

LABORATORY PRIMATE NEWSLETTER

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POLICY STATEMENT

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

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

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

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

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THE OREGON REGIONAL PRIMATE RESEARCH CENTER

Claire Lyon

Oregon Regional Primate Research Center

The Oregon Regional Primate Research Center is a 250-acre compound screened by tall firs and thickets of vine maple and bracken from the busy roads that criss-cross the northern tip of a once secluded valley. Situated at the end of the entrance road which winds past a little holly orchard is the Central Services Building, the hub of the administrative activity of the Center. To the west of this quiet park-like area lie the Research and Colony Buildings. All three buildings were dedicated in May, 1962, when the paved walkways were still dirt paths and when the sweet gum and curly willow were struggling saplings.

A little more than a year later, in September, 1963, Dr. William Montagna came from Brown University to assume the directorship. In the decade that followed, the Center staff increased to 60 scientists and 165 support personnel. A nucleus of prosimians has now grown to be probably the largest and most valuable collection in the country. The eight species, numbering 300 of the rare animals, constitute about 20% of the total animal population of the Center. Of the other 1200 animals representing nine species of nonhuman primates, about 800 are rhesus monkeys.

The Center research program embraces four major areas: reproductive biology, which includes reproductive and perinatal physiology, biochemistry, and behavior; cardiovascular and metabolic diseases; immune diseases; and cutaneous biology. The supporting services, which are research areas in their own right, are the laboratories of electron microscopy, pathology, surgery, and radiology. Both the major and supporting personnel are immeasurably helped by surgery, the data processing unit, medical illustration and photography, and by a biomedical research library of journals, books, films, and a special collection of books on primatology. A small, but carefully selected, collection of rare books in primatology is continually added to from time to time.

The brief sketches on each area of research that follow give at best only a hint of the varied investigations at the Oregon Center; nonetheless they reflect the steady growth that has marked the Center's first decade of research.

The resumé's that follow are meant to bring into clear focus the major avenues of research.

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Reproductive Physiology
Harold G. Spies, Section Head

The 15 scientists in the Division of Reproductive Physiology are concerned with a variety of problems in the fields of anatomy, cell biology, physiology, biochemistry, and endocrinology. These scientists, ranging from 28 to 45 years of age, published 29 articles in leading journals in 1972. At the national meeting of the Society for the Study of Reproduction, R. Brenner, J. Resko, and N. West received the Wyeth Award for 1972 for their investigations on hormonal regulation of oviductal epithelium.

A multidisciplinary investigation is now in progress on the factors that control reproductive events in primates, including 1) the transport, maturation, storage, and regulation of energy metabolism of spermatozoa; 2) the structure, metabolism, and metabolic control of the ovary; 3) the hormonal mechanisms whereby epithelial differentiation in the oviduct and epididymis and the involution of the post-partum uterus are regulated; 4) the regulatory relationships between gonadal steroids, pituitary gonadotropins, and brain humoral agents; and 5) the immediate and latent effects of vasectomy.

An understanding of these and other phenomena will undoubtedly lead to the development of new and better methods for controlling fertility and treating infertility, to a clearer perception of brain function in reproduction, and to a better insight into the relationship between hormones and certain types of cancer. Much of this research is supported by a program project grant from the National Institutes of Health.

Perinatal Physiology
Miles J. Novy, Section Head

Here the principal efforts are directed toward solving the biological problems that still plague intrauterine life, birth, and early infancy. Since the main causes of perinatal mortality are defective fetal growth, premature birth, asphyxia during labor, and hyaline membrane disease in the newborn, knowledge about the development of the embryo and fetus, about placental transport, and about parturition must be widened and deepened.

Experimental studies of fetal homeostasis in primates have always been limited by the inability to devise surgically chronic and stable fetal preparations. Significant progress has been made in this area and continued efforts to improve fetal-maternal preparation are yielding satisfactory results. Studies of the factors that regulate placental circulation, the transfer of oxygen and nutrients to the fetus, and the cardio-respiratory adaptations of the fetus to stress and hypoxia are putting the Center's research facilities to capacity use. Various techniques to measure uterine and umbilical blood flows, including radioisotopic, electromagnetic, and indicator dilution methods, are researched for maximum results. Chronic

fetal preparations in nonhuman primates are used to study placental growth and the maturation of fetal organ systems; the effects of prostaglandins and hormones on myometrial activity and parturition are also explored.

Biochemistry

George W. Kittinger, Section Head

The two groups in Biochemistry pursue separate but related studies in rhesus monkey fetuses. One group is studying the control of the maternal and fetal endocrine systems, including the placenta, the initiation of parturition, and the ontogeny of target tissues in the fetus of rhesus monkeys. Their focus is on how hormones--those of the pituitary, of the adrenal glands, and of the placenta--affect these tissues.

The other group is studying the mechanisms that control metabolism in the various types of muscle, especially the interrelations of carbohydrates, lipids, and amino acids. Specifically, they are studying the effects of hormones and prostaglandins on the myometrium of rhesus monkeys during pregnancy and the ovarian cycle, and on the skeletal and cardiac muscle from fetal, neonatal, and adult rhesus monkeys.

Primate Behavior

Charles H. Phoenix, Section Head

The main focus of this department is to analyze the hormonal, social, environmental, and nutritional factors that control reproductive behavior in male and female, young and old, prosimian and simian primates. Together with the reproductive physiologists and biochemists, this group continues the long-established interdisciplinary approach to the study of the numerous variables and interactions that determine reproductive behavior.

Whatever the current thrust of this group is--the relationship between play and aggression and sexual behavior in our troop of Japanese macaques or the effects of light and pheromones on the reproductive cycles of ring-tailed lemurs--their long-range goal is to elucidate the factors that control sexual behavior in man. Despite some striking resemblances between the behavior of human and nonhuman primates, the underlying motivations probably differ. The rich variety of sexual expression in nonhuman primates suggests that the exchange of gametes is not the only goal of the behavior observed.

Cardiovascular Diseases

M. Rene Malinow, Section Head

Atherosclerosis of the main coronary arteries is responsible for more than 600,000 deaths annually in the United States. Much of the current effort to check this disease is directed toward identifying

and modifying certain risk factors, especially by controlling hyperlipidemia through diet and drug therapy.

To determine whether this therapy also affects the incidence and clinical course of coronary artery disease requires expensive and prolonged observation of thousands of human patients. The use of nonhuman primates not only obviates a good deal of the cost of such research but also provides basic information for controlling the disease in man in a relatively simple way.

The annual John C. Higgins Memorial Lectures have brought the nation's foremost researchers and authorities in the field of lipoproteins and cardiovascular diseases to the Center. Held in the early fall, these lectures invite participation from the medical profession, related health fields, researchers, and teachers. The Oregon Heart Association cooperates in sponsoring the event.

Nutrition and Metabolic Diseases
Oscar W. Portman, Section Head

The common targets of this research group are the role of nutritional factors and the importance of some facets of lipid metabolism. Changes in the composition and metabolism of the arterial wall and the interaction of arterial tissue with plasma lipoproteins have been emphasized. Age and nutritionally induced atherosclerosis have been the important variables that effect arterial changes; more recently the vascular changes that accompany spontaneous and induced diabetes have been studied. Focusing as they do on alterations in lipid metabolism in the hepatobiliary system, studies of gallstones in squirrel monkeys have cast some light on the problem of atherosclerosis. Investigations of the effects of nutrition on the brain have emphasized the relationships between lipids and myelinogenesis.

Immunology
Arthur Malley, Section Head

Studies in the three major fields of investigation--allergy, transplantation, and cancer immunology--are directed not only at acquiring an understanding of the basic underlying principles but also at applying new developments in the treatment of human patients in well-controlled clinical trials.

In our allergy program, we have concentrated on isolating and characterizing various allergenic materials and on developing an understanding of the biochemical mechanism of allergic reactions. The isolation of monovalent allergen fragments provides not only a useful therapeutic agent but also a reagent that enables us to examine several aspects of antibody production.

The aim of the transplantation program is to develop a method whereby the immunologic barriers associated with graft rejection are overcome and the transplant recipient is able to evoke a normal immune response against other foreign materials. Studies on mouse melanoma tumor are aimed at developing methods to increase the specific recognition of tumor cells and to evoke a specific cell-mediated immune reaction which will eliminate the tumor.

Hematology
Marjorie LaSalle

Until recently, little was known about blood groups in nonhuman primates. Now, at least six blood group systems, consisting of 11 recognizable blood factors, have been found to occur in rhesus monkeys, and several other factors are under investigation. One such study is to determine how tissues are affected when incompatible blood is given to a nonimmunized monkey; another is to search for the cause of human "Rh babies" and to discover why the condition cannot be simulated in rhesus monkeys.

