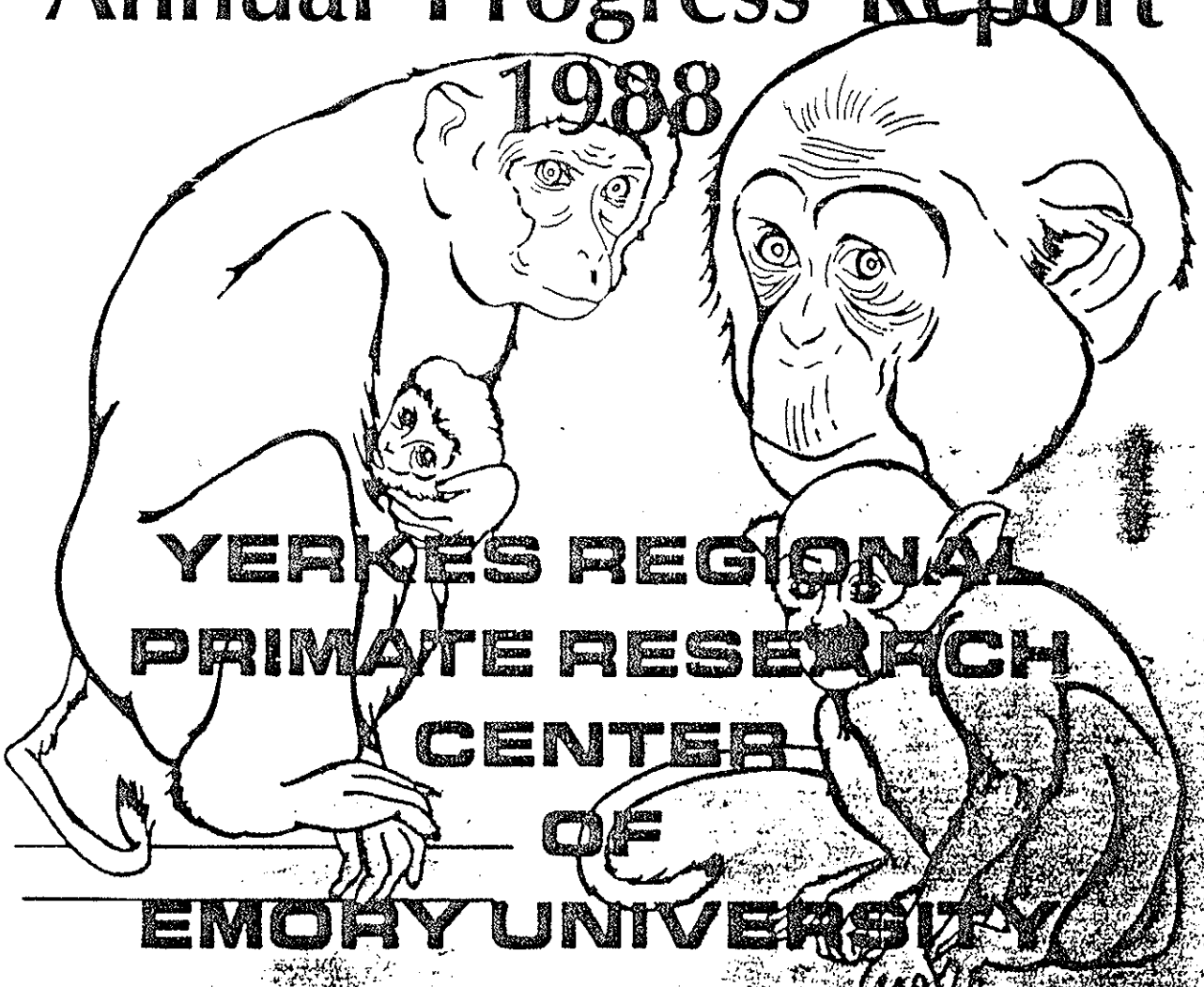
Annual Progress Report 1988



YERKES REGIONAL PRIMATE RESEARCH CENTER OF EMORY UNIVERSITY

January 1, 1988 — December 31, 1988

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Part I: NARRATIVE DESCRIPTION

A. SUMMARY OF ACCOMPLISHMENTS

1) Strengths and Weaknesses of Current Program

Major strengths of the Yerkes Center during 1988 continue to be the expansion of our research programs and increasing interaction with investigators at the host institution as well as other local, regional, and national universities and research institutions; additional improvements and expansion in the physical plant and animal housing facilities; and continued expansion of research programs, particularly those related to the development of nonhuman primate models for the acquired immunodeficiency syndrome.

The continued increase in research programs at the Yerkes Center, particularly with reference to the increased numbers of affiliate and collaborative scientists who conduct their research with nonhuman primates at the Yerkes Center, continues to be one of our major strengths. The number of affiliate and collaborative scientists now numbers 130, as compared to 113 in 1987, 107 in 1986, 96 in 1985 and 84 in 1984. Seven visiting scientists, two from U.S. Institutions, 2 from South American Institutions and 3 from European Institutions, also conducted research at the Center during 1988. In addition, there is increasing utilization of Center resources by undergraduate, graduate, and postdoctoral students from the host institution as well as other regional universities. This function of the Yerkes Center provides a unique and valuable resource for students and research investigators at local and regional universities and research institutions, as well as institutions throughout the nation and in other parts of the world. The Center also has 12 consultants in the four research divisions and the Division of Veterinary Medicine. As a result of these collaborative efforts, active and expanded research programs are currently underway in the areas of vision, development of AIDS animal models, aging, parasitic diseases and reproductive biology. In addition, planning has been completed to facilitate the initiation of a major cardiovascular research program at the Yerkes Center; this program will become active in mid-1989.

Improvements in the physical plant and animal housing facilities were continued in 1988. These improvements have resulted in better animal housing facilities and have strengthened our position as a research institution. Four additional Field Station compounds were renovated and terraced in 1988. Work was also completed at the Field Station on new indoor-outdoor runs for expansion of our rhesus and pig-tailed macaque breeding programs and work was begun on an additional compound that will also be used for expansion of our macaque breeding colonies. Work was also completed in 1988 on the assembly of 10 additional indoor/outdoor chimpanzee cages. This facility was occupied in mid-1988 and will be used to expand and enhance our chimpanzee breeding program. Work was also completed in

1988 on facilities that will be used to expand our monkey housing capabilities. These facilities were occupied in mid-1988 and will be used for general housing of monkeys and to expand housing for animals used in retrovirus studies.

The Yerkes Center remains fully accredited by the American Association for Accreditation of Laboratory Animal Care (AAALAC).

A continued weakness of the Center is our inability, due to fiscal constraints, to adequately expand our physical plant, add additional core faculty and technical positions, and to upgrade and modernize major items of equipment in response to increased national biomedical needs and demands. Due to increased research activities at the Center by core, affiliate, and collaborative scientists, there is a critical need for expansion of the physical plant for both research laboratories and animal housing if we are to continue to provide for increasing research demands in a timely manner. In addition, a failure in an increase in growth of the core grant commensurate with expansion of physical facilities leaves the Center without a sufficient continuing support system for the advances achieved. We estimate that over the past several years core grant support has erroded by approximately 25% in actual 1989 dollars.

2) Changes in Professional Personnel

Drs. Roger Buddington and James Else were added to the Center faculty during 1988. Dr. Buddington joined the faculty as an Administrative Associate and is responsible for providing support to the Center Director's Office with respect to various administrative and organizational matters. Dr. Else joined the Center as a part-time faculty member. Dr. Else will be responsible for development of collaborative overseas research programs and especially the development of collaborative programs between the Yerkes Center/Emory University and the National Museums of Kenya/Institute of Primate Research. Biographical sketches for Drs. Buddington and Else are included in the appendix. Dr. Else will be appointed full-time in summer 1989 and will hold major responsibilities in the areas of animal resources, laboratory animal management, and international programs.

3) Major Problems Encountered or Anticipated

A continuing problem faced by the Yerkes Center is the lack of sufficient laboratory and animal housing space to accommodate expanding research programs of both core and affiliate scientists in a timely manner. Due to these increasing research programs and our inability to expand adequately our physical plant, it may soon become necessary to delay approved projects until space becomes available upon completion of ongoing projects. Another anticipated problem is the impending shortage of inhouse-produced nonhuman primates that will be needed for increased numbers of research programs. Center breeding colonies have, within recent years, been

producing increasing and sufficient numbers of animals to meet the needs of Center investigators. However, with increased research activities and utilization of Center resources by affiliate scientists in meeting our regional and national obligations, we are almost to the point that our breeding colonies will no longer be able to provide for the needs of Center investigators. Consequently, unless we are able to expand adequately our breeding colonies and provide for additional animal housing space, it may soon become impossible for the Center to accommodate new research projects in a timely manner.

Another continuing problem faced by the Yerkes Center, as well as biomedical and behavioral research in general, is the constant harassment by anti-research groups. The irresponsible, destructive and frequently unlawful activities of these misguided individuals has necessitated the expenditure of considerable funds to provide increased security for our animals, equipment, physical plant and personnel. Monitoring and responding to these attacks also takes a considerable amount of time from the work of the Yerkes administration and faculty. This time and these dollars could far better be spent on activities directed towards solving important human and animal disease problems.

4) Major Equipment Items Purchased

Base Grant*

Quantity	Description	Cost
1	JEOL Transmission Electron Microscope	$ 9,600
1	Office furniture	5,792
1	IBM Wheelwriter III Typewriter	565
1	Shaking Water Bath	1,412
1	Milcare C Locker Unit	1,586
2	Station Wagons	22,661
1	Mini-Van	14,101
4	Portable Pressure Washer	3,180
1	Ohaus Balance	863
2	Maxxum Camera Bodies	1,018
1	Maxxum Lens	549
1	Radio Base Station with multiple walkie-talkies	4,301
1	Custom VEP System DIVA-I	4,000
1	Hilti Core Drill & Bits	1,200
1	Drill Sharpener	830
2	York Heating/Air Conditioning Unit	1,396
49	Rack Units with 196 Primate Cages	171,349
**1	Fence Protection System	22,009
**1	Relocatable Exterior Primate Enclosure (D Compound) at Field Station	301,923
**1	Automatic Transfer Switch for emergency generator system	4,660

**1	Prefabricated Relocatable Unit at Field Station (Employee Office/Lounge)	55,080
1	Installation of Cage Washer & Steam Boiler	79,189
2	Four Drawer Vertical Fire Resistant File Cabinet	1,232
**1	Prefabricated Relocatable Unit at Main Station (Employee Lounge)	46,793
**1	Prefabricated Relocatable Unit at Main Station (Offices for faculty and technicians involved in AIDS research)	20,373
**1	Caging for Breeding Colony at Field Station	95,735
**5	Gibbon Enclosures	38,398

Computer Equipment Purchased:

1	Terminal Server	7,225
1	Wordperfect Software	1,440
1	Supersoft Portable Drives	1,299
4	Standalone Modems	2,720
3	Apple Laserwriters	10,670
1	NEC Printer	809
2	Hewlett Packard Laser Jet Printers	3,174
10	Zenith Computers	24,637
5	Compaq Deskpro Computers	16,157
1	Emory XT Computer	1,657

* Includes all Base Grant Supplements; i.e., Improvement and Modernization and AIDS.
** These items also appear on Improvements and Additions List

Other Grants

Quantity	Description	Cost
1	Polygraph Integrator	798
1	Sysgen Durapak Drive Dual-Internal	1,656
1	American Rotator	589
1	Clinical Centrifuge with accessories	1,338
1	McIntosh Computer with accessories	2,741
1*	Benchtop Research Unit with accessories	1,358
1	Centrifuge Rotor	740
1	Backlight Box	641
8	Alltalk IV Keyboards	25,800
1	MS DOS Co-Processor	506
1	EUCC AT Computer	2,378
5	EUCC AT Microcomputer	8,250
2	HP Laserjet Printer with accessories	3,942
2	Compaq Deskpro Computer with accessories	4,914
1	Liquid Nitrogen Storage Tank	1,450

1	Unrefrigerated Tabletop Centrifuge	2,550
1	Horizontal Rotor	639
1	Alltalk Voice Recorder	2,735
1	Intro Talker	595
1	Digital Equipment	2,402
1	Microfuge 12 Table Top Centrifuge	1,980
1	Bowl Rotor	683
1	Chromium Sputtering System	34,835
3	EXT Mono Chrome	1,190
1	EUCC XT Computer	4,650
1	EUCC AT Computer	2,678
1	Platform Scale	1,978
1	Portable Sector/Linear Scanner	21,050
1	HP Laserjet Printer	1,443
1	Apple McIntosh Computer with accessories	5,315
2	Konica Copier	999
2	Monitor with Plus Card	1,407
1	Sysgen Durapak	3,690
1	Stereo Video Cassette Recorder	1,590
1	HLP 2MB Memory Upgrade	602
1	Video Picture Convertor	540
1	700 Video Multi Color Connector	625
1	Sony Camera	1,510
1	Refrigerated Recirculating Water Bath	2,665
1	Makler Counting Chamber	593
1	Biological Safety Cabinet with UV Light	4,310
1	Gel Electrophoresis Apparatus	1,300
1	Upper Buffer Vessel	550
1	Upright Freezer	5,485
1	Autosharp Knifesharpener	4,207
1	High Resolution Vidicon Camera with accessories	1,378
1	4 Pen Plotter	595
1	Digital Storage Oscilloscope	2,660
1	Sony Camera	1,795
1	Pressure Sprayer	800
1	Nikon 8008 Camera with accessories	730
3	Monochrome Computer	3,924
**5	Exterior Gibbon Enclosures	19,125
1	Luminance Source	1,655
1	SB-V1000	523
7	Sony 8mm Playback Deck with monitor	8,603
1	Toshiba Laptop Computer with RAM upgrade	1,148
1	Heurikon M120 Computer System	8,747
1	Macintosh Personal Computer	2,118

**These items also appear on Improvements and Additions List.

5) Improvements and Additions to Facilities*

** Fence Protection System	22,009

Installation of chain link fence roof for outside Great Ape Wing Nursery Playground at Main Station	4,346
** Relocatable Exterior Primate Enclosure (D Compound) at Field Station	301,923
** Automatic Transfer Switch for emergency generator system installed at Main Station	4,660
** Conversion of room 373A into restroom at Main Station	5,190
** Caging for Breeding Colony enclosure at Field Station	95,735
Completion of soil erosion control at building G-1 at Field Station	8,568
Completion of retaining wall, steps and roadway to facilitate access to Relocatable Exterior Primate Enclosure at Main Station	54,600
Install data cable wiring at Main Station	3,423
Installation of Stonehard floor in building T11C at Main Station	2,363
Convert room 373C at Main Station from storage area to office space	4,100
Convert room 104 into two offices at Main Station	4,073
Install cross-tie retaining wall adjacent to storage facility at Main Station	4,000
** Prefabricated Relocatable Unit at Field Station (Employee Office/Lounge)	55,080
** Prefabricated Relocatable Unit at Field Station (Employee Lounge)	46,793
** Prefabricated Relocatable Unit at Main Station (Offices for faculty and technicians involved in AIDS Research)	20,373
** Fabrication of five (5) Gibbon Enclosures	57,523

* Includes all Base Grant Supplements, i.e., Improvement & Modernization and AIDS.

** These items also appear on Base Grant/Other Grants Equipment List.

6) Conferences and Workshops

July 21 Presentation about Yerkes Center to U.S. Senator John Melcher.

Sept. 19-20 Presentations about Yerkes Center research to staff members of National Institutes of Health's Division of Legislative Analysis; Co-sponsored by the American Psychological Association.

7) Yerkes Visiting Speakers Series

March 24 Dr. Irving Zucker, Department of Psychology, University of California, Berkeley: "Neuroendocrine Substrates for Mammalian Circannual Rhythms." Co-sponsor: Emory Department of Psychology.

April 12 Dr. Jacques Vauclair, Charge de Recherche, Laboratoire de Neurosciences Fonctionnelles, C.N.R.S., Marseilles, France: "Handedness and Manual Specialization in Baboons and Gorillas." Co-sponsor: Emory Department of Psychology.

April 19 Dr. Bruce Dow, Department of Physiology, State University of New York at Buffalo: "Color Vision Primates." Co-sponsor: Atlanta Chapter of Society for Neuroscience.

November 10 Dr. Bjorn Lundgren, Primate Research Center, National Bacteriological Laboratory, Stockholm, Sweden: "SIV Studies in Cynomolgus Monkeys in Sweden."

November 18 Dr. Richard Leakey, Director of the National Museums of Kenya: "Origin of the Human Species." Co-sponsor: Department of Anthropology of the Emory College.

November 30 Dr. Tony M. Plant, Department of Physiology, University of Pittsburgh School of Medicine: "Neuroendocrine Mechanisms Controlling the Onset of Puberty in the Monkey." Co-sponsor: Interdepartmental Endocrine Group of Emory.

8) Administrative and Operational Changes

During 1988, Dr. Roger Buddington joined the Center faculty as an Administrative Associate in the Director's Office. Dr. Buddington will provide support to the Center Director in a variety of administrative and organizational matters. Dr. James Else joined the Center and is coordinating our African field studies and retroviral work. In 1989 he will become full-time with major responsibilities in the areas of Animal Resources and Laboratory Animal Management.

9) Narrative Progress Report for Non-Research Units

a) Clinical Medicine

The Division of Veterinary Medicine is a service unit that provides health care, supervision of husbandry and research support for approximately 2300 great apes and monkeys at the Atlanta, Lawrenceville and Panthersville facilities. The unit consists of 3 full-time veterinarians, a registered nurse, 2 veterinary technicians at the Main Station, one veterinary technician at the Field Station and an Animal Records Registrar. In early 1989 an additional clinical veterinarian was added and plans are underway for reorganization of animal care under Dr. Else.

In 1988 a total of 161 major surgical operations were performed under the supervision of the veterinary unit. Of these, 117 were experimental procedures done by the investigator, 23 were experimental procedures done by the veterinary staff for investigators and 21 were diagnostic or therapeutic procedures done by the veterinary staff. Anesthesia or surgical assistance was provided by Yerkes veterinarians in approximately 90% of the investigator surgery. All post-operative care including round-the-clock analgesic administration, nursing care and suture removal was done by the Yerkes veterinary staff.

The radiology service was utilized to radiograph 849 animals for a total of 1220 films. Of these, 733 animals were radiographed for clinical indications (illness, injury or health surveillance) and 116 for experimental reasons.

During 1988, 1120 new cases of illness or injury were treated; 1022 of these were in monkeys and 98 were in apes. The preventive medicine program for the colony is administered by the Division of Veterinary Medicine. This includes physical examination, hematology, blood chemistries, tuberculin testing and chest radiography conducted annually on great apes. Tuberculin tests on all individually housed monkeys are done every 4 months and annually on compound housed animals. All primates received from outside the Center are quarantined prior to entry into the colony. All apes are immunized against polio, influenza, Streptococcus pneumoniae and Hemophilus influenzae. All personnel are tuberculin tested semiannually if they have animal contact and annually if they do not have regular animal contact. Positive reactors are radiographed annually and the films are submitted to a radiologist at Emory Clinic for evaluation. Pre-employment reference serum is collected and repeated every two years and stored in the pathology division.

In 1988 the unit provided research support to 32 core and affiliate scientists on 37 separate projects. In addition, biological samples were made available to a number of outside

Hematology Examinations	1,634
Bone Marrow Examinations	1
Bacterial Cultures	3,094
Fungal Cultures	11
Fecal Parasitology Examinations	641
Serum Chemistries	932
Immunology Examinations	681
FACScan Phenotype Determinations	803
Pregnancy Tests	42
Urine Analysis	136
Imprint Smear Preparations	637
Spinal Fluid Examinations	70
Miscellaneous Tests	18

When compared with 1987, this number of laboratory specimens represents an increase of 699 specimens (8.7% increase). Significant increases were noted in the number of bacterial cultures, fecal parasitology examinations and FACScan phenotype determinations. Again, this is largely a function of the increase in colony size.

Selected pathogenic microorganisms isolated during the past year include:

Staphylococcus aureus
Group B, Beta Streptococcus
Klebsiella pneumoniae
Pseudomonas aeruginosa
Pasteurella multocida
Listeria monocytogenes
Shigella sonnei
Campylobacter species
Salmonella species
Aeromonas hydrophila
Shigella flexneri
Yersinia enterocolitica
Yersinia pseudotuberculosis
Yersinia fredericksenii
Yersinia kristensenii
Yersinia intermedia
Proteus vulgaris
Streptococcus pneumoniae
Hemophilus influenzae
Enteropath. E. coli

A total of 920 antibiograms were done on bacterial isolates during the year.

The most frequently encountered parasites continue to be Balantidium coli, Trichomonas species, Blastocystis hominis and Trichuris species. Fourteen cases of strongyloidiasis were encountered during the year.

Pathology Electron Microscopy Laboratory: During 1988, the pathology electron microscopy laboratory received 71 specimens for processing for ultrastructural evaluation. Specimens received included 14 spleen specimens, 21 lymph node specimens, 16 Peyer's patch specimens, 1 tongue lesion, 9 peripheral blood specimens, 1 small intestine specimen, 4 cell cultures, 3 skin specimens and 2 kidney specimens.

Specimens Collected for Other Investigators: During 1988, 4517

specimens were collected and shipped to 101 other investigators or laboratories. A partial listing of specimens provided includes serum, blood, tissue specimens, carcasses, skin, eyes, bone, and placenta. This includes 19,321 ml of whole blood, 770 ml of serum and 44 ml of plasma from 15 nonhuman primate species.

c) Primate Care and Housing---Main Station

1) Great Ape Wing

Rooms 315, 317, 319 and 321 of the Great Ape Wing Nursery were painted with StonGlaze epoxy wall surfacing material. The door to room 319 of the Great Ape Nursery was enlarged to facilitate the use of larger sized Lab-Care cages. A double door was installed to facilitate cage movement in and out of the nursery. The walkway to the Great Ape Nursery play area was enclosed with chain link fencing to further insure animal security and prevent escapes.

The Great Ape Wing staff was increased from 9 to 10 individuals. A new cold-room was installed in the Great Ape Wing, and the old cold-room space was converted to a new change and restroom for Great Ape Wing personnel. Ten new indoor-outdoor chimpanzee housing units were added as part of the chimpanzee breeding program. A digital scale was installed in the breeding wing and 5 stainless steel metabolism cages were purchased for use with chimpanzees greater than 25 kg.

Thirteen gorillas and four orangutans were placed on loan to the Atlanta Zoo for their new naturalistic ape exhibits, where Yerkes research with them continues.

Participation in the AALAS animal care tehnician certification training program in cooperation with the University Division of Animal Resources has continued and in 1988 three primate care technicians were certified at the Assistant Technician level and seven were enrolled in a laboratory animal science and technology course.

2) Small Primate Wing

Two relocatable exterior primate enclosures with a total of 5,024 square feet of floor space were installed to permit expansion of the colony for increased research activities. Additional stainless steel cages were acquired for these new REPEs, and a new cage and rack washer was purchased to be installed adjacent to these faciltites.

Floors in trailers T11C, T-14 and the Quarantine and Isolation Facility were re-surfaced with Stonhard epoxy aggregate floor covering. An epoxy wall covering was applied to the walls in

the Quarantine and Isolation facility (Stonglaze). The interior walls of trailers T-11A, T-11C and T-14 were painted.

An existing restroom and change room in the Small Primate Wing was enlarged to provide shower and locker facilities for an increased number of Small Primate Wing personnel.

d) Primate Care and Housing---Field Station

During 1988, continued emphasis was placed on improving animal housing, methods of animal care, and the performance of animal care personnel. Items accomplished during the past year are summarized below:

1. Twenty-two (22) cages were modified for blood withdrawal work and 22 stands built for them. This will eliminate the need to be constantly moving cages and stands between areas for surveys, thereby reducing the possibility of spreading diseases.

2. A new cargo net and additional swings were hung in G-1 and climbing ropes were installed in T-3 and T-4. These additions have enriched the animals' environment.

3. Rehabilitation of the inside of compounds S-1, S-2, S-3 and S-4 was completed to prevent further erosion of the soil and damage to the structural integrity of the compound walls. This was accomplished by grading the soil, installing retaining walls and drainage ditches and applying a layer of crushed rock to the surface.

4. Caging for the breeding colony enclosure was erected.

5. Installation of a relocatable exterior primate enclosure (D Compound) was begun.

e) Physical Plant

1) Main Station

The following items were accomplished during 1988:

a) Room 104 was divided into two offices. Appropriate light fixtures were installed along with new lay-in ceiling. These rooms were tied into the Yerkes security system.

b) The west corridor of the first floor was enclosed to form an office area for the laboratories which open onto that section of corridor. Security access devices were added to this area.

c) A third floor store room was converted into office space by cutting into the existing ventilation system and installing lay-in ceiling and light fixtures. A new entrance was cut to provide more direct access with the rest of the building.

d) The space previously occupied by a walk-in cooler was converted into a shower/locker room facility for the Great Ape Wing.

e) A storage space on the Small Primate Wing was incorporated into a women's restroom allowing for the addition of shower and locker space.

f) Two small change areas in the Ophthalmic Research Laboratory facility were combined to provide adequate shower and locker room space for male primate care technicians on the Small Primate Wing.

g) A prefabricated, relocatable unit was purchased for use as a faculty/staff lounge and meeting room.

h) Three new vehicles, two station wagons and a mini-van, were purchased during the year.

i) To facilitate access to the new relocatable exterior primate enclosures (REPEs) and the Great Ape Wing, as well as to prevent soil erosion, a retaining wall was installed and the cart path used by utility vehicles widened. A set of steps was cut into the embankment leading to the REPEs.

j) A second transfer switch was added to the Main Building's emergency generator system which greatly expanded the system's capacity.

2) Field Station

During 1988 the following items were accomplished:

a) An additional security alarm system was installed at the Field Station.

b) The drain pipe from the BC-1B swale was extended 30 feet to alleviate the problem of run-off water pooling on the road.

c) The Field Station roads were graded and crushed rock spread on them.

d) A new 280 gallon capacity fuel tank was purchased for the

emergency generator.

e) Multiple walkie-talkies and a base station were purchased. The walkie-talkies have greatly enhanced the ability to communicate quickly and keep in touch with all phases of operation.

f) Intercoms were installed in the home of the Superintendent and the mobile home of the Yerkes employee living on site. The intercoms will allow night security persons to call these people from anywhere in the facility, at any time.

g) A prefabricated, relocatable unit was installed as a replacement for faculty offices.

f) Radioimmunoassay

The Radioimmunoassay (RIA) Laboratory provides assay services for Yerkes (YRPRC) and non-Yerkes investigators for the analysis of hormones in biological fluids. During the calendar year 1988, investigators who utilized the services of the RIA Lab were as follows:

I.S. Bernstein, Ph.D., YRPRC and University of Georgia: Studies investigated the ontogeny of aggression and testosterone secretion in male rhesus monkeys (funded by NSF).

M. DiGirolamo, M.D., Emory University School of Medicine: Studies investigated the regulation of glucose metabolism in rats and man (funded by NIH).

T.P. Gordon, M.S., YRPRC: Studies investigated the relationship between pituitary-gonadal and pituitary-adrenal hormone secretion and immune function (funded by NIH).

J. Herndon, Ph.D., YRPRC: Studies investigated the pattern of pituitary and gonadal hormone secretion in male rhesus monkeys housed in different photoperiods.

D.R. Mann, Ph.D., Morehouse School of Medicine: Studies investigated the regulation of gonadal function in rats and monkeys (funded by NIH).

R.D. Nadler, Ph.D., YRPRC: Studies described the effects of oral contraceptives on female sexual behavior in chimpanzees (funded by NIH).

S.M. Schwartz, Ph.D., Caribbean Primate Research Center, University of Puerto Rico: Studies investigated the role of diet and metabolism in puberty onset in rhesus monkeys (funded by NIH).

K. Wallen, Ph.D., YRPRC and Dept. of Psychology, Emory University: Studies investigated the role of gonadal steroids in sexual behavior in male and female monkeys (funded by NSF).

M.E. Wilson, Ph.D., YRPRC: Studies investigated 1) the neuroendocrine regulation of puberty in monkeys (funded by NIH); 2) the neuroendocrine control of lactational infertility (funded by NIH); 3) the effects of growth hormone on adolescent and neonatal growth in rhesus monkeys (funded by Genentech Inc.).

Others: Mr. F. Sabatino, Emory University School of Medicine; Dr. K. Gould, YRPRC; Dr. N. Pope, YRPRC; Dr. E. Strobert, YRPRC; Dr. D. Martin YRPRC and Georgia State University; Dr. D. Edwards, Emory University.

During calendar year 1988, the RIA Lab performed 19,254 determinations itemized as follows:

Hormone	Number
B endorphin	182
adrenocorticotropic hormone	288
androstenedione	167
bioactive luteinizing hormone	2,460
cortisol	523
dihydrotestosterone	35
estradiol	2,718
estriol	72
estrone	106
growth hormone	2,059
human follicle stimulating hormone	22
human luteinizing hormone	34
insulin (primate)	1,093
insulin (rat)	40
insulin like growth factor-1	1,374
melatonin	192
monkey follicle stimulating hormone	2,179
monkey luteinizing hormone	2,091
progesterone	2,066
prolactin	635
T3	96
T4	96
testosterone	672
TSH	54

In addition, the direct fluorenzymeimmunoassay of pregnane glucuronide in urine was also validated in the laboratory during 1988.

The following is a listing of the assays currently available in

the RIA Lab:

ACTH	IGF-1
Androstenedione	Insulin (primate)
B-endorphin	insulin (rat)
Cortisol	LH (ape)
Creatinine	LH (ape; urine)
Custom iodinations	LH (bioactive)
DHEA-S	LH (monkey)
DHT	Melatonin
Estradiol	Osteocalcin
Estriol	Oxytocin
Estrone	Pregnane diol
Estrone Sulphate	Progesterone
Free T4	Prolactin
FSH (ape)	Reverse T3
FSH (bioactive)	Somatostatin
FSH (monkey)	T3
GH	Testosterone F
Glucagon	Testosterone M
Glucose	Total T4
hCG	Ultra TSH

g) General Office Services

This office is responsible for the following functions:

1) Time card and leave accrual records maintenance.

2) Travel arrangements and travel expense record-keeping.

3) Mail distribution.

4) Procurement, maintenance, distribution, and inventory control of office supplies.

5) Pay check distribution.

6) Photocopy equipment maintenance.

7) Reception and clearance of all visitors

h) Information Services

The Yerkes Center's Information Services Office is responsible for developing and implementing internal and external communication programs. The office, staffed by the Administrative Associate for Special Projects and a secretary, also assists the Director with special projects. The activities

of this office encompass:

1) development and production of print and audiovisual materials about the Yerkes Center, its research, and animal care and conservation programs;
2) community relations: tours and presentations for scientific, educational and other groups;
3) organization and hosting of conferences and workshops;
4) employee orientation-information: providing tours for new employees and students;
5) news media activities; and
6) special projects: assisting the Director in preparation of special articles and speeches about the Yerkes Center; and representing Yerkes in contacts with professional, scientific, medical and zoological organizations.

Through these programs, the Yerkes Center endeavors to inform its employees, the Emory University community and the general public about the goals and accomplishments of the Center's research and conservation programs.

Highlights of 1988 activities:

News Media: The Yerkes Center's research to develop a post-surgical treatment to promote sight in human infants with congenital cataracts was communicated to the public via the national and local news media. The center's loan of 25 great apes to Zoo Atlanta also was a focus of news media coverage.

Print and Audiovisual Materials: During 1988, the Administrative Associate prepared and distributed various fact sheets and articles including a document listing the Yerkes Center's contributions during the past 10 years. A report on the progress of the NIH-sponsored Chimpanzee Breeding and Research Program was drafted for review by the participating institutions. An article about Yerkes dental research activities, written by the Administrative Associate, was published in Emory Dentistry. A display about the Yerkes Center was prepared for inclusion in the "Gorillas of the Cameroon" educational building at Zoo Atlanta.

Community Relations: Presentations about the Yerkes Center were given to numerous community groups. Tours were given to new employees as well as to various scientific, educational and community groups, such as Emory Freshman Seminar groups, U.S. Congressional legislative staff, and two U.S. Legislators. In addition, the Yerkes Center's Information Officer responded to numerous letter and telephone requests for information from students and members of the public.

During 1988, the Administrative Associate was a trustee of the Friends of Zoo Atlanta and served on Zoo Atlanta's public relations and marketing committee. The Administrative Associate

also served as a member of the executive committee and board of directors of the national American Medical Writers Association. Also during 1988, the Administrative Associate was a Freshman Seminar group leader at Emory University.

Special Projects: The Administrative Associate assisted the Director with various presentations to scientific and educational groups. She co-authored with the Director and several Yerkes scientists a paper entitled "Primates," published in the June 10, 1988 edition of Science. The Administrative Associate coordinated the lecture at Emory and reception for Kenyan paleoanthropologist Richard Leakey, Director of the National Museums of Kenya.

i) Administrative Associate to the Director

The Office of the Administrative Associate is responsible for coordination of computerization at the Yerkes Center, oversight of contracts and agreements with the private sector, and liason with selected government and professional agencies.

Computerization - The following were areas of special emphasis during 1988:

Yerkes Animal Records System - Programming for the Yerkes Animal Records System was completed. This comprehensive new system was developed specifically for Yerkes during the past 18 months and supercedes the earlier, limited system, developed in-house in 1985. It improves tracking of animal acquisitions, removals, location movements, and experimental assignments. The system will allow on-line access to the clinical histories of all animals from work locations at both the Main Station and Field Station of the Center. Remote log-in by authorized collaborative scientists at off site research facilities has also been provided for.

Secretarial Work Stations - IBM PC compatibles were installed at all secretarial workstations, replacing outmoded DEC computers. Word processing software was standardized and protocols established for wordprocessing projects requiring multi- department collaboration. Training was provided through Emory University's Campus Computing Center for all secretaries and interested support personnel in DOS, UNIX, and wordprocessing. Ongoing computer training is provided through the Yerkes Center Computer Department. A major goal of secretarial computerization and modernization was the submission of this Progress Report in both hard copy and electronic formats in a timely manner. This goal was successfully attained, and the progress report was submitted on disk for the first time along with the hardcopy.

Networking and E-Mail - PC's are networked through the

Center's main computer which allows direct file sharing. Electronic mail facilities were also installed to reduce paper flow and improve communication. The majority of core personnel and their support teams were connected to the system which has in excess of 80 user IDs currently.

Off Site Access - The Yerkes Field Station communication link was upgraded by the addition of two high speed modems. Access to the Animal Records System, file sharing, and electronic mail communication with the Yerkes Main Station have been significantly improved but are not entirely satisfactory. It is anticipated that Field Station-Main Station communication links will need to be improved through alternate technologies providing a more direct link in the coming year. Access by the Language Research Center has been provided as well as modem access by collaborative scientists from other Universities. Boston University was specifically supported with access to animal records relating to research on aging.

Planning and Budgeting - The Computer Committee reviewed and approved a plan and budget for continued computerization of the Center in the coming year. In particular budgeting and accounts programming, scientific computing support, additional database programming, and increased access to nationwide databases and networks were identified as computing needs for the coming year. The drastic increase in users for Animal Records, electronic mail, and communications capabilities will necessitate substantial upgrades in the Center's main computer.

Contracts and Agreements with the Private Sector - The Yerkes Center is currently involved in 29 agreements and contracts for research sponsored by or carried out for private industry, universities, and other outside agencies. Another 11 contracts or agreements are in various stages of negotiation. In addition, the Yerkes Center has agreements with 39 organizations regarding animals on loan. Finally, the Yerkes Center is involved in three agreements relating to patents. The following is a partial list of organizations with one or more current agreements with the Center.

- American Parkinsons Disease Association
  C. R. Bard, Inc.
  Behringwerke AG
  Biotech Research Laboratories
  Boston University
  Burroughs Wellcome Co.
  Busch Entertainment Corp.
  Chiron Corp.
  Deknatel Div. of Pfizer Hospital Products Group
  Eagles Max Baer Heart Fund
  The Edna McConnell Clark Foundation

The Edna McConnell Clark Foundation
Emory - Georgia Tech Biotechnology Research Center
Genentech, Inc.
Georgia State University
American Society for Aesthetic Plastic Surgery, Inc.
Institute of Primate Research and California Primate Research Center
Metters Industries and Southern Research Institute
Morehouse University School of Medicine
Pasteur Vaccins
Rockefeller Foundation
Searle Research and Development
University of Alabama
Syntro Corporation
VLI Corporation
Zoo Atlanta
Zeus Scientific, Inc.

Liason with Selected Government and Professional Organizations - In 1988 the Administrative Associate's office provided support to two developing organizations promoting biotechnology and research: the DeKalb Chamber of Commerce Biotechnology Research Council, and the American Psychological Society.

The DeKalb Chamber of Commerce Biotechnology Research Council - The Yerkes Center has been involved with the development of the biomedical technology industry in Georgia through its participation in both the Steering Committee and the Task Force Committee of the DeKalb Chamber of Commerce Biotechnology Research Council. This initiative of the DeKalb Chamber of Commerce is intended to bring together the many biotechnology resources of the area known as the Clifton Corridor. The Clifton Corridor is not a geographical designation but instead refers to the facilities of Emory University, including the Yerkes Center, Georgia Tech, the U. S. Centers for Disease Control, the national headquarters of the American Cancer Society, and the many surrounding academic and private facilities involved in biotechnology research and development. The aim of the DeKalb Biotechnology Research Council is to stimulate advances in biotechnology research and technological development, not only in the DeKalb County areas but also in the state of Georgia. The strategy will be to invite biotechnology industries to locate in the DeKalb area based on cooperative projects with the academic and existing government and private biotechnology facilities in the county. DeKalb's initiative will then be used as a model for development of similar initiatives throughout the state. The Yerkes Center, as a regional research facility, has been supportive of this program since early in its inception.

The American Psychological Society - The recent formation of the American Psychological Society has as its stated purpose

the promotion of academic research and training in the field of psychology. The APS quickly obtained several thousand members. The office of the Administrative Associate acted as the liason to the new Society and worked to inform all core and relevant collaborative faculty members of its call for new members. A very high percentage of the faculty members contacted at the Yerkes Center have become members of the APS.

j) Bioelectronics and Instrumentation Shops

The major activities of the Bioelectronics and Instrumentation Shops during 1988 are summarized below.

Scientific Projects. Most large-scale projects for the Center's scientific staff involved automated data collection. Among these were the design, construction and programming for operant manipulanda in the endocrine-behavioral studies of Drs. Dahl and Nadler. Black Bulb Thermostats were also designed and built for these investigators' gibbon housing compounds. For Dr. Boothe's studies of the visual system, the shops built and modified animal face masks used in operant experiments. A lightproof shutter, an infrared detector, a photodetecter, test panels and animal restraint and transfer devices were built for these same studies. The Center's broadband cable system was used for the video monitoring and recording system set up for Dr. Patterson's studies of labor and delivery. Also for Dr. Patterson's studies, the shop designed and constructed a gas-tight, pressure-monitored cage of Lexan. A computer controlled visual perimetry testing system was designed and programmed for Dr. Wilson's visual system studies.

Computers and Word Processing: Electronic support was provided for the Center's computing facility. This included the wiring of terminal and Ethernet connections, as well as providing advice on purchase and operation of computer-related equipment. Six additional PC-based secretarial work stations were purchased. Uniform word-processing software was selected, learned by Shop personnel and installed. Shop personnel coordinated training of secretaries in word-processing and in network communications, and provide continuing support in these areas.

Work for Other Service Units: Security systems and alarms were maintained. Several items of equipment were designed, modified or repaired for surgical or veterinary use, including a suction pump, dental hygiene equipment, an autoclave, etc. A film processor was repaired for photographic services. Numerous miscellaneous repairs were carried out.

Consultant Services Provided to the Center by Professor Harold Warner: During the past year, Professor Harold Warner

(Emeritus), retired Chief of BME, continued to provide consultation to the Yerkes faculty. Specific consultation and assistance were provided in the following areas:

Consultation regarding operation of certain security systems at the Center.

Consultation concerning repairs and maintenance of an electrosurgical unit.

Provided information on the video communication cable, testing the performance of a 60 watt laboratory amplifier, use of the SWTL BME development computer, electrical safety with rectal probes and care of rechargeable batteries.

Assisted with a determination of the cause of problems experienced with a Wavetek generator, CRT monitor and ophthalmoscopes and rechargers.

k) General Shop

The General Shop provides an important service for scientific and support personnel at the Center. This unit is responsible for the design, fabrication, maintenance and repair of all animal caging and related research equipment within the Center.
During 1988, the General Shop responded to 203 emergency repair calls. During the same period, the General Shop completed 240 work orders submitted by scientists and support personnel. These work orders included fabrication of caging, construction of research equipment and repair of existing equipment and caging.

l) Library

The Yerkes Research Center Library is an essential resource in the research process. The library serves the information needs of the research staff and administration and provides full library service by acquiring, organizing and disseminating information for current use and by preserving relevant materials for future access.

The library contains 2,000 journal volumes and 1,950 books. There are 700 books and 4,500 reprints in special collections. These consist of archival and personal books from the libraries of former directors and from a reprint collection begun by Robert M. Yerkes. Faculty publications added to the "Contributions from Yerkes Regional Primate Research Center" now total 2,800. This bound reprint collection dates back to 1925.

The circulation figure, 6,000, remains approximately the same as for the previous year. This figure includes inhouse use, as routing journals, checking out books, photocopying requested

materials, loaning or dispensing reprints (both Yerkes' publications and collected reprints); borrowing and photocopying at Campus libraries; and borrowing through interlibrary loan from other libraries. Fewer books (39) were purchased than in 1987 (47). Journal subscriptions increased from 41 to 53. Interlibrary loan requests increased from 150 to 175. Requests for photocopies of journal papers from campus libraries increased by 150 (from 1,350 to 1,500).

Automation additions to the library were: a computer, increased computer terminal transmission speed from 1200 to 2400 baud, plus the software product, WordPerfect - all of which have enhanced the use of the existing databases, DIALOG and VUTEXT; DOBIS, an online catalog of Emory's library holdings; a Georgia online database, GOLD, which contains the holdings of OCLC (Online Union Catalog) and is used for locating and electronically routing interlibrary loan requests within the state; and a FAX machine which can be used for urgent requests.

The library is open around the clock. It is being increasingly well used for additional purposes as the Center grows and space becomes more limited. The library is used for research projects requiring a quiet place, as video coding and viewing, and for small group meetings whenever the conference room is in use. The FAX machine, which was installed in the library, is used by all units of the Center.

m) Budget and Accounts

This office is responsible for grants management of the Center's base grant and faculty research grants and contracts.

Specific functions included within this department are:

Assistance to faculty in the preparation of grant and contract proposals; projection and monitoring of grant and contract expenditures and credits; and preparation of fiscal data and reports.

n) Purchasing

This office has responsibility, authority and accountability for the supervision and coordination of the purchasing functions of the Center.

Specific functions included within this office are:

Coordinates purchase of equipment, supplies and services with University Purchasing Department;

Verifies and approves payment of invoices for goods and

services rendered by vendors;

Secures bids and quotations from vendors for equipment, supplies and services;

Monitors all contracts to insure Center and vendor compliance;

Maintains purchase order records;

Processes reimbursement to faculty and staff for authorized out-of-pocket expenditures;

Processes accounts receivable transactions, prepares invoices and maintains records;

Prepares shipping documents and arranges transportation of shipments made by the Center;

Receives, verifies and distributes shipments of equipment and supplies; and

Maintains inventory of equipment and arranges for needed repairs.

o) Photography

The Photography Department provides photographic services to the scientific and administrative staff.

During 1988, 559 requests for photographic services were received and processed. The types of photographic illustrations provided included black and white photographs, color slides and prints of people, animals, caging, lesions, equipment, experimental procedures, electronic circuitry, buildings, surgery, necropsy, gross tissue specimens, and Polaroid I.D. cards.

Other accomplishments included:

Black and white negative processing and darkroom sessions for printing were done in cooperation with investigators;

Slides were made from charts and graphs, radiographs, electron micrographs, book and magazine illustrations, photographs and other slides;

Black and white line negatives, prints and slides were produced for publication from charts and graphs;

Motion picture and slide projectors were operated for meetings and photographs of meeting sessions and speakers were taken;

Computer-generated charts, graphs and slides were prepared using

Sigma-Plot and Picture It software;

Acted as liaison with color lab for color prints for poster sessions and wall displays;

Prints from file negatives were produced to fill requests from publishers of textbooks and magazines; and

Photographs, letters and certificates were framed for display.

p) Scanning Electron Microscopy and X-ray Microanalysis Unit

The scanning electron microscopy/microanalysis facility provides scanning electron microscopy and energy dispersive x-ray analysis (Tracor TN5500) for use in training and support of research. The DS130 and TN5500 provide maximum resolution and the facility for element and image analysis. Ancillary equipment and facilities for photography, specimen preparation and metal coating are also available. Research areas of the facility include high resolution imaging and development of methods for specimen coating with very thin films, especially chromium.

