

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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CONTENTS

SOUTHWEST FOUNDATION FOR RESEARCH AND EDUCATION
S. S. Kalter..... 1

THE YERKES PRIMATE RESEARCH CENTER EMORY
UNIVERSITY. Geoffrey H. Bourne..... 8

MEETING ANNOUNCEMENTS: AALAS BRANCHES SPON-
SORING N. J. SYMPOSIUM.....19

MEETING ANNOUNCEMENTS: SYMPOSIUM ON SCIENCE
& RESEARCH IN THE ZOOLOGICAL GARDEN19

PROPOSED REGULATIONS MAY HURT PRIMATE IMPORTS
FOR SCIENTIFIC USE.....20

MEETING ANNOUNCEMENTS: VI ICLA SYMPOSIUM22

CATALOGUE OF CURRENT PRIMATE FIELD STUDIES22

CARIBBEAN PRIMATE CENTER TO RAISE LABORATORY
MONKEYS FOR FEDERAL GOVERNMENT.....23

VISITING SCIENTIST PROGRAM AT LEMSIP.....24

INDIA PLANNING TO REDUCE RHESUS EXPORT.....24

MEETING ANNOUNCEMENTS: FOURTH CONFERENCE ON
EXPERIMENTAL MEDICINE AND SURGERY IN
PRIMATES25

OFFER OF VOLS. 1-9 OF NEWSLETTER27

SECTIONAL SERIES OF EARS AND LARYNGES OF
PRIMATES OFFERED27

CALAS CALL FOR PAPERS27

RECENT BOOKS AND ARTICLES28

ADDRESS CHANGES33

SOUTHWEST FOUNDATION FOR RESEARCH AND EDUCATION

S. S. Kalter

Since its inception in December of 1941, the Southwest Foundation for Research and Education has concentrated on basic research activities in a variety of biomedical areas. Many of these activities center around the use of nonhuman primates as the experimental animal. Appropriately, the animal colony at the Southwest Foundation has been approved in all aspects by the American Association for Accreditation of Laboratory Animal Care. Interests pursued at the Southwest Foundation have involved such diverse fields as biochemistry, molecular biology, effects of hormones on tissues and organs, hormone metabolism, reproductive physiology emphasizing the endocrinological aspects of reproduction in experimental animals and in humans, microbiology and infectious diseases with emphasis on virology, immunology, and parasitology. Recently, there has been an increased effort in such specific problem areas as cancer, congenital malformations, neurologic diseases (such as multiple sclerosis), atherosclerosis, and in the field of environmental sciences.

Approximately 200 individuals make up the staff of the Foundation. Recently an affiliation has been formed with the University of Texas system and the Southwest Research Center which permits a greater freedom in the exchange of ideas and programs between the members. In essence, this affiliation involves The University of Texas at San Antonio, The University of Texas Health Science Center (consisting of the schools of medicine, dentistry, and nursing), Southwest Research Institute, and the Southwest Foundation for Research and Education.

Research Facilities

The laboratories of the Foundation are well equipped with scientific equipment valued in excess of \$2,000,000. All items required for basic biomedical research are available including much specialized equipment. Facilities used by the staff of Southwest Foundation include approximately 165,000 sq. ft. of modern laboratories in the following buildings:

The Urschel Memorial Research Laboratory is the main building and contains, in addition to laboratory space, the Administrative Offices, conference rooms, computer room, library, library stacks, reading rooms and print shop. These laboratories are highly specialized and provide space for the satisfactory pursuit of programs in biochemistry, protein chemistry, organic chemistry, clinical chemistry, and reproductive biology.

The Microbiology Building Complex consists of the main microbiology laboratories including those for bacteriology, immunology, infectious

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diseases, mycology, parasitology, and virology. Two suites for electron microscopy, an AEI and Hitachi, are completely equipped for performing appropriate procedures. The infectious areas have the necessary air flow and safety cabinets (Blickman, type III and laminar flow cabinets) for handling all known pathogens, for example *Herpesvirus simiae* (B virus), Marburg agent, etc. A surgical suite is available in this laboratory equipped with X-ray facilities and recovery room, for operating on highly infectious animals. Also contained in this building are the necessary support services (glassware preparation and sterilization), offices for the professional staff as well as the office of the NIH/WHO Regional Reference Center for Simian Viruses.

The Animal Quarantine Building contains pathology, histology, clinical bacteriology and experimental parasitology laboratories. It also has space for the quarantine and conditioning of newly arrived primates as obtained from Africa or other sources. This building is apart from all the others in order to maintain an effective isolation of animals until their quarantine period is over.

The Ferdinand P. Herff Memorial Laboratory houses a number of diverse laboratories including those for tissue culture, media preparation, arboviruses, serology, hematology, raising of germfree simians, behavioral sciences, biomedical communications, shipping and receiving and the maintenance shop. Adjacent to this building is a smaller laboratory for neurophysiology.

The Tom Slick Memorial Laboratory comprises laboratories involved in anatomy, biochemistry, protein chemistry, molecular biology and organic chemistry. These laboratories contain the necessary equipment for performance of the analytical procedures required of these disciplines.

The Physical and Biological Science Laboratory is concerned with such specialties that principally provide a physical chemistry capability--electronic and fluorescent spectroscopy, magnetic circular dichroism spectroscopy, electron spin resonance spectroscopy and their application to biological systems.

Animal Buildings and Caging house approximately 1,000 nonhuman primates and a large number of other laboratory animals such as mice, rabbits, guinea pigs, hamsters, etc. Goats, chickens, geese and an assortment of other animals necessary for a variety of biologic purposes are kept in out-lying buildings. Nonhuman primate species include the baboon (*Papio cynocephalus*), chimpanzee (*Pan* spp.), marmoset (*Saguinus oedipus* and *S. fuscicollis*), capuchin (*Cebus apella*) and squirrel monkey (*Saimiri sciureus*) all in breeding situations, and a variety of other simians as necessary for specific experimental studies.

These animals are maintained in either large gang or colony cages, individual indoor/outdoor cages, or individual indoor cages. All of the

colony cages are connected with tunnel-like chutes which lead to separating cages and a weighing unit. This arrangement permits the separation and removal of any animal within 10 minutes, and provides a run for the animals while the cages are being cleaned and the feed troughs filled. Newborn baboons are usually removed from their mothers or are Caesarian derived. These are hand reared in a nursery or maintained in germfree isolators. The baboon nursery contains incubators for the holding of the newborns until placed in individual cages.

The individual indoor/outdoor cages are used for animals that are on special experiments that require frequent monitoring, for sick or injured animals, and for controlled breeding experiments. The inside half of these cages also connects with separating chutes and a weighing unit.

Individual cages are used for animals on infectious studies or other closely-controlled experiments. For newborns, infants, or young juveniles, commercial rack-type cage units with six or eight cages to a unit are used. Large or adult animals' cages, which are constructed to provide sufficient space for freedom of movement, are fitted with squeeze backs and containers for food and water. Rooms that house individual cages are equipped with temperature and humidity control. Those used specifically for infectious studies have individual air intake and exhaust mechanisms. Ample space is left between cages to prevent all direct contact and to avoid spattering of feces, urine, discarded food and saliva.

In contrast to the baboon breeding colonies, the chimpanzee breeding facility is composed of indoor/outdoor units, each of which is large enough to house three adult chimpanzees; they can be enlarged by opening sliding doors between the cages. A two-way locking, remotely controlled, guillotine door separates the indoor and outdoor halves so that both areas can be cleaned. The indoor sections have self-feeders, water 'lixits' (Alco Manufacturing, Napa, Calif.) and concrete sleeping pads with radiant heat for cold weather. Two females and one male are generally housed in each unit, but pregnant females and juveniles are caged separately. An infant nursery is maintained for baby chimpanzees rejected by their mothers and for infants separated for experimental purposes.

Strict control is maintained over the animal colony; (a) all visitors, except handlers, veterinarians, and investigators using the animals, are barred from the animal areas (microbiological monitoring of animals and staff provides data on cross contamination) and (b) there is no mixing of species and strict measures are taken to minimize possible spread of organisms by staff.

A unique feature of the animal facility is the development of a segregated housing area referred to as the "Infectious Village." Approximately 12 small, well separated huts are available to house ani-

mals on highly infectious programs with minimal contact with other animals. Each individual hut permits a change of clothes for personnel entering that hut. A large permanent building also houses animals on infectious disease programs in separate rooms. A complete change of clothes by personnel entering the building, control of the air flow, and 100% air turnover minimizes cross contamination.

Recently added in support of the animal program was a complete cage washing and sterilization unit designed to eliminate mixing of dirty and clean cages and to provide rapid processing and sterilizing of all animal cages.

