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POLICY STATEMENT

The purpose of the *Newsletter* is to provide a central source of information about nonhuman primates and related matters, which will be of use both to the community of scientists who use these animals in their research and to those persons whose work supports such research. Accordingly, the *Newsletter* (1) provides information on care, breeding, and procurement of nonhuman primates for laboratory research, (2) disseminates general information and news about the world of primate research (such as announcements of meetings, research projects, sources of information, nomenclature changes), (3) helps meet the special research needs of individual investigators by publishing requests for research material or for information related to specific research problems, and (4) serves the cause of conservation of nonhuman primates by publishing information on that topic. As a rule, the only research articles or summaries that will be accepted for the *Newsletter* are those that have some practical implications or that provide general information likely to be of interest to investigators in a variety of areas of primate research. However, special consideration will be given to articles containing data on primates not conveniently publishable elsewhere. General descriptions of current research projects on primates will also be welcome.

The *Newsletter* appears quarterly and is intended primarily for persons doing research with nonhuman primates. Back issues may be purchased for $2.00 each. (Please make checks payable to Brown University.)

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

PREPARATION OF ARTICLES FOR THE *NEWSLETTER*.--Articles and notes should be submitted in duplicate and all copy should be double spaced. Articles in the References section should be referred to in the text by author(s) and date of publication, as for example: Smith (1960) or (Smith & Jones, 1962). Names of journals should be spelled out completely in the References section. Technical names of monkeys should be indicated at least once in each note and article. In general, to avoid inconsistencies within the *NEWSLETTER* (see Editor's Notes, July, 1966 issue), the scientific names used will be those of Napier and Napier [*A Handbook of Living Primates*. New York: Academic Press, 1967]. For an introduction to and review of primate nomenclature see the chapter by Maryeva Terry in A. M. Schrier (Ed.), *Behavioral Primatology: Advances in Research and Theory* (Vol. 1). Hillsdale, NJ: Lawrence Erlbaum Associates, 1977.

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The cover photograph is of a gray gibbon (*Hylobates moloch*)
and is used with the permission of the San Diego Zoo.

Managing Editor: Helen Janis Shuman

CONTENTS

USE OF VAGINAL CYTOLOGY DURING THE MENSTRUAL CYCLE OF LANGUR MONKEYS (*PRESBYTIS ENTELLUS ENTELLUS*)

Kamala Gopalkrishnan, S. Jayaraman, K. S. Hurkadli, and S. S. Rao

Institute for Research in Reproduction

*Some aspects of the menstrual physiology of six adult female langur monkeys (*Presbytis entellus entellus*) were studied over 30 cycles. The menstrual cycle length varied between 21-26 days. Analysis of vaginal temperature, pH, cellular pattern, and cytology during the different phases of the menstrual cycles suggested that these measures, when taken together, can predict occurrence of ovulation, which usually occurs between Days 9-10 of the cycle. Since there is little visible menstrual bleeding in a good percentage of the cycles, use of the measures reported here may provide a simple method for delineating different phases of the menstrual cycle.*

The utilization of primates in biomedical research depends on the proper understanding of their physiological functions under caged conditions. The difficulty of predicting accurately the time of ovulation and of recognizing characteristic changes during the menstrual cycle has severely limited research on reproductive studies in nonhuman primates. The most direct and accurate method for determining ovulation is observation of the ovaries during laparotomy. Several other methods for diagnosis have been attempted which were confirmed by actual recovery of eggs from the genital tract (Betteridge et al., 1970; Hartman, 1939). Several indirect methods and measures have been employed to detect ovulation. These include vaginal cytology (Blakley, 1968; De Allende et al., 1945; Hutchinson, 1970), qualitative and quantitative cervical mucus changes (David & Mastroianni, 1968; Erikson, 1960), sex skin changes in coloration and swelling (Erikson, 1963; Kuehn et al., 1965; Zuckerman, 1937), hormonal studies of blood and urine (Blakley, 1969; Lasley et al., 1974; Ramaswamy, 1975; Shandilya et al., 1976), rectal bimanual palpation of ovaries (Hartman, 1937, 1939; Mahoney, 1970), and vaginal lavage sedimentation (Corner, 1923; Erikson, 1961). Several investigators have described the cyclic changes of endocervical mucus as related to the menstrual cycle. Reports are available in the human female regarding the chemical and physical alteration of endocervical mucus peculiar to a particular phase of the menstrual cycle (Compos Da Paz, 1951; Pommerenke, 1946; Urdan & Kurson, 1955). When taken individually, all these approaches for the detection of ovulation have produced inconclusive results.

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This report describes aspects of the menstrual physiology of langur monkeys studied as part of an investigation of the utility of this species as a model for studying human reproduction.

Materials and Methods

Six adult female langurs, individually housed in open wire cages, were used in this study. The monkeys were fed on monkey pelleted diets (Hindustan-Lever) supplemented with fresh vegetables, and kept at room temperature and natural daylight.

A waste trough under each cage was inspected daily for signs of blood. If blood was observed, the animal was examined to determine whether it was a result of vaginal bleeding or due to hemorrhage from trauma. The vaginal temperature, pH and cervical smears (both air dried and cytology smears) were taken daily for 5 to 6 menstrual cycles. In all, 30 cycles were studied.

