

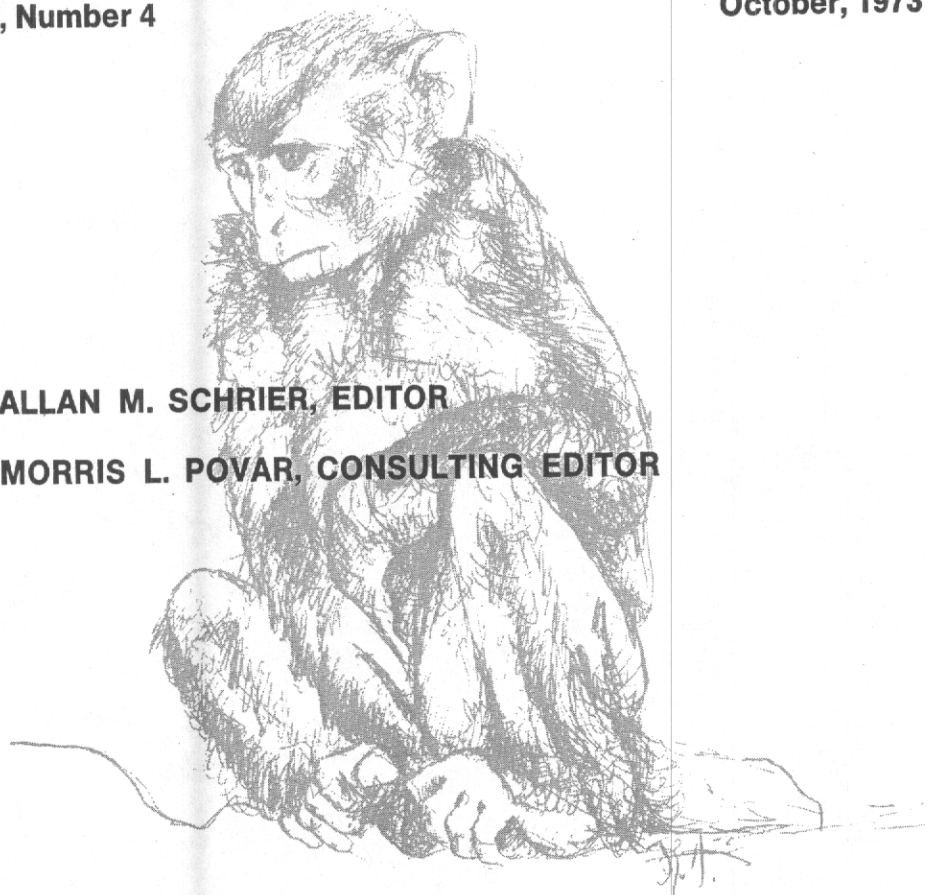
LABORATORY PRIMATE NEWSLETTER

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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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EDITOR'S NOTES

Primate Center Series

The responses to our recent *Newsletter* Questionnaire (see July, 1973 issue) indicated that many readers would be interested in learning more about the activities and facilities of the various primate centers in both the United States and other countries. A series of articles describing primate centers begins in this issue with the Delta Regional Primate Research Center at Tulane University and the Regional Primate Research Center at the University of Washington.

Conservation Resolutions

We note the recent flurry of resolutions promulgated by various national and international bodies in favor of conservation of nonhuman primates. We thoroughly sympathize with this cause (see Editor's Notes, January, 1971 issue) and have dutifully published most of the resolutions that have been forwarded to us. There is no doubt that resolutions have their value. When properly timed and properly worded, they can stir men to action they might not otherwise take. But when we begin to see what may be an unduly large number of them, we are reminded of that old legislative maxim: "When in doubt, pass a resolution." We cannot put aside the feeling that perhaps the time for resolutions is past, and that it is now time for constructive suggestions (some have appeared in the past year in the pages of the *Newsletter* and elsewhere) and for positive action to conserve primate populations while ensuring an adequate supply of them for research.

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IMPLANTATION SURGERY IN INFANT MONKEYS¹

Martin Reite, Stephen D. Walker, J. Donald Pauley

University of Colorado Medical Center

During the past several years, we have been developing an implantable multichannel biotelemetry system for use in studies of physiological correlates of behavior in infant monkeys. In the course of developing the necessary surgical implantation technique, we have had the occasion to perform a variety of surgical procedures on several dozen infant *Macaca nemestrina* monkeys ranging in age from four to 15 months (850-1350 gm).

Our telemetry system is a seven channel, pulse amplitude modulated FM system that transmits heart rate, body temperature, eye movement (EOG), muscle activity (EMG), and three channels of EEG. The system consists of two packages, a signal conditioning RF oscillator package (30 × 45 × 10 mm) and a separate battery package (21 × 32 × 15 mm). These packages are implanted in the anterior abdominal wall, and electrode leads are tunneled subcutaneously to their various terminations. Thus, the surgical procedure consists of four essential parts: (1) abdominal implantation, (2) subcutaneous dissection for the electrode cable, (3) electrode implantation, and (4) wound closure.

Since young primates are increasing in importance as research subjects in psychobiology, we felt it would be helpful to other investigators contemplating implantation or other surgical work with infant monkeys if we detailed our anesthetic, surgical and post-operative experience to date.

Although developed with our specific application in mind, we believe that these procedures have a general applicability, in part or in toto, to other forms of experimental intervention in infant monkeys.

Minor or very short duration surgical procedures can be undertaken with an intramuscular (IM) anesthetic agent such as **phencyclidine (Sernylan, Bio-ceutic Laboratories)** or a short acting barbiturate such as methohexital (see Mattson & Gardner, 1970). Longer procedures require a long acting general anesthetic, which in turn necessitates greater control over administration and anesthetic depth than can be obtained with IM administration. The small size of the animal, and the inherent complexity and expense of the procedure practically precludes inhalation anesthesia. The intravenous (IV)

¹This research was supported by Grant No. MH19514 from NIMH, Grant No. NS08511 from NIH (Neuroscience Instrumentation), and a grant from The Grant Foundation to Dr. I. Charles Kaufman of the University of Colorado Medical Center. M. R. is supported by NIMH Research Scientist Development Award No. K01-MH46335.

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route, on the other hand, is inexpensive and simple to operate, and it provides good control over anesthetic depth and immediate access to the vascular system should any other medications need be given. We routinely use IV sodium pentobarbital for general anesthesia and have yet to experience a serious anesthetic complication.

As is the case with all anesthetic agents, solid food should be withheld for 12 hours pre-operatively. Water is not withheld, as monkey infants can become dehydrated rather rapidly. If the infant is with its mother, it can, of course, continue to nurse. The infant is premedicated with phencyclidine hydrochloride (1 mg/kg IM) and a single dose (20 mcg) of atropine sulfate. The premedication provides a 20 to 30 minute period of relative unresponsiveness. During this time, operative sites can be shaved and cleaned, and an IV started in the saphenous vein on the posterior aspect of the calf using a 25 gauge pediatric scalp vein infusion set flushed with sterile saline. After the scalp vein needle is in place, a solution of sodium pentobarbital (Diabotal, Diamond Laboratories, diluted 1:1 with sterile saline) (30 mg/cc) is slowly injected as the general anesthetic. The barbiturate solution is injected in 0.1 cc aliquots, waiting 15 to 30 seconds for an observed effect before delivering the next aliquot. We do not administer a predetermined dosage to the infant, but rather administer the drug until the desired anesthetic depth is obtained. This usually requires between 0.5 cc and 0.7 cc of the barbiturate solution or about 15-20 mg/kg. Anesthetic depth is monitored by degree of body relaxation and the status of the medial and lateral palpebral reflexes. The palpebral reflexes consist of blinking when the bridge of the nose (medial reflex) or skin immediately lateral to the eye (lateral reflex) is tapped. With increasing anesthetic depth, the lateral reflex is lost before the medial, and anesthetic depth is optimal at this point, i.e., when only the medial reflex still exists (although it may be depressed). Respiration is varyingly depressed and must be watched carefully, and a patent airway must be maintained. We have found that disposable plastic pediatric endotracheal tubes 4 mm in diameter cut to about 8 cm in length are useful in maintaining the airway. Placed in the infant's mouth extending behind the tongue into the pharynx, they provide a path for air exchange, prevent the tongue from falling back and obstructing the airway, and facilitate suctioning should it be necessary. Apneic periods are rare, but do occur. They can be terminated with artificial respiration. EKG and respiration monitors, although valuable if available, are not necessary.

When the desired anesthetic level has been reached, an intravenous drip is established with 5% dextrose in normal saline at one drop per minute. This delivers approximately 4 cc/hr of fluid, which is sufficient to keep the IV open and yet not enough to over hydrate the animal during a fairly long procedure. If we presume extracellular fluid (ECF) to approximate 20% of the lean body mass (Fingerg, 1972), the monkey infant's extracellular fluid would approximate 200 ml. Accordingly, plasma volume, comprising about 25% of ECF, would be about 50 ml in a 1000 gm infant. Thus, an infusion rate of 4 cc/hr is equivalent to about 8% of plasma volume per hour. The infusate, of course, would tend to distribute itself across the

total ECF volume. To prevent clotting, it is advisable to flush the IV unit several times an hour by opening the control valve wide for several drops, then restoring the normal slow drip rate. It is helpful to use a 250 cc IV bottle as it is easier to observe small shifts in fluid level with a small container.

Adequate depth of anesthesia is maintained by clinical observation. If the animal exhibits reflex movements or shows increased muscle tone during the course of the procedure, small supplementary intravenous aliquots are adequate to re-establish adequate anesthetic depth in a previously anesthetized animal.

We monitor the animal's body temperature constantly throughout the procedure with a rectal thermistor probe and a constant readout meter (Virtronics, Model 50-DC, Virtis Company, Inc., Gardiner, New York, 12525). Anesthesia depresses body temperature and small monkeys have little in the way of heat reserves. Body temperature is maintained between 36-38°C using an inexpensive electric heating pad placed under the animal.

