LABORATORY PRIMATE NEWSLETTER

Volume 7, Number 4

October, 1968

Edited by

Allan M. Schrier

Consulting Editor: Morris L. Povar

Psychology Department
Brown University
Providence, Rhode Island

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].

All correspondence concerning the Newsletter should be addressed to:
Allan M. Schrier, Psychology Department, Brown University, Providence, Rhode Island 02912.

Acknowledgment

The Newsletter is supported in part by U. S. Public Health Service Grant FR-00419 from the Division of Research Facilities and Resources, N. I. H.

CONTENTS

HOW A YOUNG CHIMPANZEE WAS TOILET TRAINED

Beatrice T. Gardner and R. Allen Gardner

University of Nevada

The toilet training of young primates is notoriously difficult. In the case of the chimpanzee, these difficulties are ascribed to an absence of selection pressure for bladder and bowel control in a species that is largely arboreal and that lacks permanent habitations. Yet Reynolds (1965) reports that he and other field observers found sleeping nests used by chimps were usually perfectly clean. Moreover, on the ground, Reynolds found a considerable proportion of feces by the side of fallen logs, and he infers that chimps may squat on logs while excreting to avoid contact with fecal matter.

When research demands that chimpanzees be kept in close contact with human beings and in something resembling human habitations, one tries harder. As Kellogg and Kellogg (1933) remarked, when introducing data on the toilet training of Gua and Donald in their chapter on learning, "...probably the most exact and certainly the most persistent training through which the average human baby is conducted is in learning to control the bladder and bowels. Such training is begun usually at the age of less than a year and may continue as long as three or four years. If properly managed it is an invariable, methodical, day-and-night procedure which few subsequent endeavors in the lifetime of the individual can equal in either regularity or extensiveness. Here, then, should be an excellent field in which to compare the learning abilities of the two organisms, without modifying their ordinary childlike surroundings or conducting them through unusual or irregular processes of training."*

Washoe, a wild-born female chimpanzee, is the subject of a project on the acquisition of sign language. The laboratory conditions under which she is kept, while not patterned after those of a human family, as in the case of Kellogg and Kellogg (1933), involve a manimum of confinement and a maximum of social interaction with human companions. Since late June, 1966, Washoe has been living in a housetrailer and has had free access to a yard with trees, jungle gym, etc. One or more human companions are with her at all times that she is awake.

Figure 1 shows an 18-month record of the toilet training of Washoe, who was about 1-1/2 years old at the start of training. For some months previously, we followed a procedure that is far easier than toilet training: Washoe was kept in diapers and was changed whenever these became soiled or wet. In November, 1966, we started to place her on the nursery chair at approximately one-hour intervals. We would deviate from the one-hour schedule in order to take advantage of occasions when Washoe was highly likely to defecate or urinate, such as after naps.

*The reader may observe that this quotation reflects the child-rearing practices of the 1930's.

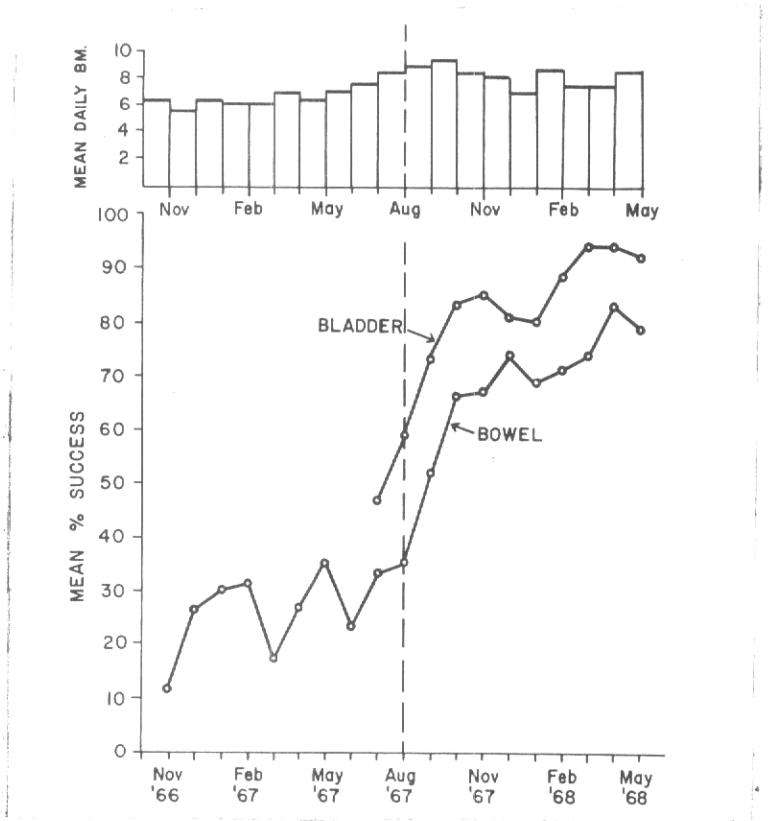

Figure 1. Progress in toilet training of the chimpanzee, Washoe. A success is scored when Washoe uses the nursery chair or toilet for bladder voiding or bowel movements. The broken vertical line in the graph represents the time at which the change in training procedure was made. It is apparent that progress was quite rapid after this change.

When Washoe was not on the nursery chair, she always wore diapers.

The record shows that many months passed with little progress. We praised Washoe extravagantly for any success, sometimes rewarding her with tidbits. We scolded her for failures, especially those that occurred within minutes of a session on the nursery chair. We tried amusing her while she sat and we tried ignoring her. Two observations offered slight encouragement. Washoe came to prefer to be clean, and would attempt to remove her diapers when these became soiled. She learned something of the function of the nursery chair, for she would leave immediately after defecating or voiding, but would remain the required 5 minutes when no bowel or bladder response occurred.

During the summer of 1967, Washoe began to resist diaper changing, especially by new assistants. One day, early in August, we instituted

a change in procedure: for a few hours, while Washoe was indoors, the diapers were removed. Within the hour Washoe, for the first time, ran to the nursery chair spontaneously, sat on it, and used it. She also attempted to put her diaper on again, just before the next excretion. For some time, we left a diaper on her bed and used this behavior as a signal to order her to the toilet.

With this change in training procedure, progress was quite rapid (Figure 1). As our confidence increased, the diapers were removed for longer and longer periods of time. There was a relapse when Washoe was first allowed to go outdoors without diapers. At the time of this writing, however, Washoe uses the nursery chair commonly while outdoors, and almost inevitably when indoors. Throughout her training, we have kept a record of each bowel or bladder response and the 15-minute period during which it occurred. Originally, the purpose of the record was to provide data in selecting favorable time for placing Washoe on the nursery chair. The morale-boosting effect of later entries, and, ultimately, the realization that a complete record would provide useful data on toilet-training, prompted us to continue careful recording.

Washoe now interrupts play, meals, or her bath, and even climbs down from a tree in order to use the nursery chair. Since April, 1968, she regularly removes her diapers and uses the nursery chair in the morning, if she awakens before a human companion arrives. Washoe uses the same signal as Gua did--touching her bottom--when she is about to defecate or void and is far from the toilet. Generally, one of her companions takes her by the hand and runs with her to the nearest toilet or nursery chair. Although she was trained with nursery chairs only, Washoe spontaneously transferred to using regular toilets. Moreover, the chimp has certainly learned something of the importance her human friends attach to her toilet habits: when she has engaged in mischief and we are after her in wrathful pursuit, Washoe commonly dashes to a nursery chair and sits down.

References

Kellogg, W. N., and Kellogg, Louise A. The ape and the child. New York: McGraw Hill, 1933, pp. 194-195.

Reynolds, V. Budongo: An African forest and its chimpanzees. New York: Doubleday, 1965.

AVAILABILITY AND BIOMEDICAL RESEARCH UTILITY OF THE TALAPOIN MONKEY, *CERCOPITHECUS* (*MIOPITHECUS*) *TALAPOIN*

Robert W. Cooper

Institute for Comparative Biology, Zoological Society of San Diego

Arthur A. King

JEJA, Inc., Primate Research Services, Simpsonville, Maryland

The talapoin monkey, *Cercopithecus* (*Miopithecus*) *talapoin* (Figure 1), is native to the tropical rain forests of West central Africa from southern Cameroun to northern Angola (Hill, 1966b). It is by far the smallest of all Old World (catarrhine) monkeys; in our experience adults of the subspecies native to southern Cameroun and Rio Muni (*C. t. talapoin*) weigh 0.9 to 1.4 kg. Because all other truly diminutive primates are either prosimians, marmosets, or New World (platyrrhine) monkeys, *C. talapoin* is man's nearest small primate relative. It is also the only small primate species which has a true menstrual cycle and, together with *C.* (*Allenopithecus*) *nigroviridis*, is the only member of the genus *Cercopithecus* to evidence perineal swelling during estrus (Tomilin, 1940; Zuckerman, 1933). The talapoin monkey has reproduced in a number of zoological gardens recently (Anon., 1967; House & Mahoney, 1966; Morris & Jarvis, 1960-1962, 1965-1967) as well as in several laboratories (Krohn, personal communication, 1965; Hill, 1966a). Although infrequently exhibited in zoos, it has not been a difficult species to maintain in captivity; the present longevity record was established by a male Angolan talapoin monkey, *C. t. ansorgei*, which arrived at the Philadelphia Zoo on 6 October 1939 and died in June 1967 after twenty-seven and a half years of captive life (Jones, 1967). On the basis of phylogenetic status, physical size, reproductive characteristics, and the growing knowledge of its biology (Barberis, 1967; Fooden, 1961; Gautier-Hion, 1966; Oxnard, 1966; Peters & Gordon, 1968; Sabater & Jones, 1967; Wiener *et al.*, 1965, 1966), the talapoin monkey must be considered a most promising candidate for biomedical research utilization.