Two vaginal smears were collected from each monkey every day by introducing a sterile swab into the vagina and the slough collected and spread on a prelabeled clean slide. One smear was allowed to air dry and the other was immediately dropped into a fixative of 1:1 alcohol ether and stained by Pastakia's (1955) modified method of Papanicolaou. The air dried smears were checked for their cellularity. The vaginal temperature was routinely recorded before smears were taken. A menstrual cycle was calculated from the first day of bleeding of one cycle to the onset of bleeding in the subsequent cycle. Moderate to scanty flow was sometimes observed on the first day with little or no observable bleeding thereafter. However, vaginal swabs were positive from Day 1 through Day 4. The cycle length was calculated accordingly.

As there is not much visible menstrual bleeding and very scanty visible mucus, unlike bonnet monkeys (*Macaca radiata*) (Ovadia et al., 1971), the air dried smears were studied for changes, if any, in the cellular pattern. The squamous and other types of cells present in the sample exhibited a form of polarity that with reduced illuminating light of the microscope, appear as black beads lying parallel to one another. A characteristic cellular pattern was noted in the follicular and secretory phases of the cycle. This was characterized as loose, compact and dense. The fixed smears were surveyed for abundance of well preserved cells and proper staining. The general cleanliness as well as the presence or the absence of red blood cells (RBC) and white blood cells (WBC) was noted. Then the smears were examined for individual types of cells.

Results

External bleeding was observed only in 50 to 60% of the cycles, and was maximal between 18-24 hr after the initiation of bleeding. In

a few of the animals, there were heavy bleeding episodes while, in a few others, visible external bleeding was never observed. In the latter cases, bleeding was observed only on the vaginal swabs. Only a little blood was observed on the swabs on the 3rd day, although in a lesser number of cycles, some was seen even on the 4th day.

The cycle length observed was between 21-26 days (Mode = 22) (Figure 1) with ovulation, as suggested by indirect measurements, occurring on the 9th or 10th day. There was a dip in the temperature around the 9th day (Figure 2). The mean peak temperature before the dip was compared with the mean temperature on the day of dip; similarly a comparison was made between the mean temperature on the day of the dip and the mean peak temperature after the dip. Tests of significance indicated that the difference in peak and dip temperatures were significant (t tests, $p < .05$) in almost all cases (Table 1). The vaginal pH values during different days of the menstrual cycle varied from 6.2-7.0. The pH values were inversely proportional to the temperature (Figure 3).

The cellular pattern during the menstrual phase exhibited many RBC and WBC, few squamous cells, mucus debris, and densely arranged vaginal epithelial cells (Figure 4a). This picture was found to be followed by a loose type of vaginal epithelial pattern predominating with few RBC and debris. During the ovulatory phase, a clean loosely structured epithelium was noted (Figure 4b). Later it became more closely packed (Figure 4c). This compact pattern became dense during the pre-menstrual period (Figure 4d). These characteristic changes could be utilized along with the dip in temperature and vaginal cytology to approximate the time of ovulation more precisely.

The cytology smears were classified according to the different phases of menstrual cycle and then the different types of cells were counted. The preovulatory and ovulatory smears were marked by an absence of leukocytes and by a clean background (Table 2). In the rest of the phases, leukocytes were present. During the postmenstrual phase, the squamous cells were compact with few leukocytes, RBC, and debris (Figure 5a). The preovulatory phase consisted mainly of squamous, intermediate and superficial cells, singly and in groups, followed by the ovulatory pattern characterized by a clean background upon which the cells, which have a halo around the nucleus, occur singly (Figure 5b). The postovulatory phase was marked by the presence of leukocytes (Figure 5c). This increase in number of leukocytes was seen as a dense cellular pattern in air dried smears (Figure 4a). With this picture one could predict with considerable accuracy that menstruation would occur within two days. This was found to be a very useful observation in calculating the cycle length. During the menstrual phase there were leukocytes, RBC, mucus, debris, and endocervical columnar cells (Figure 5d).

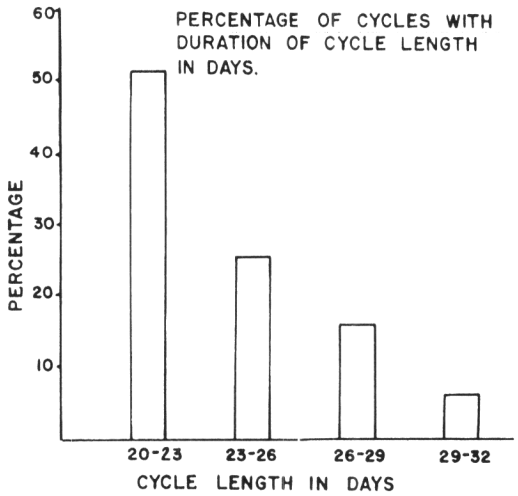

Fig. 1. The cycle length.