Surgical Procedures

Implantation Techniques

Although physically small, the monkey infant can tolerate a significant degree of surgical manipulation providing sterility is maintained and proper attention is paid to good surgical technique.

Our application calls for implanting several fairly sizeable packages in the animal for a long period of time. We elected to utilize both sides of the abdominal wall as implant sites, and the results to date have been quite successful. Intraperitoneal implantation was considered but discarded because of the possible complications resulting from post-surgical adhesions or physical distortion of the G.I. tract. Possible subcutaneous locations were also discarded. Our previous experience had indicated that subcutaneous placement of a sizeable foreign object, even though biologically inert, tended to compromise the blood supply to the overlying skin, inviting tissue breakdown.

The routine abdominal implantation procedure begins with a midline skin incision from a point approximately 1 cm below the xyphoid cartilage to 0.5 cm below the umbilicus. The skin and subcutaneous tissue are very carefully loosened from the area of the incision and subcutaneous pockets are dissected to facilitate two subsequent, more lateral incisions in both left and right abdominal walls. A second deep longitudinal incision is made approximately 4 mm to the right of the midline, being careful to incise only the external facial (muscular aponeurosis) layer and the muscle layer itself. Care must be exercised to avoid entering the peritoneal cavity at this point. A pocket can now be dissected laterally, posterior to the muscle layer and anterior to the peritoneum and its overlying fascia.

It has not been possible to separate individual abdominal muscle layers in monkey infants. Using blunt dissection, this pocket can be extended caudally and laterally, providing a sizeable space for implantation of apparatus.

In a similar fashion, a second large pocket can be created in the opposite abdominal wall. In our applications, the two packages implanted in opposite abdominal walls are connected by a three-wire silastic covered cable. Such an interconnection creates no difficulties if the subcutaneous connecting cable is long enough to extend beyond the rostral end of the initial skin incision when it is finally closed. As a general rule, we have found that foreign objects, such as wires, should not lie or pass directly beneath a skin incision, as the danger of impaired wound healing is greatly increased.

Subcutaneous Tunneling

We direct a silastic tube containing electrode lead wires subcutaneously from the abdominal area to the head. This is accomplished by running the tube in two stages up the anterior chest wall and across the right side of the neck to the right posterior aspect of the skull.

In the first stage, a small 1 cm horizontal skin incision is made near the right clavicle. Long clamps are then used in dissecting a subcutaneous passage connecting the shoulder incision with the midline abdominal incision, following which the silastic tube is pulled through to exit the shoulder incision. Another skin incision is made in the posterior midline of the scalp in order to bring the tube to the head.

A major concern in routing wires subcutaneously is the nearly constant movement-related stress the wires are subjected. We recommend multi-stranded Teflon coated stainless steel wire for this purpose, as its resistance to stress hardening is extremely high. A commercially available wire consists of seven strands of .002-inch stainless steel wire coated with Teflon with a final thickness of .008-inch including insulation (Part No. 316SS 7/44T, Medwire Corporation, 121 S. Columbus Avenue, Mt. Vernon, New York 10553). We use cables made up of up to eight such multi-stranded insulated wires inserted in .030 I.D. silastic tubing (Vivosil medical grade silicone elastic tubing, No. 7002-030, Becton, Dickinson and Co., Rutherford, New Jersey).

Electrode Implantation

Our electrodes (EEG, EKG, EOG, and EMG) consist of 3 mm diameter stainless steel discs or washers punched from 0.003-inch-sheet stainless steel. They are welded (during surgery) to the ends of their respective lead wires by a small capacitor discharge welder of our design (Walker & Reite, 1973). The EKG, EOG and EMG electrodes are anchored in subcutaneous tissue; the EEG electrodes are placed extradurally. The animal's head is placed in a stereotaxic unit, and small holes are drilled through the skull

over the desired cortical locations using a portable dental drill. The electrodes are inserted, and the holes are packed loosely with Gelfoam and covered with Kadon or other dental acrylic material.

Closure of Surgical Incisions

All surgical incisions should be closed in layers (e.g., muscle layer, subcutaneous tissue, skin). Interrupted 3-0 chromic catgut sutures about 3/16 inch apart are used for muscle and subcutaneous tissues. Unprotected skin incisions can be closed with interrupted stainless steel suture wire (.010 inch, 30 gauge). Steel sutures have proven impervious to grooming, and the unprotected incisions heal rapidly and well. Alternatively, the abdominal skin incisions can be closed with normal suture materials, the chest and abdomen wrapped with a sterile Kling gauge bandage (taped well in place), and a small leather vest installed to cover the bandage. Before final closure, skin incisions are dusted with a topical antibiotic powder (Terramycin topical powder with Polymyxin B, Pfizer Laboratories).

Recovery

We routinely administer a single intramuscular injection of 200,000 units of benzanthine penicillin G (Bicillin L-A, Wyeth Laboratories) after surgery as a precautionary measure. Since our animals are loose in a social group and not available for close observations, we would have difficulty detecting any signs of early wound infection were it to occur.

The animals awaken from the anesthetic within 3-6 hours following completion of surgery (a function of the actual time under anesthesia and the amount of pentobarbital administered). Post-anesthetic excitement is greatly diminished if recovery takes place in a quiet and dark cage, minimizing all form of sensory stimulation. When the infants are alert enough to walk fairly steadily, they can be returned to their mothers, and the mother and infant can be returned to a group pen in 48 hours if desired. Other animals have not, in our experience, molested the operated infant. Sutures can be removed 10 days post-operatively.

The operated infants are less active than normal during the first few post-operative days, but within 4 to 6 days their behavior is indistinguishable from non-operated control infants of the same age.

Conclusions

The method of total implantation of monitoring apparatus is highly desirable in studies involving physiological/behavioral correlations. Animals instrumented in this manner have no external appliances such as backpacks or skull caps to interfere with or alter social behavior, nor do they have the problems associated with wires or other apparatus exit-

ing the body via a chronic skin interruption.

We believe that the surgical techniques we have outlined here are adaptable to a variety of experiments utilizing young, nonhuman primates.

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AVMA ADOPTS RESOLUTION OPPOSING WILD ANIMALS AS PETS*

At the 110th Annual Meeting of the American Veterinary Medical Association held in Philadelphia on July 17-19, 1973, the House of Delegates adopted a resolution opposing the keeping of wild and exotic animals as pets. The resolution, presented by the Association's Council on Public Health and Regulatory Veterinary Public Health and the Council on Veterinary Services, reads as follows:

The AVMA strongly opposes the keeping of wild and exotic species of animals as pets and believes that all commercial traffic of these animals for such purposes should be prohibited.

Two reasons the councils offered in support of the resolution were that exotic species, which people like to own because they are unusual or are regarded as status symbols, create disease, diet and exercise problems different from those encountered with domestic animals. They also pose a difficult problem when the owner tires of them and wants to dispose of them. Frequently zoos will not take the animals, and they are "too domesticated" to return to the wild. Euthanasia may be the only answer.

The councils urged that veterinarians exert their influence to discourage the keeping of wild or exotic animals as pets.

*From *CDC Veterinary Public Health Notes*, July, 1973, 3.

THE DELTA REGIONAL PRIMATE RESEARCH CENTER

Peter J. Gerone

Tulane University

Like other primate laboratories, the Delta Regional Primate Research Center (DRPRC) is dedicated to the efficient use of non-human primates in biomedical research. Although our major effort is to solve human problems, a significant by-product of our research is an attempt to gain a better understanding of the 20 species of nonhuman primates in our animal colony. Indeed, the basic objective of some of our projects is to study the species.

An important feature of this Center is the diversity of research that can be done within its confines. This is made possible by the many scientific disciplines represented by our resident, visiting, and collaborating scientists drawn here by the opportunity to use nonhuman primates in their research. The synergistic effect of this mixture of skills and talents greatly increases efficiency in utilizing monkeys and apes.

We are well equipped to make possible this broad scope of research programs. A compound of field cages, the largest of which is 100' x 400', will accommodate several species of primates. The one-acre cage, complete with observation booth, is ideal for behavioral studies and can easily house a colony of chimpanzees or any of several other species of nonhuman primates. Other outdoor cages are suitable for smaller species. One of these, equipped with a wire mesh canopy and enclosing an area of natural vegetation, is ideal for marmosets and other smaller monkeys.

Our specially designed infectious disease laboratories can operate at several different levels of containment ranging from the use of biological and laminar flow cabinets to strict isolation. Our most hazardous microbiological research is confined to an isolation building. Potentially contaminated areas are entered by way of change rooms and shower facilities. Air balancing is used to help control contamination. Materials exit by way of autoclaves or in sealed decontaminated containers. Such facilities make it possible to safely handle many disease agents that would be too hazardous for most conventional laboratories.

A unique feature of this center is the radiation field for chronic low-dose exposure of animals. The radiation source is from 1800 curies of cobalt-60 and the field is a 30° sector several hundred feet in length. The radiation area is protected by a number of physical and electronic barriers to prevent accidental exposure of intruders. Animals housed in

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the path of the radiation can be exposed for 18 or more hours each day.

DRPRC operates under the aegis of Tulane (University) Medical Center of New Orleans. The laboratory is situated on 500 acres of forested land near Covington, Louisiana (about 35 miles from New Orleans). The semitropical climate makes possible outdoor caging of most species of monkeys, an economic advantage of no small import. The Center, which was formally dedicated in 1964, is staffed by 120 employees, including the following 19 scientists: Peter J. Gerone, Sc.D., Director. Animal Care: Robert H. Wolf, D.V.M.; J. P. Caballero, D.V.M. Bacteriology: Oscar Felsenfeld, M.D. Biochemistry: Yu-Teh Li, Ph.D.; Su-Chen Li, Ph.D. Neurobiology: Kenneth R. Brizzee, M.D.; Helmut Hofer, Ph.D.; J. Mark Ordy, Ph.D. Parasitology: Thomas C. Orihel, Ph.D.; Sharon K. File, Ph.D. Urology: James A. Roberts, M.D.; Jack R. Goodman, M.D.; Richard M. Harrison, Ph.D. Virology: William P. Allen, Ph.D.; Ambhan D. Felsenfeld, M.D.; Robert C. Lowrie, Jr., Sc.D.; Louis N. Martin, Ph.D.; S. R. S. Rangan, Sc.D.