Cutaneous Biology
William Montagna, Section Head

This group of investigators is concerned with a wide variety of biological properties of the skin of man and that of other animals, and in particular nonhuman primates. Morphological studies--light microscopic, and transmission and scanning electron microscopic--continue on all cutaneous appendages, under normal, experimental, and abnormal conditions. Investigations to date are directed toward the development of skin, the biology of sebaceous glands both under experimental conditions and in acne, and a wide spectrum of studies ranging from melanocytes from mouse, man, and rhesus monkey to melanomas cultured under specific conditions and to the normal and lazer-irradiated melanophores of fish, amphibians, and mammals. Studies of the phenomenon of baldness have led to a variety of experimental procedures and newer methods of analyses. Nearly all of these investigations emphasize the comparison between the properties that characterize man and those of other animals.

Electron Microscopy
Wolf H. Fahrenbach

This laboratory provides research facilities for eight full-time investigators and training for one postdoctoral fellow and one predoctoral trainee. In addition to controlling the quality of cellular fractions for biochemical studies, the staff supplies technical support for several other projects. Major studies have included the identification and description of anomalies of the pancreas and vascular system associated with spontaneous diabetes in Celebes apes. The use of the scanning electron microscope, especially as it applies to skin surfaces and appendages, has

been upgraded and refined.

Pathology
Wilbur P. McNulty, Section Head

The morphological and clinical analysis of "spontaneous" diseases in nonhuman primates and the comparison between these diseases and their counterparts in man are the primary goals of this laboratory. However, the autopsy and clinical records often raise more questions than they answer. Therefore, subsequent experimentation to clarify etiology, pathogenesis, and therapeutic modification is an integral part of the total research. Analysis of experimentally provoked disease is a second function, either alone or in collaboration with other investigators. For the health and longevity of the Center animals, the laboratory also provides the Colony with diagnostic help in the control of diseases.

Radiology
Robert S. Miller

Designed mainly as a support facility, the radiology department uses three X-ray rooms to study animal health, osseous and other anatomy, and bone growth. By means of the special head unit or portable equipment, radiographs are obtained during surgery to aid in certain techniques. Fetuses of known gestational age have been radiographed for data that will enable Center investigators to estimate the ages of animals whose gestational age is not known. A longitudinal study of the age of bones of rhesus monkeys also continues.

Data Processing
Ingrid Palm, ADP Director

As a research support component, Data Processing has as its major function to store accumulated data in the computer-based file of animal records and to retrieve selected information for both periodic and one-of-a-kind reports. Approximately 200 or more retrievals on the history of various research animals are made annually. Tallies based on data in the file are compiled for surgery, pathology, animal science, and individual investigators. Among the new statistical programs developed to analyze data from a number of laboratories is a sequence of two programs for the efficient design and analysis of radioimmunoassays.

Medical Services
John D. Hill, Section Head

Medical Services develops the methods and performs the surgical procedures that meet the experimental needs of the investigators and at the same time promotes the recovery of the animals for as many additional and different projects as possible. This system relieves the investigator of concern about surgery skill, methods, aseptic technique, and postoperative care and frees him to design experiments,

analyze data, and publish the results. On the other hand, it enables surgery personnel to concentrate on improving their techniques. Centralization also provides more space for operating rooms and related activities, economy of bulk purchasing of supplies, easy availability of specialized instruments, physiological recorders, and other expensive equipment. During the past year, 1,137 operations were performed for 31 investigators.

Colony Operation
Arthur S. Hall, Section Head

The new installation of 400 wall-hanging cages with automatic watering devices represents one of our most recent efforts at improving the primate management and husbandry in the fully accredited animal facility. A modern centralized cage-cleaning facility is also nearing completion and on the planning board is more automation to maintain humane care for 1500 animals and to provide an even more efficient work schedule.

Strict control of Colony animals is observed. They are routinely weighed and TB-tested and females are checked for pregnancy. The menstrual cycles of each caged breeding female are checked and recorded daily. Approximately one-third of the present animals were born at the Center as part of the breeding program. The Colony maintains a nursery, postoperative care, quarantine and isolation quarters, a clinic for administering to minor injuries or illnesses, and a clinical laboratory for analyses in hematology, chemistry, urinalysis, bacteriology, and parasitology, and for assisting investigators.

Funding

As at the other regional primate research centers, the basic operation of the Oregon Center is funded by the National Institutes of Health, Division of Research Resources, Animal Resources Branch. Scientific investigations are individually funded by various government sources, health organizations, foundations, and thoughtful individuals. Cost of the Oregon Center operation is about \$3.3 million a year. The Medical Research Foundation of Oregon is the Center's fiscal agent for receiving and administering all funds.

Professional Staff

Division of Research

Reproductive Physiology. Harold G. Spies, Ph.D., Section Head; Nancy J. Alexander, Ph.D.; Robert M. Brenner, Ph.D.; E. Rene Casillas, Ph.D.; Dale D. Hoskins, Ph.D.; Reid L. Norman, Ph.D.; John A. Resko, Ph.D.

Perinatal Physiology. Miles J. Novy, M.D., Section Head.

Biochemistry. George W. Kittinger, Ph.D., Section Head; Clarissa H. Beatty, Ph.D.; Rose Mary Bocek, Ph.D.

Behavior. Charles H. Phoenix, Ph.D., Section Head; G. Gray Eaton, Ph.D.; Theodore I. Grand, Ph.D.; Richard N. Van Horn, Ph.D.

Cardiovascular & Metabolic Diseases.

Cardiovascular Diseases. M. Rene Malinow, M.D., Section Head.

Nutrition & Metabolic Diseases. Oscar W. Portman, M.D., Section Head; Charles F. Howard, Jr., Ph.D.

Immune Diseases. Arthur Malley, Ph.D., Section Head; Marjorie LaSalle, Ph.D.; Billie J. Wilson, Ph.D.

Cutaneous Biology. William Montagna, Ph.D., Section Head; Mary Bell, Ph.D.; Funan Hu, M.D.; Dennis D. Knutson, M.D.

Central Services

Administrative Services. William Montagna, Ph.D., Director; Charles H. Phoenix, Ph.D., Assistant Director; E. Donald PicKell, B.S., Business Manager; A. O. Toyooka, B.A., Associate Director for Business Affairs; Edward S. West, Ph.D., Assistant to the Director.

Research Services.

Laboratory of Electron Microscopy. Wolf. H. Fahrenbach, Ph.D., Section Head.

Laboratory of Pathology. Wilbur P. McNulty, Jr., M.D., Section Head; James L. Palotay, D.V.M.; Hideo Uno, M.D.; Linda M. Pasztor, Ph.D.

Radiology. Robert S. Miller, M.D.

Animal Sciences

Colony Operation. Arthur S. Hall, D.V.M., Section Head; C. James Mahoney, D.V.M.S., Ph.D.

Medical Services (Surgery). John D. Hill, D.V.M., Section Head

THE PRIMATE CENTER TNO¹

History and Current Administration

The colony of the Primate Center TNO was initiated in 1960 to provide researchers of the Radiobiological Institute TNO with nonhuman primates to study biomedical subjects for which the customary laboratory animals proved to be inadequate. Soon, however, requests for primates came from institutes throughout the Netherlands and, as word spread of the primates and resources available, from many parts of western Europe. With the expansion of the colony and its new international role, it became evident that the creation of a national center similar to those in the USA was necessary. In the late sixties, therefore, the Primate Center TNO was established as an independent unit of the Health Research Organization, one of the divisions of the National Organization for Applied Scientific Research. The Center operates on an annual budget provided by the government and receives additional financial support in the form of grants and contracts from national and international organizations. Reimbursement for services rendered, such as the use of facilities, testing of biological products, the supply of primates, etc. are on a non-profit basis and form a relatively small part of the Center's revenues.

A nucleus of full-time scientists and laboratory personnel carry out the Center's own research programs. In addition, investigators from the Radiobiological Institute and the Institute for Experimental Gerontology engage in a number of collaborative studies. The close proximity of the three institutes enables the sharing of personnel and specialized equipment as well as administrative, workshop and library services. This productive cooperation and pooling of resources has created a stimulating atmosphere in which multidisciplinary research is pursued. Through faculty appointments of several of the REP's² staff members, a close affiliation with the Universities of Leiden, Rotterdam and Amsterdam (all within 35 miles) has been established.

The Primate Center's Own Research Programs

In line with the general policy of the Health Organization TNO the Primate Center's own research programs are mostly clinically oriented. The investigations can be broadly divided into biomedical and behavioral studies. The biomedical work deals mainly with immunological subjects and is a continuation of studies which were begun at the Radiobiological Institute before the establishment of the Primate Center. The behavioral studies were

¹This article is based on a brochure that has recently been prepared by the Primate Center TNO, Lange Kleiweg 151, Rijswijk (ZH), The Netherlands. TNO is an abbreviation for Applied Scientific Research.