Research Programs

As indicated above, the Foundation's research program is highly diversified and dependent upon the interests of the individual investigator. There are, therefore, those areas of research not associated with animals or primates in particular. No attempt will be made to indicate research activities that do not involve use of nonhuman primates.

Reproductive Biology.--Several programs utilize the baboon: One study is concerned with developing procedures for embryo transfer. There are satisfactory methods for use in cattle, which have to be modified for primates. Use of primate models will permit studies of intrauterine environment as well as genetic diseases that may have bearing on humans.

Other efforts in reproductive biology evaluate contraceptive or abortifacient agents in the baboon. Use of a nonhuman primate for such studies permits collation of results not permissible with other laboratory species. In addition, the effects of various steroids, either independently or in combination, are under study in the baboon. Further, neuronal regulation of ovarian function pertaining to this animal is being analyzed.

Atherosclerosis.--A program utilizing the baboon as a model for cholesterol-induced atherosclerosis combines the staffs of the University of Texas Medical School and the Foundation. In these studies, the effects of multiple environmental agents and inherited traits, as well as their interactions with one another, are being determined over an experimental period extending from birth to sexual maturity. Of concern in these studies are the effects of infant nutrition (breast vs. formula) on serum lipids, cholesterol metabolism, hemostatic mechanisms, and the long-term reaction of the animal to dietary cholesterol and type of fat. Behavioral characteristics are assessed by the signal count technique. Heritability of selected characteristics is computed and selective matings will be designed to test heritability and to enhance or reduce heritable characteristics.

Physical and Biological Sciences.--In order to study the many facets of cell surface chemistry, a group has been established with capabilities to examine aspects of cellular biology, e.g., lipid biochemistry, steroid chemistry, enzyme immunology, nucleic acid chemistry, together with a phys-

ical chemistry capability devoted to studies of cell membranes.

Cancer.--Several independent and collaborative efforts are underway attempting to understand the etiology and/or the basic biologic mechanism underlying the disease called cancer.

One team of parasitologists is concerned with the potential of parasites such as *Schistosoma* to produce bladder cancer. These investigators have been developing a primate model that may explain why and how bladder cancers are induced in a relatively large segment of the population infected with *Schistosoma hematobium*.

Another group of investigators is interested in determining whether or not the baboon may be utilized for an evaluation of the development of prostatic cancer. Such studies include an analysis of the induction of carcinogenesis by various chemicals and an evaluation of testosterone metabolism on this process.

A third group is involved in attempts to associate viruses and cancer. Both RNA and DNA viruses are under study with an assortment of simian species as model systems. The discovery of a C-type (oncornavirus) virus in primate (including human) placentas has provided a tool whereby this group of agents may be evaluated as a possible inducer of cancer in primates. Association of this virus group with other animal cancers has been well established. Cultivation of this RNA virus *in vitro* now permits in-depth analysis of the role this virus plays in oncology. Other cancer studies are concerned with DNA viruses, namely the herpesviruses, and their relationship to cancer. The epidemiologic association of herpesviruses with such human diseases as Burkitt's lymphoma as well as cervical cancer and their direct causal association with animal cancer as seen in the chicken (Marek's disease), frog (Lucke's adenocarcinoma), and monkey (lymphoproliferative disease) suggests continued study on the role of this virus group in production of tumors. In support of these investigators are a number of laboratories including molecular biology with a capability for detecting enzymatic activity associated with tumor viruses and a tissue culture laboratory capable of providing cell cultures from many different hosts either as primary or as serial cultures.

Immunology.--Humoral and cellular immunologic responsiveness of several different species of primates to various viruses, especially those associated with oncogenesis, are under study. In order to evaluate the immune competence of primates, various criteria such as antibody formation, lymphocyte stimulation, reaction skin tests, hematologic and serum protein values are being determined. These studies provide an analysis of the clinical response of each primate species to systemic and local inoculation, correlated with many tests of bursal-immune, thymic-immune and nonspecific-defense functions in the defense against herpesviruses and other agents. This study is a collaborative effort with staff of The University of Texas Medical School and Brooke General

Hospital, Fort Sam Houston. Another immunology study attempts to determine aspects of parasitic infection relating to host immunologic responsiveness.

Microbiology.--Routine bacteriology, mycology and parasitology are performed in conjunction with Animal Resources, not only as a monitoring and surgery service but as laboratory support for clinical problems. In-depth studies are carried out whenever laboratory findings indicate pursuit of a particular problem. Thus, a team of parasitologists is defining the various protozoa and helminths that utilize simians as their natural (and perhaps unnatural) hosts.

Hematology.--Hematological support is provided for all programs involving animals. Principally involved in providing support for clinical problems, hematological data are also supplied to research programs and independent investigations on the various simians.

Clinical Chemistry.--This laboratory has established on the baboon a range of values for a variety of clinical laboratory measurements which are used in the study of humans and also provides parameters which indicate the health of the animal. These services are provided for investigators in support of their research.

Surgery.--A competent staff of veterinary surgeons is available to investigators in need of such assistance. Several completely equipped surgeries, along with necessary support of these operations, are available. One surgery is designed to permit surgical procedures on infectious animals. Recovery areas are available for post-operative surveillance of animals.

Pathology.--Complete pathological and histopathological services are available to all investigators by a staff trained in primate pathology. Collaborative and independent research is carried out by the pathology service.

Virology.--Extensive virological support of the colony animals is available through the services of the NIH/WHO Regional Reference Center for Simian Viruses. This capability not only offers highly specialized services and expertise on viruses of simians but permits comparative virological studies on a wide selection of primates. Further, the international scope of the program allows for collaborative studies with the staff of many primate facilities all over the world. In this regard, the Simian Virus Reference Center provides the following for investigators working with primates:

1. A working repository for simian viruses.
2. A source of certified reference seed virus and specific antiserum.

3. A source of consultation services.
4. A virus diagnostic service, including identification and characterization of viruses, for users of nonhuman primates unable to perform this task. This service also includes screening for the presence of human viruses.
5. A source of information and exchange of organisms among primate centers and other health organizations.
6. A training center for interested students in virological laboratory procedures associated with primate investigations.

This laboratory is also involved in developing better methodology for diagnosis of viral infections of simians especially relating to virus isolation and identification. Serologic surveys are performed continuously for retrospective information pertaining to previous infections. Most important of these surveys is that for the herpesviruses including *Herpesvirus simiae* (B virus).

In addition, research activities include such problems as congenital malformations due to infectious agents and multiple sclerosis. With regard to this last disease, while our efforts are concentrated on attempting to produce multiple sclerosis in one or another simian host, our scope extends to other clinical entities possibly due to "slow viruses."

In conjunction with all our efforts involving conventionally reared animals, a germfree capability whereby primates are maintained for use in these various experimental programs has been also developed. Several different simian species have now been maintained in this germfree state for up to one year. We are now attempting to develop techniques to hold primates indefinitely.

Future Considerations

No fixed concept limits the Foundation in its future planning. Our intent is to provide a facility and scientific atmosphere permitting investigators to pursue research activities of their own choice and interests. Availability of a large nonhuman primate colony offers these investigators an opportunity to develop programs not permissible in most research institutions. Thus, an animal model phylogenetically close to man may be used for those studies that simply cannot be done in man and where extrapolation of data derived from other animal hosts may be misleading. An enormous body of information has been collected on the baboon. These data suggest that the simian reflects a comparability to the human that permits a prediction of action in man which is the goal of our research activities.

THE YERKES PRIMATE RESEARCH CENTER
EMORY UNIVERSITY

by

Geoffrey H. Bourne

The Yerkes Primate Center has been involved in the maintenance and breeding of great apes since 1930, that is for a period of 44 years. During that time the breeding program has resulted in the production of 239 infant chimpanzees and 30 other apes. The Center is unique among other primate centers in that it holds the largest collection of great apes in the world, and very likely the largest collection that has been gotten together in the history of the world.

The Center is comprised of two main facilities, the main Center situated on the Emory University Campus and the Field Facility located 30 miles northeast of the Main Center, adjacent to an interstate highway.

The facility at the Main Center specializes in keeping apes (chimpanzees, orangutans and gorillas) in a caged situation. The animals are confined in a wing which is divided up into 50 pens, each of which has an outside run. There is a special nursery for baby apes. There is also a well equipped metal shop for repairing caging and developing and fabricating special cages as well as sophisticated testing devices and special cages for handling, restraining and transporting various apes.

The building at the Main Center is 3 floors and contains laboratories for a wide range of research disciplines.

There is a library, a surgical facility for conducting aseptic procedures and treatment rooms on the animal wings for minor procedures such as physical examinations, blood collection and treatment. There is also a pharmacy, laboratories for clinical chemistry, hematology, parasitology, electron microscopy, cytogenetics, and tissue sectioning, an x-ray department, photographic suite and medical illustrator's room.

In addition to the large animal wing where most of the 154 great apes are kept, there is a small animal wing which houses 200-300 monkeys. There are also quarantine and isolation facilities.