Because of its small size and unspectacular markings, the talapoin has been little sought after for zoological exhibition. This fact, coupled with the slow development of air trade routes from Europe and the U.S. to West central Africa has contributed to the relative obscurity of the talapoin outside of its natural habitat. In recent years only small numbers of immature talapoins, originating on a seasonal basis from Rio Muni (Spanish Guinea) and intended largely for the pet trade in Spain, have usually become available on the world market.

Although we have been interested in including *C. talapoin* in our

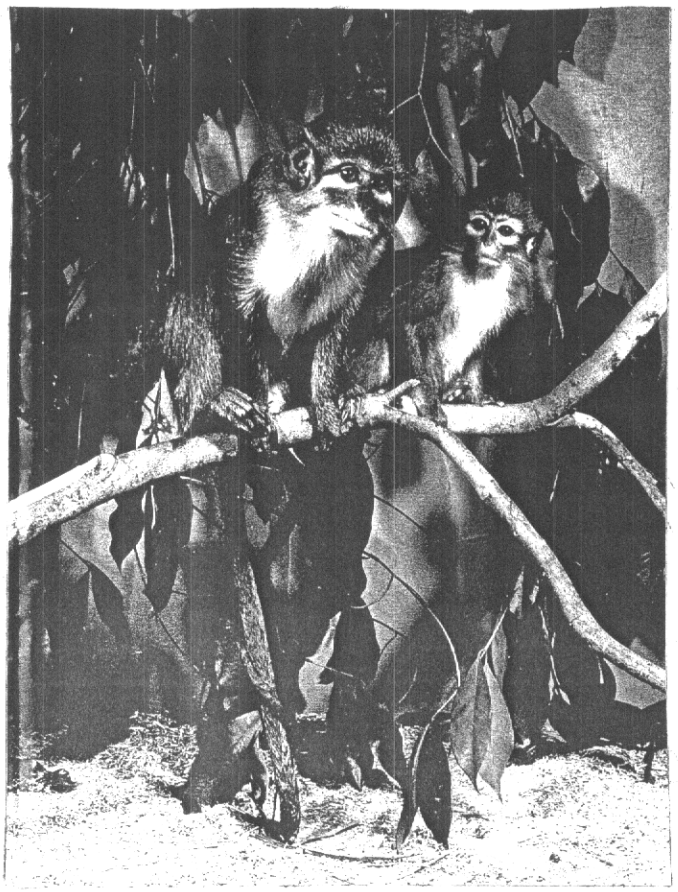

Figure 1. The talapoin monkey.

program of reproductive evaluation since 1964[1], the lack of commercial availability of adult specimens and the unknown or unreported status of natural talapoin populations had prevented it. Several years of extensive correspondence failed either to produce adult talapoins from existing supply sources in Rio Muni or to stimulate the development of new lines of supply in Cameroun, Gabon, or Angola. However, the potential biomedical research utility of the talapoin was judged sufficient to warrant a first-hand study of the natural population and commercial supply situations.

In November, 1967 the authors, after laying considerable groundwork, traveled to Barcelona and Madrid, Spain, and there documented the major use of imported juvenile talapoin monkeys as exotic household pets. From Spain we flew to Bata, the capital of Rio Muni and geographic origin

---

[1]This program is being carried out under contract PH-43-63-56 within the Special Virus Leukemia Program of the National Cancer Institute, U.S. Public Health Service.

of the several thousand immature talapoins which reach Spain and Majorca each year. There we were fortunate to have the generous collaboration of Dr. Clyde Jones, who, accompanied by his family, had been studying primate ecology and behavior in Rio Muni for more than a year under the auspices of the Delta Regional Primate Research Center and the National Geographic Society. With his assistance we were able to observe talapoins in their natural habitat as well as the means utilized by indigenous hunters to capture this small and elusive primate, i.e., usually with snares made of plant fiber. We found that many adults are captured in this fashion but were not purchased by dealers due to their low value as pets. Dr. Jones also provided talapoin specimens for physical examination and measurement as well as for post mortem parasite and tissue collections.

Although talapoins are very plentiful in Rio Muni and the only primate species there with an expanding population (Sabater & Jones, 1967), the necessity to route all exportation through Spain, coupled with the uncertain political future of this small colony (10,000 sq. mi.; 258,000 population) scheduled for independence in 1968, led us to expend most of our efforts in Cameroun. The authors were preceded to Cameroun by Don Hunsaker, Professor of Zoology at San Diego State College, and his assistant, who surveyed several talapoin study sites suggested by Dr. Thomas Struhsaker, who was then studying primate behavior in Cameroun under the auspices of the Rockefeller University and the New York Zoological Society. The population density of the talapoin in southern Cameroun seemed at least to equal that of Rio Muni. As in Rio Muni and Gabon (Gautier-Hion, 1966), they are seldom found far from water and are always met close to farms and villages. In Cameroun, the talapoin, because of its small size, is the only monkey species not actively hunted with shotguns for food. It is a recognized agricultural pest and because of its adaptation to secondary growth, seems easily capable of withstanding the population pressure exerted by the trapping of modest numbers for exportation.

Commercial sources of supply for juvenile and adult talapoins are now being developed by JEJA, Inc. and some experience has been gained in the breeding colony management of this species. In San Diego, the Primate Research Colony at the Institute for Comparative Biology (Cooper, 1964) received shipments of talapoins in January, March, and April of this year (from JEJA, Inc.); the present population is about 50 animals. They have been caged in 6 by 6 by 5 ft. cages in social groups of one male with up to six females, and in 6 by 3 by 5 ft. cages in groups of one male with as many as four females. Some fighting has been observed among females, but removal and rearrangement of several particularly aggressive females has controlled the problem. Of the approximately 30 fully mature females in the colony, at least 13 have become pregnant to date; three of these have aborted at early stages, which is not surprising considering their relatively short stay in captivity. It has been possible to retrospectively date all conceptions within a period of a few days on the basis of daily perineal swelling observations. Commercially prepared food (Wayne Monkey Diet, Allied Mills, Inc., Chicago,

Illinois) has been the exclusive diet of these animals after an initial period of acclimatization. Physical restraint and handling are accomplished regularly without difficulty using a small net and leather gloves.

At least two additional talapoin colonies are now in existence in the U.S. A small colony of these animals was established in the Brown University Primate Behavior Laboratory a few years ago and is described in this issue of the Newsletter (p. 9). Drs. Tom Clewe and Clyde Jones have recently established a talapoin colony at the Delta Regional Primate Research Center in Covington, Louisiana. Other groups are presently expressing interest in utilizing this unique primate in their research. Now that a commercial supply of talapoins is being developed, we are hopeful that these animals will be evaluated in a broad range of biomedical investigations.

References

Anon. Arrivals and births. Chester Zoo News, 1967, 2-3.

Barberis, L. The idiograms of three species of the genus Cercopithecus, C. talapoin, C. aethiops and C. mona. In D. Starck, R. Schneider, and H. J. Kuhn (Eds.) Progress in primatology. Stuttgart: Fischer, 1967. Pp. 155-159.

Cooper, R. W. A description of a unique outdoor primate colony. Laboratory Animal Care, 1964, 14 [6], 474-482.

Fooden, J. Urinary amino acids of non-human primates. Zoologica: New York Zoological Society, 1961, 46, part 3, (11-15), 167-179.

Gautier-Hion, A. L'ecologie et l'ethologie du Talapoin (Miopithecus talapoin talapoin). Biologia Gabonica, 1966, 11 [3], 311-329.

Hill, W. C. O. Laboratory breeding, behavioural development and relations of the Talapoin (Miopithecus talapoin). Mammalia, 1966, 30 [3], 353-370. (a)

Hill, W. C. O. In Primates. Comparative anatomy and taxonomy, Vol. VI. Cercopithecoidea. Edinburgh: University Press, 1966. (b)

House, B., and Mahoney, R. W. Introducing "Skip"--the baby Talapoin Monkey. Animal Kingdom, 1966, 69 [1], 1-7.

Jones, M. L. Record Talapoin monkey. Longevity notes, International Zoo News, 1967, 14 [4], 99.

Morris, D., and Jarvis, C. (Eds.), International Zoo Yearbook. London: Zoological Society of London, 1960-1962, 1965-1967.

Oxnard, C. E. Vitamin B_{12} nutrition in some primates in captivity. Folia Primatologica, 1966, 4 [6], 424-431.

Peters, J. H., and Gordon, G. R. Histaminase activities in the plasma of subhuman primates and man. Nature, 1968, 217, 274-275.

Sabater, J., and Jones, C. Notes on the distribution and ecology of the higher primates of Rio Muni, West Africa. Tulane Studies in Zoology, 1967, 14 [3], 101-109.

