

LABORATORY PRIMATE NEWSLETTER

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POLICY STATEMENT  
(Revised January, 1968)

The primary purpose of the Laboratory Primate Newsletter is to provide information on maintenance, breeding, and procurement of nonhuman primates for laboratory studies. A secondary purpose is to disseminate general information about the world of primate research. Requests for information, for special equipment, or for animal tissues or animals with special characteristics will be included in the Newsletter. As a rule, the only research articles or summaries that will be accepted for the Newsletter are those that have some practical implications or that provide general information likely to be of interest to investigators in a variety of areas of primate research. However, special consideration will be given to articles containing data on primates not conveniently publishable elsewhere. General descriptions of current research projects on primates will also be welcome.

The Newsletter appears quarterly, and the mailing list is open to anyone in the primate field expressing an interest. There is no charge for new issues and back issues for the current year. Back volumes will be furnished free of charge to any library operated by a nonprofit organization with the understanding that they will be kept in the library. Individuals may purchase Volume 1, 2, 3, and 4 for \$4.00 per volume, and Volumes 5 and 6 for \$2.00 per volume. (Please make checks payable to Brown University.)

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

Preparation of articles for the Newsletter.--Articles and notes should be submitted in duplicate and all copy should be double spaced. Articles in the reference section should be referred to in the text by author(s) and date of publication, as for example: Smith (1960) or (Smith & Jones, 1962). Names of journals should be spelled out completely in the reference section. Technical names of monkeys should be indicated at least once in each note and article. In general, to avoid inconsistencies within the Newsletter (see Editor's Notes, July, 1966, issue), the scientific names used will be those of Fiedler [In H. Hofer, A. H. Schultz, & D. Starck (Eds.), *Primatologia*. Vol. 1. Basel, Switzerland: Karger, 1956. Pp. 1-266].

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THE LABORATORY FOR EXPERIMENTAL MEDICINE AND SURGERY IN PRIMATES:  
PHILOSOPHY AND PURPOSE

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In 1966, the Committee of Scientists for the use of Primates in Medical Research was established in New York (Lab. prim. Newsltr, 1966, 5 [3], 18). At the first meeting, the Committee reached a number of conclusions. The Committee felt that primates are too different from other laboratory animals to be kept as a small part of a standard animal colony in a medical research institution. They are too expensive and their care is too exacting and time-consuming to justify maintenance of small colonies by single investigators. The larger the number of animals, the more efficient and less expensive is their maintenance per animal, and the easier it is to provide specialized medical supervision of routine health care for the colony. They agreed, as well, that plans must be developed for assuring supplies of primates and that knowledge of primate anatomy, physiology, pathology, etc. is still fragmentary and urgently requires intensive study. A Steering Committee was formed to work toward the creation of a primate laboratory which would correspond with the existing needs. It was hoped that this laboratory would be widely supported by the medical and lay community as a supplementary resource to other medical facilities. The Steering Committee visited numerous primate facilities in this country and abroad, and consulted with many scientists. A concept of a unique kind of primate facility emerged from this Committee's work which is now being implemented in the form of the present interinstitutional Laboratory for Experimental Medicine and Surgery in Primates (LEMSIP) of New York University Medical Center. The nucleus of the new laboratory is the already existing small primate laboratory of the Facility for Forensic Serology of the same Medical Center.

The approach of LEMSIP consists of helping other workers to establish their own research programs in its facilities, in their own

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institutions, or in both. In such a way, the professional know-how of the LEMSIP staff, the animals, and the available facilities are being used to support research of many workers, who in turn act as consultants, providing their own professional abilities to solve problems of research and animal care which are outside of our own area of competence. The collaboration is not limited to the help of scientists from various institutions in problems arising in our own laboratory; we are also able to arrange, through exchange of information on capabilities and needs, for collaboration between workers from different institutions whose specialties complement one another's areas of research. For instance, help of an obstetrical team from New York has made possible investigation of viral transfer from mother to fetus carried out by a New England team in our primate laboratory.

Each of the consultants is motivated by his interest in the primate laboratory which supports his own research programs, and by the benefits which he, in turn, derives from the consultations provided by others. Thus, the primate laboratory gains time, effort, and talents of people who might not otherwise be available for consultations.

Many research projects require only periodic supply of a large number of fresh normal samples, as for example studies of blood groups, serum specificities, biochemistry of hemoglobins, viral flora, etc. In order to justify better the maintenance of a relatively large number of animals for any one of such purposes, additional investigations are carried out on the same animals, according to research plans which do not interfere with the normal condition of the simultaneously investigated parameters. Moreover, a larger number of animals can accommodate more research projects per animal, by allowing for rest or incubation period on one kind of experiment while using the same animals in different kinds of studies. Furthermore, larger professional and technical staff, justified by more research studies, helps to solve the problem of a full twenty-four hour, seven-day week of maintenance and observation.

#### Location of the Laboratory

The Committee of Scientists for the Use of Primates in Medical Research recommended that the site of the Laboratory should be within 90-minutes driving time from mid-town Manhattan. The problem of the distance was emphasized because experience has shown that excessive distance and traveling time, or unattractive road conditions, discourage utilization of out-of-town primate facilities. The actual site was provided by the New York University Medical Center in the N. Y. U. University Valley, Sterling Forest, New York, which is a 45- to 60-minute drive from most of the major medical institutions in New York.

The size of the Laboratory to serve the New York area was estimated on the basis of a projected need for 5,000 primates. It was estimated that the floor space of such a laboratory needed to house 5,000 animals would be of about six acres. The land requirements for the Laboratory

had to satisfy the following conditions: 1. Different species of primate animals should be kept in separate quarters. 2. The quarantine building must be set well apart from other buildings. 3. Parking facilities, roadways, intervening space for sanitary drainage, etc., create the need for additional acreage. 4. Vocalization of some primate species is particularly unpleasant, and makes a buffer zone necessary if located in a residential area.

#### The Purpose of LEMSIP

The purpose of LEMSIP is to provide research and educational facilities for biomedical investigators interested in the use of primates. Strong emphasis is placed on the support of medical research, although investigators from other specialties are also assisted wherever possible. All bonifide biomedical institutions qualify for participation in LEMSIP. The Laboratory also has its own scientific staff and ongoing biomedical research programs. It is not primarily an animal farm or a procurement business, although it provides long-term care, procurement, and processing facilities. The principle objectives of the Laboratory are: 1. To provide professional know-how, space, facilities, animals, and technical staff for the use of investigators, under the general supervision of the Director closely advised by the Utilization Committee which is composed of representatives from the participating institutions.<sup>2</sup> 2. To obtain, examine, condition, certify, and deliver healthy primate animals for use within the laboratories of the collaborating institutions. 3. To obtain, provide, and deliver appropriate materials, biologicals, sera, organs, etc. to the investigators. 4. To provide know-how, professional supervision, technical staff, and portable equipment for research carried on intramurally in collaborating institutions, whenever such help is approved by the Utilization Committee.

The principal objectives emphasize the importance of research among the functions of the Laboratory. Moreover, while we believe that our physical plant offers optimal possibilities for primate research, we leave it to the scientist to decide whether he prefers to utilize our facilities or to pursue his primate work and receive our assistance in his own institution.

The secondary objectives of the Laboratory are to maintain its own ongoing research program in medical primatology, and to serve as a center for the dissemination of information in that area.

A tertiary objective of the Laboratory is to provide training opportunities to professional and technical persons desiring to work with nonhuman primates.

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<sup>2</sup>The first author is the present Director of LEMSIP, and the second author is the Chairman of the Utilization Committee.

Although still relatively small, the success of LEMSIP may be measured by the publication so far of 76 scientific papers in various areas of medical research. Currently, there are more than 40 projects of outside investigators being supported by the facilities of LEMSIP.