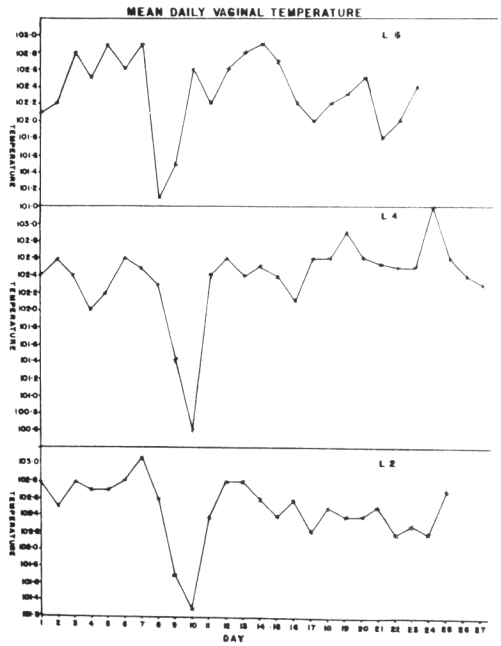

Fig. 2. The mean daily temperature in three different monkeys for six cycles.

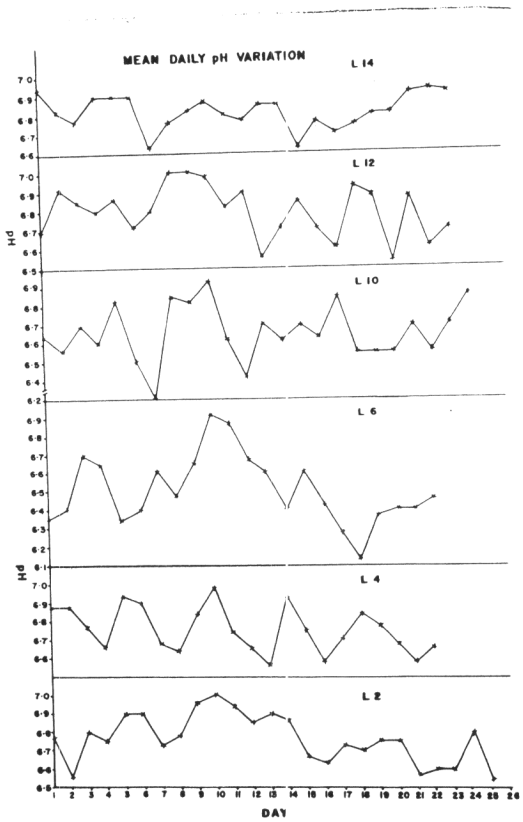

Fig. 3. The mean daily vaginal pH in different langur monkeys.

Table 1

Mean Temperature and Standard Deviation Before and After the Dip

Animal No.	Peak Day & Temperature Before the Dip		Lowest Temperature and Day of the Dip		Peak Day and Temperature After the Dip	
	day	temp	day	temp	day	temp
L2	7	103.1 (±0.76)	10	101.3 (±1.08)	12	102.8 (±0.40)
L4	6	102.6 (±0.10)	10	100.9 (±0.93)	12	102.6 (±0.25)
L6	7	102.9 (±0.48)	9	101.2* (±1.30)	14	102.9 (±0.42)
L10	5	103.0 (±1.74)	9	100.4* (±0.32)	12	103.0* (±0.71)
L12	5	103.3 (±0.43)	9	101.9 (±0.89)	14	103.1 (±0.53)
L14	5	103.7 (±0.30)	9	101.7 (±1.64)	12	103.8 (±0.25)
Mean		103.1		101.2		103.0

*Difference between asterisked value and preceding value is not statistically significant.

Table 2

Vaginal Cytology During Different Phases of the Menstrual Cycle

Phase of the Cycle	Day	Vaginal Cytology				
		Superficial	Intermediate	Parabasal	WBC	RBC
Menstrual	1-2	-	+	++	++	++
Post-menstrual	3-6	+	++	+	+	+
Pre-ovulatory	7-8	++	++	+	-	-
Ovulatory	9-10	++	++	-	-	-
Post-ovulatory	11-19	++	++	-	+	-
Pre-menstrual	20-	+	+++	-	+++	-

Discussion

The appearance of the vaginal epithelial cells and the physical characteristics found during the menstrual cycle of langur monkeys confirm and extend the findings of David and Ramaswamy (1971). The langur monkey does not show any skin changes corresponding to the phases of the menstrual cycle. The biochemistry and histology of the reproductive organs have been extensively studied by David and Ramaswamy (1971) and Ramaswamy (1975). The percent body weight of testis of langurs is similar to man unlike in the rhesus monkey. Further, in this species, estriol is the major urinary endproduct of estrogen metabolism during pregnancy as in the human female, and pregnanadiol is one of the major urinary metabolites of progesterone during pregnancy (Ramaswamy, 1975). Langurs have a straight cervical canal in contrast to that of rhesus monkeys (*Macaca mulatta*) and other macaques, in which the cervical canal is serpentine (Demmers et al., 1972). The fallopian tube of the langur is nontortuous as in humans, whereas it is tortuous in other nonhuman primates (Goldzieher et al., 1973). Thus, langurs might serve as very good models for testing of different contraceptives, especially the intrauterine devices. Once these animals start menstruating, the cycles are very regular with a difference of only a few day. In the present study 71.4% of the menstrual cycles ranged between 21-26 days with a mode of 22 days, which is in agreement with the report of David and Ramaswamy (1969).