Research being conducted by this Center combined with the work of a number of affiliates covers a wide range of interests. A brief description of each major project follows.

Anatomy

Histological studies of the sublingual structures of prosimians and New World monkeys are to determine the species in which these organs exist and to try to establish their evolutionary significance. These organs have combined characteristics of a true sublingua and frenal lamella.

Bacteriology

Borrelia, which causes relapsing fever, can interfere with trypanosomes which cause Chagas' disease (American trypanosomiasis). This interference phenomenon is being studied in nonhuman primates. We have succeeded in identifying certain antigens which are common to these taxonomically unrelated organisms.

Our research on the development of vaccines against enteric bacteria continues. A number of streptomycin-dependent mutants suitable as vaccine strains against vibrios, dysentery bacilli and pathogenic *E. coli* have been selected and are being evaluated.

Inasmuch as *Vibrio parahaemolyticus* has become increasingly important as a cause of diarrhea associated with the ingestion of seafoods, we are surveying marine life in the Gulf of Mexico to determine the incidence of this bacterial contamination. Preliminary evidence suggests that pathogenic strains can be distinguished from non-pathogenic strains by infecting monkeys and noting their clinical response.

Cholera is a disease that almost invariably occurs in undernourished populations, so we are investigating the interrelationships of nutrition and

cholera infections in monkeys. The immune response of an infected monkey to a variety of diets is being compared with control animals. The nutritional parameters that are varied include amounts of proteins and vitamin B complex and the number of calories.

Biochemistry

Sphingolipidoses are diseases resulting from metabolic defects. Patients who are genetically devoid of certain glycohydrolases show accumulations of Sphingolipids. Our Biochemistry Department has been active in identifying these missing enzymes and in finding sources of these enzymes in other natural products. The glycosidases have served as valuable tools in the structural analyses of complex carbohydrates.

Neurobiology

Our neurobiology program is primarily linked to the effects of radiation on the development of the cerebral cortex. Pregnant and baby squirrel monkeys will be subjected to prolonged low-dose radiation emanating from a Cobalt-60 source. The effects of this exposure on the vulnerability of brain development will be measured by anatomical, biochemical and behavioral techniques.

Oncology

Attempts are being made to define the immune response of squirrel monkeys to *Herpesvirus saimiri* (HVS). Our program is to infect laboratory-born squirrel monkeys that are free of antibodies to HVS and to monitor their immune response at both humoral and cellular levels. In addition, we will investigate the general pathogenesis of this virus in its natural host.

Simian C-type viruses are also included in our research programs. At present we are searching for *in vitro* methods to assay simian sarcoma virus (SSV-1), gibbon lymphoma virus (GLV) as well as the SSV-1-associated virus (SSAV-1). The immunological relationship of these viruses is also under study and attempts are being made to produce neoplasms *in vivo* by inoculation of infant primates.

Parasitology

The objective of this research is to use the nonhuman primate to study parasites of man and to learn more about the natural parasites of the simian host, especially those that can also infect man. Most of this research is with filariae, schistosomes and a variety of intestinal nematodes. Maturation, reproduction and aging of these parasites and their interactions with the host are being studied. Our programs are now being expanded to include studies of the arthropod vectors of some of these parasites.

Reproductive Physiology

We have two major interests in reproductive physiology research. The first is in developing an intrauterine device that will slowly release progestin to reduce the spontaneous expulsion rate of the implanted IUD. To accomplish this end, progestin is incorporated into the silastic used to make the IUD's.

Our second interest is the study of the effects of vasectomy in a rhesus monkey. In this project, we hope to identify the histological and immunological consequences of vasectomies.

Urology

Acute pyelonephritis is being produced in stumptail monkeys by blocking renal tubules with oxamide and then intravenously inoculating *E. coli*. Our current interest is to determine the role of the ureter in pyelonephritis. A possible contributing factor to chronic pyelonephritis may be vesicoureteral reflux during bladder infections. Attempts are being made to surgically induce reflux in monkeys to see if this contributes to kidney disease.

We are also interested in the interrelationships of hypertension and pyelonephritis. Since these conditions often occur concomitantly in human patients, there may be a cause and effect relationship. If this is indeed the case, we would like to establish which is the cause and which is the effect. These studies are being done in larger primates, such as baboons, to facilitate the surgical procedures required to produce experimental hypertension.

Virology

Other areas of virology are being researched in addition to the viral oncology mentioned above. Chimpanzees are being tested for their susceptibility to various allotypes of Australian antigen. The animals used in these studies were shown to be antibody free before inoculation. The infected animals are being monitored clinically and biochemically.

In another project, several nonhuman primate species are being tested for susceptibility to adenovirus, type 8. This virus causes epidemic keratoconjunctivitis in humans. There is no known laboratory host that is susceptible to the eye infections caused by this virus. Finding such a host would permit us to evaluate methods of prophylaxis or therapy.

During the past five years we have had two spontaneous outbreaks of a severe exanthematous disease in patas monkeys. The disease is caused by the herpes-like virus that produces marked liver damage. We are trying to find the source of these infections and at the same time determine the suitability of this disease as a model for varicella infections in man. The herpes virus involved is antigenically related to varicella-zoster.

Cooperative Research

In addition to the research projects of our staff cited above, we have a number of studies under way that are conducted by research affiliates of the center. Among these has been a continuing study by Dr. Rainer Lorenz on the Behavior and Biology of *Callicebus moloch* and *Callimico goeldii*. We now have reasonably stabilized colonies of both species and these are providing data that will be valuable in maintaining these animals in captivity.

Another Research Affiliate, Dr. Robert McAfee, is investigating the ability of microwave radiation to produce cataracts. The purpose of this study is to establish the dose-effect relationship and to determine the underlying basis of the cataractogenic potential of microwaves.

Dr. David Klein and his colleagues are studying peripheral nerve regeneration and repair using surgical procedures. The rhesus monkey is the laboratory model for these studies.

The Center is cooperating in a research program on atherosclerosis. Dr. Gerald S. Barenson is directing the program as head of a Specialized Center for Research on atherosclerosis. We are surveying various simian species for the incidence of arterial lesions. These studies will be expanded to include some breeding programs for genetic purposes.

Another collaborative program is on diseases involving immunological sensitization of the host. In a study with Dr. Peter Baram of the American Dental Association Laboratories in Chicago, we are attempting to transfer sensitivity from human to chimpanzee lymphocytes. The extracted human lymphocytes are from patients that are hypersensitive to various antigens.

With Dr. R. G. Mason of Chapel Hill, N. C., we are studying the blood compatibility and thrombogenic properties of various materials that have potential use as vascular cannulae. The materials are tested by surgical implantation in the anterior vena cava of rhesus monkeys.

Finally, the Center cooperates with many researchers to provide specimens essential to their work. These requests are usually short-term or on a one-time basis and are too numerous to mention here. Filling these needs is one of our more important responsibilities because it gives us the opportunity to contribute to many areas of biomedical research.

REGIONAL PRIMATE RESEARCH CENTER AT THE UNIVERSITY OF WASHINGTON

Dorothy J. Reese

University of Washington

The Regional Primate Research Center at the University of Washington, one of seven such centers built and supported by the National Institutes of Health, was founded in 1961. The four-storied Center building is integrated into the Health Sciences Center complex and adjoins the basic medical science departments of Physiology & Biophysics, Biological Structure, Biochemistry, and Genetics. This location permits easy access to many central facilities, to other medical, dental, nursing, and public health departments, and to other University schools and colleges. The Primate Field Station, the breeding facility of the Center, is a renovated maximum security mental prison located on the campus of Eastern State Hospital at Medical Lake, Washington, approximately 300 miles from the main Center.

Scientific Staff

The scientific staff of the Center is divided into two major categories. Core Staff members, who hold joint appointments in the Center and an academic department, perform their primary research efforts in the Primate Center. Research Affiliates, whose major commitments are to other University departments or other institutions, use the facilities of the Primate Center to carry out specific research programs. At present there are 11 Core Staff members, 55 Research Affiliates, and about 200 associated professional scientists and graduate students working in the Center.

Core Staff Members

Since the Core Staff members belong to a variety of academic departments, their research programs focus on different problems and fields of investigation. Douglas M. Bowden, M.D., Assistant Professor of Psychiatry and Behavioral Science, is studying physiological aspects of social and emotional behavior. One series of studies is directed toward identifying the neural systems which mediate reward of "pleasure" by determining brain sites that elicit a self-stimulation response from the monkey. Another line of investigation involves equipping monkeys with blood pressure telemetry packs and exposing them to a variety of stressful and relaxing social situations to determine how blood pressure changes in different emotional states.

June L. DeVito, Ph.D., Assistant Professor of Neurological Surgery, is conducting neuroanatomical studies of central neural connections.

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Cortical or subcortical lesions are made and after appropriate survival times the animals are sacrificed and the brains are treated with the Nauta or Fink-Heimer method for demonstrating degenerating axons. Connections are traced by using autoradiography to detect axoplasmic transport. Investigations include projections of the hippocampus and interconnections of thalamic structures.

Eberhard E. Fetz, Ph.D., Assistant Professor of Neurological Surgery and Physiology & Biophysics, is concerned with the functional relations between precentral cells and muscles. Correlations between cell and arm muscle activity are observed during a variety of responses, including active and passive arm movement and operatively conditioned patterns of cell and muscle activity. A servo-system is used to control and monitor force and position at wrist and elbow joints during movements.