During 1988, the SEM Facility provided support to numerous research projects including studies of changes in sperm morphology associated with freeze preservation; enamel crystal structure in humans; early myocyte-muscle development; assessment of laser corneal surgery; ultrastructural changes in the adrenal cortex with age; and maintenance of intra-arterial stents in pig, rabbit and dog.

B. HIGHLIGHTS

1) Research Completed

a) CNS Grafting for Parkinsonism

The administration of MPTP to adult macaque monkeys destroys the dopaminergic cells in the nigrostriatal pathway and produces a movement disorder with many of the characteristics of Parkinson's Disease. This unique model is being used to evaluate CNS grafting techniques that might be applicable to the treatment of this increasingly common human disease. Following the documentation of baseline behavioral and physiological parameters, MPTP injections are given until Parkinson-like characteristics develop. Behavioral alterations are monitored by clinical examinations, performance on learned tasks and computer analysis of spontaneous activity. Biochemical alterations are monitored by levels of CSF catecholamine activity. Once the degree of neurologic deficit is documented, either a fetal mesencephalic cell suspension is engrafted stereotactically in

multiple areas of the caudate and putamen, or adrenal medullary tissue is placed in the caudate by a transcortical, intraventricular approach. Postoperatively, the same behavioral and physiological parameters are measured to assess response to both types of treatment.

To date, six macaques have been transplanted successfully, and have provided preliminary data supporting the hypothesis that grafting of fetal dopaminergic tissue in the brain is effective in reversing behavioral and biochemical abnormalities that occur in primates with experimentally induced Parkinson's Disease. These animals have been studied extensively for pathological alterations using standard light microscopic, electron microscopic, immunocytochemical and catecholamine-fluorescent techniques. Grafted dopaminergic cells have been identified within the caudate and putamen. Animals receiving adrenal grafts have also shown behavioral improvements and surviving grafted cells. Long-term evaluations of transplanted subjects are needed to determine the ultimate potential for transplantation in the treatment of Parkinson's Disease by each of these techniques.

b) Prophylactic Effects of AZT Following Exposure of Macaques to an Acutely Lethal Variant of SIV

A variant of SIV (SIV/SMM/PBj_{14}) derived from a chronically infected pig-tailed macaque causes an acute, fulminating clinical disease and death in experimentally infected pig-tailed macaques. This animal model system, which should prove to be extremely useful in the rapid evaluation of newly developed antiretroviral drugs, has been used in a preliminary study to evaluate the prophylactic effects of AZT when administered shortly after virus exposure.

In this study, four groups of three pig-tailed macaques were given 10 $TCID_{50}$ of SIV/SMM/PBj_{14}. AZT at 100 mg/kg/day, divided into 3 doses, was given subcutaneously for a period of 14 days. Treatment was initiated at 1 (group 1), 24 (group 2) or 72 (group 3) hours after virus exposure; group 4 animals were untreated. All animals except one in group 1 were virus positive at 10 days post-inoculation. Three animals in groups 1 and 2 remained clinically normal; all other animals developed clinical disease within 10-17 days of virus exposure. One death occurred in group 1, and 2 deaths occurred in each of the other groups. Survivors in groups 3 and 4 are showing clinical disease and immunosuppression, whereas survivors in groups 1 and 2 are clinically normal with normal immunological parameters. One animal in group 1 has no evidence of SIV infection. Survivors in groups 3 and 4 have 30-fold higher antibody titers than survivors in groups 1 and 2, suggesting that the former had more antigenic stimulation due to increased virus replication.

These data indicate that some protection is provided by AZT when

treatment is initiated within 24 hours of exposure to an acutely lethal simian HIV-like virus. This preliminary study further documents the usefulness of this animal model in the rapid evaluation of antiretroviral drugs.

2) Research in Progress

a) Artificial Breeding of Great Apes

The breeding capacity of the captive great ape population must be optimized to ensure maintenance of a population adequate for species preservation and supply of animals for appropriate research. Artificial breeding methods, particularly artificial insemination and the use of cryopreserved semen, are potentially useful techniques to produce offspring from incompatible or inexperienced partners, or to ensure continued genetic presence of individuals removed from the breeding colony due to death or infectious disease.

In order to improve the breeding success of captive great apes and to provide for genetic diversity in the population, studies are underway to improve artificial insemination techniques and to provide for improved methods for cryopreservation of great ape semen. Methods are being used for synchronization of ovulation by stimulation of the cycle with clomiphene citrate, and detection of natural ovulation using LH detection kits developed for human use. A number of extenders, including glycerol and DMSO, have been evaluated in a variety of freezing protocols to develop improved methods for the cryopreservation of great ape sperm. Currently, it appears that semen parameters exceeding a count of 1×10^8/ml and more than 75% live sperm, extended with a final concentration of 7.8% glycerol and frozen in a programmable freezer over a 3 hour period, provides the best results. The fertilizing capacity of such semen has been demonstrated by the initiation of two chimpanzee pregnancies.

Observations to date, and anticipated further improvements in artificial insemination and cryopreservation techniques, are expected to make significant contributions toward the breeding, preservation and utilization of captive great apes.

b) Social and Endocrine Effects on Immune Function

These studies, recently initiated at the Yerkes Field Station, are predicated on several related observations that provide evidence that factors inherent in typical housing environments of macaques and other monkeys can alter immune function and susceptibility to infection. Both clinical and experimental data show that endocrine variables alter immune function and response. For example, both estrogens and androgens act to suppress cell-mediated immunity, and sex hormones influence immune-mediated pathologic conditions. Pituitary hormones also play a role, as

prolactin is an immunoregulator and growth hormone acts directly to regulate T-cell function. Current indications are that the hypothalamic-pituitary-gonadal-thymic axis has an important role in the hormonal regulation of immune function, and spontaneous variations in activity of the hypothalamic-pituitary-gonadal axis are characteristic of many species. For example, rhesus macaques exhibit an annual mating cycle in association with which mature animals exhibit dramatic changes in gonadal, pituitary and hypothalamic activity and, thus, possible changes in immune function.

Apart from possible effects of the physical environment, monkeys housed socially are also exposed to a variety of psychosocial stimuli which may have important consequences for immune function. In this regard, the immune system may be viewed as a major integrative network involved in biological adaptation with a large number of studies, both experimental and clinical, showing that psychosocial variables and/or stress produce both endocrine responses, including changes in adrenal, pituitary and gonadal secretion, and direct effects on humoral and cell-mediated immune responses. Such stimuli induce adaptive hormonal responses and immune alterations via integration with other physiological systems that may, in some instances, increase susceptibility to infection and disease.

Monkeys housed in groups exhibit a social organization including a dominance hierarchy and relatively high rates of social conflict and agonistic behavior. Consequently, stress or potential stress-inducing events may be common, thus providing an ideal setting for the systematic study of these phenomena. These studies are expected to contribute to a better understanding of the increasingly important area of psychoneuroimmunology as well as provide information that can be used to improve the social housing and clinical care of captive primates.

C. INSTITUTIONAL REVIEW COMMITTEES AND ALLOCATION OF RESOURCES

1) Executive Committee

The Yerkes Executive Committee is charged with the overall and general responsibilities in the areas of policy and program planning for the Center. This committee consists of the Center Director (Chair), Associate Director for Scientific Programs, Associate Director for Administration, Division Chiefs, and coordinators for the Field Station and Language Research Center. This committee meets monthly. It is anticipated that Dr. Else will join this committee in 1989. Composition of the committee is as follows:

Executive Committee

Name	Degree	Academic Titles	Department or Division	Institution
F. King (Chair)	Ph.D.	Center Director	Administration	Yerkes
		Professor	Anatomy and Cell Biology	Emory Univ.
		Professor	Psychology	Emory Univ.
		Associate Dean	School of Medicine	Emory Univ.
J. Magnotta	B.A.	Associate Director for Administration	Administration	Yerkes
H. McClure	D.V.M.	Associate Director for Scientific Programs, Research Professor and Chief, Division of Pathobiology and Immunobiology	Pathobiology and Immunobiology	Yerkes
		Assistant Professor	Pathology	Emory Univ.
L. Byrd	Ph.D.	Research Professor and Chief, Division of Behavioral Biology	Behavioral Biology	Yerkes
		Associate Professor	Pharmacology	Emory Univ.
		Adjunct Professor	Psychology	Emory Univ.
		Adjunct Professor	Psychology	Ga. Tech.
K. Gould	D.V.M. Ph.D.	Research Professor and Chief, Division of Reproductive Biology	Reproductive Biology	Yerkes
		Adjunct Professor	Biology	Emory Univ.
B. Swenson	D.V.M.	Associate Research Professor and Chief, Division of Veterinary Medicine	Veterinary Medicine	Yerkes

Executive Committee (Cont'd)

Name	Degree	Academic Titles	Department or Division	Institution
J. Tigges	Ph.D.	Research Professor and Chief, Division of Neurobiology	Neurobiology	Yerkes
		Professor	Anatomy and Cell Biology	Emory Univ.
		Professor	Ophthalmology	Emory Univ.
T. Gordon	M.S.	Assistant Research Professor and Field Station Coordinator	Behavioral Biology	Yerkes
		Adjunct Professor	Psychology	Emory Univ.
D. Rumbaugh	Ph.D.	Affiliate Scientist and Language Research Center Coordinator	Behavioral Biology	Yerkes
		Professor and Chairman	Psychology	Georgia State Univ.

2) Yerkes Animal Resources Committee

The Animal Resources Committee is responsible for the review, evaluation and monitoring of research projects proposed to be conducted at all three Yerkes research sites: the Main Station, the Field Station and the Language Research Center. In addition, the committee is specifically charged with the following responsibilities: (a) evaluate and make recommendations to the Center Director regarding all proposed Center research projects; review of proposals takes into consideration scientific merit, relationship to the Center's mission, funding status, appropriateness of the primate species selected, and the provision of humane treatment to the experimental animals; (b) make recommendations regarding the assignment of primates and housing space for research projects; (c) make recommendations regarding the breeding of primates at the Center; and (d) evaluate and make recommendations on any problems or conflicts that may arise in the area of animal care, housing, support services or research protocols. This committee serves as the primate subcommittee for the Emory University Institutional Animal Care and Use Committee (IACUC). In this capacity, the Yerkes Animal Resources Committee has the responsibility for review of all

Emory University proposals which involve the use of nonhuman primates. It is anticipated that this committee will rotate membership and chairs in future years and that Dr. Else will be added. The composition of this committee is as follows:

Yerkes Animal Resources Committee

Name	Degree	Academic Titles	Department or Division	Institution
H. McClure (Chair)	D.V.M.	Associate Director for Scientific Programs, Research Professor and Chief, Division of Pathobiology and Immunobiology	Pathobiology and Immunobiology	Yerkes
		Assistant Professor	Pathology	Emory Univ.
T. Gordon (Co-Chair)	M.S.	Assistant Research Professor and Field Station Coordinator	Behavioral Biology	Yerkes
		Adjunct Professor	Psychology	Emory Univ.
D. Anderson	D.V.M.	Associate Research Professor	Pathobiology and Immunobiology	Yerkes
L. Byrd	Ph.D.	Research Professor and Chief, Division of Behavioral Biology	Behavioral Biology	Yerkes
		Associate Professor	Pharmacology	Emory Univ.
		Adjunct Professor	Psychology	Emory Univ.
		Adjunct Professor	Psychology	Ga. Tech.
K. Gould	D.V.M. Ph.D.	Research Professor and Chief, Division of Reproductive Biology	Reproductive Biology	Yerkes
		Adjunct Professor	Biology	Emory Univ.

Yerkes Animal Resources Committee (Cont'd)

Name	Degree	Academic Titles	Department or Division	Institution
J. Herndon	Ph.D.	Associate Research Professor	Neurobiology	Yerkes
		Adjunct Assistant Professor	Biology	Emory Univ.
		Adjunct Assistant Professor	Psychology	Emory Univ.
J. Magnotta (ex officio)	B.A.	Associate Director for Administration	Administration	Yerkes
R. Nadler	Ph.D.	Research Professor	Reproductive Biology	Yerkes
		Adjunct Associate Professor	Psychology	Emory Univ.
J. Roberts (ex officio)		Superintendent	Main Station Animal Care Unit	Yerkes
D. Rumbaugh	Ph.D.	Affiliate Scientist and Language Research Center Coordinator	Behavioral Biology	Yerkes
		Professor and Chairman	Psychology	Georgia State Univ.
S. Smith (ex officio)		Superintendent	Field Station Animal Care Unit	Yerkes
B. Swenson	D.V.M.	Associate Research Professor and Chief, Division of Veterinary Medicine	Veterinary Medicine	Yerkes
J. Tigges	Ph.D.	Research Professor and Chief, Division of Neurobiology	Neurobiology	Yerkes
		Professor	Anatomy and Cell Biology	Emory Univ.
		Professor	Ophthalmology	Emory Univ.

3) Yerkes AAALAC Accreditation Committee

This Committee was formally established to analyze the deficiencies and needs of the Center in order to obtain AAALAC accreditation, and to set a timetable and plan for the achievement of the required improvements. Although full AAALAC accreditation has been received, this committee has remained active. The committee meets at least two times per year to review animal housing facilities and animal use to assure that full AAALAC accreditation is maintained. It is anticipated that Dr. Else will join this committee in 1989. The composition of this Committee is as follows:

Yerkes AAALAC Accreditation Committee

Name	Degree	Academic Titles	Department or Division	Institution
H. McClure (Chair)	D.V.M.	Associate Director for Scientific Programs; Research Professor and Chief, Division of Pathobiology and Immunobiology	Pathobiology and Immunobiology	Yerkes
		Assistant Professor	Pathology	Emory Univ.
B. Swenson	D.V.M.	Associate Research Professor and Chief, Division of Veterinary Medicine	Veterinary Medicine	Yerkes
J. Roberts		Superintendent	Main Station Animal Care Unit	Yerkes
S. Smith		Superintendent	Field Station Animal Care Unit	Yerkes
J. Magnotta	B.A.	Associate Director for Administration	Administration	Yerkes
T. Gordon	M.S.	Assistant Research Professor and Field Station Coordinator	Behavioral Biology	Yerkes
		Adjunct Professor	Psychology	Emory Univ.

4) Computer Committee

This committee reviews all base grant computer purchases and coordinates computer use at the Yerkes Main Station and Field Statio The committee is also available as a resource to any investigator wh needs information about computers. The composition of this committe is as follows:

Computer Committee

Name	Degree	Academic Titles	Department or Division	Institut
R. Boothe (Chair)	Ph.D.	Associate Research Professor	Neurobiology	Yerkes
		Associate Professor	Psychology	Emory Un
		Assistant Professor	Ophthalmology	Emory Un
R.Buddington	Ph.D.	Administrative Associate	Administration	Yerkes
J. Herndon	Ph.D.	Associate Research Professor	Neurobiology	Yerkes
		Adjunct Assistant Professor	Biology	Emory Uni
		Adjunct Assistant Professor	Psychology	Emory Uni
V. Speck	B.A.	Electronics Shop Technician	Biomedical Engineering	Yerkes
E. Smith	Ph.D.	Associate Research Professor	Behavioral Biology	Yerkes
		Associate Professor	Anthropology	Emory Uni
		Adjunct Associate Professor	Biology	Emory Uni
J. Magnotta	B.A.	Associate Director for Administration	Administration	Yerkes

5) Library Committee

This committee provides guidance with regard to the library needs of the scientific and veterinary staff, and makes recommendations on journal and volume purchases, and library policies and procedures. T composition of this committee is as follows:

Library Committee

Name	Degree	Academic Titles	Department or Division	Institution
E. Smith (Chair)	Ph.D.	Associate Research Professor	Behavioral Biology	Yerkes
		Associate Professor	Anthropology	Emory Univ.
		Adjunct Associate Professor	Biology	Emory Univ.
J. Herndon	Ph.D.	Associate Research Professor	Neurobiology	Yerkes
		Adjunct Assistant Professor	Biology	Emory Univ.
		Adjunct Assistant Professor	Psychology	Emory Univ.
N. Johns		Librarian	Administration	Yerkes
J. Magnotta	B.A.	Associate Director for Administration	Administration	Yerkes
B. Swenson	D.V.M.	Associate Research Professor and Chief, Division of Veterinary Medicine	Veterinary Medicine	Yerkes
M. Wilson	Ph.D.	Assistant Research Professor	Behavioral Biology and Reproductive Biology	Yerkes
		Associate in Medicine	Endocrinology	Emory Univ.

6) Affirmative Action Committee

The three main areas of responsibility of this committee include: (1) to serve as a vehicle for the proper disposition of complaints or grievances by employees concerning discrimination on the basis of race or sex; (2) to monitor the Center's implementation of Policies for Faculty Appointments and Promotions as approved by the Office of Equal Opportunity Programs; and (3) to provide for communication between the administration of the Center and the Office of Equal Opportunity Programs with regard to University policies on hiring, promotion and personnel matters. The composition of this committee is as follows:

Affirmative Action Committee

Name	Degree	Academic Titles	Department or Division	Institution
D. Anderson (Chair)	D.V.M.	Associate Research Professor	Pathobiology and Immunobiology	Yerkes
D. Houseworth		Asst. Superintendent	Animal Care	Yerkes
K. Pralinsky	B.A.	Assistant Superintendent, Main Station	Physical Plant	Yerkes
F. Jewell		Receptionist	Administration	Yerkes
J. Magnotta (ex officio)	B.A.	Associate Director for Administration	Administration	Yerkes

7) Main Station Space Utilization Task Force

This task force was established to survey, evaluate and make recommendations to the Director's office regarding space utilization at the Yerkes Main Station. It carried out its tasks extrememly well. The need for such a group was necessitated by a substantial increase in animal housing space and number of research projects during the past few years, with no increase in laboratory, office and support services space. The task force was charged with the responsiblity of assessing the utilization of all areas of the Main Station and formulation of recommendations regarding any changes needed to maximize and more efficiently use the presently available space. It is anticipated that this Task Force will no longer be required in 1989, and will be discontinued. The composition of this task force has been as follows:

Main Station Space Utilization Task Force

Name	Degree	Academic Titles	Department or Division	Institution
J. Tigges (Chair)	Ph.D.	Research Professor and Chief, Division of Neurobiology	Neurobiology	Yerkes
		Professor	Anatomy and Cell Biology	Emory Univ.
		Professor	Ophthalmology	Emory Univ.

Main Station Space Utilization Task Force (Cont'd)

Name	Degree	Academic Titles	Department or Division	Institution
L. Byrd (Co-Chair)	Ph.D.	Research Professor and Chief, Division of Behavioral Biology	Behavioral Biology	Yerkes
		Associate Professor	Pharmacology	Emory Univ.
		Adjunct Professor	Psychology	Emory Univ.
		Adjunct Professor	Psychology	Ga. Tech.
K. Gould	D.V.M. Ph.D.	Research Professor and Chief, Division of Reproductive Biology	Reproductive Biology	Yerkes
		Adjunct Professor	Biology	Emory Univ.
J. Magnotta	B.A.	Associate Director for Administration	Administration	Yerkes
H. McClure	D.V.M.	Associate Director for Scientific Programs; Research Professor and Chief, Division of Pathobiology and Immunobiology	Pathobiology and Immunobiology	Yerkes
		Assistant Professor	Pathology	Emory Univ.
B. Swenson	D.V.M.	Associate Research Professor and Chief, Division of Veterinary Medicine	Veterinary Medicine	Yerkes

8) Task Force on 1988 Budget

Due to projected changes for FY 1988-89 in the Center's Base Grant budget, this task force was charged with the responsibility of critically and thoroughly evaluating all aspects of the Center's operating costs. Following this evaluation, recommendations were made to the Director concerning the allocation of funds in the most efficient manner. It is anticipated that Dr. Else will be joining this group in 1989. The composition of this task force is as follows:

1988 Budget Task Force

Name	Degree	Academic Titles	Department or Division	Institution
J. Magnotta (Chair)	B.A.	Associate Director for Administration	Administration	Yerkes
T. Gordon	M.S.	Assistant Research Professor and Field Station Coordinator	Behavioral Biology	Yerkes
		Adjunct Professor	Psychology	Emory Univ.
H. McClure	D.V.M.	Associate Director for Scientific Programs; Research Professor and Chief, Division of Pathobiology and Immunobiology	Pathobiology and Immunobiology	Yerkes
		Assistant Professor	Pathology	Emory Univ.
B. Swenson	D.V.M.	Associate Research Professor and Chief, Division of Veterinary Medicine	Veterinary Medicine	Yerkes

9) Animal Records Committee

The committee's charge is to develop an animal records system that can be adapted for computer use to facilitate storage, retrieval and processing of animal records relating to husbandry and mangagement, medical history and research utilization. It is anticipated that Dr. Else will join this committee in 1989, and Dr. Buddington as well. The composition of this committee is as follows:

Animal Records Committee

B. Swenson (Chair)	D.V.M.	Associate Research Professor and Chief, Division of Veterinary Medicine	Veterinary Medicine	Yerkes
T. Gordon	M.S.	Assistant Research Professor and Field Station Coordinator	Behavioral Biology	Yerkes
		Adjunct Professor	Psychology	Emory Univ.

Animal Records Committee (Cont'd)

Name	Degree	Academic Titles	Department or Division	Institution
R. Boothe	Ph.D.	Associate Research Professor	Neurobiology	Yerkes
		Associate Professor	Psychology	Emory Univ.
		Assistant Professor	Ophthalmology	Emory Univ.
H. McClure	D.V.M.	Associate Director for Scientific Programs; Research Professor and Chief, Division of Pathobiology and Immunobiology	Pathobiology and Immunobiology	Yerkes
		Assistant Professor	Pathology	Emory Univ.
G. Cannon	B.S.	Animal Records Registrar	Veterinary Medicine	Yerkes

10) Biohazard Safety Committee

The Biohazard Safety Committee was formed in 1986 to monitor the use, storage and disposal of hazardous materials at the Primate Center to insure that all Yerkes laboratories are in full compliance with OSHA and EPA regulations governing safety in the laboratory. The composition of this committee is as follows:

Biohazard Safety Committee

Name	Degree	Academic Titles	Department or Division	Institution
M. Wilson (Chair)	Ph.D.	Assistant Research Professor	Behavioral Biology and Reproductive Biology	Yerkes
		Associate in Medicine	Endocrinology	Emory Univ.
D. Anderson	D.V.M.	Associate Research Professor	Pathobiology and Immunobiology	Yerkes

Biohazard Safety Committee (Cont'd)

Name	Degree	Academic Titles	Department or Division	Institution
K. Pralinsky	B.A.	Assistant Superintendent, Main Station	Physical Plant	Yerkes
J. Magnotta	B.A.	Associate Director for Administration	Administration	Yerkes

II) Ophthalmology Research Laboratory Building Use Committee

The responsibility of this committee is to consider and make assignments of space in the Ophthalmology Research Laboratory Building on the Yerkes premises to assure cooperation and smooth coordination of scientific projects conducted by Yerkes core faculty and members of the Emory University Department of Ophthalmology. In matters in which the committee cannot reach agreement among the members, these are taken to the Director of the Yerkes Center and the Chairman of the Department of Ophthalmology for adjudication. The composition of this committee is as follows:

Ophthalmology Building Use Committee

Name	Degree	Academic Titles	Department or Division	Institution
H. McClure	D.V.M.	Associate Director for Scientific Programs; Research Professor and Chief, Division of Pathobiology and Immunobiology	Pathobiology and Immunobiology	Yerkes
		Assistant Professor	Pathology	Emory Univ.
J. Magnotta	B.A.	Associate Director for Administration	Administration	Yerkes
B. McCarey	Ph.D.	Affiliate Scientist	Pathobiology and Immunobiology	Yerkes
		Associate Professor	Ophthalmology	Emory Univ.
D. Broussard	---	Department Administrator	Ophthalmology	Emory Univ.

12) Summer Internship Committee

This committee is charged with the responsibility of evaluating applicants for the Yerkes summer internship program; selection of the most outstanding applicants for which positions are available and making recommendations to the Director concerning the selected applicants and the Yerkes Division or investigator to whom the applicants could most appropriately be assigned. The composition of this committee is as follows:

Summer Internship Committee

Name	Degree	Academic Titles	Department or Division	Institution
L. Byrd (Chair)	Ph.D.	Research Professor and Chief, Division of Behavioral Biology	Behavioral Biology	Yerkes
		Associate Professor	Pharmacology	Emory Univ.
		Adjunct Professor	Psychology	Emory Univ.
		Adjunct Professor	Psychology	Ga. Tech.
D. Anderson	D.V.M.	Associate Research Professor	Pathobiology and Immunobiology	Yerkes
M. Tigges	Ph.D.	Associate Research Professor	Neurobiology	Yerkes
		Associate Professor	Anatomy and Cell Biology	Emory Univ.

D. DISSEMINATION OF INFORMATION

As in past years, the Center has continued to use the following mechanisms for the dissemination of information:

1) Brochures and literature are distributed to Yerkes staff, all officers and departments of Emory University, other universities, institutions, public mailing list, legislators, professional societies and associates.

2) Articles are published in NIH and Emory University publications and in newspapers and magazines.

3) Lectures and videotape and slide presentations are presented at other institutions and to the public, as well as at scientific and professional meetings.

4) Seminar programs on behavioral biology of primates and the Yerkes visiting speaker series are scheduled throughout the year.

Additional documents on Center research programs, the conduct of research and animal care at the Center, the importance and benefits of animals to human health, and primate contributions to human health have been developed for distribution to faculty and staff, the news media and the general public, as needed.

A detailed "Application to Conduct Research at the Yerkes Center" has been developed and distributed to all Center faculty; this document is also distributed to departmental chairmen at Emory and other regional universities, and is provided to all investigators interested in initiating research projects at the Center. This application includes information on research opportunities at the Center, criteria for the use of primates in research, Center access policy, standards and procedures for working with nonhuman primates, guidelines for experimental surgery and procedures and guidelines for the preparation and submission of research proposals.

PART II - DESCRIPTION OF PROGRAM ACTIVITIES

APPENDIX TO INSTRUCTIONS OPPE:DRR 06/01/85
DRR SCIENTIFIC CLASSIFICATION

AXIS I

Code Nos.	RESOURCE MATERIAL/RESEARCH AREA (Maximum 6 Codes)
1	Animals
	a. Vertebrates, Mammal
	b. Vertebrates, Non-Mammal
	c. Invertebrates
2	Biological/Chemical Compounds
3	Biomaterials
4	Cells & Subcellular Material
5	Human Subjects
6	Membrane/Tissue/Isolated Organ
7	Microorganisms
	a. Bacteria
	b. Viruses
	c. Parasites
	d. Other
8	Plants/Fungi
9	Technology/Technique Development
10	Other (SPECIFY)
12	Clinical Trials
	a. Multicenter b. Single Center
	ANATOMICAL SYSTEM/RESEARCH AREAS
13	Cardiovascular System
14	Connective Tissue
15	Endocrine System
16	Gastrointestinal System
	a. Esophagus
	b. Gallbladder
	c. Intestine
	d. Liver
	e. Pancreas
	f. Stomach
17	Hematologic System
18	Integumentary System
19	Lymphatic and Recticulo-Endothelial System
20	Muscular System
21	Nervous System
22	Oral/Dental
23	Reproductive System
24	Respiratory System
25	Sensory System
	a. Ear
	b. Eye
	c. Taste/Smell/Touch
26	Skeletal System
27	Urinary System
28	Other (SPECIFY)

AXIS II

Code Nos.	RESEARCH AREAS (Maximum 6 Codes)
30	Aging
32	Anesthesiology
34	Anthropology/Ethnography
36	Behavioral Sci/Psychology/Social Sci
38	Bioethics
39	Biotechnology (rDNA, CDNA, hybridoma)
40	Communication Science
42	Computer Science
44	Congenital Defects or Malformations
46	Degenerative Disorders
48	Device, Protheses, Intra/Extracorporeal
50	Drug Studies
	a. Toxic b. Other c. Orphan Drugs
52	Engineering/Bioengineering
54	Environmental Sciences
	a. Toxic b. Other
56	Epidemiology
58	Genetics, Including Metabolic Errors
60	Growth and Development
62	Health Care Applications
64	Immunology and Allergy
66	Infectious Diseases
68	Information Science
70	Instrument Development
72	Mental Disorders/Psychiatry
74	Metabolism and Transport
	a. Carbohydrate
	b. Electrolyte, Mineral, Water Balance
	c. Enzymes
	d. Gases
	e. Hormone
	f. Lipid
	g. Nucleic Acid
	h. Protein and Amino Acid
76	Neoplasms/Oncology
	a. Benign b. Malignant
78	Nutrition
80	Radiology/Radiation Nuclear Medicine
	a. Ionizing (Xray, Nuclear Reactor)
	b. Non-ionizing (Microwave, Radar)
82	Rehabilitation
84	Statistics/Mathematics
86	Surgery
88	Transplantation
90	Trauma/Burns
92	Other (SPECIFY)

DIVISION OF BEHAVIORAL BIOLOGY

Larry D. Byrd, Ph.D., Chief

Core Faculty:
L. Byrd
I. Bernstein
T. Gordon
E. Savage-Rumbaugh
E. Smith
K. Wallen
M. Wilson

Associate, Affiliate and Collaborative Faculty:

R. Barr	Department of Pediatrics, McGill University
G. Berntson	Departments of Psychology and Pediatrics, Ohio State University
S. Boysen	Department of Psychology, Ohio State University
J. Branch	Yerkes Regional Primate Research Center, Emory University
J. Dahl	Yerkes Regional Primate Research Center, Emory University
C. Ehardt	Department of Anthropology and Linguistics, University of Georgia
D. Estep	Department of Psychology, University of Georgia
H. Gouzoules	Department of Psychology, Emory University
S. Gouzoules	Yerkes Regional Primate Research Center, Emory University
D. Gust	Yerkes Regional Primate Research Center, Emory University
L. Howell	Yerkes Regional Primate Research Center, Emory University
M. Konner	Department of Anthropology, Emory University
T. Maple	School of Psychology, Georgia Institute of Technology, and Zoo Atlanta
M. Marr	School of Psychology, Georgia Institute of Technology
E. Menzel	Department of Psychology, State University of New York at Stony Brook
H. Miles	Department of Anthropology, University of Tennessee at Chattanooga
R. Mitchell	Yerkes Regional Primate Research Center, Emory University
R. Morris	Department of Psychology, Georgia State University
M. Romski	Department of Communication, Georgia State University
D. Rumbaugh	Department of Psychology, Georgia State University
A. Smith	School of Psychology, Georgia Institute of Technology
S. Smith	Terminus Design, Inc., Ellenwood, Georgia
H. Terrace	Department of Psychology, Columbia University
M. Tomasello	Department of Psychology, Emory University
R. Tuttle	Department of Anthropology, Evolutionary Biology and The College, University of Chicago
D. Wenzel	Yerkes Regional Primate Research Center, Emory University
P. Whitten	Department of Obstetrics and Gynecology, Yale University School of Medicine
I. Wundram	Department of Anthropology, Oxford College of Emory University

Visiting Scientist:

E. Toback	Research Department, Los Angeles Zoo

PART II, SECTION A — DRR SCIENTIFIC SUBPROJECT FORM

GRANT NUMBER P 5 1 R R 0 0 1 6 5 - 28

REPORT PERIOD: January 1, 1988 to December 31, 1988

INSTITUTION: Yerkes Regional Primate Research Center

2 Science Code AXIS I	2 Science Code AXIS II	3 (a) Investigator(s) (b) Degree(s) (c) PRC Division/Unit (d) Non-Host Institution	COR E	OTHER	4 Usage Factor Number	4 Usage Factor Species Used	5 ARB Funds Allocated
1a 16c	36 60 74a 78	(a) Barr, Ronald G. Smith, Euclid O. (b) MDCM, FRCP(C) (RGB); Ph.D. (EOS) (c) Behavioral Biology (d) McGill University (RGB)	X	X	4	*Pan troglodytes*	

1. Descriptive Title (80 characters):
Lactose Absorption and Behavior in Infant Chimpanzees (*Pan troglodytes*)

Abstract:

This is an ongoing project to test the primary hypothesis that incomplete lactose absorption can induce distress behavior in infant chimpanzees (*Pan troglodytes*). The hypothesis is being tested using controlled feeding trials in which either the quantity of lactose or the feeding pattern is changed. In addition, measures of hydrogen excretion recorded during control periods will yield new data on whether, and for how long, incomplete lactose absorption occurs under standard nursery feeding conditions. Moreover, behavioral observations enable the characterization of any overt behavioral changes that may be associated with the ingestion of formula with added lactose. During the current phase of the project, each subject is tested at two, four, six and eight weeks of age under three feeding conditions: Control; Lactose 1 (14.0 gm lactose/100 cc); and Lactose 2 (18.0 gm lactose/100 cc). Outcome measures include behavioral states and events, and incomplete lactose absorption as determined by breath-hydrogen analysis. During 1988, three infants were introduced to and completed the protocol. The breath-hydrogen measures from the first five subjects (not including the pilot infant) have been analyzed, and the results suggest that when the infant chimpanzees were subjected to feeding regimens similar to those of humans, lactose was absorbed incompletely in patterns similar to those seen in human infants. However, when infant chimpanzees were placed on more natural, frequent feeding regimens, lactose absorption was more complete. All behavioral measures recorded to date have been entered into a data set in preparation for analysis. The long-range goal of this project is to determine whether changing lactose absorption levels affects infant behavior in an orderly and predictable manner. The results will provide information that will enhance our understanding of a major behavioral problem in human and nonhuman infants.

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GRANT NUMBER P 5 1 R R 0 0 1 6 5 - 28

REPORT PERIOD: January 1, 1988 to December 31, 1988

INSTITUTION: Yerkes Regional Primate Research Center

2 Science Code AXIS I	2 Science Code AXIS II	3 (a) Investigator(s) (b) Degree(s) (c) PRC Division/Unit (d) Non-Host Institution	COR E	OTHER	4 Usage Factor Number	4 Usage Factor Species Used	5 ARB Funds Allocated
1a 15 23	36 60	(a) Bernstein, Irwin S. (b) Ph.D. (c) Behavioral Biology (d) University of Georgia	X		36	*Macaca mulatta*	

1. Descriptive Title (80 characters):
Modification of Abnormal Male Aggressive Behavior

Abstract:

Male rhesus macaques (*Macaca mulatta*), reared in a normal social group in which all adult males were absent, shared abnormal agonistic and social behaviors toward infants and females. This was hypothesized to be due to the lack of specific social learning experience, the socialization of adolescent males by adult males. During late adolescence, an attempt was made to return these males to a normal rearing condition by re-introducing a group of adult males to the social group as a way of providing the essential socialization experiences. It was hypothesized that the natal males would defeat the non-natal males with the aid of their matrilines, but the attempt was made because this was considered by the Research Review Committee to be less stressful than transferring the natal males. Although it appeared that the non-natal males might be able to defeat the natal males during the first few weeks following their re-introduction into the group, the original hypothesis proved correct. The matrilines aided the natal males, and the top matriarch is alpha. During the fall of 1989, the natal males will be transferred, as they normally do in their natural habitats, and the experiment will continue.

PART II, SECTION A — ORR SCIENTIFIC SUBPROJECT FORM

GRANT NUMBER P 5 1 R R 0 0 1 6 5 - 28

REPORT PERIOD: January 1, 1988 to December 31, 1988

INSTITUTION: Yerkes Regional Primate Research Center

2 Science Code AXIS I	2 Science Code AXIS II	3 (a) Investigator(s) (b) Degree(s) (c) PRC Division/Unit (d) Non-Host Institution	CORE	OTHER	4 Usage Factor Number	4 Usage Factor Species Used	5 ARB Funds Allocated
1a 13 21	36 68	(a) Berntson, Gary, G. Boysen, Sarah T. (b) Ph.D. (both) (c) Behavioral Biology (d) Ohio State University (both)		X X	5	*Pan troglodytes*	

1. Descriptive Title (80 characters):

Psychophysiological & Electrophysiological Indices of Cognitive Processes in Apes

Abstract:

The Primate Cognition Project has extended ongoing work on numerical competence in chimpanzees. Studies have included the exploration of motor tagging by a chimpanzee during counting, which established the functional significance of these behaviors relative to analogous behaviors that have been observed in young children during the early stages of learning to count. Studies which addressed a young chimpanzee's representational use of number symbols in two novel counting paradigms were completed. The utilization of transitive inference logic in a study of ordinality was also undertaken and completed during the study period. That study investigated the ability of chimpanzees to recognize an ascending and descending ordinal relationship in a sequence of colored boxes and in an Arabic number series (1-5). In the psychophysiological area, two studies were completed which involved (a) an investigation of the infant chimpanzees' cardiac reactivity patterns when exposed to chimpanzee vocalizations and (b) a more detailed exploration of heart-rate responses to chimpanzee screams and laughter (of wild chimpanzees). Using an auditory-oddball paradigm, studies of event-related potentials (ERPs) in two infant chimpanzees were also completed in conjunction with the heart-rate studies described above.

PART II, SECTION A — DRR SCIENTIFIC SUBPROJECT FORM

GRANT NUMBER P 5 1 R R 0 0 1 6 5 - 28

REPORT PERIOD: January 1, 1988 to December 31, 1988

INSTITUTION: Yerkes Regional Primate Research Center

2 Science Code AXIS I	2 Science Code AXIS II	3 (a) Investigator(s) (b) Degree(s) (c) PRC Division/Unit (d) Non-Host Institution	CORE	OTHER	4 Usage Factor Number	4 Usage Factor Species Used	5 ARB Funds Allocated
1a 23	36 60	(a) Branch, Jane E. (b) Ph.D. (c) Behavioral Biology (d) N/A		X	40	*Macaca mulatta*	

1. Descriptive Title (80 characters):

A Description of Suckling Patterns in Rhesus Mother-Infant Pairs

Abstract:

Although suckling and other mother-infant interactions have been studied extensively in most primate species, little information is available concerning nipple preferences of mothers or infants. The aim of this study was to determine in rhesus monkeys (*Macaca mulatta*) whether individual mother-infant pairs would demonstrate an asymmetrical nipple preference and whether suckling patterns would correspond with the nursing mother's hand preference or the infant's hand preference. Twenty mother-infant pairs served as subjects for this study. Hand preferences were assessed using three food-reaching tasks. Approximately 60% of the mothers used their right hands preferentially, 30% used their left hands preferentially, and 10% demonstrated no reliable hand preference. The hand preferences of the infants were inconsistent, with each animal frequently changing the hand used to execute a task. Each mother-infant pair was observed four times per day for the occurrence of nursing bouts. If nursing occurred during an observation period, the nipple involved was noted. In the majority of suckling bouts recorded before the infant was about two months of age, each infant used one nipple preferentially, and it tended to be the nipple contralateral to the mother's preferred hand. After two months of age, the infants were more likely to distribute their nursing activities between both nipples, spending only a slightly greater proportion of time at the preferred nipple. The findings of this study suggest that nipple preference may be a possible behavioral correlate of cerebral lateralization.

PART II, SECTION A	DRR SCIENTIFIC SUBPROJECT FORM
GRANT NUMBER P 5 1 R R 0 0 1 6 5 - 28	
REPORT PERIOD: January 1, 1988 to December 31, 1988	
INSTITUTION: Yerkes Regional Primate Research Center	

2 Science Code		3 (a) Investigator(s) (b) Degree(s) (c) PRC Division/Unit (d) Non-Host Institution	CORE	OTHER	4 Usage Factor		5 ARB Funds Allocated
AXIS I	AXIS II				Number	Species Used	
1a 21	36	(a) Branch, Jane E. (b) Ph.D. (c) Behavioral Biology (d) N/A		X	8 5	*Pan troglodytes* *Pan paniscus*	

1. Descriptive Title (80 characters):
Hand Preferences in Captive Pygmy and Common Chimpanzees

Abstract:

The purpose of this project was twofold. Firstly, this project sought to describe hand preference in pygmy chimpanzees (*Pan paniscus*), a species of ape for which handedness has yet to be reported. Secondly, an attempt was made to examine the hypothesis that there is a relationship between degree of bipedalism and the existence of a unilateral population hand preference by comparing the hand preferences of the pygmy chimpanzee, which reportedly spends a disproportionate amount of time locomoting in a bipedal posture, with those of the more quadrupedal common chimpanzee (*Pan troglodytes*). Five pygmy chimpanzees and eight common chimpanzees served as subjects. The hand preferences of individual animals were assessed using three different food-reaching tasks, with a minimum of 100 trials per task per animal. Data were analyzed using a Chi-square statistic to ascertain whether each animal used one hand preferentially across tasks and then to determine whether each species demonstrated a hand preference across tasks. The common chimpanzees demonstrated a bimodal pattern of handedness, with approximately half of the animals using their left hands preferentially and half using their right hands preferentially. Three of the four pygmy chimpanzees used their right hands almost exclusively, and one exhibited a tendency to use his left hand preferentially, but this tendency did not achieve statistical significance. The data derived from this study do support the currently controversial hypothesis that there is a relationship between the degree of bipedality exhibited by a species in its natural environment and the degree to which that species exhibits a unilateral hand preference, but the small sample size makes the results difficult to interpret.

PART II, SECTION A — DRR SCIENTIFIC SUBPROJECT FORM

GRANT NUMBER P 5 1 R R 0 0 1 6 5 - 28

REPORT PERIOD: January 1, 1988 to December 31, 1988

INSTITUTION: Yerkes Regional Primate Research Center

2 Science Code AXIS I	2 Science Code AXIS II	3 (a) Investigator(s) (b) Degree(s) (c) PRC Division/Unit (d) Non-Host Institution	COR E	OTHER	4 Usage Factor Number	4 Usage Factor Species Used	5 ARB Funds Allocated
1a 9 20 21	36 60	(a) Branch, Jane E. Patterson, C. Anne Platzman, Kathleen A. (b) Ph.D. (JEB, KAP); M.D. (CAP) (c) Behavioral Biol. (JEB); Pathobiology and Immunobiology (CAP); Reproductive Biol.(KAP) (d) N/A		X X X	15	*Macaca mulatta*	

1. Descriptive Title (80 characters):

Development of a Scale to Assess Rhesus Physical and Neuromotor Development

Abstract:

Although the rhesus monkey has been used frequently as a model for human growth and development, surprisingly few descriptive data have been published on its early neuromotor development. The primary objective of this study was to develop a scale based on the Brazelton Neuromotor Behavioral Assessment Scale, used to describe infant development in humans, which would be useful and valid for describing neuromotor functioning in infant rhesus monkeys. A second aim was to describe the physical and neuromotor development of newborn and infant rhesus monkeys in terms of the onset and offset of behaviors contained in the scale. Using this scale, 15 infant rhesus monkeys (*Macaca mulatta*), maintained in the nursery of the Yerkes Center, were assessed daily for a period of three months. Measures of physical growth, including weight, crown-rump length, abdominal skin-fold thickness and others, were recorded on a weekly basis. Five of the 15 animals were infants of mothers that had served as subjects in a previous study designed to simulate asphyxia by reducing oxygen levels during labor and delivery, which leads to a cerebral palsy-like syndrome in the infant. Data were compiled to provide the mean age in days, range and standard deviation for which the onset and offset of the behaviors occurred. Growth measures were also compiled to show averages at successive weeks of age. These data are in close agreement with the few data published on growth and development in rhesus monkeys, and they suggest that the proposed scale may be a valid and useful scale for investigators who have a need to describe physical and neuromotor development in the rhesus monkey.

PART II, SECTION A — DRR SCIENTIFIC SUBPROJECT FORM

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REPORT PERIOD: January 1, 1988 to December 31, 1988

INSTITUTION: Yerkes Regional Primate Research Center

2 Science Code AXIS I	2 Science Code AXIS II	3 (a) Investigator(s) (b) Degree(s) (c) PRC Division/Unit (d) Non-Host Institution	COREa	OTHERb	4 Usage Factor Number	4 Usage Factor Species Used	5 ARB Funds Allocated
1a 2 13 15 21	36 50b 54b 72	(a) Byrd, Larry D. Howell, Leonard L. (b) Ph.D. (both) (c) Behavioral Biology (d) N/A	X	X	30 2	*Saimiri sciureus* *Pan troglodytes*	

1. Descriptive Title (80 characters):
Behavioral and Physiological Concomitants of Drug Abuse

Abstract:

The objective of this research is to characterize the effects selected drugs can have on the central nervous system of conscious nonhuman primates by studying the effects of these drugs on learned behavior, to determine the effects the drugs can have on heart rate, arterial blood pressure and core temperature at doses that have effects on behavior mediated via the central nervous system, and to determine whether the behavioral, cardiovascular or thermoregulatory effects are enhanced, diminished or blocked by other drugs or by behavioral procedures. Methods used have included the direct measurement of arterial blood pressure and heart rate as indices of cardiovascular activity, the direct measurement of colonic temperature as an index of thermoregulatory activity, and learned, schedule-controlled behavior as an index of central nervous system activity. Experiments have demonstrated the involvement of the dopamine system in the behavioral and reinforcing effects of cocaine through the use of specific dopamine agonists and antagonists. Among the antagonists studied were Sch 23390 (D_1), spiperone (D_2), raclopride (D_2) and haloperidol (D_1 and D_2). Agonists included SKF 38393 (D_1) and apomorphine (D_1 and D_2). This research is now beginning to identify drugs that can block or attenuate the effects of cocaine. In addition to developing appropriate animal models for studying the effects of drugs, the project also uses the animal models to generate a better understanding of the effects certain types of drugs can have in humans and animals, and to identify ways in which undesirable effects of the drugs can be attenuated. The long-range objective is to characterize the behavioral, cardiovascular and thermoregulatory effects of various drugs that may have abuse liability or that may have therapeutic value in treating drug abuse.