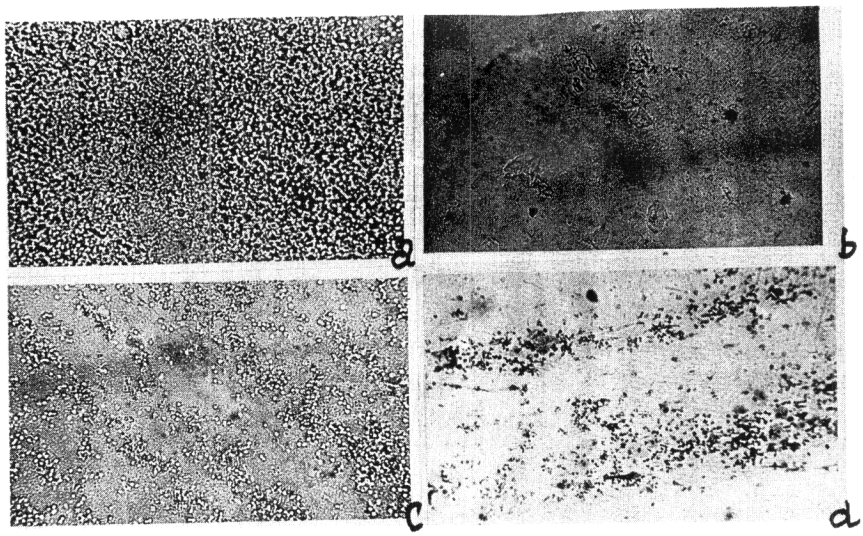

Fig. 4. a) Dense cellular pattern in air dried vaginal smears; b) loose cellular pattern in air dried vaginal smears; c) compact cellular pattern in air dried vaginal smears; d) compact--dense cellular pattern in air dried vaginal smears.

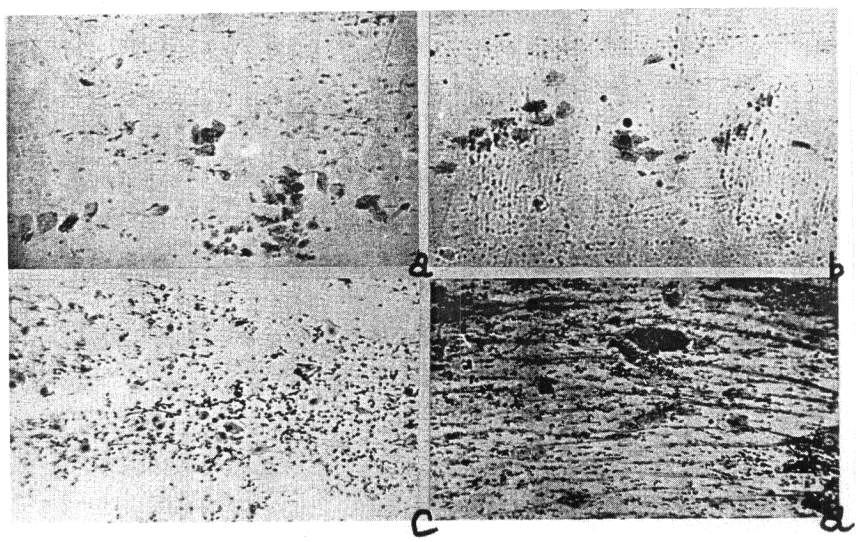

Fig. 5. a) Post menstrual smear (Papanicolaou's staining); b) ovulatory smear (Papanicolaou's staining); c) menstrual smear (Papanicolaou's staining); d) menstrual smear (Papanicolaou's staining).

We used the vaginal temperature, pH, cellular pattern, and vaginal cytology as parameters for ovulation. The dip in the temperature coincided with a loose type of cellular pattern on Day 9. The dip on the 9th day and the subsequent peak was also reported by David and Ramaswamy (1969). In the human female, a dip in the basal temperature is noted a day or two after ovulation (Austin, 1972) and then there is a rise. It has been reported that a small rise in basal temperature, known as the "thermogenic response," is caused by corpus leuteal progesterone (Urdan & Kurson, 1955). In the present study, the vaginal pH reached a maximum at mid-cycle, as has also been reported by Moghissi et al. (1972) for humans. The characteristic pattern of vaginal cytology with the presence of superficial squamous cells and clean background without leukocytes will be indicative of the time of ovulation. As in human females, the superficial and intermediate cells were found to occur singly without clumping.

Due to these unvarying physical and cellular characteristics, it appears that the study of cervical mucosa will provide a simple and an accurate method for determination of different phases of the menstrual cycle.

Summary

Thirty menstrual cycles were studied in six langur monkeys. The relationship between the vaginal temperature, pH, vaginal cellular pattern and vaginal cytology during the different phases of menstrual cycle were investigated. The cycle length varied between 21-26 days with a mode of 22 days. A dip in the vaginal temperature was observed on day 9-10 which correlated well with other parameters. The vaginal pH varied between 6.2 and 7.0 during the different phases of the cycle and there was a definite inverse relationship between the vaginal temperature and the pH. The loose vaginal cellular pattern observed at the time of ovulation was replaced by compact cellular pattern which persisted until premenstruation. Prior to menstruation a dense cellular pattern was observed. With this dense pattern the next menstruation could be predicted accurately. Thus, it can be concluded that the degree and intensity of vaginal cellularity can be used to predict stages of the menstrual cycle.

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* * *

WORKSHOP ON APE INFERTILITY

There is growing concern about sterility in captive male gorillas and chimpanzees. The Interagency Primate Steering Committee of the National Institutes of Health, the Chicago Zoological Society and the Zoological Society of the Milwaukee County Zoo will sponsor a workshop on infertility in male great apes at the Terrace Garden Hotel in Atlanta, Georgia from Sunday 23 November through Tuesday 25 November, 1980. The Yerkes Regional Primate Research Center of Emory University is making most of the logistical arrangements in Atlanta. For details, contact Dr. Benjamin B. Beck, Chicago Zoological Park, Brookfield, IL 60513; 312-485-0263 X70.