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#### LABORATORY-REARED INFANTS FOR SALE

We have in our laboratories at the present time seven (7) infant rhesus monkeys which are extra to our needs. These primates were bred here and carry a fairly full medical and ecological background. There are four (4) females and three (3) males. They have not been used for any experimentation and range in weight from 2-1/2 to 6 lbs. We are willing to sell these youngsters for a reasonable price by negotiation, bearing in mind that they would be more expensive than the cost of a primate from a commercial dealer.--Roger Thacker, Administrative Assistant for Vivariums, The Ohio State University Hospitals, 410 West 10th Avenue, Columbus, Ohio 43210. Area Code 614, 293-8541.

## LABORATORY FOR EXPERIMENTAL MEDICINE AND SURGERY: DESIGN AND OPERATION\*

Joseph H. Davis, Bruce R. McPherson, and J. Moor-Jankowski

Laboratory for Experimental Medicine and Surgery in Primates

New York University Medical Center, N. Y.

The maintenance and handling of chimpanzees, gibbons, baboons, and macaques at the Laboratory for Experimental Medicine and Surgery in Primates (LEMSIP), of the New York University Medical Center, is oriented primarily toward immunological research. The Laboratory is, however, developing other capabilities in the broad fields of experimental medicine and surgery (see preceding article, this issue). This article describes the Laboratory and the procedures followed in the maintenance and handling of the animals.

### Basic Requirements for Housing of Primates for Medical Research

Four years ago, when planning the laboratory which is serving as the foundation for LEMSIP, we drew up a list of requirements for using nonhuman primates in medical research. Thus, the laboratory is based on our own experience and knowledge of these animals, rather than on any previous design. The list is as follows: (1) Easy accessibility of the animal for handling. (2) Greatest possible visibility of the animal in the cage for purposes of observation. (3) Animal rooms which are large enough to be self-contained to prevent the spread of possible infections between animal rooms. (4) Maintenance methods which would limit spread of possible infections among animals within the self-contained animal rooms. (5) Flexibility of housing methods to conform with the variable behavior and living habits of various primate species, while not being influenced by anthropomorphic considerations. (6) Flexibility of housing space which would be amenable to low-cost transformations whenever required by experimental protocols. (7) Highest possible efficiency and automation to eliminate routine and repetitious unskilled and semi-skilled tasks in order to keep labor costs down, and to attract superior research-oriented personnel. (8) Overall economy in housing, equipment, and operation, based on careful analysis of all costs. Emphasis placed on achieving maximum research results per dollar of expenditure.

### Housing and Caging

Presently, primates at LEMSIP are housed in what we call "labmobiles" (Beechcraft Mobile Homes, Inc., Atlanta, Georgia). These are prefabricated modular units, mounted on steel frames and transportable on wheels. Caging systems hang on the walls of the labmobiles and, in some cases, on the

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ceiling as well.

Chimpanzees up to 6 years old are currently housed in galvanized wire mesh cages (Harford Metal Products, Aberdeen, Maryland), measuring 3 ft. deep, 4 ft. wide, and 6 ft. high. This large cage is also used as a baboon breeding cage. Each cage has a guillotine door in front and sliding doors on both sides. The floors and ceilings of the cage are constructed of heavy galvanized bars. Each cage has provision for two removable floors so that one can remove a dirty floor after inserting a clean one. The water and feeding devices are mounted on the outside of the cage for easy removal and to avoid damage by the animal. To obtain water, the primate must suck on a metal tube as if through a straw, and to obtain food it must pass its hand through the cage opening into the food hopper. This particular cage can adequately house chimpanzees up to 40 kg and baboons of any size. When used as a baboon breeding cage, the female is brought to the male by attaching the female's cage (i.e. our standard baboon cage) onto the frame encasing the side sliding door of the breeding cage. In most cases, transferring the female either to or from this unit requires only a single technician. When used for housing of chimpanzees, the cages are set up in banks of four, with one cage in four kept unoccupied for transfer of animals through side doors. Once out of quarantine, chimpanzees are allowed to have bodily contact through the wire mesh provided they are healthy.

Baboons are housed in galvanized wire cages which are 20 by 36 by 48 in. and hang on the walls of the labmobiles. These cages have a squeeze back restrainer, a guillotine door, and a water and feed device similar to, but smaller than that on the standard chimpanzee cage.

Adult macaques are housed either in the standard baboon cages or, in the case of smaller macaques, in identical but smaller (20 by 36 by 36 in.) hanging wire cages. Gibbons are presently housed in the standard baboon cages, which we do not consider adequate. In the near future gibbons will be housed in cages similar in size to those of chimpanzees. We are trying to standardize our caging systems as much as possible and, whenever possible, to use the same type of cage for different species.

Because of the recent relocation of the laboratory and its modular growth, it has not yet been possible to separate all the different primate species. However, this important requirement will soon be satisfied.

At present, all caging systems are housed in our standard 10-by-50-by-7-1/2 ft. labmobile caging units. A maximum of twenty-two hanging wire baboon-type cages, or a maximum of eight chimpanzee cages, can be effectively suspended on each of the two walls of a labmobile.

Each labmobile caging unit contains two heating/air-conditioning systems (Westinghouse) which are mounted on the roof. These systems consist of electrically operated heat pumps providing either heated or refrigerated air. Each heat pump is equipped to condition 300 cubic

feet of fresh air per minute at 10°F to 95°F. We have found through three years of experience that these systems, when backed up with double density, fiberglas insulation in all walls, ceilings, and floors, can maintain conditions, plus or minus 2°, at ranges of 0°F to 104°F ambient temperature. Conditioned fresh air can be exchanged up to 10 times an hour in the animal housing units, but we usually maintain 6 to 8 exchanges. However, in specially designed areas, the rate can be made as high as 17 changes per hour.

All animal wastes fall through the floors of cages onto 2-mil-thick polyethylene sheeting, lying directly on the labmobile floor. The edges of the plastic are folded to prevent liquids from spreading onto the floor. This method, of course, does not prevent a small amount of splashing onto the non-covered floor area, which occurs anyway because primates often urinate in a standing position.

Once daily, after feeding, watering and protocol taking, this sheeting is folded up and wrapped, placed in a closed container and removed from the labmobile caging unit. The entire floor area and wall below the cages are mopped with bactericidal and fungicidal disinfectant solution immediately after the plastic sheeting is removed. New plastic sheeting is then rolled out in 20' sections beneath the caging. All wastes are disposed of daily in a smokeless incinerator (Silent Glow, Hartford, Conn.) equipped with an efficient afterburner.

We refer to the above procedure as a "dry system". It allows us to eliminate drains, and the many problems associated with drains in primate quarters. It also eliminates aerosol formation and direct splashing from "hosing down" operations. It allows for better humidity control and minimizes cleaning problems associated with most of the more common "wet systems". It is important to note that the interiors of the labmobiles are protected by waterproof epoxy paint, which we have found to be reasonably satisfactory. However, proper preventive maintenance and careful handling of equipment is required to preserve the protective coating on the floors.

Adequate lighting in the labmobile caging units is provided by twin 8' fluorescent tubes located in the center of the ceiling extending the entire length of the labmobile.

Each labmobile caging unit has double doors at both ends. It is planned that the double doors on the outer end will lead into a 6-ft.-wide corridor preceded by an anteroom. The double doors on the central corridor end of each unit enter into a 3-by-11-by-7-ft. anteroom which is a part of the central connector (see Figure 1). Food and supplies are stored on one side of this anteroom and water outlets and cleaning equipment are located on the other side. All anterooms will be equipped with exhaust fans to provide a negative air pressure barrier between the individual caging units and the common corridors serving all the primate caging units. Two independent exhaust systems are planned for each ante-

room to insure maintenance of the negative pressure barrier in case of mechanical failure of one of them.