²The Radiobiological Institute, the Institute for Experimental Gerontology and the Primate Center form the REP group of the Health Research Organization TNO.

initiated after the establishment of the ethology group in 1969. Both divisions of the Primate Center--Biomedical and Behavioral--have purposely limited the diversity of their research programs in order to become highly specialized in only a few selected areas of science.

Biomedical Research

Immunology and in particular immunogenetics are the main subjects of the Center's biomedical research programs. The studies concentrate on the identification of the genetic systems which control histo-compatibility antigens as well as immunological defenses responsible for resistance to disease, possibly cancer. The availability of pedigreed families of rhesus monkeys and, on a more modest scale, of chimpanzees made it possible to study in depth these and other aspects of primate immunogenetics. Consequently, the Center has become an authority in primate immunogenetics and transplantation immunology and serves as a reference laboratory for tissue typing of rhesus monkeys and chimpanzees. Another subject which is being thoroughly studied is immunosuppression. By introducing the *in vivo* primate-test to monitor the efficacy of anti-lymphocyte serum (ALS), the Center has been instrumental in developing and standardizing this promising new immunosuppressive agent for man. *In vivo* testing of ALS in macaques is now required by the authorities in most countries where it is produced and used for patients.

Behavioral Research

The studies of the ethology group concentrate on the methods by which monkeys establish and maintain peaceful relationships. One study focuses on the analysis of interactions between pairs of monkeys, in particular the role that 'grooming behavior' may play. Another project is concerned with the relationship between mothers and infants and its influence on the subsequent social development of the infant. In addition, various forms of pathological behavior are being investigated. Currently the experiments are carried out with macaques but chimpanzees will be employed in future investigations.

Research Facilities

Because of its international function the Center must provide a large variety of research facilities which are flexible in their adaptability to a broad range of disciplines. In this respect the close proximity and collaboration of the three REP institutes is particularly profitable: several services and facilities offered by the Primate Center are in fact provided by its sister institutes. By virtue of this close collaboration, the Center can provide a range of skills and facilities which is not usually available in a single institute. The most important ones can be listed as follows.

Surgery.--An operation room is equipped for sophisticated experimental surgery. Highly trained personnel (professional as well as technical) will carry out or assist in a wide range of surgical procedures, anesthesia and postoperative care. The Rijswijk group has specialized in organ transplantation and various types of microsurgery. Isolation rooms insure optimal recovery conditions and can be used to control the environment to meet research needs such as isolation for immune-deficient animals.

Immunology.--Most of the common immunological and immunochemical procedures can be carried out at the REP institutes. The Primate Center has specialized in tissue typing techniques and serves as a reference laboratory for histocompatibility systems of rhesus monkeys and chimpanzees. One of the immunological services routinely performed for governmental agencies and pharmaceutical companies is the *in vivo* testing of anti-lymphocyte serum in monkeys.

Bacteriology.--Services, provided by staff of the Radiobiological Institute, are available for studies in gnotobiology as well as for fundamental and clinically-oriented bacteriological studies. Furthermore, facilities have been designed for the strict isolation of animals, including the maintenance of germ-free primates. As a routine service to the Primate Center, the REP's bacteriology division supervises quarantization and monitors the enteric flora of the stock animals.

Hematology and Biochemistry.--Equipment and trained personnel are available to perform the hematological and biochemical examinations required for modern biomedical research.

Pathology.--The pathology staff of the Radiobiological Institute performs post-mortem examinations on the Center's animals and provides a routine histology service. Specialized equipment includes an electron microscope and apparatus for quantitative immunofluorescence.

Radiation Biology.--Several radiation sources in the Institute for Experimental Gerontology are available for both total-body and local irradiation. Sources include two 300kV X-ray machines, a 1200 Curie ^{137}Cs γ ray source which is also suitable for extracorporeal irradiation of blood and three Van de Graff neutron generators with an accelerating voltage of up to 3.75 MeV. Skilled personnel are responsible for dosimetry and will assist in animal irradiation. Extensive facilities for the handling and counting of radioisotopes are available. For data processing a computer and a programmer's service can be provided.

Ethology.--Several scientists are engaged in the study of various aspects of social and pathological primate behavior. Facilities provide interchangeable experimental units to enable a wide range of parameters to be studied in the laboratory. The department is expanding rapidly and a new building for behavior research is being constructed.

Primate Colony

The Primate Center TNO maintains about 800 animals representing large colonies of rhesus (*Macaca mulatta*), stumptails (*Macaca arctoides*), and chimpanzees (*Pan troglodytes*). There are also smaller colonies of marmosets (*Callithrix jacchus*), galagos (*Galago crassicaudatus*), squirrel monkeys (*Saimiri sciureus*) and baboons (*Papio cynocephalus*). Six separate buildings are used to house the different colonies. The majority of the animals are kept in "squeeze cages" to facilitate handling of individual monkeys.

Modern husbandry methods are practiced to insure healthy animals suitable for research. All imported primates are quarantined for a minimum period of 90 days in isolated facilities. During the quarantine period the animals are tuberculin tested every 4 weeks, treated for parasitic infestations and routinely monitored for enteric pathogenic organisms. These precautions insure the supply of properly sanitized animals. Monkeys kept permanently in the Primate Center remain under veterinary and bacteriological supervision to prevent the spread of disease among animals and personnel.

The Primate Center TNO maintains one of the largest chimpanzee colonies in the world. The chimpanzees are maintained at the Center because of their close similarity to humans, particularly in regard to their blood groups and tissue antigens. Research on these animals is restricted to investigations which do not entail morbidity. Redundant older males are distributed to zoological gardens or wild life parks. Through breeding the size of the colony is nevertheless maintained at about 65 individuals. They are housed in facilities designed to provide favorable conditions for juveniles and adults alike. Indoor and outdoor play cages, breeding units, juvenile group cages and individual night cages have been provided to meet the special needs of these apes. The success of this endeavor is evidenced by the birth of six babies in 1972 alone. Breeding is carried out in a "harem-type" fashion so as to produce a maximum number of full and half siblings suitable for genetic studies.

Breeding colonies of about 100 rhesus and 30 stumptail females produce approximately 50 infants annually. Large units with outdoor compartments are available for gang breeding and smaller cages for timed matings of pairs. These breeding colonies produce mostly pedigreed families for the Primate Center's own immunogenetic research programs. To meet the increasing demand for pregnant females, fetal material and animals for reproductive physiology research, a new facility is under construction which will more than double the present breeding capacity by the end of 1973.

Services of the Primate Center

As already indicated, the Primate Center provides a number of services to the research community. These can be divided into: 1. Provision of animals plus facilities and/or technical know-how at the Center. If the Center contributes significantly to the planning of experiments and interpretation of results, this becomes a "collaboration" partly financed by the Center. 2. Provision of imported, conditioned animals; these can be kept at the Center for long-term projects or simply delivered to customers elsewhere. 3. Provision of animals according to particular "specifications" such as timed pregnancies, fetuses, young infants, animals of a particular age, laboratory-bred animals, etc. These, too, can be either kept at the Center or delivered elsewhere. 4. Provision of biological material including samples of blood, serum, urine, tissues, etc. To make the most efficient use of the resources, efforts are made to "pool" requests and make delivery coincide with sacrifice of animals for other reasons. 5. *In vivo* testing of biological material or pharmacological products at the Center. Examples are the *in vivo* testing of anti-human lymphocyte serum or the testing of new drugs for possible teratogenic or oncogenic effects. 6. The leasing of animals for short-term experiments at other institutes. 7. Providing biotechnical and scientific information to the research community regarding primate husbandry and biology.

All services, except No. 7 which is obviously gratuitous, are reimbursed on a non-profit basis. Requests are reviewed by the Center's staff for feasibility and ethical acceptability, whereupon conditions and costs are submitted to the potential customer. Periodic questionnaires are sent to users of the Center's primates and services to obtain an indication of future needs. The planning of the Center's expansion of animals stock and facilities are to a large extent based on these estimated requirements.

Future of the Primate Center

Broadly speaking, the Primate Center TNO has a triple function: it is a research institute with its own specialized programs, it provides suitable animals and facilities to the research community and it breeds primates for specific purposes, including preservation. The Center's current size is clearly not sufficient to function optimally, particularly with regard to the large-scale breeding of primates. Thus, shortly after the Center's establishment in the late sixties, a 10-year expansion plan was submitted to the national authorities. The plan proposed to triple the Center's staff and facilities within a decade and enlarge the breeding facilities in such a way that the estimated demand for laboratory primates in the Netherlands around 1980 could be satisfied by the Center's own production. A study by an efficiency bureau indicated that nearly a 10-fold increase of existing breeding facilities would be required to achieve this goal; only then would the breeding of macaques become an economically feasible proposition. At the present time (1973) such major investments in

primate breeding facilities may seem somewhat extravagant. However, there is an ever-increasing demand for laboratory primates and a diminished supply of primates from their natural habitats due to urbanization, export restrictions, etc. In the light of these developments, major investments for breeding at European primate centers may be necessary in the long run. Planned breeding of primates for research purposes should preferably be done on the basis of international collaboration. In fact, such collaboration on a European level is the subject of current discussions between national representatives of primate facilities and the European Economic Community in Brussels. The future supply of laboratory primates and preservation of certain primate species also has the attention of the World Health Organization.