The Field Station houses mainly monkeys (600-700) and some chimpanzees. We plan to add some gorillas and orangutans in the near future. Most of the animals at the Field Station are kept in wire enclosed compounds varying in size from 50' square to 125' square. In addition, apes will be placed on two islands which have been built in a 12 acre lake now being created on our property.

In addition to the two major facilities, the Center has established

a small chimpanzee breeding colony on an island off the Georgia coast which is equipped with a protected boat dock and an enclosed feeding and capturing area. Other breeding groups have been established temporarily on islands at Lion Country Safari, a few miles south of Atlanta. A breeding group of oranges is also located at the Atlanta Zoo.

The Yerkes Primate Research Center was developed from the Yerkes Laboratories for Primate Biology which was founded at Orange Park, Florida in 1930 by Dr. Robert Yerkes, who at that time was a Professor of Psychology at Yale University. Dr. Yerkes enlisted the help of a number of leading biologists to choose the site and eventually the Rockefeller Foundation purchased a 200 acre tract of land at Orange Park, erected the necessary buildings, purchased equipment and met the operating expenses for the next 10 years. The newly erected buildings were turned over to Yale University on June 9, 1930. On June 10th, 4 chimpanzees, Dwina, Bill, Pan and Wendy arrived to take up residence. The first ape birth at the new laboratories was on September 11th of that same year, when Alpha was born to Dwina. It is of interest that the present Yerkes Center houses two chimpanzees, Geoff and Sanford, which are the great great grandchildren of Bill, one of the original four animals. Wendy, one of the other founders, died recently. She had 5 great grandchildren of which 4 are still living at the Center, the 5th was a mongoloid which survived for nearly 2 years. In addition to the original four animals, Dr. Yerkes received a gift of thirteen chimpanzees from the Abreu family in Cuba and a group of 16 from Pastoria in French Guinea, which were donated by Pasteur Institute in Paris.

By 1932 the laboratories were well under way. They were included in the Laboratories of Comparative Psychobiology of Yale University, made up of 3 geographically separate centers, the new laboratory and primate quarters in conjunction with the laboratories of neurophysiology at Yale School of Medicine in New Haven, the anthropoid breeding and observation station at Orange Park, Florida; and arrangements for the cooperative use of temporary and permanent scientific stations in Africa, where chimpanzees and gorillas could be studied in their native habitats.

In 1941 when Yerkes retired as Director, the laboratory population had reached 45 chimpanzees and Dr. Carl Lashley became the second Director. Dr. Lashley was followed by Dr. Henry Nissen, who was followed for a brief period by Dr. Lee Peacock as acting Director and then by Dr. Arthur Riopelle. The present author became Director in 1962 when the laboratories, with the aid of Federal Funds from the NIH Primate Center Program, became established as the Yerkes Regional Primate Research Center. The laboratories had been presented to Emory University by Yale in 1956 and when funds became available for building a new facility, it was decided to establish it on the Emory campus. The facility was completed in 1965 and the animals and staff moved up from Orange Park in July of that year. The Center currently houses 112 chimpanzees, 36

orangutans, 14 gorillas, and 993 smaller primates. The Center is supported primarily by a continuing grant from the Animal Resources Branch, National Institutes of Health. Numerous individual research projects are funded by outside grants from private sources, as well as separate institutes of NIH and other government agencies.

Research

At present, research at the Yerkes Center is concentrated in 5 main areas or divisions. 1. Behavior (which has always been a major interest); Division Head: vacant. 2. Neurosciences, which includes neurophysiology, neuroanatomy and neurochemistry; Division Head: Adrian Perachio. 3. Great Ape Reproductive Biology; Division Head: Charles Graham. 4. Experimental Pathology; Division Head: Geoffrey H. Bourne. 5. Primate Medicine and Surgery; Division Head: Michale Keeling.

Behavior

In the behavioral area, studies on the talapoin monkey and various apes have confirmed the historic assertions of both Köhler and Yerkes that great apes are capable of abstractive learning processes not commonly found among monkeys, particularly the more primitive ones. Studies on the chimpanzee have also demonstrated that voluntary smoke inhalation (smoking) is a method of administering psychoactive drugs. A number of animals have reached reliable levels of smoking behavior that permit drug manipulation to be done. The administration of marijuana via smoking was found to affect immediately operant lever pulling on a differential reinforcement for low rates of responding (DRL) schedule. There is some evidence that stereotyping behavior increases following the administration of methamphetamine.

In studying the problem of alcohol, young chimpanzees and young rhesus monkeys have been made physically dependent upon ethanol and produced mild to severe symptoms when the substance was abruptly removed from the diet. Animals which have died during these withdrawal symptoms have shown edema of the brain, which suggests that the concept of forcing fluids into human patients with delirium tremens would be undesirable. The disappearance of ethanol from blood has been determined for young chimpanzees and rhesus monkeys, both during and following periods of chronic ethanol ingestion. The disappearance rates increased during periods of ethanol administration and decreased during subsequent abstinence periods, which is a finding consistent with reports using human subjects. Another item of interest is that during periods of chronic ethanol ingestion there is a rise in blood methanol levels, both in young chimpanzees and in rhesus monkeys. Similar changes in blood methanol concentration have recently been reported in man. Although the importance of a chronic blood methanol level has not yet been established, it is possible that methanol may play a significant role in the physical dependence on ethanol.

Studies on cross-modal perceptual integration in apes and monkeys are being carried out at the Center. It was found that apes are capable of matching abstract information coming from two different sensory modalities, i.e., vision and touch. Previous attempts to demonstrate this ability had been successful only in man, and some neurologic theories suggested that only man is capable of it. In addition, it has been shown that nonhuman primates are able to perceive the representational character of photographs and drawings.

Work is currently underway to determine whether or not monkeys, which are phylogenetically and morphologically simpler than apes, are able to do the same cross-modal tasks. The results will have evolutionary and neurologic significance. This basic research has suggested a promising approach to the understanding of some special learning deficits, e.g., dyslexia, which occur in considerable numbers of human children. In addition, the assessment methods developed with apes may be applied almost without change to the assessment of these deficits in humans.

The Yerkes laboratories were the first to demonstrate that isolation of infant primates, in this case chimpanzees, resulted in abnormal behavior, and in this particular study baby chimpanzees were taken from their mothers at birth and kept in total isolation for 20 months. The behavioral aberrations which developed from this treatment are now well known, especially since the Wisconsin center was subsequently able to show a similar effect in rhesus monkeys treated in the same way. However, the Yerkes Center has demonstrated an important difference between aberrant chimpanzees and monkeys. The former when mixed with normal chimpanzees improve behaviorally, and the rhesus monkeys do not improve when mixed with normal specimens of their own kind, although they can be improved by the use of monkey "therapists."

Dr. Duane Rumbaugh has developed a computer-controlled environment within which the language-relevant behaviors of young apes can be studied. The system allows for objective inquiry into conditions that differentially foster the development and expression of such skills. A language, termed "Yerkish", has been devised specifically for this project. Words are color-coded geometric symbols which are the keys of the console on which the animal works. The system allows for conversation between the ape subjects and the human experimenters. The computer is always the intermediary to monitor the use of syntax and to record for fine grain analyses the essence of the communiques. Successful two-way communication with a young chimpanzee, Lana, has been established using this system.

Neurosciences

The Neuroanatomy Department is engaged on anatomical studies of the brain which involve the tracing of the accessory optic tract and the study of the efferent fibers of the visual areas of various primates. For several decades it has been accepted that in primates, in-

cluding man, there were three visual cortical areas arranged in a concentric fashion; that is, area 17 is surrounded by areas 18 and 19. Although the validity of this concept has been questioned now and then, it was not really challenged until recently. With the advent of new methods, it has been shown that in primates there are at least five different visual cortical areas that are not necessarily arranged in a concentric fashion. Two new areas are areas MT and DM. The neuro-anatomic laboratory at the Yerkes Center is interested in what areas of the brain receive fiber connections from, and thus could be influenced by, visual area MT. It appears that in primates this area is linked to a very large number of cortical sites: for example, nine different areas on the contralateral side of the brain. On the other hand, visual areas 18 and 19 are connected with only three or four cortical areas. This laboratory has also demonstrated that the cortico-cortical connections of area 17 originate in the upper three layers of the cortex. It has also shown that the connective tissue space in the accessory optic system has capillaries which differ from those usually found in the brain in that they possess an extracellular perivascular connective tissue space. The only other areas in the brain that have similar vascular arrangements are the pineal gland, the subcommissural organ, the pituitary, and the area postrema. It is of interest that these structures are all involved in secretion.