Albert F. Fuchs, Ph.D., Associate Professor of Physiology & Biophysics, is conducting neurophysiological studies of the oculomotor system. The objective of the research is to describe inputs to the oculomotor nuclei from three anatomically verified sources: the vestibular nuclei, the pontine and mesencephalic reticular formations, and the cerebellum. This is done by correlating neuron firing patterns in these structures with eye movements and adequate vestibular stimulation.

Charles C. Gale, Ph.D., Associate Professor of Physiology & Biophysics, is investigating the role of the central nervous system in integrating sensory inflow thermoreceptor neurons, and activating neural and hormonal regulatory mechanisms concerned with changes in temperature and metabolism. Emphasis is placed on studying central nervous system coordination of multiple systems which alter rate of heat loss and gain and thus precisely regulate body temperature. By studying endocrine, metabolic, neuromuscular, behavioral, and cardiovascular parameters in a variety of thermal challenges, an integrated schema of temperature regulation in conscious primates can be constructed.

W. Ellis Giddens, Jr., D.V.M., Ph.D., Assistant Professor of Pathology and Core Staff Pathologist, is investigating basic reactions of the respiratory tract to injury, emphasizing viral oncogenesis in the lung. The purpose of the research is to determine if lung cancer can be induced in primates by oncogenic herpesvirus, acting alone and in concert with chemical carcinogens and to ascertain whether oncogenic herpesviruses can be transmitted and cause neoplasia when introduced by the respiratory route.

John A. Glomset, M.D., Research Professor of Medicine, is concerned with plasma cholesterol metabolism. The objective is to accumulate detailed information concerning the biochemistry and physiology of the plasma lipoproteins in order ultimately to provide a rational basis for understanding the pathogenesis of atherosclerosis and essential familial hypercholesterolemia.

Erich S. Luschei, Ph.D., Associate Professor of Physiology & Biophysics, is concerned with the study of neurophysiological processes involved in normal coordinated movements of the mandible. The activity of neurons in the motor nucleus of the fifth nerve, nucleus supratrigeminalis, and ventromedial pontine reticular formation is related to characteristics of jaw movements. The effects on conditioned and ingestive jaw movements produced by permanent and reversible lesions of the face area of precentral cortex are evaluated.

Theodore C. Ruch, Ph.D., Professor of Physiology & Biophysics, who was the first Director of the Center, is interested in central pain mechanisms and the neural control of micturition. He is currently engaged in completing the 20th edition of Ruch and Patton's *Physiology and Biophysics*.

Gene P. Sackett, Ph.D., Professor of Psychology, is working on developmental psychology, primarily the identification of dimensions of rearing experiences necessary for normal behavior development in primates. The experiment assesses the main effects and interactions of social, nonsocial, and response feedback rearing dimensions on modifying the debilitating effects of total isolate behavior. Special areas of study include "therapy" employing operant behavior modification procedures, the importance of emotional "emergence trauma" effects, and the effects of social-sensory isolation rearing with added telemetered electrical brain stimulation as a source of varied input.

Orville A. Smith, Ph.D., Professor of Physiology & Biophysics and Director of the Center, is investigating central neural control of cardiovascular function. Electromagnetic flow transducers, pressure catheters, and vessel occluders are implanted chronically to monitor and manipulate cardiovascular responses in trained, awake monkeys during periods of emotion, eating, sleep, and exercise. Also, the neural mechanisms underlying the psychological experience of emotion are investigated by producing lesions in the hypothalamus and parts of the brainstem that influence cardiovascular function.

Research Affiliates

The Research Affiliates include faculty members from many departments in the University of Washington, as well as members from Eastern Washington State College, Western Washington State College, and Washington State University. Part of the regional obligation of the Primate Center is fulfilled through the affiliate program. Current Research Affiliates come from the following departments: Anesthesiology, Anthropology, Bioengineering, Biological Structure, Biology, Chemistry, Engineering, Gastroenterology, Hematology, Medicine, Microbiology, Neurological Surgery, Obstetrics & Gynecology, Ophthalmology, Oral Biology, Orthodontics, Orthopedics, Otolaryngology, Pathobiology, Pathology, Pediatrics, Physiological Nursing, Psychology, Rehabilitation Medicine, Restorative Dentistry, and Urology. A sample of the programs being conducted by Research Affiliates includes the following: Vestibular Control of Neck Musculature, Immunological Studies of Male Accessory Glands

and Their Secretions, Reproductive Physiology: Oviduct Motility and Gamete Transport, Toxicology of Antineoplastic Agents, Autonomic Nervous System Regulation of Glucagon Secretion, Iron Metabolism, Hypothalamic Regulation of Metabolic Substrates, Blood Cell Kinetics and Platelet Immunization, Neuro-ophthalmology of the Primate Visual System, Aging and Joint Function, Auditory Physiology, Structural and Functional Analyses of Primate Hemoglobins, Arterial Smooth Muscle Cell in Atherosclerosis, Population Density, Oral-Facial Growth and Development in Primates, Cerebral Microcirculation, Primate Vocalization, Metabolism of High Density Lipoproteins, Feeding and Behavior, Experimental Allergic Encephalomyelitis, Methylmercury Teratogenesis.

Facilities and Service Divisions

Some of the special facilities of the Center include an isolated virus area for research with contagious or dangerous microorganisms; a semi-enclosed roof area with large observation compounds for group behavior research; a series of computers for experimental control, data gathering, and data manipulation; and an electron microscopy laboratory. Research laboratories are flexible, that is, large rooms are subdivided by placement of equipment rather than by walls, thus making maximum use of floor space. Many of the animal cage care functions have been automated, including automatic waste flushing systems under cages and automatic watering systems, thereby reducing handling and increasing sanitary living conditions.

The Primate Center also has several service divisions to provide support for investigators, allowing them more freedom to concentrate on their principle objective of research. The Administrative Division includes the Center Director, Orville A. Smith, the Administrative Services Manager, Charles F. Bach, and other staff personnel concerned with secretarial, administrative, financial, and editorial support. The Instrumentation Development Division, headed by Francis A. Spelman, Engineer, fabricates, designs, modifies, and maintains the routine and specialized equipment needed for primate care and research. The Primate Colony Division, headed by Lloyd A. Dillingham, D.V.M., and the Primate Field Station, supervised by Gerald A. Blakley, D.V.M. and William R. Morton, V.M.D., provide for the supply, care, and health of the primates and assist in research coordination.

The Primate Information Center (PIC), managed by Maryeva W. Terry, supplies bibliographic information relevant to research on nonhuman primates. Recent articles with any reference to primates are listed with author's addresses in the weekly PIC publication, *Current Primate References*. The PIC also provides several other kinds of literature surveys, including retrospective bibliographies on a given topic, recurrent bibliographies as supplements when additional relevant citations are indexed, and tabulations of normal values obtained in common clinical laboratory tests, with some determinations of biochemical and physiological parameters. All of these services are available on request to the international scien-

tific community.

Through these and other mechanisms, maximum use is made of primates, laboratory space, facilities, and support personnel. Several more general programs also offer support to investigators. One is the Tissue Distribution Program, supervised by Glenn H. Knitter. When primates are sacrificed for research projects, tissues important for research are taken by the principal investigator and all remaining tissues are retrieved for the Tissue Program. Fresh, frozen, and fixed tissues and cadavers are available upon request to investigators throughout the world. Requests that cannot be satisfied immediately are kept on file and filled when appropriate material becomes available.

Another program involves short term, small scale pilot projects. This program was initiated to allow investigators to determine whether primates would be desirable experimental subjects for their particular research. If they can try their approach on several animals, problems can be solved, modifications can be applied, and the decision to use or not to use primates can be substantiated. Another purpose for pilot projects is to allow an investigator to gather initial data to determine feasibility of a new program and to support a grant application.

A third program, the Visiting Scientists Program, provides facilities, supplies, and primates to investigators who come to work with Core Staff members or other Center staff. Although they cannot be supported with salaries, they are able to work in the Center for varying lengths of time to accomplish specific research goals. Hopefully, this program can be expanded in the future to allow more use of the large permanent Field Station colony.

Primate Resources

Colonies and Breeding

The census of primates maintained in the Seattle Center averages about 400 animals and in the Primate Field Station, about 900 animals. The species used routinely for research include *Macaca nemestrina*, *M. mulatta*, *M. fascicularis*, *Simiri sciureus*, and *Papio cynocephalus*. Primates are transported between the two facility locations by commercial airline. All primates except *M. nemestrina* are purchased from commercial importers. The *M. nemestrina* and some *M. fascicularis* are imported directly from Malaysia and Indonesia.

Although the Primate Center is not yet self-sufficient in production of research animals, the Primate Field Station does provide critical types of primates: timed-conception fetuses, age-known infants, and infants of known pedigreed and environmental background. Breeding is done in the harem room situation with one male and 6-8 females per room. Several large rooms are used for breeding multiple males and females. Cages are used for timed-conception breeding. *M. nemestrina* is the primary breeding species,

with a present census of 530 adult animals. Smaller colonies of *M. fascicularis* and *P. cynocephalus* are also used for infant production. Whenever possible, monkeys are multiply used, either simultaneously or sequentially. Adult animals housed at the Field Station as breeding stock are used for nontraumatic studies.

Kutai Research Station

The Primate Center is currently organizing a research station on the east coast of Kalimantan, Indonesian Borneo. The Indonesian government has donated land on the Sengatta River in the Kutai Reserve, and has financed the building of one pre-fabricated living unit. The University of Washington School of Medicine financed a second living unit and other permanent equipment. Although the present facilities are only a start for what would be anticipated as a complete biological research station, they are now in use and will continue to be used by field workers as a base camp. The purpose of the Kutai Research Station is to make available to the scientific community one of the largest selections and varieties of the world's biology. Several other objectives are important. First, detailed information on the behavior and habitat of native animal populations, particularly primates, would facilitate the development of scientifically based conservation programs. Second, the research station would involve Indonesian scientists and would provide an educational facility to train students.