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PRIMATOLOGISTS IN CENTRAL EUROPE PLAN SOCIETY

At the VIIIth Congress of the International Primatological Society in Florence in July, 1980 a committee was formed for the founding of a *Gesellschaft für Primatologie*. The organization is to serve the regional interests of all primatologists in central Europe. German will be the language used. It is planned to affiliate with the International Primatological Society (IPS). Present members of the IPS of the region may then avoid the relatively high individual bank draft fees in transmitting membership dues by having them transferred collectively. Group air fares for members attending the International Congresses may provide further advantages. An organizational meeting is planned for early in 1981 to be followed by a meeting with a more formal program in the subsequent summer. For details write to: H. S. Robert Glaser, Justus Liebig Universität, Karl-Glöckner-Str. 210C, Biol, D-6300 Giessen, West Germany.

* * *

SOURCES SOUGHT BY FDA TO ESTABLISH AND MAINTAIN MARMOSET BREEDING COLONY

The purpose of this program is to establish and maintain a colony of breeding marmosets, the predominant species being that of *Saguinus labiatus* with smaller numbers of *S. mystax*. The colony shall contain approximately 200-300 pairs of breeding animals which shall be provided by the government. The potential contractor shall be responsible for providing appropriate housing and technical staff to manage the colony. It is anticipated that the production capacity of this colony shall be approximately 150-160 newborns per year.

Respondents to this announcement will be evaluated in accordance with the following criteria which are listed in descending order of importance: (1) Breeding experience as documented through scientific publication and/or operation of a breeding colony of marmosets. (2) Commitment to a program of marmoset breeding by on-site facilities necessary to accommodate 200-300 pairs of marmosets with offspring. (3) Demonstrate an awareness of the epidemiological considerations needed to protect the colony against infection and disease transmission within the breeding colony.

Organizations having demonstrated experience in the specific areas mentioned above are invited to submit a concise and complete resume describing, (1) organization background and expertise, and (2) qualifications and experience of the proposed personnel who might be assigned to such project(s). Unnecessarily elaborate brochures or other presentations of a general nature beyond that sufficient to provide the information called for herein are neither required nor desired. This synopsis is not a request for proposal.

Responses must be submitted in four (4) copies. The government does not intend to award a contract on the basis of this request for sources, or to otherwise pay for the information solicited.

Responses should be directed to the Food and Drug Administration, Negotiated Contracts Branch, Attention: Frank P. Lawton, HFA-512, 5600 Fishers Lane, Room 12A-17, Rockville, MD 20857.

* * *

"I BET YOU THOUGHT I COULDN'T FIT IN HERE!"

NEWS BRIEFS

California Primate Center Director Named

Dr. Charles E. Cornelius, dean of the College of Veterinary Medicine at the University of Florida, has been named director of the California Primate Research Center, at the University of California, Davis. The appointment is effective October 1, 1980. The Center, one of the seven primate research centers supported by the Division of Research Resources of NIH, is currently engaged in studying the effects of environmental factors in nonhuman primates, perinatal biology and reproduction, respiratory diseases, infectious diseases and immunology, and behavioral biology. A native of Huntington Park, California, Cornelius is a DVM and also has a doctorate in comparative pathology, both obtained at the University of California at Davis. He was a post-doctoral NIH Fellow in gastroenterology at Albert Einstein College of Medicine. His main research interests are in liver physiology and pathology, and metabolic diseases. He has authored or co-authored more than 120 scientific papers pertaining to studies in organic anion transport by liver; choleresis; comparative mechanisms of jaundice; and the use of animal models to study human disorders.

Gorilla World Opens at San Francisco Zoo

This new exhibit consists of over one-half acre of area with live trees, stream, waterfalls, rock work and Kikuyu grass. Eight separate public viewing areas allow the public to view the animals from different angles, including one section where the glass window allows the zoo visitor to come within inches of the animals. The Zoo's five gorillas were moved on July 26, 1980 to the new exhibit. The exhibit is designed to hold twelve animals comfortably. There is an off-exhibit holding unit where the animals can be housed individually or as a group.

REVISED DIRECTORY OF GRADUATE PROGRAMS IN PRIMATOLOGY AND PRIMATE RESEARCH ISSUED

The new *Directory* has been issued as a Supplement to the October, 1980 issue of the *Laboratory Primate Newsletter* and has been mailed with that issue. Undergraduates may obtain single copies free of charge by writing to the *Newsletter*.

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

BOOKS

Non-Human Primate Models for Study of Human Reproduction. T. C. Anand Kumar (Ed.). Basel: Karger, 1980. Soft cover. 232 pp. [Price: DM 107. Approx. $53.00].