The neurophysiologic studies at Yerkes are concerned with (1) neural mechanisms of behavior and (2) neural mechanisms of sleep and wakefulness. A series of experiments have been in progress for the last six years in the neurophysiologic laboratory in localizing the neuromechanisms that can control the expression of social and emotional behaviors. Aggressive and sexual behaviors have been produced in monkeys which are equipped with chronically implanted electrodes through which, via telemetry, stimulation can be applied. These electrodes are implanted in the subcortical regions of the brain and, for instance, the attack responses which are produced by stimulation can be altered social variables as measured by intensity, duration, and object of evoked aggressions. Preliminary estimate of the hierarchy of attack objects suggests that evoked attack is similar to spontaneous aggressive behaviors. Stimulation of other portions of the hypothalamus may induce stimulus-bound sexual behavior. This has been found to be sensitive to changes in the hormonal status of the female, in other words, to vary during the different stages of estrus. Similarities between electrically evoked responses and the naturally occurring social acts indicate that this is a useful technique for localizing the areas of the central nervous system that control emotional and social behaviors.

Sleep and wakefulness studies have been conducted on the influence of vestibular stimulation on sleep. This involves rotating animals at constant velocity in a centrifuge. Movements of the animals on the centrifuge while rotation is in progress stimulates the semicircular canals of the inner ear, and this produces vestibuloocular reflexes. Recordings of the eye movements over a 24-hr period, i.e., with EEG's and EMG's,

have been taken from animals before, during, and following long periods of continuous rotation. The preliminary findings of these experiments indicate that this form of vestibular stimulation causes significant decrease in a particular stage of sleep, which in the terminology of some investigators has been labeled "deep sleep." The implications of these findings are indicative of some hazards that may be encountered in prolonged manned space missions on rotating space platforms. These studies also provide information on the basic mechanisms underlying sleep and wakefulness.

Other studies on the brain at the Yerkes Center include those which are concerned with the effects of low protein intake on RNA, DNA, and enzymes in primate brains, particularly a low protein intake in the expectant mother. Observational studies on the human have shown clear evidence of affected mental development after severe periods of malnutrition, particularly during the critical periods of development of the brain. The taxonomic closeness of primates to humans makes them ideal experimental animals compared to widely used rodents to study the impact of protein-calorie malnutrition of the developing nervous system. Like humans, monkeys also have a prenatally developed brain, and work is in progress to show the impact on the nervous system of the fetus and the neonate of experimentally induced maternal malnutrition in pregnancy. Cytochemical observation obtained from young juvenile squirrel monkeys in which protein malnutrition was induced by feeding a diet with 2% protein to a group of experimental animals for a period of 15 weeks, showed the sensitivity of the nervous system to dietary abuse.

Great Ape Reproductive Biology

A good example of collaboration with other institutions is shown by the reproductive physiology program which is coordinated at the Center and funded by the Ford Foundation. Urine collected from apes under study is forwarded to the Emory University Medical School where it is assayed for estrogens and to the Harvard Medical School where it is assayed for gonadotropins. At the Center, studies are made of the sexual swelling, temperature changes by an implanted temperature sensor, vaginal smears and uterine histology, and by direct observation of the ovaries by endoscopy. The combined studies will eventually give a valuable coordinated picture of the sexual cycle in great apes which should have important human applications. In fact, these studies have shown a close endocrinologic resemblance between human and chimpanzee in the hormonal control of the menstrual cycle. The reproductive biology group in collaboration with the pathology department have found malignant tumors of the uterine corpus in squirrel monkeys continuously treated with large doses of the estrogen-mimetic compound diethylstilbestrol. This is the first time that carcinogenicity of an estrogenic substance in a primate has been demonstrated. It is of considerable significance in view of the long-term estrogen therapy used in humans for ovarian replacement therapy and for contraception and the use of diethylstilbestrol for fattening cattle for human consumption.

Experimental Pathology

In the area of experimental pathology an interesting inter-institutional program has developed between Duke University and the Yerkes Center. Work with chimpanzees has provided an invaluable experimental model for studies of the role of tissue antigens and tissue transplantation. It appears that direct transplant of organs from chimpanzees to humans is not feasible because of the presence of heterophilic antigens in chimpanzees to which all humans react adversely; however, the chimpanzee has most of the antigens found in the major histocompatibility locus of man, which makes these species extremely useful in studies having a direct clinical relationship to the role of antigens in man. The chimpanzee thus becomes a unique experimental model for the study of problems involved in organ transplantation. Experiments on transplantation immunity which morally and ethically cannot be attempted in man can be tried in this species. Moreover, the experiments can be better controlled in chimpanzees. Chimpanzees are currently being used to evaluate new methods of immunosuppression for human organ transplants. Chimpanzee antisera to chimpanzee transplantation antigens are capable of defining certain human transplantation antigens; thus, it is possible to manufacture "reagents" for human tissue-typing in the body of the chimpanzee without resorting to the hazard of using human volunteers. The histocompatibility loci are being investigated in the chimpanzees at the center and the immunologic group is being traced through four generations of chimpanzees in the Yerkes colony. This has already been accomplished for material histocompatibility antigens through three of these generations. The colony pedigree over the last 40 years is still being organized and provides a unique opportunity to study the inheritance of these antigens.

The Immunology Program also uses primates as a source of antibodies specific for membrane associated antigens of human tumor cells. Antisera in monkeys to tissue culture lines of human melanomas have been produced and high titred cytotoxic antibodies specific for human melanoma antigens. Perhaps more interesting and striking are the studies on the production of high titred cytotoxic antibodies in monkeys and chimpanzees, some of which are specific for an antigen which is common to acute and chronic lymphocytic leukemia cells and others which distinguish several antigens or myelogenous leukemia cells. The antisera to the leukemia specific antigens have already proven to be of diagnostic value, since they can establish serologically the type of leukemia that is present or will evolve from those cases in which a clinical or morphological diagnosis is in doubt, e.g., in undifferentiated leukemias or leukemoid reactions. The antisera do not react with cells from patients with erythroleukemia, polycythemia vera, Hodgkin's Disease, lymphoma or infectious mononucleosis.

The antigens are removed from the leukemic cell membranes in particulate form by digestion with trypsin. The particulate antigen prepared from cells from a patient with chronic lymphocytic leukemia has been used to immunize a chimpanzee. A high titred antiserum specific for human lympho-

cytic leukemia cells has been produced. Large batches of this anti-serum are being prepared and will be passively administered to acute and chronic lymphocytic patients in a combined immunotherapy and drug-therapy regimen.

The antisera are also of diagnostic value since it is possible to distinguish which way undifferentiated leukemia will go, e.g., lymphocytic or myelocytic. The specificity is exquisite and it is possible to distinguish as little as 10% leukemia cells in patients in remission. Those patients in complete remission are negative with the antisera.

The Center has also been associated with the Eggleston Children's Hospital at Emory University in cross-circulation studies between chimpanzees and humans. Two children in a hepatic coma have been subjected to this procedure, which involves connecting the blood circulation of the child in series with that of the chimpanzee. There is no doubt that many lives could be saved by this procedure. It is limited by the fact that, although the majority of humans belong to the "O" blood group, a minority of chimpanzees belong to that group. Selective breeding of chimpanzees for this blood group is possible, but it would take a long time for a significant number of animals to be bred and would be very expensive. If animals used for this purpose could be used more than once, a real breakthrough in the use of chimpanzees for this form of therapy would be possible.

The veterinary pathology department of the Center is involved in studying the effects of feeding milk from leukemic cows to infant rhesus monkeys and infant chimpanzees. None of the monkeys have developed leukemia so far, but there is evidence of the disease in two of the chimpanzees. It is also holding and monitoring a group of Air Force monkeys which were exposed to atomic radiation during the 1950's. Breeding experiments have been carried out with these animals to look for genetic defects, but none have been found to date, although an increased stillbirth rate has been observed. There also appears to be an increased incidence of cancer in these animals.

The pathology and behavior departments also identified, within the last few years, a chimpanzee born at the Center which was a mongoloid with an additional chromosome, retarded mental and physical development, with epicanthal folds in the eyes, and also with heart defects and increased susceptibility to disease, in other words, resembling what is found in human cases of Down's disease. This is the first and only case of mongolism in a nonhuman primate reported so far.

A young chimpanzee has recently been noted to have a chromosomal abnormality which appears to be a balanced translocation. The parents of this animal are being studied to determine if this anomaly may be present in one of them. Balanced translocations are found with some frequency in the human population but apparently have not been recorded

before in nonhuman primates. The occurrence of this abnormality and that of the Down's-like syndrome indicate that nonhuman primates, especially the great apes, may be used for models in investigating some of the cytogenetic abnormalities that affect man. These studies demonstrate how similar are the gene pools of the great apes and humans.