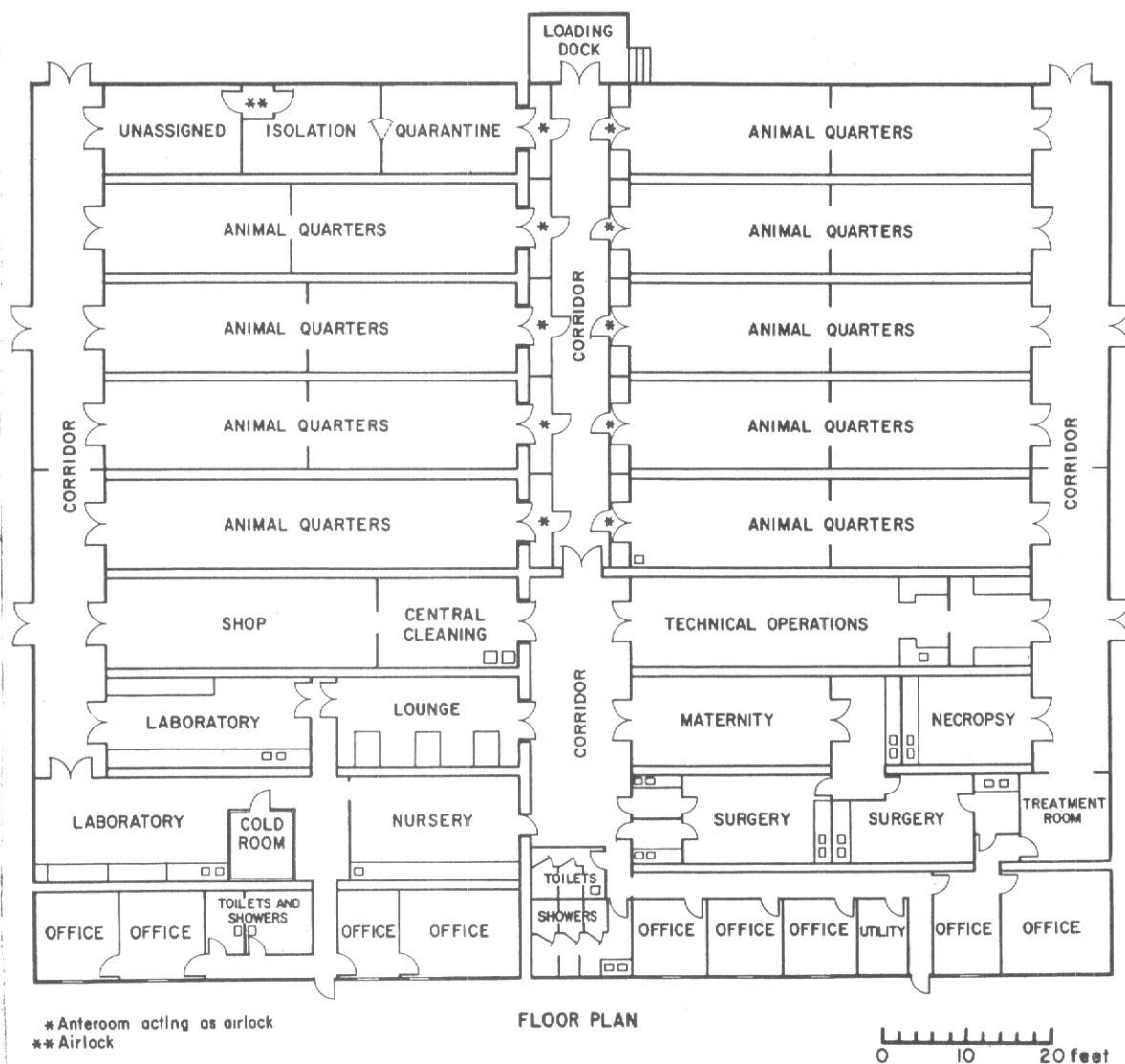


Fig. 1. Floor Plan of the First Labmobile Compound in LEMSIP

The present laboratory complex will ultimately form a standard compound of labmobiles. Ten labmobiles, a central connecting labmobile, and two outside corridor labmobiles will provide caging space, storage, and passageway for 350 to 400 primate animals. This section of the compound is separated from all other areas both physically by a door, and operationally by laboratory regulations. The other section of the compound, consisting of nine labmobiles, will provide space for offices, laboratories, a surgery,

a nursery, a maternity unit, an animal technical work area, a lounge, a shop, a cleaning room, toilets, and shower facilities (Figure 1). Each area is equipped with independent air handling and conditioning systems.

At present, the surgery, nursery, and maternity labmobiles are not yet in place; however the flexibility of the basic design serves to provide smaller, temporary areas in existing units for all the current needs of obstetrics and surgery.

The future growth of LEMSIP is planned along the lines of multiple separate compounds of 20 labmobiles housing 350 to 400 animals per compound. Separate smaller compounds are planned for quarantine.

#### Quarantine

The present quarantine unit is divided in three rooms, plus a negative air pressure barrier located in the anteroom adjoining the central common corridor, and a planned anteroom barrier to be located in the outside corridor. Each room is maintained by its own complete air handling and filtering system. The center room, preceded by its own anteroom, is equipped to handle isolation cases by being entirely surrounded by a 4-in. air space (a room suspended within a room) maintained under a constant exhaust.

A technician trained in isolation and quarantine techniques is assigned to the quarantine unit, whenever it is occupied. The quarantine technician wears completely disposable protective coverings, i.e., boots, trousers, coat, mask, and cap.

Before an incoming animal is accepted into the quarantine, it has to meet the following requirements: (1) It has to have been tuberculin tested, and negative for a 72-hr. period just prior to arrival. (2) It must not exhibit respiratory, gastro-intestinal, or other obvious troubles. (3) It must not be a known carrier of disease. (4) It must have been acclimated for no less than two weeks, and be guaranteed to live for at least seven days after arrival at the laboratory. Carefully screened exceptions to the above rules are allowed for rare or otherwise valuable animals.

After arrival at the quarantine area, the animals are immediately tuberculin tested, given a general physical examination, and hematological, parasitological, bacteriological, and urinary examinations. The animals are maintained on electrolyte solution for the first 10 days after their arrival. The electrolyte solution is prepared by adding 10 ml of our standard electrolyte concentrate and 50 g of sucrose to 1 liter of water. The sucrose is added to make the solution more palatable and attractive for the animal. The standard electrolyte concentrate is prepared in bulk and is stored under refrigeration. It consists of: sodium lactate (60% syrup), 280.2 mg per ml; potassium chloride, 134.2



mg per ml; potassium (tri basic) phosphate, 22.2 mg per ml; and lactic acid 85%, 9 mg per ml. The final solution is prepared by diluting 10 ml of concentrate with 1 liter of water. The total electrolytes (mEq/liter) are:  $\text{Na}^+$  - 25,  $\text{K}^+$  - 21,  $\text{Cl}^-$  - 18,  $\text{PO}_4^-$  - 30, and Lactate<sup>-</sup> - 26.

Once an animal has been judged to be clean and adjusted to its new environment, it is moved to the general caging areas. Before any animal can pass into our general colony area it must have been in quarantine for no less than 45 days and have been judged to be free of disease and parasites for a minimum of 10 days. In the event that an infectious disease is discovered in a particular group of new animals during this period, the routine quarantine for the entire group starts again from the day of detection.

#### Routine Animal Husbandry

Daily protocols are kept on each animal's bowel movements, urine output, food and water intake, prophylaxis acceptance (i.e., intake of isoniazid, vitamin supplements, etc.), menstrual cycle, and general appearance. This protocol is recorded prior to the removal of the plastic sheeting containing animal wastes, but after morning feeding, watering, and distribution of prophylaxis supplements. Thus, our waste collection system provides information on the entire waste of each animal accumulated directly beneath its cage for a 24-hr. period. It is therefore essential that the floor in each labmobile caging unit be level.

Distribution of commercial monkey chow is carried out daily at 8:15 a.m. and 4:15 p.m. Distribution of isoniazid, our tuberculosis prophylaxis therapy, 10 to 15 mg per kg, when indicated, is carried out in two doses at 8:00 a.m. and 4:00 p.m., by distributing it on sugar cubes in 10 mg aliquots prior to the distribution of monkey chow. Commercially available fruit-flavored, chewable, multiple vitamin tablets are distributed after the cleaning operation at about 10:00 a.m. each day. Fruits or vegetables are distributed daily at noon time, mainly to establish a rapport between the animal and the technician responsible for its care.