Goals

The interest in the Kutai Research Station as well as all of the other activities within the Primate Center are focused on the goals of the Primate Centers Program: to pursue basic and biomedical research of nonhuman primates directed toward the solution of human health and social problems; to develop a resource of scientists, methods, equipment, and training for primate studies; to develop improved breeding, housing, health, and management techniques in order to supply pedigreed, healthy primates for research and to preserve species in danger of extinction; and to report findings of studies to primate users and others throughout the world.

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CAGES FOR SALE OR TRADE

We have six primate cages for sale or trade, as appropriate. Purchased from Labco Division of Partsco Inc. in 1967, they are described as follows: One 2-section 34 × 78 × 32 inch cage with squeeze device and five 2-section 34 × 78 × 32 inch cages without squeeze devices. These six cages were purchased originally at \$785 each and \$685 each, respectively. Contact: Roger L. Halley, Department of Psychology, Olds Hall, Michigan State University, East Lansing, Michigan 48823.

TARSIUS BANCANUS (HORSFIELDS TARSIER) PREYING ON SNAKES

Carsten Niemitz

Justus-Liebig-Universitaet, Giessen, W-Germany

In the course of a field study in Sarawak, we collected data on the general biology, ecology, biometry and, especially, behavior of *Tarsius bancanus*. This field work, which lasted 16 months, was done by the author under the supervision of Dr. H. Sprankel (Professor of Medical Pathology at Giessen University). It was a joint project of this University and the Sarawak Museum, Kuching, East Malaysia (Niemitz, 1973).

It is known that both *T. syrichta* and *T. bancanus* eat reptiles (Harrisson, 1963; Grand & Lorenz, 1968). Although *Cebus* (Kortland & Kooij, 1963) and *Callimico* (Lorenz, 1971) are known to prey on snakes, this fact has not yet been recorded for any prosimian.

During nightly observations of the tarsiers, using an infra-red viewing instrument, we saw an adult male catching a small snake. It caught its prey inside the jungle on a moonless night that seemed completely dark to the naked eye. The tarsier was perching on a small tree about 40 cm above the ground. It jumped onto the snake and, without hesitating, grasped it with at least one hand, while biting it several times in a fast sequence behind its head. We could not observe the movement of the other hand, but what we were able to observe indicated that the pattern of movements in catching snakes is the same as when these animals catch lizards. They grasp a lizard with one hand and steady it with the other. However, if the prey is too big, they also use the second hand for grasping, which is probably what the animal did in the present case. As the snake started curling up, the tarsier wrestled with it on the ground for more than 15 seconds. Then it jumped to a small tree, carrying the snake in its mouth and started eating the reptile, which was still moving vigorously, holding it with the left hand.

From the few flashlight photographs which were taken on this occasion, it can be seen that the snake (*Maticora intestinalis*?) was about 30 cm long and roughly 1 cm in diameter. The fact that the tarsier observed had already eaten rather much prey during two hours prior to this catch indicates that snakes of that size are a suitable prey for this species. This seems to me to be of some ecological importance. In 20 min the tarsier ate about 2/3 of the snake but then dropped the remainder, which we later recovered and preserved. In this connection, it must also be stated that no tarsier we observed ever caught a frog, while other primates are known to do so (Lorenz, 1971). One tarsier when fed a frog among other things it ate eagerly, suddenly shook its head and shoulders in the typical gesture of disgust common to many mammals including man.

This first record of a prosimian preying on snakes contributes a new aspect to the complex of primate-snake relationship. The spectrum of diet of *Tarsius bancanus* in the wild will be described in a more comprehensive paper about the field study mentioned above.

References

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- Kortlandt, A. & Kooij, M. Protohominid behaviour in primates. *Zoological Society of London, Symposium*, 1963, 10, 61-88.
- Lorenz, R. Goeldi's Monkey *Callimico goeldii* Thomas 1904 preying on snakes. *Folia primatologica*, 1971, 15, 133-142.
- Niemitz, C. Puzzle about *Tarsius*. *Sarawak Museum Journal*, in press.

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ISRAEL PRIMATE SOCIETY FOUNDED

The Israel Primatological Society was founded last June at a meeting held in the Wix Auditorium of the Weizmann Institute of Science. Attending were over 40 participants, among them anthropologists, psychologists, scientists working with nonhuman primates, zoo directors and veterinarians and zootechnicians from all the major research institutes of the country. The association has a membership of 70 including two foreign members. It was established to promote and further research with nonhuman primates and to create a center of factual information, such as location of apes and monkeys in the country and their use in various types of research.

The desirability of setting up a national primate center was discussed in view of the pending study by the Israel National Council for Research and Development on the economic viability of such a center.

A six-member governing board was elected with Prof. D. Samuel as chairman and E. Benhar as secretary, both of the Weizmann Institute of Science, Rehovot. Other members of the board are: Dr. M. Abeles of Hadassah Medical School, Jerusalem; Dr. M. Avram, Director of the Tel-Aviv Zoo; Dr. Tikva S. Natan of the Rambam Hospital, Haifa and Mr. Joel Amiran of the National Council for Research and Development.

TIGONI PRIMATE RESEARCH CENTRE: FINANCIAL SUPPORT URGENTLY NEEDED

Thelma E. Rowell

University of California, Berkeley

The Tigoni Primate Research Centre is located in Limuru, Kenya and is under the direction of Dr. S. Richards (P.O. Box 114, Limuru, Kenya). Limuru is about half an hour's drive from Nairobi, where there are all the facilities one expects in a major city. It is just south of the Equator, so that the major seasonal changes are the two annual wet seasons; day length changes very little. Since it is high, the climate is generally cool, though warm enough for monkeys to live outdoors without extra heat throughout the year.

Tigoni has been in operation for about 12 years. Breeding and other records exist for the whole period. There have been few additions to the stock since the first few years, so that a high proportion of the current breedingstock is itself home reared. There are currently about 150 animals, including breeding groups of the following species: *Colobus abyssinicus*, *Cercopithecus neglectus*, *C. mitis albogularis*, *C. mitis stuhlmanni*, *C. aethiops*, *C. ascanius*, *C. mona*, *Erythrocebus patas*, *Cercocebus albigena*, and *C. torquatus*. Of these, the vervet is one of the most numerous and successful in the colony, and is the best known of the available species. The Centre should be able to supply high quality known history animals of this species on a commercial basis to other research institutions. To the best of my knowledge Tigoni is the only place in the world where species other than the vervet are available for research in any numbers. These groups of African monkeys have so far been studied very little but present some fascinating problems. My own research, for example, is concentrating on some interesting variations in reproductive physiology and behavior which are not paralleled in the better known macaques.

The animals are housed in large (about 8 x 16 feet) outdoor cages constructed of timber and weldmesh with concrete floors. The cages are arranged in banks and can be joined to make larger housing units as required. There is also a large shed which can be heated and provides some 15 or 20 indoor-outdoor cage units. Altogether, there are 50 or 60 large cages where the animals live in breeding groups.

Currently, operation of the Centre costs about \$1000 a month (excluding only the Director's salary). This works out at 3¢ per monkey per day. The general health of the animals is good, though a better diet would be needed if the breeding program were increased. I estimate that 10¢ or even 15¢ per monkey per day would be needed to provide a better diet and some

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routine maintenance work.

In addition to animal housing, the Centre includes a director's house with a large office area, also another guest house and a guest apartment, and housing for some of the maintenance staff. There are storage buildings for food, equipment, etc., a Landrover and a garage for it, and a small laboratory currently equipped for simple histology.

Only a small part of the Centre's land is currently being used; some food for the animals is grown on part of the remainder. The land is owned by the National Museum of Kenya. The Museum is a separate institution from the University of Nairobi, but closely associated with it.

While in Nairobi recently I discussed Tigoni with the Vice Chancellor of the University and the Heads of the Departments of Anatomy and Zoology, with the Director of the Museum and with influential museum Trustees. All these people expressed keen interest in the Centre and are anxious to see it become the viable research institution which it obviously could be. The new director has already been given an adjunct position in the Department of Zoology, and the relevant departments would like to cooperate in research and exchange facilities with the Centre.

Tigoni is in a desperate financial situation. A few more months running costs are available, partly from a personal loan to Dr. Richard Leakey, the Director of the National Museum. After that the Centre will have to close unless new support can be found.

Those of us who work with primates have repeatedly expressed the need for institutions where tropical monkeys could be studied in a semi-natural environment. We are also unanimous in stating that research monkeys should be bred specifically for research, and that this is very expensive in Europe or the USA. Repeated attempts have been made to found primate centers in Africa, all of which have failed because of the large initial capital cost which funding agencies have not been willing to accept.

In Tigoni, we have a unique opportunity. It is in a healthy place; disease risk is minimal; Kenya is the most sophisticated and stable of the tropical countries and the Centre has enthusiastic local support. Above all, Tigoni is already in existence, with physical plant and well established breeding monkeys, so the frightening initial capital outlay is not a problem. One can go and start work there next week. The upkeep of animals there costs a fraction of what can be achieved in temperate countries, and this differential will remain. If Tigoni were regarded only as a monkey farm, animals could be bred and shipped to research institutions in temperate zones at less cost than they could be produced at these institutions.

The objection might be raised that Tigoni's species are not those

generally used in primate research. (The vervet, it should be noted, was being increasingly used until the Marburg virus scare; it clearly was recognized as having research potential.) I think this is short sighted. In the vast majority of projects, primates are being used essentially as a substitute for human beings. It is possible, but unlikely, that in the rhesus monkey we have the perfect research model for the human system. In fact, a few other species are already regarded as preferable subjects for some types of research, and it seems probable that other monkeys will offer new insights as soon as the management problems have been worked out.

I am preparing my own research proposal for work on physiological and behavioral changes associated with equatorial breeding seasons, which can only be done at Tigoni--if it survives.

Tigoni has been used as a base for field studies of monkeys also. This seems to me an important aspect of its potential which should continue.