PART II, SECTION A	DRR SCIENTIFIC SUBPROJECT FORM
GRANT NUMBER P 5 1 R R 0 0 1 6 5 - 28	
REPORT PERIOD: January 1, 1988 to December 31, 1988	
INSTITUTION: Yerkes Regional Primate Research Center	

2 Science Code		3			4 Usage Factor		5
AXIS I	AXIS II	(a) Investigator(s) (b) Degree(s) (c) PRC Division/Unit (d) Non-Host Institution	COR E	OTH ER	Number	Species Used	ARB Funds Allocated
1a 21 24	50b	(a) Byrd, Larry D. Howell, Leonard L. (b) Ph.D. (both) (c) Behavioral Biology (d) N/A	X	X	4	*Macaca mulatta*	

1. Descriptive Title (80 characters):
Respiratory Stimulant Effects of Methylxanthines

Abstract:

Methylxanthines are valuable therapeutic agents used to treat respiratory depression, and are especially useful in the treatment of bronchial asthma and breathing difficulties in newborn infants. Previous studies have indicated that methylxanthines stimulate respiration directly by altering sensitivity to carbon dioxide, but the specific mechanisms that mediate this effect have not been clearly identified. Research is ongoing to determine the role of endogenous adenosine and phosphodiesterase inhibition in methylxanthine-induced changes in carbon dioxide sensitivity. Ventilation in unanesthetized monkeys is monitored continuously using a pressure-displacement head plethysmograph, and drug effects on ventilation are recorded during exposure to normal atmospheric conditions and during exposure to elevated concentrations of carbon dioxide in inspired air. Baseline measures of respiratory frequency, tidal volume and minute volume during exposure to air or 3%, 4% and 5% carbon dioxide balanced in air have been determined in four monkeys. The effects of a full range of doses of caffeine on these measures of ventilation have also been determined. During the next eight months, studies will assess the effects of selected methylxanthines that differ in relative affinity for adenosine receptor subtypes ($A_1\backslash A_2$) and in potency as adenosine antagonists or phosphodiesterase inhibitors. The objective of this research project is to characterize in a nonhuman primate model, the rhesus monkey, the respiratory effects of caffeine and other selected methylxanthines and to investigate the biochemical mechanisms that mediate these effects. The results will provide information regarding the neurochemical basis of respiratory function and will increase the likelihood of improving pharmacological intervention in pathological states of respiratory control in humans and in nonhuman subjects.

PART II, SECTION A — DRR SCIENTIFIC SUBPROJECT FORM

GRANT NUMBER P 5 1 R R 0 0 1 6 5 - 28

REPORT PERIOD: January 1, 1988 to December 31, 1988

INSTITUTION: Yerkes Regional Primate Research Center

2 Science Code AXIS I	2 Science Code AXIS II	3 (a) Investigator(s) (b) Degree(s) (c) PRC Division/Unit (d) Non-Host Institution.	COR	OTHER	4 Usage Factor Number	4 Usage Factor Species Used	5 ARB Funds Allocated
1a 2 13 15 21	36 50b 54b 72	(a) Byrd, Larry D. Howell, Leonard L. (b) Ph.D. (both) (c) Behavioral Biology (d) N/A	X	X	30	*Saimiri sciureus*	

1. Descriptive Title (80 characters):
Behavioral Modulation of Cardiovascular Activity

Abstract:

The central nervous system is known to be the source of control of learned behavior, especially as differentiated from spinal or reflexive behavior. The central nervous system is also recognized now as being involved in the regulation of cardiovascular activity, especially the regulation of blood pressure and heart rate. How the modulation of cardiovascular activity becomes integrated with or influenced by ongoing, centrally-mediated behavior is not well understood. Laboratory studies have identified behavioral procedures that can induce increases and decreases in arterial blood pressure and heart rate during daily periods in a controlled environment. Experiments are underway to study the development of decreased cardiovascular activity in the squirrel monkey, to identify factors determining its development, and to identify conditions under which decreases can be maximized. The long-range objective of this research is to characterize relations between changes in cardiovascular activity and ongoing behavioral processes.

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2 Science Code AXIS I	2 Science Code AXIS II	3 (a) Investigator(s) (b) Degree(s) (c) PRC Division/Unit (d) Non-Host Institution	COR E	OTHER	4 Usage Factor Number	4 Usage Factor Species Used	5 ARB Funds Allocated
1a 2 9 21 25b	30 36 46 50b 72	(a) Byrd, Larry D. Branch, Jane E. Smith, Anderson D. Marr, M. Jackson (b) Ph.D. (all) (c) Behavioral Biology (d) Georgia Institute of Technology (ADS, MJM)	X	X X X	10	*Macaca mulatta*	

1. Descriptive Title (80 characters):

Recall and Recognition in Aged Rhesus Monkeys

Abstract:

The rapid increase in the elderly population in the United States has made a valid animal model of memory essential for developing and testing strategies to alleviate severe memory impairment. Since studies of memory typically have involved linguistically-competent human subjects, mnemonic processes have been confounded with linguistic ability. Studies on human and animal memory have demonstrated remarkable similarities in human and nonhuman memory processes, and they indicate that findings derived from animal experiments, which are not confounded by linguistic ability, can enhance our understanding of human memory. The present, ongoing project has attempted to develop the rhesus monkey (*Macaca mulatta*) as a model for studying human memory by examining the performances of old, mid-age and young animals on a delayed-recall task which is similar to tasks commonly used to study human memory. The methodology used in this study is based on a touch-sensitive cathode ray tube (CRT) upon which a microcomputer displays visual stimuli that a subject must recall and reproduce after an intervening period of time (delay) has elapsed. High levels of accuracy on the recall task following very brief delays are characteristic of all three age groups. Accuracy levels declined with increasing delays for all age groups, although the decline was more pronounced for the oldest animals. Similar results are often obtained with humans performing analogous tasks. Several pharmacologic compounds were tested to determine their potential effect on test performance and to enhance our understanding of the neuropharmacology of memory and aging.

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2 Science Code AXIS I	2 Science Code AXIS II	3 (a) Investigator(s) (b) Degree(s) (c) PRC Division/Unit (d) Non-Host Institution	COOPERE	OTHER	4 Usage Factor Number	4 Usage Factor Species Used	5 ARB Funds Allocated
1a 23	36	(a) Estep, Daniel Q. Hambright, M. Karen (b) Ph.D. (DQE); M.S (MKH) (c) Behavioral Biology (d) University of Georgia (both)		X X	20	*Macaca arctoides*	

1. Descriptive Title (80 characters):
Pilot Observations of Social and Sexual Behavior in Stumptail Macaques

Abstract:

This project was an extension of research on stumptail macaques conducted previously to fulfill the requirements for an M.S. degree (see Hambright, 1988). The objectives were to (1) reestablish an adequate level of interobserver reliability for behavior categories and individual animals, (2) collect pilot data for the further development of a subsequent investigation of the form, function and contextual correlates of copulatory, agonistic behavior in stumptail macaques, and (3) determine the feasibility of research protocols for such an investigation. Subjects were 20 adult members of a social group of stumptail macaques maintained at the Yerkes Field Station. To achieve these objectives, dominance data (winner-lose outcomes of dyadic, agonistic interactions) were recorded using *ad libitum* sampling, and the group was scanned for all occurrences of copulatory behavior (defined as the occurrence of an intromissive mount of a female by a male). The contextual association of agonistic behavior and copulation was defined based on time rules used by Hambright (1988). All data have been collected, and analysis is currently underway. The results will be used to increase the reliability of measures to be obtained for a doctoral dissertation project. Data collected on dominance relationships will contribute to the longitudinal record of dominance relationships in this group and to the data base of the subsequent dissertation project. Moreover, observational data collected on rates of copulatory behavior in undisturbed conditions will be used to determine whether the dissertation project will be a long-term, non-manipulative study, a short-term manipulative study, or some combination of both.

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2 Science Code AXIS I	2 Science Code AXIS II	3 (a) Investigator(s) (b) Degree(s) (c) PRC Division/Unit (d) Non-Host Institution	COR E	OTHER	4 Usage Factor Number	4 Usage Factor Species Used	5 ARB Funds Allocated
1a 15 23	36	(a) Gordon, Thomas P. Gust, Deborah A. Wilson, Mark E. (b) M.S. (TPG); Ph.D. (DAG, MEW) (c) Behavioral Biology (TPG, DAG); Behavioral Biology & Reproductive Biology (MEW) (d) N/A	X X	X	24	*Macaca mulatta*	

1. Descriptive Title (80 characters):
Factors Influencing Primate Reproduction

Abstract:

The objective of this research project is to elucidate the proximate variables that control or influence reproductive phenomena in Old World monkeys in order to provide a basis for interpreting the functional significance of primate reproductive mechanisms from the perspective of evolutionary biology. Social, environmental and endocrine variables are being examined, both independently and in confluence, to determine the effects which these factors exert on sexual behavior, gonadal function and individual reproductive success. Ovulatory function is assessed by monitoring both ovarian and pituitary gonadotropic hormones as well as other hormones, including prolactin and pineal melatonin, that have been implicated in the control of primate reproduction. To examine the temporal relationship among estradiol (E2), growth hormone (GH) and somatomedin-C (Sm-C) and how this relationship may be altered by age and reproductive status, three groups of female rhesus monkeys (Young: 4 years of age; Prime: 9 years of age; Old: 20 years of age) were studied from January through June, 1988, a period encompassing the annual change from ovulatory to anovulatory status. The reproductive pattern was similar among groups: ovulatory cycles were observed from January through April, and anovulation with low levels of E2 were noted thereafter. Neither GH nor Sm-C exhibited a seasonal change. However, significant age differences were observed, with GH and Sm-C highest in the Young group, intermediate in the Prime and lowest in the Old. Attention has also focused on the relationships between social dominance and reproductive success, and the hypothesis that low status and/or absence of social support may induce stress and negatively affect reproduction. These studies have confirmed that both rank and kinship influence social behavior, feeding, and physiological indices of arousal such as cortisol.

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2 Science Code AXIS I	2 Science Code AXIS II	3 (a) Investigator(s) (b) Degree(s) (c) PRC Division/Unit (d) Non-Host Institution	COR	OTHER	4 Usage Factor Number	4 Usage Factor Species Used	5 ARB Funds Allocated
		(a) Gordon, Thomas P.	X				
1a	36	Gust, Deborah A.		X	36	*Cercocebus*	
15	62	McClure, Harold M.	X			*atys*	
	64	Wilson, Mark E.	X				
		(b) M.S. (TPG); Ph.D. (DAG, MEW); D.V.M. (HMM)			12	*Macaca mulatta*	
		(c) Behav. Biol. (TPG,DAG); Pathobiol. & Immunobiol (HMM); Behav. Biol. and Reprod. Biol. (MEW)					
		(d) N/A					

1. Descriptive Title (80 characters):

Social and Endocrine Effects on Immune Function

Abstract: This work is predicated on several related observations that provide compelling evidence that factors inherent in typical housing environments of macaques and other monkeys can alter immune function and susceptibility to infection. There is a growing body of data, both clinical and experimental, showing that endocrine variables alter immune function and response. For example, both estrogens and androgens act to suppress the cell-mediated immune system, and sex hormones influence immune-mediated pathological conditions. Pituitary hormones also play a role, as prolactin is an immunoregulator and growth hormone acts directly to regulate T-cell function. The current picture indicates that the hypothalamic-pituitary-gonadal-thymic axis has an important role in the hormonal regulation of immune function, and spontaneous variations in activity of the hypothalamic-pituitary-gonadal axis are characteristics of many species. For example, rhesus macaques exhibit an annual mating cycle in association with which mature animals exhibit dramatic changes in gonadal, pituitary and hypothalamic activity and, thus, possible changes in immune function. Apart from possible effects of the physical environment, monkeys housed socially are also exposed to a variety of psychosocial stimuli which may have important consequences for immune function. In this regard, the immune system may be viewed as a major integrative network involved in biological adaptation with a large number of studies, both experimental and clinical, showing that psychosocial variables and/or stress produce both endocrine responses, including changes in adrenal, pituitary and gonadal secretion, and direct effects on humoral and cell-mediated immune responses. Such stimuli induce adaptive hormonal responses and immune alterations via integration with other physiological systems that may, in some instances, increase susceptibility to infection and disease. Monkeys housed in groups exhibit a social organization including a dominance hierarchy and relatively high rates of social conflict and agonistic behavior. Consequently, stress or potential stress-inducing events may be common, thus providing an ideal setting for the systematic study of these phenomena.

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2 Science Code		3			4 Usage Factor		5
AXIS I	AXIS II	(a) Investigator(s) (b) Degree(s) (c) PRC Division/Unit (d) Non-Host Institution	COREE	OTHER	Number	Species Used	ARB Funds Allocated
1a	36 40	(a) Gouzoules, Harold T. Gouzoules, Sarah M. (b) Ph.D. (both) (c) Behavioral Biology (d) None		X X	68	*Macaca nemestrina*	

1. Descriptive Title (80 characters):
Ontogeny of Semantic Communication in Primate Aggression

Abstract:

This ongoing project continued to investigate scream vocalizations emitted by pigtail macaques (*Macaca nemestrina*) during agonistic encounters using spectrographic and multivariate analyses. These vocalizations are an important factor in the recruitment of support from allies against opponents. Screams recorded from 45 monkeys living in a stable, captive group at the Yerkes Field Station were classified using direct discriminant analysis. The pigtail macaques used acoustically-distinct classes of screams depending upon features of the agonistic context; four types of screams were associated with the relative rank of the opponent and the severity of the aggressive encounter. A comparison of the pigtail macaque screams with those of rhesus macaques (*M. mulatta*) revealed that the acoustic features of the calls used by the two species in identical agonistic contexts were very different. For example, matrilineal kinship did not appear to be related to specific call types in pigtail macaques as it did for rhesus macaque screams. There were significantly more classification errors for the calls of monkeys under three years of age than for those of older monkeys in each of the four agonistic contexts. Calls which were correctly classified into the four agonistic contexts were assigned a significantly higher probability for older monkeys, suggesting that the calls of older monkeys were closer to the "prototype" for a particular context than were those of younger monkeys. Proper contextual usage and the emission of screams appear to undergo developmental modification. Among juveniles, females were found to be more proficient than males both in the proper contextual usage and in the production of recruitment screams. These differences in phonological and semantic usage suggest a nonhuman primate model for understanding sex-related differences in the development of communicative competence in humans.

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2 Science Code AXIS I	2 Science Code AXIS II	3 (a) Investigator(s) (b) Degree(s) (c) PRC Division/Unit (d) Non-Host Institution	COOPERE	OTHER	4 Usage Factor Number	4 Usage Factor Species Used	5 ARB Funds Allocated
1a	36	(a) Gouzoules, Harold T. Gouzoules, Sarah M. St. Andre, Elizabeth J. (b) Ph.D. (HTG, SMG); M.A. (EJSA) (c) Behavioral Biology (d) N/A		X X X	75	*Macaca mulatta*	

1. Descriptive Title (80 characters):
Kin Recognition in Primates

Abstract:

Although it is well known that many Old World monkeys, especially females, behave preferentially toward their maternally-related kin, there is less evidence to support paternally-related kin recognition in these species. This project attempted to ascertain whether young rhesus monkeys (*Macaca mulatta*) are able to recognize their paternally-related siblings and how gender might influence such kin recognition. The subjects consisted of 23 immature members of a captive group of rhesus monkeys living in a large, outdoor compound at the Yerkes Field Station. Paternity was determined using blood-typing reagents and a serum protein polymorphism developed for designating paternity in rhesus monkeys. Focal-animal data on the frequency and duration of behaviors were recorded blind for all interactions between subjects. The results indicated that dyads of paternally-related female siblings engaged in grooming and were in proximity more frequently and for longer periods of time than were non-sibling dyads. Moreover, there were consistent trends for contact, approach and play behaviors. Paternally-related female sibling dyads engaged in these behaviors more frequently than did non-sibling dayds, while male-female dyads showed the opposite pattern. There was no clear preference for paternally-related siblings or non-siblings in the small number of male-male dyads studied. Results of this study suggest that female rhesus monkeys have some ability to recognize their paternally-related siblings. Whether or not such recognition extends to patterns of agonistic aiding is the focus of the current study.

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2 Science Code		3			4 Usage Factor		5
AXIS I	AXIS II	(a) Investigator(s) (b) Degree(s) (c) PRC Division/Unit (d) Non-Host Institution	COR	OTHER	Number	Species Used	ARB Funds Allocated
1a	36	(a) Gust, Deborah A. Gordon, Thomas P. (b) Ph.D. (DAG); M.S. (TPG) (c) Behavioral Biology (d) N/A	X	X	16	*Pan troglodytes*	

1. Descriptive Title (80 characters):
An Investigation of Choice in a Captive Group of Chimpanzees

Abstract:

Choice related to food acquisition is an externally valid means by which to investigate cognitive abilities in chimpanzees. Although a large body of work exists concerning forging by chimpanzees in the wild, most studies have not been able to quantify food availability over time in designated food patches and, therefore, cannot relate food availability to decision-making regarding foraging. Foraging theories have been tested primarily using single subjects under controlled conditions. In order to assess whether these theories could be applied to the behavior of a social group of chimpanzees (*Pan troglodytes*), three feeding apparatuses located along three of the four sides of an outdoor compound served as simulated food patches. The subjects' responses to a simulated depletion of one food patch while the amount of food in the other two patches remained constant (representing the average of the habitat) generally conformed to the Marginal Value Theorem which states that an animal will leave a food patch when its instantaneous rate of gain falls below the average of the habitat. Single-subject studies have demonstrated that, when given a choice, animals will select the food reinforcement with the briefest delay. This concept, delay to reinforcement, was investigated under social conditions in a group of chimpanzees using a procedure in which food was available immediately in one feeding apparatus and, depending upon the treatment, after 15, 60, 120 or 180 seconds had elapsed in a second apparatus. There was no significant difference in the proportion of animals that chose either station during any of the treatment delays. However, when a single chimpanzee that regularly chose the station associated with the delay was tested alone, she selected the station which offered immediate reinforcement. These data provide valuable information concerning the cognitive abilities of chimpanzees and the role social factors can play in choice regarding foraging.

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1a	36 54b	(a) Maple, Terry L. (b) Ph.D. (c) Behavioral Biology (d) Georgia Institute of Technology and Zoo Atlanta		X	14	*Gorilla gorilla*	

1. Descriptive Title (80 characters):
Post-occupancy Evaluation of Gorilla Exhibits

Abstract:

A post-occupancy evaluation was conducted to quantify the adjustment of fourteen gorillas to new, naturalistic surroundings at Zoo Atlanta. Thirteen of the gorillas are on loan to the Zoo from the Yerkes Regional Primate Research Center. A preliminary analysis of the data has revealed the following: (1) the gorillas have continued to explore the novel environment on a stable basis for six months; (2) the gorillas steadily, but cautiously, explored much of their enclosure, but they exhibited habitual tendencies to occupy certain locations and resisted the opportunity to explore the entire enclosure; and (3) there were marked group differences in the animals' propensity to explore and distribute themselves throughout the enclosure, with one group exhibiting considerable reticence to disperse. It is hypothesized that the male which led the group members, with other males on each side, may have been more wary about losing females to his competition. Based on these very preliminary results and on more detailed, ongoing data analysis, it is apparent that the naturalistic habitat has facilitated the expression of natural behaviors in the gorilla inhabitants.

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1a 21	36 36 60	(a) Morris, Robert D. (b) Ph.D. (c) Behavioral Biology (d) Georgia State University		X	4 2	*Pan troglodytes* *Pan paniscus*	

1. Descriptive Title (80 characters):
Neuropsychological Foundations Project

Abstract:

The understanding of lateralized brain functioning in nonhuman primates and in humans with severe developmental disabilities provides basic information regarding (1) how various brain systems have developed and (2) what are the basic brain-related abilities necessary for complex cognitive functioning, especially communication-related skills. This project has developed a variety of neuropsychological assessment techniques which do not require invasive procedures to study basic lateralized functioning across various subject populations, including nonhuman primates, and severely/profoundly impaired children who do not have skills. These studies have shown that chimpanzees which have undergone extensive language training exhibit brain-laterality patterns that are very similar to those found in humans. One study showed evidence that these chimpanzee subjects processed meaningful symbols in the same hemisphere in which symbolic information is processed in humans. A series of other studies addressed the issue of how children with severe/profound mental retardation and no speech are able to process language symbols and lateralized information. The results suggest that their brain functions may be similar in many ways to those of normal children and that the understanding of their neuropsychological functioning will provide information which will be helpful in developing their communicative abilities to the highest potential. Although these studies have used very different subjects, they are both focused on developing a more in-depth understanding of the basic functions which represent the foundation skills necessary to develop higher-order cognitive abilities, especially those functions related to language development. Such studies should provide new insights into the treatment of disabled populations.

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1a 2 15 23	36 50b	(a) Nadler, Ronald D. Dahl, Jeremy F. Toback, Erna L. (b) Ph.D. (RDN, JFD); M.A. (ELT) (c) Reproductive Biology (RDN); Behavioral Biology (JFD, ELT) (d) Los Angeles Zoo (ELT)	X	 X X	2	*Pan troglodytes*	

1. Descriptive Title (80 characters):
Behavioral Effects of Oral Contraceptives in Chimpanzees

Abstract:
The goal of this research is to enhance our knowledge of hominoid socio-sexuality and neuroendocrinology, resulting in a greater understanding of normal and pathological human sexual and social behavior, particularly with respect to the proximate causation of sexual activity by hormonal control. This is significant in at least two respects: (1) divorce, sexual abuse and fatal sexually-transmitted diseases are increasing in the United States, Late Luteal Phase Dysphoria affects the lives and productivity of about one-third of the women in the U.S., and hormonal preparations are used in contraception; and (2) great apes, such as the chimpanzee (*Pan troglodytes*), are becoming increasingly valuable in biomedical research, cannot be imported and must be bred with the greatest effectiveness in captivity. The specific objective of this research was three-fold: (a) to complete data collection on a project (R.D. Nadler, P.I.) to examine the relationships between fluctuations in hormones [estrogens, progesterone, luteinizing hormone (LH)] and behavior in chimpanzees using two types of pair-test situations in which the female either did or did not control access to the male; (b) to proceed with analyses of the completed database for the project comprising 74 intermenstrual cycles (monitored hormonally), 18 of which included intensive behavioral testing (in fact, data from 120 cycles are now available); and (c) to formalize the methodology used in the collection of behavioral data. Initial analyses have led to a number of tentative conclusions. Administration of oral contraceptives caused a reduction of sexual activity from control (normal) cycles. In addition, the work distinguishes among normal cycles: (a) cycles with single and double LH peaks; (b) cycles with relatively short-acting ovarian follicles and inadequate luteolyzation as compared to cycles with long-acting follicles and adequate luteolyzation; (c) cycles with abnormal phenomena during the luteal phase, particularly the latter half; and (d) cycles of nulliparous females that exhibit relatively low levels of E_1G as compared to multiparous females.

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		(a) Nadler, Ronald D.	X				
1a	36	Dahl, Jeremy F.		X	6	*Hylobates lar*	
15	74e	Gould, Kenneth G.	X				
23		Wilson, Mark E.	X				
		Collins, Delwood C.		X			
		(b) Ph.D. (all)					
		(c) Reprod. Biol. (RDN, KGG, DCC, MEW); Behav. Biol. (JFD,MEW)					
		(d) N/A					

1. Descriptive Title (80 characters):

Reproductive Behavior and Physiology of Gibbons (*Hylobates lar*)

Abstract:

The overall objectives of this project are the same as those described for the project on "Reproductive Behavior and Physiology of the Great Apes". The specific aim of this work is to describe the reproductive behavior and physiology of the gibbon and, for the first time, to show the relationship between the temporal distribution of sexual activity and fluctuations in female hormone levels during the progress of the ovarian cycle. The significance of this work lies in the mating strategy and social organization of these hominoids. They are monogamous and live in family groups consisting of pair-bonded adults and their immature offspring. This is in contrast to the polygamous mating strategies of the great apes, *i.e.* the multi-female groups of gorillas, the dispersed social structure of orang-utans and the large social networks of chimpanzees. Several major goals were achieved during the first year of the project. Firstly, five new spacious, experimental enclosures were fabricated in which the subjects can be housed while behavioral tests are being conducted and the progress of the ovarian cycle is being monitored. Secondly, the perineal sex swelling of four females was documented through 36 intermenstrual intervals (IMIs), and body fluids were collected for analysis of hormone levels from three adult females through 19 IMIs. Thirdly, the subjects were trained to lever-press on devices that are critical to conducting restricted-access tests in which either the female or the male controlled access to his/her partner by pressing a lever to open a connecting door. Fourthly, comparative data on the reproductive characteristics of both gibbons and the great apes continued to be collected.

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1a 5	36 40 92 (Comparative Psychology)	(a) Rumbaugh, Duane M. Savage-Rumbaugh, E. Sue Romski, Mary Ann Morris, Robert D. Brody, Gene H. (b) Ph.D. (all) (c) Behavioral Biology (d) Georgia State Univ. (DMR, MAR, RDM); Univ. of Georgia (GHB)	X	X. X X X	5 3 23	*Pan troglodytes* *Pan paniscus* *Homo sapiens*	

1. Descriptive Title (80 characters):

Biobehavioral Studies of Language and Cognition: A Program Project

Abstract:

The objective of this program project is to investigate basic psychological processes in chimpanzees (*Pan troglodytes*) and bonobos (*Pan paniscus*) with the goal of explicating requisites to significant dimensions of human competencies in language and the use of numbers. In Project 1, *Language Acquisition in Pan paniscus*, the bonobos have learned symbols spontaneously and have indicated that they are able to understand human speech with remarkable precision. Research is providing strong evidence of their ability to comprehend syntactically the encoded requests of humans. Project 2, *Cognitive Studies in Pan troglodytes*, focuses on the parameters of the chimpanzee's use of numbers in a formal counting sense. It also explores the chimpanzee's ability to combine separate quantities and numbers and, in addition, investigates their abilities to use maps of the environment. The goal of Project 3, *Georgia State University Mental Retardation Project*, is to study processes of language acquisition of severely- and profoundly-retarded school-aged children. This project draws heavily upon the principles derived from Project 1 (above). Project 4, the *Neuropsychological Foundations Project*, focuses on elucidating the role of the right and left cerebral hemispheres in the processing of symbols that have semantic meanings. Project 5, the *Family Correlates Project*, is designed to explicate the structure and function of the family of the mentally-retarded child as they are affected by the child's symbol and language learning.

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1a	36 40	(a) Rumbaugh, Duane M. Savage-Rumbaugh, E. Sue Menzel, Emil W. Terrace, Herbert S. (b) Ph.D. (all) (c) Behavioral Biology (d) Georgia State Univ. (DMR); State Univ. of New York (EWM); Columbia Univ. (HST)	X	X X X	3	*Pan troglodytes*	

1. Descriptive Title (80 characters):

Cognitive Studies in *Pan troglodytes*

Abstract:

The objectives of this project are to elucidate the emergence of basic competencies in the use of numbers, counting, combining quantities and reading maps for the purpose of solving problems. The summation phenomenon highlighted last year has been replicated this year and is a robust phenomenon. Chimpanzees can choose the greater pair of two quantities of foods in order to obtain the greater amount of food. Current studies using Arabic numerals in lieu of items of food are now being conducted to determine whether the chimpanzees might be capable of proto-addition (*i.e.* the ability to choose the pair of numbers that will net the greater total without possessing the capacity to add, in a formal sense). The animals are also learning to count, in a 1,2,3,4,5 manner, specific items through the use of sophisticated software and, thereby, to partition the counted from the uncounted items and to count to a predesignated level or quantity. The chimpanzees can also use even poor-quality video representations of familiar areas in order to obtain access to prized foods that they have seen being hidden in various locations. The results of this project should prove to be an important factor in defining some of the basic parameters of the emergence of advanced, cognitive competencies. Those parameters might help teach children who, because of brain impairments, have otherwise failed to learn to count and/or to use representations of their environments.

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AXIS I	AXIS II				Number	Species Used	
5	36 82	(a) Romski, Mary Ann Abrahamsen, Adele A. Savage-Rumbaugh, E. Sue (b) Ph.D. (all) (c) Behavioral Biology (d) Georgia State Univ. (MAR, AAA)	 X	X X	13	*Homo sapiens*	

1. Descriptive Title (80 characters):

Georgia State University Mental Retardation Project

Abstract:

During calendar year 1988, this project has continued to analyze data from the longitudinal study of symbol acquisition in 13 school-aged subjects (mean age: 12.8 years) with mental retardation. In order to determine the consequences (*i.e.* in terms of effectiveness) of the subjects' symbol communications, another coding was added to the extant Communication Coding Scheme and is currently being applied to over 500 longitudinal transcripts of the subjects' communicative interactions. The scope of the project has been increased by the addition of two new studies. First, a study of subordinate-category sorting skills, using procedures adapted from the nonhuman primate model research, was initiated. Following the subjects' receptive and productive acquisition and use of symbols, superordinate-level lexigrams (*i.e.* FOOD, DISH and FUN) were taught by means of a sorting task. In this task, subjects acquired the meanings of symbols in the superordinate category and then successfully sorted previously-learned lexigrams (*e.g.* ice cream, fork, baseball) into bins labeled with the appropriate categorical symbol. Data analyses are underway, and additional subjects will participate in the study during 1989. Second, six symbol-experienced subjects are participating in a study to compare the acquisition of symbols plus printed English with the acquisition of printed English alone. Data collection is underway and will be completed at the end of the 1988-89 school year.

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GRANT NUMBER P 5 1 R R 0 0 1 6 5 - 28

REPORT PERIOD: January 1, 1988 to December 31, 1988

INSTITUTION: Yerkes Regional Primate Research Center

2 Science Code AXIS I	2 Science Code AXIS II	3 (a) Investigator(s) (b) Degree(s) (c) PRC Division/Unit (d) Non-Host Institution	COR E	OTHER	4 Usage Factor Number	4 Usage Factor Species Used	5 ARB Funds Allocated
1a 5	36 40	(a) Savage-Rumbaugh, E. Sue (b) Ph.D (c) Behavioral Biology (d) N/A	X		3 1 2	*Pan paniscus* *Pan troglodytes* *Homo sapiens*	

1. Descriptive Title (80 characters):
Language Acquisition in *Pan paniscus*

Abstract:

Kanzie, an 8-year-old male bonobo (*Pan paniscus*), has continued to demonstrate an ever-increasing facility in the comprehension of spoken English. His skills include not only the recognition of single words, but also extend to a variety of sentence forms. Several experimental approaches have been devised to examine Kanzi's language-comprehension abilities in laboratory and field settings. These include both symbol/photograph selection methods as well as situations in which Kanzi serves as the actor in a communication addressed to him. Kanzi has maintained his productive symbol vocabulary and has evidenced an improving ability to expand his own communications and to respond to the queries of others. This laboratory has also documented his comprehension of audiotaped material and has used such stimuli in a study of individual voice recognition.

Panbanisha (*P. paniscus*) and Panpanzee, a common chimpanzee (*P. troglodytes*), continued to serve as subjects in the co-rearing study. Both subjects increased the number of symbols used during 1988, although Panbanisha continued to use a greater variety of symbols than did Panpanzee. Both animals began to use comments, statements and symbol combinations. Tests continued to be conducted on comprehension of spoken English using a photograph-selection paradigm. Panbanisha consistently exhibited comprehension of more single words than did Panpanzee, although Panpanzee evidenced understanding of slightly over half of the words presented.

Two human subjects (6 and 34 months of age at the beginning of 1988) also continued to participate in this project. The older child, who was already using speech, learned all lexigrams presented within two months. The younger child first communicated gesturally. In subsequent months, she demonstrated comprehension of English followed by appropriate use of lexigrams. The final communicative mode which she developed was productive English.

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2 Science Code AXIS I	2 Science Code AXIS II	3 (a) Investigator(s) (b) Degree(s) (c) PRC Division/Unit (d) Non-Host Institution	COR E	OTHER	4 Usage Factor Number	4 Usage Factor Species Used	5 ARB Funds Allocated
1a	34 36 92 (Behavioral Ecology)	(a) Smith, Euclid O. (b) Ph.D. (c) Behavioral Biology (d) N/A	X		±78	*Papio cynocephalus*	

1. Descriptive Title (80 characters):
Male Migration in Yellow Baboons (*Papio cynocephalus*) in the Tana Primate Reserve

Abstract:

The application of life-history theory to the study of nonhuman primates is of enormous importance for our understanding of the evolutionary ecology of primate social systems. One of the most important and risky behaviors a nonhuman primate undertakes during a lifetime is immigration from the natal group and emigration into a breeding group. Migration is virtually ubiquitous for nonhuman primates, but there are pronounced gender and species differences. The process of male immigration/emigration is only beginning to be understood but, along with birth and death, they clearly constitute major life-history events. The study of male immigration/emigration is one of the most important aspects of male life history because it has direct implications for ecological theories of primate social structure, population genetics and inbreeding avoidance, and gender differences in reproductive and parenting strategies. This project is a field study of the demography of a population of free-ranging yellow baboons (*Papio cynocephalus cynocephalus*) in the Tana River Primate Reserve, southeastern Kenya. The goal of the research is to collect specific data on one habituated and individually-known group in the Reserve. First, detailed observations are being made on immigrant males and, hopefully, on emigrant males as well. Second, a systematic survey of the entire Reserve has been conducted to determine the precise number and distribution of baboon groups. Finally, patterns of intertroop encounters are being monitored because intertroop encounters likely play a significant role in patterns of male emigration/immigration.

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2 Science Code		3			4 Usage Factor		5
AXIS I	AXIS II	(a) Investigator(s) (b) Degree(s) (c) PRC Division/Unit (d) Non-Host Institution	COR E	OTHER	Number	Species Used	ARB Funds Allocated
1a	34 36 92 (Behavioral Ecology)	(a) Smith, Euclid O. Decker, Barbara S. (b) Ph.D. (EOS); M.A. (BSD) (c) Behavioral Biology (d) N/A	X	X	2 free-ranging groups	*Colobus badius rufomitratus*	

1. Descriptive Title (80 characters):

Behavioral Ecology of the Tana River Red Colobus

Abstract:

Africa's two most endangered nonhuman primates, the Tana River red colobus (*Colobus badius rufomitratus*) and the Tana River mangabey (*Cercocebus galeritus galeritus*), inhabit East Africa's only true riverine forests which lie along the Tana River in eastern Kenya. A census conducted in 1985 revealed that the populations of both of these subspecies have declined dramatically during the past ten years, the red colobus by 83% with only 200-300 individuals remaining and the mangabeys by a possible 25% to 800-1,100 individuals. This project, funded in part by a dissertation improvement grant, seeks to determine the reasons for the decline and to formulate a conservation strategy for these endangered primates and their habitat in the Tana River Primate Reserve. The three hypotheses that have been offered to explain this population decline will be tested: (1) a disease epidemic; (2) a marked decline in food supplies during the short-term drought in 1984; and (3) loss of food resources resulting from a gradual senescence of the forests, either naturally or due to hydroelectric and irrigation schemes upriver. Census data on two groups of red colobus have been collected and are currently being analyzed. Data have also been collected on feeding as well as on ranging patterns. Finally, phenological sampling of food sources has been conducted.

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2 Science Code AXIS I	2 Science Code AXIS II	3 (a) Investigator(s) (b) Degree(s) (c) PRC Division/Unit (d) Non-Host Institution	CORE	OTHER	4 Usage Factor Number	4 Usage Factor Species Used	5 ARB Funds Allocated
1a	36	(a) Tomasello, W. Michael Gust, Deborah A. Frost, G. Thomas (b) Ph.D. (all) (c) Behavioral Biology (d) University of Georgia (GTF)		X X X	21	*Pan troglodytes*	

1. Descriptive Title (80 characters):

A Longitudinal Investigation of Chimpanzee Gestural Communication

Abstract:

This was a longitudinal study of chimpanzee gestural communication. The subjects were seven 5- to 8-year-old chimpanzees (*Pan troglodytes*) living as members of a semi-natural group maintained at the Yerkes Regional Primate Research Center Field Station. The subjects of this study were also observed in a study conducted four years ago [see Tomasello *et al.* (1985)]. Nearly identical operational definitions and observational procedures were used in the two studies. Longitudinal comparisons between the two observation periods revealed that the development of chimpanzee gestural communication is best characterized as a series of ontogenetic adaptations: as particular social functions (*e.g.* nursing, playing, grooming, etc.) arise, decline or change, gestural communication follows suit. Most gestures appear to be conventionalized by individuals in direct social interaction with conspecifics. Some gestures may be learned by "second-person imitation", *i.e.* one individual copying a behavior directed toward it by another individual. No evidence was found for "third-person imitation", *i.e.* an individual copying a gesture used between two other individuals.

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2 Science Code AXIS I	2 Science Code AXIS II	3 (a) Investigator(s) (b) Degree(s) (c) PRC Division/Unit (d) Non-Host Institution	CORE	OTHER	4 Usage Factor Number	4 Usage Factor Species Used	5 ARB Funds Allocated
1a 15 23	36	(a) Wallen, Kim Davis-DaSilva, Maryann (b) Ph.D. (KW); M.S. (DDM) (c) Behavioral Biology (d) N/A	X	X	15	*Macaca mulatta*	

1. Descriptive Title (80 characters):
Hormonal and Environmental Influences on Behavior

Abstract:
This project is an extension of work on environmental influences on hormonal modulation of sexual behavior in rhesus monkeys. The goal is to understand the cause of the great modifiability of hormonal influences on behavior seen in rhesus monkeys. Previous work revealed that the most easily-detected effects of steroids in female rhesus monkeys were obtained when females were observed in socially-complex environments having multiple females. This project investigated the relationship among sex ratio, social rank and hormonal condition on sexual behavior in male rhesus monkeys. Subjects were three groups of three adult males and six ovariectomized, estrogen-treated females. Males were tested under three social conditions: a pair-test (1:1 sex ratio); a 3-male/1-female group test; and a 3-male/3-female group test (1:1 sex ratio). During each test, one male was androgen-suppressed via chronic GnRH agonist (WY 40972) treatment, one male was not treated and one male received GnRH agonist plus daily testosterone injections. All males received all treatments in a counterbalanced order. Social rank and test condition profoundly affected sexual behavior. During multi-male tests, only the alpha male mated routinely, the beta male mated in one group during one test, and the gamma males never mated. During pair-tests, the effect of hormonal condition was not significant, a result that was expected based on previous castration studies using pair tests. The marked effect of social condition appeared to be related to female interactions. Although the males lived with each other continuously, interactions with females were limited to actual testing time. It appeared that the females interacted preferentially with alpha males and used lower-ranking males to solidify their alliances with alpha males. These results demonstrate the importance of the social environment on modulation of male sexual behavior. This study underscored the importance of establishing stable social relations between both males and females before studying hormonal action. Work is underway to investigate this question in a long-term, stable, multi-male/multi-female group.

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AXIS I	AXIS II	(a) Investigator(s) (b) Degree(s) (c) PRC Division/Unit (d) Non-Host Institution	COR E	OTHER	Number	Species Used	ARB Funds Allocated
1a	36	(a) Wallen, Kim Drea, Christine (b) Ph.D. (KW); B.S. (CD) (c) Behavioral Biology (d) N/A	X	X	85	*Macaca mulatta*	

1. Descriptive Title (80 characters):
Influence of Social Factors on the Acquisition of Learning Sets

Abstract:
Harlow's studies of problem-to-problem transfer led to development of the notion of "learning sets", which argues that subjects "learn to learn" and extensive experience with one member of a family of tasks improves performance on subsequent tasks of the same type. Traditionally, learning-set experiments involve object discrimination in a controlled environment (*e.g.* WGTA). The goal of this project is to examine the acquisition of a color-reversal task in a social group of rhesus monkeys. The project seeks to characterize the demographics of the acquisition of color discrimination in regard to age, sex and social ranking and to determine whether these subject characteristics correlate with successful acquisition of the reversal task. The project also seeks to determine whether one monkey will, as a solution strategy, allow another group member to solve the cognitive problem and then seize the reward. The group was presented four green and four orange boxes (31 x 37 x 21 cm), each with 3 x 3 cm openings separated by a 3 x 2 m metal panel. After an initial habituation period when all boxes contained a mixture of sand, small rocks and 20 peanuts, subjects received four sets of 40 10-minute trials where only one color box contained peanuts and the others contained sand and small rocks. For each set of 40 trials, the colors of the stocked boxes were reversed. Trials were videotaped, and behavioral data were recorded on a portable microcomputer and verified by detailed coding of video records. All agonistic encounters in the vicinity of the boxes were recorded to obtain evidence of the influence of dominance relations on successful solution of the task. An equal proportion of males and females succeeded in obtaining peanuts. No age difference was found between animals successfully solving the task and those failing to do so. The complete analysis will address details of the patterns of attempts to solve the task and the social relationships between solvers and nonsolvers. The results will provide information about traditional learning-set formation in a complex social context and will expand our knowledge of social influence on cognitive function.

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1a 15 23	36	(a) Wallen, Kim Lovejoy, Jennifer (b) Ph.D. (both) (c) Behavioral Biology (d) N/A	X	X	10	*Macaca mulatta*	

1. Descriptive Title (80 characters):

Role of Adrenal Steroids in Female Rhesus Sexual Behavior

Abstract:

The role of adrenal androgens in modulating sexual behavior in female rhesus monkeys was investigated by suppressing adrenal-cortical steroid secretion via chronic administration of dexamethasone phosphate (Dex). Previous research has suggested that adrenal androgens are necessary for the display of sexual interest in female primates; however, those studies used ovariectomized, estrogen-treated females. Thus, the role of adrenal androgens in conjunction with a full complement of ovarian steroids is unknown. Eight intact, cycling female rhesus monkeys were observed during two ovulatory cycles. During one cycle, females received 0.086 mg/kg/day Dex administered via an osmotic minipump that had been implanted using sterile technique under anesthesia. Females received sterile water via minipump during a second cycle. The order of Dex and water treatments was counterbalanced. Dex treatment reduced cortisol by 90%, androstenedione by 75% and testosterone by more than 50%. Luteinizing hormone and estradiol were nonsignificantly elevated during Dex treatment, while luteal progesterone was significantly elevated by Dex. All eight females displayed cyclic fluctuations in sexual activity during both Dex and water treatments. There were no significant differences between Dex and water cycles, although frequency of female sexual initiation was higher during Dex treatment than during control cycles. Data derived from this study provided no evidence that adrenal cortical androgens are necessary for female rhesus sexual behavior. In fact, both the endocrine and the behavioral data tended to suggest that adrenal androgens had a chronic low-level inhibitory influence rather than a facilitating one. These results suggest that female rhesus monkeys are similar to other female mammals in their pattern of endocrine modulation of sexual behavior. When these results are combined with those of previous work in this laboratory, female rhesus monkeys appear to rely solely on steroids of ovarian origin for the modulation of sexual behavior.

DIVISION OF NEUROBIOLOGY

Johannes Tigges, Ph.D., Chief

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D. W. Vaughan	Department of Anatomy, Boston University
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1a 6 9 21	30 36 46 50a 64 88	(a) Bakay, Roy A. E. Watts, Ray L. Byrd, Larry D. Iuvone, P. Michael (b) M.D. (RAEB, RLW); Ph.D. (LDB, PMI) (c) Neurobiology (RAEB, RLW, PMI); Behavioral Biology (LDB) (d) N/A	X	X X X	14	*Macaca mulatta*	

1. Descriptive Title (80 characters):

CNS Grafting for Parkinsonism

Abstract:

The purpose of this project is to evaluate CNS grafting technique for treatment of a Parkinson-like syndrome. The model uses the administration of MPTP to destroy dopaminergic cells in the nigrostriatal pathway and produce a movement disorder with many of the characteristics of hemiparkinsonism or parkinsonism. The original techniques were developed in the rat and are now being tested in the primate to determine if the same potential for behavioral plasticity and immunologic privilege is present. Modifications were required for grafting into primates; direct application of rodent technique was inadequate.

After baseline data were obtained, MPTP was injected repeatedly until Parkinson-like characteristics were demonstrated. Both bilateral and unilateral administrations have been studied. Behavioral alterations were monitored by clinical examinations, performance on learned tasks and computer analysis of spontaneous activity. Biochemical alterations were monitored by CSF catecholamine activity. Once the degree of deficit was documented, either a fetal mesencephalic cell suspension was grafted stereotactically in multiple areas of the caudate and putamen or adrenal medullary tissue was placed in the caudate by a transcortical intraventricular approach. Postoperatively, the same parameters were studied.

Six animals were transplanted successfully, and they provided preliminary data supporting the hypothesis that grafting of fetal dopaminergic tissue in the brain is effective in reversing behavioral and biochemical abnormalities in primates. These animals have been studied extensively for pathological alterations using standard light microscopic, electron microscopic, immunocytochemical and catecholamine-fluorescent techniques. Grafted dopaminergic cells have been identified within the caudate and putamen. Adrenal grafts have also shown behavioral improvements and surviving grafted cells. Long-term evaluations of transplanted subjects are essential to determine the ultimate potential for transplantation in the treatment of Parkinson's disease by each of these techniques.