Tomilin, M. I. Menstrual bleeding and genital swelling in Miopithecus (Cercopithecus) talapoin. Proceedings of the Zoological Society of London, 1940, 110, 43-45.

Wiener, A. S., Moor-Jankowski, J., and Gordon, E. B. The relationship of the H substance to the A-B-O blood groups. International Archives of Allergy, 1965, 29, 82-100.

Wiener, A. S., Moor-Jankowski, J., Gordon, E. B., and Davis, J. The blood factors I and i in primates including man, and in lower species. American Journal of Physical Anthropology, 1965, 23 [4], 389-396.

Zuckerman, S. In Functional affinities of man, monkeys and apes. London: Kegan Paul, Trench, Trubner, 1933.

* * *

REQUEST FOR ILLUSTRATIONS FOR A BOOK ON LABORATORY ANIMAL DISEASE

High quality black and white illustrations are needed for a book on laboratory animal diseases. The greatest need is for photographs and photomicrographs showing etiologically defined signs and lesions of the viral, bacterial and noninfectious diseases. Any illustration used will be credited to the contributor and his institution.--Robert J. Flynn, Division of Biological and Medical Research, Argonne National Laboratory, 9700 South Cass Avenue, Argonne, Illinois 60439.

A NOTE ON THE TALAPOIN MONKEY, CERCOPITHECUS (MIOPITHECUS) TALAPOIN, AS A LABORATORY ANIMAL

Allan M. Schrier and Morris L. Povar

Psychology Dept., Brown University

This paper describes our experience with a small group of talapoin monkeys [Cercopithecus (Miopithecus) talapoin] that has been maintained in the Brown University Primate Behavior Laboratory for approximately the past three years. We were interested in determining the suitability of these animals for behavioral research. The talapoin is of special interest because it is the smallest living Old World monkey. It has the anatomical features (including the brain) of the Old World monkey, but the small size of such New World monkeys as the squirrel monkey (Saimiri sciureus). Hence, it seemed to us that use of these monkeys might have the dual advantage of providing an animal with the more advanced behavioral characteristics of Old World monkeys, but whose small size would allow greater economy of housing and maintenance.

Little is known about the talapoin monkey as a laboratory animal, perhaps in part because it has been difficult to obtain and relatively expensive.[1] Some information on the laboratory care of these animals was published recently by Hill (1966). He also reported what he believed was the first birth of a talapoin monkey in a laboratory (1966, also see Anon., 1965). Hill's reports suggested that these animals would be very difficult to maintain in the laboratory. However, since he did not offer any evidence that these animals could not be maintained under the same conditions as other commonly used laboratory monkeys, we felt it worthwhile to try to do so.

The talapoins, four females and nine males, arrived in our laboratory between August, 1965, and March, 1966. Four of the animals (Group I) had undergone a conditioning period of unspecified length and appeared to be in very good shape on arrival. The remainder (Group II) were raw animals and were obviously not as well as the four just described. Based on the appearance of their dentition, the animals varied in age from young to mature adults. Several of the Group II animals had severely decayed teeth on arrival. They were individually housed in stainless steel cages, without shelves, 18 in. wide by 22 in. high by 23 in. deep, in air-conditioned rooms. Hill's monkeys were kept under a temperature of 80°F and about 80% humidity. While our animals were in quarantine during the first three months after arrival, the temperature was 78°F ± 2° and the relative humidity was 50% ± 10%. In the colony rooms to which the animals were moved following quarantine, the temperature was 72°F ± 2° and the relative humidity ranged from approximately 30% in the winter to 70% in the summer. Artificial fluorescent light was provided from 7:30 a.m. to 7:30 p.m.

---

[1] As Cooper and King's article in this issue (p. 4) suggests, procurement may no longer be as great a problem.

Hill (1966) recommended a complicated diet that would be quite impractical for maintaining a laboratory colony. We decided, therefore, to feed the animals only the standard commercial diet[2] that we feed our Old World monkeys. Each of the animals was fed the standard biscuits softened with water for the first week. They all accepted this food satisfactorily. After that, each animal's daily diet consisted solely of about 50 gm of dry biscuits. Water was supplied from automatic tongue-operated water valves (Schrier, 1966).

In all, four of the animals have died. All were males and from Group II. Two died in the first 2 months in the laboratory. Necropsy revealed severely necrotic livers of uncertain etiology. Nematodes were observed in sections of the liver. A third animal died during the spring of 1967. All of its teeth were absent and it was emaciated. The last death followed an epileptiform convulsion. Necropsy did not reveal a cause. The remaining nine animals have thrived. Weight gain of the males in the first year was approximately 10% to about 1200 gm and has remained at about that level since then. The weight of the females has remained at about 1 kg. In 1967 it was observed that two females had markedly distended vulvas, obviously a sign of estrus. In January, 1968, four males and four females were paired in the same size cages and under the same environmental conditions previously provided for single animals. Two females conceived and were visibly pregnant by March. When advanced pregnancy was obvious the females were separated from the males. One infant was born on June 30 and the second on August 22 of this year. Both infants have been growing rapidly and their mothers have maintained lactation and their weight without any supplemental diet. No changes in the environmental temperature or humidity was provided for the infants.

The animals have performed very well in behavioral experiments with sugar pellets used as rewards. They were put through the standard procedure that we use (Schrier, 1965) to accommodate macaques to our Wisconsin General Test Apparatus. They adapted to the test procedures more readily than did a group of rhesus monkeys that were being trained at the same time, but this may have been the result of the talapoins having been in the laboratory much longer than the rhesus monkeys had been. The talapoins readily learned a color and form discrimination learning set task.

In conclusion, in contrast to previously published information, it was possible to maintain a colony of talapoin monkeys solely on conventional monkey food in an environment which was suitable for maintenance of a large, successful colony of macaques. Two females were able to reproduce and lactate under these procedures, producing healthy, rapidly developing offspring. Furthermore, the talapoins seem to perform at least as well as macaques in behavioral tasks.

---

[2]Rockland Primate Diet, Teklad, Inc., Monmouth, Ill. This is a dated food in biscuit form with Vitamin C added.

References

Anon. Birth of a talapoin reported. Laboratory Primate Newsletter, 1965, 4 [2], 7.

Hill, W. C. O. Laboratory breeding, behavioural development and relations of the talapoin (Miopithecus talapoin). Extrait de Mammalia, 1966, 30, 353-370.

Schrier, A. M. Pretraining performance of three species of macaque monkeys. Psychonomic Science, 1965, 3, 517-518.

Schrier, A. M. The Primate Behavior Laboratory of Brown University. American Journal of Psychology, 1966, 79, 124-127.

* * *

REQUEST FOR PRIMATE MATERIAL: FROZEN OR PRESERVED CARCASSES FOR SKELETON PREPARATION

A need for skeletons of nonhuman primates exists for teaching of an undergraduate course in human biology which includes examination of skeletons of various primates. A graduate course in primatology is also planned which will require a wide range of primate skeletons. Preserved or frozen carcasses are requested for the preparation of skeletons.--H. Butler, Department of Anatomy, University of Saskatchewan, Saskatoon, Canada

* * *

REQUEST FOR PRIMATE MATERIAL: TARSIUS PLACENTAS

Placentas of Tarsius are urgently needed as part of a comparative study of the architecture of primate placentas to which colleagues have generously contributed in the past. This form is of special interest because it is the only prosimian with a hemochorial placenta (as far as I know). Placentas fixed in any conventional fixative are suitable. They will be sectioned serially, and the donor will receive representative sections if he desires. Information on stage of pregnancy, size of fetus, etc. is desired.--Peter Gruenwald, M.D., Sinai Hospital, Baltimore, Md. 21215.

BLOOD GROUPS OF NONHUMAN PRIMATES: PROGRESS REPORT[1]

J. Moor-Jankowski and Alexander S. Wiener

Laboratory of Experimental Medicine and Surgery in Primates, and the Department of Forensic Medicine, New York University School of Medicine

The first phase, 1963-1964, of our investigation was devoted to the occurrence in nonhuman primates of human blood groups. After human-type[2] blood groups were demonstrated in various species of apes and monkeys, the serological properties of these blood groups in simians were further investigated. The results obtained (Moor-Jankowski & Wiener, 1964) laid the foundation for the next phase of our work, 1965-1966, when by isoimmunization and cross-immunization[3] blood groups peculiar to non-human primates, i.e., their simian-type[4] blood groups, were demonstrated in chimpanzees, gibbons, and Celebes black apes.

During 1967-1968 efforts have been made in the following areas: 1. Continuation of our studies of human-type blood groups in apes and monkeys. 2. Continuation of our studies of simian-type blood groups in chimpanzees and gibbons. 3. Extension of the studies on simian-type blood groups to the primate species most widely used in experimental medical research, namely, macaques and baboons. 4. Application of new findings made in primate animals to the elucidation of the genetics and serology of human blood group systems. 5. Providing information, reagents and training to workers using experimental primate animals, notably for organ and tissue transplantation and for post-irradiation bone-marrow transplantation experiments.

The details of the work done during the past two years can be found in the 21 papers listed in the References. In order to provide a broad view of advances achieved and of the general direction of the work, only the more salient accomplishments will be reviewed here.