According to the proposed 10-year expansion plan, the personnel of the Center should be doubled by 1976 and tripled toward 1980. A separate new research building will also be constructed. The concept of shared administration and central services by the three REP institutes will be maintained. Around 1980 the macaque breeding stock should be comprised of approximately 1000 females to guarantee the yearly production of 500 animals. According to current estimates this should satisfy the requirements for laboratory monkeys in the Netherlands. Chimpanzees will continue to be bred on a scale large enough to provide future generations of geneticists with pedigreed chimpanzee families. Whether other primate species will be bred at the Rijswijk Center will depend on the future demand and on the choice of breeding programs by other primate facilities in Europe.

A final point of consideration in the future plans of the Center is the possible creation of a primate park somewhat similar to the one already existing in Japan. Part of the planned new breeding and holding facilities of the Center could be constructed as an attractive primate park accessible to the public. Such a park could have a certain educational as well as recreational value. Macaque breeding would take place in honeycomb-shaped units with in- and outdoor runs. These are to be placed in an area of hills, trees and meadows adjacent to the already existing Primate Center. Colonies of chimpanzees and possibly other large primates could be kept and displayed on islands in artificial lakes; an attractive method which has been successfully applied elsewhere. It should be reemphasized, however, that this utopian plan is still in the earliest phases of preparation. Yet, in view of the increasingly difficult supply and threatened extinction of several valuable primate species, such primate preservation parks might become a realistic proposition in the near future.

RECOVERY FROM HERPES B VIRUS INFECTION REPORTED*

On April 13, 1973, a 28-year-old research assistant in California became ill with right-sided paresthesia, sore throat, and low-grade fever. On April 19, he had anorexia, stiff neck, and difficulty concentrating and moving his right fingers and was hospitalized. His temperature rose to 103°F., and on April 22, he had bladder paralysis. His electroencephalogram became diffusely abnormal, but a brain scan and a carotid arteriogram were normal. Serial spinal taps showed normal pressure, but moderate lymphocytosis and increased protein.

The patient was diagnosed as having encephalitis due to *Herpesvirus B* (*Herpesvirus simiae*, monkey B virus). By May 1, he had bilateral paralysis and a respiratory arrest, and a tracheostomy was performed. Human plasma containing *Herpesvirus B* antibody was supplied by CDC but was not administered since his condition had stabilized; he steadily improved until late June when recovery was nearly complete.

No viruses could be isolated from stool, urine, throat washing, or cerebrospinal fluid specimens, but serologic tests at the California Regional Primate Research Center, Davis, California, and at the State Viral and Rickettsial Disease Laboratory confirmed the diagnosis.

The patient worked regularly with rhesus monkeys (*Macaca mulatta*) in the laboratory; 9 of the 26 monkeys to which he was exposed were found to have *Herpesvirus B* antibody, indicative of latent infection. (Reported by the California State Department of Health: California Morbidity, No. 37, September 21, 1973.)

Editorial Note.--A total of 24 cases of monkey B virus infection have been reported throughout the world, half from the United States. Of the 24 patients, 23 had encephalitis, and 18 died. Of the 5 survivors, 3 had serious neurologic sequelae, 1 was expected to recover completely, and this case had a documented full recovery. Of the 17 cases for which information is available, 14 had received a bite or scratch wound, 1 had a history of a puncture with a contaminated needle, 1 had been cut on 2 occasions by glass from monkey tissue cell culture, and 1 had no reported prior injury. The mechanism for infection in this case is unknown.

Monkey B virus is most commonly found in rhesus, cynomolgous, and bonnet macaque monkeys. These monkeys are often used in laboratories, and the rarity of this disease despite frequent human contact with infected monkeys suggests a high degree of resistance to the pathogenic effects of this virus.

*From *Morbidity and Mortality*, 1973, 22, 333-334.

HISTORY OF THREE LITTLE-KNOWN NEW WORLD
POPULATIONS OF MACAQUES¹

Glenn Hausfater

University of Virginia

Phillip Walker

University of Chicago

On several different occasions, free-ranging populations of rhesus monkeys (*Macaca mulatta*) and crab-eating monkeys (*M. fascicularis*) have been introduced into the New World. These introduced populations were usually intended as breeding colonies to supply animals for medical research, but populations have also been established for use in behavior research and for public exhibition. The free-ranging rhesus monkey populations at the Caribbean Primate Research Center in Puerto Rico are well-known and have been the subject of extensive research on social behavior. The existence of a free-ranging population of crab-eating macaques at Monkey Jungle near Miami, Florida, and of a free-ranging population of rhesus monkeys at Silver Springs, Florida, is less widely recognized. Recently, a group of Japanese monkeys (*M. fuscata*), the Arashiyama West troop, was introduced into a large outdoor enclosure at La Moca, Texas, under the management of the University of Texas, and social groups of macaques also are maintained in large enclosures at several of the regional primate centers.

This brief communication summarizes information on three little-known colonies of macaques established in the New World between 1940 and 1950. Two of these populations were introduced intentionally, as breeding groups for medical research, and the third population was introduced unintentionally as a by-product of a commercial monkey-importing facility. Since one of these populations is still in existence and may be of scientific value for purposes of comparison with those listed above, this note has been prepared.

During World War II, numerous rhesus monkeys were released on

¹We wish to acknowledge and thank the following individuals for information provided to us: Mr. Frank V. DuMond of Monkey Jungle, Florida; Mr. Robert A. Campbell of the South Carolina Wildlife Resources Department; Dr. Oswaldo Cruz Filho; and various members of the faculty of sciences at the University of Havana, Havana, Cuba.

Authors' addresses: G.H., Department of Psychology, University of Virginia, Charlottesville, Virginia 22901; P.W., Department of Anthropology, University of Chicago, Chicago, Illinois 60637.

Morrillo del Diablo Key near the Isle of Pines, Cuba. The monkeys were intended as a breeding colony to supply research animals for studies in experimental pathology; however, sometime in the 1950's this plan was abandoned. The key was rocky and barren, and the monkeys soon exhausted the natural foods available. An unknown number of the monkeys were successful in swimming to the Isle of Pines and several sightings of monkeys were reported from the area of Presidio Beach. However, the monkeys failed to establish themselves on the Isle of Pines and several biologists who have recently visited that area heard no mention of monkeys from the residents. Monkeys were shot and trapped on the Isle of Pines, and thus their failure to become established may not be due solely to natural causes.

In 1947, the Okite Farm was established near Bluffton, South Carolina, by the March of Dimes Foundation. The farm was used as an acclimatization and veterinary station for monkeys imported into the United States for use in polio research. Although the farm is no longer in use as a monkey-importing station, the holding cages and other buildings are well-maintained and could be developed into an excellent research facility.

The Okite Farm held from 3000 to 7000 monkeys at any one time, and these were primarily rhesus monkeys, though crab-eating monkeys, baboons (*Papio* sp.), and spider monkeys (*Ateles* sp.) also passed through the facility on occasion. Only one cage door of chain link fence stood between the monkeys and freedom, and former workers at the farm reported that it was common for whole cages of monkeys to escape. Most of the escaped monkeys were retrapped on the grounds of the farm and the local people were instructed to shoot any monkeys seen on their land. However, numerous escaped monkeys were kept by residents of the area as pets.

The escaped monkeys never successfully established themselves in the woods surrounding the Okite Farm, though one female did give birth to an infant while in the woods. Both human intervention through hunting and trapping and harsh winters contributed to their extinction. However, in 1956-57, newspapers and magazines carried stories of a monkey population on Hilton Head Island, a coastal island located 10 miles from Bluffton. In fact, one rhesus monkey was shot on the island in 1957, though there is no evidence that more than one or two monkeys ever reached Hilton Head and the possibility that they were transported there by man cannot be ruled out. Publicity agents for Hilton Head, which was then undergoing development as a resort community, intimated that monkeys were a centuries-old feature of the island, but no reliable reports of monkeys on Hilton Head prior to 1956 can be found. Currently, no monkey population exists in the Bluffton-Hilton Head area of South Carolina. The skeleton and skin of the one monkey shot on Hilton Head is in the zoology collection at the Department of Biology of the University of South Carolina.