Four times a year, each animal is routinely tested for tuberculosis and given hematological, parasitological, bacteriological, and urinary examinations. The tuberculin testing is performed by intradermal injection into an eyelid of 0.1 cc of intermediate-strength PPD (Parke, Davis). If any reaction is observed, the following test is performed after two weeks: A swath is shaved across the abdomen of the animal and the intradermal inoculation is performed in three separate sites. The first site receives 0.1 cc of first-strength PPD, the second site receives 0.1 cc of intermediate strength, and the third site receives 0.1 cc of second-strength. If this test proves to be positive, the animal is destroyed and incinerated. Routine physical examinations are presently carried out twice yearly. Of course, tuberculin testing is not performed

on animals immunized with the use of complete Freund's adjuvant.

New animal technicians are trained on the job, including training in medical institutions collaborating with LEMSIP. Every staff member is assigned specific tasks within a functional laboratory group which has its own color code designation. This color code restricts staff members to particular areas. They are not permitted without necessary clearances into areas for which they are not coded. Individuals performing tasks in any animal quarter are required to wear protective outer clothing, including rubber foot covers which are routinely disinfected, suits which are changed daily, disposable head wear and disposable gloves which are replaced after each routine.

All waste disposal, husbandry equipment cleaning, and animal husbandry supply distribution are carried out by supportive services staff. Dirty cages, feed-water devices, mops, mop buckets, and closed waste cans are removed at predetermined intervals and replaced by clean equipment. Animal technicians place the dirty equipment in the corridor, just outside the anteroom, from where it is removed by the supportive services personnel who replace it with clean equipment. The supportive services personnel have no access to the animal rooms. Steam cleaning of cages, etc. takes place outdoors where all reserve cages are allowed to stand for at least 72 hours. With this discipline, at the present time, we change each animal's cage once per month and each feed-water device once per week.

On a standard daily schedule, animal supplies are checked and/or replenished in the anterooms in the central animal services corridor.

#### Restraining Methods

The handling of larger and/or non-cooperative animals is carried out either through physical restraint utilizing the squeeze-back mechanism incorporated in all but the large chimpanzee cages, or with the aid of an intra-muscular tranquilizer injection. In most cases we use a phencyclidine hydrochloride compound (Sernylan, Parke, Davis) at a dose from 0.4 mg to 1.0 mg/kg body weight, depending on the desired effect ranging from moderate to complete anesthesia-like tranquilization.

Large male baboons and non-cooperative chimpanzees exceeding 20 kg and housed in large chimpanzee cages without the squeeze-back mechanism require the use of a modified short-range tranquilizer pistol (Palmer Chemical Company, Douglasville, Georgia) with an appropriate load of phencyclidine.

No animal is tranquilized or anesthetized unless it has had no food during the preceding 12 hours and unless it has drunk an appropriate amount of electrolyte solution during the period of 6 to 12 hours preceding anesthesia.

If the size and conditioning of the animal allows direct physical handling and restraint by personnel without the use of drugs, then it must be handled with the use of double-thickness leather mittens. The personnel are taught that all bites and scratches must be avoided and be regarded as potentially extremely dangerous. Under no circumstances is any direct animal-to-man contact allowed without a protective barrier.

Utilizing the above methods we have maintained primates for one year in the southern United States and for two and one-half years in New York State. There has been no loss of animals to disease, and all animals have been in excellent health as demonstrated by their appearance and laboratory tests.

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#### MEETING REPORTS:

##### CONFERENCE ON EXPERIMENTAL MEDICINE AND SURGERY IN PRIMATES

This conference, sponsored by the New York Academy of Sciences, was held September 27-30, 1967. The conference was co-chaired by E. I. Goldsmith and J. Moor-Jankowski. There were about 500 registered participants.

The conference was divided into eight sessions: (1) Taxonomy and comparative biology; (2) Experimental cardiovascular studies; (3) Genetic markers, phylogenesis and evolution in primates; (4) Contribution of nonhuman primates to the study of perinatal problems, gynecology and obstetrics; (5) Supply, maintenance and handling of nonhuman primates for medical research; (6) Experimental surgery; (7) Virology, infectious diseases and parasitology; (8) Toxicology. In addition, members of the staff of the Aeromedical Research Laboratory, Holloman Air Force Base, New Mexico, demonstrated with live monkeys and a chimpanzee their techniques for chairing the animals and their methods of evaluating the animals' performance under conditions of space flight.

An opinion survey was conducted at the conference which indicated that another such conference would be desirable, preferably in two years. A second conference is now planned for the third week of September, 1969. For further information write to either E. I. Goldsmith, New York Hospital, Cornell Medical Center, 525 East 68th Street, New York, N. Y. 10021 or J. Moor-Jankowski, Laboratory for Experimental Medicine & Surgery in Primates, New York University Medical Center, 550 First Avenue, New York, N. Y. 10016.

## MAN MAKES HIMSELF?

N. A. Drekopf\*

New York City

Most anthropologists will agree that one of the more exciting developments in our discipline in recent years has been the discovery of the science of primatology. We concede that work on animal behavior has been done in the past by zoologists, comparative psychologists, ethnologists, and an extinct breed of scholar known as the "naturalist" (e.g., Darwin, Wallace, Agassiz, etc.), but their efforts have been insignificant when compared to the edge-cutting research now being done by anthropologists. Only members of our discipline have had the courage and imagination to extrapolate from the behavior of baboons, macaques, gorillas, and chimpanzees to a line of inquiry that has shed light upon the social evolution of early man. They have thus developed a methodology which allows us to determine the parameters of primitive human existence through analysis of the possibilities and limitations inherent in the organic equipment and behavioral inventory of our precursors. It is this Inferential Method which I intend to faithfully apply in the present paper.

It has been convincingly argued that hands are the father of man. Now, all primates have considerable manual dexterity, but it is agreed that the evolution of the full potential of the forelimbs is dependent upon the abandonment of quadrupedal motion and the lifting of the hands from the ground. Quite clearly, this is not a characteristic of the terrestrial monkeys and apes, all of which (or whom, depending upon one's opinion as to their capacity for culture) use their forelimbs in locomotion, and most scholars see arboreal existence as a precondition of the evolution of man. Attention has properly been turned to the arboreal primates in our search for insight into human evolution, but the observation of these creatures in the wild is made difficult by the fact that the human observer cannot follow them and usually cannot even see them.

The research upon which this paper is based suffered from this limitation, and, regretfully, it was necessary to observe arboreal monkeys in captivity. Except for brief trips to the Bronx Zoo, for comparative purposes, all the data were collected at Kornbluth's Katskill Kongo, a game farm in Grossinger, New York. The primate population at this research station included three spider monkeys, one capuchin, and two squirrel monkeys. (Mr. Kornbluth also had in his collection an aged hyena, a descended skunk, and two stuffed owls.) The monkeys lived largely on knishes thrown to them by tourists; since this is probably not characteristic in their natural habitat, I will not dwell heavily

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\*Mr. Drekopf is the alter ego of Dr. Robert F. Murphy, Department of Anthropology, Columbia University, who it should be noted, has confined his primate researches to occasional trips to the zoo with his children.

on feeding. The focus of this paper, however, is upon the use of the hands, and it is worthwhile to note at this juncture that I observed one squirrel monkey catch with his right hand a piece of halvah thrown from a distance of fifty feet. All the animals observed exhibited considerable manual dexterity, an ability made possible by the fact that they were usually in a sitting posture. Thus, though they do not have true bipedal gait, they very rarely used their forelimbs in locomotion. In fact, they moved around very little at all due to a limitation in space that was made necessary by the recent expansion of Kornbluth's Kottage Kolony, where I resided while in the field.