---

[1]All the studies described in this report have been aided by U.S. Public Health Service grants GM-12074, GM-09237-05/06, FR-00316-02/03, by NSF grant GB-6038, by USAF Contract F29600-68-C-0027, and by the Health Research Council of New York City grant U-1885.

[2]As defined by us, human-type blood groups are determined in simian blood by suitably modified human blood-grouping reagents.

[3]As defined by us, cross-immunization is the immunization of one species with antigenic material from a closely related species, e.g., chimpanzees injected with red cells of man or of gibbons.

[4]As defined by us, simian-type blood groups are determined by reagents specially prepared against simian red cells. The Rh factor of human blood was the first blood factor discovered with such a simian-type reagent.

1. Human-type blood factors were investigated in marmosets (Wiener, Moor-Jankowski, & Gordon, 1967), in response to requests from numerous workers interested in the use of those animals.

2. New cross-immune-type and simian-type blood factors in chimpanzees (Wiener, Moor-Jankowski, Gordon, & Kratochvil, 1966; Wiener, Henley, Moor-Jankowski, & Gordon, 1967; Wiener, Moor-Jankowski, & Kratochvil, in press) are $\underline{\underline{K^c}}$[5], $\underline{\underline{L^c}}$, $\underline{\underline{M^c}}$, two as yet unnamed factors, and $\underline{\underline{c^c}}$, which because of its unique importance for blood groups of man and for comparative phylogenetics will be discussed separately. Altogether, 16 blood factors peculiar to chimpanzees have been discovered since the beginning of this investigation. Thus, chimpanzee blood groups are presently almost as well investigated as those of man.

Limited studies in gibbons resulted in the discovery of an additional simian-type blood factor $\underline{\underline{C^G}}$ (Wiener, Moor-Jankowski, Gordon, Daumy, & Davis, 1966); more rapid advances in the study of these apes is anticipated following the establishment at the Laboratory of Experimental Medicine and Surgery in Primates of our own colony of 14 gibbons. Information on these animals is being sought because of their potential value for biomedical experimentation as small, relatively inexpensive anthropoid apes.

3. Large series of investigations were started on simian-type blood groups of baboons (Moor-Jankowski, Wiener, Gordon, & Davis, 1967; Moor-Jankowski & Wiener, 1967; Wiener, Moor-Jankowski, Cadigan, & Gordon, in press) and macaques (Moor-Jankowski, Wiener, Gordon, & Davis, 1967; Moor-Jankowski & Wiener, 1967, 1968; Wiener, Moor-Jankowski, Cadigan & Gordon, in press), in response to requests from numerous workers interested in the use of these readily available primates for a variety of medical research projects. Five simian-type blood factors, $\underline{\underline{A^P}}$, $\underline{\underline{B^P}}$, $\underline{\underline{C^P}}$, and two as yet unnamed, have been so far found in baboons. The following ten simian-type blood factors have been found in rhesus monkeys: $\underline{\underline{A^{rh}}}$, $\underline{\underline{B^{rh}}}$, $\underline{\underline{C^{rh}}}$, $\underline{\underline{D^{rh}}}$, and in collaboration with Dr. Hans Balner, Holland, $\underline{\underline{H}}$, $\underline{\underline{E}}$, $\underline{\underline{K}}$, $\underline{\underline{M}}$, $\underline{\underline{T}}$, $\underline{\underline{V}}$. Some of the eight antisera crossreact selectively with other species of macaques.

4. Elucidation of genetics and serology of human blood group systems and new information on comparative phylogenesis has resulted from the following findings in primate animals.

The strong reaction of anti-$\underline{\underline{H}}$ reagents with red cells of group B, genotype BB, gibbons (Wiener, Moor-Jankowski, Gordon, Daumy, & Davis, 1966; Wiener, Moor-Jankowski, Cadigan, & Gordon, in press) indicates

---

[5]To avoid ambiguity, symbols for blood factors and their corresponding antibodies are printed in bold type (double underline), symbols for genes are printed in italics (single underline), while symbols for agglutinogens, phenotypes and blood group systems are printed in regular type.

that the antigen H is not the product of gene O as previously believed. Moreover, this observation, together with the demonstration of the poor reactivity of the A_1 and H antigens in chimpanzee red cells (Wiener, Moor-Jankowski, & Kratochvil, in press), as well as in red cells of human newborns, indicates that antigens H, A_1 and B develop in parallel, and that the substance H is not the precursor of the blood group substances A and B as has been suggested previously.

Red cells of all chimpanzees react with human anti-Rh_o sera. However, the same sera absorbed with red cells of certain chimpanzees demonstrate individual blood differences in chimpanzees. Remarkably these absorbed human anti-Rh_o sera give parallel reactions with a newly-produced isoimmune chimpanzee antiserum anti-c^c (Wiener, Moor-Jankowski, Gordon, & Kratochvil, 1966; Wiener & Moor-Jankowski, in press). The factor c^c is antithetical to the blood factor C^c of the chimpanzee C-E-F blood group system. This new finding is the most striking evidence for our concept that the chimpanzee C-E-F system and the human Rh-Hr system are counterparts of one another; it also demonstrates the close relationship of man to chimpanzee.

Our immunological studies on blood groups and serum proteins so far largely confirm the concepts of classical phylogenetics. The anthropoid apes are certainly the closest relatives of man. Among the apes, the chimpanzee appears to be most closely related to man, as demonstrated also by the long time survival and immunological reactions of transplanted, blood group compatible chimpanzee kidneys in human recipients. As far as the red cell blood groups are concerned, gibbons appear to be more closely related to man than gorillas and orangutans, which, however, is not borne out by our serum protein studies.

Our blood group studies also confirm the classical position that the Old World monkeys are more closely related to man than the New World monkeys. Therefore, in our studies, which are oriented to the situation in man, we are limiting ourselves primarily to the investigation of Old World monkeys, and, more specifically, to the most widely used species, baboons and macaques.

References

Moor-Jankowski, J., & Wiener, A. S. Blood groups and serum specificities of apes and monkeys. Laboratory Primate Newsletter, 1964, 3 [4], 1-14.

Moor-Jankowski, J., & Wiener, A. S. Sero-Primatology: a new discipline. In D. Starck, R. Schneider, and H. J. Kuhn (Eds.) Progress in Primatology. Stuttgart: Fischer, 1967. Pp. 373-381. (a)

Moor-Jankowski, J., & Wiener, A. S. Blood groups of apes and monkeys: Human-type and simian-type. In D. Starck, R. Schneider, and H. J. Kuhn (Eds.) Progress in Primatology. Stuttgart: Fischer, 1967. Pp. 382-410. (b)

Moor-Jankowski, J., & Wiener, A. S. Blood groups of non-human primates: Summary of currently available information. In C. H. Kratochvil (Ed.) First Holloman Symposium on Primate Immunology and Molecular Genetics. Primates in Medicine. Vol. I. Basel/New York: Karger, 1968. Pp. 49-67.

Moor-Jankowski, J., & Wiener, A. S. Blood group antigens in primate animals and their relation to human blood groups. In Proceedings of WHO European Symposium on the Use of Primates in Medical Research, Lyon 1967. Primates in Medicine. Vol. II. Basel/New York: Karger, in press.

Moor-Jankowski, J., Wiener, A. S., Gordon, E. B., & Davis, J. H. Blood groups of baboons demonstrated with isoimmune sera. Nature (London), 1967, 214, 181.

Moor-Jankowski, J., Wiener, A. S., Gordon, E. B., & Davis, J. H. Blood groups of monkeys: demonstrated with isoimmune rhesus monkey sera. International Archives of Allergy, 1967, 32, 373-377.

Moor-Jankowski, J., Wiener, A. S., & McRitchie, R. Isoantibodies produced in chimpanzees by cross immunization with gibbon red cells. International Archives of Allergy, in press.

Rowe, A. W., Vermeulen, J., & Moor-Jankowski, J. In vivo survival in primates of blood frozen by a droplet spray technique. Transfusion, in press.

Wiener, A. S., Henley, C., Moor-Jankowski, J., & Gordon, Eve B. Chimpanzee red cell isoantibody of a "new" specificity, anti-K^c, produced by cross-immunization of chimpanzees with human blood. Journal of Immunology, 1967, 98 [5], 1011-1014.

Wiener, A. S., Kratochvil, C. H., & Moor-Jankowski, J. Implications of studies in chimpanzees for the serology of the human Rh-Hr blood types. In C. H. Kratochvil (Ed.) First Holloman Symposium on Primate Immunology and Molecular Genetics. Primates in Medicine. Vol. I. Basel/New York: Karger, 1968. Pp. 95-99.

Wiener, A. S., & Moor-Jankowski, J. Blood groups of non-human primates, and their implications for studies in man. In Proceedings of John A. Hartford Conference on Blood Transfusion. Vol. 1. New York: Better Bellevue Association, 1967. Pp. 75-103.

Wiener, A. S., & Moor-Jankowski, J. Blood groups of apes and monkeys--their implications for experimental medicine. Annals of New York Academy of Sciences, in press.

Wiener, A. S., Moor-Jankowski, J., Balner, H., & Gordon, E. B. Blood groups in monkeys: demonstrated with antisera produced by combined

skin transplantation and isoimmunization with red cells. International Archives of Allergy, in press.