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1a 6 9 21	36 86	(a) Bakay, Roy A. E. Epstein, Charles Ribak, Charles (b) M.D.; M.D.; Ph.D. (c) Neurobiology		X X X	6	Macaca mulatta	

1. Descriptive Title (80 characters):

Plasticity of the Neocortex and the Development of Epilepsy

Abstract: In order to investigate the anatomical basis for the development of focal epilepsy, we are employing the alumina model in nonhuman primates. This is a chronic model which produces spontaneous seizures and is very similar to injury induced human epilepsy. By evaluating the specific alterations of multiple neurotransmitters in the neocortex as the maturation of the epileptic focus progresses, we are attempting to elucidate the sequence of events required in focal cortical epileptogenesis.

Using electroencephalographic recordings to determine the stage of epileptogenesis being evaluated, our data clearly demonstrates GABAergic cell loss early in the developing epileptic focus which becomes statistically significant when seizure activity becomes manifest. Accompanying the initial loss of GABAergic terminals is an initial increase in the number of GABA neurotransmitter receptor binding sites observed using receptor autoradiographs. As cell loss progresses and the development of epileptiform activity begins to be observed the number of GABAergic receptors markedly decreases in the epileptic focus. Surrounding the epileptic focus is an area of apparent increased number of GABAergic receptors. Quantitative studies suggest the receptor loss for GABA is due to a loss in absolute receptor numbers and not a change in receptor affinity. Multiple other neurotransmitter receptors are also lost in the epileptic focus but these are not lost to the same degree in the focus or in the tissues surrounding the focus. Ultrastructural synaptic survey demonstrates a greater loss of symmetrical (presumably inhibitory) synapses with the development of seizure activity.

The GABAergic-chloride ion receptor complex appears to be critical in the development of an epileptic focus as a result of injury. Similar changes are not observed on the contralateral homogenous cortex or in surgical or non-surgical controls. Recently similar studies have been initiated to determine if similar changes occur in focal injury to subiculum or amygdala. We are attempting to develop a unilateral model for temporal lobe epilepsy to determine potential differences in epileptogenesis.

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1a 21 25b	36 44 60	(a) Boothe, Ronald G. (b) Ph.D. (c) Neurobiology/Neuro-psychophysics	X	10 10	Macaca nemestrina Macaca mulatta	

1. Descriptive Title (80 characters):
Behavioral Studies of Strabismus and Amblyopia

Abstract:

We are conducting psychophysical tests of 10 Macaca nemestrina monkeys that have a naturally occurring strabismus. The goal of these studies is to determine the sensory consequences of allowing an untreated strabismus to run its natural course. This provides a standard against which treatments of strabismus can be compared. These studies have clinical relevance for human patients with strabismic amblyopia.

We are also conducting behavioral tests of 10 Macaca mulatta monkeys that have an experimentally induced aphakia. These monkeys have been assigned to various treatment groups, and we are comparing the behavioral outcomes for each treatment. These findings have clinical relevance for children born with unilateral cataracts.

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AXIS I	AXIS II	(a) Investigator(s) (b) Degree(s) (c) PRC Division/Unit (d) Non-Host Institution	COR E	OTHER	Number	Species Used	ARB Funds Allocated
1a 25a	30	(a) Feldman, Martin L. Harrison, J. M. (b) Ph.D.; Ph.D. (c) Neurobiology (d) Boston University		X X	15	Macaca mulatta	

1. Descriptive Title (80 characters):
Ambient Noise Exposures of Caged Macaca Mulatta

Abstract:

One 3-day research visit to Yerkes Regional Primate Research Center was made in 1988. As with past and planned future visits, the purpose of the research conducted is to record, totally non-invasively (no physical contact with animals), ambient sounds to which caged animals are exposed. Such sounds include ambient background, animal-produced vocalizations and other sounds, and sounds related to maintenance of the animals. Recordings utilize a microphone and tape recorder and a sound level meter, and sound samples are recorded at various times during the day, both coincident and non-coincident with scheduled activities such as feeding, room washdown, and transport of animals. The aim of the work is to characterize the long-term overall sound exposure levels of the animals in order to determine whether chronic sound exposure levels are harmful to the animals' auditory systems as they age. Analysis of the data to date clearly suggests that the chronic exposure levels are not harmful.

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1a 2 6 21 25	30 60	(a) Iuvone, P. Michael Tigges, Margarete Fernandes, Alcides Tigges, Johannes (b) Ph.D.; Ph.D.; M.D.; Ph.D. (c) Neurobiology	 X X	X X	9	Macaca mulatta	

1. Descriptive Title (80 characters):

Dopamine Synthesis and Metabolism in Rhesus Monkey Retina

Abstract:

Dopamine (DA) is an important retinal neurotransmitter and neuromodulator, whose action has been implicated in processing of visual information, light adaptation, regulation of cellular metabolism in photoreceptors, and regulation of ocular growth. In addition, administration of bromocriptine, a dopaminergic agonist, has been reported to decrease photoreceptor damage in experimental models of retinal degeneration. Most studies of retinal DA have been conducted with lower vertebrates as subjects, and it is not known to what extent dopaminergic functions are similar in primate retinas. As an initial step in investigating the regulation of DA neurons in primate retinas, we examined the postnatal development, influence of age, and the effects of visual deprivation on the dopamine system in the retina of rhesus monkeys. Retinas were obtained from animals that were terminated for other reasons (i.e., participation in another study or terminal illness). The level of retinal DA was lowest at birth, and more than doubled by 3-4 weeks of age. This level remained relatively constant in older infants and adult monkeys up to 34 years of age. These data suggest that dopaminergic function is established in the early postnatal period and is maintained throughout the maximal life span of the rhesus monkey. Monocular visual deprivation produced with opaque contact lenses decreased retinal levels of DA and DOPAC, a DA metabolite, and the activity of tyrosine hydroxylase, the regulatory enzyme of DA synthesis. Thus, DA synthesis and metabolism are reduced by light deprivation. These results suggest that retinal DA neurons in primate retina are activated by light exposure.

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AXIS I	AXIS II				Number	Species Used	
1a 2 21 25b	50b 60 62	(a) Iuvone, P. Michael Tigges, Margarete (b) Ph.D.; Ph.D. (c) Neurobiology	X	X	8	Macaca mulatta	

1. Descriptive Title (80 characters):
Pharmacological Approaches to Ocular Growth and Myopia

Abstract:

Myopia is a common visual disorder that affects a large percentage of the population of the United States. In myopics, distant images focus in front of the retina, in part due to excessive elongation of the eye. The cause of myopia is not known, and there are no known measures to prevent its development. Deprivation of form vision in juvenile humans, monkeys and chickens leads to excessive eye growth and myopia. This effect appears to be mediated locally by the retina and may involve the action of specific neuromodulators. Recent studies suggest that retinal dopamine (DA) may be involved in ocular development. In newly hatched chickens, form deprivation causes myopia, increases ocular growth, and decreases retinal dopaminergic activity. Local administration of apomorphine, a DA receptor agonist, prevents the exaggerated axial growth of the eye and, in part, the development of myopia. These studies have profound clinical implications for the prevention or retardation of the progression of myopia in humans. However, before clinical trials can be justified, the hypothesis that altered dopaminergic activity plays a role in myopia should be tested in nonhuman primates. We have therefore initiated a pilot study to examine the effects of topical application (eye drops) of apomorphine on a primate model of exaggerated ocular growth. In infant rhesus monkeys, monocular visual deprivation with opaque contact lenses increases the axial length of the eye and depresses dopaminergic activity in the retina. Four occluded monkeys are being given 1% apomorphine eye drops, while 4 others receive the vehicle. Axial length of the eye is being monitored by A-scan ultrasonography. The results thus far suggest that apomorphine has prevented the occlusion-induced exaggerated axial growth in 3 of these 4 monkeys.

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2 Science Code AXIS I	2 Science Code AXIS II	3 (a) Investigator(s) (b) Degree(s) (c) PRC Division/Unit (d) Non-Host Institution	COOPERATIVE	OTHER	4 Usage Factor Number	4 Usage Factor Species Used	5 ARB Funds Allocated
1a	21	(a) Kennedy, Philip R. Bakay, Roy A. E. (b) M.D., Ph.D.; M.D. (c) Neurobiology		X X	3	Macaca mulatta	

1. Descriptive Title (80 characters):

A Long-term Recording Electrode with Potential Prosthetic Uses

Abstract:

A long-term recording electrode has been developed by one of us (PRK) in rats. It is based on neural regeneration whereby neurites grow into a piece of sciatic nerve placed in a hollow glass cone implanted in cortex. Electrical activity of these neurites is recorded by a gold recording wire fixed inside the cone. The expectation with respect to neural prosthetic applications is that recording control signals from the motor cortex of a quadriplegic, for example, will result in more precise and multiple mode control of functional neuromuscular stimulation devices that active the paralyzed muscles.

In the monkey, the neurite growth found in the rat is seen here also. Recordings also show a number of single units. Present experiments are aimed at assessing the longevity of recordings, the durability of their signal-to-noise ratios and the information content of the signals. Only when this data is in hand will the cone electrode be considered for human use.

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2 Science Code AXIS I	2 Science Code AXIS II	3 (a) Investigator(s) (b) Degree(s) (c) PRC Division/Unit (d) Non-Host Institution	COR E	OTHER	4 Usage Factor Number	4 Usage Factor Species Used	5 ARB Funds Allocated
1a 21	30	(a) Peters, Alan (b) Ph.D. (c) Neurobiology (d) Boston University		X	8	Macaca mulatta	

1. Descriptive Title (80 characters):

Aging in the Primate Nervous System

Abstract:

The study is concerned with aging of the nervous system of the rhesus monkey. The study carried out by this investigator is part of a Program Project, funded through the National Institute on Aging, to examine what changes occur in the cerebral cortex as aging occurs. Thus far, it has been found that few if any neurons appear to be lost from area 17, primary visual cortex, during aging. Also, there is little accumulation of lipofuscin in the neurons. In contrast, the neuroglial cells all accumulate lipofuscin, although preliminary studies suggest that there is little increase in neuroglial cell numbers.

In preparations examined by electron microscopy aging changes are more evident. Thus, some myelinated axons are seen to be degenerating in older rhesus monkeys, and some degeneration of dendrites is also evident. Most interesting is the occurrence of some large holes in the neuropil. The source of these holes is not known, but it is postulated that they may arise due to the degeneration, and ultimate loss of a few neurons.

This work is continuing and being extended to examine other areas of the cerebral cortex. It is aimed at determining if the rhesus monkey will provide a useful model for human aging.

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2 Science Code		3			4 Usage Factor		5
AXIS I	AXIS II	(a) Investigator(s) (b) Degree(s) (c) PRC Division/Unit (d) Non-Host Institution	COREE	OTHER	Number	Species Used	ARB Funds Allocated
1a	21 30 36	(a) Rosene, Douglas L. Moss, Mark B. (b) Ph.D.; Ph.D. (c) Boston University		X X	26	Macaca mulatta	

1. Descriptive Title (80 characters):

Age-Associated Changes in Basal Forebrain and Limbic System in Rhesus Monkeys

Abstract:

This is a project which is focused on a combined behavioral and anatomical assessment of the relationship between aging, memory function and the morphological state of specific basal forebrain and limbic system structures in the monkey central nervous system. Monkeys ranging in age from five to over 30 years of age will be assessed for visual recognition memory function and visuomotor performance. Following behavioral testing, anatomical experiments will be performed aimed at the quantitative assessment of cholinergic activity in the basal forebrain and hippocampal formation. Tissue from the same brains will be prepared for ultrastructural analysis. Silver stain techniques will be used to assess the presence and distribution of senile plaques. Thionin stained series of sections will be prepared to perform standard cell counting techniques.

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1a 21	30	(a) Tigges, Johannes Tigges, Margarete Peters, Alan (b) Ph.D.; Ph.D.; Ph.D. (c) Neurobiology/Neuro-anatomy	X X	 X	8	Macaca mulatta	

1. Descriptive Title (80 characters):
Somatopetal Synapses on Betz Cells of Macaca mulatta

Abstract:

This laboratory is involved in studying age-related phenomena in the brain. The results may help to devise ways and means to retard the aging process. Betz cells are giant pyramidal cells in the primary motor cortex. In the aging human brain they are said to die in significant numbers; this loss supposedly contributes to the slowing of movements in aged individuals. Human brain tissue can be acquired only after death or during an autopsy/biopsy; however, tissue collected this way is not well-suited for electron microscopic studies. Therefore, we have to rely on well-fixed nonhuman primate tissue in order to study aging phenomena in the brain.

We have begun to study the ultrastructure of Betz cells in well-fixed rhesus monkey brains in order to determine the factors leading to the demise of these giant cells. Preliminary findings indicate an extraordinary accumulation of lipofuscin, which may lead to a decreased functional state of Betz cells. In addition, old Betz cells accumulate distinct inclusion bodies of unknown function and etiology. Data on the number and size of somatopetal synapses have been collected but not analyzed. Furthermore, in the neuropil of area 4 are age-related changes like breakdown of myelin and formation of large holes, which may be caused by dying neurons. A quantitative analysis is in progress.

The valuable tissues obtained from aged monkeys are being shared with several investigators and will be used for a number of studies in a concerted effort to develop the rhesus monkey as a model for human aging.

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1a	21	(a) Tigges, Margarete Tigges, Johannes Boothe, Ronald G. Wilson, James R. Eggers, Howard M. Gammon, J. Allen (b) Ph.D.;Ph.D.;Ph.D.; Ph.D.;M.D.;M.D. (c) Neurobiology/Neural Ultrastructure	X X X X	 X X	5	Macaca mulatta	

1. Descriptive Title (80 characters):

Effects of Binocular Deprivation on Area 17 of Infant Rhesus Monkeys

Abstract:

In humans, amblyopia (which means dimness of vision) is a common visual impairment. It is characterized by the absence of structural lesions in the visual system. Visual deprivation during a critical period of development can cause amblyopia. "Refinement of animal models of visual deprivation and amblyopia" was recommended with high priorities in the National Plan for Vision Research of the NEI. Studies of binocularly deprived newborn rhesus monkeys were designed to analyze the effects of abnormal visual stimulation on the histology of the visual system during development with the goal to uncover structural defects underlying amblyopia. Some of the same monkeys from the study of eye development were used to determine the effects of binocular deprivation on the CNS, especially area 17, which appears to be most vulnerable to deprivation. Histochemical staining for CO as a long-term metabolic marker was employed to establish the status of ocular dominance columns (ODC) in infant rhesus monkeys treated like human infants born with monocular cataracts. Our preliminary data show that an occluded eye, which is similar to "patching the good eye" in human babies, competes rather successfully in area 17 for synaptic space with an aphakic fellow eye. Under our deprivation conditions, the amount of cortical territory an occluded eye retains compared to an aphakic eye depends on the amount of occlusion. For visually impaired human babies, some ophthalmologists advocate occlusion therapy to protect an impaired visual system during early development, like "preserving a clean slate" (Jampolsky, 1978). This idea still lacks unequivocal basic science support. Therefore, the results from our monkey studies should contribute to resolve this controversy among pediatric ophthalmologists. They may also lead to devise and evaluate better techniques for treating amblyopia. In addition, new insights into basic mechanisms underlying competitive interactions during the postnatal development of cortex will be gained.

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AXIS I	AXIS II	(a) Investigator(s) (b) Degree(s) (c) PRC Division/Unit (d) Non-Host Institution	COR	OTHER	Number	Species Used	ARB Funds Allocated
1a	25b	(a) Tigges, Margarete Tigges, Johannes Fernandes, Alcides Eggers, Howard M. Gammon, J. Allen (b) Ph.D.; Ph.D.; M.D.; M.D.; M.D. (c) Neurobiology/Neural Ultrastructure	X X	 X X X	38 18	Normal Macaca mulatta Experimental Macaca mulatta	

1. Descriptive Title (80 characters):

Axial Eye Growth of Normal and Visually Deprived Infant Monkeys

Abstract:

Newborn human babies are hyperopic. The eyes develop postnatally towards emmetropia. Certain congenital malformations as well as environmental factors, however, can derange this process and produce myopia. Myopia remains one of the major causes of visual disability and continues to be a health problem of major proportions (Curtin, B. J., The Myopias, 1985). Little is known about its cause. We are using newborn rhesus monkeys to study the postnatal growth of the eyes under normal and environmentally manipulated conditions with the aim to increase our basic knowledge of factors involved in the control of the postnatal development of the eye of primates. Another goal of these studies is to design, test and implement better clinical managements for human babies which are at risk to develop myopia. The experimental methods used are very similar to those used for human babies with monocular congenital cataracts. Postnatal eye growth is monitored at regular intervals using ultrasonography to measure axial length of the eyes of anesthetized monkeys. All normal monkeys are returned to the Yerkes colony after A-scan measurements. We found that the postnatal development of the eye follows a schedule which fs very similar to that of human children by displaying a rapid growth phase shortly after birth and a more gradual growth until puberty.

Binocular manipulations resulted in differences in axial length between the 2 eyes. Aphakic eyes were shorter and continuously occluded eyes were longer compared to eyes of age-matched controls. After 3 h of occlusion per day, however, the occluded eyes grew like normal eyes. The experimental monkeys for this project are being shared with Drs. Boothe, Wilson and Iuvone.

Because of the close similarities in postnatal growth, anatomy and function between the visual system of monkeys and humans, these results are important for the rehabilitation of human infants with congenital cataracts.

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AXIS I	AXIS II	(a) Investigator(s) (b) Degree(s) (c) PRC Division/Unit (d) Non-Host Institution			Number	Species Used	ARB Funds Allocated
1a 20 21	30	(a) Vaughan, Deborah W. (b) Ph.D. (c) Neurobiology (d) Boston University		X	8	Macaca mulatta	

1. Descriptive Title (80 characters): Aging and the Primate Nervous System (Project IV: Aging and the Lower Motor Neurons of the Primate Spinal Cord)

Abstract:

The project uses rhesus monkeys to investigate the extent to which these primates can be considered models for human aging of spinal cord lower motor neurons and muscle fibers. To this end, these efferent components and selected target organ will be morphologically compared with the intent of demonstrating temporal patterns of age change that may be parallel, or quite divergent, within a simple neural system. Although not exactly concatenate, the structures represent regions that are linked together, and in fact, with the cellular populations there are synaptically-related members. Recognition of the independent nature of aging change in such components of the central nervous system will provide great insight into the aging process in general.

The animals used are aged from 5 years to 25+ years. Quantitative and qualitative analysis focuses on the lower motor neurons in the lateral motor cell column that centers on the eighth cervical segment, with special reference to neurons of the dorso-dorsolateral region of the caudal portion of the column. Among these neurons are those that innervate the lumbrical muscles of the hand, muscles which are morphometrically examined to determine fiber loss of atrophic alterations. Light microscopic analysis of frozen sections of one half of the C_6 to T_1 extent of cord serves for neuron counts as well as for determining the location of blocks selected from the remaining hemisection for electron microscope morphometry of selected lower motor neurons. Nerves emanating from the motor neurons are examined in the ventral roots of these spinal cord segments for axon and myelin change and in the motor end plates of the lumbrical muscle for deteriorative change. The aim of this work is to contribute understanding of how advancing age affects a defined neuromuscular system.

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1a	92 Neuro-science	(a) Wilson, James R. Tigges, Margarete Boothe, Ronald G. (b) Ph.D.; Ph.D.; Ph.D. (c) Neurobiology/Neuro-physiology	X X X		10	Macaca mulatta	

1. Descriptive Title (80 characters):
Ocular Dominance in Striate Cortex of Aphakic Monkeys

Abstract:

The use of long-wear soft contact lenses offers an excellent technique for correcting the visual input to an aphakic eye or to block the input to a normal eye. Using this technique, we are studying the behavioral, electrophysiological and anatomical results of various conditions of monocular aphakia in rhesus monkeys. All monkeys had the experimental procedures (e.g., natural lens removal, corrective lens fitting, occluder lens, etc.) initiated within a few weeks after birth. Following at least a one year period of postnatal rearing, the monkeys were set up for visually evoked potentials (VEPs). This method uses the new swept VEP techniques of Drs. Norcia and Tyler at the Smith-Kettlewell Institute. So far, the amplitudes of the VEPs from each eye correlate with the rearing conditions relative to which eye has had the best visual input during development. We conclude from these results that the amount of cortical activity correlates well with the degree of normal vision provided to a developing monkey, and that given a relatively normal input, free from competition from the normal eye, an aphakic eye can retain physiological cortical connections. This is the first year of a continuing grant. All of the monkeys are part of a study which shares them with two other researchers. The results of this study are contributing to the way in which monocular aphakia in human infants is treated.

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1a 4 21	92 Neuro- science	(a) Wilson, James R. (b) Ph.D. (c) Neurobiology/Neuro-physiology	X		6	Saimiri sciureus	

1. Descriptive Title (80 characters):
Morphological/physiological Relationships in Primate LGN

Abstract:

Neurons in the lateral geniculate nucleus of squirrel monkeys (Saimiri sciureus) are characterized electrophysiologically and are injected with horseradish peroxidase. Subsequently, these injected neurons are embedded in plastic and thoroughly examined under the light and electron microscopes. Qualitative and quantitative analyses of their synaptic inputs are conducted. Correlations are then sought between the morphological and physiological data in order to find the structural bases for neuronal properties of these thalamic neurons. A search for the origin, types and synaptic positioning of extrageniculate inputs, particularly from the brainstem, is being continued. The overall, long-term goal of this research is to define the function and microcircuitry of the lateral geniculate nucleus Such information should ultimately lead to an understanding of what the connections are, how it functions with those connections, and under what conditions the system can be changed.

A new grant has been submitted to NIH to continue this research. A few squirrel monkeys are being used to provide preliminary data for this new research. In the long term, this data will be part of the basis for determining the functions of the thalamus in sensory processing and help to define health problems associated with improper processing of sensory signals.

DIVISION OF PATHOBIOLOGY AND IMMUNOBIOLOGY

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1a 28 (All systems)	46 50b 56 64	a) Anderson, Daniel C. McClure, Harold M. b) D.V.M.; D.V.M. c) Pathobiology and Immunobiology	X X		106 19 3 3 2 1 1	Macaca mulatta Macaca nemestrina Macaca nigra Macaque hybrids Saimiri sciureus Cercocebus atys Macaca arctoides	

1. Descriptive Title (80 characters):

Amyloidosis in Nonhuman Primates

Abstract:

The occurrence of a high incidence of spontaneous amyloidosis (135 cases in 14 years) in the Yerkes colony (primarily in outdoor-housed animals) has presented a unique opportunity to evaluate the epidemiology, pathogenesis, etiology, immunologic features and possible modes of treatment or prevention of this increasingly important human and animal disease problem. The tissue distribution of amyloid, pathologic features, and clinical features of this disease in nonhuman primates are comparable to that seen in man. The disease in both man and nonhuman primates, as well as other animal species, is usually a progressive fatal disease, with no satisfactory method of treatment.

Amyloidosis has been observed in 7 species of nonhuman primates (106 rhesus, 19 pig-tails, 3 black apes, 3 macaque hybrids, 2 squirrel monkeys, 1 mangabey monkey and 1 stumptail macaque) housed in 22 different outdoor compounds. The disease has been diagnosed throughout the year and has occurred in animals from 9 months to more than 30 years of age. A significant number of the animals with amyloidosis have a history of arthritis.

Efforts are currently underway to more effectively diagnose amyloidosis early in the course of the disease. This will be accomplished primarily by rectal, small intestine or liver biopsy in animals with clinical signs of amyloidosis. Animals with early amyloidosis will then be monitored periodically by hemogram, blood chemistry and immunologic evaluations. The latter will include immunoglobulin determinations and phenotyping of the peripheral blood mononuclear cells. Evaluation of these parameters during various stages of the disease may provide data which can be used to suggest possible treatment modalities.

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1a 4	64	a) Ansari, Aftab A. McClure, Harold M. Sell, Kenneth W. b) Ph.D.; D.V.M.; M.D., Ph.D. c) Pathobiology and Immunobiology	X X	 X	40 20 20	Cercocebus atys Macaca nemestrina Macaca mulatta	

1. Descriptive Title (80 characters):

Studies of SIV Specific Cell Mediated Immunity in Nonhuman Primates

Abstract:

With the knowledge that cell mediated immunity (CMI) plays an important role in the defense of the host against viral infections, an in vitro assay that measures CMI against SIV/SMM (a retrovirus that causes AIDS in monkeys) has been established during the past year. Briefly, nylon wool purified T-cells ($4x10^5$/culture) are co-cultured with autologous antigen presenting cells (APC), $1x10^5$/culture which have been pulsed with ultraviolet and psoralen inactivated preparations of SIV/SMM. The cultures are incubated for 5 days at 37°C in a 7% CO_2 humidified atmosphere. The proliferative response of these T-cells is determined by the measurement of the uptake of methyl-^{3}H-thymidine. Experiments have been conducted that demonstrate that this proliferative response is specific since T-cells from uninfected rhesus macaques and SIV/SMM seronegative and virus negative sooty mangabeys failed to proliferate when co-cultured with autologous APC pulsed with SIV/SMM. The proliferative response was seen in both $CD4^+$ and $CD8^+$ cells. The proliferative response of $CD4^+$ T-cells and $CD8^+$ T-cells was MHC-Class II and MHC-Class I restricted respectively. Of interest was our finding that addition of chloroquine and leupeptin to APC's inhibited the ability of these APC's to present SIV/SMM to antigen specific T-cells from both rhesus macaques and sooty mangabeys. These data suggest that antigen processing is required for the presentation of appropriate SIV/SMM antigens to specific T-cells. Further, SIV/SMM pulsed APC's could be treated with paraformaldehyde and still retain their capacity to present antigen to T-cells whereas, treatment of APC's with PF prior to pulsing, abolished their ability to induce T-cell proliferation. These data provide an assay and tools for the fine dissection of the cellular components involved in the immune response to SIV/SMM.

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1a 4	64	a) Ansari, Aftab A. McClure, Harold M. Sell, Kenneth W. b) Ph.D.; D.V.M.; M.D., Ph.D. c) Pathobiology and Immunobiology	X X	 X	30 30	Macaca mulatta Cercocebus atys	

1. Descriptive Title (80 characters):
Phenotype and Functional Studies of Natural Killer and LAK Cells in Rhesus and Sooty Mangabeys

Abstract:

Greater than 75% of the sooty mangabey monkeys at the Yerkes Regional Primate Research Center are naturally infected with SIV without any apparent clinical symptomatology. On the other hand, experimental infection of rhesus macaques with SIV results in a clinical syndrome similar to human AIDS. These differences with regard to SIV infection prompted us to examine the natural immunosurveillance system of peripheral blood mononuclear cells (PBMC) from SIV infected and uninfected monkeys of these 2 species. Phenotypic and functional studies of precursor and effector NK and LAK cells in the PBMC from these 2 species were carried out using monoclonal reagents, flow microfluorometry (FMF) and the standard in vitro ^{51}Cr release assay against prototype K-562 (NK sensitive) and RAJI (NK resistant, LAK susceptible) target cell lines. Data indicate that both NK and LAK cell activity in the PBMC of sooty mangabeys was significantly ($p < .01$) greater than those in rhesus macaques. The predominant NK effector cells and LAK cell precursors were shown to be Leu-19$^-$, CD8$^+$ in the PBMC of sooty mangabeys and LEU-19$^+$, CD8$^-$ in the PBMC of rhesus macaques as determined by panning depletion techniques and FMF analysis. On the other hand, the predominant LAK effector cells were found to be dual marked Leu-19$^+$, CD8$^+$ in rhesus macaques and Leu-19$^-$, CD8$^+$ in sooty mangabeys. These qualitative and quantitative differences were not due to SIV infection of these 2 species since PBMC from both SIV seropositive and virus positive and SIV seronegative, virus negative monkeys gave similar results. Of importance is the finding that the functional NK and LAK precursor cells are CD8$^+$ and CD8$^-$ in sooty mangabeys and rhesus macaques respectively. These data may have implications for the natural SIV/SMM virus positive asymptomatic state of sooty mangabeys and may provide useful tools for tracing the ontogeny and lineage derivation of NK and LAK cells.

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1a 3 4 7c 17	64 66	a) Collins, William E. b) Ph.D. c) Pathobiology and Immunobiology d) Centers for Disease Control, USPHS		X	7	Pan troglodytes	

1. Descriptive Title (80 characters):

Adaptation of Plasmodium Species to Chimpanzees for Malaria Vaccine Studies

Abstract:

The major objective of this study is the induction of Plasmodium species infection in chimpanzees for production of parasites for use in malaria vaccine development studies. Animals are inoculated and parasites obtained for (1) development of monoclonal antibodies to blood-stages, (2) preparation of genomic libraries, (3) extraction of m-RNA for genetic engineering studies with E. coli, (4) antigen for serologic tests, (5) infection of mosquitoes through membrane feeding to produce sporozoites for (a) genetic engineering studies, (b) production of monoclonal antibodies, (c) to infect Aotus and Saimiri monkeys for the study of hypnozoites and to test the efficacy of experimental vaccines, and (6) production of immune sera. During the past year, the following parasites and animals have been inoculated: Plasmodium ovale in two chimpanzees (C-400 and C384), Plasmodium vivax in five chimpanzees (C-202, C-515, C-451, C-501 and C-384) and Plasmodium malariae in one chimpanzee (C294).

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1a	36	a) Donahoe, Robert M.		X	26	Macaca mulatta	
2	50b	McClure, Harold M.	X				
4	58	Byrd, Larry D.	X				
7b	64	Fultz, Patricia N.	X				
17	66	Ansari, Aftab A.	X				
19	72	Wenzel, DeLoris M.		X			
		b) Ph.D.; D.V.M.; Ph.D.; Ph.D.; Ph.D.; Ph.D.					
		c) Pathobiology and Immunobiology and Behavioral Biology					

1. Descriptive Title (80 characters):

AIDS and Opiates: A Monkey Model

Abstract:

Intravenous drug addiction is a serious threat for the spread of acquired immunodeficiency disease syndrome (AIDS). There is certain knowledge that transmission of AIDS by intravenous drug abusers relates to their needle-sharing habits, but it may also relate to the immunomodulatory properties of addicting drugs. This project is aimed at testing the latter possibility. Twenty rhesus monkeys (Macaca mulatta), 10 receiving morphine and 10 receiving placebo, are currently being assessed for behavioral and immunological status in a longitudinal study design. Early (two weeks) after beginning chronic morphine treatment, several T-cell parameters were depressed while NK-cell activity was enhanced in morphine-dependent animals. Eight weeks later, most of the control T-cell parameters increased markedly over pre-morphine levels and above levels expressed by morphine-dependent monkeys. This indicates that early in the study, the animals probably had not fully adapted to environmental conditions that caused depressed baseline levels of T-cell expression and, consequently, immunological effects of morphine probably covaried in respect to the influence of environmental factors. Immune parameters correlated with behavioral parameters. Morphine depressed behavioral function at the time early changes in immunity were recorded. Right-handed monkeys receiving morphine experienced higher levels of NK-cell activity than did left-handed monkeys and those showing no preference concerning handedness. A separate group of six monkeys infected with SIV/SMM and morphine-dependent for the past seven months have not yet shown evidence of ARC/AIDS. Viral isolations from these animals have been similar to those from control animals. Thus, the influence of chronic morphine dependence on the course of SIV infection has yet to be determined in these ongoing experiments.

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2 Science Code AXIS I	2 Science Code AXIS II	3 (a) Investigator(s) (b) Degree(s) (c) PRC Division/Unit (d) Non-Host Institution	COR	OTHER	4 Usage Factor Number	4 Usage Factor Species Used	5 ARB Funds Allocated
1a 7c 14 17	39 64 66	a) Eberhard, Mark L. Tsang, Victor C.W. McClure, Harold M. Zea Flores, Guillermo b) Ph.D.; Ph.D.; D.V.M.; M.D. c) Pathobiology and Immunobiology d) Centers for Disease Control	X	X X X	3 3 7	Pan troglodytes Cercocebus atys Erythrocebus patas	

1. Descriptive Title (80 characters):
Characterization of Onchocerca Antigens, Animal Model Development and Ocular Immunopathogenesis

Abstract:

This study has two main objectives: (1) development and evaluation of a primate model for onchocerciasis, and (2) investigation of the antigenic makeup of various stages of Onchocerca volvulus and their immunological relevance with respect to human and animal hosts, and specific disease conditions and/or immunity. During this reporting period, animals inoculated in 1987 have been monitored for the appearance of microfilariae in the skin and/or seroconversion indicating developing or patent infections. Several of the animals (1 chimpanzee, 1 mangabey, 2 patas) have received additional booster inocula of infective larvae during the past year. Immunologically, only one chimpanzee is reacting to a few small molecular weight antigens. No other animals are responding to Onchocerca antigens. No positive skin snips have been obtained to date. None of the patas or mangabey monkeys have shown parasitological or immunological evidence of infection. We will continue these studies during the upcoming year, paying attention to animals receiving multiple inoculations, and in one or two cases, with large inocula. Differences in response between singly and multiply inoculated and small and large inocula will be especially helpful in ultimately understanding the host parasite interaction. Results from human patients are more promising. We were able to define and isotype an antigen specific response to several antigens. There is a clear distinction between resistant and infected individuals. We hope to correlate the animal and human reactivity during the upcoming year.

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2 Science Code AXIS I	2 Science Code AXIS II	3 (a) Investigator(s) (b) Degree(s) (c) PRC Division/Unit (d) Non-Host Institution	CORE	OTHER	4 Usage Factor Number	4 Usage Factor Species Used	5 ARB Funds Allocated
1a 7b 19	56 64 66	a) Fultz, Patricia N. McClure, Harold M. Otsyula, Moses Isahakia, Mohamed Else, James G. b) Ph.D.; D.V.M.; M.S.; Ph.D.; D.V.M. c) Pathobiology and Immunobiology d) Institute of Primate Research, Kenya	X X X	 X X 	39 30	Cercopithecus mitis Cercopithecus aethiops	

1. Descriptive Title (80 characters):

Seroprevalence of SIV Infection in Feral Kenyan Monkeys

Abstract:

To gain an understanding of the frequency of natural infections and the possible origin of primate lentiviruses, populations of feral monkeys from various regions of Kenya are being surveyed for the presence of antibodies to simian immunodeficiency viruses. Serum samples obtained from various species, including Sykes and African green monkeys and baboons, are being screened by radioimmunoprecipitation (RIP) and enzyme immunoassay (EIA) for antibodies to SIV/SMM, SIV_{agm}, HIV-2 and HIV-1. In addition, these same sera are being tested for antibodies to the oncovirus STLV-1 by RIP and EIA techniques employing the human virus, HTLV-1, which has been postulated to be of African origin. Preliminary analysis of 69 samples shows that 62% of Sykes monkeys and 47% of African green monkeys were positive for antibodies to SIV, while 28% of Sykes monkeys and 33% of African green monkeys were positive for antibodies to STLV-1. There was concordance between those sera positive for antibodies to SIV/SMM, HIV-2 and SIV_{agm}. No correlation between exposure to SIV and STLV-1 was observed. These studies should identify those areas of Kenya endemic for SIV infection. Future studies will be aimed at isolating novel viruses and determining the extent of genetic variability among the nonhuman primate lentiviruses.

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2 Science Code AXIS I	2 Science Code AXIS II	3 (a) Investigator(s) (b) Degree(s) (c) PRC Division/Unit (d) Non-Host Institution	COREa	OTHERb	4 Usage Factor Number	4 Usage Factor Species Used	5 ARB Funds Allocated
1a 2 7b	39 50b	a) Fultz, Patricia Anderson, Daniel C. McClure, Harold M. Sonigo, Pierre Montagnier, Luc b) Ph.D.; D.V.M.; D.V.M.; M.D., Ph.D.; M.D. c) Pathobiology and Immunobiology d) Institut Pasteur	X X X	 X X	1	Macaca nemestrina	

1. Descriptive Title (80 characters):

Characterization of the Biologic Properties of SIV/SMM(PBj_{14})

Abstract:

Biologic properties of a variant of SIV/SMM-9, designated SMM-PBj_{14}, are being analyzed *in vitro* and compared with those of the parent virus, SMM-9. Specific properties being assessed include: (i) ability to replicate in peripheral blood mononuclear cells (PBMC) from different primate species and in different cell lines of human origin; (ii) ability to form syncytia with different $CD4^+$ cell lines; (iii) ability to be neutralized by serum from macaque PBj; (iv) ability of sCD4 and various monoclonal antibodies to block infectivity of the viruses; and (v) ability to replicate in macaque PBMC maintained in the absence of mitogenic stimulation and interleukin 2. Sequential virus isolates obtained from macaque PBj between the time of inoculation with SMM-9 and the isolation of SMM-PBj_{14} 14 months later are also being tested for these same properties in an effort to define the evolution of specific phenotypes. Preliminary results suggest either that multiple mutations have occurred or that specific variants in the original inoculum have been selected *in vivo*. Furthermore, the analysis of sequential isolates indicate that some phenotypes can be dissociated, e.g., the ability to form syncytia with Sup-T1 cells and induction of proliferation. These studies, in conjunction with molecular analysis, may lead to the identification of genomic sequences that determine specific biologic properties, including those sequences that determine pathogenicity. Molecular cloning and sequencing of the LTR and *env* regions of SMM-9 and SMM-PBj_{14} show that SIV/SMM belongs to the HIV-2/SIV_{mac} group of viruses.

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1a 2 7b 17 19	39 64 66 92- Vaccines	a)Fultz, Patricia Girard, Marc Mawle, Allison b) Ph.D.; Ph.D.; Ph.D. c) Pathobiology and Immunobiology d) Pasteur Vaccins and Centers for Disease Control	X	X X	14	Pan troglodytes (non-Yerkes animals)	

1. Descriptive Title (80 characters):

Immunization and Challenge of Chimpanzees with HIV-1

Abstract:

In efforts to develop a vaccine against HIV-1, chimpanzees are being immunized with various HIV-1 antigen preparations which include: recombinant vaccinia viruses expressing gp120env, p25gag or nef; purified inactivated whole virions; purified gp120env, p18gag, nef or vif proteins formulated with an MTP-based adjuvant; and peptides representing the major neutralizing epitope on gp120. Following immunization, HIV-specific humoral and cell-mediated immune responses were monitored by EIA, immunoblot, radioimmunoprecipitation and neutralization assays (humoral) and by assessment of proliferation to HIV antigens and the presence of cytotoxic T lymphocytes (cell-mediated). One animal immunized with whole virus was challenged by intravenous inoculation of 30 TCID of LAV-1_{BRU}; however, virus was recovered from peripheral blood cells within 2 weeks of inoculation and on all subsequent attempts, indicating the vaccine was not protective. Failure to protect could have been related to the lack of neutralizing antibodies to the challenge virus at the time of challenge. In general, most HIV antigens have failed to elicit significant neutralizing antibodies, which suggests that other approaches at immunization may be necessary.

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1a	62	a) Fultz, Patricia	X		4	Pan troglodytes	
2	64	Dina, Dino		X			
7b	66	Steimer, Kathelyn		X			
17		McClure, Harold	X				
19		Anderson, Daniel	X				
		b) Ph.D.; M.D.; Ph.D.; D.V.M.; D.V.M.					
		c) Pathobiology and Immunobiology					
		d) Chiron Corporation					

1. Descriptive Title (80 characters):

Therapeutic Immunization of HIV-infected Chimpanzees

Abstract: Immunosuppression can be a major effect of HIV infection. In general, HIV-specific immune responses decrease over time after infection; often, these decreases precede progression of disease to AIDS. It has been hypothesized that hyperimmunization of persons infected with HIV prior to loss of immune function and development of AIDS might prevent further disease. However, since activation of lymphocytes is required for replication of HIV, it is possible that immunization of HIV-infected persons might induce virus expression. To test the effect of post-infection immunization, HIV-infected chimpanzees were immunized twice with purified HIV gp120env or p53gag antigens given intramuscularly 4 weeks apart. Parameters measured included: EIA antibody titers to seven HIV antigens; neutralizing antibody titers to two diverse HIV isolates; cell-mediated cytotoxic activity; and numbers of HIV-infected peripheral blood mononuclear cells (PBMC). Post-infection immunization resulted in increases in antibody titers to the specific HIV-immunogen, but there were no significant increases in overall anti-HIV titers. In addition, there was no obvious effect on cell-mediated immune responses or neutralizing antibody titers. Titration of PBMC before and after immunization showed a transient increase in numbers of PBMC, suggesting that activation of HIV replication may have occurred. Activation, however, appeared to be nonspecific because the control animal, that received only adjuvant, also had increases in numbers of infectious PBMC. At the time of immunization with HIV p53gag, one chimpanzee was lymphopenic (with numbers of CD4 cells decreased by more than 80% of normal levels) and also was mildly thrombocytopenic. In this animal, immunization resulted in a 3-fold increase in antibodies to p25gag antigen and a 6-fold increase in numbers of infectious PBMC. No changes in hematologic parameters or clinical condition were noted. This study suggests that post-infection immunization with these antigens may have limited effect on HIV-specific immunity, and may induce HIV replication. Further study is warranted.

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2 Science Code AXIS I	2 Science Code AXIS II	3 (a) Investigator(s) (b) Degree(s) (c) PRC Division/Unit (d) Non-Host Institution	COR E	OTHER	4 Usage Factor Number	4 Usage Factor Species Used	5 ARB Funds Allocated
1a 7b 19	64 66	a) Fultz, Patricia N. Stricker, Ray McClure, Harold M. Anderson, Daniel C. b) Ph.D.; M.D.; D.V.M.; D.V.M. c) Pathobiology and Immunobiology d) University of California at San Francisco	X X X	 X 	20 12 1	Cercocebus atys Macaca mulatta Macaca nemestrina	

1. Descriptive Title (80 characters):
Role of Humoral Immune Response in Infection by SIV/SMM

Abstract:

SIV/SMM causes no apparent disease in naturally infected sooty mangabey monkeys but results in an AIDS-like disease following experimental inoculation of macaque monkeys. To identify those factors that may play a role in maintenance of the asymptomatic state in mangabeys, various aspects of the humoral immune responses of SIV/SMM-infected mangabeys and macaques were compared. The analysis included comparisons of total antibody titers to SIV/SMM, serum neutralizing activity against cell-free virus, the ability of serum to inhibit syncytia formation by infected cells or to inhibit reverse transcriptase activity, the presence of autoimmune responses to histone H2B and native DNA, and the ability of serum antibodies to lyse SIV/SMM-infected cells in the presence of complement. The results indicate no significant differences were detected in any of the parameters measured with one exception: antibodies to histone H2B and native DNA were found predominantly in serum from infected macaques but not from infected mangabeys. This suggests that a major component of disease progression, not only in SIV infection of macaques, but also in HIV infections of people, may be due to autoimmune mechanisms. Therapeutic strategies that interfere with or abrogate autoimmunity, e.g., immunosuppression, paradoxically may be beneficial.

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2 Science Code		3			4 Usage Factor		5
AXIS I	AXIS II	(a) Investigator(s) (b) Degree(s) (c) PRC Division/Unit (d) Non-Host Institution	CORE	OTHER	Number	Species Used	ARB Funds Allocated
1a 2 7b 17 19	39 64 66 92- Vaccines	a) Fultz, Patricia Gregersen, Jens b) Ph.D.; Ph.D c) Pathobiology and Immunobiology d) Behringwerke	X	X	12	Pan troglodytes (non-Yerkes animals)	

1. Descriptive Title (80 characters):

Immunization and Challenge of Chimpanzees with HIV-1

Abstract:

In efforts to develop an effective vaccine against HIV-1, chimpanzees are being immunized with purified whole virions that have been inactivated and formulated with three different adjuvants, which include alum, incomplete Freund's and BWZL, a new adjuvant preparation under development by Behringwerke AG. Following immunization, humoral and cellular immune responses are being assessed by EIA, immunoblot, neutralization, and proliferation to purified virus. In addition, the responses elicited by the three adjuvants are being compared quantitatively and qualitatively.

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AXIS I	AXIS II				Number	Species Used	
1a 4 7c	64	a) Greene, Bruce M. Unnasch, Thomas R. b) M.D.; Ph.D. c) Pathobiology and Immunobiology d) University of Alabama at Birmingham		X X	2	Pan troglodytes	

1. Descriptive Title (80 characters):

Characterization and Molecular Cloning of Antigens of O. volvulus

Abstract:

Onchocerciasis is a leading cause of blindness in humans, and causes debilitating and disfiguring skin disease. There is no means of prevention and no practical means of cure. Therefore, vaccine development is a high priority. The only animal species that can reliably be infected is Pan troglodytes. Simulium damnosum containing infective larvae of Onchocerca volvulus were irradiated (20kr), dissected, and the larvae inoculated into two Pan troglodytes. Lymphocyte blastogenic response and antibody response (Western Blots) in the challenged animals has been followed serially. The most striking finding was a prompt and marked increase in lymphocyte blastogenic response to O. volvulus antigen, but not to streptolysin or PPD. Experiments are underway to develop lines and clones to the O. volvulus antigen as a first step towards vaccine development.