In the 1940's, about 300 rhesus monkeys were released on an island, Ilha do Pinheiro, in Guanabara Bay, Rio de Janeiro, Brazil. The monkeys

were intended for use in medical research on yellow fever. Although no accurate population records are now available, about 100 monkeys still inhabit the island, and a full-time caretaker is employed to feed and care for the monkeys. This undisturbed and free-ranging colony of macaques may provide valuable comparative information on seasonality of breeding and births that could be of use to researchers at other New World colonies of macaques. Further information on the colony may be obtained from Dr. Oswaldo Cruz Filho, Director, Instituto Oswaldo Cruz, Avenida Brasil, 4365--Manguinho, Rio di Janeiro, Brazil.

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INFORMATION ON COLLECTIONS OF MAMMAL SPECIMENS TO BE OFFERED

The Committee on Collections of the American Society of Mammalogists is surveying North American collections of specimens of recent (as opposed to fossil) mammals. Collections of living animals as such will not be included. This information will be used to prepare an updated list of collections. The latest list is that of the *Journal of Mammalogy*, 1963, 44 [4], 471-500, of which, incidentally, I still have copies if someone could use one. Questionnaires will be mailed out soon. Anyone who has a collection (small or large) and who does not receive a questionnaire should write to Dr. Jerry Choate (Chairman of the Committee on Collections), Museum of the High Plains, Fort Hays Kansas State College, Hays, Kansas 67601.

The Committee on Information Retrieval is planning methods of improving the flow of information, especially information about specimens in collections. These two committees met jointly in early December to pursue their objectives, including the formulation of a national plan for the purpose.--Sydney Anderson, The American Museum of Natural History, Central Park West at 79th Street, New York, New York 10024.

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ELDERLY BABOONS AND OWL MONKEYS WANTED

Female baboons, *Papio anubis* over 15 years preferred, and female owl monkeys, *Aotus trivirgotus*, the older the better, wanted. Contact: Robert C. Hall, M. D., 750 East Adams St., Syracuse, N. Y. 13210 (Phone: 315-473-4550).

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EXCHANGE OF PRIMATOLOGY COURSE OUTLINES

A graduate course in primatology is being offered in the spring quarter at Michigan State University. The instructors are interested in exchanging course outlines and reference lists with instructors of other primatology courses in the United States. Contact: Drs. W. R. Dukelow & L. Clemens, Endocrine Res. Unit, Mich. State U., East Lansing, Mich. 48824.

FOOD-SHARING IN FREE-RANGING *ATELES GEOFFROYI*
(RED SPIDER MONKEYS)

Ron Dare

University of Oregon

Voluntary food-sharing among nonhuman primates, in which food is actively donated by one individual to another, has been reported for only a few genera in captivity: *Pan troglodytes* (Nissen & Crawford, 1936; Mason, 1970), *Gorilla gorilla* (Schaller, 1963), and *Pygathrix nemaeus* (Kavanagh, 1972; McKenna, Personal communication, 1973). If passive food-sharing is considered (in which the donor does not actively offer food, yet makes no protest to its being shared), captive *Hyllobates lar* may be added to the brief list (Berkson & Schusterman, 1964).

Among free-ranging, nonhuman primates, however, only *Pan troglodytes* has been reported to indulge in either voluntary or passive food-sharing (Goodall, 1965; Reynolds & Reynolds, 1965; Van Lawick-Goodall, 1968, 1971; Teleki, 1973). In fact, the paucity of reports on such behavior among most primates has prompted Kummer (1971) to state categorically that "there is no sharing or passing of gathered food" among nonhuman primates (other than chimpanzees).

From early April to mid-December, 1972, I observed a free-ranging group of *Ateles geoffroyi* on Barro Colorado Island, a biological preserve in the Canal Zone (Panama). I witnessed various instances of passive food-sharing among the monkeys, particularly in and around areas of human disturbance and artificial food-sources. In addition, other scientists, both temporary and long-term residents of the biological station, contributed some of their personal observations to my data. Some of the more dependable informants reported instances of behavior which bear directly on the subject of nonhuman primate food-sharing.

For example, during the second week of December, 1971, a group of the monkeys were present in the main clearing area. (My data indicate increased presence of monkeys in the clearing area during the height of the rainy season [Nov.-Dec.], when fruit productivity seems to diminish in the forest). Dr. Terry Erwin and his wife La Verne, entomologists from the National Museum of Natural History (Smithsonian), were watching the group (Erwin & Erwin, Personal communication, 1972). They noticed two monkeys (sex and age undetermined by the Erwins, but within "adult" size range) on the metal roof of a nearby structure. The larger animal descended to

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Eugene, Oregon 97403.

the edge of the corrugated roof, reached down, and secured two bananas from a large stalk which was left lying on the ground by *Homo sapiens*. The monkey immediately retreated back up the roof, and gave one of the bananas to its companion. The two then sat together, each eating a banana.

The larger monkey repeated this same sequence at least two more times. In each case the recipient did not seem to actively solicit food; rather, the monkey who gathered the bananas seemed to be offering a share to the other by extending the fruit toward the latter.

My guess that the donor-monkey was an adult female, and that the recipient was her sub-adult offspring seems to be strengthened by some additional observations. These were made by Dr. Nicholas Smythe, a Zoologist in charge of the Smithsonian environmental-monitoring program on Barro Colorado Island. He has seen adult female spider monkeys from this group actively donating banana-portions to their offspring during the height of the rainy season (Smythe, Personal communication, 1972). Such behavior was again restricted to artificial sources of food (many of the spider monkeys raid animal cages scattered in and around the clearing area) during a period of relatively low fruit-productivity in the forest.

My own observations, while restricted to passive food-sharing (often of scavenged bread), were not restricted to mother-offspring interactions, but also included some adult-adult sharing (females). Further details, including the significance of these observations in the light of other reports, and in terms of food-sharing as an emergent hominid trait, are in preparation.

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PRIMATE MATERIAL WANTED: ORGANS FOR DNA RESEARCH

I have been researching the homologies of higher primate satellite DNAs as a guide to human evolution, and, perhaps, as a source of inspiration regarding the biological meaning of satellite DNA in general. My colleagues and I have found that homology exists between at least one human satellite DNA and the satellite DNAs of chimpanzee, orangutan and gorilla, as shown by molecular hybridisation experiments with cytological preparations. (Jones, K. W., Prosser, J., Corneo, G., Ginelli, E. & Bobrow, M. Satellite DNA, Constitutive Heterochromatin and Human Evolution. In R. A. Pfeiffer, (Ed.) *Modern Aspects of Cytogenetics: Constitutive Heterochromatin in Man*. Stuttgart/New York: Schattauer, 1972.)

We wish to extend this research and urgently require fresh-frozen tissues for the extraction of DNA. Any organ will do, including placentas or stillborn fetuses. Material should be consigned in dry ice to the address below. We are interested in all primates, but especially in higher primates including Hylobatidae. Also of great interest are chromosome preparations made in the conventional air drying method. I would be interested to hear from anyone who may have a potential source of any of these materials or who may suggest means of obtaining them or who is likely to come into possession of such material in the course of their work. Contact: Dr. K. W. Jones, Institute of Animal Genetics, University of Edinburgh, West Mains Road, Edinburgh, EH9 3JN, Great Britain.

WORLDWIDE STUDY OF NONHUMAN PRIMATES IN BIOMEDICAL RESEARCH INITIATED

The first comprehensive worldwide survey of nonhuman primates used in medical research has been announced by the Division of Research Resources (DRR), National Institutes of Health, Bethesda, Md.

Faced by the possibility that researchers may have to start breeding their own primates within the next five years, the DRR has awarded a \$60,000 contract to the Institute of Laboratory Animal Resources of the National Academy of Sciences. The purpose of the survey is to determine which primates are in short supply and need to be bred for medical research.

Each year, scientists in the United States use about 56,000 monkeys and apes in their attempts to better understand human health problems. They rely mostly on imported animals because the supply from domestic breeding programs is small. According to experts, the survival of several primate species used in medical research is being threatened. The encroachment of small towns and farms in developing nations is destroying the animals' traditional tropical forest habitat. In an effort to save certain species, many countries are placing export restrictions on primates, ranging from the night monkey imported from Columbia for malaria research, to the rhesus monkey, the most popular primate for medical and biological investigations. Although experts feel that present research is not in jeopardy, they believe that within five years scientists will have to rely heavily on breeding colonies.

Dr. Nancy Anne Muckenhirn, a zoologist and primatologist, will be in charge of the primate survey (see announcement below). After analyzing available data, she will recommend field studies to fill in additional facts, working in close cooperation with the Institute of Laboratory Animal Resources' Primate Conservation Committee. Initial census figures will be published within one year. (From DRR news release, November 1, 1973.)