Wiener, A. S., Moor-Jankowski, J., Cadigan, F. C., Jr., & Gordon, E. B. Comparison of the A-B-H blood group specificities and M-N blood types in man, gibbons (Hylobates), and siamangs (Symphalangus). Transfusion, in press.

Wiener, A. S., Moor-Jankowski, J., & Gordon, Eve B. Blood groups of apes and monkeys. VII. The human-type A-B-H factors in gelada monkeys (Theropithecus gelada). American Journal of Physical Anthropology, 1966, 25, 235-238.

Wiener, A. S., Moor-Jankowski, J., & Gordon, E. B. Blood groups of marmosets. Laboratory Animal Care, 1967, 17, 71-76.

Wiener, A. S., Moor-Jankowski, J., Gordon, E. B., Daumy, O. M., & Davis, J. H. Blood groups of gibbons, further observations. International Archives of Allergy, 1966, 30, 466-473.

Wiener, A. S., Moor-Jankowski, J., Gordon, E. B., & Kratochvil, C. H. Individual differences in chimpanzee blood demonstrated with absorbed human anti-Rh_o sera. Proceedings of the National Academy of Sciences, 1966, 56 [2], 458-462.

Wiener, A. S., Moor-Jankowski, J., & Kratochvil, C. H. Blood groups of chimpanzees. In Primates in Medicine. Vol. V. Basel/New York: Karger, in press.

Wiener, A. S., Wisecup, W., & Moor-Jankowski, J. A "new" simian-type blood factor L^c, associated with the C-E-F blood group system of chimpanzees. Transfusion, 1967, 7, 351-354.

* * *

LABORATORY-REARED INFANT MONKEYS FOR SALE

Six rhesus infants (5 males, 1 female) and two stump-tailed infants (1 male, 1 female), all laboratory bred and hand-reared, are for sale. The rhesus were born between January 1 and June 1, 1967. The stump-tails were born during June and August, 1967. All now weigh between 5 and 7 lb. They were separated from their mothers on the day of birth and served briefly in a study of sucking behavior.--Morris L. Povar, Psychology Department, Brown University, Providence, R. I. 02912. Telephone: Area Code 401 863-2807.

BABOONS IN TRANSPLANTATION RESEARCH AT THE UNIVERSITY OF STELLENBOSCH[1]

J. J. W. Van Zyl, G. P. Murphy[2] and J. N. de Klerk

Faculty of Medicine, University of Stellenbosch

Bellville, South Africa

The objective of this paper is to indicate the value which we at the University of Stellenbosch place on the baboon (Papio ursinus) as an experimental subject. These animals are among the most successful, biologically speaking, of the wild primates. In the rural areas of South Africa they have survived, thrived, and multiplied, despite, or perhaps because of, the increasing intensity of agricultural development. It should be kept in mind that the work described involves nearly every department of the faculty, and to a large extent represents the work carried out by the conjoint effort of The Johns Hopkins University and the University of Stellenbosch.

Housing

The animal housing at the Karl Bremer Hospital of the University of Stellenbosch was completed in mid-1967 and is at present being extended and improved. When our present program of construction is completed we will have 52 large cages, each of which will be able to contain several fully-grown animals. In addition we will have room for 40 to 50 individual cages. All told, we will therefore be able to maintain between 150 and 200 animals without any overcrowding.

Since July of last year we have received a total of 1300 baboons, mostly from a relatively small number of persons who have made special efforts, but also from a large number of others who have delivered small numbers of animals. The animals are delivered directly from their native habitat.

Medical Care

The animals are all subjected to a routine registration procedure in which they are allotted numbers, weighed, and examined for illness. Blood is taken for ABO and other bloodgrouping factors as well as baseline hematological studies. At the same time samples of stools are taken for microbiological examination for microorganisms as well as parasites. This latter investigation is very important to pick out

---

[1]Based on a paper delivered before the Association of Surgeons of South Africa, Cape Town, May 1, 1968.

[2]The Brady Urological Institute of The Johns Hopkins Hospital

animals which may precipitate epizootics of diarrhea in the colony.

Bacteriological specimens are taken from all baboons shortly after arrival. The investigations are performed in the Department of Medical Microbiology under the direction of Prof. H. D. Brede. Determination of the flora from the saliva and the intestinal tract, the skin and the genito-urinary tract are made. The incidence of staphylococci in the snout of baboons was astonishingly high (54.1%). No case of tuberculosis has been found in any of the 1,100 newly received animals examined by cultural methods and on autopsy.

The following pathogenic organisms were found in the fecal flora: Enteropathogenic Eschericia coli occurred in 52 of 427 baboons (12%) and the most common were types 026 and 055. Salmonella sundsvall was isolated from 46 baboons, not one of whom showed signs of clinical disease. This type seldom occurs in human beings in the Cape. Under the influence of immunosuppressive treatment in baboons, these organisms migrated into the spleen and kidneys and could be cultured from all organs at post mortem. Shigella flexneri type IV was isolated from about 4% of all the baboons without clinical signs. Shigella flexneri type II occurred only sporadically. One third of all animals were free from parasites, 46.4% carried Trichura trichiura, 13% trichostrongylus, 12% Strongyloides stercoralis, 8.3% ascaris and 10% entamoeba.

Research Projects

The number of animals used is high by any standard and the following is an indication of the uses to which they were put. While this paper primarily concerns the transplantation work, it should be noted that certain additional projects are in progress: (1) A study of the baboon prostrate anatomy and physiology and experimental production of prostatic carcinoma is in progress by Dr. Schoonees of the Department of Urology. (2) Dr. Groenewald of the Department of General Surgery has produced aortic coarctation in a number of animals. These will in due course be available for a variety of hemodynamic and other studies. (3) A study is in progress on erythropoietin formation (EPF) in anephric baboons to determine the extent of extrarenal EPF and to determine its source. This study is being carried out in conjunction with Dr. E. Mirand of the Roswell-Park Memorial Institute at Buffalo and arises from the demonstration of active EPF in an anephric human.

Anesthesia

An important development of the research program has been the elaboration of a reliable, yet simple and safe anesthetic method suitable to various procedures. Safe handling and minor surgery on baboons is readily performed after intramuscular phencyclidine (1 mg/kg) sold under the trade name of Sernylan (Parke-Davis & Co., Detroit, Mich.). This drug acts very rapidly to produce one to two hours restraint and analgesia

without unconsciousness. For major intrathoracic surgery it becomes necessary to supplement this drug: Administration of the tranquilizer diazepam (Valium, Roche, Nutley, New Jersey) by intravenous injection (0.5 mg/kg) has proved very successful, either with phencyclidine alone, or preferably with endotracheal nitrous oxide and oxygen in addition. Profound muscular relaxation is produced with spontaneous respiration. No muscle relaxants are ever required, the animals can be intubated without difficulty, and respiration can readily be controlled for intrathoracic surgery. The anesthetic technique is so simple that it can be carried out by junior laboratory staff without risk of cardiovascular or respiratory depression, yet with profound muscular relaxation. The main disadvantage is a tendency to hypothermia following skin vasodilatation. Awakening after anesthesia is particularly rapid with a nitrous oxide technique. Among the desirable properties of diazepam as opposed to pentobarbital are (a) good visceral analgesia, (b) lack of respiratory center depression, and (c) a marked central muscular relaxant action. As an alternative, for intracardiac surgery, endotracheal halothane and oxygen following phencyclidine seems to offer an advantage. Higher oxygen tensions and a more rapid awakening are obtained at a time when the rate of detoxication and excretion of injected drugs may be depressed.

Cardiovascular Surgery

The use of the baboon as a subhuman primate in experiments necessitating the use of a heart lung machine has definite and very important advantages. (1) As baboon blood groups correspond to the human ABO groups the heart lung machine can be primed with compatible blood. (2) Baboons tolerate cardio-pulmonary bypass well. Even lengthy perfusions of up to 3 hours using high flow rates of 100 to 125 ml/min/Kg bodyweight are followed by prompt and complete recovery. During nine experimental mitral valve replacements, no deaths occurred on the table in marked contrast to our experience with mongrel dogs. (3) For cardiac transplantation, also, the baboon seems far superior to the mongrel dog. Donors and recipients of suitable size can be selected for blood groups and leucocyte antigen compatibility. The whole procedure is easily accomplished through a left thoracotomy. In nine experimental transplantations performed to date, survival of up to two days has been obtained without the use of immunosuppression. The survival time of the heart transplant animals is admittedly very short, but we have not yet evolved a reliable system of controlled nursing for these animals and those that did survive up to two days were let loose in small cages without any real attention beyond the administration of antibiotics. The fatalities were, as far as we could determine, mostly the result of pulmonary complications. In the future a sternum splitting approach will be used. As soon as more reliable results are obtained, the animals will be subjected to immunosuppressive treatment and we are at present evolving an anti-lymphocyte serum in addition to a variety of other biological materials. The simultaneous presence of postoperative baboon renal and cardiac transplants will probably afford an opportunity for comparing the immunological situation of these two different transplant groups.

(4) The anatomy of the heart and the great vessels is closely related to that of the human being. The anastomoses of the atria, aortas and pulmonary arteries present no great problem provided adequate lengths on the donor preparations are obtained and fine suture material is used. (5) The size of the heart corresponds closely to the body weight, simplifying the selection of donor-recipient pairs. (6) Heparinization is achieved with doses similar to those used in humans and the heparin is effectively neutralized by Protamine Sulphate. (7) The bleeding tendency so commonly observed following cardio-pulmonary bypass in dogs, has not been encountered in any of our baboon experiments.