The proceedings of a Satellite Symposium to the VIIth Congress of the International Primatological Society, Bangalore, India, January, 1979. Contents: Husbandry. Breeding husbandry of captive Japanese monkeys, by K. Oshima; Breeding of bonnet macaques in captivity in India, by S. R. Munshi; Husbandry and breeding of bonnet monkeys (*Macaca radiata*), by B. R. Srinath. Biology of Reproduction. Hormonal regulation of puberty in the rhesus monkey, *Macaca mulatta*, by M. Arslan, P. Zaidi, A. A. Zaidi, F. B. Akhtar, & M. H. Qazi; Reproductive profile of the rhesus monkey with reference to the testing of contraceptives, by T. C. Anand Kumar, G. F. X. David, D. N. Sharma, C. P. Puri, V. Puri, A. K. Dubey, A. Sehgal, A. Sankaranarayanan, & J. S. Pruthi; Reproductive endocrinology of bonnet monkeys, by G. S. R. C. Murty, K. Ramasharma, V. R. Mukku, B. R. Srinath, & N. R. Moudgal; Hormonal changes during the menstrual cycles in the crab eating monkey, *Macaca fascicularis*, by P. Varavudhi & V. Yodyingyuad; Reproductive biology of the owl monkey, *Aotus trivirgatus griseimembra*, by A. F. Dixson, R. D. Martin, R. C. Bonney, & D. Fleming. Endocrine and morphological aspects of the menstrual cycle in the cebus monkey (*Cebus apella*), by C. A. Nagle, J. H. Denari, A. Riarte, S. Quiroga, R. Zárate, N. I. Germino, A. Merlo, & J. M. Rosner; Progesterone secretion by the ovary and placenta during pregnancy in the marmoset monkey, *Callithrix jacchus*, by J. P. Hearn & P. C. Chambers; Follicular maturation, ovulation, tubal transport and fertilization in primates, by W. R. Dukelow; Implantation in nonhuman primates: I. A comparison of morphological events, by A. C. Enders & A. G. Hendrickx; Implantation in nonhuman primates: II. Endocrinology, by A. G. Hendrickx & A. C. Enders; Morphology of the monkey testis: Comparison with human and with lower mammalian species, by M. Dym; Ultrastructure of the epididymis in the rhesus monkey, by A. Prakash, T. C. Anand Kumar, & M. R. N. Prasad; Testicular and adrenal steroids

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In many cases, the original source of reference in this section has been the Current Primate References prepared by The Primate Information Center, Regional Primate Research Center SJ-50, University of Washington, Seattle, WA 98195. Because of this excellent source of references, the present section is devoted primarily to presentation of abstracts of articles of practical or of general interest. In most cases, abstracts are those of the authors. Any author wishing to have a published paper abstracted in this section may do so by sending the Editor a copy of the reprint with a summary or abstract and indicating his desire on the reprint.

in the adult rhesus monkey, by E. Nieschlag & E. J. Wickings; Behavioural and neuroendocrine factors regulating prolactin and LH discharges in monkeys, by S. Hansen, E. B. Keverne, N. D. Martensz, & J. Herbert; Breeding chimpanzees for biomedical research: A 9-year evaluation, by C. J. Mahoney. Testing Contraceptives. Testing nasal spray contraceptives in the rhesus monkey, by T. C. Anand Kumar, G. F. X. David, V. Puri, & A. Sehgal; Effect of immunization against follicle stimulating hormone on spermatogenesis in the rat and the monkey, by H. G. Madhwa Raj, M. R. Sairam, M. Dym, N. Kotite, F. S. French, C. Sloan, & R. Chen Dy; Immunization against hCG: Efficacy and teratological studies on baboons, by G. P. Talwar, C. Das, A. Tandon, M. G. Sharma, M. Salahuddin, & S. K. Dubey; A nonhuman primate model to study the efficacy of testicular inhibin preparations in suppressing circulating FSH levels, by H. M. Shashidhara Murthy, K. Ramasharma, & N. R. Moudgal; Effects of 6-chloro 6-deoxyglucose (6C6D) on the fertility and libido of male marmoset monkeys, by J. P. Hearn; Nonhuman primates as models for evaluation of fertility regulating agents--Antiandrogens, by M. R. N. Prasad; Toxicological models for testing chemical fertility regulating agents, by R. Heywood & R. W. James.

The Use of Nonhuman Primates in Cardiovascular Diseases. S. S. Kalter (Ed.). Austin: University of Texas Press, 1980. 473 pp. [Price: $35.00]

This volume presents papers given at a symposium sponsored by the Southwest Foundation for Research and Education and held during February, 1979. Contents: Opening Session. Remarks on primate supply, by C. McPherson; Perspectives on cardiovascular research in primates, by R. W. Wissler. Session 1. Comparative atherosclerosis in nonhuman primates, by T. B. Clarkson; Plasma lipoproteins in atherogenesis in nonhuman primates, by L. L. Rudel; Naturally occurring and experimentally induced atherosclerosis in nonhuman primates, by M. L. Armstrong, A. Trillo, & R. W. Prichard. Session 2. Blood vessel interactions in nonhuman primates, by C. J. Schwartz; The fine structure of coronary artery atherosclerosis in nonhuman primates and man, by H. C. Stary; Homocystinemic and hyperlipidemic primate models of chronic vascular disease, by L. A. Harker; Studies on the cellular mechanisms of the increased atherogenicity of low density lipoproteins from nonhuman primates with diet-induced hypercholesterolemia, by R. W. St. Clair & J. J. Mitschelen. Session 3. Nonhuman primates as surrogates evaluating preventive and therapeutic regimens, by O. A. Smith, Jr.; Regression of atherosclerosis in nonhuman primates--An overview, by M. R. Malinow; Antihypertensive drugs, by R. Pick; Evaluation of basal blood pressure in African green monkeys, by E. T. Angelakos; Factors affecting plasma carnitine and cholesterol in nonhuman primates, by F. P. Bell; Occurrence of cardiac arrhythmias during Pavlovian conditioning in *Macaca mulatta*, by D. C. Randall; Altered myocardial function and collagen in diabetic rhesus monkeys on atherogenic diet, by T. J. Regan, B. Haider, H. A. Oldewurtel, &