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RESEARCH POSSIBLE AT PLANNED *SAGUINUS MYSTAX* BREEDING ISLAND

Information received at the end of July indicates that Mr. Mike Tsalickis plans to start a new *Saguinus mystax* breeding island in Columbia, South America. Mr. Tsalickis has experimented for some years with stocking the island of Santa Sofia near Leticia, Columbia with *Saimiri* for propagation, and now plans to buy another island, upriver from Santa Sofia, to start a new "ranch" for *Saguinus mystax*. Mr. Tsalickis is willing to have a primatologist or institution involved in this project from its beginning, provided that no costs arise to him from this association. Anyone interested would have to build accommodation on the island and provide his own support funds.

Mr. Tsalickis plans on capturing monkeys for release on the island, which has no monkey population, within approximately two months, but is prepared to delay if someone shows serious interest. The advantages in having a primatologist involved in the choice, capture, marking, release and continuous study of the animals involved are obvious. Enquiries should be sent to Robert C. Bailey or Mike Tsalickis, Leticia, Amazonas, Columbia, South America.--Note supplied by: Barbara Harrison, Dept. of Anthropology, Cornell University, Ithaca, N.Y. 14850.

NEWBORN NONHUMAN PRIMATES FOR SALE

Laboratory-bred infant or fetal rhesus (*Macaca mulatta*), cynomolgus (*M. fascicularis*), and African green (*Cercopithecus aethiops*) monkeys of known gestational age will be available after January 1974 for abortifacient, teratologic, intra-uterine, or neonatal studies. Contact: Litton Bionetics, Inc., Department of Laboratory Animal Science, 5510 Nicholson Lane, Kensington, Maryland 20795. Telephone (301) 881-5600.

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CHIMPANZEES AVAILABLE

Up to twelve juvenile and adult male chimpanzees (*Pan* species) are available immediately for breeding or chronic non-terminal research use. Contact: Dr. Roy Kinard, National Institutes of Health, Building 37, Room 1B26A, Bethesda, Maryland 20014. Telephone (301) 496-6135.

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ANTERIOR PITUITARIES FROM *MACACA MULATTA* WANTED

We need many anterior pituitaries from rhesus monkeys of either sex for preparation of reagents for hormone assays. In U. S. contact: Dr. Fred J. Karsch, Reproductive Endocrinology Program, Department of Pathology, University of Michigan, School of Medicine, Ann Arbor, Michigan 48104. In Canada contact: Dr. Richard F. Weick, Department of Physiology, University of Western Ontario, London, Ontario N6A 3K7.

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BLOOD FROM *ATELES* AND *BRACHYTELES* WANTED

Blood from both male and female monkeys is needed. Two ml from each animal collected into heparanized tubes by sterile technique. Tubes should be clearly labelled as to species, sex, and individual. Shipping costs will be paid if necessary. Contact: Mr. David V. Hughey, Dept. of Anthropology, University of Pittsburgh, 234 Atwood St., Pittsburgh, Pa. 15260. Telephone: (412) 624-4092.

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

Books

Primate locomotion: Some links with evolution and morphology. (*Primatologia*, Vol. 4, No. 11) J. T. Stern, Jr. & C. E. Oxnard. Basel: Karger, 1973. [Price: \$23.60]

Contents: I. Introduction. II. Locomotor Classifications. III. Vertical Clinging and Leaping. IV. The Limbs in Tension. V. Other Patterns of Movement.

Medical primatology 1972. Part I: General primatology, reproduction and perinatal studies, genetics, phylogenetics and evolution. E. I. Goldsmith & J. Moor-Jankowski (Eds.). Basel: Karger, 1972. [Price: \$43.40]

A volume of selected papers from the 3rd Conference on Experimental Medicine and Surgery in Primates, held in Lyon, France, June, 1972. The many papers are arranged in the following sections: 1. General Primatology: Husbandry, Management, Breeding, Choice of Species, Conservation. Communication Media in Medical Primatology. 2. Reproduction and Perinatal studies. 3. Genetics, Phylogenetics and Evolution.

Medical primatology 1972. Part II: Experimental surgery, transplantation immunology, oral medicine, and neurophysiology and experimental psychology. E. I. Goldsmith & J. Moor-Jankowski (Eds.). Basel: Karger, 1972. [Price: \$37.20]

A volume of selected papers from the 3rd Conference on Experimental Medicine and Surgery in Primates, held in Lyon, France, June, 1972. The papers in this volume are arranged in sections with the same headings as given in the title of the volume.

Medical primatology 1972. Part III: Infectious diseases, viral oncology, pharmacology and toxicology, and cardiovascular studies. E. I. Goldsmith & J. Moor-Jankowski (Eds.). Basel: Karger, 1972. [Price: \$43.40]

A volume of selected papers from the 3rd Conference on Experimental Medicine and Surgery in Primates, held in Lyon, France, June, 1972. The papers in this volume are arranged in sections with the same headings as given in the title of the volume.

* *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.

Gibbon and Siamang. Vol. 2. Anatomy, Dentition, Taxonomy, Molecular Evolution, and Behavior. D. M. Rumbaugh (Ed.) Basel: Karger, 1973. [Price: \$41.85]

Contents: A. H. Schultz, The skeleton of the hylobatidae and other observations on their morphology; J. E. Frisch, The hylobatid dentition; E. Donisch, A comparative study of the back muscles of gibbon and man; E. Simons & J. Fleagle, The history of extinct gibbon-like primates; Linda L. Darga, M. Goodman & M. L. Weiss, Molecular evidence on the cladistic relationships of the hylobatidae; J. Biegert, Dermatoglyphics in gibbon and siamangs; C. E. Parker, Manipulatory behavior and responsiveness; R. L. Gossette, Comparative analysis of serial discrimination reversal performances of the gibbon, *hylobates lar*; R. C. Arnold, Births of gibbons in captivity.

An atlas of primate gross anatomy: Baboon, chimpanzee, and man. D. R. Swindler & C. D. Wood. Seattle: University of Washington Press, 1973. [Price: \$30.]

The atlas, which includes 149 plates, is arranged in the following sections: Osteology, Head and Neck, Superior Member, Back, Thorax, Abdomen, Pelvis, Inferior Member, Muscle-Bone Maps, and Muscle Charts: Origin, Insertion, Innervation.

Reports

Nonhuman primates. Standards and guidelines for the breeding, care, and management of laboratory animals. (2nd ed.--Rev.) Washington, D. C.: National Academy of Sciences, 1973.

This is a report of the Subcommittee on Revision of Nonhuman Primate Standards, Committee on Standards, Institute of Laboratory Animal Resources, National Research Council. The report is available from Printing and Publishing Office, National Academy of Sciences, 2101 Constitution Ave., N. W., Washington, D. C. 20418. Contents: Conservation of rare and endangered species of primates; Taxonomy and abbreviated profiles of the order primates; Facilities; Cages and equipment; Quarantine and laboratory conditioning procedures; Preventive medicine and diseases; Standard procedures for detection of tuberculosis; Personnel: Health and management; Husbandry; Breeding systems; Artificial rearing; General management.

Bibliographies

Aeromedical review: Selected topics in laboratory animal medicine. Vol. XVI. The Chimpanzee. Butler, Thomas M. Brooks Air Force Base, Texas: USAF School of Aerospace Medicine, April, 1973. (Review 1-73)

This is one of a series of Aeromedical Reviews entitled "Selected Topics in Laboratory Animal Medicine". These publications contain information on the care and use of animals in biomedical research; they are intended for veterinary educators, managers of animal

colonies, and individuals who use animals in scientific investigations. The information in these reviews was initially presented as lectures and handouts for residents in laboratory animal medicine and veterinary surgery and in the annual symposia on Current Trends in Laboratory Animal Medicine. The authors are veterinarians who are specialists in the respective fields of laboratory animal medicine, pathology, toxicology, and surgery. This work was directed and coordinated by the staff of the Veterinary Education Branch, Education Division, USAF School of Aerospace Medicine, Brooks Air Force Base, Texas 78235.

Disease

Comparison of old tuberculin and purified protein derivative in *Macaca mulatta*. Smith, A. W. & Wolochow, H. (Naval Biomed. Res. Lab., Sch. Pub. Hlth., U. Calif., Berkeley, Calif. 94625) *Laboratory Animal Science*, 1973, 23, 373-376.

One group of monkeys (*Macaca mulatta*) was vaccinated intravenously with viable Bacille Calmette-Guerin and another group received, intravenously, cell wall suspension prepared from *Mycobacterium bovis* strain *Bovinus I*. Each group was subsequently tested with 25 mg of Old Tuberculin and 250 tuberculin units of purified protein derivative, intrapalpebrally, at 21 and 42 days post inoculation. This comparison showed Old Tuberculin to be more reliable in detecting tuberculin hypersensitivity than did purified protein derivative.

Pathogenic properties of *Molineus torulosus* in capuchin monkeys, *Cebus apella*. Brack, M., Myers, B. J. & Kuntz, R. E. (Div. Microbiol. & Inf. Dis., Southwest Found. Res. & Ed., San Antonio, Tex. 78284) *Laboratory Animal Science*, 1973, 23, 360-365.

The lesions of natural infections of *Molineus torulosus* in capuchin monkeys (*Cebus apella*) were described. These nematodes induced thrombophlebitis, chronic pancreatitis, and granulomas in the submucosa of the duodenum and jejunum.

Glomerular lesions in 'Normal' and *Schistosoma mansoni*-infected baboons (*Papio cynocephalus*). Brack, M., McPhaul, J. J., Jr., Damian, R. T. & Kalter, S. S. (Div. Microbiol. & Inf. Dis., Southwest Found. Res. & Ed., San Antonio, Tex. 78284) *Journal of Medical Primatology*, 1972, 1, 363-373.

