report No. 62-9*, Holloman AFB, New Mexico, 1962.

Rohles, Frederick H., Jr. The chimpanzee: a topical bibliography, addenda. *Aeromedical Research Laboratory Technical Report No. 63-27*, Holloman AFB, New Mexico, 1963.

Rohles, Frederick H., Jr. The chimpanzee: a topical bibliography, second addenda. *Aeromedical Research Laboratory Technical Report No. 67-4*, Holloman AFB, New Mexico, 1967.

First Holloman Symposium on Primate Immunology and Molecular Genetics, edited by C. H. Kratochvil. Series: *Primates in Medicine*. Vol. 1. Basel, Karger, 1968.

* * *

LAGOTHRIX LAGOTHRICHA WANTED

Two or 3 frozen or embalmed complete adult specimens, male and female, of the wooly monkey, *Lagothrix lagothricha* for thesis research in anatomy. Will pay cost of specimens and shipping upon receipt and inspection of the animals. Contact: Linda K. Ziemer, Department of Anatomy, The Johns Hopkins Univ., Sch. of Med., 724 N. Wolfe St., Baltimore, Md. 21205.

ADDRESS CHANGES

Allen Barnett
Dept. of Pharmacology
Schering Corp.
Orange St.
Bloomfield, N. J. 07003

F. D. Burton
Scarborough College
West Hill, Ontario
Canada

Larry D. Byrd
Chairman, Div. Prim. Behav.
Yerkes Reg. Prim. Res. Ctr.
Emory University
Atlanta, Georgia 30322

Robert G. Carlson
Japan Upjohn Ltd.
Box 49, Shinjuku Sumitomo Bldg.
Shinjuku-Ku, Tokyo, Japan 160-91

William C. Cole
Vet. Med. Div.
Biomedical Lab.
Edgewood Arsenal, Md. 21010

Elizabeth M. Cuthbertson
333 Lowell Ave.
Mill Valley, Ca. 94941

James M. Danilovitz
R. D. #1, Box 105
Lake Ariel, Pa. 18436

Ron J. Dare
Dept. of Soc. & Anthro.
Box 3BV
New Mexico State Univ.
Las Cruces, N. M. 88003

G. T. Dibley
Ministry of Co-operative
Forestry & Community Devel.
P. M. B. 3097, Kano
Nigeria

Erik Eriksen
Ingersvej 33
2920 Charlottenlund
Copenhagen, Denmark

B. J. Everitt
Dept. Anatomy
University of Cambridge
Downing St.
Cambridge CB2 3DY England

Yaakov M. Getz
14000 W. Nine Mile Rd.
Oak Park, Mich. 48237

Philip G. Grant
Dept. of Anthropology
Univ. of Texas
Austin, Texas 78712

Malcolm D. Jones
Dept. Radiology
U. of Texas, Hlth. Sci. Ctr.
7703 Floyd Curl Dr.
San Antonio, Texas 78284

Carol S. Kujala
799 Eaglemount Ave.
Mississauga, Ontario
Canada

Harry J. Krzywicki
785 Troy Court
Aurora, Colorado 80011

Kiu Leung
Dept. of Immunopathology
Scripps Clinic & Res. Found.
476 Prospect St.
La Jolla, Ca. 92037

Gilbert Manley
Dept. of Anthro., U. of Durham
South End House
South Rd.
Durham DH1 3TG England

Christopher E. Parker
Psychology Department
San Diego State University
San Diego, Ca. 92115

John T. Rawlinson
Zoology Dept.
Hammersmith Hospital
Ducane Rd.
London, W12 OHS, England

Arthur C. Risser, Jr.
Bird Dept. S. D. Zoo
P. O. Box 551
San Diego, Ca. 92112

F. R. Robinson
1600 West State St.
West Lafayette, Indiana 47906

Norman J. Scott
Nat'l. Fish & Wildlife Lab.
Dept. of Biol., Univ. of N.M.
Albuquerque, N. M. 87106

Lawrence G. Sharpe
NIDA Addiction Res. Ctr.
Box 2000, Leestown Pike
Lexington, Ky. 40507

Nancy Smith
5609 20th Av. N.E.
Seattle, Wash. 98105

Jonathan Wegener
Wright Institute of Otology
Community Hospital
1500 N. Ritter Ave.
Indianapolis, Indiana 46219

Arthur Wills
3523 Edwards St.
Landover, Md. 20785

Martin D. Young
Coll. of Vet. Med.
Box 216 Miller Hlth. Ctr.
University of Florida
Gainesville, Florida 32610