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1a 3	48 52	a) Hester, T. Roderick Cukic, J. b) M.D.; P.A.-C. c) Pathobiology and Immunobiology		X X	10	Macaca mulatta	

1. Descriptive Title (80 characters):
Capsular Contracture and Histology of Smooth-Walled Silicone, Textured Silicone, and Polyurethane Covered Mammary Implants

Abstract:

Available data indicate that textured surface mammary implants are less likely to result in clinically significant capsular contracture than are smooth-walled devices. The polyurethane-covered silicone gel implant has been the most widely used textured implant. At present it is unclear whether the effect of the polyurethane is primarily related to its textured surface or to nuances of its chemical structure. In an attempt to answer this question, 14 smooth-walled, 16 textured silicone, and 17 polyurethane-covered implants were placed in 10 rhesus monkeys. The primary purpose of this research is to determine whether a textured surface silicone (biochemically inactive) will be as effective in preventing capsular contracture as polyurethane (biochemically active). An all-important part of this study has been to chart histologic activity occurring around the three types of implants. Also, tensiometric studies of capsular tension has allowed direct measurements of degrees of capsular contracture occurring around the implants in a controlled setting in a primate model. Finally, quantitative measurement of collagen present in the capsules has been done to help determine the relative importance of bulk versus pattern of collagen deposition. These studies will contribute to a better understanding of mammary implants and should help to eliminate or minimize adverse reactions associated with such implants.

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1a 2	62 64 66	a) Keyserling, Harry L. Nahmias, Andre J. McClure, Harold M. b) M.D.; M.D.; D.V.M. c) Pathobiology and Immunobiology	X	X X	4	Macaca mulatta	

1. Descriptive Title (80 characters):
Development of Antibody Screening Cell Assays Against Tetanus Toxoid in Rhesus Monkeys

Abstract:

This study is designed to develop new immunologic techniques for measuring antibody secreting cells in peripheral blood of monkeys. Recently, assays have been developed in humans to quantitate antibody secreting cells for various antigens (i.e. tetanus toxoid, human immunodeficiency virus). This methodology [ELISPOT] may be useful to diagnose and monitor therapy for AIDS. Simian immunodeficiency virus (SIV) is similar to human immunodeficiency virus (HIV) and SIV-infected rhesus monkeys provide a primate model for the study of vaccines, immunobiology and therapy for primate retroviruses. It is important to adapt the ELISPOT assay used in humans for evaluation of immune response in rhesus monkeys. Tetanus toxoid has been selected as the prototypic antigen to be studied since there is extensive human experience with this antigen and monkeys have already been immunized with tetanus in a prior study. Preliminary results from four animals indicate that antibody secreting cells against tetanus toxoid can be quantitated in monkeys following a booster dose of tetanus toxoid.

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1a 2	62 64 66	a) Keyserling, Harry L. McClure, Harold M. b) M.D.; D.V.M. c) Pathobiology and Immunobiology	X	X	12	Macaca mulatta	

1. Descriptive Title (80 characters):

Transplacental Active Immunization of Rhesus Monkeys

Abstract:

The human neonate is deficient in responding to antigenic stimuli to protein antigens in the first few months of life and to polysaccharide antigens during the first two years of life. If immunization strategies and techniques could be developed to prime the fetus in utero and administer a booster dose at the time of delivery, infection may be prevented or the severity decreased. The placenta has been thought to be a significant barrier to the passage of antigens from mother to fetus. Studies conducted in large animals with a sufficiently long gestational period have shown that by the third trimester the fetus can respond to certain antigenic stimuli with a good response similar to an adult.

Eight pregnant rhesus monkeys were immunized with dT (diphtheria tetanus) vaccine; four animals at approximately 100 and 130 days gestation and four animals at approximately 130 days gestation. Infants born to these mothers were bled within 5 days of birth. These eight infants together with four additional control infants were bled at 2, 4, and 6 months and immunized with dT vaccine and PRP-D vaccine. PRP-D vaccine is a diphtheria-polyribosylribitol phosphate (the Haemophilus type b capsular polysaccharide) preparation. The final sera have been collected and preliminary assays for tetanus and diphtheria antibody have been completed. PRP assays are under development. Antibody titers and isotype class will be compared among the three experimental groups.

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Ia 27	48 62 86	a) Malizia, Anthony A.,Jr. Woodard, John R. Newton, Nancy E. Anderson, Daniel C. Wyly, J. Bradley Rushton, H. Gil b) M.D.; M.D.; M.D.; D.V.M.; M.D.; M.D. c) Pathobiology and Immunobiology	X	X X X X X	5 5	Macaca mulatta Macaca nemestrina	

1. Descriptive Title (80 characters):

Intravesical Injection of Teflon for Vesicourethral Reflux

Abstract:

Intravesical/subureteric injection of Polytef paste has been used to treat vesicoureteral reflux in over 1000 children worldwide. This has been done without FDA approval and only limited animal studies have been performed. Our study in non-refluxing monkeys demonstrates not only distant migration of Polytef particles from the injection sites but also the development of huge foreign body granulomas at all intravesical injection sites. We have also demonstrated that these granulomas can be clearly imaged radiologically. CT scanning and magnetic resonance imaging at intervals up to three years show over a six-fold increase in the average volume of these granulomas. We have also found that ultrasound (the most common method used to follow human children) poorly defines granuloma size.

We injected 0.4 cc (1/2 of human dosage) of Polytef paste transurethrally into the intravesical/subureteric space of ten monkeys. Five monkeys were sacrificed at six months and two monkeys at 32 months. The injection sites, pelvic and paraortic nodes, kidneys, liver, lungs, and brain of each monkey were studied by standard and polarized light microscopy. Local and distant migration of Polytef particles from the injection sites were confirmed in all animals. A voluminous local granulomatous reaction was found at all intravesical injection sites. In addition, at 32 months these granulomas have developed a neovascularity which allows for their continued growth. In the three living animals the granulomatous reaction is being followed radiologically by both CT scanning and magnetic resonance imaging allowing documentation of their growth over time.

We believe that until the long term effects in humans are known, Polytef paste should not be used in children with a normal life expectancy. To our knowledge we have the only long-term living animal model for continued study.

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1a 25b	62 86	a) McCarey, Bernard E. van Rij, Gabriel Wood, Mark b) Ph.D.; M.D.; M.D. c) Pathobiology and Immunobiology		X X X	20	Macaca mulatta	

1. Descriptive Title (80 characters):

Feasibility Study of Hydrogel Intracorneal Implants

Abstract: The use of hydrogel intracorneal lens implants for refractive keratoplasty has raised questions concerning the cornea's physiological response to implants, in particular the effects of refractive keratoplasty on the epithelial, stromal and endothelial cell layers. The margin of safety in maintaining a normal metabolism and nutrient supply has not been clarified. The epithelial maintenance involves respiration and protein synthesis in order to retain cell integrity and to replenish the desquamating surface epithelial cells. The implant alters the diffusion pathway for nutrients and amino acids by adding thickness in the stroma. Since minimum nutritional requirements of the cells have not been defined, the margin of safety with the implant is unknown, as is the implant's effect on epithelial wound healing. Another concern is that potential atmospheric oxygen deprivation to the endothelium caused by the implant may cause long-term endothelial changes comparable to those observed with extended wear contact lenses. Corneal tissue remodeling is a concern to all refractive keratoplasty techniques. The hydrogel implant causes refractive change by altering the anterior corneal curvature, yet epithelial hypoplasia and hyperplasia and new collagen deposits cause a gradual reversal of power correction. Remodeling factors, such as keratectomy diameter, implant design and the mechanical force of the eyelids against the epithelium will be investigated. Eight primates with hydrogel intracorneal lenses will be monitored for long-term morphology changes, such as epithelial hypoplasia anterior to aphakic implants, and redox-fluorometry changes in epithelial and endothelial cell metabolism. An additional ten primates will receive myopic implants to determine the refractive predictability and stability, as well as the topographic changes and morphological alterations. Relationships between hydrogel implants and corneal physiology may be applied to other refractive keratoplasty techniques. Improved clinical techniques for refractive surgery can be devised by better understanding of the cornea's physiological response to surgery.

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1a 25b	62 86	a) McCarey, Bernard E. van Rij, Gabriel Wood, Mark b) Ph.D.; M.D.; M.D. c) Pathobiology and Immunobiology		X X X	6	Macaca mulatta	

1. Descriptive Title (80 characters):

Refractive Synthetic Epikeratoplasty

Abstract:

In 1980, Kaufman and Werblin introduced the concept of manufacturing donor corneas into lenticules to be sutured onto the surface of the cornea. The purpose was to modify the refractive power of the eye. The procedure became known as epikeratophakia. The technique is presently in FDA human clinical trials. The major clinical concern is the quality of the epithelial cells that migrate over the lenticule. In many patients, the epithelial cells are poorly adhered to the corneas and may become dislodged. A practical concern is the availability of donor tissue to be manufactured (a cryolathe technique) into epikeratophakia lenticules.

Chiron Ophthalmics, Irvine, California has proprietary epithelial growth factors (EGF) and synthetic polymers that they feel can be used in combination as a synthetic epithelial lens (SEL). The product has the potential of overcoming the epithelial adhesion and material availability problems of the conventional epikeratophakia lenticule.

The present study is evaluating the Chiron SEL materials for biocompatibility and refractive alteration that they create to the eye.

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1a 28 (All systems)	30 76a 76b 80a	a) McClure, Harold M. Anderson, Daniel C. b) D.V.M.; D.V.M. c) Pathobiology and Immunobiology	X X		76	Macaca mulatta	

1. Descriptive Title (80 characters):

Evaluation of the Long-term Effects of Irradiation in Rhesus Monkeys

Abstract: A group of 76 rhesus monkeys (55 irradiation-exposed and 21 non-exposed controls of comparable age) has been studied from year 10 to year 32 post-irradiation. Studies were designed primarily to document the incidence and characterize the types of tumors which occurred in this unique population. During this period, 73 of the initial group of animals died. Thirty-five of the 73 (47.9%) animals which died had one or more neoplasms at the time of death. Tumors occurred in 30 of 53 (56.6%) irradiation-exposed animals which died, and in 5 of 20 (25.0%) non-exposed controls which died. Consequently, 30 of 35 (85.7%) tumor cases occurred in irradiation-exposed animals.

Tumors were diagnosed in 17 of 25 (68%) bomb-exposed animals which died; 7 of 16 (44%) Co^{60} exposed animals; and in 4 of 5 (80%) animals exposed to pure neutron irradiation. During the same time period, a tumor incidence of approximately 4% was encountered in other rhesus monkeys in our colony that were 10 years of age or older at the time of death.

The most frequently encountered tumors involved the intestinal tract (12 adenocarcinomas and 1 leiomyosarcoma), and the second most frequently involved organ was the pancreas (2 acinar cell carcinomas, 1 acinar cell adenoma, and 4 islet cell adenomas). Other tumor types, in decreasing order of frequency, included adrenal adenomas or pheochromocytomas (4), soft tissue sarcomas (3), basal cell carcinomas of the skin (3) kidney carcinomas or adenomas (3), pituitary adenomas (2), thyroid carcinoma and adenoma (2), uterine leiomyoma(2), splenic hemangioma (2), lymphoma (2), 2 esophageal leiomyomas, and one each of glioblastoma of the brain, leukemia, seminoma, subcutaneous fibroma, subcutaneous lipoma, liver cell carcinoma, cholangiocarcinoma, salivary gland adenoma, hemangioma of the skin, squamous cell carcinoma of the mouth, and breast carcinoma. These observations suggest that irradiation exposure is cancerogenic in the rhesus monkey, and that tumors may occur many years following exposure.

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1a 7b	64 66	a) McClure, Harold M. Anderson, Daniel C. Ansari, Aftab A. Fultz, Patricia N. b) D.V.M.; D.V.M.; Ph.D.; Ph.D. c) Pathobiology and Immunobiology	X X X X		6	Macaca nemestrina	

1. Descriptive Title (80 characters):
Pathogenicity of Biologic Clones of SIV/SMM/PBj$_{14}$

Abstract:

In order to provide additional evidence that SIV/SMM/PBj$_{14}$, a variant of SIV/SMM derived from a chronically infected macaque, is the cause of acute, lethal disease, two biologic clones generated by limiting dilution of virus obtained from a lymph node of animal PBj have been evaluated for pathogenicity in pig-tailed macaques.

Three pig-tailed macaques inoculated with the first biologic clone seroconverted and became virus positive within three weeks of inoculation. Although none of these animals developed acute clinical disease, two of the three animals developed chronic diarrhea, weight loss and severe immune suppression at 10-15 months post-infection. One of these animals subsequently died 19 months post-infection. This animal's clinical condition and immune parameters had become progressively worse; just prior to death the animal had 8% $CD4^+$ cells (340) and a $CD4^+/CD8^+$ cell ratio of 0.18. A second animal is showing progressive immunosuppression (7% $CD4^+$ cells and a $CD4^+/CD8^+$ cell ratio of 0.10 at 21 months post-infection) and a progressive deterioration of clinical condition. Although the third animal has shown periodic episodes of diarrhea, it continues to show normal immune parameters.

The pathogenicity of a second biologic clone was subsequently evaluated by intravenous inoculation of three pig-tailed macaques. All three of these animals developed acute clinical disease within 5-6 days of inoculation and died within 7-8 days of inoculation (same clinical appearance as that seen with the original PBj isolate). The pathologic findings in these animals were also identical to that seen in animals inoculated with the original PBj isolate.

These observations provide further evidence that the PBj isolate is the sole cause of acute clinical disease and death in experimentally infected pig-tailed macaques.

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1a 7b	56 66	a) McClure, Harold M. Anderson, Daniel C. Fultz, Patricia N. b) D.V.M.; D.V.M.; Ph.D. c) Pathobiology and Immunobiology	X X X		7 2	Macaca mulatta Macaca nemestrina	

1. Descriptive Title (80 characters):

Evaluation of Transmission of SIV/SMM by Contact

Abstract:

As part of ongoing studies on the use of SIV/SMM-infected macaques as models for AIDS, studies were designed to determine whether infection with this HIV-like retrovirus could be transmitted by direct or indirect contact with infected animals. To evaluate this possible mode of transmission, three young rhesus macaques and two young pig-tailed macaques were housed in individual cages in the same room with SIV/SMM-infected rhesus and pig-tailed macaques. In addition, four young rhesus macaques were housed in the same cage with comparably aged SIV/SMM-infected rhesus (one infected and one non-infected animal per cage).

The three individually caged rhesus have now been housed in the same room with infected macaques for a period of 45 months; the two individually caged pig-tailed macaques have been maintained in the same room with infected macaques for a period of 24 months. The four rhesus housed in the same cage with infected rhesus have been maintained under these conditions for a period of 24 months. The SIV/SMM-infected cage mate of two of the latter animals died from an AIDS-like disease at five and 16 months after the introduction of a non-infected cage mate.

These 9 sentinel animals have been evaluated at intervals of 3 weeks to 3 months since the study was initiated. This has included physical examinations, hemogram evaluations, serologic evaluation for antibodies to SIV/SMM, and culture of peripheral blood mononuclear cells for SIV/SMM. All animals have remained clinically normal, seronegative and virus negative. These observations indicate that SIV/SMM is not transmissible to animals housed in adjacent cages or to non-infected animals housed in the same cage with infected animals (all animals were sexually immature). These data indicate that SIV, like HIV, is not transmitted by casual contact.

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1a 7b 19	56 64 66	a) McClure, Harold M. Anderson, Daniel C. Ansari, Aftab A. Fultz, Patricia N. Gordon, Thomas b) D.V.M.; D.V.M.; Ph.D.; Ph.D.; M.S. c) Pathobiology and Immunobiology and Behavioral Biology	X X X X X		131	Cercocebus atys	

1. Descriptive Title (80 characters):
Natural SIV Infection in Sooty Mangabeys

Abstract:

Since discovery of a natural T-lymphotropic retrovirus infection in the Yerkes mangabey colony, we have continued to monitor this colony to determine the incidence of infection and define the possible modes of transmission. The colony of 131 animals was divided into 2 groups to facilitate more frequent capture for specimen collection related to viral screening and tracking the timing of seroconversion in immature animals. To date, 16 of 26 (62%) animals in a small group of 30 animals (4 not checked) and 51 of 71 (72%) animals in the larger group of 101 animals (30 not checked) have been found to be seropositive. Except for young animals, all antibody positive animals that have been cultured have been virus positive. Semen samples cultured from two virus positive animals were virus negative.

Despite the high incidence of infection in the colony, there is no apparent difference in the incidence of disease in the mangabey colony as compared to other monkey colonies at Yerkes. Diseases noted in mangabeys which might be associated with an SIV infection include 2 cases of herpetic (CMV) glomerulitis, 1 case of gastric and colonic amebiasis and 1 case of ulcerative gingivitis (noma). An adult female mangabey recently developed a lymphocytosis and diffuse, nodular, lymphoreticular lesions of the skin which have persisted for more than a year. This animal is seropositive for both SIV/SMM and STLV-I.

The high infection rate in mature animals and the occurrence of occasional infections in infants suggest that transmission of SIV/SMM may be comparable to the transmission of HIV (by sexual contact or perinatally). These observations suggest the use of this colony of naturally infected mangabeys as a model system for study of the epidemiology and pathogenesis of an HIV-like retrovirus, for identification of cofactors that may be associated with the occurrence of clinical disease, and to evaluate immune responses that prevent the development of clinical disease.

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1a 7b	64 66	a) McClure, Harold M. Anderson, Daniel C. Ansari, Aftab A. Fultz, Patricia N. b) D.V.M.; D.V.M.; Ph.D.; Ph.D. c) Pathobiology and Immunobiology	X X X X		12	Macaca nemestrina	

1. Descriptive Title (80 characters):
Determination of the Minimal Infectious Dose of An Acutely Lethal Variant of SIV/SMM (SIV/SMM/PBj$_{14}$)

Abstract:

The objective of this study was to determine the minimal infectious (lethal) dose of an acutely lethal variant of SIV/SMM (SIV/SMM/PBj$_{14}$) derived from a chronically infected pig-tailed macaque. To accomplish this, six groups of two pig-tailed macaques were inoculated intravenously with 10-fold serial dilutions of the PBj isolate, or doses ranging from 10^4 to 0.1 TCID$_{50}$.

All animals given 10 TCID$_{50}$ or greater became infected and developed acute clinical disease. Although there was no evidence the two recipients of 1 TCID$_{50}$ became infected, one animal that received 0.1 TCID$_{50}$ was infected and at 6 weeks post-infection had reduced numbers of CD4$^+$ cells that decreased progressively until death 9 months post-infection. In the other animals, disease onset ranged from day 7 (10^4 TCID) to day 12 (10 TCID) post-infection, with death occurring from day 8 to 16. One animal survived the acute disease but showed a progressive decrease in CD4$^+$ cells and died 7 months post-infection, with emaciation, oroesophageal candidiasis, lymphadenopathy, splenomegaly, lymphopenia and a CD4$^+$/CD8$^+$ cell ratio of 0.16.

The lowest dilution (10^{-3} or 10 TCID$_{50}$) of a pool of the PBj isolate to infect all animals also resulted in death of both animals within 16 days, supporting our belief that SIV/SMM/PBj$_{14}$ is the sole agent responsible for the acute lethal disease. There was a correlation between dose and onset of disease and death. Two longer-term survivors showed decreasing numbers of CD4$^+$ cells, weight loss, lymphadenopathy, lymphopenia and opportunistic infections. The development of clinical disease in these animals appeared to correlate with a marked reduction in CD8$^+$ cells.

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1a 7b	64 66	a) McClure, Harold M. Anderson, Daniel C. Ansari, Aftab A. Fultz, Patricia N. b) D.V.M.; D.V.M.; Ph.D.; Ph.D. c) Pathobiology and Immunobiology	X X X X		12 6	Macaca nemestrina Cercocebus atys	

1. Descriptive Title (80 characters):

Outcome of SIV/SMM/PBj$_{14}$ Infection in Animals Previously Infected with SIV/SMM

Abstract:

Preliminary studies have indicated that infection with SIV/SMM in the mangabey monkey provides protection to a subsequent challenge with SIV/SMM/PBj$_{14}$, an acutely lethal variant of SIV/SMM. In these studies, 3 of 4 SIV/SMM-seronegative mangabeys developed acute clinical disease and died within 12 days of challenge with SIV/SMM/PBj$_{14}$. Two SIV/SMM-seropositive and virus positive mangabeys remained clinically normal following challenge with the PBj isolate.

Due to the potentially important implications of these preliminary observations with respect to vaccine development, additional studies have been initiated to determine whether prior infection with SIV/SMM provides any protection to a subsequent challenge with SIV/SMM/PBj$_{14}$ in the pig-tailed macaque. In these studies, three groups of 3 pig-tailed macaques will be challenged with the PBj isolate at 3 weeks, 3 months and 9 months post-infection with SIV/SMM. A fourth group of three pig-tailed macaques, not infected with SIV/SMM, will be challenged with SIV/SMM/PBj$_{14}$ as controls.

These studies should provide information on whether any protection is immune mediated or due to some other factor, as well as information on the length of time needed to develop a protective immune response. Information will also be obtained on whether a specific type of immune response must develop to provide protection. These studies have important implications toward the development of effective lentivirus vaccines.

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1a 2 7b 19	50b 64 66	a) McClure, Harold M. Anderson, Daniel C. Ansari, Aftab A. Fultz, Patricia N. Lehrman, Sandra N. b) D.V.M.; D.V.M.; Ph.D.; Ph.D.; M.D. c) Pathobiology and Immunobiology d) Burroughs Wellcome	X X X X	 X	12	Macaca nemestrina	

1. Descriptive Title (80 characters):
Prophylactic Effect of AZT Following Exposure of Macaques to an Acutely Lethal Variant of SIV ($SIV/SMM/PBj_{14}$)

Abstract:

A variant of SIV ($SIV/SMM/PBj_{14}$) derived from a chronically infected pig-tailed macaque causes an acute clinical disease and death within 7-21 days in experimentally infected pig-tailed macaques. This animal model system, which should prove to be extremely useful in the rapid evaluation of newly developed antiretroviral drugs, has been used in a preliminary study to evaluate the prophylactic effects of AZT when administered shortly after virus exposure.

In this study, four groups of three pig-tailed macaques were give 10 $TCID_{50}$ of $SIV/SMM/PBj_{14}$. AZT at 100 mg/kg/day, divided into 3 doses, was given subcutaneously for a period of 14 days. Treatment was initiated at 1 (group 1), 24 (group 2) or 72 (group 3) hours after virus exposure; group 4 animals were untreated. All animals except one in group 1 were virus positive at 10 days post-inoculation. Three animals in group 1 and 2 remained clinically normal; all other animals developed clinical disease within 10-17 days of virus exposure. One death occurred in group 1 and 2 deaths occurred in each of the other groups. Survivors in groups 3 and 4 are showing clinical disease and immunosuppression, whereas survivors in groups 1 and 2 are clinically normal and have normal immunological parameters. One animal in group 1 has no evidence of SIV infection. Survivors in groups 3 and 4 have 30 fold higher antibody titers than survivors in groups 1 and 2, suggesting that the former had more antigenic stimulation due to increased virus replication.

These data indicate that some protection is provided by AZT when treatment is initiated within 24 hours of exposure to an acutely lethal simian HIV-like virus. This preliminary study further documents the usefulness of this animal model in the rapid evaluation of antiretroviral drugs.

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1a 7b	64 66	a) McClure, Harold M. Anderson, Daniel C. Ansari, Aftab A. Fultz, Patricia N. b) D.V.M.; D.V.M.; Ph.D.; Ph.D. c) Pathobiology and Immunobiology	X X X X		12 1	Macaca mulatta Macaca nemestrina	

1. Descriptive Title (80 characters):

Spectrum of Disease in Macaque Monkeys Chronically Infected with SIV/SMM

Abstract:

Twelve rhesus and one pig-tailed macaque have been monitored for 28-41 months following experimental infection with 10^4 TCID of SIV/SMM. Twelve of the 13 animals became virus positive and seroconverted within 3 to 6 weeks of exposure; the remaining animal seroconverted at 6 months, but has remained virus negative. Most of the infected animals developed clinical disease characterized by variable degrees of diarrhea, weight loss, peripheral lymphadenopathy, skin rash and immunosuppression.

Six of the 13 animals (46%) died between 14 and 28 months post-infection, following prolonged clinical disease characterized by chronic diarrhea and weight loss, lymphadenopathy and hemogram abnormalities. Histologic findings ranged from prominent follicular hyperplasia to severe lymphoid depletion, with lymphoid tissues often showing an infiltrate of syncytial giant cells. One animal had intestinal cryptosporidiosis and two had brain lesions comparable to those seen in AIDS encephalopathy in humans. Three of the remaining seven animals have an ARC-like disease and are showing gradual deterioration of their clinical condition. These animals, as well as animals that died, had progressive decreases in $CD4^+$ cells and in $CD4^+/CD8^+$ cell ratios.

These observations further document the marked clinical, pathologic and immunologic similarities between human AIDS and the SIV-infected macaque model.

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1a 3 6 9 16b,c,e	39 60 64 76	a) Metzgar, Richard S. b) Ph.D. c) Pathobiology and Immunobiology d) Duke University Medical Center	X		3	Pan troglodytes	

1. Descriptive Title (80 characters):

Immunological and Molecular Studies of Primate Antigens

Abstract:

The overall goals of this project are to continue to define selected antigens of human cells and to use nonhuman primates for evaluating potential human tumor vaccines. The uniqueness of the study is that it utilizes the immunologic perspectives of a species remarkably similar to man to recognize epitopes on human antigens that may not be seen by other mammalian species.

The specific aims are to establish immunogenicity and to produce chimpanzee monoclonal and monospecific polyclonal antibodies to selected human tumor antigens related to growth differentiation and transformation of secretory epithelial cells of the G.I. tract especially the pancreas.

Chimpanzee monoclonal antibodies (MOABS) have been reliably produced to several antigens of human pancreatic adenocarcinoma cells. Some of the antigens defined by these MOABS have a ubiquitous human tissue distribution and are similar to a series of human monoclonal antibodies produced after immunization of patients with a human colorectal tumor vaccine (Cancer Research 48:7273, 1988). Other MOABS were isolated from chimpanzees injected with deglycosylated pancreatic tumor mucins and show a restricted tissue distribution. The specificity of these MOABS and the molecular properties of the antigens they define is currently being evaluated.

To date all of the chimpanzee MOABS are IgM type immunoglobulins and were produced by first immortalizing chimpanzee B cells with EB virus (EBV) and then fusing the immortalized cells with a mouse-human heterohybridoma. During the next year we will evaluate methods to pre-select surface IgG expressing EBV immortalized cells before fusion and to evaluate class switching methods on the existing chimpanzee IgM producing hybridomas.

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AXIS I	AXIS II				Number	Species Used	ARB Funds Allocated
1a 7b 21	66	a) Mirra, Suzanne S. Anderson, Daniel C. McClure, Harold M. b) M.D.; D.V.M.; D.V.M. c) Pathobiology and Immunobiology	 X X	X	7 20	Macaca mulatta Macaca nemestrina	

1. Descriptive Title (80 characters):

Neuropathological Study of SIV-Infected Macaques

Abstract: Simian immunodeficiency virus (SIV) infection in macaque monkeys produces central nervous system (CNS) lesions sharing some histopathological features with human immunodeficiency virus (HIV) infection of the CNS in man. Retrospective autopsy studies of SIV-infected macaques have shown meningoencephalitis with multinucleated giant cells and macrophages within meninges and parenchyma of the brain. Yet little is known about the early changes in the nervous system with SIV infection. In order to investigate such changes, we examined autopsy brains and spinal cords from macaque monkeys at various intervals post-SIV inoculation. We used a mangabey-derived SIV isolate (PBj_{14}) passaged through a pig-tailed macaque (PBj) which usually produced a fulminant acute illness and death within one to two weeks post-intravenous inoculation. Thus far, we have examined brains from 17 pig-tailed macaques dying 8-18 days post inoculation with PBj_{14}; two additional animals died at 7 and 9 months respectively. Three of the brains were obtained from macaques inoculated with blood collected at death from PBj. We are also examining brains from chronically ill animals infected with other SIV isolates. Preliminary neuropathological study reveals lesions in the brian as early as eight days post inoculation. Two main changes have been identified in animals dying soon after infection: (1) Choroid plexitis characterized by mononuclear cell and occasional multinucleated giant cell inflammation, along with degeneration and necrosis of the choroid plexus epithelial cells and (2) Meningitis with mononuclear and multinucleated giant cell inflammation (present in some animals only). Parenchymal lesions within the brain were rare. In contrast, the chronically infected animals displayed a less striking choroid plexitis but more frequent parenchymal granulomatous lesions with multinucleated giant cells. We plan to continue neuropathological examinations in parallel with virological, immunocytochemical, and electron microscopic studies to assess the pathogenesis of SIV infection in macaques. These studies may provide important information related to the pathogenesis of CNS involvement in acquired immunodeficiency syndrome (AIDS).

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1a 7b 7c	64 66	a) Nguyen-Dinh, Phuc McClure, Harold M. Collins, William E. Anderson, Daniel C. b) M.D., M.P.H.; D.V.M.; Ph.D.; D.V.M. c) Pathobiology and Immunobiology d) Centers for Disease Control	 X X	X X 	12	Macaca mulatta	

1. Descriptive Title (80 characters):

Effect of SIV Infection on Plasmodium fragile Malaria in a Simian Model

Abstract:

Malaria and the acquired immunodeficiency syndrome (AIDS) coexist in many parts of Africa , raising two important questions: a) does infection with the human immunodeficiency virus (HIV) increase the severity of malarial infections? and b) do frequent malarial infections in Africa facilitate the development of HIV infection and clinical AIDS? To complement ongoing epidemiologic studies in Africa, animal studies are being conducted in this project. The rhesus monkey, Macaca mulatta, is a suitable model for human infections with Plasmodium falciparum, when infected with the simian malaria parasite P. fragile. In addition, infection of M. mulatta by the simian immunodeficiency virus (SIV/SMM) is a model for HIV infections in humans. In the current study, three groups of 4 monkeys each were followed. Two groups (A and B) were inoculated with P. fragile, and developed 7-10 days later, malaria parasitemias that followed a typical chronic, persistent course. Six weeks later, SIV/SMM was inoculated in 2 groups: one malaria-infected group (group B) and the remaining group (C), which was malaria free. All 8 SIV infected animals became virus-positive and SIV-seropositive (7 of 8 at 4 weeks post SIV inoculation). To date, no major difference has been detected between SIV-positive and negative animals in terms of their malaria parasitemia and their serologic response to the parasite antigens, as ascertained by immunofluorescence. None of the malaria-infected animals inoculated with SIV, however, has yet developed clinical or laboratory changes (such as a reversal of helper/suppressor T cell ratio) suggestive of SIV-related disease. Follow-up will be continued to determine whether: a) animals infected with SIV develop more severe P. fragile malaria, or differ in their immunologic response, and b) animals infected with P. fragile present a different evolution of their SIV infection and/or disease.

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1a 9 13 21	48 52 70 86	a) Patterson, C. Anne Brann, Alfred W. Klein, Luella b) M.D.; M.D.; M.D. c) Pathobiology and Immunobiology		X X X	20	Macaca mulatta	

1. Descriptive Title (80 characters):
Telemetry Documentation of Fetal Heart Rate and EEG Before and During Birth in Rhesus Monkeys

Abstract:

Asphyxia and subsequent cerebral palsy continue to be a problem in the human infant. Cerebral palsy is thought to be associated with asphyxia that is sustained before labor begins. To address this problem, a very small telemetry transmitter was developed to implant during the last trimester in the fetal primate. Heart rate is received from a radio signal promptly after surgery; thus the fetus is monitored for the remainder of gestation and throughout labor and delivery. A second transmitter is placed on the uterus during surgery and telemeters EEG data showing the uterine contraction pattern.

During the past year 17 fetal primates had surgery. Eleven of these subjects were liveborn and had follow-up studies regarding developmental performance and motor skills. These tests were devised specifically to evaluate the performances of the normal infant as a baseline. This will allow us to discern the differences in development and motor skills of the affected infant.

Heart rate and uterine EEG were recorded for all implanted animals. The deliveries were also recorded via a video camera and VCR. This equipment was purchased during the past year.

Further refinement of the telemetry device has also been accomplished.

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1a 7b 19	66	a) Ribas, Jorge L. Anderson, Daniel C. McClure, Harold M. b) D.V.M.; D.V.M.; D.V.M. c) Pathobiology and Immunobiology d) Armed Forces Institute of Pathology	 X X	X	8 9	Macaca mulatta Macaca nemestrina	

1. Descriptive Title (80 characters):
Immunohistochemical and Histopathological Study of SIV-Induced CNS Infection in Nonhuman Primates

Abstract:

Subacute encephalitis is a common neurologic complication of HIV infection in man. SIV infection in macaque monkeys may also result in a retroviral-induced meningoencephalitis. The major cell type supporting HIV replication in the brain appears to be randomly distributed mononucleated and multinucleated macrophages and possibly T-lymphocytes and endothelial cells.

In these recently initiated studies, the SIV infected macaque will be used to: (1) define the neuropathology of SIV infection in macaque monkeys; (2) identify expression of SIV antigens by neural or non-neural cells; and (3) characterize these cells phenotypically. Studies are being conducted with CNS tissues from macaques chronically infected with SIV/SMM and tissues from macaques that died acutely (7 to 21 days) following infection with an acutely lethal variant of SIV ($SIV/SMM/PBj_{14}$).

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2 Science Code		3			4 Usage Factor		5
AXIS I	AXIS II	(a) Investigator(s) (b) Degree(s) (c) PRC Division/Unit (d) Non-Host Institution	COREE	OTHER	Number	Species Used	ARB Funds Allocated
1a 2	50b	a) Schinazi, Raymond F. Nahmias, Andre McClure, Harold M. Anderson, Daniel C. b) Ph.D.; M.D.; D.V.M.; D.V.M. c) Pathobiology and Immunobiology	 X X	X X	20	Macaca mulatta	

1. Descriptive Title (80 characters):
National Cooperative Drug Discovery Group/AIDS, GEVA Group

Abstract:

The purpose of the studies was to characterize and compare the distribution and elimination of two potent and selective antiretroviral agents in rhesus monkeys. In addition, the absorption of AzddU after oral and subcutaneous administration was assessed as a prelude to studies in monkeys infected with simian immunodeficiency virus. The pharmacokinetics of the antihuman immunodeficiency virus type 1 nucleosides, 3'-azido-2', 3'-dideoxyuridine (AzddU) and 3'-azido-3'-deoxythymidine (AZT) were characterized in rhesus monkeys. Steady-state volume of distribution and half-life were similar for both compounds. However, total clearance of AZT was higher than for AzddU. In addition, pharmacokinetic parameters for AZT in rhesus monkeys were comparable to those reported previously in human patients. Oral absorption of AzddU and AZT was virtually complete after 60 mg/kg. However, bioavailability of both nucleosides was markedly lower (<50%) after 200 mg/kg indicating the involvement of a saturable absorption mechanism. The nucleosides were also absorbed well after subcutaneous administration. AzddU and AZT penetrated the cerebrospinal fluid with CSF:serum concentration ratios ranging between 0.05-0.25 one hour after drug administration. The glucuronides of AZT and AzddU were readily detected in urine. Hemogram and blood chemistry values for animals receiving either AZT or AzddU did not exhibit any significant changes when compared to untreated monkeys. The similar pharmacokinetic characteristics of AzddU compared to AZT suggest that clinical trials of AzddU are warranted.

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2 Science Code AXIS I	2 Science Code AXIS II	3 (a) Investigator(s) (b) Degree(s) (c) PRC Division/Unit (d) Non-Host Institution	CORE	OTHER	4 Usage Factor Number	4 Usage Factor Species Used	5 ARB Funds Allocated
1a 2 9 19	39 64 76b	a) Seigler, H.F. b) M.D. c) Pathobiology and Immunobiology d) Duke University Medical Center	X		1	Pan troglodytes	

1. Descriptive Title (80 characters):
The Immunogenicity of Human Tumor Antigens

Abstract:

Our primary objective in the studies being conducted in chimpanzees has been to evaluate the immunogenicity of selected melanoma tumor associated antigens in a highly purified form. Earlier studies have suggested that these TAA can be immunogenic as part of the intact melanoma cell membrane. In order to provide a more well-defined immunogenic stimulus which can potentially be manipulated to maximize the immune response, we have purified two TAA and are studying the chimpanzee response to these as an approximation of the human response. Ultimately, we hope these studies will lead to improved therapeutic approaches to melanoma in man. We have documented the immunogenicity of a high molecular weight melanoma TAA. Most recently, we have completed our initial investigation into the immunogenicity of a second melanoma TAA, the disialoganglioside, GD3. This molecule is weakly immunogenic in chimpanzees; additional studies are planned in which we will attempt to augment the immunogenicity of the GD3.

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2 Science Code AXIS I	2 Science Code AXIS II	3 (a) Investigator(s) (b) Degree(s) (c) PRC Division/Unit (d) Non-Host Institution	COREE	OTHER	4 Usage Factor Number	4 Usage Factor Species Used	5 ARB Funds Allocated
1a 25b	62 70 86	a) Sternberg, Jr., Paul Michels, Mark b) M.D.; M.D. c) Pathobiology and Immunobiology		X X	20	Macaca mulatta	

1. Descriptive Title (80 characters):

Selective Wavelength Attenuation in Prevention of Retinal Phototoxicity

Abstract:

The role of selective wavelength attenuation in prevention of retinal phototoxicity has been understood poorly. Using the operating microscope and the phakic rhesus monkey model, we conducted two experiments using selective filtration in one eye of each pair. Each pair was exposed to a specific exposure time of light to evaluate: 1) the utility of blue visible attenuation and 2) the utility of infrared attenuation in the prevention of retinal phototoxicity. A marked clinical difference by masked grading of photographic and fluorescein angiography was noted between filtered and control eyes in 100% of eyes studied, with a significant number of filtered eyes demonstrating no lesion. No clinical difference was noted in the eyes studied with infrared attenuation. A different degree of pathology was appreciated between filtered and unfiltered eyes at the electron micrographic level for eyes with longer exposure times. We conclude that attenuation of blue visible light increases phototoxicity threshold thereby increasing safe operating time, but a similar benefit to infrared attenuation was demonstrated only at the electron microscopic level.

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2 Science Code AXIS I	2 Science Code AXIS II	3 (a) Investigator(s) (b) Degree(s) (c) PRC Division/Unit (d) Non-Host Institution	COREE	OTHER	4 Usage Factor Number	4 Usage Factor Species Used	5 ARB Funds Allocated
1a 25b	62 70 86	a) Waring, George O. Hanna, Khalil Fantes, Francisco b) M.D.; M.D.; M.D. c) Pathobiology and Immunobiology		X X X	15	Macaca mulatta	

1. Descriptive Title (80 characters):

Laser Corneal Myopic Keratomileusis: Histopathology of Wound Healing

Abstract:

Laser corneal myopic keratomileusis was performed in 30 eyes of 15 rhesus macaques and the animals were followed by slit lamp biomicroscopy for evidence of corneal scarring. At different intervals postoperatively, animals were sacrificed and the corneas prepared for light microscopy, transmission electron microscopy, and immunohistochemistry. Slit lamp examinations showed that all corneas epithelialized within 7 days. The corneas remained clear by slit lamp examination until approximately 4-6 weeks postoperatively. Varying degrees of corneal scarring was then noted to develop in over two-thirds of the eyes treated. Histopathologic examination revealed the cause of the scarring to be subepithelial fibroplasia. Abnormalities were also present in the basal epithelial layer in some specimens. Immunohistochemistry revealed that the subepithelial scar was composed of Type III collagen, consistent with a normal corneal wound healing response to injury. These studies are being continued to provide a better understanding of the development of these adverse reactions and to develop mechanisms whereby such adverse reactions can be prevented or minimized.

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2 Science Code AXIS I	2 Science Code AXIS II	3 (a) Investigator(s) (b) Degree(s) (c) PRC Division/Unit (d) Non-Host Institution	COR E	OTHER	4 Usage Factor Number	4 Usage Factor Species Used	5 ARB Funds Allocated
1a 17	39 88	a) Winton, E.F. McClure, Harold M. Anderson, Daniel C. b) M.D.; D.V.M.; D.V.M. c) Pathobiology and Immunobiology	 X X	X	12	Macaca mulatta	

1. Descriptive Title (80 characters):
Pre-Chemotherapy Marrow Priming with Recombinant CSF's

Abstract:

Bone marrow suppression and the resultant cytopenias persist as a major dose limiting toxicity secondary to chemotherapy. With the development of recombinant human (rHu) colony stimulating factors (CSF's) and interleukins (IL's) there is hope that chemotherapy related bone marrow dysfunction may be attenuated. We propose that CSF's (and/or IL's) may be used to prime the blood forming system prior to chemotherapy administration. Such priming would first result in an expansion of bone marrow cells by means of enhanced proliferation of progenitor cells (colony-forming cells, CFU's). Secondly, with cessation of priming therapy, we predict the overexpanded marrow cells will be down-regulated to lower than normal proliferative state by intrinsic marrow regulatory mechanisms. Cell-cycle dependent chemotherapy administered at the time of the nadir of marrow cell proliferation post-priming would be predictably less toxic, and spare many of the overexpanded proliferative marrow cells.

We have proposed an animal model using rhesus monkeys (Macaca mulatta) to investigate the details of rHu GM-CSF, and IL-3 priming of marrow. Before, during and after administration of rHu hematopoietin we will obtain marrow from animals to quantify CFU number, and by means of ^{3}HTdR suicide, S-phase CFU. Such studies will permit us to determine at which time following rHu CSF priming the maximal number of non-S-phase progenitors occurs. Further experiments will test the validity of the model in predicting a protective effect of CSF priming by means of administering a bolus dose of chemotherapy drug at that time of maximal number of non-S-phase progenitors. The basic information on bone marrow cell kinetics following CSF perturbation will have broad applicability in the design of rational sequential CSF-chemotherapy combinations.

DIVISION OF REPRODUCTIVE BIOLOGY

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R. Nadler
M. Wilson

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D. Collins	Hormone Research Laboratory, VA Medical Center
R. Eley	Institute of Primate Research, Kenya
B. Hinton	Division of Urology, University of Virginia
D. Mann	Department of Physiology, Morehouse College School of Medicine
D. Martin	Division of Respiratory Therapy, Georgia State University
P. Musey	Research Services, VA Medical
K. Platzman	Department of Psychiatry, Emory University School of Medicine
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P. Srivastava	Department of Biochemistry, University of Georgia
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J. Preedy	Research and Development, VA Medical Center

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R. Reichelt	Maurice E. Müller-Institut, University of Basel, Switzerland

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2 Science Code		3			4 Usage Factor		5
AXIS I	AXIS II	(a) Investigator(s) (b) Degree(s) (c) PRC Division/Unit (d) Non-Host Institution	COR E	OTHER	Number	Species Used	ARB Funds Allocated
6	13	(a) Apkarian, Robert P. Black, Alexander J. (b) M.A.; M.D. (c) SEM Facility		X X		N/A	

1. Descriptive Title (80 characters):

Evaluation of the Effects of a New Design of Angioplasty Balloon Catheter

Abstract:

The study is designed to evaluate the effects of a new design of angioplasty balloon catheter in the atherosclerotic rabbit. The linear everting balloon unrolls across the stenosis and may cause less mechanical trauma to the arterial wall than standard balloon catheters.

Preliminary studies have shown the presence of flattened adherent endothelial cells in segments of artery instrumented with the linear everting balloon, a phenomenon not previously noted with standard dilatation catheters. The present study seeks to further explore the acute effects of this device, and to determine whether there are any differences in the degree of re-endothelialization or smooth muscle cell proliferation during the healing phase.

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9	52 92 Physics	(a) Apkarian, Robert P. Carr, Larry Family, Fereydoon (b) M.A.; Ph.D.; Ph.D. (c) SEM Facility		X X X		N/A	

1. Descriptive Title (80 characters):

Highly Granular Films of Tin

Abstract:

Highly granular films of tin on sapphire substrates have been prepared by vacuum deposition. The distribution of grain sizes is compared with a recently developed theoretical model of granular film formation. SEM photographs and digital images are used to determine grain size distributions within the film. The anticipated range of grain sizes is from 10 to 20 nm up through 1 to 2 microns. Other information sought relates to the aspect ratio of individual grains. We expect a broad grain size distribution, consequently several images are recorded for each film, taken at a number of different magnifications.

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6	25b	(a) Apkarian, Robert P. Fantes, Francisco E. (b) M.A.; M.D. (c) SEM Facility		X X		N/A	

1. Descriptive Title (80 characters):

Excimer Ablations on Corneas

Abstract:

This is a qualitative study undertaken to evaluate the role of excimer laser ablation for modification of corneal defects. Excimer ablation is being performed on rabbits, cows, monkeys and human eyes (eye bank). SEM is a most suitable technology for evaluation of the uniformity and smoothness of the ablation prior to extended use in humans.