Renal Transplantation

Over 400 renal transplantations were performed with the primary object of testing a variety of immunosuppressive materials.

The preparation of baboon antilymphocyte serum and substances affecting complement is now in progress.

Various studies on kidney functions have been completed: (1) Renal plasma flow measurements were carried out on 174 animals. These determinations served as control values for the allotransplantation program. (2) In vivo renal functional perfusion experiments on isolated organs were performed on 200 kidneys. (3) The effect of anoxic and hypoxic status on the performance of fresh kidneys during isolated perfusion was also determined.

* * *

REQUEST FOR INFORMATION ON HEARING

I am in the process of writing a review of the behavioral evidence for hearing in nonhuman primates. Although I am familiar with the laboratory work that has been done, I am able to find very little reference to hearing by field investigators or early primatologists. I would be grateful for any literature, references, or comments.--William C. Stebbins, Ph.D., Kresge Hearing Research Institute, University of Michigan, Ann Arbor, Michigan 48104.

PRIMATE INFORMATION CENTER

Maryeva W. Terry

Regional Primate Research Center

University of Washington, Seattle, Washington 98105

The purpose of the Primate Information Center (PIC) is to supply to the international scientific community bibliographic and other information relevant to research about or based on nonhuman primates. Its activities are supported by the Regional Primate Research Center at the University of Washington which, in turn, was built and is supported by the National Institutes of Health (Animal Resources Branch of the Division of Research Facilities and Resources). The PIC is an outgrowth of T. C. Ruch's concept of a "Handbook of laboratory primates," and was a part of the original program of the Washington Primate Center. The PIC's services have been generally available for about four years. Although it has served a goodly number of investigators during this time, many seem to be unaware of its existence or of the nature of its services. The following, then, is a description of PIC services presently available on request.

Current Primate References, a listing of recent articles on primatology and research with primates, with addresses of authors when available. The contents of this list are the product of a weekly search of new literature received by the University of Washington Libraries; weekly searches of journals received by the Oregon Regional Primate Research Center, New England Regional Primate Research Center, and the Regional Primate Research Center at the University of Washington; a monthly service from MEDLARS, the National Library of Medicine's literature indexing and computerized retrieval service; and a monthly listing of recent Russian literature prepared by the Primate Information Centre, Institute of Experimental Pathology and Therapy, Sukhumi, U.S.S.R., and translated into English by the PIC. The PIC also subscribes to the ASCA service of the Institute for Scientific Information, publishers of Current Contents.

Retrospective bibliographies. Citations gathered by the PIC are indexed according to subject matter and stored for future retrieval. The major exception to this practice is composed of abstracts of society proceedings, which appear only in Current Primate References. Conversely, the indexed files contain citations never published in Current Primate References because they were found after they could be considered to be "current."

Citations on a given topic in all living nonhuman primates or in one genus or species of primate can be retrieved and assembled into a bibliography. Bibliographies prepared in this manner cover mainly articles published since 1940. Earlier literature on anatomy, physiology,

psychobiology and pharmacology is listed in Bibliographia primatologica (Ruch, 1941) and that on spontaneous disease in Diseases of laboratory primates (Ruch, 1959). (The Primate Information Center does have card files containing the earlier citations in other areas. These files are not, however, organized for mechanized retrieval and are searched only in connection with projects having a broad significance which will justify the great cost of retrieval by inspection.)

Requests for retrospective bibliographies may be made in writing or by telephone (206-543-4376); no special key or thesaurus of topics is needed. The user is asked to phrase his question in normal sentences rather than by listing possible key words, because the interrelationships of the latter are sometimes obscure. If the user can supply a brief, general statement of his research problem, the PIC staff may be able to suggest related items not covered by the question itself. Questions are processed by the persons who index the literature and who are therefore reasonably familiar with the terminology and scientific issues involved.

In general, the PIC tries to discourage requests for bibliographies of primate genera or species not accompanied by some indication of topic of interest. When such requests are received, the PIC attempts to provide a "natural history" bibliography--anatomy, physiology, psychobiology, phylogeny, taxonomy and colony management--rather than to search all its files, which contain more than 20,000 citations. Such a bibliography will not, however, be prepared for Macaca mulatta (rhesus monkey), Saimiri sciureus (squirrel monkey), or either genus. The cost of preparing these very large bibliographies is far in excess of their potential value to the individual user. Exceptions to this rule may be made for users preparing comprehensive monographs and bibliographies.

The bibliographies of the genera Pan, Papio, and Theropithecus (chimpanzee and baboon) contain only literature published since 1965 because the earlier literature is indexed in published bibliographies prepared by organizations having had access to the PIC files. Users interested in this literature are referred to:

Rohles, F. H., Jr. The chimpanzee. A topical bibliography. ARL-TDR-62-9, ARL-TDR-63-27, and ARL-TR-67-4; available from the U.S. Department of Commerce Clearinghouse for Federal Scientific and Technical Information, Springfield, Virginia.

The baboon. An annotated bibliography, available with its supplements from the Southwest Foundation for Research and Education, San Antonio, Texas.

Recurrent bibliographies. Once a retrospective bibliography has been prepared, it may be supplemented as additional relevant citations are indexed. This service is not automatically instituted, but must be specifically requested. For technical reasons, the question for a recur-

rent bibliography cannot always be identical with the question for a retrospective bibliography; the changes, if any, are usually toward a more general question for the recurrent service. Such changes are negotiated with the user.

Normal values. The Primate Information Center is extracting from the literature the results of common clinical laboratory tests and some determinations of biochemical and physiological parameters. The resulting file includes extracts from normative studies, data on control groups in experimental studies and some unpublished data from the Regional Primate Research Centers. In general, the contents of these files are not suitable for use as values against which results in other animals can be compared, but they do indicate the range of values which have been obtained and the work needed to establish norms.

The contents of any of these files is available on request. Some can be provided only as sets of extracts; others have been or are being reduced to tabular form to bring together data from various studies on similar animals. The resulting papers are being published by the PIC. Presently available titles in this series are:

Urine volume in nonhuman primates: A tabulation from the literature.

Adrenal and gonadal hormones in plasma and urine of nonhuman primates: A tabulation from the literature

Enzymes in blood of nonhuman primates tabulated from the literature: I. Cholinesterase, alkaline phosphatase and other hydrolyzing enzymes

Request for Reprints

The Primate Information Center would greatly appreciate receiving reprints of all scientific articles on nonhuman primates and research with nonhuman primates. Such reprints are an assistance in assuring that articles are not overlooked and facilitate indexing and extracting of the literature.

References

Ruch, T. C. Bibliographia primatologica. New Haven: Historical Library, Yale Medical Library, 1941.

Ruch, T. C. Diseases of laboratory primates. Philadelphia: Saunders, 1959.

NONHUMAN-PRIMATE-ASSOCIATED HEPATITIS--NEW JERSEY*

Between April 1 and June 1, 1968, five animal handlers, who cared for approximately 50 nonhuman primates caged as pets in an area of a private home in Toms River, New Jersey, developed hepatitis. The onsets of illness were April 1, 3, 5, May 29, and June 1. All patients were males from 17 to 33 years of age, and all experienced nausea, upper abdominal discomfort, vomiting, fever, and jaundice. Bilirubin determinations ranged from 3.2 to 8.2 mg percent and SGOT's from 51 to 590. Three patients were hospitalized; there were no deaths. None of the patients gave a history of contact with a jaundiced person or ingestion of raw shellfish during the 2 months prior to their illness, and none reported receiving transfusions of blood or having self-administered parenteral drugs during the 6 months prior to onset of illness.

The three animal handlers who had onsets of illness during the first week in April had begun work at the home from 2 to 6 months before becoming ill, and they left their employment 1 to 3 days after their illness began. The other two animal handlers each began work 1 month prior to developing hepatitis. One of these, however, worked only 4 days, May 1-4; he developed hepatitis on June 1. Neither of these two men had been employed during the onsets of illness of the first three cases.

The five patients had been responsible for cleaning the cages of the primates and feeding them. Their duties required them to come into close physical contact with the animals, and all five had been either bitten or scratched on the hands or forearms by them. Although seven other persons also had close contact with the animals, they reported no illness. Transaminase determinations performed on June 13 on these seven persons were normal.

Between April and June 1, 1968, the collection of primates in the home included six woolly monkeys, five spider monkeys, 19 capuchins, 17 ringtail monkeys, two Celebes apes, and two black siamangs. There have never been any chimpanzees on the premises. Of the animals in the home, 23 were acquired after January 1, 1968, and 19 of these were under 1 year of age. No cases of jaundice had occurred in the animals or in the employees of the two animal firms which supplied the primates acquired since January. (Reported by Ronald Altman, M.D., Acting Director, Division of Preventable Diseases, and Paul Marzinsky, Senior Field Representative, New Jersey State Department of Health; and two EIS Officers.)

---

*From Morbidity and Mortality Weekly Report, 1968, 17, 32. (Prepared by Communicable Disease Center, U.S.P.H.S., Atlanta, Georgia.)