The monkeys observed by me at KKK only employed their hands in eating during 5% of the time. This again is an artificial limitation which must be corrected if we are to properly interpret the wild state. That the animals spent so little time in feeding was largely a function of meteorological conditions. Rainy and cool weather during the summer in which the field work was conducted drastically lowered the number of tourists, and therefore the knishes, and the A.S.P.C.A. ultimately closed Kornbluth's Katskill Kongo after half the animals had died. Mr. Kornbluth has since declared bankruptcy, a great loss to primatological research.

Even with the above slight deviation from natural conditions, a startling fact was noted. Approximately 40% of the manual movements of the monkeys were oriented to scratching and delousing (perhaps a higher figure than in the natural state due to the conditions of the cage), but, and this should be carefully noted, 55% of hand use was in masturbation. It has long been known that this practice is common among monkeys, but I believe that this is the first time in which hard figures have been compiled. Frequency of masturbation varied from one squirrel monkey that masturbated on the average of 130 times daily to a spider monkey that communed with himself 723 times during a 24-hour period.<sup>1</sup> It was noted that towards the end of each day fatigue impelled the latter animal to use his prehensile tail for the purpose. This behavior, which I term caudurbation, has not previously been reported in the literature. These inordinately high rates of self-congress do not necessarily imply that most of the monkey day was taken up in such activity, for each episode lasted only three and one-half seconds.

It is possible now to consider the implications of these finds for evolution using the Inferential Method outlined in the introduction of this paper. (A tabular presentation of the full data will appear in a book to be published shortly by Pincus-Hall, Inc.) Man, it is agreed, developed culture through the use of his hands in the making of tools. There is also little doubt that the monkey hand, as we know it, is just about as evolved as was man's at the time when he made his breakthrough to humanity. The difference between the proto-human and the

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<sup>1</sup>The only female in the troop was the capuchin monkey. This, however, seems to have little bearing upon the data or the conclusions given below.

monkey lay exactly in the differential uses of the forelimbs by each primate. Our thesis that there is not all that much difference between the monkeys and man leads to a query of the usual assumption that the ancestry of monkeys and of man became differentiated early in the Tertiary Era. I would suggest instead that the two lines parted company in the Pliocene. The inferential basis for this statement is contained in the data presented above. I submit that man and the monkey had reached approximately the same stage of evolution during the Pliocene period (there is very strong support among certain eminent physical anthropologists for such parallelism), but man made tools with his newly evolved manual equipment whereas the monkey masturbated. The result was that this almost human creature rapidly degenerated, becoming the fuzzy and unintelligent animal that we now see in the zoo. While I will grant that occasional, even daily, masturbation has not produced marked deterioration among Homo sapiens, one can only wonder at the evolutionary consequences if men were to do so hundreds of times a day as reported in this paper for monkeys. Given these considerations it would perhaps be more profitable to look upon the monkey not as a prehuman, but as insane. It thus becomes necessary to reclassify the monkey as being a member of the genus Homo. Sapiient he is not, however, so I will suggest the term Homo onanismus drekopfii, a name that at once combines his close relationship to man with his principal activity and at the same time incorporates the name of the writer.<sup>2</sup>

It may now be asked why man took the direction of tool making and Homo onanismus directed his interests inwards. The answer is really very simple: female monkeys remained victims of the estrus cycle while the human woman gained control over her generative abilities. During most of the year, the male Homo onanismus had no forms of gratification other than those provided from his own resources, a routine which was only occasionally broken by a female coming into heat.<sup>3</sup> Infrequent

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<sup>2</sup>This will strike some readers as immodest, but I should stress that the theory outlined in this paper has never been presented before, and the wording of my reclassification indicates only that I bear sole responsibility for it. I wish to restate my obligation to others, however, for the basic methodology that has produced these conclusions. Pioneering though my theory may be, I am optimistic that even more startling results will follow the further application of this method.

<sup>3</sup>The inference could be challenged by citing the availability of homosexual outlets to the monkeys in my sample population. Patterned and regular homosexuality is, however, confined to Homo sapiens, and there would seem to be excellent ecological reasons for this. These derive from population considerations, but not from the point of view of the birth rate, as would be the inclination of most ecologists. Rather, we should consider the rate of morbidity and the accompanying fact that most forms of homosexuality are highly unsanitary. Primatologists have observed that of all the nonhuman primates only the gorilla fouls himself, but not even a gorilla would foul himself by another gorilla.

though these occasions may have been, biological compulsion required the female to present herself in a subordinate manner, and penetrability of the identity was maximized. Lacking choice alternatives, she never advanced to the position of a social person, unlike her human counterpart. The ultimate key to understanding humanity, then, is not that the Homo sapiens females are in heat all the time: they are not. Rather, they are able to choose exactly when to go into heat and are thereby able to control the males. The female stages this with sufficient frequency that man chooses to use his hands for externally oriented work, usually instigated by women. The female is therefore ultimately responsible for the evolution of culture. In conclusion, we may correct V. Gordon Childe's famous title. Man did not make himself--women made men--only monkeys make themselves.

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#### REQUEST FOR PRIMATE MATERIAL: SLOW LORIS MUSCLE TISSUE

I am interested in obtaining samples of muscle from the slow loris (Nycticebus coucang). Information regarding age of the animal, if known, and the site of the sample should be included. The samples should be properly fixed prior to shipments and clearly labeled. I would be happy to correspond with anyone who could provide this material. --Richard S. Pope, Laboratory of Neurophysiology, Good Samaritan Hospital and Medical Center, 1015 N.W. Twenty Second Ave., Portland, Ore. 97210.

# PROTECTIVE-ADOPTIVE-AGGRESSION IN YOUNG CEBUS MONKEYS<sup>1</sup>

Stuart Zola

Psychology Department, Northeastern University and  
Department of Nutrition, Harvard School of Public Health

The writer has recently observed a form of aggressive behavior in a colony of young cebus monkeys (Cebus albifrons) which he has termed "Protective-adoptive-aggression" (PAA). Apparently, PAA has not been described before this, and the writer would appreciate hearing from anyone who has made similar observations.

The observations suggesting the concept of PAA were made only incidently within the framework of a larger current study of aggression and social interaction among young cebus monkeys in captivity. All the monkeys in this experiment are delivered by cesarean section and raised on artificial terrycloth mothers. Initial feedings are done by the writer and laboratory technicians around the clock until a self-feeding schedule can be instituted. Observations are made through one-way windows, by two observers recording simultaneously (interscorer agreement is nearly 90%).

The behavior was first observed when a young monkey (about 60 days old) was placed in a cage with two older monkeys for approximately 20 minutes a day. The two older monkeys were both about 13 months old and already familiar with each other, having been cage mates for at least five months. During the first two sessions, the two older monkeys spent time either examining the unfamiliar monkey cautiously or, occasionally, threatening it; very often they simply paid no attention to it. Then, one of the older monkeys appeared to "adopt" the new monkey and to "protect" it when it seemed to be threatened. The protector's behavior consisted of lying on top of the new monkey (who would sometimes react by ventral clutching to the protector), watching it, and occasionally threatening the other familiar monkey or other aspects of the environment. The adopted monkey's behavior seemed to have little effect on the behavior of the protector. In subsequent tests for PAA, instances have been observed where the protector will actually attack his cage mate of over a year, and although no severe wounds are inflicted, the seriousness of the attack cannot be questioned.

Another interesting aspect of PAA arose when the writer attempted to remove an infant from a cage with the protector present. All of the monkeys in this study have been handled from birth by the writer as part of the laboratory-rearing procedure. They are also held by him for the purpose of drawing blood samples once a week in connection with a

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<sup>1</sup>This work was supported in part by a grant (5T01 GM-00333-08 NTS) from the United States Public Health Service.



nutrition study. He has never been bitten on these occasions. But, when attempting to remove the adopted infant, the behavior of the protector seemed automatic, and the bite was deep enough to draw blood. This behavior occurred in every instance that an attempt at removal was made, and the author finally had to go through an intricate process of scaring the protector away long enough to grab the younger infant and close the cage door before the protector recovered.