Histopathological and immunohistochemical studies of the kidneys of 18 'normal' captive baboons (*Papio cynocephalus*) revealed that, with increasing age, spontaneously occurring glomerular lesions tended to increase. They ranged from focal thickenings of the basement membrane or the mesangium matrix to more advanced lesions. In older animals, focal chronic glomerulitis was observed. Focal immunofluorescence was seen only in the minor histopathological lesions. The kidneys of nine baboons infected with *Schistosoma mansoni* did not differ from those of the 'normal' baboons. No significant immunoglobulin deposits could be demonstrated in the renal tissues from

the infected animals.

Bordetella bronchiseptica in monkeys: agglutinin survey and isolation from asymptomatic individuals. Graves, I. L. & Shah, K. V. (Johns Hopkins U., Baltimore, Md. 21205) *Journal of Medical Primatology*, 1972, 1, 344-353.

30% of the rhesus monkeys caged in a mainland laboratory colony in Puerto Rico had serum agglutinins for *Bordetella bronchiseptica*. In contrast, only 12% of the free-ranging rhesus on the offshore island of Cayo Santiago and none of the free-living rhesus from Northern India had agglutinins. In addition, no agglutinins were found in sera from free-living long-tailed macaques and silver leaf monkeys in Malaysia. In the Puerto Rican laboratory colony, the frequency of the agglutinins was directly related to the age of the monkeys. Two of 14 seronegative monkeys that were removed from Cayo Santiago and placed in the laboratory colony developed agglutinins 15 and 85 days after joining the colony. The organism was cultured from the nasopharynx of two healthy cynomolgus monkeys housed at the University of Michigan. *B. bronchiseptica* agglutinins were found in six species of monkeys.

Aerobic bacterial flora of chimpanzees - a four-year study. Boncyk, L. H. & Kalter, S. S. (Div. Microbiol. & Inf. Dis., Southwest Found. Res. & Ed., San Antonio, Tex. 78284) *Journal of Medical Primatology*, 1972, 1, 333-343.

The aerobic bacterial flora of a chimpanzee colony maintained in captivity has been followed over a 4-year period. In many respects, this flora is similar to that of man. *E. coli* is the most commonly isolated bacteria from the intestinal tract. Alpha streptococci predominate in the mouth. Both *Shigella* and *Salmonella* were recovered in routine samplings and did not appear to be (with one exception) associated with sick animals. Enteropathogenic *E. coli* group B appears to be involved in illness - 56% of the isolates were from sick animals. The value of obtaining bacteriology specimens from the oral cavity or vagina of these animals, sick or healthy, is questioned.

Spontaneous lesions seen at necropsy in 7 owl monkeys (*Aotus trivirgatus*). Chapman, W. L., Jr., Crowell, W. A. & Isaac, W. (Dept. Med. & Surg., Col. Vet. Med., U. Ga., Athens, Ga. 30601) *Laboratory Animal Science*, 1973, 23, 434-442.

End-stage kidneys were diagnosed histopathologically in 7 laboratory-maintained owl monkeys. Other major pathologic findings included gallstones (2 cases), giant cell pneumonia (2 cases), and a dissecting aneurysm of the aorta (1 case).

Lead poisoning in zoo-dwelling primates. Zook, B. C., Sauer, R. M., Bush, M. & Gray, C. W. (Dept. Path., Sch. Med., Geo. Wash. U., Wash., D. C. 20006) *American Journal of Physical Anthropology*, 1973, 38, 415-424.

Lead intoxication was diagnosed in 42 primates at the National Zoological Park. Diagnoses were made clinically by the observation of signs of encephalopathy and the finding of 200 µg lead or more/100 ml blood, or postmortem by the presence of renal acid-fast intranuclear inclusion bodies and excess lead in liver specimens. 25 of the primates had signs or lesions of lead encephalopathy.

Lead poisoning was most common in the Cercopithecidae, and in the summer months. Lead encephalopathy was most frequent in juveniles. Leaded paint on the monkey cages was determined to be the source of poisoning. Blood studies revealed slight hypochromic anemia and immature and stippled erythrocytes. Post-mortem lesions included acid-fast intranuclear inclusions in renal tubular and other epithelial cells; metaphyseal bone changes (lead lines); necrosis of striated muscle fibers; and other lesions. Treatment of one monkey for encephalopathy was attempted and proved successful.

Monkeypox virus. Cho, C. T. & Wenner, H. A. (Dept. Ped., U. Kansas Med. Ctr., Kansas City, Kansas 66103) *Bacteriological Reviews*, 1973, 37, 1-18.

MPV was isolated in 1958 during outbreaks of a pox disease in laboratory colonies of cynomolgus monkeys in Copenhagen. Since then, several outbreaks have occurred in different species of nonhuman primates housed in laboratories in various parts of the world. Naturally occurring infections among monkeys in their native habitat is unknown; however, the appearance of infection by MPV in children residing in West Africa suggests that wild monkeys (or related species) are the likely harborers of MPV.

Studies on the biological properties of MPV indicate that it is closely related to the vaccinia-variola subgroup of poxviruses. Clinically, monkeypox as found in monkeys and in human beings cannot be differentiated from variola.

Serological surveys to determine the frequency of specific antibody to poxviruses in different monkey populations show wide ranges between species; on the average, less than 12% of monkeys originating from different parts of the world contain HI antibody. Whether acquisition of infection was in their native habitat, or followed captivity, remains unknown. Epidemiological surveillances suggest that a natural reservoir of smallpox in nonhuman primates is unlikely; however, further observations are needed, particularly with respect to monkey populations with high infection rates based on existent HI antibodies.

MPV is pathogenic to man; hence, protection of human beings against monkeypox by vaccination with vaccinia virus is mandatory among those who handle monkeys or tissue cultures of primate species.

Unquivocal answers cannot be given to questions asked in the introductory section, concerning the epizootiology of monkeypox.

A checklist of parasites and commensals reported for the chimpanzee (*Pan*). Myers, B. J. & Kuntz, R. E. (Southwest Found. Res. & Ed., San Antonio, Tex. 78284) *Primates*, 1972, 13, 433-471.

Physiology and Behavior

Visual-optical characteristics of caged and semifree-ranging monkeys. Young, F. A. & Leary, G. A. (Pri. Res. Ctr., Wash. State U., Pullman, Wash. 99163) *American Journal of Physical Anthropology*, 1973, 38, 377-382.

Five species of macaques and one species of mangabey comprising a total of 324 monkeys (132 males and 192 females) were given visual examinations which included measures of corneal curvature, depth of the anterior chamber, thickness of the lens, depth of the vitreous chamber, total axial length, total power of the eye and intraocular pressure as well as the refractive error of eye under cycloplegia in the anesthetized monkey.

Cercocebus and *Macaca mulatta* demonstrated the greatest amount of myopia and *Macaca fascicularis* the least, with *M. speciosa*, *M. fuscata*, and *M. nemestrina* in order between these extremes. The *M. nemestrina* eye approximates that of the chimpanzee in size and relationship of the components. The findings indicate that males have larger eyes than females, the curvature of the cornea decreases as the axial length increases, and there is a close relationship between the length of the eye and the amount of myopic refractive error. There is some evidence that amount of myopia and the percentage of animals showing a myopic refractive error are related to the visual conditions and the behavior patterns of the different species.

Amino acid levels in the plasma of fasting macaques (*Macaca cyclopis*, *M. fascicularis*, and *M. mulatta*). Chao, W. R., Berridge, B. J., Jr. & Peters, J. H. (Life Sciences Div., Stanford Res. Inst., Menlo Park, Calif. 94025) *Laboratory Animal Science*, 1973, 23, 380-384.

Levels of proteins, 26 amino acids and related compounds, and L-asparaginase activity in plasma of 12 normal, adult, fasting monkeys of each of 3 species of macaques (*Macaca mulatta*, *M. cyclopis*, and *M. fascicularis*) were determined. Differences in the levels of proteins or amino acids were rare between the sexes of these species. However, quantitative differences were frequent among the 3 species in the levels of amino acids and related compounds. All exhibited easily measurable levels of 3-methylhistidine, an amino acid undetectable in plasma from fasting man; higher levels of arginine, aspartic and glutamic acids, glycine, histidine, and taurine; and lower levels of threonine and valine than those found in human plasma previously. No L-asparaginase activity was detectable in the plasma of these simians--a result identical to earlier findings in man.

Facilities and Care

The problem of age estimation: a study using rhesus monkeys (*Macaca mulatta*). Gavan, J. A. & Hutchinson, T. C. (Dept. Anthropol., U. Missouri, Columbia, Mo. 65201) *American Journal of Physical Anthropology*, 1973, 38, 69-82.

Accurate estimation of chronological age for animals of unknown birth date is important in a variety of circumstances. This is particularly true for nonhuman primates and especially true for rhesus monkeys. Data, useful for this purpose, have been organized in a variety of ways. The purpose of this paper is to duplicate some of these methods and to check their accuracy.

In general, three methods of organizing data were used. The parameters for each method were estimated from one group of rhesus monkeys. Accuracy of age estimation was determined from a closely related, second group which had been raised under approximately the same conditions and from a third group of unrelated monkeys raised under different conditions.

Some methods provided better estimations than others, but none was absolutely accurate. The analyses indicate that the degree of inaccuracy of a method should be determined on a sample which is independent of the one from which the parameters were estimated.

Varying infant rhesus social housing. Chamove, A. S. (Psychol. Dept., Stirling U., Stirling, Scotland) *Journal of the Institute of Animal Technicians*, 1973, 24, 5-15.

A socially adequate rhesus monkey can be produced from housing with relatively restricted social opportunity. Social experience with more than one other peer, or age-mate, from around the age of 3 months either (a) housed continuously in a group, (b) housed continuously in pairs which change weekly, (c) given 30 minutes of social experience/day in a group, or (d) given a few hours of social experience in changing pairs in a rather small cage results in animals having a level of social facility desirable in subsequently individual- or group-housed macaques.

Papio cynocephalus age determination. Reed, O. M. (Southwest Found. Res. & Ed., San Antonio, Tex. 78284) *American Journal of Physical Anthropology*, 1973, 38, 309-314.