NONHUMAN-PRIMATE-ASSOCIATED HEPATITIS--OAKLAND COUNTY, MICHIGAN*

Between May 10 and June 13, 1968, three animal handlers, who had contact with tropical and exotic animals at an animal brokerage near Detroit, Michigan, developed hepatitis, and a fourth animal handler had possible hepatitis.

The first case was in a 17-year-old male who had onset of illness on May 10. Although he began work at the brokerage on May 2, he had frequent contact with young chimpanzees during visits to the brokerage in April. On June 13 after a 3-week prodrome of headache, fatigue, fever, abdominal pain, and anorexia, he developed jaundice and had abnormal liver function tests. He had not received immune serum globulin (ISG) prior to or after becoming employed at the brokerage.

The second case was in an 18-year-old male who became ill on May 16. He had begun work at the brokerage February 17 and had not received globulin prophylaxis since his employment. He experienced a 2-week prodrome of headache, malaise, anorexia, and developed dark urine and jaundice on May 31 when liver function tests including an SGOT and LDH were abnormal.

The third case was a 24-year-old male who began work at the brokerage on May 13. He became ill on June 13 with headache, fever, chills, and anorexia. He subsequently developed dark urine which lasted 1 week, but he denied jaundice and yellow sclerae. Tests of liver function were not performed. Prior to working at the brokerage, this patient had been employed as an animal handler at a zoo, and according to zoo policy, he had received ISG in November, 1967.

All three patients denied ingestion of raw shellfish or contact with a known hepatitis case during the 2 months prior to their illnesses. All three gave no history of transfusions of blood or blood products or use of parenteral drugs in the 6 months prior to illness.

There was a fourth possible hepatitis case in a 17-year-old male who began work at the brokerage in January, 1968, and who became ill on June 11 with nausea, vomiting, and diarrhea. He subsequently developed fatigue, loss of taste for cigarettes, and anorexia. He denied dark urine and jaundice, and although he was hospitalized for 4 days beginning June 13, bilirubin and transaminase determinations were not performed. He had received 10 cc of gamma globulin in February, 1968.

The four handlers had been responsible for the care and cleaning of all animals housed at the brokerage. Primates housed at the brokerage

---

*From Morbidity and Mortality Weekly Report, 1968, 17, 271. (Prepared by Communicable Disease Center, U.S.P.H.S., Atlanta, Georgia.)

comprised a variety of species, including chimpanzees (implicated in previous hepatitis outbreaks, Hillis, 1961), Celebes apes, and woolly monkeys. No cases of jaundice had occurred among the chimpanzees and other primates at the brokerage, and there had not been a higher than expected death rate among the animals.

Prior to these four cases, five cases of hepatitis with jaundice had occurred among the owners and employees of the brokerage. These cases occurred between 1960 when the brokerage entered into chimpanzee importation and supply and June, 1966, when the brokerage began administering ISG at 3- to 4-month intervals to all employees. However, since January, 1968, ISG had not been regularly administered to personnel at the brokerage. (Reported by Thomas McInerney, M. D., Physician, William Beaumont Hospital; Frank Condon, M.D., M.P.H., Deputy Director, and Theodore M. Barr, D.V.M., Veterinarian, Oakland County Health Department; Donald B. Coohon, D.V.M., Deputy Chief, Bureau of Epidemiology, Michigan State Department of Public Health; and an EIS Officer.)

Reference

Hillis, W. D. An outbreak of infectious hepatitis among chimpanzee handlers at a United States Air Force Base. American Journal of Hygiene, 1961, 73 [3], 316-328.

* * *

REQUEST FOR PRIMATE MATERIAL: INTRACTABLE, AGED, OR SEVERELY ILL CHIMPANZEES

We are studying, at the New England Regional Primate Research Center, the neuroanatomy of the auditory system in a number of primates and it is planned to include the chimpanzee. The cost and value of the chimpanzee makes it impossible to purchase these animals simply to perfuse them and remove their brains. It is, however, perfectly feasible to use animals which are intractable, aged, or very ill provided we can perfuse them before death. We are looking for four to six such animals. If any dealer or research institution wishes to dispose of a chimpanzee, we will arrange to pick the animal up.--J. M. Harrison, Department of Psychology, 111 Cummington Street, Boston, Mass. 02215, or M. L. Feldman, New England Regional Primate Research Center, Harvard Medical School, Southborough, Mass.

AN EASY AND EFFECTIVE METHOD TO OBTAIN BLOOD SAMPLES FROM THE LESSER GALAGO (*GALAGO SENEGALENSIS*)*

Duane E. Haines

Department of Anatomy, Michigan State University

East Lansing, Michigan

In order to determine the normal blood picture of the lesser galago, a technique that is similar to that used in sampling blood from cats has been successfully used with the lesser galago.

The galago has two or three main vessels running longitudinally from the margin to the base of the ear, and a distinct marginal vein running around the periphery of the pinna. Since the pinna of the ear is relatively devoid of hair, adequate blood for PCV, hemoglobin, all differential counts and determinations, and complete electrophoresis can be obtained by lancing any of these longitudinal or marginal vessels. This technique has been successfully used on over 30 different animals in the present study.

Using the peripheral vessels in the pinna of the ear has several advantages over venipuncture. First, the animal is quite easily restrained, therefore any struggle does not expose thin venous walls to trauma from a needle. Second, legs, arms and tail do not interfere with the procedure. Third, any hematoma that forms is relatively small, does not interfere with any significant venous return, and disappears in 2-5 days. Fourth, after samples are obtained, clotting is rapid and the small lance mark heals in a few days.

Active animals with consequent vasodilation of the ear vessels afford no problem in the collection of adequate samples. Animals just beginning their active cycle will usually have minimal blood circulation to the ear; however, in such cases, vasodilation can be encouraged by briskly rubbing or snapping the pinna.

---

*Thanks are due Miss Irene Brett for technical assistance. Supported by PHS FR-00366, and by a General Research Support Grant, College of Veterinary Medicine.

CORRESPONDENCE

Further on Koch's O.T. vs. P.P.D. for TB Testing

Sir: I have noted Dr. Burn's comments on page 24 of the July issue of Laboratory Primate Newsletter and would like to make a few comments inasmuch as reference has been made to my activities in the Editor's Note.

1. Either PPD or Koch's Old Tuberculin may be employed with equal success in testing for tuberculin skin hypersensitivity. However, preference for PPD rests on the greater uniformity of the product as it is now produced and the fact that it does not elicit nonspecific allergic reactions when utilized repetitively even at frequent intervals.

2. The equivalent doses, as seen in quantitative studies in guinea pigs or monkeys with induced disease, are 0.0025 mg of PPD and 5 mg of K-OT. The latter is best utilized in 0.05 ml of diluent.

3. The shaved or closely clipped abdominal skin is unquestionably a better site for tests of tuberculin hypersensitivity than the palpebral fold (upper eyelid). In the first place low grade reactions on the abdomen are easier to read than those on the eyelid and are not likely to be confused with negatives. Secondly, and most important, the successful use of either PPD or K-OT depends upon the injection of the entire volume of solution intradermally (not subcutaneously) and retention of same at the injection site. These desiderata are more easily accomplished in the abdominal skin than in the eyelid.

4. The time has come for an end to arguing about the merits of one or another procedure of testing via citation to authority. Anyone who has the misfortune to encounter a hypersensitive monkey has the tool for satisfying himself as to the relative merits of K-OT and PPD, of abdominal skin and palpebral fold as testing sites, and of relation of size of reaction to quantity of reagent injected. To gain such information would require holding of the hypersensitive subject in the animal colony but forty-eight hours after the first identification. This is a time when the motto "I shall not guess when I can know" should prevail.

L. H. Schmidt, Director
National Center for Primate Biology
Davis, California 95616

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

Books

The squirrel monkey. Rosenblum, L. A., & Cooper, R. W. (Eds.) New York: Academic Press, 1968.

This book presents data on the basic biological characteristics of Saimiri sciureus, its care, treatment, and research use. The following are the topics covered: Squirrel Monkey Taxonomy and Supply by Robert W. Cooper; The Parasites of Saimiri: In the Context of Platyrrhine Parasitism by Frederick L. Dunn; Observations of Squirrel Monkeys in a Colombian Forest by Richard W. Thorington, Jr.; The Squirrel Monkey in a Seminatural Environment by Frank V. DuMond; Some Aspects of Female Reproductive Physiology in the Squirrel Monkey by Leonard A. Rosenblum; Observations of the Relationship Between Embryological Development, Time of Conception, and Gestation by Charles M. Goss, Lee T. Popejoy, II, John L. Fusiler, and Tom M. Smith; Physical Growth and Dental Eruption in Captive-bred Squirrel Monkeys, Saimiri sciureus (Letica, Colombia) by James O. Long and Robert W. Cooper; Mother-infant Relations and Early Behavioral Development in the Squirrel Monkey by Leonard A. Rosenblum; Social Communication in the Squirrel Monkey by Peter Winter; The Learning and Sensory Capacities of the Squirrel Monkey in Phylogenetic Perspective by Duane M. Rumbaugh; Brain Mechanisms in the Behavior of the Squirrel Monkey by Lawrence R. Pinneo; The Squirrel Monkey in Aerospace Medical Research by Dietrich E. Beischer; Use of the Squirrel Monkey in Pharmacology by Harley M. Hanson; The Laboratory Care and Clinical Management of Saimiri (Squirrel Monkeys) by C. Max Lang; and Base-line Blood Determinations of the Squirrel Monkey by Albert E. New.