PAA can be defined as the behavioral sequence, stare, threat, and attack, which is triggered by the presence of a human, another monkey, or, as some data suggest, an inanimate object, and the presence of a relatively familiar younger infant. With regard to the factors influencing PAA, the data obtained so far suggest the following: (1) The degree of threat posed seems to determine whether or not PAA will occur and its intensity. (2) Degree of familiarity seems to be important. PAA does not occur when an unfamiliar infant is placed in a cage with other monkeys. However, the infant does not necessarily have to interact actively with the older animal before the latter will show PAA. Furthermore, there is the suggestion of a threshold of familiarity above which PAA behavior ceases to occur. After the adopted monkey has become adapted to the group, the protector monkey no longer initiates PAA behavior. (3) PAA does not seem to be undirected aggression since a necessary condition is a threatening environment. When a younger infant is placed in a cage with only one other monkey, PAA has never been observed (except in the case of an inanimate object). Thus, there must be some external stimulus to trigger the behavior sequence. (4) PAA behavior does not seem to be sex-determined since it occurs in all combinations of protector-adopted sex differences. Males will protect younger males or females, and similarly females will protect younger females and males with equal intensity. In comparing two photographs, one a male protector and an adopted male and another of a female protector and an adopted male, there is absolutely no way to differentiate the threat moves in terms of sex differences. (5) It appears that the more dominant of the two familiar monkeys will be the one to initiate PAA or to become the protector. Additional data bearing on this point are now being gathered.

PAA appears to occur without the benefit of specific learning. The nursery in which the infants are raised is isolated from other monkey rooms and, indeed, these infants have never even seen an adult monkey. Obviously, their artificial mothers offer no active protection.

The present population consists of nine monkeys, six of which so far have exhibited PAA. The three remaining monkeys are the youngest of the group (between three and five months old) and thus far, even when placed with each other, have not exhibited PAA, although they have all been "adopted" by the older monkeys in the group.

The protective behavior has been observed in infants as young as 10 months old, and is quite different from behavior related to inanimate

objects. An animal that will aggressively protect his adopted younger monkey in a threatening situation will, in the same situation, but with only an inanimate object present, such as a relatively familiar new ball or other toy, immediately give up the object and retreat. The fact that the threshold for retreat by a protector appears to be raised considerably in the protective-adoptive situation (as opposed to an animal protecting an inanimate object) suggests that PAA at such an early age is functionally adaptive for the species, in that even very young and immature members take on protective roles.

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"DISEASES OF LABORATORY PRIMATES" AVAILABLE AGAIN

After being out of print for several years, Diseases of laboratory primates by T. C. Ruch is again available from the publisher, W. B. Saunders Co., Philadelphia. The book available is a reprinting of the first edition, not a revision.

## THE GREEN MONKEY DISEASE EPISODE--1967\*

Late in July, 1967, four shipments of African green monkeys (Cercopithecus aethiops) from Uganda arrived in West Germany. Most of the animals were destined for two companies--the Behringwerke AG in Marburg and the Paul Ehrlich Institute in Frankfurt--where their kidneys were to be used in the manufacture of vaccines.

By early September, 20 employees at Behringwerke and four at Ehrlich Institute became ill with "green monkey disease." Four other persons--doctors and other medical workers who cared for the employees --also became ill. Seven of the employees died. Most of the victims had taken part in nephrectomies on the monkeys to obtain kidney tissue for use in cell cultures. Others had come in contact with tissue cultures. (See VPH Notes, Sept. 1967.)

Initial symptoms of the disease included severe prostration, nausea, vomiting, diarrhea, and muscle ache. Other symptoms were conjunctivitis, rash, changes in white cell counts, and bleeding from mucous membranes. There was also involvement of the liver, heart, and brain. Deaths usually occurred 7 to 12 days after onset of illness. The fatality rate was 25 per cent.

On September 1, 1967, the National Communicable Disease Center (NCDC) was invited by the German Ministry of Health to send observers to study the outbreak. James W. Mosley, M.D., chief of the Epidemiology and Research Analysis Section, and John H. Richardson, D.V.M., chief veterinarian, Domestic Operations Section Foreign Quarantine Program, left immediately for Frankfurt. They visited the laboratories involved and studied the patients. NCDC's concern was valid. An estimated 12,000 green monkeys enter the United States each year and are used primarily for vaccine production.

After the complete clinical picture had unfolded, all observers agreed that the disease represented a new disease entity. Although green monkey disease resembles some of the hemorrhagic fevers, it corresponds to none in all respects. A wide variety of treatments seemed to have no effect on the disease.

Uganda stopped exporting green monkeys, pending further investigation. At the National Institutes of Health, the Division of Biologics Standard placed an embargo on the use of African green monkey kidney cell cultures for vaccine manufacture in the United States. It also banned the release of Sabin polio vaccine made after July 1, 1967. The embargo, thought to be only temporary, remained in effect 3 months--until December 15.

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\*From CDC Veterinary Public Health Notes, March, 1968, prepared by the Veterinary Public Health Section of Epidemiology Program of the National Communicable Disease Center, Atlanta, Georgia.

Meanwhile the search for the cause of green monkey disease was underway in various parts of the world. German investigators sent tissue and sera from humans and monkeys to 30 laboratories in England, Russia, Pakistan, and the United States.

At NCDC in Atlanta two scientists--Rosyln Robinson, Ph.D., and Robert Kissling, D.V.M.--set to work in a mobile laboratory borrowed from the National Cancer Institute. The laboratory was designed and built as a prototype facility by the Dow Chemical Company for the NCI for leukemia studies. The laboratory, still in use at NCDC, has facilities for incubating organisms, is lined with stainless steel, and has enclosed cabinets with windows and rubberized glove ports to allow scientists to work with specimens without actually having contact with infectious organisms.

In November, Drs. Robinson and Kissling were still baffled by the disease producing agent. It was not clear whether it was a virus, a rickettsia, a protozoan, or something else. The agent, apparently too large to belong to any known group of viruses, is closer to the size of a rickettsia, but does not, like rickettsiae, respond to antibiotic sensitivity tests and will not grow in chicken embryos as rickettsiae do.

In December, scientists in Hamburg, Germany, at the Bernhard Nocht Institute for Marine and Tropical Diseases isolated and photographed what they were sure was the infectious agent--a previously unknown virus. They described it as cane shaped, about 650 angstroms long, and having bright stripes down the length of its body. The NCDC investigators said the new "Marburg virus" seemed to correspond to an organism observed in the mobile laboratory.

The work at NCDC will not stop with the discovery of the cause of green monkey disease. Drs. Robinson and Kissling are busy developing antigens and diagnostic tests that could be used in examining all monkeys imported into the United States.

The embargo on green monkeys was lifted on December 15, but new safety measures were inaugurated: the quarantine requirement for monkeys used in vaccine production was doubled--from 6 to 12 weeks; all vaccines manufactured from African green monkey kidney cell cultures must undergo an additional safety test in guinea pigs; and vaccines prepared from those cultures taken after July 1 would be considered for release provided quarantine and test requirements were met.

In addition to reemphasizing the value of animal quarantine regulations and the importance of the existing battery of tests and procedures which ensure safe vaccines and safety for laboratory workers, the incident has had more far reaching results. At a recent conference sponsored by the Division of Biologics Standards, Dr. Walter Hennensen, professor of medicine at the Behringwerke in Marburg, presented a series of recommendations compiled by an international committee. These included the follow-

ing: Regard all monkeys from all parts of the world as potentially infectious animals; monkeys of the same species should not be transported more than two to a cage, and monkeys of different species should not be transported or housed in the same cage, same room, or even in rooms connected by the same air-conditioning system. A minimum 6-week quarantine was recommended for monkeys before handling. Personnel handling monkeys should wear protective clothing, and those handling monkey organs should consider all such tissue as potentially infectious.