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1a 4	23	(a) Apkarian, Robert P. Gould, Kenneth G. (b) M.A.; Ph.D. (c) SEM Facility	X	X	4 4	Pan troglodytes Macaca mulatta	

1. Descriptive Title (80 characters):

Surface Changes in Mammalian Sperm

Abstract:

Surface changes in mammalian sperm are associated with alteration in fertilizing capacity. The best documented of these is phenomenon of capacitation and its association with altered swimming patterns and loss of the acrosomal membranes. Other changes, of a pathological nature, occur when sperm die, or during freeze preservation. These changes may, or may not be related to altered motility. This study intends to correlate changes in the membranes of sperm with quantitated alteration in swimming patterns, both before and after freeze preservation. Fixed, critical point dried sperm will be examined with either Au/Pd or Cr coatings. We will try to evaluate the relative value of the two coating techniques for future study of these phenomena. In addition, the relative effect of fixatives on the visibility and analysis of sperm structure, especially the mitochondria, will be quantitated. A final analysis will evaluate mechanical cell disruption techniques such as tape stripping, or shearing between glass slides as methods for observing sperm structures within the membranes of the sperm head.

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6	13	(a) Apkarian, Robert P. Robinson, Keith A. (b) M.A.; Ph.D. (c) SEM Facility		X X		N/A	

1. Descriptive Title (80 characters):

Pig Coronary Arteries Intravascular Stent Placement

Abstract:

Pig coronary arteries will undergo angioplasty or intravascular stent placement. Animals will be treated with either heparin only (controls) or heparin plus RheothRx F-68 polymer surfactant. The extent of intraluminal thrombosis will be assessed by SEM, with respect to determining differences between control and RheothRx treatment. Pig coronary arteries with intravascular wire coil stents will be examined to determine the luminal cellular responses to the prosthesis. Documentation of morphological consequences to stenting, including thrombosis, ulceration, and ultrastructural characteristics of the luminal cell type(s) will be obtained.

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6	13	(a) Apkarian, Robert P. Robinson, Keith A. (b) M.A.; Ph.D. (c) SEM Facility		X X		N/A	

1. Descriptive Title (80 characters):
PTFE Vascular Grants

Abstract:

PTFE vascular grafts of various diameters have been implanted in the femoral and carotid arteries of dogs for 6 to 8 weeks. SEM is used to examine the luminal cellular responses to these grafts. In particular, it is used to analyze the endothelialization of the grafts, particularly at the anastomoses of the grafts to the native arteries. Any areas which show persistent absence of endothelium, mural thrombosis, or myointimal thickening are of especial concern and dictate modification of graft structure or implantation technique.

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1a	36	(a) Bard, Kim A. Papoušek, Hanuš (b) Ph.D.; M.D. (c) Reproductive Biology (d) Max Planck Institute for Psychiatry, Dept. of Develop. Psychobiol.		X X	5	Pan troglodytes	

1. Descriptive Title (80 characters):
Foundations of Parenting in Apes and Human: Microanalytic Study of Intuitive Parenting

Abstract:

During parent-infant interactions in humans, there are several episodes in which parents stimulate the infant's integrative development (i.e., learning and/or cognitive capacities). These episodes have been labeled didactic interventions. They are also thought to be intuitive since they occur often without conscious awareness (i.e., at a nonrational level) but less quickly than reflexive acts. Intuitive behaviors appear to universal across cultures, gender, age, and parental status (although experience with infants is probably a necessary prerequisite). It is reasonable to suspect, therefore, that there is an evolutionary root to intuitive parenting. The specific aim of this project is to investigate this hypothesis through naturalistic observations of chimpanzees, a close phyletic relative. This perspective will also provide a heuristic framework for the understanding of learned maternal behavior in the chimpanzee. This is important if we hope to document behaviors indicative of maternal competence. Knowledge of appropriate maternal behaviors in advance of birth may be vital as we devise intervention programs to help chimpanzees who are "at risk" for developing maternal inadequacies. Nonintrusive observations of five mother-infant chimpanzee pairs have been collected on videotape. The best interactive sessions have been selected from the following periods, arranged by infant age, 2-4 weeks, 6-8 weeks, and 10-12 weeks. These sessions will be used to document mother-infant interactions in the chimpanzee. To date, mutual gaze and general context have been microanalytically coded from a few sessions. Analysis has not yet begun.

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2 Science Code AXIS I	2 Science Code AXIS II	3 (a) Investigator(s) (b) Degree(s) (c) PRC Division/Unit (d) Non-Host Institution	COR E	OTHER	4 Usage Factor Number	4 Usage Factor Species Used	5 ARB Funds Allocated
1a	36 20 21 25	(a) Bard, Kim A. Platzman, Kathleen A. Suomi, Stephen J. Swenson, R. Brent (b) Ph.D.; Ph.D.; Ph.D.; D.V.M. (c) Reproductive Biology (d) NICHD Laboratory of Comparative Ethology	X	X X X	10	Pan troglodytes	

1. Descriptive Title (80 characters):

Neurobehavioral Responsivity of Neonatal Nursery-Reared Chimpanzees

Abstract:

The relative paucity of information on neonatal chimpanzees stands in sharp contrast to the extent of knowledge concerning normative human neonatal behavior. The Brazelton Neonatal Behavioral Assessment Scale (BNBAS) is an interactive test used with human neonates. It is most often used to describe the dynamic functioning of the newborn. The BNBAS has been administered to ten nursery-reared chimpanzees. Only the orientation items have been analyzed to date. These include orientation to social stimuli (human face, human voice and chimpanzee sounds), orientation to inanimate stimuli (red ball and rattle), and alert responsiveness. Several general statements can be made. Chimpanzees have the capacity for sustained attention to visual and auditory stimuli. Chimpanzees are socially responsive during the neonatal period. Moreover, they appeared to respond better and more consistently to social versus nonsocial stimuli. Tentatively, it can be concluded that the orientation ability of neonatal chimpanzees is similar to that of above average human neonates. A number of issues have been raised by this study which have implications for understanding neonatal behavioral organization in chimpanzees: (a) neonatal chimpanzees may have a greater focal length than human infants (it appears to be approximately 24 inches for chimpanzees compared to approximately 10 inches for human infants). This has implications for the extent to which neonatal chimpanzees are visually responsive to the environment beyond their caregivers; and (b) two types of animate auditory stimuli were used, human voice and chimpanzee grooming sounds. It appears that at least some neonatal chimpanzees exhibit differential behavioral responses other than orientation to these two sounds (e.g., different types of responsive vocalization, changes in muscle tone). Further research will address the extent of individual differences in orientation ability among neonatal chimpanzees.

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1a	36	(a) Bard, Kim A. Platzman, Kathleen A. Swenson, R. Brent (b) Ph.D.; Ph.D.; D.V.M. (c) Reproductive Biology	X	X X	12	Pan troglodytes	

1. Descriptive Title (80 characters):

Cognitive Development and Temperament in Young Chimpanzees

Abstract:

The cognitive competence of human infants and young children has been assessed with the use of the Bayley Scales of Infant Development more frequently than any other measure of infant cognition. Age-related norms have been established through this extensive testing. Additionally, this test package yields quantified descriptors of temperamental factors such as cooperation, emotional and muscular tone, reactivity, and endurance. The Bayley was administered to 12 infant chimpanzees: 2 infants were tested once a month, from 3 to 11 months of age; 3 infants were tested once a month, from 6 to 14 months of age; 2 infants were tested at 6 months, 12 months, 15 months, and 18 months of age; and 5 infants, of ages ranging from 3 to 27 months, were tested a single time. A total of over 50 sessions were conducted. Over 40 of these sessions were recorded on videotape. This will allow for detailed analysis in the future. The 30 - 40 minute test sessions provided physical and cognitive stimulation to all chimpanzees. This assessment technique as applied to chimpanzees is expected to show a) the cognitive competence of chimpanzees compared with human infants and rhesus monkeys; b) individual differences and age-related norms of cognitive ability in nursery-reared chimpanzees; and c) individual differences in temperamental characteristics that are exhibited during the test.

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2 Science Code AXIS I	2 Science Code AXIS II	3 (a) Investigator(s) (b) Degree(s) (c) PRC Division/Unit (d) Non-Host Institution	COOPERE	OTHER	4 Usage Factor Number	4 Usage Factor Species Used	5 ARB Funds Allocated
1a	36	(a) Bard, Kim A. Swenson, R. Brent (b) Ph.D.; D.V.M. (c) Reproductive Biology	X	X	6	Pan troglodytes	

1. Descriptive Title (80 characters):

Neurobehavioral Responsivity in Mother-Reared Chimpanzees

Abstract:

Naturalistic observations of chimpanzee mother-infant pairs were conducted to describe the spontaneous behavioral repertoire of chimpanzee infants. The specific goals of this project are (1) to ascertain the health and well-being of newborn chimpanzee through nonintrusive observation; (2) to document the different behavioral states of neonatal chimpanzees; (3) to provide normative data on infant behavioral development that can be compared with behavioral development of infants who are placed in the nursery due to inadequate maternal care. Daily observations were made of 6 chimpanzee infants from birth through 30 days of age. Observers collected data on muscle tone, nursing bouts (frequency and duration), and behavioral states with an emphasis on states of wakefulness. Observations lasted for a minimum of one hour and continued either until nursing occurred, or another behavior indicative of good health was observed. Videotapes of the behavior of the mother and infant were collected during the first hour of each day's observation. After the neonatal period, when the infants are less at risk, observations decrease to two times per week for the next 2 months. All of these hour-long sessions are videotaped. These data have not yet been analyzed, however, informal reports have been useful to inform the Veterinary Department and caretaking staff of the daily status of newborn chimpanzees.

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1a	36	(a) Bard, Kim A. Suomi, Stephen J. Swenson, R. Brent (b) Ph.D.; Ph.D.; D.V.M. (c) Reproductive Biology (d) NICHD Laboratory of Comparative Ethology	X	X X	7	Pan troglodytes	

1. Descriptive Title (80 characters):

Attachment in Nursery-Reared Chimpanzees: Ainsworth Strange Situation

Abstract:

The Ainsworth Strange Situation is a laboratory-based assessment originally used with 1-year-old human infants. It is designed to classify the security of an infant's attachment with their mothers. The evolutionary basis of attachment theory requires a specification of the relationship between attachment and adult competence, especially in biologically-relevant terms such as reproductive success. In chimpanzees, the security of attachment bonds in infancy has been linked to reproductive competence in adulthood, although prospective data have yet to be presented. A slightly modified version of the Ainsworth Strange Situation was administered to 7 young chimpanzees: two were 12 months of age, three were 15 months of age, and two were 21 months of age. Each 30-minute session was videotaped. The following behavioral patterns will be classified for each individual: (1) the use of the attachment figure as a secure base from which to explore a novel and interesting room; (2) behavioral responses to brief separations (3 minutes or less) from the attachment figure; (3) responses to the return of the attachment figure; and (4) behavioral responsiveness to a stranger. Assessments of the quality of attachment will be obtained, as recommended by Ainsworth. It is anticipated that there will be individual differences in chimpanzees, as there are in human children, in emotionality, reunion with the attachment figure, and response to new social and nonsocial objects. In the short-term, knowing an individual's behavioral profiles will provide valuable information when making caretaking decisions, such as giving objects (social or nonsocial) that might enhance an individual's adaptation to new situations. The long-term consequences of different behavioral profiles will be determined when social, cognitive, and reproductive (especially maternal) competence is assessed in adulthood.

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1a 22 26	60	(a) Eley, Robert M. Tarara, Ross Ochieng, Francis (b) Ph.D.; Ph.D.; B.Sc. (c) Reproductive Biology (d) Institute of Primate Research, Kenya		X X X	82	Cercopithecus aethiops	

1. Descriptive Title (80 characters):

A Study of Physical Development in the Vervet Monkey

Abstract:

Colony born and raised vervet monkeys are an alternative to macaques as research models. However, to date little is known of development and maturation. In order to provide normative data for future studies, a mixed cross sectional and longitudinal research design (54 paired observations, 28 single observations) was utilized to study growth and development of vervet monkeys (Cercopithecus aethiops) from 2 weeks to 5 years of age. For paired observations a period of 9 days to 6 months elapsed between the two measurements with the shorter periods for the younger animals and the longer periods for the oldest.

Weight, skinfold thicknesses and 22 skeletal measurement were taken by standard procedures on anesthetized animals. During the reporting period all raw data were transferred to an SPSS data entry module for subsequent analysis.

Preliminary analyses have been completed on rates of growth for all parameters using the longitudinal data and on measurements for the mature animals using the cross sectional data for animals more than 3 years of age. Yet to be completed is characterization of skeletal development up to that time.

PART II, SECTION A — DRR SCIENTIFIC SUBPROJECT FORM

GRANT NUMBER P 5 1 R R 0 0 1 6 5 - 28

REPORT PERIOD: January 1, 1988 to December 31, 1988

INSTITUTION: Yerkes Regional Primate Research Center

2 Science Code AXIS I	2 Science Code AXIS II	3 (a) Investigator(s) (b) Degree(s) (c) PRC Division/Unit (d) Non-Host Institution	COR E	OTHER	4 Usage Factor Number	4 Usage Factor Species Used	5 ARB Funds Allocated
1a 9	23 48	(a) Gould, Kenneth G. (b) Ph.D. (c) Reproductive Biology	X		6	Pan troglodytes	

1. Descriptive Title (80 characters):

A Telemetry System for Measuring Body Temperature in Chimpanzees

Abstract:

The mortality rate of chimpanzees in the first year of life approximates 15%. Reduction of this rate would benefit management of the captive chimpanzee population. Strict monitoring of the perinatal period would permit attendants to be present at time of birth to identify problems with labor, delivery or post natal abuse of the infant. This project continues to evaluate the use of vaginal temperature telemetry as a potentially valid method to monitor the onset of delivery. "Mini-Mitter" transmitters (Mini-Mitter Co., Inc.), broadcasting on 27.675, 27.695 and 27.715 KHz have been calibrated and used to monitor vaginal temperature in more than 10 female chimpanzees using modified vaginal sponges (Today Sponge, VLI Corporation) as carriers for the transmitters. A data capture device was developed to permit remote, continuous monitoring of several transmitters. At this time the transmitters have been tested in nonpregnant females. The data capture device is undergoing modification to increase the range of detection, as the device should be best used with the female in a large enclosure. Subsequent to that development, the coming year will involve their use in pregnant animals.

PART II, SECTION A — ORR SCIENTIFIC SUBPROJECT FORM

GRANT NUMBER P 5 1 R R 0 0 1 6 5 - 28

REPORT PERIOD: January 1, 1988 to December 31, 1988

INSTITUTION: Yerkes Regional Primate Research Center

2 Science Code AXIS I	2 Science Code AXIS II	3 (a) Investigator(s) (b) Degree(s) (c) PRC Division/Unit (d) Non-Host Institution	CORE	OTHER	4 Usage Factor Number	4 Usage Factor Species Used	5 ARB Funds Allocated
1a 9	23	(a) Gould, Kenneth G. Martin, David E. (b) Ph.D.; Ph.D. (c) Reproductive Biology Georgia State Univ.	X	X	12	Pan troglodytes	

1. Descriptive Title (80 characters):

Artificial Breeding of Great Apes

Abstract:

The breeding capacity of the captive great ape population must be optimized in order to ensure maintenance of a population adequate for species preservation and supply of animals for appropriate research. Artificial breeding methods, particularly artificial insemination, are appropriately used to produce offspring from incompatible or inexperienced partners, or to ensure continued genetic presence of individuals removed from the breeding colony by reason of death or infectious disease. We are using methods for synchronization of ovulation by stimulation of the cycle with clomiphene citrate, and detection of natural ovulation using LH detection kits developed for human use. Currently used methods for primate artificial breeding provide between 25% (Chimpanzee) and 85% (Rhesus) success rates. A method has been developed to freeze primate sperm using glycerol as cryoprotectant. Using an extended freezing protocol and 7.8% glycerol, the recovery rate of sperm motility is as high as 60%. Although the process being used has initiated pregnancy by artificial insemination, further development of freezing methods for primate sperm is needed to provide samples adequate for routine use in artificial breeding programs.

PART II, SECTION A — DRR SCIENTIFIC SUBPROJECT FORM

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2 Science Code AXIS I	2 Science Code AXIS II	3 (a) Investigator(s) (b) Degree(s) (c) PRC Division/Unit (d) Non-Host Institution	COR E	OTHER	4 Usage Factor Number	4 Usage Factor Species Used	5 ARB Funds Allocated
1a 9	23	(a) Gould, Kenneth G. Young, Leona G. (b) Ph.D.; Ph.D. (c) Reproductive Biology	X	X	3 3	Pan troglodytes Macaca mulatta	

1. Descriptive Title (80 characters):

Cryopreservation of Great Ape Semen

Abstract:

Quantitative analysis of sperm motility and swimming patterns are being used to correlate sperm velocity and linearity with fertilizing capacity. Semen collected using masturbation, artificial vagina or electrostimulation is evaluated using the heterologous assay of sperm penetration into zona-free oocytes. The choice of collection method depends on the size and nature of the species and on the behavior of the individual male. Semen evaluation is conducted in a manner similar to that used in the human, but the normal values differ between species. This evaluation is being extended to provide consideration of the influence of season on semen quality.

Development of adequate methods for cryopreservation of ape sperm is necessary for optimum application of artificial breeding methods. We have tested a number of extenders, including glycerol and DMSO, in a variety of freezing protocols. Presently it appears that semen parameters exceeding a count of 1 x 10^8/ml and more than 75% live sperm, extended with a final concentration of 7.8% glycerol and frozen in a programmable freezer over a 3 hr period provides the best result. The in vitro and in vivo fertilizing capacity of such semen has been demonstrated by the initiation of two chimpanzee pregnancies, one of which is presently ongoing.

PART II, SECTION A — ORR SCIENTIFIC SUBPROJECT FORM

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INSTITUTION: Yerkes Regional Primate Research Center

2 Science Code AXIS I	2 Science Code AXIS II	3 (a) Investigator(s) (b) Degree(s) (c) PRC Division/Unit (d) Non-Host Institution	COR	OTHER	4 Usage Factor Number	4 Usage Factor Species Used	5 ARB Funds Allocated
1a 4	15, 23	(a) Mann, David R. Adams, Samuel R. Gould, Kenneth G. Orr, T. Edward Collins, Delwood C. (b) Ph.D.; D.V.M.; Ph.D. Ph.D.; Ph.D. (c) Reproductive Biology (d) Morehouse School of Medicine	X	X X X X	23	Macaca mulatta	

1. Descriptive Title (80 characters):

Possible Direct Effects of GnRH Analogues on the Monkey Testis

Abstract:

It has not been determined whether GnRH analogues have a direct effect on the primate testis. The objective of this project was to evaluate possible direct effects of GnRH-analogues on testicular steroidogenesis. In Exp. 1, the effect of treatment with a GnRH agonist on basal concentrations of serum testosterone and peak values of serum testosterone after administration of hCG was determined. One group of adult male monkeys was treated with a low dose (5-10 μg/day) and a second group with a high dose (25 μg/day) of a GnRH agonist for 44 weeks. Basal and peak testosterone concentrations were both significantly reduced by GnRH agonist treatment in all groups compared to untreated control animals, but the percentage rise in serum testosterone above basal values in response to hCG administration was unchanged by agonist treatment. In Exp. 2, the GnRH agonist (100 or 400 ng) or a GnRH antagonist (4 μg) was infused into the testicular arteries of adult monkeys. The agonist did not alter testosterone concentrations in the testicular vein or testosterone and LH values in the femoral vein. In Exp. 3, testicular interstitial cells from monkeys were incubated with three concentrations (10^{-9}, 10^{-7} and 10^{-5} M) of the GnRH agonist or a GnRH antagonist with and without hCG. After 24 h, neither basal nor hCG-stimulated testosterone production was affected by the presence of the GnRH agonist or antagonist. The results from all 3 experiments clearly suggest that GnRH agonist treatment does not directly alter steroid production by the monkey testis.

PART II, SECTION A — ORR SCIENTIFIC SUBPROJECT FORM

GRANT NUMBER P 5 1 R R 0 0 1 6 5 -28

REPORT PERIOD: January 1, 1988 to December 31, 1988

INSTITUTION: Yerkes Regional Primate Research Center

2 Science Code AXIS I	2 Science Code AXIS II	3 (a) Investigator(s) (b) Degree(s) (c) PRC Division/Unit (d) Non-Host Institution	COR E	OTHER	4 Usage Factor Number	4 Usage Factor Species Used	5 ARB Funds Allocated
1a, 4	15, 23 30	(a) Mann, David R. Gould, Kenneth G. (b) Ph.D.; Ph.D. (c) Reproductive Biology (d) Morehouse School of Medicine	X	X	38	Macaca fasicularis	

1. Descriptive Title (80 characters):
Effect of Estrogen and Growth Hormone on Bone Mass in GnRH Agonist Treated Monkeys

Abstract:

We are examining the effect of growth hormone and conjugated estrogens (Premarin) alone or in combination on the preservation of bone mass in GnRH analogue induced hypogonadotropic-hypogonadism in female monkeys. Animals are placed on a calcium diet equivalent to that consumed by women in the United States and then are treated with a GnRH agonist to induce a postmenopausal-like endocrine condition. Bone density and markers of bone activity will be monitored over a 6-month period. Animals will be treated with either estrogen, growth hormone or estrogen and growth hormone to assess the effect on bone mineral content. This study will enhance our understanding of bone loss following menopause and will test the efficacy of two treatment regimens in reversing this condition.

PART II, SECTION A	ORR SCIENTIFIC SUBPROJECT FORM

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REPORT PERIOD: January 1, 1988 to December 31, 1988

INSTITUTION: Yerkes Regional Primate Research Center

2 Science Code		3 (a) Investigator(s) (b) Degree(s) (c) PRC Division/Unit (d) Non-Host Institution	COORE	OTHER	4 Usage Factor		5 ARB Funds Allocated
AXIS I	AXIS II				Number	Species Used	
1a 4	15, 23	(a) Mann, David R. Wallen, Kim Gould, Kenneth G. Collins, Delwood C. (b) Ph.D.; Ph.D.; Ph.D.; Ph.D. (c) Reproductive Biology (d) Morehouse School of Medicine	 X X 	X X	18	Macaca mulatta	

1. Descriptive Title (80 characters):

Neonatal Testosterone and Primate Sexual Development

Abstract:

The objective of this study was to examine the effect of blockade of neonatal activation of the pituitary-testicular axis, using a GnRH agonist, on sexual development in male rhesus monkeys. Monkeys were treated with either a GnRH agonist (10 μg/day; n = 8) or vehicle (n = 9) for 112 days using osmotic minipumps beginning at 10-13 days of age. In control monkeys serum LH and testosterone concentrations during the first 3 postnatal months were similar to those in adults; they then declined to very low levels. GnRH agonist administration caused an immediate and precipitous decline in serum LH and testosterone concentrations to very low levels, and both remained low throughout the rest of the agonist administration period. Neither group had any significant elevation in serum LH or testosterone concentrations during the next 2 years. In the control monkeys serum LH and testosterone began to rise during the third year, with a rapid increase occurring during the fall coincident with the breeding season. This peripubertal rise of LH and testosterone secretion was associated with rapid enlargement of the testes and the appearance of sperm in ejaculates. The monkeys who had received GnRH agonist had subnormal serum LH and testosterone increases, and testicular enlargement was also attenuated compared to that in the control animals during the third year of life. Semen samples were recovered from only 50% of the GnRH agonist-treated monkeys during this period, and the sperm count per ejaculate was suppressed. The serum LH responses of the GnRH agonist-treated monkeys to an iv bolus dose of GnRH (5 μg/kg BW) during the third year were normal. These results suggest that the induction of reversible hypogonadotropin-hypogonadism in neonatal male monkeys alters subsequent testicular development and peripubertal endocrine changes. Thus, neonatal activation of the pituitary-testicular axis may be a critical developmental event in the process of sexual development in male primates.

PART II, SECTION A — DRR SCIENTIFIC SUBPROJECT FORM

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REPORT PERIOD: January 1, 1988 to December 31, 1988

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2 Science Code AXIS I	2 Science Code AXIS II	3 (a) Investigator(s) (b) Degree(s) (c) PRC Division/Unit (d) Non-Host Institution	CORE	OTHER	4 Usage Factor Number	4 Usage Factor Species Used	5 ARB Funds Allocated
1 5 15 23	52 60 62 82	(a) Martin, David E. Warner, Harold Perkash, Inder (b) Ph.D.; Prof. Emeritus; M.D. (c) Reproductive Biology (d) V.A. Hospital, Palo Alto, Ca.		X X X	2 17	Pan troglodytes Homo sapiens	

1. Descriptive Title (80 characters):

Reproductive Function in Paraplegic Men

Abstract:

The overall objective of this research project is to provide technology which will assist paraplegic male patients in their sexual rehabilitation as they strive to restore their normal functioning in society. We have pioneered the sophistication of technology and methodology for using rectal probe electrostimulation (RPE), using great apes as animal models, and have successfully adapted this technology to produce erection and ejaculation in paraplegic patients. These important physiologic functions are either impaired or essentially lost in terms of normal function when spinal cord injury occurs. Recent work has emphasized the miniaturization and streamlining of instrumentation to produce a RPE device suitable for clinical trials by trained professionals. We have created and incorporated a computer program to provide repeatable rhythmic current delivery in prescribed stimulus patterns as part of the stimulation device. This is fully integrated with all safety aspects of the device to provide automatic shutoff when previously determined by the patient or safe limits of current delivery are reached, or voluntary shutoff at any time by the person using it. It is planned to produce several of these devices for clinical trials at various Veterans Administration Hospitals, thereby providing additional experience and suggestions for improvement prior to possible commercialization.

PART II, SECTION A — DRR SCIENTIFIC SUBPROJECT FORM

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INSTITUTION: Yerkes Regional Primate Research Center

2 Science Code AXIS I	2 Science Code AXIS II	3 (a) Investigator(s) (b) Degree(s) (c) PRC Division/Unit (d) Non-Host Institution	COR	OTHER	4 Usage Factor Number	4 Usage Factor Species Used	5 ARB Funds Allocated
1a	74c 74e	(a) Musey, Paul I. Collins, D.C. Gould, Kenneth G. (b) Ph.D.; Ph.D.; Ph.D. (c) Reproductive Biology (d) Atlanta University	X	X X	6	Saimiri sciureus	

1. Descriptive Title (80 characters):

Biochemical Endocrinology of New World Primates: The Squirrel Monkey

Abstract:

The New World monkeys, such as the squirrel monkey, marmoset and owl monkey, may have plasma levels of estradiol-17β and progesterone that are 10-100 times higher than the levels found in the Old World monkey and the human. In this study, we propose several possible mechanisms for maintaining the high plasma levels of estradiol-17β and progesterone and describe experiments to determine the mechanism that is operating to maintain these elevated levels in the Squirrel Monkey. We will determine whether the high levels of estradiol-17β and progesterone reported to be present in the plasma of squirrel monkeys result from increased production or decreased metabolism using standard methods for studying steroid dynamics available in our laboratory. Based on the results of the dynamic experiments, further studies will characterize the mechanism by which the high levels of steroids are maintained in the plasma. The role of sex steroid binding globulin or progesterone binding globulin in this phenomena will be determined by measuring the amount and characteristics of these binding proteins in the Squirrel Monkey.

Finally, we postulate that the increased plasma levels of estradiol-17β and progesterone would be reflected by an increased level of estradiol-17β and progesterone in hormonally sensitive tissues. We postulate that these increased tissue level of estradiol-17β and progesterone will lead to a hyperstimulation of the hormonally sensitive tissues unless some compensation is made at the receptor level to decrease this responsiveness. This hypothesis will be tested in vitro by determining the binding characteristics of sex steroids in hormonally responsive tissues.

PART II, SECTION A	ORR SCIENTIFIC SUBPROJECT FORM

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2 Science Code AXIS I	2 Science Code AXIS II	3 (a) Investigator(s) (b) Degree(s) (c) PRC Division/Unit (d) Non-Host Institution	COR E	OTHER	4 Usage Factor Number	4 Usage Factor Species Used	5 ARB Funds Allocated
1a 15 23	36 74e	(a) Nadler, Ronald D. Dahl, Jeremy F. Collins, Delwood C. Gould, Kenneth G. (b) Ph.D.; Ph.D.; Ph.D. (c) Reproductive Biology	X X	 X X 	6	Pan troglodytes	

1. Descriptive Title (80 characters):

Reproductive Behavior of Chimpanzees

Abstract:

The objective of this research is to clarify the factors involved in the initiation of sexual interactions by chimpanzees, especially those factors associated with mating during pregnancy and the increased frequency of mating during the cycle by captive animals, in comparison to wild ones. Early research suggested that mating temporally dissociated from the presumptive time of ovulation resulted from high male sexual motivation, male dominance over females and the inability of the female to avoid and/or escape from the male within the captive cage, i.e., resulted from the male's influence. The present research is designed to clarify the basis of the male's influence, an issue of importance to broad concepts bearing on the regulation of reproductive behavior, the captive maintenance of chimpanzees and their breeding under captive conditions. One experiment investigates the male's motivation throughout the menstrual cycle by requiring males to perform an operant response (lever-pressing) to gain access to a female. A second experiment investigates the motivation of the female during pregnancy by use of the same operant procedures, but with female control. Our hypotheses are that mating will occur in both experiments and both will be associated with maximal anogenital swelling of the female. If the hypotheses are supported, the implications are that 1) the increased mating during the cycle in traditional pair-tests is due to stimulatory influences associated with the test procedures per se and 2) the mating reported during pregnancy is part of the species-typical repertoire of female chimpanzees. Regardless of the specific nature of the results, the data will be useful for defining captive conditions which support and facilitate species-typical patterns of behavioral interaction, significant for animals welfare and captive propagation.

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2 Science Code AXIS I	2 Science Code AXIS II	3 (a) Investigator(s) (b) Degree(s) (c) PRC Division/Unit (d) Non-Host Institution	COR	OTHER	4 Usage Factor Number	4 Usage Factor Species Used	5 ARB Funds Allocated
1a 15 23	36 74e	(a) Nadler, Ronald D. Dahl, Jeremy F. Gould, Kenneth G. Wilson, Mark E. Collins, Delwood C. (b) Ph.D.; Ph.D.; Ph.D.; Ph.D.; Ph.D. (c) Reproductive Biology	X X X 	 X X	6	Hylobates lar lar	

1. Descriptive Title (80 characters):

Reproductive Behavior and Physiology of the Gibbon

Abstract:

The objectives of the research are 1) to determine whether a hypothesis regarding the ultimate (evolutionary) causation of differences in reproductive behavior, anatomy and physiology, derived from research on the polygynous great apes, is supported by research on the monogamous gibbon and 2) to determine the relationship among female (and male) sex hormones, genital swelling and test conditions in the proximate activation of reproductive behavior in this lesser ape. Oppositely sexed pairs of gibbons will be studied behaviorally in commodious enclosures during natural menstrual cycles and pregnancy. Detectability of subtle behavioral changes in the female and male will be increased by use of pair-tests, in which either the male or the female control access to its partner. Behavioral responsiveness to hormonal changes is likely to be greater in pair-tests on gibbons than on group-living primates because gibbons normally live as pairs. As one of a relatively few species of nonhuman primates that live in parental or family groups, the gibbon differs from the great apes in its social organization. Concomitantly, its mating system represents one end of a continuum with respect to intermale competition for estrous females, a continuum predictive of several aspects of reproductive function in the great apes. Since intermale competition in the gibbon is minimal, our hypothesis is that male sex initiative, courtship behavior, penile visibility, preovulatory copulation and relative testis size will all be relatively low in comparison to the great apes i.e., similar to gorilla. Research on the gibbon, thereby, constitutes an opportunity to assess comparatively the relevance of a monogamous mating system to the regulation of reproductive behavior in the extant nonhuman hominoids. The research should also help to clarify the physical and social conditions which are most relevant to the captive maintenance and breeding of gibbons.

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2 Science Code AXIS I	2 Science Code AXIS II	3 (a) Investigator(s) (b) Degree(s) (c) PRC Division/Unit (d) Non-Host Institution	COR E	OTHER	4 Usage Factor Number	4 Usage Factor Species Used	5 ARB Funds Allocated
1a 9 6	26 30	(a) Pope, Nancy S. Gould, Kenneth G. (b) Ph.D.; Ph.D. (c) Reproductive Biology	X	X	106	Macaca mulatta	

1. Descriptive Title (80 characters):

Effects of Age and Sex on Bone Density in the Rhesus Monkey

Abstract:

Normative data for bone density of cortical and trabecular bone in the rhesus monkeys is described in the present study. Changes of bone density (g/cm2) for the humerus, the third lumbar vertebra, and the eighth caudal vertebra of the rhesus monkey show differences due to age and sex of the subjects (males n = 57; females n = 49). In general, bone density increased with age and then reached a plateau at approximately 3 to 4 years in all bones measured. In the humerus, older females (> 30 years) had a significantly lower bone density than females of 4 to 24 years, while bone density in older males did not decrease. In the vertebrae, some evidence of advanced age-related decreases in bone density was found in both sexes. These results indicate that the rhesus monkey shows a natural pattern of change in bone mineralization which parallels that seen in humans. The physiological similarity between the rhesus monkey and human further suggests a potential role for this species in the future investigation of osteoporosis.

PART II, SECTION A — DRR SCIENTIFIC SUBPROJECT FORM

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INSTITUTION: Yerkes Regional Primate Research Center

2 Science Code		3			4 Usage Factor		5
AXIS I	AXIS II	(a) Investigator(s) (b) Degree(s) (c) PRC Division/Unit (d) Non-Host Institution	COREE	OTHER	Number	Species Used	ARB Funds Allocated
1a 2	23	(a) Pope, Nancy S. Gould, Kenneth G. (b) Ph.D.; Ph.D. (c) Reproductive Biology	X	X	4	Macaca mulatta	

1. Descriptive Title (80 characters):
Synchronization of the Menstrual Cycle Through the Use of an Oral Progestin in the Rhesus Monkey

Abstract:

This study was undertaken to demonstrate the feasibility of using oral progestins for menstrual cycle synchronization in female rhesus monkeys. After a control cycle, 4 subjects were treated for 21 consecutive days with 0.044 mg/kg/day of the oral progestin altrenogest. During the subsequent 6 week period the timing and occurrence of menses and ovulation were observed. During the control cycle, the 4 subjects ovulated over a 6 day period; following progestin treatment all subjects menstruated within a 4 day range, and 3 of the 4 subjects ovulated within 24 hours of each other. This should prove to be a sufficient degree of ovulation synchrony to allow for successful embryo transfer between females.

DIVISION OF VETERINARY MEDICINE

R. Brent Swenson, D.V.M., Chief

Core Faculty:	J. Orkin	
	E. Strobert	
	B. Swenson	
Consultants:	B. Gay	Consultant in Medicine Radiology Department Emory University
	E. Keener	Consultant in Medicine Private Practice in Neurosurgery Atlanta, Georgia

PART II, SECTION A — DRR SCIENTIFIC SUBPROJECT FORM

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INSTITUTION: Yerkes Regional Primate Research Center

2 Science Code AXIS I	2 Science Code AXIS II	3 (a) Investigator(s) (b) Degree(s) (c) PRC Division/Unit (d) Non-Host Institution	COR E	OTHER	4 Usage Factor Number	4 Usage Factor Species Used	5 ARB Funds Allocated
1a 23	36 60 92 (Breeding)	a) Swenson, R. Brent Gould, Kenneth G. Nadler, Ronald D. Gordon, Thomas P. b) D.V.M.; D.V.M., Ph.D.; Ph.D.; M.S. c) Veterinary Medicine	X X X X		76	Pan troglodytes	

1. Descriptive Title (80 characters):
Establishment of a Chimpanzee Breeding and Research Program

Abstract:

A dedicated breeding group of chimpanzees has been established that is expected to produce 8-12 healthy and behaviorally normal offspring per year which will be used to establish a stable, self-sustaining breeding population to guarantee future availability of these animals for behavioral and biomedical research programs. The breeding activities are conducted using an existing social group of chimpanzees, pair and harem matings, and artificial inseminations. Infants are managed in such a way as to maximize social experience, including mother-rearing, peer-group rearing when nursery care is required and fostering of nursery-reared infants onto competent mothers.

Research is also being done in areas that will promote improved reproductive success and improved behavioral outcome. This includes investigation of early detection of labor using telemetry; investigation of hormonal manipulation to shorten interbirth intervals without separating infants from their mothers; methods of gamete preservation to improve artificial breeding techniques; investigation of developmental criteria in infants that might be predictive of future reproductive performance and identification of early rearing techniques that are conducive to subsequent successful reproduction.

This breeding program has been quite successful, with 14 chimpanzee births occurring in 1988. A total of 30 chimpanzee births have occurred during the past two years, since initiation of this breeding program, as compared to a total of 14 chimpanzee births during the preceding two years.

PART II, SECTION B GRANT NUMBER P 5 1 R R 0 0 1 6 5-28

INVESTIGATORS WITH PUBLIC HEALTH SERVICE SUPPORT

Fill out a separate form for each of the following categories: Check one

[■] CORE RESEARCH & DEVELOPMENT [ ] OTHER

1. Last Name, First Middle 2. Institution ONLY if Non-Host Institution	3. Sources of Support (Other than this grant) (a) Type	(b) Agency Abbrev.	(c) Grant/Contract Number	(d) Funds
Boothe, Ronald G.	FED	NEI	EY-05975	$119,987
Byrd, Larry D.	FED	NIDA	DA-01161	143,458
Gould, Kenneth G.	FED	DRR	RR-03587	79,437
	FED	DRR	RR-86-01	43,000
King, Frederick A.	FED	DRR	RR005224	888,000
McClure, Harold M.	FED	NIAID	AI-26055	71,829
	FED	DRR	RR-00165-28S1	1,357,922
	FED	CDC	200-88-0607	323,196
Metzgar, Richard S. Duke Univ. Medical Center	FED	NCI	CA-40044	108,256*
	FED	NCI	CA-32672	181,539*
	FED	NCI	CA-47507	112,386*
Seigler, Hilliard F. Duke Univ. Medical Center	FED	NCI	CA-32672	81,567*
Swenson, R. Brent	FED	DRR	RR-03591	341,449
Tigges, Johannes	FED	NIA	2P01-AG00001	53,306
Tigges, Margarete	FED	NEI	5R01-EY06001	65,432
Wilson, Mark E.	FED	NICHD	HD-16305	74,441
	FED	NICHD	HD-18120	100,000

*Only a portion of these funds are used at the Yerkes Center

4. Total Other Support	
(a) This Page	$4,145,893
(b) Grand Total (Cumulative)	$4,145,893

PART II, SECTION B GRANT NUMBER P 5 1 R R 0 0 1 6 5-28

INVESTIGATORS WITH PUBLIC HEALTH SERVICE SUPPORT

Fill out a separate form for each of the following categories: Check one

☐ CORE RESEARCH & DEVELOPMENT ■ OTHER

1. Last Name, First Middle 2. Institution ONLY if Non-Host Institution	3. Sources of Support (Other than this grant) (a) Type	(b) Agency Abbrev.	(c) Grant/Contract Number	(d) Funds
Boysen, Sarah T. Ohio State University	FED	NIMH	MH-44022	$ 34,071*
Donahoe, Robert	FED	NIDA	DA-04400	137,260*
Mann, David R. Morehouse School of Medicine	FED	NICHHD	HD-23295	50,789*
	FED	NICHHD	HD-23295	72,087*
Miles, H. Lyn White Univ. Tennessee at Chattanooga	FED	NICHD	HD-14918	41,185*
Moss, Mark B. Boston University	FED	NIA	AG-04321	124,449*
Musey, Paul I.	FED	DRR	RR-08247	97,126*
Peters, Alan Boston University	FED	NINCDS	NS-07016	138,217*
	FED	NINCDS	NS-07152	135,601*
	FED	NIA	AG-00001	19,221*
Rosene, Douglas L. Boston University	FED	NIA	NS-19416	119,386*
Rumbaugh, Duane M. Georgia State University	FED	NICHD	HD-06016	724,541*
Vaughan, Deborah W. Boston University	FED	NIA	AG06154	104,730*
Waring, George O.	FED	NEI	EY-07388	168,316*

*Only a portion of these funds are used at the Yerkes Center.

4. Total Other Support	
(a) This Page	$1,966,979
(b) Grand Total (Cumulative)	$1,966,979

PART II, SECTION B GRANT NUMBER P 5 1 R R 0 0 1 6 5 - 28

INVESTIGATORS WITH SUPPORT OTHER THAN PUBLIC HEALTH SERVICE

Fill out a separate form for each of the following categories: Check one

■ CORE RESEARCH & DEVELOPMENT ☐ OTHER

1. Last Name, First Middle 2. Institution ONLY if Non-Host Institution	3. Sources of Support (Other than this grant) (a) Type	(b) Agency Abbrev.	(c) Grant/Contract Number	(d) Funds
Bernstein, Irwin S. University of Georgia	FED	NSF	BNS-8616691	$ 50,569
Nadler, Ronald D.	FED	NSF	BNS-8708406	104,000
Smith, Euclid O.	FED	NSF	BNS-8610531	9,784
Wallen, Kim	FED	NSF	BNS-8607295	42,430

*Only a portion of these funds are used at the Yerkes Center

4. Total Other Support	
(a) This Page	$658,096
(b) Grand Total (Cumulative)	$658,096

PART II, SECTION B GRANT NUMBER P 5 1 R R 0 0 1 6 5 - 28

INVESTIGATORS WITH SUPPORT OTHER THAN PUBLIC HEALTH SERVICE

Fill out a separate form for each of the following categories: Check one

☐ CORE RESEARCH & DEVELOPMENT ■ OTHER

1. Last Name, First Middle 2. Institution ONLY if Non-Host Institution	3. Sources of Support (Other than this grant) (a) Type	(b) Agency Abbrev.	(c) Grant/Contract Number	(d) Funds
Bakay, Roy A.E.	FED	VA	0772-001	$42,680
Barr, Ronald G. McGill University	FED (Canada)	MRC	MA-7602	27,369
ersity . and .W. ease imate				
Gouzoules, Harold T. and Gouzoules, Sarah M.	FED FED	NSF NSF	BNS-8406435 BNS-8719230	17,000 29,475
Mann, David R.	FED	USAID	5053-G-SS-7025	99,310*
Martin, David E. Georgia State University	FED	VA	V640-P-4136	36,425*

4. Total Other Support	
(a) This Page	$ 985,053
(b) Grand Total (Cumulative)	$1,228,793

CONTINUED ON NEXT PAGE

PART II, SECTION B GRANT NUMBER P 5 1 R R 0 0 1 6 5 - 28

INVESTIGATORS WITH SUPPORT OTHER THAN PUBLIC HEALTH SERVICE

Fill out a separate form for each of the following categories: Check one

☐ CORE RESEARCH & DEVELOPMENT ■ OTHER

1. Last Name, First Middle 2. Institution ONLY if Non-Host Institution	3. Sources of Support (Other than this grant) (a) Type	(b) Agency Abbrev.	(c) Grant/Contract Number	(d) Funds
Ribas, Jorge L.	FED	DOD	APC-U941	80,000*

4. Total Other Support	
(a) This Page	$ 243,740
(b) Grand Total (Cumulative)	$1,228,793

PART II, SECTION C GRANT NUMBER P 5 1 R R 0 0 1 6 5 - 28

INSTITUTION: Yerkes Regional Primate Research Center

REPORT PERIOD: January 1, 1988 to December 31, 1988

Fill out a separate form for each of the following categories: Check one

■ CORE RESEARCH & DEVELOPMENT ☐ OTHER

							TOTAL
Number Published:	BOOKS	0	PAPERS	27	ABSTRACTS	33	60
Number in Press:	BOOKS	0	PAPERS	42	ABSTRACTS	8	50

Author(s) Title of Article, Journal, Volume, Number, Pages (e.g., 44-48), Year Published

*Anderson, D., McClure, H., Ansari, A. and Fultz, P.: Spectrum of disease in macaques chronically infected with SIV/SMM. In: Symposium on Nonhuman Primate Models for AIDS, San Antonio, TX, November 16-18, 1988, p. 46 (Abstract).

*Anderson, D., McClure, H. and Fultz, P.: Pathology of SIV/SMM infections in mangabeys and chronically infected rhesus macaques. In: Symposium on Nonhuman Primate Models for AIDS, Atlanta, Georgia, October 8-10, 1987, p. 8 (Abstract).***

*Anderson, D.C., McClure, H.M., Ribas, J.L., Ansari, A., Fultz, P., Mirra, S.: Neuropathologic study of SIV infected macaques. In: Vth Int. Conf. AIDS, Montreal, Canada, June 4-9, 1989 (Abstract)(In Press).

*Ahmed-Ansari, A., Brodie, A.R., Fultz, P.N., Sell, K.W. and McClure, H.M.: Flow microfluorometric analysis of peripheral blood mononuclear cells from primates - correlation of phenotype with immune function. Am. J. Primatol. (In Press).

*Ahmed-Ansari, A., Powell, J.D., Fultz, P.N., Anderson, D., Sell, K.W. and McClure, H.M.: Viral antigen processing requirements for the in vitro T cell specific proliferative response to SIV/SMM. In: Symposium on Nonhuman Primate Models for AIDS. San Antonio, TX, November 16-18, 1988, p.40 (Abstract).