There is also a unit in the Center which is particularly concerned with histochemistry and with muscle structure and function. One of the interesting findings of this laboratory is that some degree of myopathy is widespread among nonhuman primates, being especially obvious in wild-born or wild-raised animals and is particularly common in the squirrel monkey. This laboratory is also involved in studies of the basic problems involved in manned space flight, using rhesus monkeys. Another finding of interest by this unit is the location of the presence of sarcosporidial infection in the muscles of nonhuman primates. This infection has been found to have a crippling effect on some rhesus monkeys and to be present also in some of the muscle fibers of one of our gorillas.

Primate Medicine and Surgery

Studies being carried out by the Division of Simian Medicine and Surgery include: 1) Clinical application in great apes and monkeys of a yet unnamed parenteral anesthetic (CI-744) which is a combination of tiletamine and flupyrazapon (diazepenone). 2) Great ape dentition and skeletal development studies. 3) Great ape gestational physiology. Detailed pelvic examination descriptions correlated with hematology, chemistries, pelvic radiography and serum and urine chorionic gonadotropic levels during all stages of gestation. 4) Investigations and documentation of ophthalmological norms in great apes and monkeys by use of the fundic camera. 5) Feasibility study of establishing and maintaining a breeding group of chimpanzees off the coast of Georgia (Ossabaw Island). 6) Nutritional requirements of the gorilla and vitamin B complex deficiencies (niacin). 7) Identification and therapy of rheumatoid-like arthritis in the gorilla. Confirmation of a new strain of Mycoplasma in the gorilla as the etiological agent is being pursued by Dr. T. Brown, Arlington, Virginia. 8) Enhancement of gorilla breeding efficiency by investigating semi-free ranging maintenance of gorillas in corrals or small island.

Veterinary clinical resident program.--Each year a recent DVM graduate is selected to serve a two year residency at the primate center for on the job training in simian medicine and surgery.

Surgical support.--1) Immunology Program: anesthesia and surgical assistance with thymectomies, splenectomies, thoracic duct cannulations and other immunologically related surgery. 2) Reproductive Endocrinology Program: anesthesia and surgical techniques involving multiple repeated laparoscopic invasions in the chimpanzees. Other techniques of experimental surgery involving manipulation of repro-

ductive organs in the chimpanzee. 3) Cardiovascular Instrumentation Program: Anesthesia and postoperative management of chimpanzees surgically implemented with cardiovascular radio telemetry for monitoring pressures, flows, and dimensions. Supporting Dr. E. W. Hawthorne, Howard University and Dr. H. Sandler, NASA-Ames, and Dr. H. L. Stone, Marine Biological Institute, Texas, who are investigating concepts, approaches and principles for investigating targeted cardiovascular problem solving using invasive techniques with great apes as experimental models. 4) Experimental surgical technique of destroying the laryngeal air sac in the orangutan. 5) Anesthesia and postoperative care of a study involving the placement and evaluation of silicone-dacron prosthetic lumbar discs being pursued by Dr. J. Urbanick, Duke University. 6) Anesthesia and special postoperative care for microsurgical techniques of nerve and tendon repair and grafting performed by Dr. L. Vasconez of Emory University. 7) Special experimental surgical techniques requested by investigators.

Emory Medical School Collaborative Projects.--1) Experimental allergic encephalomyelitis is being produced in the rhesus monkey by encephalitogenic protein fragments isolated by Dr. Kibler of Emory University. The study is supported by the Multiple Sclerosis Society and involves testing synthetic and modified synthetic active peptides for capacity to alter allergic encephalitis in monkeys. 2) We are attempting to establish an animal model for evaluations of altered carbohydrate metabolism during uremia for Dr. Roy Wiggins, an internist in Atlanta.

Collaborative studies outside the primate center and university.--1) Dr. T. H. Huissman, Medical College of Georgia: nonallelic structural genes for gamma chains for fetal hemoglobin in great apes. 2) Dr. A. S. Weiner, N.Y.U. Medical Center: blood groups of the gorilla and orangutan. 3) Dr. G. Szabo, Harvard University: skin biopsies and blood from gorillas and orangutans for related studies in human genetics. 4) Dr. U. S. G. Kuhn, Center for Disease Control: serological studies of venereal disease (gonococcus) in the chimpanzee. 5) Dr. F. A. Green, State University of New York: erythrocyte membrane phospholipids and protein in great apes. 6) Dr. G. Wickham, University of Florida: the chimpanzee as an animal model for open angle glaucoma. 7) Dr. P. Binnette, V. A. Hospital, Buffalo, New York: identification and purification of plasma proteins of the great apes. 8) Dr. G. Kellerman, M. D. Anderson Hospital, Houston, Texas: Devise a test for screening "high risk" lung cancer individuals. Involves the identification and isolation of enzymes involved in the development of lung cancer.

Bioengineering

This section has been responsible for the design and construction of the computer peripheral control interface for the chimpanzee language project. For the artificial breeding of great apes, instrumentation consisting of rectal probes, patch panels and stimulating wave-form gen-

erators have been designed, constructed and employed in electroejaculation experiments on chimpanzees.

A temperature telemeter has been designed and implanted in an ovariectomized chimpanzee for use in the studies on reproductive biology of great apes. It has now been successfully tested. The longevity of the implanted transmitter was almost five months although its predicted life was 3 to 4 months. Core temperature data is now being recorded 100% of the time in the experimental animals.

Special study

A functional analysis of primate locomotor and manipulatory systems is also being carried out. This study is of an interinstitutional nature, the principal investigators being Dr. Russell Tuttle of the University of Chicago and Dr. John V. Basmajian of Emory University. Electromyographic recordings are made of selected forelimb, hindlimb and back muscles in gorilla, chimpanzee, and orangutan subjects as they move quadrupedally and bipedally on horizontal and inclined surfaces, climb vertical supports, hang and swing from a trapeze and manipulate objects. Information derived from these studies are used to elucidate the biomechanical correlates of (a) knuckle-walking postures and locomotion in the African apes (chimpanzees and gorilla), and (b) bipedalism, (c) vertical climbing, (d) manual and pedal suspensory posturing, and (e) pollical opposition and other manipulating actions of the manual digits of all three apes. Comparison of results of these studies on apes with available information on human electromyography will be used to devise models of possible evolutionary pathways of man and apes. Telemetric apparatus is being developed that may have clinical applications as well as serving evolutionary anthropological research.

Graduate Program in Primatology

In the Center there are not only collaborative studies of the various research projects but also a cooperative graduate program in primatology with the University of Georgia. This program gives a Ph.D. in primatology with accent on behavior. It is sponsored by the Psychology Department of the University of Georgia and it is probable that a similar doctoral program sponsored by the Anthropology Department will be started at a later date. Plans are afoot for a doctoral program with Georgia State University.

Under the auspices of the International Union for Conservation of Nature, the Yerkes Center keeps the International Studbook for Orangutans. More than 400 orangutans are known to be in captivity in nearly 25 countries. Approximately two-thirds of these animals are in the United States at nearly 40 zoos and institutions. Thirty-eight of these animals are at the Yerkes Center where there have been 21 orangutan births since 1967.

Pygmy Chimpanzee Project

The Yerkes Center, in association with the National Academy of Sciences and scientists from Harvard University, Stanford University, the Smithsonian Institution, and the Republic of Zaire in West Africa, is endeavoring to set up a breeding group of pygmy chimpanzees in Zaire. The object is to make these animals more readily accessible for study by international scientists.

Permanent Faculty Members

Neuroscience: Adrian Perachio, Johannes Tigges, Sohan Manocha, Margery Alexander. *Behavior:* Ronald Nadler, Richard Davenport, Irwin Bernstein. *Great Ape Reproductive Biology:* Charles Graham. *Experimental Pathology:* Geoffrey Bourne, M. Nelly Golarz, Harold McClure, Jerjang Chang, Hilliard Seigler, Richard Metzgar. *Simian Medicine and Surgery:* Michale Keeling, Ken Riddle. *Biomedical Engineering:* Harold Warner.

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MEETING ANNOUNCEMENTS: AALAS BRANCHES SPONSORING
N. J. SYMPOSIUM

The Delaware Valley and Metropolitan New York branches of the American Association for Laboratory Animal Science are once again sponsoring a symposium to be held at the Ramada Inn in East Brunswick, N. J. on June 6 & 7, 1974. The topic will be the "Indepth Study of Non-human Primates" at both the scientific and technical sessions. For further information, contact Mr. William H. Mitchell at "PAM", P. O. Box 70, New Britain, Pa. 18901.

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MEETING ANNOUNCEMENTS: SYMPOSIUM ON SCIENCE &
RESEARCH IN THE ZOOLOGICAL GARDEN

The Zoological Society of Philadelphia is organizing a "Centennial Symposium on Science and Research" in Philadelphia on November 12-14, 1974, to commemorate the 100th anniversary of the Philadelphia Zoological Garden. The theme of the symposium is science and research in the zoological garden. The following topics will be covered: 1) Research in the zoo, 2) Contributions of the zoo to comparative medicine, 3) Zoo animal medicine, and 4) The developing science of zoo management.--Contact: Dr. Robert L. Snyder, Philadelphia Zoological Garden, 34th St. & Girard Ave., Phil., Pa. 19104.