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SURVEY OF PRIMATES IN BIOMEDICAL RESEARCH

A nationwide survey of primates has been initiated recently, as part of a worldwide study (see announcement above), to assess the species and numbers used in biomedical research. The purpose of the survey is to synthesize current information on the status of wild populations and their habitats, to examine trends in usage of primate species and to recommend which primates should be bred in large numbers for research.

As a part of this study, questionnaires will be sent to American organizations that use, breed, and import primates. If any readers are associated with laboratories that maintain or supply primates, but have not received a questionnaire during November, please notify us. Your

cooperation in providing your figures and views will help to make these data and recommendations as representative as possible.

For inclusion in our mailing list, please notify: Dr. Nancy A. Muckenhirn, Institute of Laboratory Animal Resources, National Academy of Sciences, 2101 Constitution Avenue, Washington, D.C. 20418 (Telephone: 202-389-6692).

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BROWN *CEBUS APELLA* AVAILABLE COMMERCIALY

A new area in Paraguay for the supply of brown *Cebus apella* has opened up. (The black capuchin from Peru is no longer obtainable because of export restrictions imposed by the Peruvian government.)

Twenty large adult brown *Cebus* recently arrived in Miami on Braniff Airlines and were immediately delivered to one of North Florida's laboratory primate suppliers. One of our agents has remained in Paraguay to demonstrate to tribesmen hunters how these animals may be captured without causing any mortality. Bi-weekly shipments are expected and owners of laboratory conditioning facilities may contact us in Miami for information about future availability of this species.--Mrs. Ann B. Dostaler, Blue Ribbon Pet Farms, 8772 S. W. 131 St., Miami, Fla. 33156 (Telephone: 305-238-1173).

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FREE-RANGING, COMMERCIAL BREEDING COLONY BEGUN

In June, 1973, Charles River Breeding Laboratories, Inc. stocked Key Lois (between Marathon and Key West, Florida) with approximately 100 rhesus monkeys. They had been obtained in Kashmir and kept at the company's headquarters in Wilmington, Mass. for 7 months quarantine. These animals represent the nucleus of what the company hopes will become a free-ranging, commercial breeding colony.

The supplier will be Primate Imports of New York City, 50% of the stock of which Charles River acquired in August, 1973. It is expected that rhesus monkeys will become available from the Key Lois facility within 3 to 4 years. (Based on information in the *Charles River Digest*, 1973, 12 [3], 3.)

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According to U. S. Dept. of the Interior, 90,559 primates were imported into the United States in 1972.

RHESUS FETAL LIVERS WANTED

We request livers from rhesus monkey 100-140 day embryos. In return, we can provide interested investigators with embryonic rhesus monkey tissues, other than fetal liver, of varying maturation time. Contact: Dr. B. Lüwenberg, Radiobiological Institute TNO, 151, Lange Kleiweg, Rijswijk (Z.H.), The Netherlands.

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REQUEST FOR CHIMPANZEE SKELETAL MATERIAL

We are initiating research into the non-metric skeletal traits of primates. We have need for a number of complete chimpanzee skeletons. Adults, either sex, any sub-species. We will pay shipping and moderate handling costs and will accept fixed or frozen cadaver material as well as skeletal material. Contact: Michael Finnegan, Department of Sociology and Anthropology, Kansas State University, Manhattan, Kansas, 66506 (Telephone: 913-532-6867).

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SAGUINUS CARCASSES TO BECOME AVAILABLE

Up to 24 carcasses of *Saguinus o. oedipus* will become available between now and January, 1975, at the rate of about 2 per month. If anyone is interested in specific organs or parts of these animals, I would be glad to collaborate within the limits of my resources. Contact: Patricia Warner, Inderena, Apartado Aereo 421, Sincelejo, Sucre, Colombia, SA.

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TIME-OF-MATING DATA BEING COLLECTED

The Endocrine Research Unit of Michigan State University is interested in exchanging basic data relating the time of ovulation (as determined by laparoscopy, laparotomy or LH peaks) to the time of mating in any non-human primate species as a part of a computer model simulation study. The period of time with male-female contact should be 24 hours or less. Of special interest are those animals where mating periods were three hours or less and cases where cycle length and the time of ovulation in consecutive cycles is known. Individuals interested in these matters are encouraged to correspond with: Dr. W. Richard Dukelow, Endocrine Research Unit, Michigan State University, East Lansing, Michigan 48823, USA.

MONKEY CAGES FOR SALE

Three stainless steel monkey cage racks (20" x 60") with 8 individual stainless steel cages in each. (Cage dimensions: 12" wide x 18" high x 16" deep). Each cage has front door and a sliding false back for immobilizing monkey in front of cage. Individual stainless steel feeder boxes which can be hooked on to cages are also provided. Rack has water reservoir on top which conducts water to location behind each individual cage. Racks also have stainless steel troughs, downspouts, and panels. All in very good condition. Best offer. Contact: Mrs. Jeanette F. Koffler, Department of Psychology, Princeton University, Princeton, New Jersey 08540 (Phone: 609-452-4459).

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CHIMPANZEE WANTED

We require one chimpanzee, preferably a young adult of either sex, for use in a chronic, non-terminal immunological project. Contact: Dr. R. Bigelli, Connaught Laboratories, Ltd., 1755 Steeles Ave. West, Willowdale, Ontario, Canada.

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USED LARGE PRIMATE CAGES WANTED

These cages must have squeeze backs and be about 36" high and 36" deep, for baboons up to 25 kg. Contact: Robert C. Hall, M. D., 750 East Adams Street, Syracuse, N. Y. 13210 (Phone: 315-473-4550).

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REQUEST FOR INFORMATION: BODY WEIGHTS OF LIVING PRIMATES

Unpublished weight data or data published outside of the standard "primate journals" are desired to enlarge our records for captive and free-ranging primates. Information from laboratory colonies is welcome. Contact: Irven DeVore, 320 William James Hall, Harvard University, Cambridge, Ma. 02138.

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HAMADRYAS BABOON COLONY AVAILABLE

Total 34 animals including 12 males - 22 females. The entire group was captured in Ethiopia in April/May 1972 and have been living together in the U. S. since July, 1972. Have reproduced. Contact: Gene Hartz, International Animal Exchange, Inc., 1489 E. Nine Mile Rd., Ferndale, Michigan 48220 (Phone: 313-545-2820).

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

Books

Laboratory Primate Handbook. R. A. Whitney, Jr., D. F. Johnson & W. C. Cole. New York/London: Academic Press, 1973. [Price: \$9.50]
This book emphasizes the protection of animal and human health through correct housing, handling, and husbandry procedures. It treats not only the well-known infections and parasites to which nonhuman primates are subject, but also several recently recognized diseases that can be transmitted to humans. Contents: Taxonomy and identification--Introduction. Classification of living primates; Primate procurement and production--Introduction. Conditioned (stabilized) primates. Unconditioned primates. Domestically bred primates. Sources of nonhuman primates. Primate conservation; Housing and care--Outdoor primate quarters. Indoor primate quarters. Daily maintenance; Preventive medicine and public health--Introduction. Personnel protection. Quarantine and conditioning procedures; Restraint and special techniques--Preanesthesia and anesthesia. Restraint. Specimen collection and drug administration; Nutrition and nutritional diseases--General nutrition. Vitamins. Other nutritional requirements; Generalized infectious diseases--Tuberculosis. Viral Diseases. Other generalized infections; Localized infectious diseases and parasites--General. Mouth and Teeth. Gastrointestinal Tract. Other abdominal viscera. Respiratory tract. Blood parasites. Skin parasites and fungal infections; Physiological data--Hematology, blood chemistry and other values. Reproductive data; Federal policies, regulations, and standards--General. The animal welfare act. Excerpts from NIH policy issuance. Federal importation and quarantine regulations.

The baboon: Microbiology, clinical chemistry and some hematological aspects. (*Primates in Medicine*, Vol. 8) S. S. Kalter. Basel: Karger, 1973. [Price: \$22.35]

This volume presents the results of the microbiological, hematological, and clinical chemistry studies that were part of a 6-year project the aim of which was to provide information on the baboon's normal condition and basic biological characteristics. Contents include chapters on Bacteriology, Mycology, Rickettsial Infections, and Virology authored by S. S. Kalter and the following chapters:

*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.

Clinical Chemistry, by A. De La Pena, C. Matthijssen & J. W. Goldzieher; Hematology, by M. L. Berchelmann & S. S. Kalter; and Parasitology, by R. E. Kuntz, B. J. Myers & J. A. Moore.