Whatever the long-range implications of the green monkey disease incident may be, officials at NCDC and DBS feel that it is unlikely that the disease will appear in this country. As Dr. David J. Sencer, NCDC director, said, "Our controls are probably the strictest in the world."

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#### IS THE LABORATORY ANIMAL OBSOLETE?\*

Computers.--According to the Rand Corporation of Santa Monica, California, complex biochemical experiments can be performed without using animals, patients, or laboratory analysis. Additional advantages are saving in time, the avoidance of laboratory error, and the possibility of exploring biochemical frontiers for which no satisfactory methods of laboratory analysis exist. According to the researchers, the application of modern, high-speed, digital-computer techniques to medicine "opens a whole new era of clinical research and treatment."

A continuing study is being made by this organization in the development of mathematical tools for use in the medical sciences. Recent developments in program techniques have made possible the simulation of the blood chemical system. To validate such a model a set of rigorous experiments was designed to be independently performed on blood in the laboratory and on the blood model. During the course of a blind competition between the computer and the laboratory, scores of discrepancies between results were encountered, but in almost all instances it was possible to attribute the error to the laboratory.

Since the computer displays such an accurate picture of blood chemistry, it may serve as an excellent teaching tool for medical students. (Taken from: "A Study of Blood by Chemical Analysis and by Digital Computer: A Comparative Evaluation." Pub. by the Rand Corporation of Santa Monica, Calif.)

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\*From a leaflet distributed by Friends of Animals, Inc., 17 West 60 Street, New York, N. Y. 10023. The information in the leaflet was compiled by The Promoters of Animal Welfare, c/o 18 Manor Close, Great Horkeley, Colchester, Essex, England.

Tissue Culture.--Dr. S. T. Agyun of Turkey (University of Ankara) claims that a very large proportion of animal experiments could be replaced by tissue culture and has tried for a number of years to interest the universities of the world in adopting his tissue culture methods in toxicology and pharmacology. These methods, he feels, possess all the advantages of and none of the acknowledged disadvantages from the use of animals for a variety of purposes--physiological, immunological, dosage assessment and so on. In his view, it is also the best way to investigate cancer. He says that such tissue cultures yield results more quickly than animal experiments, are cheaper, more accurate, and can be applied to disease causes which may occur in certain animals or humans and not in others.

Unicellular Organisms.--Studies on unicellular organisms have been in progress for some years and a symposium was held during the 15th Annual Meeting of the American Institute of Biological Sciences on the industrial uses of protozoa. It was explained that certain protozoa whose internal chemistry is remarkably similar to that of humans have proved useful in the screening of drugs for side effects, for measuring the amount and quality of vitamins and proteins in foods and for detecting the cancer-causing ability of certain chemicals. (Reported New York Times, 8/26/64.) Dr. Seymour H. Hutner at Haskins Laboratories, New York, a specialist in this field, says in his published papers that the use of the "little animals" (protozoa) would spare the "big animals."

It is thought at Haskins Laboratories that research on Euglena may provide answers for important nutritional questions related to resistant anemia and leukemia-type disorders, to name just two possible applications. Ochromonas is now widely used at the Laboratory as a replacement for rats and chickens in biological testing and several pharmaceutical companies are using it as a screening method for anticancer agents.

Sea Urchin Eggs.--According to Dr. Ross F. Nigrelli, Director of the Laboratory of Marine Biochemistry and Ecology at the New York Aquarium: "In testing drugs we use sea urchin eggs because the fertilization cycle is well known and results are available within 48 hours. The eggs may be stimulated to develop without fertilization...or there may be deviations in cell division. We could have told them about thalidomide very quickly, had we tested it on sea urchin eggs."

Water Mould.--Drs. E. S. Beneke and Y. Lingyappa, University of Michigan, have found that a certain water mould is an excellent test object for potential anticancer drugs. References from "Green Medicine" by Margaret B. Krieg by permission of publishers, George G. Harrap & Co., Ltd., London.

Human Diploid Cells.--In America, where monkey-kidney tissue is used in the production of polio vaccine, it is thought that a potential danger of this vaccine is that it might conceivably induce cancer in

the recipient, just as it does experimentally in hamsters and certain human tissue culture. The alternative is the use of particular human diploid cell strains in the manufacture of vaccines, developed by Dr. L. Hayflick of Wistar Institute, Philadelphia. Techniques originally developed in his laboratory have shown that a small piece of human embryonic lung obtained from an aborted fetus can be grown in tissue culture continuously for approximately one year without acquiring properties of malignant cells. It has been calculated that cells derived from this single human diploid cell strain called WI-38 can be used to grow sufficient virus to immunize the population of the world against many virus diseases, including polio.

Dr. Maurice R. Hilleman, director of virus and biology research at the Merck Institute (U.S.A.) stated in the American Review of Respiratory Diseases, 1964, 90, 683: "Another advantage of diploid cells is their freedom from contamination by undesirable viruses, naturally present in many animal cultures." "In fact," he states, "had such cells been available in the earlier period, it is problematical whether monkey-kidney cells would have been chosen for preparing polio vaccines and more recently developed vaccines." Dr. Hilleman also stated that diploid cells permit the growth of viruses that cannot now be grown in animal cells: "This could pave the way," he said, "for development of killed and live virus vaccines, especially the rhinoviruses, which are a principal cause of the common cold and for which there is no specific control." (See also Science, 1964, 143, 976.)

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

Books

The baboon. An annotated bibliography. Supplement II. San Antonio, Texas: Southwest Foundation for Research and Education, 1967.

Disease

Disease from monkeys. (Anon.) British Medical Journal, 1967, 4, 758-759.

This article reviews the pathogens which might be transmitted to man from newly imported monkeys, mentioning simian herpes virus (B virus), rabies, and the agent which caused the Marburg incident. This latter, involving outbreak of disease among humans in contact with vervet monkeys, is described in some detail. The article goes on to say that whereas the larger pharmaceutical houses and institutes such as the Medical Research Council can and do quarantine their monkeys, many newly imported primates are received by smaller scientific laboratories and by pet shops with no control whatsoever. The danger to personnel employed by such establishments is stressed, and the possible need for legislation leading to some form of quarantine discussed. The article suggests that investigations leading to the substitution of stable diploid cell lines for primary monkey tissue cultures in vaccine manufacture might be desirable.

Shigellosis in the baboon (Papio sp.). Pinkerton, Mary E. (Div. Microbiol. Infect. Dis., Southwest Found. Res. & Educ., San Antonio, Texas) Laboratory Animal Care, 1968, 18, 11-21.

Cultural surveys for shigellae have been made in 3 ecological groups of baboons: (1) wild, (2) newly imported, and (3) captive-residential. Preliminary storage of rectal swabs from wild baboons in transport media for several weeks may have accounted for the virtual lack of recovery of Shigella isolates. The percentage of baboons shedding shigellae in the newly-imported and captive animals was practically identical (37.8% and 35.0%, respectively), but the incidence of S. flexneri was higher in the latter group, 27.5% as

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\*In many cases, the original source of references in the following section has been the Current Primate References prepared by The Primate Information Center, Regional Primate Research Center, University of Washington. Because of this excellent source of references, the emphasis here has been shifted to presentation of abstracts of articles of practical or of general interest, rather than simply listing them.



opposed to 18.9% in the newly imported group. In the latter, presumed S. sonnei accounted for most of the other isolates. However, cultures which were thought to be S. sonnei on a biochemical basis, agglutinated weakly or not at all in the corresponding antiserum. There were a few isolates of S. boydii and others which cross-reacted with both S. boydii and S. dysenteriae poly-antisera. S. flexneri, serotype 1-a, was predominant in captive baboons which were clinically well. A few animals showing diarrhea also yielded this serotype, but the sugar reactions were slightly different. Antibody determinations in sera of wild and captive baboons and also in human sera (African native and animal handler) showed the following: (1) Antibodies to S. dysenteriae serotype 1 were found only in African natives; (2) S. boydii antibody was lacking in wild baboon sera but present in that of the captive baboons as well as in the two human groups; (3) there was a complete lack of antibody to S. sonnei in all of the baboon sera tested, whereas there was a high incidence in the human sera; (4) antibody to S. flexneri serotype 1-a was present in all baboon sera, and there was evidence of increased response in resident animals, suggesting that this serotype is native to the baboon. Moreover, there was also conspicuous evidence of antibody to serotypes 2-a, 4-a, and 5 in both groups. Indications of increased response to serotype 3-a in the captive baboons, and to a lesser extent to serotype 6, were noted, suggesting that these may be acquired types. Although antibodies to all of these serotypes were found in the human sera, the relative incidence was less than in the baboons.