PROPOSED REGULATIONS MAY HURT PRIMATE IMPORTS FOR SCIENTIFIC USE¹

Proposed regulations governing importation of injurious wildlife (published in the Dec. 20, 1973 *Federal Register*) appeared to be of little interest to biomedical researchers until it was found that the proposal classifies all primates as "injurious wildlife." In addition, the proposed importation requirements impose the same restrictions for medical or scientific purposes as apply to Endangered Species.

The proposed regulations' intent is to control importation of all wildlife and to prohibit--except for scientific, educational, zoological or medical purposes--those which are considered injurious to human beings, or to the interests of agriculture, horticulture, forestry or wildlife resources.

Of particular interest is the general statement contained in the introduction of the proposal: "a determination (has been made) based on scientific evidence presently available that all wildlife is or would be injurious to one or more of the named interests at some time or place when imported into the United States."

In view of an impending crisis in available primate supplies for research, application of this determination to all primates is questionable. This approach could be justified if the result means cessation of primate importation for the pet trade and diversion of a substantial number of primates to the needs of the biomedical research community. The usefulness of these animals to pet stores is highly doubtful and the possible dangers to human health because of improper handling can be documented.

The proposed regulations dealing with the granting of permits to educational, scientific and medical institutions for importation of animals are much too rigid. They are, in fact, unworkable as proposed.

As now proposed, the application for an importation permit would require: (1) A full statement of justification including details of the project and planned disposition of the wildlife upon termination of the project; (2) A description of the institution or facility where the animals will be used, including photographs or diagrams of the area where they will be housed; (3) A detailed statement on the method of capture, whether or not the animal has shown any signs of disease, parasites or other abnormalities and what, if any, medical treatment the animal has received; (4) A brief resume of the technical expertise available, including any experience the applicant or his personnel have

¹From *National Society for Medical Research Bulletin*, 1974, 25[2], 1-2.

had in transporting and maintaining such animals; (5) A complete statement of the proposed methods of transportation including a description of the cage or enclosure.

Applications for permits would be evaluated by the Director, Bureau of Sports Fisheries and Wildlife, Department of Interior in determining whether the project for which the animals are required is of sufficient merit to justify the degree of threat or injury presented by such importation.

Following importation the proposed regulations would require a research facility to: (a) Report receipt of shipment to the Director within 10 days of importation; (b) Confine all importations and their progeny to the premises authorized in the permit; (c) Notify the Director by letter within 10 days of an animal's death.

The proposed rule is certainly a trial balloon sent up to elicit comments, so groups who have a commercial interest in many species of wildlife can be expected to take potshots at it.

The Dec. 20, 1973 notice states that an Environmental Impact Statement will be published in conjunction with the proposal, and that comments will be accepted for 60 days following publication of that impact statement.² In addition, public hearings on the proposal will be held in Washington, D. C., San Francisco, Calif. and Miami, Florida. The dates, times, and places of the hearings will be announced later. They will not be scheduled within the 60 day period allowed for comments.

Department of Interior representatives have told NSMR that considerations will be given to suggestions for modification of the proposal so as not to impede the movement of primates to research facilities when final regulations are drafted.

Copies of the proposed rules can be obtained by writing: Bureau of Sport Fisheries and Wildlife, Suite 600, 1612 K Street, Washington, D. C.

NSMR will file a position paper on the proposed rules with the Department of Interior prior to the close of the 60 day period allowed for comment. Members of the NSMR National Council, as well as all *Bulletin* readers, are urged to provide the Society with their views on this matter and send comments directly to the Department of Interior should they so desire.

²These had not been published up to March 22, 1974, so there is still time to comment on the proposal.--*Newsletter* ed.

MEETING ANNOUNCEMENTS: VI ICLA SYMPOSIUM

The International Committee on Laboratory Animals (ICLA) will hold its 6th Symposium in Thessaloniki, Greece, on 8-12 July 1975 on the themes:

1. Laboratory animals in the study of reproduction.
2. Training in laboratory animal science.

Interested scientists are invited to submit papers related to these main topics. Two hundred word abstracts should be mailed before February 1st, 1975 to the Chairman of the Program Committee: Dr. Nicolae Simionescu, Yale University School of Medicine, Cell Biology Department, 333 Cedar St., New Haven, Conn. 06510 U.S.A.

Proceedings of the Symposium will be published. Further details are available from the Chairman of the Program Committee.

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CATALOGUE OF CURRENT PRIMATE FIELD STUDIES

The first issue of this listing was produced in January 1974 as a supplement to the first issue of *Primate Eye* (the news bulletin of the Primate Society of Great Britain). There are still about 100 copies available, which can be obtained from Dr. D. J. Chivers, Sub-department of Veterinary Anatomy, Tennis Court Rd., Cambridge CB2 1QS. U. K., on receipt of at least \$1.50 (half-price if resident in Europe). This subscription will cover the cost of producing and distributing by air mail the next two issues.

We are dependent on your support (1) to produce the next issues (The Primate Society of Great Britain can only subsidize the listing to a limited extent), and (2) to provide evidence of demand when we seek outside funding for subsequent issues. So far we have received only 33 subscriptions, apart from those who have joined or are members of our Society, and only 7 of these are individuals who contributed items to the first listing and who received copies promptly. If you think there is a need for a regular listing of on-going primate field studies throughout the world please subscribe (personal checks are easily negotiable).

The success of this venture depends on these small subscriptions, as well as on the contribution of details of your field studies. The closing date for entries for the next issue is October 1, 1974.

CARIBBEAN PRIMATE CENTER TO RAISE LABORATORY MONKEYS FOR FEDERAL GOVERNMENT

The University of Puerto Rico's Caribbean Primate Research Center has contracted to supply several hundred monkeys annually to the U. S. Food and Drug Administration (FDA) for vaccine "proofing" in what represents that agency's first attempt to meet part of its needs with domestically bred animals.

Terms of the \$337,000 two-year initial contract, signed last week by Dr. Adán Nigaglioni, Chancellor of the Medical Sciences Campus at the University of Puerto Rico, call for establishing a free-ranging colony of 1,000 females on La Cueva island off the south coast of Puerto Rico. The Center will provide the first 300 animals on loan from existing stocks, with the FDA to ship in additional monkeys, purchased elsewhere, until the target population is reached.

Dr. Clinton Conaway, the Center's scientific director, said that 1,000 females should yield about 500 young animals a year for laboratory use without depletion of the colony itself. Under the FDA contract, infants will be weaned at six months of age and moved to corrals until needed in Washington for vaccine testing programs.

Increasing scarcities of wild primates on the world market motivated the FDA to launch its breeding project, according to Dr. Conaway. Several thousand rhesus monkeys are required annually for the testing of polio and other vaccines as new batches come off pharmaceutical company production lines.

La Cueva is one of three locations maintained by the Caribbean Primate Research Center with support from the Division of Research Resources of the National Institutes of Health channeled through the University of Puerto Rico's Medical Sciences Campus. Oldest of the Center's island colonies is Cayo Santiago, now devoted exclusively to naturalistic and observational investigation on free ranging monkeys in intact social groups.

At the La Parguera site, which includes La Cueva island, experimental manipulation is normally permitted in connection with behavior-oriented studies. The FDA colony, however, will not be subjected to manipulative procedures. But all animals will be individually marked and the population monitored to obtain demographic data.

VISITING SCIENTIST PROGRAM AT LEMSIP

A series of Indian scientists are to obtain additional training at the Laboratory for Experimental Medicine & Surgery in Primates (LEMSIP) during the next few years. The first, Dr. B. R. Srinath, B.V.Sc. (D.V.M.) arrived in January, 1974. His stay as a visiting scientist for a period of nine months is sponsored by the World Health Organization.

Dr. Srinath is a Veterinary Scientific Officer at the Central Animal Facility, Indian Institute of Science, Bangalore, India. In his position in India he assisted research workers of the departments of biochemistry, pharmacology and microbiology in their animal experimentation including surgery on primate animals. His main interest is reproductive physiology and surgical techniques involved in that area.

The purpose of his visit to LEMSIP is training in experimental surgery and in breeding techniques under Professor Wendell H. Niemann. After completion of his training at LEMSIP Dr. Srinath will return to the Indian Institute of Science to resume his research work and to assist in the planning and organization of the Indian National Primate Center and the Regional Primate Centers.

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INDIA PLANNING TO REDUCE RHESUS EXPORT

The following is from a note sent by Dr. Charles McPherson, Chief, Animal Resources Branch, Division of Research Resources, on March 4, 1974, to recipients of Rhesus Monkey Certificates of Need.