M. M. Lyons; Effect of cortisol on the development of atherosclerosis in cynomolgus monkeys, by E. A. Sprague, R. G. Troxler, D. F. Peterson, R. E. Schmidt, & J. T. Young; Influence of mild excesses of vitamin D_3 on arterial wall and its role in arteriosclerosis, by C. B. Taylor, S. K. Peng, P. Tham, & B. Mikkelson. Session 4. New models of cardiovascular disease and related factors with nonhuman primates, by C. McPherson; Behavioral patterns and stress in the etiology of cardiovascular disease, by J. V. Brady & A. H. Harris; The baboon as a model for cigarette smoking, by H. C. McGill, Jr. & W. R. Rogers; Hemodynamics of arterial hypertension in cynomolgus monkeys, by J. A. Herd, P. A. Low, R. F. Rodger, & L. H. Hartley; Obesity development, Aging, by E. J. Masoro; Stress-induced cardiomyopathy in squirrel monkey, by K. C. Corley, F. O'M. Shiel, & H. P. Mauck; The use of baboons in lipid pharmacology, by A. N. Howard, R. Zschocke, R. Löser, & G. Hofrichter; Biomedical implications of behavioral variability in old world monkeys, by J. R. Kaplan; Enterovirus infection and dietary hypercholesteremia in cardiovascular disease, by R. M. Loria & G. E. Madge; Human diseases needing models, by M. J. Jesse; How might immunogenetics relate to cardiovascular disease: by W. H. Stone; Streptococcal infections and the heart in nonhuman primates (with a comparative note on household pets), by A. Taranta; Symposium summary, by T. B. Clarkson.

Evolutionary History of the Primates. Frederick S. Szalay & Eric Delson. New York: Academic Press, 1980. 580 pp. [Price: $43.]

A documentation and analysis of the fossil record and evolutionary history of the primates. The authors' aim is to present as much information as possible in one volume on the fossils, on primary systematic hypotheses and their tests by known facts. This book does not attempt to treat the background subjects necessary for a full appreciation of the text. Therefore, some acquaintance with evolutionary biology, methods of systematics, particularly methods of phylogenetic inference, as well as basic mammalian morphology may be necessary. To partially compensate for this approach a glossary is included in which certain technical terms that may not be within the everyday usage of all scholars are defined.

Social Behaviour in Primates. Neil Chalmers. Baltimore: University Park Press, 1980. Soft cover. 256 pp. [Price: $19.95]

An introduction to primate social behavior. The aim of the author is to present the major ideas stemming from work on social behavior of these animals rather than to present a comprehensive review of the data on this topic. Contents: Preliminaries. Primate groups: Size, composition and use of space. The social structure of primate groups. Infant development. Sexual behaviour. Dominance and subordinacy. The adaptiveness of primate social behaviour. Social behaviour in man and non-human primates.

Baboon Mothers and Infants. Jeanne Altmann. Cambridge, MA: Harvard

University Press, 1980. 242 pp. [Price: $17.50]

This book presents some of the data and theory stemming from the author's participation in the long-term field project at the Amboseli National Park in Kenya. Contents: Introduction. Baboons and their habitat. Methods. Demography: Births, deaths, and interbirth intervals. Ecology and maternal time budgets. Social milieu. Maternal care in the postnatal period. Infant development and mother-infant spatial relationships. Weaning and infant independence. Conclusions and speculations. Appendix 1. Maternal genealogies in Alto's group. Appendix 2. Selective case history descriptions of all mother-infant dyads with emphasis on adult male and kin associations. Appendix 3. Selective case history descriptions of all adult males. Appendix 4. Behaviors recorded in this study and analyzed in the text. Appendix 5. Residuals from linear regression of daily time infants spent in contact with their mothers at each age.

Orang-Utan Behavior. Terry L. Maple. New York: Van Nostrand Reinhold, 1980. 268 pp. [Price: $25]

This volume presents results of research on organutans in the field, laboratory, and zoo. Reflecting an applied orientation, there is an emphasis on problems of captive management, husbandry, and conservation. Contents: 1. Orang-utan in its natural habitat. 2. General behavior of orang-utan. 3. Expression and emotion in orang-utan. 4. Orang-utan sexuality. 5. Birth and parental behavior. 6. Intellect of the orang-utan. 7. The captive habitat. 8. Conservation of the orang-utan. 9. Epilogue: Does the orang-utan have a future?

Bibliographies

Field research on Japanese monkeys: An historical, geographical, and bibliographical listing. Baldwin, L. A., Koyama, N., & Teleki, G. (303 Special Services Bldg., Penn. State U., Univ. Park, PA 16802) *Primates,* 1980, *21*, 268-301

This eighth report in a series covering field research on the ethology and ecology of nonhuman primates includes all field surveys and studies conducted on Japanese macaques (*Macaca fuscata*) over the past 30 years. Other species of macaques in Asia and north Africa will be covered in a forthcoming report, the final one of the series.