The age of non-domesticated primates has always been a question to the scientific investigator. This question was magnified in the early 1960's when primate research hit a new peak. Age development standards became necessary to conduct many projects demanding developmental information. This project utilized known aged *Papio cynocephalus* baboons. Skull, muzzle, long bone and tooth development measurements were taken on a linear growth program for five years. These data, when programmed for the computer, gave a reliable regression curve age predictability of one month up to 40 months and a three month age predictability up to 72 months for *P. cynocephalus*. Data taken from known-aged animals not in the survey proved the reliability of the project.

Breeding

Sexual behavior of male pigtail macaques in the laboratory. Nadler, R. D. & Rosenblum, L. A. (Yerkes Reg. Pri. Res. Ctr., Emory U., Atlanta, Ga. 30322) In W. Riss (Ed.) *Brain, Behavior and Evolution*. Basel: Karger, 1973, Pp. 18-33.

The sexual behavior of 4 adult male pigtail macaques was recorded during two tests with each of 2 estrogen-primed females. The behavior of the males was highly consistent across tests and females but, quantitatively, varied significantly from male to male. The pigtailed males were multiple mount ejaculators that achieved one to three ejaculations in 1 h. A median number of eight intromissive mounts, separated by intermount intervals of 1.6 min, preceded first ejaculations. Median ejaculatory latency was 18.5 min, while the postejaculatory interval was 33 min. Each male had a characteristic number of thrusts and rate of thrusting per mount. The group medians were 12 thrusts per mount and 2.3 thrusts per sec, respectively. The multiple mount pattern of the male pigtailed macaques resembles that of the rhesus and Japanese macaques but differs from the single mount pattern of the bonnet and stump-tail macaques.

Breeding the African green monkey, *Cercopithecus aethiops*, in a laboratory environment. Johnson, P. T., Valerio, D. A. & Thompson, G. E. (Dept. Lab. Ani. Sci., Litton Bionetics, Inc., 5510 Nicholson Lane, Kensington, Md. 20795) *Laboratory Animal Science*, 1973, 23, 355-359.

A breeding colony of African green monkeys (*Cercopithecus aethiops*) was established in our laboratory in 1967 to provide newborn animals for long-term carcinogenic studies. Menstrual cycles were monitored by taking daily vaginal swabs. For menstrual flows too scant to observe grossly, an occult blood test was employed. The mean length of menses was 3.7 days; the mean menstrual cycle length was 30.9 days. 19% of the menstrual cycles were classified as amenorrheic. The mean initiation of menses following live births was 56.9 days. The conception rate after colony acclimatization averaged 19.8%. Pregnancy was determined by intrarectal digital palpation. The mean length of gestation was 163.2 days; the mean birth weight was 321.3 g. The fetal wastage rate was 28%.

Detecting ovulation in *Macaca nemestrina* by correlation of vaginal cytology, body temperature and perineal tumescence with laparoscopy. White, R. J., Blaine, C. R. & Blakley, G. A. (Reg. Pri. Res. Ctr., U. Wash., Seattle, Wash. 98195) *American Journal of Physical Anthropology*, 1973, 38, 189-194.

Vaginal cytology, basal body temperature, and perineal tumescence were correlated with laparoscopic observations during the menstrual cycles of five pigtail monkeys (*Macaca nemestrina*) of known fertility. Percentages of cells obtained in vaginal smears revealed systematic variation in the presence of cell types in relation to the menstrual cycle. Measuring the percentage of exfoliate vaginal epithelial cells containing pyknotic nuclei proved to be of little value for separating

the menstrual cycle into its follicular and luteal phases, nor did body temperature provide an accurate index for the occurrence of ovulation. Perineal tumescence, however, measured from the first day of menses to onset of detumescence, was a reliable indicator of the lengths of the follicular and luteal phases as correlated with laparoscopic confirmation of ovulation. Maximal perineal tumescence usually occurred within 12 hours of ovulation, although on one occasion the two events were separated by 48 hours.

Labor and delivery behavior in rhesus monkeys (*Macaca mulatta*). Brandt, E. M. & Mitchell, G. (Dept. Psychol., Dept. Beh. Biol., & Calif. Pri. Res. Ctr., U. Calif., Davis, Calif. 95616) *American Journal of Physical Anthropology*, 1973, 38, 519-522.

The present report is a description of 14 rhesus macaque (*Macaca mulatta*) births, five of which have been filmed in 16 mm colored silent film. All of the females shown in the film are feral, but descriptions of births in laboratory females are also included in the report. Time of delivery, observational techniques, signs of labor, differences with parity, and behaviors of both mothers and infants are included. A brief description of a few feet of film of a breech birth is also presented. The behaviors of adult males, who were sometimes present during delivery, are described.

The characteristic labor posture is the squat, although some females crouch or lie down. Other birth behaviors are reaching back, licking, and stretching. Primiparous mothers generally have longer and more difficult deliveries and often appear to be nervous or clumsy shortly after the birth. The infant's behavior varies with its health; the present report describes the behavior of five infants. The behavior of adult males who witness births is variable, ranging from intense curiosity to aggression.

Ecology and Field Studies

Field research on baboons, drills, and geladas: an historical, geographical, and bibliographical listing. Baldwin, L. A. & Teleki, G. (U. Ga., Atlanta, Ga. 30303) *Primates*, 1972, 13, 427-432.

Preliminary information of the pygmy chimpanzees (*Pan paniscus*) of the Congo Basin. Nishida, T. (U. Tokyo, Hongo, Tokyo, 113 Japan) *Primates*, 1972, 13, 415-425.

Local information was collected on the ecology of pygmy chimpanzees in the Lac Tumba Region, Zaire. Population density very small; habitat: secondary swamp forest with occasional trespass of 'esobe' grassland; locomotion: quadrupedal walking on the ground; diet: primarily frugivorous and vegetarian, but insects, honey and fish are consumed. Many kinds of cultivated plants are also eaten; sleeping nests are built in a tree in the same fashion as ordinary chimpanzees; group size is fairly large, from 15 to 40 head; human persecution is very severe.

Instruments and Techniques

Mini-computer controller for a behavioral primate laboratory.

Barensten, R. I. & Lockard, J. S. (Dept. Neurol. Surg., U. Wash., Seattle, Wash. 98195) *Behavior Research Methods and Instrumentation*, 1973, 5, 111-113.

The design of an interface and the software necessary to use a small laboratory computer to study semi-restrained and semi-roaming experimental epileptic monkeys are described.

A technique for fixation of chronically implanted catheters in unrestrained primates. Flower, R. W. (Applied Physics Lab., The Johns Hopkins U., Silver Spring, Md. 20910) *Journal of Applied Physiology*, 1973, 34, 500-501.

A technique is described for fixation of chronically implanted catheters in the cephalic vessels of unrestrained primates and other larger laboratory animals. Catheter termination is made by rigidly mounting the catheter hub to the skull by slightly modifying the configuration of a Sheatz-type electrode holder. Normal movement of the animal in its cage can be uninhibited, and attempts by the animal to remove the catheter are obviated.

An inexpensive feeder for rapid delivery of monkey pellets. Henton, W. W. & Iversen, I. H. (Dept. Exp. Psychol., U. Oxford, Oxford, England) *Journal of Experimental Analysis of Behavior*, 1973, 19, 529-530.

A pellet feeder that reliably delivers food pellets within approximately 100 msec. can be made with two relays and a length of metal tubing.

Methodology and management of Simian toxicology studies with emphasis on special technics. Thornett, H. D., Martin, D. P., Valerio, D. A. & Hart, E. R. (Biomed. Res. Div., Bionetics Res. Lab., Inc., 7300 Pearl St., Bethesda, Md. 20014) *Laboratory Animal Science*, 1973, 23, 350-354.

This paper reports the management and special technics employed in long-term studies of a group of 250 female rhesus monkeys (*Macaca mulatta*) being observed for chronic drug effects. A description of management, the initial stages of the studies, and the routine care of simians is presented. In addition, several special technics are discussed, including force feeding, collection of cervical and vaginal material for cytological evaluation, and collection of urine for steroid analyses.

A nonsurgical method for restraining the head during behavioral tests in primates. Goldberg, I. A., Kowler, E. & Taub, E. (Inst. for Beh. Res., 2429 Linden Lane, Silver Spring, Md. 20910) *Behavior Research Methods and Instrumentation*, 1973, 5, 309-310.

A head-restraint apparatus, in conjunction with a soft helmet, proved to be an appropriate alternative to surgical restraint. The equipment is easy to construct, requires no special machining, and uses components that are inexpensive and readily available. In addition, the

monkeys adjust to it well. In experiments currently underway, the technique has been employed in over 50 consecutive 1- to 2 1/2-h daily sessions for each of 7 animals. Performance on the experimental task, which requires pointing at visual targets, has not been affected, and food reinforcements are readily accepted.

A method for the construction and use of contact occluders for small animals. Bonnet, K. A. (Stanford Res. Inst., Menlo Park, Calif. 94025) *Physiology and Behavior*, 1973, 10, 623-625.

A method is described for constructing contact lenses for laboratory animals. Occluding, diffusing and clear lenses can be readily produced. Lenses slightly larger than the corneal surface remain in place through experimental handling and are easily retrieved. The method can be used for repeated production of lenses from a single mold.

Conservation

Colobus monkeys and the tourist trade. Mittermeier, R. A. (Museum Comp. Zool., Harvard U., Cambridge, Mass. 02138) *Oryx*, 1973, 12, 113-117.

The colobus monkey is not yet an endangered species but the author fears that it may become one if the trade in colobus skins continues at its present level. He describes a short survey he made in Kenya and Tanzania, where colobus rugs are a popular item in tourist shops; in only two months he either saw or was told about stocks of skins representing over 27,000 colobus monkeys killed. He suggests that full protection should be given now--before the animal has to go in the Red Data Book--with a ban on all trade in colobus skins until populations can be assessed.

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