The government of India is planning to reduce the number of rhesus monkeys it will allow to be exported by approximately 40% 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.

We do not plan, at this time, 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.

MEETING ANNOUNCEMENTS: FOURTH CONFERENCE ON EXPERIMENTAL
MEDICINE AND SURGERY IN PRIMATES

This conference will be held in Jerusalem, Israel, February 24-27
1975. The following sessions will constitute the program:

Monday, February 24

- 9:00 - 9:30 Opening session
9:30 - 12:30 Current practice in maintenance, handling & experimenta-
tion, Chairmen: J. R. Held, E. Melby
12:30 - 2:00 Lunch and film session
2:00 - 5:30 Toxicology and drug metabolism, Chairmen: C. H.
Kratochvil, H. Weber
Drug abuse, Chairman: Charles Lieber
Evening Informal get together (Cocktails)

Tuesday, February 25

- 9:00 - 12:30 Brain function and behavior, Chairmen: A. Kling,
Carlos Guzman-Flores
Oncogenesis
12:30 - 2:00 Lunch and film session
2:00 - 5:30 Experimental psychology & psychopathology, Chairmen:
A. Schrier, D. Samuel
Experimental Surgery, Chairmen: E. I. Goldsmith,
Gerald Murphy
Evening Folklore evening at the Khan Club

Wednesday, February 26

- 9:00 - 12:30 Neurology and neurophysiology, Chairmen: R. Naquet,
D. Ploog
Cardiovascular studies, Chairmen: H. E. Stary,
R. W. Wissler
12:00 - 2:00 Lunch and film session
2:00 - 5:30 Environmental medicine, Chairman: Uri Marinov
Oral medicine, Chairmen: J. Hammer, III, H. Triadan
Evening Reception (Cocktails) by the mayor of Jerusalem at
the Israel Museum

Thursday, February 27

- 9:00 - 12:30 Immunology, Chairmen: H. Balner, N. Gengozian
Perinatology I, Chairmen: R. A. Chez, D. Hill
12:30 - 2:00 Lunch and film session
2:00 - 5:30 Ophthalmology, Chairmen: E. Barany, R. W. Bellhorn
Perinatology II, Chairmen: M. Panigel, S. Solomon
Teratology and developmental biology, Chairmen:
A. G. Hendrick, H. Nishimura
Evening Banquet (optional)

Abstracts of the Conference will be published well in advance in the *Journal of Medical Primatology*; abstracts in single space on page size (11" x 8.1/2") or (28 cms. x 22 cms.) with sufficient margin, should be submitted prior to June 31, 1974 to Session Chairmen or to J. Moor-Jankowski, M.D., LEMSIP, New York University Medical Center, 550 First Avenue, New York, N. Y. 10016, U.S.A.

Arrangements have been made with a travel firm to offer various special travel plans, involving non-affinity group air fares, specifically designed for the meeting. One such 10-day plan, including round trip air fare from New York, 1st Class hotel accommodations, etc., will be available for approximately \$609 per person (based on fares in effect April 1, 1974).

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"ALL THIS ATTENTION IS
VERY FLATTERING!"

OFFER OF VOLS. 1-9 OF NEWSLETTER

I will forward, free of charge, all issues of Volumes 1-9 of the *Laboratory Primate Newsletter*. They are assembled in a looseleaf binder.--Contact: Andrew F. Herd, 2003 Walmsley Drive, Eastburn Acres, Wilmington, Delaware 19808.

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SECTIONAL SERIES OF EARS AND LARYNGES OF PRIMATES OFFERED

We have sectional series of ears and larynges from a number of species of primates. For our own collection every tenth section is stained and saved, but the remaining nine are saved, albeit unstained and could be given to anybody interested. Of course, no charge.--Contact: Dr. George Kelemen, Los Angeles Foundation of Otolaryngology, 2130 West Third St., Los Angeles, Calif. 90057.

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CALAS CALL FOR PAPERS

Papers in any area of laboratory animal science are invited for presentation at the 1974 Convention of the Canadian Association for Laboratory Animal Science (L'association canadienne pour la technologie des animaux de laboratoire), to be held in Saskatoon, Saskatchewan, on August 13-16, 1974. Please submit titles to: Dr. F. M. Loew, Animal Resources Centre, University of Saskatchewan, Saskatoon, Canada, S7N 0W0.

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

Books

Behavioral Regulators of Behavior in Primates. C. R. Carpenter (Ed.)
Lewisburg, Pa.: Bucknell Univ. Press, 1974. [Price: \$27.50]

Contents: I. Theoretical contributions. 1. Regulatory functions of arousal in primate psychosocial development, by W. A. Mason. 2. Biology of communication and population structure, by G. R. Stephenson. 3. Innate mechanisms in primate social behavior, by G. P. Sackett. II. Dynamics of primate colonies. 1. Social organization of wild chimpanzees, by Y. Sugiyama. 2. Social structure of the Bushmen, by J. Tanaka. 3. Social relations in a chimpanzee colony, by T. Okano, C. Asami, Y. Haruki, M. Sasaki, N. Itoigawa, S. Shinohara, & T. Tsuzuki. 4. Fissions in the Gagyusan colony of Japanese monkeys, by Y. Furuya. 5. The third fission of a Japanese monkey group at Takasakiyama, by A. Nishimura. III. Grooming. 1. Grooming behavior as a regulator of social interactions in Rhesus monkeys, by D. G. Lindburg. 2. Grooming as a regulator of behavior in Japanese macaques, by J. Oki & Y. Maeda. IV. Ontogenetic development. 1. Development of vocalization and behavior of Japanese macaques, by S. Kawabe. 2. The development of peer behavior by method of paired rearing in infant Japanese monkeys, by C. Asami. V. Maternal regulation of infant behavior. 1. Maternal regulation of infant social interactions, by L. A. Rosenblum. 2. Mother and infant roles in the development of independence of *Macaca nemestrina*, by G. D. Jensen, R. A. Bobbitt, & B. N. Gordon. 3. Group organization of a natural troop of Japanese monkeys and mother-infant interactions, by N. Itoigawa. VI. Communicatory and adaptive behavior. 1. Social and communicative behavior in the *Cebus* monkey, by J. R. Oppenheimer. 2. Intelligent behavior of Japanese monkeys, by B. Yagi & T. Furusaka. 3. Acquisition and propagation of food habits in a troop of Japanese monkeys, by S. Azuma.

Predatory Behavior of Wild Chimpanzees. G. Teleki. Lewisburg, Pa.:
Bucknell Univ. Press, 1974.

Introduction to the Primates: Living and Fossil. S. I. Rosen. Englewood Cliffs, N. J.: Prentice-Hall, 1974.

Contents: Part I. The living primates. 1. We the primates. 2. Classification of primates. 3. The treeshrew. 4. The prosimians. 5. The

*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.

New World primates. 6. The Old World monkeys. 7. The Anthropoid Apes. 8. Man. Part II. The fossil primates. 9. From bone to stone. 10. The Dryopithecines. 11. The Australopithecines. 12. Homo erectus. 13. The Neanderthals. 14. The man of tomorrow.

Disease

Biohazards associated with simian viruses. Hull, R. N. (Lilly Res. Labs., Eli Lilly & Co., Indianapolis, Ind. 46206) In A. Hellman, M. N. Oxman & R. Pollack (Eds.) *Biohazards in biological research*. New York: Cold Spring Harbor Laboratory, 1973. Pp. 3-40.

This chapter reviews those simian viruses which have been transmitted from monkeys or monkey cell cultures to man, the factors involved in such transmission, and the consequences of the resulting infections. Some measures for prevention of human infection are discussed. At least 83 cases of human disease caused by simian viruses, or by viruses transmitted from monkeys to man, are noted. 24 of these infections terminated in death, while in some others extensive sequelae, or long periods of convalescence followed the acute infections. Other instances of infection by simian viruses without overt clinical disease are also mentioned, and serological evidence of possible infection with still other members of this group of viruses are presented. It is difficult to assess the over-all risks involved in numerical terms, since the extent of possible exposure cannot be determined. Concern over zoonoses involving monkeys developed following the first human case of B virus infection in 1934, and the tabulation of human infections began at that time. The cases cited occurred over a period of nearly 40 years. However, all but two occurred since 1950, a period marked by the accelerated use of monkeys for laboratory purposes. It seems, therefore, that the risk of acquiring infection at any one time is probably small, but that the consequences may be great, as evidenced by the 24 deaths which occurred.

Nonhuman primate virology. *Laboratory Animal Science*, 1974, 24, Part II. Proceedings of the second Virology Workshop which was held at the Delta Regional Primate Research Center, Tulane University, May 24-25, 1973. The Workshop was organized by P. J. Gerone, W. J. Goodwin, and S. S. Kalter.