A leptospirosis outbreak in a baboon (Papio sp.) colony. Fear, F. A., Pinkerton, M. E., Cline, J. A., Kriewaldt, F., & Kalter, S. S. (Div. Animal Resources, Southwest Found. Res. Educ., San Antonio, Texas) Laboratory Animal Care, 1968, 18, 22-28.

A leptospirosis outbreak was confirmed in a colony of 500 baboons (Papio sp.) at the Southwest Foundation for Research and Education. The disease was diagnosed by isolation of the organism and by serologic procedures.

Sarcoptic mange in a shipment of cynomolgus monkeys. Leerhoy, J., & Jensen, H. S. (Enterovirus Dept., Statens Serum Institut, Copenhagen) Nord. Vet.-Med., 1967, 19, 128-130.

Sarcoptes scabiei was found in a group of thirty imported cynomolgus monkeys. The clinical picture was characterized by emaciation, a mild degree of alopecia, extensive scaling, and very slight thickening of the skin. Several of the monkeys died before the infestation was diagnosed. The clinical picture differed from the "classical" description of scabies by lack of scratching and of exudative skin

lesions. Treatment with Oleum dixantogeni applied to the whole body for 24 hours cured the animals.

Histopathological and virological studies on monkeypox. Gispén, R., Verlinde, J. D., & Zwart, P. (Nat. Inst. Pub. Health, Sterrenbos 1, Utrecht, The Netherlands) Archiv für die Gesamte Virusforschung, 1967, 21, 205-216.

Pathological and immunological studies of monkeypox were made during an outbreak in a zoological garden. Monkeypox virus was isolated from 7 orangutans, 3 monkeys, and 1 anteater. The isolates resembled variola virus with regard to pock lesions in chick chorioallantoic membranes. Cynomolgus monkeys which had been immunized with smallpox vaccine proved resistant to subsequent dermal and intranasal challenge with monkeypox virus. Smallpox vaccination of newcomers in a monkey colony combined with a quarantine of 4 weeks is recommended as a preventive measure.

#### Physiology and Behavior

Clinical laboratory data derived from 102 Macaca mulatta.

Robinson, F. R., & Ziegler, R. F. (Aerospace Med. Res. Labs., Aerospace Med. Div., Air Force Systems Command, Wright-Patterson Air Force Base, Ohio 45433) Laboratory Animal Care, 1968, 18, 50-57.

Clinical laboratory data from 102 Macaca mulatta (42 males and 60 females) that had been stabilized for at least 90 days were analyzed. Some statistical differences between data from males and females were found but appear to be of little practical significance. There were statistically significant differences between last samples taken versus all samples, that apparently reflected the loss of blood from sampling procedures. These data have been very useful when used as a guide in determining the clinical health of monkeys during the stabilization period and before and after experimental studies.

Behavior of vervet monkeys (Cercopithecus aethiops). Struhsaker, T. T. (Dept. Zool., U. California, Berkeley, Calif.) University of California Publications in Zoology, 1967, 82, 1-74.

A one-year field study of vervet monkeys was conducted by the author, and the behavior of these animals is catalogued in this report.

Baseline blood values of the chimpanzee. II. The relationship of age and sex and serum chemistry values. Hodson, H. H., Jr., Wisecup, W. G., Faulkner, M. F., & Felts, P. E. (6571st ARL, Holloman AFB, New Mexico 88330) Folia Primatologica, 1968, 8, 77-86.

Statistical analyses of 1935 serum chemistry determinations at the 6571st Aeromedical Research Laboratory indicate that the serum chemistry values of the chimpanzee are, in general, similar to man. The serum potassium and, possibly, calcium levels are somewhat lower than the norm for man. There appears to be a decrease in serum urea nitrogen in the female chimpanzee with age and a decrease in serum total protein of the male chimpanzee at 80-100 months. Although there were variations in the serum electrolytes, CO<sub>2</sub> and pH values which were correlated with the age of the chimpanzee in the present study, these variations were probably due to excitement of the younger chimpanzee at the time the blood was drawn.

A survey of physiological measurements in Macaca mulatta. Stahl, W. R., & Malinow, M. R. (Oregon Regional Primate Research Center, Beaverton, Ore.) Folia Primatologica, 1967, 7, 12-33.

The rhesus monkey (Macaca mulatta) has been studied most intensively of all nonhuman primates from the physiological viewpoint. Recent laboratory data from the Oregon Regional Primate Research Center and published literature findings have been used to prepare tables dealing with: metabolism, oxygen uptake, respiration rate, minute volume, lung volumes, respiratory mechanical parameters, lung and blood gas tensions, heart rate, cardiac output, stroke volume, blood pressures, ECG intervals, renal function parameters, specific blood volume, plasma volume, and total body water. The results are adequate to define normal values for all of the above variables. Findings in the rhesus monkey are compared with normal levels in man and limited data on other nonhuman primates.

### Drugs

Safety and tolerance of repeated anesthesia with CI-581 (Ketamine) in monkeys. Bree, M. M., Feller, I., & Corssen, G. (U. Mich. Med. Cen., Ann Arbor, Mich.) Anesthesia and Analgesia, 1967, 46, 596-600.

CI-581 appeared safe and effective as an anesthetic for mulatta monkeys, even when the animals were vaccinated and challenged with Pseudomonas aeruginosa organisms. Tolerance to this drug seemed to develop, as shown by decreasing periods of anesthesia during the course of repeated administrations in doses of 25 mg per kg. No pathologic lesions were found traceable to the drug and no abnormal behavior was observed. Animals remained in good health throughout the experiment.

### Instruments and Techniques

Neue Fernreizapparatur für kleine Primaten. Maurus, M. (Max-

Planck-Institut für Psychiatrie, München). Die Naturwissenschaften, 1967, 22, 593.

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Restraint periods in a monkey chair in excess of 35 days do not appear to produce pathological symptoms when the device described is used.

An inexpensive head restraint system for long term intravenous administration of drugs in the monkey. Trost, J. G., Talley, W., & Whitney, G. D. (Aerospace Med. Div., 6571st Aeromed. Res. Lab., Holloman Air Force Base, New Mexico) Tech. Rep. No. ARL-TR-67-27, 6571st Aeromedical Research Laboratory, Holloman Air Force Base, New Mexico, 1967.

A head restraint system allowing intravenous administration and self-administration of compounds in monkeys under conditions of minimal restraint is described. The system has functioned well even with large male macaques and requires no handling of the subjects for administration of drugs. Additional advantages of the present system, its ease of fabrication, light weight, and low cost are discussed.

A plexiglas helmet assembly for use on small primates. Talley, W. H., Trost, J. G., & Whitney, G. D. (Aerospace Med. Div., 6571st Aeromed. Res. Lab., Holloman Air Force Base, New Mexico) Tech. Memo No. ARL-TM-68-1, 6571st Aeromedical Research Laboratory, Holloman Air Force Base, New Mexico, 1968.

Current drug addiction research requires adaptation of catheterized monkeys to protective cables or spring restraint apparatus which run from the animal's head to the cage wall. A helmet that is used for adapting animals to a simulated environment prior to surgical implant of the catheter has been developed. The method, materials, and application are discussed.

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