Comparative Ecology and Behaviour of Primates. P. Michael & J. H. Crook (Eds.) New York/London: Academic Press, 1973. [Price: \$28.00]

This book is the outcome of a joint conference of the Primate Society of Great Britain and the Association for the Study of Animal Behaviour. Contents: Ecology and behaviour: A review of the behaviour and ecology of the lesser mouse lemur, R. D. Martin; Differences in behaviour between some arboreal and terrestrial species of African monkeys, N. R. Chalmers; An introduction to the socio-ecology of Malayan forest primates, David J. Chivers; Social and ecological features of talapoin monkey--comparisons with sympatric cercopithecines, A. Gautier-Hion; Population composition and adaptive organisation among orang-utans of the Kutai reserve, Peter S. Rodman. Sexual behaviour and social dynamics: Social communication among squirrel monkeys: Analysis by sociometry, bioacoustics and cerebral radio-stimulation, Detlev Ploog & Manfred Maurus; Sexual behaviour of male primates and the role of testosterone, Richard P. Michael, Margo Wilson & T. M. Plant. Intergroup encounters in the wild Barbary Macaque *Macaca sylvanus*, John M. Deag; The social structure of wild chimpanzees: A review of field studies, Yukimaru Sugiyama; The social grooming of male chimpanzees, M. J. A. Simpson; Some observations on the sexual behaviour of captive lowland gorillas, Jorg P. Hess. Primates and human ethology: Introduction, Detlev Ploog; A description of some human greetings, Adam Kendon; Primate ethology and human social behaviour, M. J. Waterhouse & H. B. Waterhouse; Sex differences in behaviour of London and Bushman children, N. G. Blurton-Jones & M. J. Konner; Temporal clusters and individual differences in the behaviour of pre-school children, Peter K. Smith; Sex differences in the activities and social interactions of nursery school children, C. Brindley, P. Clarke, C. Hutt, I. Robinson & E. Wethli.

Disease

Infectious diseases of primates related to capture and transportation. Vickers, J. H. (Pitman-Moore Inc., Johnson & Johnson Company, Washington Crossing, N. J. 08560) *American Journal of Physical Anthropology*, 1973, 38, 511-513.

Several field trips to India, Africa, Southeast Asia and South America were recently made to review and analyze disease problems related to capture and transportation of nonhuman primates. Wild primates are often exposed to a variety of diseases as they come into contact with people and other animals prior to shipment. These include tuberculosis, measles, shigellosis and various simian viruses.

Even with the best trapping methods, extensive advance planning with cargo centers of various air terminals is necessary for proper handling

of shipments. More and more frequently, airlines personnel fail to take even the most basic care of their live animal cargo.

Specific recommendations are made to improve overseas trapping, handling and transportation procedures to reduce infectious diseases in imported primates.

Neoplasms and proliferative lesions in 1065 nonhuman primate necropsies. Seibold, H. R. & Wolf, R. H. (Tulane U., Delta Reg. Pri. Res. Ctr., Covington, La. 70433) *Laboratory Animal Science*, 1973, 23, 533-539.

Three uterine leiomyomas, a squamous papilloma of the lip, a subcutaneous lipoma, and an adenomatosis of Brunner's glands were found in a total of 52 *Pan troglodytes*. Two uterine leiomyomas, a subcutaneous mast cell tumor, 2 pancreatic islet cell tumors, a mucinous papilloma of the stomach, and a papillary adenoma of the kidney were found in 317 *Macaca mulatta*. Malignant tumors in the same group of macaques were an adenocarcinoma of the ileum and a papillary adenocarcinoma of the kidney. A subcutaneous lipoma, a thyoma, and a chromophobe pituitary adenoma were found in 134 *M. arctoides*. A lipoma of the maxillary bone was found in 1 of 158 *Erythrocebus patas*, an ovarian adenocarcinoma in a single *Cebus albifrons*, a mixed carcinoma of the liver in 1 of 16 *Cercopithecus aethiops*, A capillary hemangioma of the cutis in 1 of 17 *Papio papio*, a mixed salivary gland tumor in a single *Papio comatus*, and a pheochromocytoma of the adrenal medulla in 1 of 9 *M. fascicularis*. Proliferative lesions that were found included 6 cases of endometriosis, an adenomatous hyperplasia of everted endocervical mucosa, and a gastric polyp ("papilloma") caused by *Nochtia nochtii* in the 317 *M. mulatta*. There were 15 cases of gastric polyp caused by *N. nochtii* and an inflammatory esophageal polyposis in the 134 *M. arctoides*.

Tuberculin testing in rhesus monkeys (*Macaca mulatta*): A comparative study using experimentally sensitized animals. Snyder, S. B. & Fox, J. G. (Div. of Lab. Ani. Med., Stanford U. Med. Ctr., Stanford, Ca. 94305) *Laboratory Animal Science*, 1973, 23, 515-521.

Tuberculin skin tests using 8 strengths of old tuberculin (100-10,000 tuberculin units) and 3 strengths of purified protein derivative (1-250 tuberculin units) were performed on a group of 12 adult rhesus monkeys (*Macaca mulatta*) that were experimentally sensitized to killed *Mycobacterium tuberculosis* by intramuscular injections containing Freund's complete adjuvant. Intrapalpebral and abdominal skin test sites were used. The results demonstrated that between animals there was a variation in the lower threshold of sensitivity to tuberculin, with no apparent correlation to the amount of sensitizing antigen given. Comparisons of the skin sensitivity reactions to purified protein derivative and old tuberculin were made in the eyelid and abdominal skin in the same animal. Soluble antigen fluorescent antibody tests were also performed on sera from these animals. The findings illustrated some important features of tuberculin sensitivity in rhesus monkeys.

Control of losses in freshly-imported laboratory primates during the acclimatization period. Lewis, P. F. (Commonwealth Serum Lab., Parkville, Victoria, Australia) *American Journal of Physical Anthropology*, 1973, 38, 505-510.

Observation of large numbers of freshly-trapped rhesus and crab-eating macaques transported by air from Asia to an Australian laboratory has shown that severe losses may occur during the first few weeks following importation and that it is up to 12 weeks before the animals become properly acclimatized to the new environment. Deaths which occur during this period are primarily due to enteric and/or respiratory tract bacterial pathogens. In addition, endoparasitic infestations are almost invariably present; and viral infections may enhance the virulence of other pathogens.

Measures which have been taken to reduce losses during the period of stabilization involve good husbandry, the treatment of parasites, and the prophylactic use of antibiotics. However, greatest success has been achieved by partly acclimatizing monkeys to captivity in the country of origin, during which period they are treated for intestinal helminths. Only robust, adolescent animals are selected for dispatch to Australia by air in small consignments.

Strongyloidosis in two infant orangutans. McClure, H. M., Strozier, L. M., Keeling, M. E. & Healy, G. R. (Yerkes Reg. Pri. Res. Ctr., Emory U., Atlanta, Ga. 30322) *Journal of the American Veterinary Medical Association*, 1973, 163, 629-632.

Strongyloides infection in 2 infant orangutans (*Pongo pygmaeus*) resulted in their death at 8 and 9 months of age after a clinical illness characterized by anorexia, lethargy, anemia, and signs of respiratory tract disease. The orangutans did not have diarrhea or other clinical evidence of gastrointestinal illness, and did not have increased eosinophil counts. One orangutan had purulent meningitis from which *Clostridium butyricum* was isolated. *Strongyloides* larvae were identified throughout all layers of the small intestines and colon, and in the lungs, lymph nodes, and connective tissue around the aorta, pancreas, and adrenal glands in both orangutans. In addition, larvae were found in the brain, kidneys, pericardium, testicles, and thyroid and prostate glands of one orangutan.

Aortic intimal lesions and serum lipids in wild baboons. van der Watt, J. J., Kotzé, J. P., Kempff, P. G., du Plessis, J. P. & Laubscher, N. F. (Nat. Res. Inst. for Nutritional Dis., Pretoria, S. A.) *Journal of Medical Primatology*, 1973, 2, 25-38.

Due to the sparsity of information on blood lipid values and naturally occurring arterial lesions in wild baboons, 77 newly captured baboons (*Papio ursinus orientalis*) of both sexes were examined. The body weights, used as indicators of age, ranged from 1.3 to 35.9 kg. Within 24 h after capture, venous blood samples for determination of blood lipid values were obtained prior to euthanasia. Autopsies were conducted immediately and the aortas, with the iliac arteries attached, were

fixed prior to gross staining with Sudan IV for determination of intimal sudanophilia, while representative blocks of aortic tissues were examined histologically. All intimas exhibited some degree of fatty streaking and approximately 63% of the aortas contained fibromuscular intimal plaques. During the immediate postnatal period, the serum cholesterol levels of the neonate rose sharply from the average birth level of 75 to 224 mg%. A gradual decrease in serum cholesterol levels then accompanied the increase in body weight (age) after weaning until the average adult value of 85 mg% was attained in juveniles of 15 kg body weight. No correlation was found between serum cholesterol, triglycerides, total fatty acids, aortic intimal sudanophilia and body weight, but the indications are that a relationship may exist between body weight and severity of aortic intimal hyperplasia. Male baboons weighing between 10 and 15 kg and females weighing between 6 and 10 kg are considered to be the most suitable animal models for experimental atherosclerosis research.