Contents: Preface, P. J. Gerone; Virology and the nonhuman primate, P. J. Gerone; Use of nonhuman primates in virus research, R. L. Heberling & S. S. Kalter; Activities of the NIH-WHO regional reference center for simian viruses, S. S. Kalter & R. L. Heberling; Studies on simian foamy viruses and syncytium-forming viruses of lower animals, P. B. Johnston; Viral epizootics in captive nonhuman primates, C. Espana; Natural and experimental infections of nonhuman primates with respiratory viruses, E. C. Dick & C. R. Dick; Oncogenic DNA viruses of nonhuman primates: A review, L. A. Falk; C-type oncogenic viruses of nonhuman primates, S. R. S. Rangan; Spontaneous lymphoma of the nonhuman primate, J. S. Manning & R. A. Griesemer. Discussion, Virus from stump-

tailed monkey (*Macaca arctoides*) kidney cultures, S. R. S. Rangan, R. C. Lowrie, J. A. Roberts, P. B. Johnston, & R. P. Warrick; Pathology and clinical history of Delta Herpesvirus infections in patas monkeys, R. H. Wolf, H. F. Smetana, W. P. Allen, & A. D. Felsenfeld; Recent studies in the isolation and characterization of Delta Herpesvirus, W. P. Allen, A. D. Felsenfeld, R. H. Wolf, & H. F. Smetana; Ascorbic acid (vitamin C) and its effect on para-influenza type III virus infection in cotton topped marmosets, B. L. Murphy, D. H. Krushak, J. E. Maynard, & D. W. Bradley; Spontaneous neoplasms of nonhuman primates. Attempted transmission to immunosuppressed hosts and *in vitro* characterization, J. L. Cicmanec, R. H. Neubauer, W. C. Wallen, C. C. Darrow II, & H. Rabin; Attempts to demonstrate type-C virus in normal and neoplastic tissues of non-human primate origin, R. H. Neubauer, W. C. Wallen, W. P. Parks, H. Rabin & J. L. Cicmanec.

Physiology and Behavior

Biological values for juvenile grivets (*Cercopithecus aethiops matschiei*) of highland Ethiopia. LaCroix, John T., Judge, David M. & Saxton, Larry D. (U. S. Naval Med. Res. Unit No. 3 Field Fac., Ethiopia, APO N. Y. 09319) *Laboratory Animal Science*, 1974, 24, Part I, 111-113.

Hematologic and rectal temperature values were determined on 30 clinically normal juvenile grivet monkeys (*Cercopithecus aethiops matschiei*) in highland Ethiopia. Determinations included total white blood cell count, differential white cell classification, thrombocyte count, packed cell volume, hemoglobin, erythrocyte sedimentation rate, urea nitrogen, serum glutamic oxalacetic transaminase, alkaline phosphatase, and rectal temperature.

Breeding

Cycles of mating behaviour, oestrogen and progesterone in the thick-tailed bushbaby (*Galago crassicaudatus crassicaudatus*) under laboratory conditions. Eaton, G. G., Slob, A. & Resko, J. A. (Oregon Reg. Prim. Res. Ctr., 505 NW 185th Av., Beaverton, Ore. 97005) *Animal Behaviour*, 1973, 21, 309-315.

Vaginal smears and blood samples were taken throughout the reproductive cycle of female *Galago c. crassicaudatus*. Blood plasma was assayed for oestradiol and progesterone, and vaginal smears were initially classified dioestrus or vaginal oestrus. During vaginal oestrus the females were tested daily for sexual receptivity by being placed with a male. Those days on which the male achieved intromission were reclassified as behavioural oestrus. During dioestrus the females were tested weekly with males. Female receptivity increased and then declined across a 6-day period of behavioural oestrus during the 44-day cycle. Fully cornified smears were characteristic of the period of maximal receptivity and oestradiol secretion. The luteal phase lasted 24 days with a plasma progesterone peak midway through dioestrus.

Notes on reproduction in captive squirrel monkeys (*Saimiri sciureus*). Lorenz, R., Anderson, C. O. & Mason, W. A. (Delta Reg. Prim. Res. Ctr., Three Rivers Rd., Covington, La. 70433) *Folia primatologica*, 1973, 19, 286-292.

Over a 6-year period, a colony of *Saimiri* was established for experimental behavioral research. Heterosexual pair housing prevailed, and a number of offspring was produced. Females apparently underwent a lengthy adjustment process, inasmuch as viable infant production was infrequent until the female had been paired for three breeding seasons. Males required only a short period of adjustment, if any, to become effective breeders. Breeding was seasonal and births occurred during the summer. The mean maximum gestation for five females who delivered in one year was 162.6 days (range 152-168 days, n=5). The short gestations for some of these females relative to those previously reported by other investigators suggest a broad range of variability in gestation for this species. The possibility that some of these five females conceived very soon after being paired with males is discussed with regard to social and coital influences on ovulation.

Laparoscopy and precise mating techniques to produce dated pregnancies in *Macaca fascicularis*. Dukelow, W. R. (Endocrine Res. Unit, Michigan State Univ., East Lansing, Mich. 48823) *Proceedings of the International Congress on Animal Reproduction*, 1973, 7, 529-531.

Using laparoscopy at close intervals, 18 to 20 hours before the expected time of ovulation, one can observe characteristic changes in the development of the follicle which enable approximation of the time of ovulation in macaques. Once the expected time of ovulation is known, females are placed with fertile males for periods of time of only 20 to 30 minutes to allow mating to occur. Using these techniques we have determined gestation length in our colonies to be 164.5 days \pm 30 minutes. A photographic record of follicular development can be obtained with either color or infrared laparography.

Reproduction in indoor squirrel monkey colony. Hupp, E. W. (Biol. Dept., Texas Woman's Univ., Denton, Texas 76204) *Proceedings of the International Congress on Animal Reproduction*, 1973, 7, 2313-2320.

Procedures used during the past 5 years in a reproducing colony of approximately 30 adult squirrel monkeys (*Saimiri sciureus*) and their offspring are discussed. Cages with 1 male and 3 or 4 females were kept in animal rooms at temperatures between 21°C and 30°C, relative humidity of 10% to 90%, with the higher temperatures and humidity in winter; and a constant 12-hour light-dark cycle. The monkeys were fed Purina Monkey Chow and Purina Monkey Chow 25, supplemented with vitamins, orange juice, powdered milk, fruit, peanuts and crackers. A total of 32 live births was obtained; 25 monkeys survived to weaning at 4 to 6 months of age. An average of 0.54 live births and 0.42 offspring weaned was obtained per female per year. Colony conceived animals were born from February to September, with most of the births in May to August.

Ecology and Field Studies

O mono *Brachyteles arachnoides* (E. Geoffroy). Situação actual do especie no Brasil. [Present status of the woolly spider monkey in Brazil.] Aguirre, A. C. Editado pe la Academia Brasileira de Ciencias como contribuição ao programa biologico internacional. Rio de Janeiro, GB, 1971. Pp. 3-53.

Contents: Taxonomic history; Distribution before 1500; Behavior, food habits, breeding; Economic importance; Relations with other monkeys and with man; Present distribution and numbers (range map); Local disappearances; Specimens in museums; Protective measures.

Instruments and Techniques

Primate head restrainer using a nonsurgical technique. Friendlich, A. R. (Dept. of Ophthal., Wilmer Inst., Johns Hopkins Univ., Baltimore, Md. 21205) *Journal of Applied Physiology*, 1973, 35, 934-935.

When recording from the brain of the alert, behaving primate it is often desirable to rigidly restrain the monkey's head by making physical contact with a skull implant. Existing methods require surgery under aseptic conditions. This paper describes a head restrainer which can be quickly and easily attached without surgery under a local anesthetic.

Laparoscopic technique for the examination of the ovaries in the rhesus monkey. Bosu, W. T. K. (Primatlab. för Reproduktionfors., Univ. of Uppsala, P. O. Box 565, S-751 22 Uppsala, Sweden) *Journal of Medical Primatology*, 1973, 2, 124-129.

Over a hundred laparoscopic examinations have been carried out in rhesus monkeys during the normal menstrual cycle and during medication. With the method and the apparatus described it was possible for one person alone to perform the laparoscopy and the photography. No complications have occurred with the use of the method. Laparoscopic examination was more difficult in fat animals. A slight bleeding occurred in the mesovarium in two animals, but had no serious aftereffects. The preliminary laparoscopic examination provided a panoramic view of the pelvic contents. The anterior and dorsal aspects of the uterus, adnexa and the urinary bladder were clearly visible.

Aeromedical review: Selected topics in laboratory animal medicine. Vol. II. *The design of laboratory animal homes.* Simmonds, Richard C. Brooks Air Force Base, Texas: USAF School of Aerospace Medicine, December, 1973. (Review 7-73)

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