*Ansari, A.A., Brodie, A., Fultz, P. and McClure, H.: Dual color flow microflurometry using a panel of monoclonal reagents for the identification of mononuclear cell subsets in primates and an in vitro assay for SIV specific T cell proliferation. In: Symposium on Nonhuman Primate Models for AIDS, Atlanta, Georgia, October 8-10, 1987, p. 16 (Abstract).***

*Bernstein, I.S.: Kinship and behavior in nonhuman primates. Behav. Genet. 18:511-524, 1988.

Bernstein, I.S.: The trouble with multi-authored books: Review of Primate Societies, edited by B. Smuts, D. Cheney, R. Seyfarth, R. Wrangham and T. Struhsaker. Am. J. Primatol. 15:85-87, 1988.

Bernstein, I.S.: Saving sociobiology: The use and abuse of logic. Behav. Brain Sci. (In Press).

Indicate by an asterisk (*) that the resource was given credit.

Core Faculty Publications (Cont'd)

Bernstein, I.S.: Perceptions are nonshared environments. Behav. Brain Sci. (In Press).

Bernstein, I.S.: Metaphor, cognitive belief and science. Behav. Brain Sci. (In Press).

*Bernstein, I.S.: The correlation between kinship and behavior in nonhuman primates. In: Kin Recognition, edited by P. Hepper, Cambridge University Press, New York (In Press).

*Bernstein, I.S. and Baker, S.C.: Activity patterns in a captive group of black apes (Macaca nigra). Folia Primatol. (In Press).

*Boothe, R.G.: Visual development: Central neural aspects. In: Handbook of Human Growth and Developmental Biology, Vol. 1, Part 1: Development of the Nervous System, edited by E. Meisami and P. Timiras, CRC Press, Inc., Boca Raton, Florida, pp. 179-191, 1988.

*Boothe, R.G.: Experimentally induced and naturally occurring monkey models of human amblyopia. In: Comparative Perception, edited by M. Berkley and W. Stebbins, John Wiley & Sons, New York, New York (In Press).

*Boothe, R.G., Joosse, M.V. and Quick, M.W.: Orbital geometry of the accessory lateral rectus muscle in macaque monkeys. Soc. Neurosci. Abstr. 14:958, 1988 (Abstract).

*Boothe, R.G., Kiorpes, L., Williams, R. and Teller, D.: Operant measurements of contrast sensitivity in infant macaque monkeys during normal development. Vision Res. 28:387-396, 1988.

*Boothe, R.G., Quick, M.W., Joosse, M.V. and O'Dell, C.D.: Studies of monkeys with a naturally occurring strabismus. Int. J. Primatol. 8:444, 1987 (Abstract).

*Byrd, L.D. and Howell, L.L.: An historical overview of behavioral pharmacology. Emory Univ. J. Med. 2:287-295, 1988.

*Byrd, L.D. and Smith, E.O.: Amphetamine's effects on the social behavior of group-living monkeys. Pharmacol. Biochem. Behav. 30:553, 1988 (Abstract).

*Else, J.G.: Conservation efforts at the Tana River Primate Reserve, Kenya. Primate Conservation 8:165-166, 1987.**

Else, J.G.: Research in fertility regulation: The role of Old World primates. In: Proceedings XII World Congress Fertil. Steriol., Parthenon Publishing, U.K., 77-84, 1987.

Core Faculty Publications (Cont'd)

*Else, J.G., Poole, T.B., Wolfle, T., Narrareno, J.B., Darsono, C.L., Eudey, A.A., Box, H.O., Suleman, M.A., Croxatto, H., Houghton, P., Held, J.R. and Nishia, T.: International guidelines for acquisition, breeding, captive care and use of nonhuman primates. Int. J. Primatol. 8:409, 1987 (Abstract).**

Fultz, P.N.: The biology of human immunodeficiency viruses. In: The Epidemiology of AIDS: Origin, Expression, and Control of the Human Immunodeficiency Virus Infection, edited by R. Kaslow and D. Francis, Oxford University Press, New York, NY (In Press).

*Fultz, P.N.: Nonhuman primates and the acquired immunodeficiency syndrome: a union of necessity. J. Med. Primatol. (In Press).

Fultz, P.N.: Animal model systems and the acquired immunodeficiency syndrome. In: Current Topics in AIDS, Volume 2, edited by M. Gottlieb, D. Jeffries, D. Mildvan, A. Pinching, T. Quinn and R. Weiss, John Wiley and Sons Limited, Chichester England (In Press).

*Fultz, P., Anderson, D., Switzer, W. and McClure, H.: Characterization of a variant of SIV/SMM. In: Symposium on Nonhuman Primate Models for AIDS, Atlanta, Georgia, October 8-10, 1987, p. 14 (Abstract).***

*Fultz, P.N., Horaist, C., McClure, H.M., Steimer, K.S., Dina, D. and Mawle, A.C.: Postinfection immunization of human immunodeficiency virus-infected chimpanzees with recombinant HIV-1 env and gag antigens. In: Vaccines 89, edited by R. Chanock, F. Brown, R. Lerner and H. Ginsberg, Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (In Press).

*Fultz, P., McClure, H., Hu, S.-L., Anderson, D. and Swenson, B.: Update on chimpanzee-HIV studies. In: Symposium on Nonhuman primate models for AIDS, Atlanta, Georgia, October 8-10, 1987, p. 28 (Abstract).***

*Fultz, P.N., McClure, H.M., Swenson, R.B. and Anderson, D.C.: HIV infection of chimpanzees as a model for testing chemotherapeutics. Intervirology (In Press).

Fultz, P., McClure, H., Swenson, R.B., Anderson, D.C. and Montagnier, L.: Animal models of retrovirus infections. Proceedings of the International Seminar on Retroviral Infections in Intertropical Africa, Franceville, Gabon, April 26-29, 1988 (Abstract).

*Fultz, P.N., Steimer, K., Mawle, A., McClure, H., Horaist, C. and Dina, D.: Postinfection immunization of HIV-1-infected chimpanzees with recombinant HIV-I env and gag antigens. Proceedings of Modern Approaches to New Vaccines Including Prevention of AIDS, Cold Spring Harbor, NY, September 14-18, 1988, p. 144 (Abstract).

*Fultz, P.N., Switzer, W., and Horaist, C.: Biological properties of a variant of SIV/SMM. Symposium on Nonhuman Primate Models for AIDS, San Antonio, TX, November 16-18, 1988, p. 22 (Abstract).

Core Faculty Publications (Cont'd)

*Fultz, P.N., Switzer, W., Horaist, C., McClure, H. and Wain-Hobson, S.: Characterization of a variant of SIV/SMM with increased virulence. In: Proceedings of IV International Conference on AIDS, Stockholm, Sweden, June 12-16, 1988, p. 70 (Abstract).

*Fultz, P., Switzer, W., McClure, H., Anderson, D. and Montagnier, L.: Infection of rhesus macaques with HIV-2. In: Symposium on Nonhuman Primate Models for AIDS, Atlanta, Georgia, October 8-10, 1987, p. 32 (Abstract).***

*Fultz, P.N., Switzer, W., McClure, H.M., Anderson, D. and Montagnier, L.: Simian models for AIDS: SIV/SMM and HIV-2 infection of macaques. In: Vaccines 88: New Chemical and Gentic Approaches to Vaccination, edited by H. Ginsberg, F. Brown, R. Lerner and R. Chanock, Cold Spring Harbor Laboratory, Cold Spring Harbor, NY, pp. 167-170, 1988.

Fultz, P.N., Switzer, W.M., Schable, C.A., Desrosiers, R.C., Silva, D.P. and McCormick, J.B.: Seroprevalence of HIV-1 and HIV-2 in Guinea Bissau in 1980. AIDS 2:129-132, 1988.

*Gordon, T.P.: Training and handling of group housed macaques for research and breeding. Int. J. Primatol. 8(Suppl.):13, 1987 (Abstract).**

*Gordon, T.P., Wilson, M.E. and Gust, D.A.: Age differences in growth hormone and somatomedin-C secretion in female rhesus monkeys. Am. J. Primatol. 14:423, 1988 (Abstract).

*Gould, K.G.: Artificial breeding of nonhuman primates. In: Proceedings of the NCRR Conference on Comparative Reproduction in Mammals and Man, November 23-27, 1987, Nairobi, Kenya, National Museums of Kenya (In Press).

*Gould, K.G.: Techniques and significance of gamete collection and storage in the great apes. J. Med. Primatol. (In Press).

*Gould, K.G. and Mann, D.R.: Comparison of electrostimulation methods for semen recovery in the rhesus monkey (Macaca mulatta). J. Med. Primatol. 17:95-103, 1988.

*Gould, K.G., Young, L.G. and Hinton, B.T.: Alterations in primate sperm motility with maturation and during exposure to theophylline. Am. J. Primatol. 15:325-336, 1988.

*Gould, K.G. and Styperek, R.P.: Improved methods for freeze preservation of chimpanzee sperm. Am. J. Primatol. (In Press).

*Herndon, J.G.: Using the SAS language to build a computerized system for logging and tabulation of behavioral observations. Physiol. Behav. 44:421-429, 1988.

Core Faculty Publications (Cont'd)

*Herndon, J.G., Umpierre, D.M. and Turner, J.J.: Effects of two different patterns of estradiol replacement on the sexual behavior of rhesus monkeys. Physiol. Behav. (In Press).

*King, F.A.: Introductory remarks. In: Symposium on Nonhuman Primate Models for AIDS, Atlanta, Georgia, October 8-10, 1987, p. 6 (Abstract).***

King, F.A.: Animals in research: The case for experimentation. In: Taking Sides: Clashing Views on Controversial Psychological Issues, edited by J. Rubinstein and B. Slife, Dushkin Publishing Group, Inc., Guilford, Connecticut, 1988, pp. 32-37.

King, F.A.: Estudios sobre comportamiento de primates. In: Tendencias Actuales de la Primatologia, edited by J. Martinez-Contreras, Universidad Autonoma Metropolitana Press, Mexico City, Mexico, p. 49-59, 1988.

King, F.A.: Investigaciones biomedicas con primates. In: Tendencias Actuales de la Primatologia, edited by J. Martinez-Contreras, Universidad Autonoma Metropolitana Press, Mexico City, Mexico, p. 13-21, 1988.

King, F.A.: Chimps and research (Letter to the Editor). Science 242:1227, 1988.

*King, F.A. and Gould, K.G.: The role of primate centers in research and conservation. Int. J. Primatol. 8:414, 1988 (Abstract).

*King, F.A., Yarbrough, C.J., Anderson, D.C., Gordon, T.P. and Gould, K.G.: Primates. Science 240:1475-1482, 1988.

*McClure, H., Anderson, D., and Fultz, P.: Response of pig-tailed macaques to SIV/SMM infection. In: Symposium on Nonhuman Primate Models for AIDS, Atlanta, Georgia, October 8-10, 1987, p. 11 (Abstract).***

*McClure, H.M., Anderson, D.C., Fultz, P.N., Ansari, A.A., Lockwood, E. and Brodie, A.: Spectrum of disease in macaque monkeys chronically infected with SIV/SMM. Vet. Immunol. Immunopathol. (In Press).

*McClure, H.M., Anderson, D., Ansari, A. and Fultz, P.N.: Update on the pathogenicity of SIV/SMM/PBj$_{14}$, an acutely lethal variant of SIV/SMM. In: Symposium on Nonhuman Primate Models for AIDS, San Antonio, TX, November 16-18, 1988, p. 47 (Abstract).

*McClure, H.M., Anderson, D.C., Ansari, A.A. and Fultz, P.N.: Pathology of chronic SIV/SMM infection in macaque monkeys. Lab. Invest. (Abstract)(In Press).

*McClure, H.M., Anderson, D.C., Ansari, A.A. and Fultz, P.N.: Clinicopathologic findings in nonhuman primates infected with an acutely lethal variant of SIV/SMM. Lab Invest. (Abstract)(In Press).

Core Faculty Publications (Cont'd)

*McClure, H.M., Anderson, D.C., Fultz, P., Ansari, A., Brodie, A. and Lehrman, S.: Prophylactic effects of AZT following exposure of macaques to an acutely lethal variant of SIV (SIV/SMM/PBj$_{14}$). In: Vth Int. Conf. on AIDS, Montreal, Canada, June 4-9, 1989 (Abstract)(In Press).

*McClure, H.M., Anderson, D.C., Ansari, A. and Fultz, P.: In vivo analysis of the minimal infectious dose of an acutely lethal pool of SIV (SIV/SMM/PBj$_{14}$). In: Vth Int. Conf. on AIDS, Montreal, Canada, June 4-9, 1989 (Abstract)(In Press).

*Nadler, R.D.: Estrus and mating of the great apes. In: Primates - The New Revolution, edited P. Seth, Scholarly Publ., Houston (In Press).

*Nadler, R.D.: Homosexual behavior in nonhuman primates. In: Homosexuality/-Heterosexuality: The Kinsey Scale and Current Research, edited by D. McWhirter, S. Sanders and J. Reinisch, Oxford University Press, New York, (In Press).

*Nadler, R.D.: The psychological wellbeing of captive gorillas. In: Psychological Wellbeing of Captive Primates, edited by E. Segal, Noyes Publ., (In Press).

*Nadler, R.D.: Sexual aggression in common chimpanzees, gorillas and orang-utans. Int. J. Primatol. 8:451, 1987 (Abstract).**

*Nadler, R.D.: Sexual aggression in common chimpanzee, gorilla and orang-utan, Prim. Rep. (In Press).

*Nadler, R.D.: Sexual aggression in the great apes. Ann. N.Y. Acad. Sci. 528:154-162, 1988.

*Nadler, R.D.: Sexual and reproductive behavior. In: Orang-utan Biology, edited by J. Schwartz, Oxford University Press, New York, pp. 105-116, 1988.

*Nadler, R.D.: Sexual initiation in wild mountain gorillas. Int. J. Primatol. (In Press).

*Nadler, R.D. and Dahl, J.F.: Sexual aggression in nonhuman primates. Prim. Rep. (In Press).

*Nadler, R.D. and Dahl, J.F.: Sexual behaviour of the great apes. In: Perspectives in Primate Biology, edited by P. Seth and S. Seth, Scholarly Publ., Houston (In Press).

*Nadler, R.D. and Dahl, J.F.: Reproductive biology at the Yerkes Regional Primate Research Center and the nature of animal welfare extremism. Lab. Prim. Newsl. (In Press).

Core Faculty Publications (Cont'd)

*Nadler, R.D., Dahl, J.F., Collins, D.C., Gould, K.G. and Wilson, M.E.: Effects of oral contraceptives on chimpanzees: Preliminary report. Proceedings of the NCRR Conference on Comparative Reproduction in Mammals and Man, November 23-27, 1987, National Museums of Kenya, Nairobi, Kenya (In Press).

*Nadler, R.D., Dahl, J.F., Wallen, K., Loy, J.D., Lloyd, S.A.C. and Dixson, A.F.: Sexual aggression in nonhuman primates. Int. J. Primatol. 8:408, 1987 (Abstract).**

*Nadler, R.D., Dahl, J.F., Wilson, M.E., Gould, K.G. and Collins, D.C.: Reproductive behaviour and physiology of the chimpanzee. In: Proceedings of the NCRR Conference on Comparative Reproduction in Mammals and Man, November 23-27, 1987, National Museums of Kenya, Nairobi, Kenya (In Press).

*Savage-Rumbaugh, E.S.: A new look at ape language: Comprehension of vocal speech and syntax. In: Nebraska Symposium on Motivation 1987: Comparative Perspectives in Modern Psychology, edited by D.W. Leger, University of Nebraska Press, Lincoln, 1988, pp. 201-225.

Savage-Rumbaugh, E.S.: Review of Apes of the World: Their Social Behavior, Communication, Mentality, and Ecology by R.H. Tuttle. Am. Anthropol. 90:479, 1988.

Savage-Rumbaugh, E.S.: Review of East of the Mountains of the Moon by M.P. Ghiglieri, Contemp. Psychol (In Press).

Savage-Rumbaugh, E.S.: Deception and social manipulation in symbol, using apes. In: Machiavellian Intelligence: Social Expertise and the Evolution of Intellect in Monkeys, Apes and Humans, edited by R. Byrne and A. Whiten, Oxford University Press, New York, 1988, pp. 224-237.

*Savage-Rumbaugh, E.S.: Language acquisition in a nonhuman species: Implications for the innateness debate. Devel. Psychobiol. (In Press).

Savage-Rumbaugh, E.S.: Language training of great apes. In: The Cambridge Encyclopedia of the Human Species, edited by R. Martin, D. Philbeam and S. Jones, Cambridge University Press, New York (In Press).

*Savage-Rumbaugh, E.S., Sevcik, R.A. and Hopkins, W.D.: Symbolic cross-modal transfer in two species of chimpanzees. Child Devel. 59:617-625, 1988.

*Savage-Rumbaugh, E.S., Romski, M.A., Hopkins, W.D. and Sevcik, R.A.: Symbol acquisition and use in three species, Pan troglodytes, Pan paniscus, and Homo sapiens: Environmental and species variables. In: Understanding Chimpanzees, edited by P. Heltne, Chicago Academy of Sciences, Chicago (In Press).

*Savage-Rumbaugh, E.S. and Rumbaugh, D.M.: A theory of language acquisition in apes. In: Biobehavioral Foundations of Language Development, edited by N. Krasnegor, D.M. Rumbaugh and R.L. Schiefelbusch (In Press).

Core Faculty Publications (Cont'd)

*Savage-Rumbaugh, E.S., Sevcik, R.A. and Brakke, K.E.: Symbols: Their communicative use, combination, and comprehension by bonobos (Pan paniscus). In: Advances in Infancy Research, Vol. 7, edited by L.P. Lipsitt and C. Rovee-Collier, Ablex Publishing Corp., Norwood, New Jersey (In Press).

Smith, E.O.: Review of Primate Conservation in the Tropical Rain Forest, C.W. Marsh and R.A. Mittermeier, eds. Swara 11:13-14, 1988.

*Smith, E.O.: Savanna-dwelling baboons in the Tana River Primate Reserve. Am. J. Phys. Anthropol. (Abstract) (In Press).

*Smith, E.O. and Miller, A.L.: On female primate sexual behavior and conception. Curr. Anthropol. 29: 487-488, 1988.

*Smith, E.O. and Whitten, P.L.: Triadic interactions in savanna-dwelling baboons. Int. J. Primatol. (In Press).

*Tigges, J. and Fernandes, A.: Axial length development in normal and aphakic eyes of rhesus monkey (M. mulatta). Int. J. Primatol. 8:443, 1987 (Abstract).**

*Tigges, J., Gordon, T.P., McClure, H.M., Hall, E.C. and Peters, A.: Survival rate and life span of rhesus monkeys at the Yerkes Regional Primate Research Center. Am. J. Primatol. 15:263-273, 1988.

*Tigges, J., Tigges, M. and Peters, A.: Are there age-related neuronal changes in area 4 of rhesus monkey (M. mulatta)? Int. J. Primatol. 8:514, 1987 (Abstract).**

*Tigges, M., Iuvone, P.M., Tigges, J., Fernandes, A. and Gammon, J.A.: Development of retinal dopamine system and lateral geniculate nucleus (LGN) in normal and visually deprived infant rhesus monkeys. Int. J. Primatol. 8:444, 1987 (Abstract).**

*Tigges, M., Tigges, J., Fernandes, A., Eggers, H.M. and Gammon, J.A.: Axial eye growth of normal and visually deprived infant monkeys. Invest. Ophthalmol. Vis. Sci. Suppl. (Abstract) (In Press).

*Tigges, M., Tigges, J., McDonald, J.K., Slattery, M. and Fernandes, A.: Postnatal development of neuropeptide Y-like immunoreactivity in area 17 of normal and visually deprived rhesus monkeys. Visual Neurosci. (In Press).

*Wallen, K.: Environmental modulation of ovarian influences on female rhesus sexual behavior. Int. J. Primatol. 8:451, 1987 (Abstract).

*Wallen, K.: Mate selection: Economics and affection, a commentary on "Sex differences in human mate preferences: Evolutionary hypothesis tested in 37 cultures." Behav. Brain Sci. (In Press).

Core Faculty Publications (Cont'd)

*Wallen, K.: Nonfertile mating in rhesus monkeys: Sexual aggression or miscommunication? Primate Rep. (In Press).

*Wallen, K. and Lovejoy, J.C.: Androgens and female sexual behavior in group-living rhesus (Macaca mulatta). Int. J. Primatol. 8:497, 1987 (Abstract).**

*Wilson, J.R.: Electron microscopic analyses of HRP-injected neurons in the monkey's lateral geniculate nucleus. Invest. Ophthalmol. Vis. Sci. Suppl. 29:114, 1988 (Abstract).

*Wilson, J.R., Bullier, J. and Norton, T.T.: Signal-to-noise comparisons for X and Y cells in the retina and lateral geniculate nucleus of the cat. Exp. Brain Res. 70:399-405, 1988.

*Wilson, J.R.: Synaptic organization of individual neurons in the macaque lateral geniculate nucleus. J. Neurosci. (In Press).

*Wilson, J.R. and Hendrickson, A.E.: Serotonergic axons in the monkey's lateral geniculate nucleus. Visual Neurosci. 1:125-133, 1988.

*Wilson, J.R., Lavallee, K., Joosse, M., Hendrickson, A., Boothe, R. and Harwerth, R.: Visual fields of monocularly deprived macaque monkeys. Behav. Brain Res. (In Press).

*Wilson, M.E. and Gordon, T.P.: Nocturnal changes in serum melatonin during female puberty in rhesus monkeys: A longitudinal study. J. Endocrinol. (In Press).

*Wilson, M.E. and Gordon, T.P.: Short-day melatonin pattern advances puberty in seasonal breeding rhesus monkeys. J. Reprod. Fertil. (In Press).

*Wilson, M.E. and Gordon, T.P.: Season determines the timing of first ovulation in rhesus monkeys (Macaca mulatta) housed outdoors. J. Reprod. Fertil. (In Press).

*Wilson, M.E., Gordon, T.P., Rudman, C.G. and Tanner, J.M.: Growth hormone effects on the tempo of puberty in female rhesus monkeys. In: Abstracts of the Endocrine Society, 70th Annual Meeting, New Orleans, Louisiana, 1988, p. 332 (Abstract).

*Wilson, M.E., Gordon, T.P., Rudman, C.G. and Tanner, J.M.: Effects of a natural versus artificial environment on the tempo of maturation in female rhesus monkeys. Endocrinology 123:2653-2661, 1988.

*Wilson, M.E., Gordon, T.P., Rudman, C.G. and Tanner, J.M.: Effects of growth hormone on the tempo of sexual maturation in female rhesus monkeys. J. Clin. Endocrinol. Metab. (In Press).

Core Faculty Publications (Cont'd)

*Wilson, M.E., Walker, M.L., Pope, N.S. and Gordon, T.P.: Prolonged lactational infertility in adolescent rhesus monkeys. Biol. Reprod. 38:163-174, 1988.

** From Abstracts of the XIIth Congress of the International Primatological Society (July 24-29, 1988); published (1988) in Volume 8 of the International Journal of Primatology, dated October, 1987.

*** From the Symposium on Nonhuman Primate Models for AIDS, held in Atlanta, Georgia, October 8-10, 1987 and published in 1988, or 1987 publications that were not listed in the 1987 Annual Center Progress Report.

PART II, SECTION C GRANT NUMBER P 5 1 R R 0 0 1 6 5 -28

INSTITUTION: Yerkes Regional Primate Research Center

REPORT PERIOD: January 1, 1988 to December 31, 1988

Fill out a separate form for each of the following categories: Check one

☐ CORE RESEARCH & DEVELOPMENT ■ OTHER

							TOTAL
Number Published:	BOOKS	0	PAPERS	45	ABSTRACTS	49	94
Number in Press:	BOOKS	0	PAPERS	50	ABSTRACTS	6	56

Author(s) Title of Article, Journal, Volume, Number, Pages (e.g., 44-48), Year Published

*Abrahamsen, A.A., Romski, M.A. and Sevcik, R.A.: Change and the causes of change. Am. J. Ment. Retard. (In Press).

*Abrahamsen, A.A., Romski, M.A. and Sevcik, R.A.: Concomitants of success in acquiring an augmentative communication system: Changes in attention, communication, and sociability. Am. J. Ment. Retard. (In Press).

*Apkarian, R.P.: Conditions required for detection of specimen specific SE-I secondary electrons in an analytical SEM. J. Microsc. (In Press).

*Apkarian, R.P. and Gutekunst, M.D.: High resolution topographic imaging of enamel crystal surfaces. In: 46th Annual Meeting of the Proceedings of the Electron Microscopy Society of America, San Francisco, California, pp. 188-189, 1988.

*Apkarian, R.P., Gutekunst, M.D. and Joy, D.C.: A high-resolution SE-I SEM study of enamel crystal morphology. J. Elec. Micro Tech. (JEMT) (In Press).

*Apkarian, R.P. and Joy, D.J.: Analysis of metal films suitable for high resolution SE-I microscopy. In: Microbeam Analysis 1988, edited by D.E. Newbury, San Francisco Press, California, pp. 459-462, 1988.

*Bakay, R.A.E.: Neural grafts: Evaluation of potential surgical technique for clinical studies. In: Proceedings of The Third National Conference on Alzheimer's Disease and Dementia, edited by H. J. Altman (In Press).

Bakay, R.A.E. and Barrow, D.L.: Neural transplantation for Parkinson's disease. J. Neurosurg. 69:807-810, 1988.

*Bakay, R.A.E., Fiandaca, M.S., Sweeney, K.M., Colbassani, H.J. Jr. and Collins, D.C.: Delayed stereotactic transplantation technique in nonhuman primates. Prog. Brain Res. 78:463-471, 1988.

*Bakay, R.A.E. and Herring, C.: Transplantation in monkeys. In: Current Concepts in Parkinson's Disease Research, edited by J. S. Schneider and M. Gupta, (In Press).

*Bakay, R.A.E., Sweeney, K., Colbassani, H., Watts, R.L., Iuvone, P.M. and Byrd, L.D.: Transcortical intraventricular adrenal medullary grafting in the treatment of hemiparkinson monkeys. Soc. Neurosci. Abstr. 14:8, 1988 (Abstract).

Indicate by an asterisk (*) that the resource was given credit.

Other Faculty Publications (Cont'd)

*Bard, K.A.: Behavioral development in young orangutans: Ontogeny of object manipulation, arboreal behavior, and food sharing. Dissertation Abstracts International B. Sci. Eng. 49:1407, 1988.

*Bard, K.A.: "Social tool use" by free-ranging orangutans: A Piagetian and developmental perspective on the manipulation of an animate object. In: Comparative Developmental Psychology of Language and Intelligence in Primates, edited by S. Parker and K. Gibson, Cambridge University Press (In Press).

*Bard, K.A., Platzman, K.A. and Suomi, S.J.: Neurobehavioral responsiveness in neonatal chimpanzees: Orientation to animate and inanimate objects. Int. J. Primatol. 8:515, 1987 (Abstract).**

*Barr, R.G., Smith, E.O., Konner, M., White, W. and McMullan, S.J.: Lactose absorption and breath hydrogen excretion in infant chimpanzees: Effects of feeding regimes. Pediatr. Res. 23:297A, 1988 (Abstract).

*Beatey, S.A.: Sex differences in social interactions of squirrel monkeys (Saimiri sciureus). Am. J. Primatol. 14:409, 1988 (Abstract).

Bloomsmith, M.A., Alford, P.L. and Maple, T.L.: Successful feeding enrichment for captive chimpanzees. Am. J. Primatol. 16:155-164, 1988.

Bolser, L.A., Runfeldt, S. and Morris, R.: Handedness in language-trained chimpanzees (Pan troglodytes) in daily activities and assessment tasks. J. Clin. Exp. Neuropsychol. 10: 40-41, 1988 (Abstract).

*Bolser, L.A. and Savage-Rumbaugh, E.S.: Periparturitional behavior of a bonobo (Pan paniscus). Am. J. Primatol. (In Press).

Boysen, S.T.: Kanting processes in the chimpanzee: What (and who) really counts? Behav. Brain Sci. 11: 580, 1988 (Abstract).

*Boysen, S. and Berntson, G.: Numerical reasoning in a chimpanzee (Pan troglodytes). Int. J. Primatol. 8:515, 1987 (Abstract).**

*Brodie, A.R., Ansari, A.A. and McClure, H.M.: Development of a panel of monoclonal antibody reagents for two color flow microflurometric analysis of nonhuman primate peripheral blood mononuclear cell subsets. In: Sixth Annual South-Central Flow Cytometry Association Meeting, Nashville, Tennessee, April 29-30, 1988 (Abstract).

*Bruce, K.E.M., Estep, D.Q. and Baker, S.C.: Social interactions following parturition in stumptail macaques. Am. J. Primatol. 15:247-261, 1988.

*Collins, D.C., Gould, K.G., and Mann, D.R.: Bioactive and immunoactive LH and the common alpha subunit during GnRH agonist treatment in female rhesus monkeys. Biol. Reprod. 38 (Suppl. 1), 1988, p. 121 (Abstract).

Other Faculty Publications (Cont'd)

*Collins, W.E., Skinner, J.C., Pappaioanou, M., Broderson, J.R., Filipski, V.K., McClure, H.M., Strobert, E., Sutton, B.B., Stanfill, P.S. and Huong, A.Y.: Sporozoite-induced infections of the Salvador I strain of Plasmodium vivax in Saimiri sciureus boliviensis monkeys. J. Parasitol. 74:582-585, 1988.

*Dahl, J.F.: Sexual aggression in captive pygmy chimpanzees (Pan paniscus). Int. J. Primatol 8:451, 1987**

*Dahl, J.F.: An unusual activity pattern for the mantled howler monkey of Belize. Am. J. Phys. Anthropol. 75:201, 1988 (Abstract).

*Dahl, J.F.: External genitalia. In: Orang-Utan Biology, edited by J.H. Schwartz, Oxford University Press, New York, pp. 133-144, 1988.

*Dahl, J.F.: An inexpensive, climate-controlled enclosure for gibbons utilizing appropriate technology. In: The Psychological Wellbeing of Captive Nonhuman Primates, edited by E.F. Segal, Noyes Publications, Park Ridge, New Jersey, (In Press).

*Dahl, J.F. and Hemingway, C.A.: An unusual activity pattern for the mantled howler monkey of Belize. Am. J. Phys. Anthropol. 75:201, 1988 (Abstract).

*Dahl, J.F. and Nadler, R.D.: Sexual aggression and extended sexual activity in pygmy chimpanzees (Pan paniscus). Primate Rep. (In Press).

*Davis-DaSilva, M. and Wallen, K.: Suppression of male rhesus testicular function and sexual behavior by a gonadotropin-releasing-hormone agonist. Physiol. Behav. (In Press).

*Donahoe, R.M., Bueso-Ramos, C., Falek, A., McClure, H. and Nicholson, J.K.A.: Comparative effects of morphine on leukocytic antigenic markers of monkeys and humans. J. Neurosci. Res. 19:157-165, 1988.

Donahoe, R.M., Byrd, L., Ansari, A., Brantley, M., Wenzel, D. and McClure, H.M.: Immunological effects of morphine in a rhesus monkey model. FASEB J. (Abstract) (In Press).

*Ehardt, C.L.: Absence of strongly kin-preferential behavior by adult female sooty mangabeys (Cercocebus atys). Am. J. Phys. Anthropol. 76:233-243, 1988.

*Ehardt, C.L.: Affiliative behavior of adult female sooty mangabeys (Cercocebus atys). Am. J. Primatol. 15:115-127, 1988.

Eley, R.M.: Nonhuman primate models for biomedical research: Breeding and captive management of old world monkeys in their country of origin. In: Proceedings of the Conference of Development Biology and Toxicology of Nonhuman Primates, Berlin, September 15-17, 1988 (In Press).

Other Faculty Publications (Cont'd)

Eley, R.M.: Nonhuman primate models for human reproductive studies. In: Proceedings of the Kenya Veterinary Association Annual Scientific Conference, Nairobi, April 21-22, 1988 (In Press).

Eley, R.M.: Editor, Proceedings of the NCRR Conference on Comparative Reproduction in Mammals and Man, November 23-27, 1987, Nairobi, Kenya, National Museums of Kenya (In Press).

Eley, R.M. and Tarara, R.P.: Some aspects of conceptus development in the olive baboon (Papio cynocephalus anubis). In: Proceedings of the NCRR Conference on Comparative Reproduction in Mammals and Man, November 23-27, 1987, Nairobi, Kenya, National Museums of Kenya (In Press).

*Eley, R.M., Tarara, R.P., Worthman, C.M. and Else, J.G.: Reproduction in the vervet monkey (Cercopithecus aethiops), III. The menstrual cycle. Amer. J. Primatol. (In Press).

Eriksson, B.F.H., Schinazi, R.F., and Chu, C.K.: Preferential inhibition of HIV-1 and SIV reverse transcriptases by the 5'-triphosphates of 3'-azido-2', 3'-dideoxyuridine (CS-87), 3' azido-3'-deoxythymidine (AZT), and 3'-azido-2', 3'-dideoxy-5'ethyluridine (CS-85). In: Proceedings of the IV International Conference on AIDS, Stockholm, Sweden, June 12-16, 1988, p. 221 (Abstract).

*Estep, D.Q., Nieuwenhuijsen, K., Bruce, K.E.M., de Neef, K.J., Walters, P.A. III, Baker, S.C. and Slob, A.K.: Inhibition of sexual behaviour among subordinate stumptail macaques, Macaca arctoides. Anim. Behav. 36:854-864, 1988.

*Fernandes, A., Tigges, M., Tigges, J., Gammon, J.A. and Chandler, C.: Management of extended-wear contact lenses in infant rhesus monkeys. Behav. Res. Meth. Instrum. Comput. 20:11-17, 1988.

*Fiandaca, M.S., Bakay, R.A.E., Sweeney, K.M. and Chan, W.C.: Immunologic response to intracerebral fetal neural allografts in the rhesus monkey. Prog. Brain Res. 78:287-295, 1988.

*Finlay, T., James, L.R. and Maple, T.L.: People's perceptions of animals: The influence of zoo environment. Environ. Behav. 20:508-528, 1988.

*Gammon, J.A., O'Dell, C.D., Quick, M.W., Fernandes, A., Wilson, J., Tigges, M., Tigges, J. and Boothe, R.G.: Visual function in monkeys modeling infantile aphakia-amblyopia treatment. Invest. Ophthalmol. Visual Sci. Suppl. 29:75, 1988 (Abstract).

Girard, M., Barre-Sinoussi, F., Rey, F., Yagello, M., Kieny, M.P., Chermann, J.C., Muchmore, E., Fultz, P., Lecocq, J.-P., Gluckman, J.-C. and Montagnier, L.: Immunization of chimpanzees against HIV using whole inactivated virions. Proceedings of the IV International Conference on AIDS, Stockholm, Sweden, June 12-16, 1988, p. 290 (Abstract).

Other Faculty Publications (Cont'd)

*Gouzoules, H. and Gouzoules, S.: Pigtail macaque agonistic screams. Am. J. Primatol. 14:423, 1988 (Abstract).

*Gouzoules, H.T. and Gouzoules, S.M.: Design features and developmental modification of pigtail macaque (Macaca nemestrina) agonistic screams. Anim. Behav. (In Press).

Graham, C.E. and Nadler, R.D.: Hormones and reproductive behavior of great apes. Int. J. Primatol. 8:456, 1987 (Abstract).**

Graham, C.E. and Nadler, R.D.: Socioendocrine interactions in great apes. In: Socioendocrinology: A New Perspective, edited by T. Ziegler and F. Bercovitch, Alan R. Liss, New York (In Press).

*Greenfield, P.M. and Savage-Rumbaugh, E.S.: Grammar in Pan paniscus: Processes of learning and invention. In: Comparative Developmental Psychology of Language and Intelligence in Primates, edited by S. Parker and K. Gibson, Cambridge University Press, New York (In Press).

*Greenfield, P.M. and Savage-Rumbaugh, E.S.: Imitation, grammatical development and the invention of protogrammar. In: Biobehavioral Foundations of Language Development, edited by N. Krasnegor, D.M. Rumbaugh and R.L. Schiefelbusch (In Press).

*Greenfield, P.M. and Savage-Rumbaugh, E.S.: Protogrammatical abilities in an ape: Learning from a model and spontaneous invention. Hum. Biol. (In Press).

*Gust, D.A.: Social factors influencing choice of food source in a captive group of chimpanzees (Pan troglodytes). Am. J. Primatol. 16:81-87, 1988.

*Gust, D.A.: Uncertain availability of a preferred food affects choice in a captive group of chimpanzees (Pan troglodytes). Am. J. Primatol (In Press).

*Gust, D.A. and Gordon, T.P.: An ecological perspective on food choice behavior in a captive group of chimpanzees (Pan troglodytes). Int. J. Primatol. 8:516, 1987 (Abstract).**

*Gust, D.A., Swenson, R.B., Smith, M.B. and Sikes, J.: An apparatus and procedure for studying the choice component of foraging in a captive group of chimpanzees (Pan troglodytes). Primates 29:139-143, 1988.

*Hambright, M.K.: Male dominance rank and copulatory agonistic behavior in stumptail macaques (Macaca arctoides). M.S. Thesis, University of Georgia, Athens, Georgia, 58 pp, 1988.

*Hambright, M.K., Estep, D.Q., Bruce, K.E.M. and Baker, S.C.: Male dominanance and copulatory agonistic behavior in stumptail macaques (Macaca arctoides). Am. J. Primatol. 14:424, 1988 (Abstract).

Other Faculty Publications (Cont'd)

*Hopkins, W.D. and Morris, R.: Laterality for visual-spatial processing in two language-trained chimpanzees (Pan troglodytes). Behav. Neurosci. (In Press).

*Hopkins, W.D., Morris, R. and Washburn, D.A.: Lateralized function for visual- spatial processing using a visual-half field paradigm in the chimpanzee (Pan). J. Clin. Exp. Neuropsychol. 10:69, 1988 (Abstract).

Hopkins, W.D., Washburn, D.A. and Rumbaugh, D.M.: Note on hand use in the manipulation of joysticks by rhesus monkeys (Macaca mulatta) and chimpanzees (Pan troglodytes). J. Comp. Psychol. (In Press).

Howell, L.L.: Respiratory effects of adenosine agonists and antagonism of the respiratory effects by methylxanthines in rhesus monkeys. FASEB J. 2:A1131, 1988 (Abstract).

*Howell, L.L. and Byrd, L.D.: Comparative effects of cocaine and a dopamine uptake inhibitor (GBR 12909). Pharmacol. Biochem. Behav. 30:559, 1988 (Abstract).

*Howell, L.L., Byrd, L.D. and Marr, M.J.: Differential effects of cocaine and pentobarbital on fixed-interval and random-interval performance. J. Exp. Anal. Behav. 49:411-428, 1988.

*Howell, L.L., Wenzel, D.M. and Byrd, L.D.: Behavioral effects of two D_2-selective dopamine antagonists, raclopride and spiperone. Pharmacol. Biochem. Behav. (Abstract) (In Press).

Ishikawa, K., Fukasawa, M., Tsujimoto, H., Else, J.G., Isahakia, M., Ubhi, N.K., Ishda, T., Takenaka, O., Kawamoto, Y., Shoutake, T., Oshawa, H., Ivanoff, B., Cooper, R.W., Frost, E., Grant, F.C., Spriatna, Y., Abe, K., Yamamoto, K. and Hayami, M.: Serological survey and virus isolation of simian T cell leukemia/T lymphotropic virus type 1 (STLV-1) in nohuman primates in their native countries. Int. J. Cancer 40:233-239, 1987.**

*Iuvone, P.M., Tigges, M., Fernandes, A. and Tigges, J.: Dopamine synthesis and metabolism in rhesus monkey retina: Development, aging, and the effects of monocular visual deprivation. Visual Neurosci. (In Press).

*Joosse, M.V., Wilson, J.R. and Boothe, R.G.: Monocular visual fields of macaque monkeys with naturally occurring strabismus. Invest. Ophthalmol. Vis. Sci. Suppl. 29:345, 1988 (Abstract).

*Kyes, R.C.: Grooming with a stone in sooty mangabeys (Cercocebus atys). Am. J. Primatol. 16:171-175, 1988.

*Kyes, R.C. and Bernstein, I.S.: Activity patterns in a crab-eating macaque group (Macaca fascicularis). Am. J. Primatol. 14:430, 1988 (Abstract).

Other Faculty Publications (Cont'd)

Lairmore, M.D., Kaplan, J.E., Rayfield, M., Brown, B., McVicar, J.W., Daniel M.D., Lerche, N.W., Nara, P.L., McClure, H.M., McKinney, R.W., Johnsen, D.O., Purcell, R., Gibbs, C.J., Jr., Hendry, M., Gerone, P., Allan, J., Ribas, J.L., Klein, J.H. and Jahrling, P.B.: Guidelines to prevent simian immunodeficiency virus infection in laboratory workers and animal handlers. MMWR 37:693-694 and 699-704, 1988.

Lansdell, H.: Laboratory animals need only humane treatment: Animal "rights" may debase human rights. Int. J. Neurosci. 42:169-178, 1988.

*Lovejoy, J. and Wallen, K.: Sexually dimorphic behavior in group-housed rhesus monkey (Macaca mulatta). Psychobiology 16:348-356, 1988.

Malizia. A.A., Jr., Woodard, J.R., Rushton, H.G., Wyly, J.B., Ball, T.I. and Newton, N.E.: Intravesical/subureteric injection of Polytef: Serial radiologic imaging. Proceedings of the Annual Meeting of American Urological Association, Boston, Massachusetts, June 1988, p. 185A (Abstract).

*Mann, D.R., Gould, K.G., Collins, D.C., Wallen, K.: Blockade of neonatal activation of the pituitary-testicular axis: Effect on peripubertal LH and testosterone secretion and on testicular development in male monkeys. J. Clin. Endocrinol. Metab. (In Press).

Mann, D.R., Lee, D., Tittle, J., Lewis, S. and Orr, T.E.: Mechanism of gonadotropin-independent effects of restraint stress on testicular steroidogenesis. Southeastern Endocrine Group Meeting, Charleston, South Carolina, May 13, 1988 (Abstract).

*Mann, D.R., and Wilson, M.E.: Hormonal changes in the plasma and testicular interstitial fluid during restraint stress. Proceedings of the 11th International Congress on Animal Reproduction and Artificial Insemination, 2:43-45, 1988.

*Maple, T.L. and Finlay, T.W.: Applied primatology in the modern zoo. Zoo Biol. (In Press).

Mawle, A.C., Ridgeway, M.R., Fultz, P., Scheppler, J.A. and McDougal, J.S.: Differential infectivity of human and chimpanzee EBV-transformed (EBV-B) B cells with HIV-1. Proceedings of the IV International Conference on AIDS, Stockholm, Sweden, June 12-16, 1988, p. 102 (Abstract).

McCarey, B.E., McDonald, M., van Rij, G., Salmeron, B., Pettit, D. and Knight, P.: Refractive results of hyperopic hydrogel intracorneal lenses in primate eyes. Arch. Ophth. (In Press).

*McDonald, J.K., Tigges, J., Tigges, M. and Reich, C.: Developmental study of neuropeptide Y-like immunoreactivity in the neurohypophysis and intermediate lobe of the rhesus monkey (Macaca mulatta). Cell Tiss. Res. 254:459-509, 1988.

Other Faculty Publications (Cont'd)

Michels, M. and Sternberg, P.: Prevention of operating microscope induced retinal phototoxicity. Invest. Ophthalmol. Visual Sci. 29:413, 1988 (Abstract).

*Milton, K. and Demment, M.W.: Digestion and passage kinetics of chimpanzees fed high and low fiber diets and comparison with human data. J. Nutr. 118: 1082-1088, 1988.

*Molfese, D.L., Morris, R. and Romski, M.A.: Semantic discrimination in nonspeaking youngsters with moderate or severe retardation: Electrophysiological correlates of neurolinguistic processing. Brain Lang. (In Press).

*Moss, M.B. and Rosene, D.L.: Behavioral and anatomical studies of the limbic system in aged rhesus monkeys. Age 11:182-183, 1988 (Abstract).

*Moss, M.B., Rosene, D.L. and Peters, A.: Effects of aging on visual recognition memory in the rhesus monkey. Neurobiol. Aging 9:495-502, 1988.

O'Dell, C.D., Harshaw, K.B., Abernathy, C., Pool, L.G. and Boothe, R.G.: The assessment of vision in a mentally retarded population. Invest. Ophthalmol. Visual Sci. Suppl. 29:431, 1988 (Abstract).

Offenbacher, S., Odle, B.M., Braswell, L.D., Johnson, H.G., Hall, C.M., McClure, H., Orkin, J.L., Strobert, E.A. and Green, M.D.: Changes in cyclooxygenase metabolites in experimental periodontitis in Macaca mulatta. J. Periodont. Res. (In Press).

*Perkash, I. and Martin, D.E.: Infertility in the paraplegic male. Curr. Ther. Infert. 3:228-231, 1988.