Studies on the prevalence of *Salmonella* serotypes in nonhuman primates. Ford, A. C., Speltie, T. M. & Hendriks, W. D. H. (Radiobiol. Inst. TNO, 151, Lange Kleiweg, Rijswijk (ZH), The Netherlands) *Laboratory Animal Science*, 1973, 23, 649-652.

Salmonellae isolated during surveys on 615 newly-imported nonhuman primates were reported. A temperature of 43°C was utilized in the incubation of the culture medium employed for primary isolations. 29 serotypes and an overall incidence of 17% were found. *Macaca arctoides*, *Pan troglodytes*, and *Galago crassicaudatus* had higher carrier rates than did *M. mulatta*. The importance of surveys for *Salmonella* serotypes among newly-imported animals is discussed.

Physiology and Behavior

Baseline blood determinations of the Taiwan macaque (*Macaca cyclopis*). Taylor, J. F., New, A. E., Chang, C-P. & Chiang, H-S. (Reprint requests to: Publications Office, NAMRU-2, Box 14, APO San Francisco, Ca. 96263) *Laboratory Animal Science*, 1973, 23, 582-587.

Peripheral hematologic and blood chemistry values were presented for adult *Macaca cyclopis* monkeys. These values represent post-quarantine, baseline determinations on 79 animals, 47 females and 32 males. Comparisons were made between males and females for all clinical values, with the only differences noted in erythrocyte count, packed cell volume, hemoglobin, and alkaline phosphatase. In each case the male values were significantly higher ($P < .01$) than the females. These values were compared to previously published studies with *M. mulatta*, and differences were seen in the following parameters: potassium, chlorides, uric acid, and cholesterol. *M. cyclopis* values for potassium were slightly above the cited range of values for *M. mulatta*, while the other 3 determinations fell slightly below the published ranges. These apparent differences were discussed in relation to other *Macaca* species blood chemistry value comparisons.

The frequency of multiple births in the genus *Lemur*. Hill, C. A. (San Diego Zool. Garden, P. O. Box 551, San Diego, Ca. 92112) *Mammalia*, 1973, 37, 101-104.

Recognition of the frequency of multiple births in the genus *Lemur* has resulted in a new approach to its taxonomy. It suggests a progression of species from primitive to less primitive. It supports J. Petter's belief that *L. variegatus* should be placed in its own genus *Varecia*. The nesting and multiple birth phenomena of *Varecia variegatus* makes this species more closely related to Insectivora than previously thought.

Erythrocebus patas--an anatomically suitable primate model for reproductive studies. Doyle, L. L. & Chandler, G. (Dept. of Obstetrics & Gynecology, Univ. of Arkansas Med. Ctr., Little Rock, Ark. 72201) *Fertility and Sterility*, 1973, 24, 648-651.

The anatomy of the reproductive tract of *Erythrocebus patas*, is more similar to the human than that of the commonly used macaques. Pathologic conditions shared by man and patas suggest that there may be more than anatomic similarity in their reproduction. Since patas are easily housed and husbanded, they may be a valuable asset to the studies of human reproductive physiology, particularly those involving intrauterine devices.

Drugs

The use of succinylcholine in the handling and restraint of rhesus monkeys (*Macaca mulatta*). Lindquist, P. A. & Lau, D. T. (U. of Ca., Physiol. Res. Facility, San Francisco Gen. Hosp., San Francisco, Ca. 94110) *Laboratory Animal Science*, 1973, 23, 562-564.

Succinylcholine was found to be a useful chemical agent for the restraint of rhesus monkeys for tuberculin testing, venipuncture, and endotracheal intubation. Additionally, succinylcholine was used in conjunction with local analgesics (e.g. lidocaine) during experimentation that precluded the use of conventional anesthetic agents and methods.

Facilities, Care, and Breeding

Studbook for the golden lion marmoset. Jones, M. L. Wheeling, West Virginia: American Association of Zoological Parks and Aquariums, 1973.

The establishment and maintenance of a small, inexpensive baboon colony for behavioral research. Benhar, E. & Samuel, D. (Brain & Beh. Group, Isotope Dept., Weizmann Inst. of Sci., Rehovot, Israel) *Journal of Medical Primatology*, 1973, 2, 11-18.

The establishment and maintenance of a small olive baboon colony for behavioral research is described. Proper design resulted in efficient and inexpensive simian husbandry and experimentation.

Breeding Sumatran orangutan *Pongo pygmaeus abeli* Lesson 1827, Coffey,

P. F. (Jersey Wildlife Preservation Trust, Channel Islands) *The Jersey Wildlife Preservation Trust*, Ninth Annual Report, 1972, 15-17.

This article describes the development and mother's care of an infant orangutan born at the Trust. Development is compared with that of another orangutan also born at the Trust.

Notes on the hand-rearing of an ursine or black and white colobus monkey. Usher Smith, J. H. (Jersey Wildlife Preservation Trust, Channel Islands) *The Jersey Wildlife Preservation Trust*, Ninth Annual Report, 1972, 26-29.

Instruments and Techniques

The automated primate research laboratory (APRL). Pace, N. & Smith, G. D. *Rep. No. NASA-CR-131642, EPL-72-1*, California University, Environmental Physiology Laboratory, Berkeley, California, 1972, 225 pp. (Nat. Tech. Inf. Serv. No. N73-21250, Nat. Tech. Inf. Serv., Springfield, Va. 22151, Paper copy \$13.95, Microfiche \$1.45).

The report essentially is a feasibility study for a space-flight experiment system utilizing a *Macaca nemestrina* as the subject. The aim of the experiment would be to determine the physiological effects of exposure to prolonged weightlessness. Although much of the report is concerned with the engineering requirements involved, it also contains a substantial review of the known physiological characteristics of the pig-tailed monkey. The principal thrust of the report is to emphasize the paramount importance of the basic animal requirements in the engineering design of such an experimental system.

A variable-temperature surrogate mother for studying attachment in infant monkeys. Baysinger, C. M., Plubell, P. E. & Harlow, H. F. (U. of Wis., Madison, Wis. 53706) *Behavior Research Methods and Instrumentation*, 1973, 5, 269-272.

A variable-temperature surrogate mother for use with infant monkeys is described. The apparatus is designed to facilitate manipulation of the infant-surrogate attachment bond. Data showing significant behavioral changes in ventral contact and locomotion as a function of depressed surrogate temperature are presented. The value of this technique in the production of psychopathology is indicated by a dramatic and progressive increase in disturbance behaviors during a 9-week test period. Implications for the use of a variable-temperature surrogate in studying animal models of psychopathology are noted.

A procedure for chronic microelectrode recording from cerebellar cortex in the awake cat and monkey. Wolfe, J. W., Rawlings, C. A. & Llinás, R. R. (USAF Sch. of Aerospace Med., Aerospace Med. Div. (AFSC), Brooks AFB, San Antonio, Tex. 78235) *Physiology and Behavior*, 1973, 10, 967-970.

Microelectrode recordings may be accomplished as early as two days postoperatively. We have successfully recorded from the same animal on three different occasions with one and two days between experiments. It must be stressed that sterile technique has to be employed when opening and sealing the tunnels, and that the animals should be maintained

on antibiotics.

Convenient sites for venipuncture in smaller primates. Foelsch, D. W. & Somazzi, E. (Zool. Garden, Basel, Switzerland) *Journal of Medical Primatology*, 1973, 2, 44-49.

Venipuncture sites in the neck, arms, legs and tail have been described and illustrated. Each of these sites may be used successfully, but the short saphenous vein, the cephalic vein or the ventral caudal vein are the most suitable.

Chronic carotid and jugular catheterization in rhesus monkeys. Fein, J. M. (Armed Forces Radiobiol. Res. Inst., Bethesda, Md. 20014) *Armed Forces Radiobiology Research Institute Technical Note*, No. AFRRI TN73-2, 1973.

A simplified technique of chronic catheterization of the common carotid artery and internal jugular vein is described. The advantages of the method are its simplicity and ease of access. The technique was used in studies involving angiography and cerebral blood flow, but can be adapted to various purposes.

A surrogate for rearing infant squirrel monkeys. Kaplan, J. & Russell, M. (Life Sci. Div., Stanford Res. Inst., Menlo Park, Ca. 94025) *Behavior Research Methods and Instrumentation*, 1973, 5, 379-380.

This paper describes a surrogate "mother" on which several squirrel monkey infants have been raised successfully for a period of 6 months. The surrogate allows ad lib nursing, provides warmth and a fur-like surface to which the infant can cling, records contact time, and contains a small speaker for presenting sounds. One of its major advantages is that the surrogate is easily adapted to suit different needs and situations. Simpler versions can be obtained by eliminating components.

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