Current veterinary therapy. III. Small animal practice. Kirk, R. W. (Ed.) Philadelphia: W. B. Saunders Company, 1968.

Contents include: Handling Monkeys by R. B. Altman; Care and Feeding of Monkeys by D. Barsky; Tuberculin Testing of Monkeys by C. P. Gandal; and the following chapters by J. H. Vickers: Osteomalacia and Rickets in Monkeys;

---

*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.

Gastrointestinal Diseases of Primates; Primate Pediatrics; Respiratory Diseases of Primates; and Surgical Techniques for Monkeys.

Disease

Occurrence of *Athesmia* sp. in the cinnamon ringtail monkey, *Cebus albifrons*. Ewing, S. A., Helland, D. R., Anthony, H. D., & Leipold, H. W. (Dept. Vet. Sci., Mississippi State University State College, Mississippi 39762) *Laboratory Animal Care*, 1968, *18*, 488-492.

Athesmia sp., probably *A. foxi*, is reported from 2 cinnamon ringtail monkeys, *Cebus albifrons*, which died soon after reaching a Kansas State University research laboratory. It is not known to what extent the liver flukes contributed to diseases in these monkeys.

Trematode (*Athesmia foxi*) infection in two squirrel monkeys (*Saimiri sciureus*). Bostrom, R. E., & Slaughter, L. J. (Vet. Pathol. Branch, Med. Res. Lab., Edgewood Arsenal, Md. 21010) *Laboratory Animal Care*, 1968, *18*, 493-495.

Athesmia foxi infection was an incidental finding in the liver of 2 squirrel monkeys (*Saimiri sciureus*). These organisms may be missed on routine gross examination because they are extremely small and do not produce grossly visible lesions. The microscopic lesions consisted of cholangectasia, partial biliary obstruction, and biliary stasis of the bile canaliculi.

Balanitis, paronychia, and onychia in a rhesus monkey. Kerber, W. T., Reese, W. H., & Van Natta, J. (Sinclair Comparative Med. Res. Farm, U. Missouri, Columbia, Mo.) *Laboratory Animal Care*, 1968, *18*, 506-507.

The occurrence of balanitis, paronychia, and onychia in a rhesus monkey (*Macaca mulatta*) is described. The monkey spent considerable time manipulating the penis with the right hand, and the infection may have been transmitted from the penis to the hand (or vice versa) in this manner. Candida albicans was isolated from the lesions and thought to be of etiological significance.

Physiology and Behavior

Aggressive interactions of captive chimpanzees living in a semi-free-ranging environment. Wilson, W. L., & Wilson, C. C. (Dept. Psychology, Univ. Washington, Seattle, Wash. 98105) Tech. Rep. No. ARL-TR-68-9, 6571st Aeromedical Research Laboratory, Holloman Air Force Base, New Mexico, 1968.

Captive chimpanzees living in a 30-acre desert environment were observed for 2-1/2 mo. during the summer of

1967. Postures, gestures, facial expressions, and to some degree vocalizations, as related to threat, attack, submission, and appeasement were identified and are described in this paper. The occurrence of protection and the use of sticks and rocks is also discussed. A preliminary study was conducted to determine the frequency of aggression and which animals were most often aggressors and/or victims of attack. It was found that threatening and attacking animals generally have a closed, tight-lipped mouth or open mouth with teeth but not gums showing. Brows are down, eyes are wide open, the body is stiff and straight, and vocalizations are frequently absent. In contrast, victims usually have the corners of the mouth drawn back exposing teeth and gums, have brows up, vocalize frequently, and assume a body posture which is crouched and low to the ground. The preliminary study revealed that aggression appears to be much more common in this captive situation than in the natural habitat. Possible reasons for this increase in aggression are suggested: Feeding procedure, population density, sex and age composition of the population, atypical early experiences, and the nature of the physical environment.

Facilities, Care, and Breeding

Laboratory observations on a prosimian primate (Galago senegalensis). Holmes, K.R., Haines, D. E., & Bollert, J. A. (Dept. Anatomy, Michigan State U., East Lansing, Michigan 48823) Laboratory Animal Care, 1968, 18, 475-477.

A colony of Galago senegalensis has been established in the Department of Anatomy of Michigan State University. Groups of 3 animals (2 females and 1 male) are housed in cages which measure 17 by 45 by 14 in. high, providing approximately 3,500 cubic inches per animal. The diet consists of monkey chow, banana, and Methiscol® as a supplement. The light cycle has been adjusted so that the animals' active period occurs during laboratory working hours. A closed circuit television system is used for periodic nocturnal observations.

Ecology, Field Studies, and Taxonomy

Population trends of rhesus monkeys in villages and towns of northern India, 1959-65. Southwick, C. H., & Siddiqi, M. R. (Dept. Pathol., Johns Hopkins Univer., Baltimore, Md.) Journal of Animal Ecology, 1968, 37, 199-204.

Data are presented that suggest a recent tendency for rhesus populations of northern India to decrease in rural areas and to increase in towns and larger human communities.

Instruments and Techniques

A device and technique for the atraumatic handling of the subhuman primate. Nahon, N. S. (Lab. Anim. Care, U. Pennsylvania, Sch. Vet. Med., Interdisciplinary Cancer Res. Unit, Philadelphia, Pa. 19104) Laboratory Animal Care, 1968, 18, 486-487.

A simplified and humane method for catching and handling laboratory primates is described. Animals are conditioned to come to the handler for a food reward and are caught and handled by a snare device which attaches to a steel ring fixed to the primate's collar. Experience in the daily handling of large numbers of pig-tailed macaques (Macaca nemistrina) used in drug evaluation has shown the method to be less time-consuming and traumatic than the use of nets or collars and chains.

Large animal urine/feces separator. Smith, R. E., Wekstein, D. R., Freeman, J. A., & Moyer, R. E. (Dept. Physiol., Sch. Med., U. Calif., Davis, Calif. 95616) Laboratory Animal Care, 1968, 18, 496-499.

An inexpensive 3-piece urine/feces separator has been developed which is suitable for long-term studies in large animals. The separator has proven effective in minimizing contamination of urine samples by fecal material, may be used without cleaning or other attention for extended periods of time, and is quite simple to fabricate.

Booklets, Pamphlets, Catalogues

Animals for research (7th ed.) Washington, D. C.: National Academy of Sciences (Publication No. 1678), 1968.

A directory of sources of laboratory animals, tissues, fluids, organs, equipment, and materials. Prepared under the auspices of the Institute of Laboratory Animal Resources. Can be purchased at a cost of $3.25 from the Printing and Publishing Office, National Academy of Sciences--National Research Council, 2101 Constitution Ave., Washington, D. C. 20418.

ADDRESS CHANGES

Larry J. Ackerman
890 Ursula St.
Aurora, Colo. 80010

Jacques Bert
60 Avenue Cantini
13--Marseille 6
France

Robert G. Braun
1708 Winne Drive
Manhattan, Kansas 66502

C. R. Coid
Clinical Res Cen Labs
Nat. Inst. Med. Res.
Mill Hill,
London, N.W.7, England

Russell L. De Valois
Tolman Hall
Univ. California
Berkeley, Calif. 94720

William Bruce Douglas
Apt. 216, Riverside Apts.
1725 E. Limberlast Dr.
Tucson, Arizona 85719

Richard E. Doyle
M154 Med. Science Bldg.
Columbia, Mo. 65201

James R. Eltringham
Dept. Radiology
Stanford University
Sch. of Med.
Palo Alto, Calif. 94304

Richard Fiennes
Delta Reg. Primate Res. Cen.
Tulane University
Covington, La. 70433

Kenneth F. Green
Psychology
Cal. State Coll.
Long Beach, Calif. 90801

Norman B. Guilloud
Lab. Anim. Program
Inst. Comparative Med.
University of Georgia
Athens, Ga. 30601

Thomas C. Hutchinson
Dept. Anthropology
Univ. of Missouri
Columbia, Mo. 65201

I. Charles Kaufman
Univ. of Colorado
Medical Center
4200 East Ninth Avenue
Denver, Colorado 80220

Robert N. Lanson
Psychology Dept.
Queens College
Flushing, N. Y. 11367

Robert L. Miller
7719 Random Run Lane
Apt. 203
Falls Church, Va. 22042

Lawrence G. Sharpe
Dept. of Psychiatry
Washington Univ.
Sch. of Medicine
St. Louis, Mo. 63110

Curt R. Schneider
800 N. Dixboro Road
Ann Arbor, Mich. 48105

Jean Scholler
Comp. Pharmacology Lab.
Balcones Research Center
University of Texas
Austin, Texas 87856

Joyce E. Shriver
Dept. Anatomy
Mount Sinai Sch. Med.
Fifth Ave. & 100th St.
New York, New York 10029

Joseph B. Sidowski
Regional Primate
Research Center
University of Wisconsin
Madison, Wisconsin 53715

Andrew J. Stynes
Dept. Psychiatry
U. Colorado Med. Cen.
4200 East Ninth Ave.
Denver, Colorado 80220

Roger Stretch
Department of Psychology
Middlesex College
Univ. Western Ontario
London, Canada