*Plenge, T., Romski, M.A. and Wacker, J.: A cooperative assessment strategy for evaluating school-aged children with language impairments. J. Learn. Disabil. 21: 551-555, 1988.

Polsky, B., Gold, J.W.M., Hardy, W.D., Fultz, P.N., Baron, P.A., Zuckerman, E.E., Chou, T.-C., Levine, S.M., Flomenberg, N., Wang, L., Watanabe, K.A., Fox, J.J. and Armstrong, D.: 3'-deoxy-3'-fluorothymidine (3'-F-TdR) inhibits HIV-1, FeLV and SIV. Proceedings of the IV International Conference on AIDS, Stockholm, Sweden, June 12-16, 1988, p. 221 (Abstract).

*Pope, N.S., Gould, K.G., Anderson, D.C. and Mann, D.R.: Effects of age on trabecular and cortical bone density in the rhesus monkey. Bone (In Press).

*Powell, J.D., Ahmed-Ansari, A., Fultz, P.N., Anderson, D., Sell, K.W. and McClure, H.M.: Phenotypic and functional differences in NK and LAK cells from naturally SIV/SMM infected and noninfected sooty mangabeys and normal rhesus macaques. In: Symposium on Nonhuman Primate Models for AIDS, San Antonio, Texas, November 16-18, 1988, p. 41 (Abstract).

Other Faculty Publications (Cont'd)

*Powell, J.D., McClure, H.M., Anderson, D., Fultz, P.N., Sell, K.W. and Ahmed-Ansari, A.: Phenotypic and functional differences in NK and LAK cells in the peripheral blood of sooty mangabeys and rhesus macaques. J. Immunol. (In Press).

*Powell, J.D., Yehuda-Cohen, T., McClure, H.M., Anderson, D., Fultz, P.N., Sell, K.W. and Ansari, A.A.: Phenotypic and functional differences in NK and LAK cells from SIV infected asymptomatic mangabeys and normal macaques: Potential protective role in SIV infection. FASEB J. (Abstract)(In Press).

*Procell, P.M., Collins, W.E. and Campbell, G.M.: Circumsporozoite protein of the human malaria parasite Plasmodium ovale identified with monoclonal antibodies. Infect. Immun. 56:376-379, 1988.

*Quick, M.W. and Boothe, R.G.: Measurement of binocular alignment in normal monkeys and in monkeys with strabismus. Invest. Ophthalmol. Visual Sci. (In Press).

*Quick, M.W., Joosse, M. and Boothe, R.: Assessment of spatial vision and visual fields in naturally strabismic monkeys. Soc. Neurosci. Abstr. 14:1244, 1988 (Abstract).

*Quick, M.W., O'Dell, C.D. and Boothe, R.G.: Long-term grating and optotype acuity in a primate model of aphakia. Invest. Ophthalmol. Visual Sci. Suppl. (Abstract) (In Press).

*Quick, M.W., Tigges, M., Gammon, J.A. and Boothe, R.G.: Early abnormal visual experience induces strabismus in infant monkeys. Invest. Ophthalmol. Visual Sci. (In Press).

*Quick, M.W., Tigges, M., Gammon, J.A. and Boothe, R.G.: Induced strabismus in infant monkeys deprived of normal visual input. Invest. Ophthalmol. Vis. Sci. Suppl. 29:10, 1988 (Abstract).

*Ribak, C.E., Farbin, S. and Bakay, R.A.E.: GABAergic neurons in the motor thalamus and thalamic reticular nucleus of monkeys with experimental focal epilepsy. In: Cellular Thalamic Mechanisms, edited by M. Bentivogli and R. Spreafico, Elsevier, New York, pp. 340-348, 1988.

Ribak, C.E., Farbin, S. and Bakay, R.A.E.: GABAergic neurons in the motor thalamus and thalamic reticular nucleus of monkeys with experimental cortical focal epilepsy. Epilepsia 29:675, 1988 (Abstract).

*Ribak, C.E., Joubran, C. and Bakay, R.A.E.: Decrease in GABAergic somata occurs in pre-seizing monkeys with alumina gel granuloma: A causal role of GABA in focal epilepsy. Epilepsy Research (In Press).

Other Faculty Publications (Cont'd)

Ribas, J.L., Baskin, G., King, N.W., McClure, H.M., Lowenstine, L.J. and Axthelm, M.L.: Development of a study set on the pathology of simian retroviral diseases. Vth International Conference on AIDS, June 4-9, 1989, Montreal, Canada (Abstract)(In Press).

*Robinson, K.A., Roubin, G.S., Siegel, R.J., Black, A.J., Apkarian, R.P. and King III, S.B.: Intra-arterial stenting in the atherosclerotic rabbit. Circulation 78:646-653, 1988.

Rodrigues, M.M., McCarey, B.E., Waring G.O.III, Hidayet, A.A. and Kruth H.S.: Crystalline keratopathy following primate intracorneal implants. Invest. Ophthalmol. Vis. Sci. (In Press).

*Romski, M.A. and Sevcik, R.A.: Augmentative and alternative communication systems: Considerations for individuals with severe intellectual disabilities. Augment. Altern. Commun. 4:83-93, 1988.

Romski, M.A. and Sevcik, R.A.: Speech output communication systems: Acquisition/use by youngsters with retardation. Augment. Altern. Commun. 4:167, 1988 (Abstract).

Romski, M.A. and Sevcik, R.A.: Speech output communication systems: Applications for youngsters with retardation. ASHA Abstr. 30:78, 1988 (Abstract).

*Romski, M.A. and Sevcik, R.A.: Augmentative communication system acquisition and use: A model for teaching and assessing progress. NSSLHA J. (In Press).

*Romski, M.A. and Sevcik, R.A.: An analysis of visual-graphic symbol meanings for two nonspeaking adults with severe mental retardation. Augment. Altern. Commun. (In Press).

*Romski, M.A. and Sevcik, R.A.: Patterns of language learning by instruction: Evidence from nonspeaking persons with mental retardation. In: Biobehavioral Foundations of Language Development, edited by N. Krasnegor, D.M. Rumbaugh and R.L. Schiefelbusch (In Press).

*Romski, M.A., Sevcik, M.A. and Pate, J.L.: Establishment of symbolic communication in persons with severe retardation. J. Speech Hear. Disord. 53: 94-107, 1988.

*Romski, M.A., Sevcik, R.A., Reumann, R. and Pate, J.L.: Youngsters with moderate or severe retardation and severe spoken language impairments I: Extant communicative patterns. J. Speech Hear. Disor. (In Press).

*Ruehlmann, T.E.: Proximity relations during rhesus macaque mating consorts. Am. J. Primatol. 14:442, 1988 (Abstract).

Other Faculty Publications (Cont'd)

*Ruehlmann, T.E., Bernstein, I.S., Gordon, T.P. and Balcaen, P.: Wounding patterns in three species of captive macaques. Am. J. Primatol. 14:125-134, 1988.

*Rumbaugh, D.M.: Cage design attenuates display patterns of male chimpanzees. Zoo Biol. 7:177-180, 1988.

*Rumbaugh, D.M.: Implications of current and future research on chimpanzee intellect. In: Understanding Chimpanzees, edited by P. Heltne, Chicago Academy of Sciences, Chicago (In Press).

Rumbaugh, D.M., Richardson, W.K., Washburn, D.A., Savage-Rumbaugh, E.S. and Hopkins, W.D.: Rhesus monkeys (Macaca mulatta), video tasks, and implications for stimulus-response spatial contiguity. J. Comp. Psychol. (In Press).

*Rumbaugh, D.M. and Savage-Rumbaugh, E.S.: Chimpanzees: Competencies for language and numbers. In: Comparative Perception, edited by M. Berkeley and W. Stebbins, John Wiley & Sons, New York (In Press).

*Rumbaugh, D.M., Savage-Rumbaugh, E.S. and Pate, J.L.: Addendum to "Summation in the chimpanzee (Pan troglodytes)". J. Exp. Psychol.: Anim. Behav. Processes 14:118-120, 1988.

*Rumbaugh, D.M., Washburn, D. and Savage-Rumbaugh, E.S.: On the care of captive chimpanzees: Methods of animal enrichment. In: The Psychological Wellbeing of Captive Nonhuman Primates, edited by E.F. Segal, Noyes Publications, Park Ridge, New Jersey (In Press).

Schinazi, R.F., Arnold, B.H. and Chu, C.K.: Activity of 2',3'-dideoxypyrimidine nucleosides against human immunodeficiency virus type 2. In: Proceedings of the IV International Conference on AIDS, Stockholm, Sweden, 1988, p. 225 (Abstract).

Schinazi, R.F., Arnold, B.H. and Chu, C.K.: The potency of various nucleosides against human immunodeficiency virus type 1 and type 2, and simian immunodeficiency virus in vitro. International Symposium: Basic and Clinical Approaches to Virus Chemotherapy, Helsinki, Finland, 1988 (Abstract).

Schinazi, R.F., Ericksson, B.F.H., Chu, C.K., Hill, C.L., Arnold, B.H., Cannon, D.L., McClure, H., Anderson, D. and Fultz, P.: Differences in potency of various nucleosides and heteropoly acids against human, nonhuman primate, and murine retroviruses. In: Symposium on Nonnuman Primate Models for AIDS, Atlanta, Georgia, October 8-10, 1987, p. 36 (Abstract).***

*Schwartz, S.M., Wilson, M.E., Walker, M.L. and Collins, D.C.: Dietary influences on growth and sexual maturation in premenarchial rhesus monkeys. Horm. Behav. 22:231-251, 1988.

Other Faculty Publications (Cont'd)

*Seres, E., Chikazawa, K., Gordon, T.P. and Wilson, M.E.: Seasonal regulation of luteinizing hormone (LH) by estradiol (E2) in adolescent female rhesus monkeys (Macaca mulatta). Int. J. Primatol. 8:517, 1987 (Abstract).**

Sevcik, R.A., Chabon, S. and Romski, M.A.: Residential communicative interaction patterns of nonspeaking adults with severe retardation. ASHA Abstr. 30: 200, 1988 (Abstract).

*St. Andre, E.J.: Paternal kin recognition in a captive group of rhesus monkeys (Macaca mulatta). Master's Thesis, Emory University, Atlanta, Georgia, 182 pp., 1988.

*St. Andre, E., Gouzoules, H., Gouzoules, S. and Stone, W.H.: The influence of gender on paternal kin recognition in captive rhesus monkeys. Am. J. Primatol. 14:407-408, 1988 (Abstract).

Storie, B., McCarey, B.E., van Rij, G., Knight, P.M. and Beuerman, R.W.: Refractive predictability of myopic hydrogel intracorneal lenses in primate eyes. Invest. Ophthalmol. Vis. Sci. (In Press).

*Swartz, S.M.: The biomechanics and structural design of the forelimb of brachiating primates. Ph.D. Dissertation, University of Chicago, Chicago, Illinois, 256 pp., 1988.

Tarara, R., Enders, A.C., Hendrickx, A.G., Gulamhusein, N., Hodges, J.K., Hearn, J.P., Eley, R.M. and Else, J.G.: Early implantation and embryonic development of the baboon: Stages 5, 6 and 7. Anat. Embryol. 176:267-275, 1987.**

*Toledo, A.A., Creighton, A.F., Goldberg, J.M., Apkarian, R.P.: The effects of estradiol on chronically damaged human fallopian tubes: Quantitative analysis using SEM. American Infertility Society Meeting, Atlanta, Georgia, October, p. S-51, 1988 (Abstract).

*Tomasello, M., Frost, T. and Gust, D.A.: A longitudinal investigation of gestural communication in young chimpanzees. Primates (In Press).

*Turner, J.J., Herndon, J.G. and Ruiz de Elvira, M.C.: A 10-month study of endogenous testosterone levels and behavior in outdoor-living female rhesus monkeys (Macaca mulatta). Primates (In Press).

Turner, T.R., Whitten, P.L., Jolly, C.J., and Else, J.G.: Pregnancy outcome in freeranging vervet monkeys (Cercopithecus aethiops). Am. J. Primatol. 12:197-203, 1987.**

Tuttle, R.H. and Cortright, G.W.: Positional behavior, adaptive complexes, and evolution. In: Orang-utan Biology, edited by J.H. Schwartz, Oxford University Press, New York, pp. 311-330, 1988.

Other Faculty Publications (Cont'd)

Van Endenburg, J.-P., Yagello, M., Girard, M., Kieny, M.-P., LeCocq, J.-P., Muchmore, E., Fultz, P.N., Riviere, Y., Montagnier, L. and Gluckman, J.-C.: Cell-mediated immune proliferative responses to HIV-1 of chimpanzees vaccinated with different vaccinia recombinant viruses. AIDS Res. Hum. Retroviruses (In Press).

*Vincent, S.L. and Peters, A.: Morphological changes in neurons and neuroglia in area 17 of aging rhesus monkeys. Anat. Rec. 220:101, 1988 (Abstract).

*Vincent, S. L., Peters, A. and Tigges, J.: The effects of aging on the neurons within area 17 of rhesus monkey cerebral cortex. Anat. Rec. (In Press).

*Weed, J.L.: The effects of matrilineal instability on the socialization of orphaned rhesus monkeys (Macaca mulatta). Am. J. Primatol. 14:450, 1988 (Abstract).

Wood, M.S., McCarey, B.E., van Rij, G., L'Hernault, N.L. and Hooper, H.A.: Intracorneal lenses: Long-term morphology in rhesus monkeys. Invest. Ophthalmol. Vis. Sci. (In Press).

Yano, J., Noda, Y., Ida, K., Mori, T. and Gould, K.G.: In vitro fertilization and embryo transfer in the chimpanzee. Jpn. J. Fertil. Steril. 33:169-173, 1988.

Yarbrough, C.: Primate dental studies; pushing toward a cure for periodontal disease. Emory Dent. 1:16-19, 1988.

*Yehuda-Cohen, T., Powell, J.D., McClure, H.M., Anderson, D., Fultz, P.N., Sell, K.W. and Ansari, A.A.: Antigen processing requirements for the in vitro proliferation to SIV by T-cells from naturally infected mangabeys and SIV infected macaques. FASEB J. (Abstract)(In Press).

** From Abstracts of the XIIth Congress of the International Primatological Society (July 24-29, 1988); published (1988) in Volume 8 of the International Journal of Primatology, dated October, 1987.

*** From the Symposium on Nonhuman Primate Models for AIDS, held in Atlanta, Georgia, October 8-10, 1987 and published in 1988, or 1987 publications that were not listed in the 1987 Annual Center Progress Report.

PART II, SECTION C GRANT NUMBER P 5 1 R R 0 0 1 6 5 - 28

INSTITUTION: Yerkes Regional Primate Research Center

REPORT PERIOD: January 1, 1988 to December 31, 1988

Fill out a separate form for each of the following categories: Check one

☐ CORE RESEARCH & DEVELOPMENT ■ OTHER

							TOTAL
Number Published:	BOOKS	0	PAPERS	7	ABSTRACTS	3	10
Number in Press:	BOOKS	0	PAPERS	8	ABSTRACTS	1	9

Author(s) Title of Article, Journal, Volume, Number, Pages (e.g., 44-48), Year Published

Publications Supported by Receipt of Tissues, Specimens or Other Services from the Yerkes Center**

*Cutler, R.G.: Peroxide-producing potential of tissues: inverse correlation with longevity of mammalian species. Proc. Natl. Acad. Sci. 82:4798-4802, 1985.

Cutler, R.G.: Aging and oxygen radicals. In: Physiology of Oxygen Radicals, Am. Physiol. Soc., pp. 251-285, 1986.

Dulik, D.M., Huwe, J.K., Bakke, J.E., Connors, M.S. and Fenselau, C.: Nucleophilic aromatic substitution of polychlorinated agrochemical sulfoxides and sulfones by glutathione. Xenobiotica (In Press).

Ferrell, R.E., Kamboh, M.I. and Freidrich, C.F.: Paternity diagnosis in chimpanzees: results from the N.I.H. chimpanzee breeding and research program. Am. J. Phys. Anthrop. 75:208, 1988 (Abstract).

Harris-Hooker, S., Sanford, G. and Emmett, N.: The effects of adenosine on the inhibition of DNA synthesis by endothelial cell membranes. FASEB J. 2:2499, 1988 (Abstract).

Jones, C., Morse, H.G., Geyer, D. and Patterson, D.: Chimpanzee chromosome 23 corrects the defect in the CHO mutant (Ade-I) lacking adenylosuccinase activity. Cytogenet. Cell Genet. 46:635, 1987 (Abstract).

Kemppainen, B.W., Riley, R.T. and Pace, J.G.: Skin absorption as a route of exposure for aflatoxin and trichothecenes. J. Toxicol. - Toxin Rev. 7 (In Press).

Koop, B.F., Siemieniak, D., Slightom, J.L., Goodman, M., Dunbar, J., Wright, P.C. and Simons, E.L.: Tarsius - and B-globulin genes: Conversions, evolution, and systematic implications. J. Biological Chem. (In Press).

*Lawlor, D.A., Ward, F.E., Ennis, P.D., Jackson, A.P. and Parham, P.: HLA-A and B polymorphisms predate the divergence of humans and chimpanzees. Nature 335:268-271, 1988.

*Ledbetter, S.A. and Ledbetter, D.H.: A common fragile site at Xq27: theoretical and practical implications. Am. J. Hum. Genet. 42:694-702, 1988.

Indicate by an asterisk (*) that the resource was given credit.

Publications Supported by Receipt of Specimens (Cont'd)

Montgomery, V. and Harris-Hooker, S.: The influence of low density lipoproteins on vascular smooth muscle cells. 30th Annual National Student Research Forum, 1989 (In Press).

*Morbeck, M.E. and Zihlman, A.L.: Body composition and limb proportions. In: Orangutan Biology, edited by J.H. Schwartz, Oxford University Press, England, pp. 285-297, 1988.

Nadol, J.B., Jr.: Synaptic morphology of inner and outer hair cells of the human organ of corti. J. Electron Microscopy Techniques (In Press).

Nadol, J.B., Jr.: Comparative anatomy of the cochlea and auditory nerve in mammals. Hearing Res. 34:253-266, 1988.

*Nadol, J.B., Jr. and Burgess, B.J.: Morphology of synapses at the base of hair cells in the organ of corti of chimpanzee. Ann. Otology, Rhinology and Laryngology (In Press).

Rizzolo, L.J.: A growth hormone-vesicular stomatitis virus G hybrid protein is rapidly degraded in lysosomes following transport to the cell surface. Eur. J. Cell Biol. (In Press).

*Swindler, D.R.: Perinatal dental development in the chimpanzee (Pan troglodytes). Amer. Assoc. Phys. Anthropology (In Press) (Abstract).

*Teumer, J. and Green, H.: Divergent evolution of part of the involucrin gene in the hominoids: unique intragenic duplications in the gorilla and human. Proc. Natl. Acad. Sci. (In Press).

*Zihlman, A.L.: Hand abnormalities in pygmy chimpanzees (Pan paniscus). Folia primatol. 49:127-136, 1987.

** Not previously reported. The variation in dates of publication is related to the length of time taken to acquire notification and/or reprints of publications of this type.

PART III -- SECTION B -- PROGRAM SPECIFIC DATA FOR PRIMATE RESEARCH CENTERS

GRANT NUMBER | P | 5 | 1 | R | R | 0 | 0 | 1 | 6 | 5 | - | 2 | 8 |

REPORT PERIOD: January 1, 1988 TO December 31, 1988

SECTION C SUMMARY STATISTICS

1. PERSONNEL

	NUMBER
a. CORE Personnel	135
Doctoral Level Scientists	25
Other Personnel	110
b. Collaborative or Affiliated Scientists	130
c. Visiting Scientists	7
d. Graduate Students	22

2. REGIONALITY

a. Scientists Provided with Specimens	101
b. Number of Specimens Provided	4,517
c. Scientists Touring the Center	174
d. Other Visitors	803

Curriculum Vitae

Name: Dr. Roger Winton Buddington

Education:

1961 - Graduated from Bunnel High School, Stratford, CT
1965 - B.A., Fairfield University, Fairfield, CT
1967 - M.A., University of Florida, Gainesville, FL
1971 - Ph.D., University of Florida, Gainesville, FL

Brief Chronology of Employment:

1963 - 1965	Research Assistant, Department of Psychology, Fairfield University, Fairfield, Connecticut
1965 - 1967	Research Assistant, Division of Neurosurgery and Center for Neurobiological Sciences, University of Florida, Gainesville, Florida
1967 - 1971	Research Fellow, Department of Psychology and Center for Neurobiological Sciences, University of Florida, Gainesville, Florida
1971 - 1972	Lecturer, National Institute of Health Graduate Program
1971 - 1972	Assistant Professorial Lecturer, George Washington University, Washington, D.C.
1971 - 1973	Postdoctoral Research Fellow, Department of Psychology, Section on Neuropsychology, National Institute of Mental Health, Bethesda, Maryland
1972 - 1973	Assistant Professorial Lecturer, University of Maryland, College Park, Maryland
1973 - 1974	Deputy Director, Research and Professional Education, Epilepsy Foundation of America, Washington, D.C.
1974 - 1975	Director, Research and Training Institute, Epilepsy Foundation of America, Washington, D.C.
1975 - 1988	Vice President, Franchise Development, Mighty Distributing System of America, Norcross, Georgia
1988 - present	Administrative Associate, Yerkes Regional Primate Research Center, Emory University, Atlanta, Georgia

Awards: National Institute of Mental Health Postdoctoral Fellowship. Awarded for study with Dr. H. Enger Rosvold, Chief, Section on Neuropsychology, National Institute of Mental Health

BIBLIOGRAPHY

1. Buddington, R.W., King, F.A. and Roberts, L. Emotionality and conditioned avoidance responding in the squirrel monkey following septal injury. Psychon. Sci., 1967, Vol. 8 (5), 195-196.

2. Buddington, R.W., King, F.A. and Roberts, L. Analysis of changes in indirect delayed response performance in monkeys with prefrontal lesions. J. Comp. Physiol. Psychol., 1969, Vol. 68 (1), 147-154.

3. Buddington, R.W. Intratrial Cue observations and delayed response performance in normal and prefrontal monkeys. Doctoral Dissertation, University of Florida, 1971.

ADDRESS

EDUCATION

B.S.	1967	Entomology, University of California
M.S.	1968	Entomology, University of California
D.V.M.	1973	College of Vet. Med., U.C. Davis
M.P.V.M.	1973	Epidemiology, University of California
Lab An Med	1977	California Primate Center, U.C.D.

CURRENT POSITIONS

Head, Biological Resources, National Museums of Kenya, Nairobi, Kenya.

Supervision research programmes of NMK Divisions of Life Science (Genetics, Mammology, Malacology, Entomology, Herpetology, Ornithology) and Plant Science (Herbarium, Phytochemistry, Propagation).

Research design and proposal submission for programme development and research expansion.

Development of collaborative programmes with national and overseas institutions.

Supervision of graduate students working at NMK, IPR and in the field.

Associate Research Professor, Yerkes Regional Primate Research Center, Emory University, Atlanta, Georgia, USA.

Development of overseas research programme

Research into the epidemiology of African primate retroviruses.

Development of collaborative Emory/NMK projects, including the Tana River Primate Reserve Research Station.

Head, Department of Ecology and Conservation, Institute of Primate Research, National Museums of Kenya

In charge of departmental research in primate field ecology and conservation.

Coordination and sponsorship of all primate field studies undertaken in Kenya.

PREVIOUS EMPLOYMENT

1977-1987	Director Institute of Primate Research National Museums of Kenya Nairobi, Kenya

PREVIOUS EMPLOYMENT (cont.)

1975 - 1977	Resident Clinical Veterinarian California Primate Research Center University of California, Davis
1973 - 1975	Fogarty Fellow Dept. of International Health San Francisco Medical Center, and Institute for Medical Research Kuala Lumpur, Malaysia
1968 - 1973	Research Associate II Department of Entomology University of California, Davis
1965 - 1968	Laboratory Assistant Department of Entomology University of California, Davis
1962 - 1965	Veterinary Assistant Grass Valley Veterinary Hospital Grass Valley, California

CONSULTANT POSITIONS

Ecological Consultant, Gallmann Memorial Foundation, P.O. Box 45593, Nairobi, Kenya (1985-present). Responsible for: feasibility study for the development of a research programme in semi-arid agriculture and wildlife conservation on the 100,000 acre Foundation ranch; coordination of research projects undertaken on the ranch; preparation of development and research funding proposals.

Consultant, World Health Organization (1985-87). Evaluation of current and proposed primate and laboratory animal facilities in China, determination of institutional strengthening requirements and assistance in the development of a research programme in reproductive biology.

Special Consultant, Yerkes Regional Primate Research Center, Emory University, Atlanta, GA (1981-86). Advise on development of research studies and field projects in Africa.

Member, Consultation Group, International Primate Resources Programme, World Health Organization, Geneva (1980-81).

Member, Consultation Group, Primates for Research in Human Reproduction Special Programme for Research in Human Reproduction, World Health Organization, Geneva (1980-82).

SPECIAL COMMITTEES OR APPOINTMENTS

Board of Directors, Kenya National Centre for Research in Reproduction (1979-1985).

Member of Board, World Wildlife Fund-Kenya (1981-82).

Member, Scientific Program and Organization Committee, International Primatological Society IXth Congress (1981-82).

Member, Kenya Live Animal Sub-Committee, International Air Transpo t Association (1981-1984

SPECIAL COMMITTEES OR APPOINTMENTS (cont.)

Member, IUCN/SSC Primate Specialist Group (1982-present).

Member, XVIIth CIOMS Round Table Conference on Biomedical Research Involving Animals (1983).

Chairman, Xth Congress, International Primatological Society (1983-84) and Congress Organizer and Host (1984).

Secretary, IPR International Advisory Board (1984 - present).

Member, Kenya Guidelines Committee for the Establishment of Basic Animal Husbandry Standards (1985-87).

Vice President (Captive Care and Breeding) and Executive Board Member, International Primatological Society (1985-present).

Project Coordinator, Tana River Primate Project, and Secretary, Tana Management Committee (1986-present).

Chairman, IPS Committee on the Standards and Ethics of Animal Care (1986-present).

Special Advisor for Africa, IPS Conservation Committee (1986-present).

Member, Laikipia Rhino Project Scientific Committee (1986-present).

PROFESSIONAL SOCIETIES

American Association for Laboratory Animal Science

American Society of Laboratory Animal Practioners

Association of Primate Veterinary Clinicians

East African Wildlife Society

Fauna & Flora Preservation Society

International Primatological Society

Kenya Museum Society

Kenya Natural History Society

Kenya Veterinary Association

National Society for Medical Research

Society for the Study of Reproduction

PROFESSIONAL AND RESEARCH INTERESTS

Policy and programme development and project management in developing countries.

Research design, implementation and application.

Wildlife conservation and ecology.

Captive animal care, propagation and ethics.

Reproductive biology and physiology.

Tropical disease control, epidemiology and zoonoses.

PUBLICATIONS

SCIENTIFIC PAPERS

Else, J.G. and C.L. Judson. 1972. Initiation of vitellogenesis in gravid Aedes aegypti (L) mosquitoes. J. MED. ENT. 9:527-530.

Washino, R.K. and J.G. Else. 1972. Identification of blood meals of hematophagous arthropods by the hemoglobin crystallization method. AM. J. TROP. MED. HYG. 21:120-122.

Dobbins, J.G. and J.G. Else. 1975. Knowledge, attitudes and practices concerning control of Dengue Haemorrhagic Fever in an urban kampung. S.E. ASIAN J. TROP. MED. PUB. HLTH. 6:120-126.

Else, J.G. and F.C. Colley. 1975. Eimeria cicaki and Isospora thavari n. spp. (Protozoa: Eimeriidae) from the house lizard Gehyra mutilata Boulenger in Malaysia. J. PROTOZOOL. 22:455-457.

Colley, F.C. and J.G. Else. 1975. Eimeria nebulosa n. sp. and Klossia pachyleparon n. sp. from the monitor lizard Varanus nebulosus in Malaysia. ANNALES de PARASIT. 6:669-675.

Else, J.G. and F.C. Colley. 1976. Eimeria tenggilingi n. sp. (Protozoa: Eimeriidea) from the scaley ant eater Manis javanica in Malaysia. J. PROTOZOOL. 23:487-488.

Else, J.G., V. Thomas, S.P. Kan and A.S. Dissanaike. 1976. Further studies on trypanosomiasis in Orang Asli (aborigines) in West Malaysia. TRANS. ROY. SOC. TROP. MED. HYG. 70:179-181.

Else, J.G., W.H. Cheong, S. Mahadevan and L.G. Zarate. 1977. A new species of cave-inhabiting Triatoma (Hemiptera: Reduviidae) from Malaysia. J. MED. ENT. 14(3):367-369.

Karr, S.L. Jr., R.V. Henrickson and J.G. Else. 1979. A survey for Anatrichosoma (Nematoda: Trichinelludea) in wild caught Macaca mulatta. LAB. AN. SCI. 29(6):789-790.

Karr, S.K. Jr., R.V. Henrickson and J.G. Else. 1980. A survey for intestinal helminths in recently wild caught Macaca mulatta and results of treatment with mebendazole and thiabendazole. J. MED. PRIMATOL. 9:200-204.

Johnson, B.K., L.G. Gitau, A. Gichogo, P.M. Tukei, J.G. Else and M.A. Suleman. 1980. Marburg and Ebola virus antibodies in Kenya primates (Letter). LANCET 1:1420-1421.

Else, J.G., M. Satzger and R.F. Sturrock. 1981. Natural infections of Schistosoma mansoni and S. haematobium in Cercopithecus monkeys in Kenya. ANNAL. TROP. MED. PARASIT. 75(1):111-112.

Johnson, B.K., L.G. Gitau, A. Gichogo, P.M. Tukei, J.G. Else, M.A. Suleman and P.D. Sayer. 1982. Marburg, Ebola and Rift Valley Fever antibodies in East African primates. TRANS. ROY. SOC. MED. 76:307-310.

Wall, H.S. and J.G. Else. 1983. Normal hematology values of Sykes monkeys. AM. J. PRIMATOL. 5(1):77-81.

Njuguna, J., H. Wall and J.G. Else. 1983. The baboon and vervet monkey as possible animal models for menstrual blood loss studies. J. OBST. GYN. E. CEN. AFRI. 2:27-29.

Sturrock, R.F., F.M. Otieno, R. Tarara, R. Kimani, R. Harrison and J.G. Else. 1984. Experimental Schistosoma mansoni infection in vervet monkeys (Cercopithecus aethiops) in Kenya: I. Susceptibility to a primary infection. J. HEMINTH. 58:79-92.

Suleman, M.A., P. Sayer, B. Johnson, R. Tarara and J.G. Else. 1984. A poliomyelitis (Wildstrain Type 1) outbreak in black and white colobus monkeys (Colobus abyssinicus). TRANS. ROY. SOC. TROP. MED. 78(5):665-669.

Wall, H.S., C. Worthman and J.G. Else. 1985. Effects of ketamine, anaesthesia, stress and repeated bleeding on the haematology of vervet monkeys. LAB. AN. 19:138-144.

Brennan, E.J., J.G. Else and J. Altmann. 1985. Wildlife management plan for vervet monkeys: Pest primates around a tourist lodge. AFR. J. ECOL. 23(1): 35-44.

Tarara, R., M.A. Suleman, R. Sapolsky and J.G. Else. 1985. Tuberculosis in wild olive baboons in Kenya. J. WILDF. DIS. 21:172-175.

Andelman, S.J., J.G. Else, J.P. Hearn and J.K. Hodges. 1985. The non-invasive monitoring of reproductive events in wild vervet monkeys (Cercopithecus aethiops) using urinary pregnanediol-3-alpha-glucuronide and its correlation with behavioural observations. J. ZOOLOGY. 205(4):467-477.

Else, J.G. 1985. Captive propagation of vervet monkeys (Cercopithecus aethiops) in harems. LAB. AN. SCI. 35(4):373-375.

Else, J.G., R.M. Eley, M.A. Suleman and R.M. Lequin. 1985. Reproductive biology of Sykes and blue monkeys (Cercopithecus mitis). AM. J. PRIMATOL. 9:189-198.

Else, J.G., R. Tarara, M.A. Suleman and R.M. Eley. 1986. Management of the baboon for reproductive research in Kenya. I. Enclosure design and reproductive success. LAB. AN. SCI. 36(2):168-172.

Eley, R.M., J.G. Else, N. Gulamhusein and R.M. Lequin. 1986. Reproduction in the vervet monkey (Cercopithecus aethiops). I. Testicular volume, testosterone and seasonality. AM. J. PRIMATOL. 10:229-235.

Else, J.G. 1986. Primate captive breeding in a source country. pp. 79-85. In: CURRENT PERSPECTIVES IN PRIMATE BIOLOGY. Eds. D.M. Taub and F.A. King. Van Nostrand and Reinhold, Co., New York.

Lee, P.C., E.J. Brennan, J.G. Else and J. Altmann. 1986. Ecology and behaviour of vervet monkeys in a tourist lodge habitat. pp 229-235. In: SELECTED PROCEED. XTH CONGR. INTERNAT. PRIMATOL. PRIMATE ECOLOGY AND CONSERVATION. Eds. J.G. Else and P.C. Lee. Cambridge University Press, U.K.

Hodges, J.K., R. Tarara, J.P. Hearn and J.G. Else. 1986. The detection of ovulation and early pregnancy in the baboon by direct measurement of conjugated steroids in urine. AMER. J. PRIMATOL. 10:329-338.

James, E.R., M. Otieno, R. Harrison, A.R. Dobinson, J. Monirei and J.G. Else. 1986. Partial protection of baboons against Schistosoma mansoni using radiation-attenuated cryopreserved schistosomula. TRANS. ROY. SOC. TROP. MED. HYG. 80(3):378-384.

Githure, J.I., A.M. Shatry, R. Tarara, J.D. Chulay, M.A. Suleman, J.M. Monirei, C.N. Chunge and J.G. Else. 1986. The suitability of East African primates as animal models for visceral leishmaniasis. TRANS. ROY. SOC. TROP. MED. 80(4):575-576.

Macpherson, C.N., J.G. Else and M.A. Suleman. 1986. Experimental infection of the baboon (Papio cynocephalus) with Echinococcus granulosus of camel, cattle, sheep and goat origin from Kenya. J. HELMINTH. 60:213-217.

Dracopoli, N.C., T.R. Turner, J.G. Else, C.J. Jolly, R. Anthony, R.C. Gallo and W.C. Saxinger. 1986. Seroepidemiological analysis of STLV-1 antibodies in feral populations of East African vervet monkeys (Cercopithecus aethiops). INT. J. CANCER. 38:523-529.

Shatry, A.M., C.O. Ajili, P. Mullama, A. Amir, G.D.F. Reid, L.D. Hendricks and J.G. Else. 1986. Infectivity of Leishmania donavani amastigotes and promastigotes in East African vervet monkeys. pp. 253-257. PROCEED. VII AN. MED. CONF., Eds. A. Njogu and M. Mugambi. KEMRI-KETRI, Nairobi.

Else, J.G., R.M. Eley, C. Wangula, C. Worthman and R.M. Lequin. 1986. Reproduction in the vervet monkey (Cercopithecus aethiops). II. Annual menstrual patterns and seasonality. AM. J. PRIMATOL. 11:333-342.

Turner, T.R., P.L. Whitten, C.J. Jolly and J.G. Else. 1987. Pregnancy outcome in free-ranging vervet monkeys (Cercopithecus aethiops). AMER. J. PRIMATOL. 12:197-203.

Tarara, R., A.C. Enders, A.G. Hendrickx, N. Gulamhusein, J.K. Hodges, J.P. Hearn, R.M. Eley and J.G. Else. 1987. Early implantation and embryonic development of the baboon: Stages 5, 6 and 7. ANAT. EMBRYOL. 176:

Sapolsky, R.M. and J.G. Else. 1987. Bovine tuberculosis in a wild baboon population. J. MED. PRIMATOL. 16:229-235.

Ishikawa, K., M. Fukasawa, H. Tsujimoto, J.G. Else, M. Isahakia, N.K. Ubhi, T. Ishda, O. Takenaka, Y. Kawamoto, T. Shoutake, H. Ohsawa, B. Ivanoff, R.W. Cooper, E. Frost, F.C. Grant, Y. Spriatna, K. Abe, K. Yamamoto and M. Hayami. 1987. Serological survey and virus isolation of Simian T-Cell Leukemia/T Lymphotropic Virus Type 1 (STLV-1) in non-human primates in their native countries. INT. J. CANCER. 40:233-239.

Else, J.G. (In press). Conservation efforts at the Tana River Primate Reserve, Kenya. PRIM. CONSER.

Else, J.G. (In press). Research in fertility regulation: The role of Old World primates. In: PROCEED. XII WORLD CONGR. FERTIL. STERIL. Parthenon Publishing, U.K.

Eley, R.M., R.P. Tarara, C.M. Worthman and J.G. Else. (Submitted). Reproduction in the vervet monkey (Cercopithecus aethiops). III. The menstrual cycle. AM. J. PRIMATOL.

Shatry, A.M., J.I. Githure, J. Monirei, R.G. Kimani, M.A. Suleman, L.D. Hendrickx and J.G. Else. (Submitted). Infectivity of subcutaneously administered Leishmania donovani promastigotes in Sykes monkeys (Cercopithecus mitis). AMER. J. TROP. MED. HYG.

VOLUMES, CHAPTERS AND POPULAR ARTICLES

Else, J.G. 1978. An international primate center in Africa. PRIMATE REPORT. 24:45-46.

Else, J.G. 1978. Institute of Primate Research: An international primate centre in Africa. LAB. PRIMATE NEWL. 17(3):6-7.

Else J.G. 1980. Institute of Primate Research Annual Report, 1979-1980. Copyprint Ltd., Nairobi. 74 pp.

Gombe, S., D. Oduor-Okelo and J.G. Else. 1980. The potential of African mammals as new models for research in human reproduction. pp. 345-358. In: ANIMAL MODELS IN HUMAN REPRODUCTION. Eds. M. Serio and L. Martini. Raven Press. New York.

Else, J.G. 1982. IPR ANNUAL REPORT 81. Artblocks (1975) Ltd., Nairobi. 42 pp.

Else, J.G. 1982. The role of a Kenya primate centre in primate conservation. pp. 124-127. In: ADVANCED VIEWS ON PRIMATE BIOLOGY. Springer-Verlag Press.

Wall, H., M. Buteyo and J.G. Else. 1983. IPR REPORT 82-83. Artblocks (1975) Ltd. Nairobi. 42 pp.

Else, J.G. 1983. A national primate centre for Kenya. KENYA PAST PRES. 15:35-39.

Else, J.G. 1983. Can we save the DeBrazza monkey in Kenya? KOMBA. II AND III:27-28.

Brennan, E.J. and J.G. Else. 1984. DeBrazzas - Is there a future in Kenya. SWARA. 7(3):12-14.

Else, J.G. and D. Eley. 1985. Please don't feed the monkeys. SWARA. 8(4):31-32.

Else, J.G. and P. Lee. 1986. PRIMATE EVOLUTION. Vol. I, Selected Proceed. Xth Congr. Internat. Primatol. Soc. 333 pp. Cambridge University Press, U.K.

Else, J.G. and P. Lee. 1986. PRIMATE ECOLOGY AND CONSERVATION. Vol. II, Selected Proceed. Xth Congr. Internat. Primatol. Soc. 393 pp. Cambridge University Press, U.K.

Else, J.G. and P. Lee. 1986. PRIMATE ONTONGENY, COGNITION AND SOCIAL BEHAVIOUR. Vol. III, Selected Proceed. Xth Congr. Internat. Primatol. Soc. 410 pp. Cambridge University Press, U.K.

Else, J.G. 1987. The Gallmann Memorial Foundation: Dedicated to the coexistence of man and nature. SWARA. 10(1):16-19.

ABSTRACTS

Washino, R.K. and J.G. Else. 1972. Identification of mosquito blood meals by the hemolobin crystallization method. PROC. CALIF. MOSC. CONTR. ASSOC. 40:121.

Else, J.G. and P. Dangsupa. 1974. Lankesteria, a gregarine protozoan previously unreported in mosquitoes of Malaysia. S.E. ASIAN J. TROP. MED. PUB. HLTH. 5:54-455.

Colley, F.C., J.G. Else and L.F. Yap. 1974. Observations on exflagellation of microgametocytes of Leucocytozoon sabrazesi. S.E. ASIAN J. TROP. MED. PUB. HLTH. 5:454-455.

Else, J.G. and F.C. Colley. 1974. Eimeria sp. from the house lizard Gehyra mutilata (Gekkonidae) in Peninsular Malaysia. S.E. ASIAN J. TROP. MED. PUB. HLTH. 5:455-456.

Else, J.G. 1980. The progress and goals of the Kenya Institute of Primate Research. ANTROPOL. CONTEMP. 3:193.

Else, J.G. 1982. Vervet captive breeding in Kenya. INTERNAT. J. PRIMATOL. 3(3):278.

Forthman-Quick, D.L. and J.G. Else, 1982. The feasibility of conditioned taste aversion. INTERNAT. J. PRIMATOL. 3(3):324.

Sturrock, R.F., R.A. Harrison, R. Tarara, F.M. Otieno, R.G. Kimani and J.G. Else. 1983. Preliminary observations on experimental Schistosoma mansoni infection in vervet monkeys. In: CUR. PUB.- HLTH. RES. TROP. Proceed. IVth Med. Sci. Conf. Eds. P.M. Tukei and A.R. Njogu. KEMRI-KETRI.

Njuguna, J.M., R.M. Eley, M.A. Suleman and J.G. Else. 1984. Reproductive and captive management of the brown bushbaby (Galago garnettii). INTERNAT. J. PRIMATOL. 5(4):368.

Tarara, R., J.G. Else and R.M. Eley. 1984. The menstrual cycle of the vervet monkey, Cercopithecus aethiops. INTERNAT. J. PRIMATOL. 5(4):384.

Tarara, R., A.C. Enders, A.G. Hendrickx, J.G. Else and J.K. Hodges. 1984. Implantation in the olive baboon: Stages V, VI and VII. INTERNAT. J. PRIMATOL. 5(4):384.

Hodges, J.K., R. Tarara and J. Else. 1984. Excretion of urinary steroid metabolite during early pregnancy in the baboon: Effects of embryo removal. INTERNAT. J. PRIMATOL 5(4):348.

Monirei, J.M., R. Tarara, M.A. Suleman and J.G. Else. 1984. Comparative histopathological findings in vervet monkeys (Cercopithecus aethiops) and baboons (Papio anubis) infected with Schistosoma mansoni. INTERNAT. J. PRIMATOL. 5(4):363.

Macpherson, C.N.L., M.A. Suleman and J.G. Else. 1984. Experimental infection of baboons (Papio sp.) with Echinococcus granulosus of human, cattle, sheep and goat origin. INTERNA. J. PRIMATOL. 5(4):358.

Otieno, M., M.A. Suleman, C.N.L. Macpherson, J. Onyango and J.G. Else. 1984. Experimental establishment of Taenia saginata in the olive baboon (Papio anubis). INTERNAT. J. PRIMATOL. 5(4):371.

Brennan, J., J.G. Else, J. Altmann and P. Lee. 1984. Ecology and behaviour of vervet monkeys in a tourist lodge habitat. INTERNAT. J. PRIMATOL. 5(4):324.

Eley, D. and J. Else. 1984. Primate pest problems in Kenya hotels and lodges. INTERNAT. J. PRIMATOL. 5(4):334.

Brennan, E.J. and J.G. Else. 1984. The status of Kenya's De Brazza monkey population: A need for immediate conservation efforts. INTERNAT. J. PRIMATOL. 5(4):324.

Western, D., E.J. Terborgh, D. Woodruff, S. Strum and J. Else. 1984. Primate conservation in the broader realm. INTERNAT. J. PRIMATOL. 5(4):313.

Eley, R.M., A.S. Hutchinson and J.G. Else. 1984. Reproductive seasonality in captive vervet monkeys, Cercopithecus aethiops. INTERNAT. J. PRIMATOL. 5(4):335.

Kudolo, G.B., M. Thiongo, R.M. Eley and J.G. Else. 1984. Estradiol and progesterone receptor dynamics in East African primates. INTERNAT. J. PRIMATOL. 4(4):354.

Suleman, M.A., J. Monirei, R. Tarara and J.G. Else. 1984. Alimentary tract disease in captive non-human primates in Kenya. INTERNAT. J. PRIMATOL. 5(4):382.

Mott, C.S., T.R. Turner and J.G. Else. 1984. Genetic differentiation in thre populations of Kenyan Cercopithecus mitis. AMER. J. PHYS. ANTHROL. 63:197.

Else, J.G. 1986. Primate conservation in Kenya. PRIM. REP. 14:154.

Else, J.G. 1986. The role of old world primates in human reproduction. 12TH CONGR. FERTIL. STERIL. OBST. GYN. SOC. SINGAPORE. 4:875.

Binhazim, A.A., A.M. Shatry and J.G. Else. 1986. Visceral leishmaniasis in the Sykes (Cercopithecus mitis) and vervet (C. aethiops) monkeys: Haematology and pathology. p. 263. In: IXth INTERNAT. CONGR. INF. PARASIT. DIS.

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