Biological aspects of circadian rhythms in nonhuman primates: A bibliography. Benella Caminiti. Seattle: Primate Information Center, 1980. [Price: $6.00. Send orders to: Primate Information Center, Regional Primate Research Center (SJ-50), University of Washington, Seattle, WA 98195]

Disease

Macaca mulatta--A new host for *Choanotaenia cestodes.* Jones, N. D.,

Brooks, D. R., & Harris, R. L. (Dept. of Comp. Med., Bowman Gray Sch. of Med. of Wake Forest Univ., Winston-Salem, NC 27103) *Laboratory Animal Science*, 1980, *30*, 575-577.

A juvenile *Macaca mulatta* that died following a peracute illness was found to be harboring about 25 mature *Chaonotaenia infundibulum* tapeworms. These cestodes commonly infest birds, occasionally insectivores, and rodents but have never been reported in nonhuman primates.

Isolation and characterization of a cytomegalovirus from the salivary gland of a squirrel monkey (*Saimiri sciureus*), Rangan, S. R. S., & Chaiban, J. (Dept. of Microbiol., Delta Reg. Prim. Res. Ctr., Tulane Univ., Covington, LA 70433) *Laboratory Animal Science*, 1980, *30*, 532-540.

Cytomegaloviruses, a subgroup of the family *Herpetoviridae*, have been reported in rhesus monkeys (*Macaca mulatta*), African green monkeys (*Cercopithecus aethiops*), an owl monkey (*Aotus trivirgatus*), and marmosets (*Saguinus fuscicollis*). Suggestive evidence for cytomegalovirus infection in capuchin monkeys (*Cebus fatuellus*) and chimpanzees (*Pan troglodytes*) has also been documented. This report describes *in vitro* isolation of a herpesvirus with the characteristic properties of cytomegaloviruses from the salivary gland tissue of a squirrel monkey (*Saimiri sciureus*).

Hepatitis A and B: Serologic survey of human and nonhuman primate sera. Eichberg, J. W., & Kalter, S. S. (Dept. of Microbiol. & Infect. Dis., Southwest Found. for Res. & Ed., PO Box 28147, San Antonio, TX 78284) *Laboratory Animal Science*, 1980, *30*, 541-543.

Sera of humans and seven species of nonhuman primates were tested by radioimmunoassay and enzyme immunoassay for the presence of hepatitis A antibody, hepatitis B surface antigen and antibody to hepatitis B surface antigen. The outcome of testing a total of 276 serum or plasma specimens was as follows: with the exception of squirrel monkeys (0%) and cotton-top marmosets (0%), a considerable percentage of all other species tested had detectable antibodies to hepatitis A virus: humans 45.9%, chimpanzees 36.6%, baboons 38.2%, vervets 57.9%, cebus monkeys 40.0% and common marmosets 50.0%. Only one human and two chimpanzees were carriers of hepatitis B surface antigen. Antibodies to hepatitis B surface antigen were detected in humans (11.3%), chimpanzees (29.9%), baboons (36.2%) and squirrel monkeys (5%). Chimpanzees showed an increasing prevalence of antibodies to hepatitis A virus and hepatitis B surface antigen with age.

Breeding

Reduction of mortality due to fighting in a colony of rhesus monkeys (*Macaca mulatta*). Kaplan, J. R., Manning, P., & Zucker, E. (Dept. of Comp. Med., Bowman Gray Sch. of Med. of Wake Forest Univ., Winston-Salem, NC 27103) *Laboratory Animal Science*, 1980, *30*, 565-570.

Mortality resulting from fighting in a breeding colony of rhesus monkeys living in groups was an important management problem. An attempt was made to understand the causes of such fighting and reduce it. It was found that the cause of the fighting was the social disruption resulting from a breeding protocol which required the regular removal of pregnant animals from groups and introduction of nonpregnant females. The basic protocol was not changed; however, social disruption was minimized, and a reduction in mortality was accomplished through alteration of group formation procedures, pregnancy palpation procedures and group composition.

Establishment of a cynomolgus monkey (*Macaca fascicularis*) breeding colony in Malaysia: A feasibility study. Werner, R. M., Montrey, R. D., Roberts, C. R., Chin Thiam Tsoy, A., & Huxsoll, D. L. (Commander, US Army Med. Res. Unit, Inst. for Med. Res., Jalan Pahang, Kuala Lumpur 02-14, Malaysia) *Laboratory Animal Science*, 1980, *30*, 571-574.

A breeding colony utilizing a harem mating system was established to study the feasibility of breeding cynomolgus monkeys, *Macaca fascicularis*, in Malaysia. Two groups consisting of 10 females and one male each were evaluated over a 3-year period. Forty births were recorded: one was stillborn, 11 died while nursing, and 28 were weaned. The average time to wean offspring was 230 days with an average weight at weaning of 0.858 kg. The average time for conception to take place after weaning was 50 days. Of the 20 breeder females, six produced three ofspring each, nine produced two offspring each, four produced one offspring each and one remained barren throughout the project. Three different weaning systems were evaluated. The best method was caging the mother-infant pair within or adjacent to the breeding room followed by a two-part cage system which allowed the infant to continue nursing and also obtain solid food inaccessible to the mother.

Feeding behavior and diet of the Japanese monkey (*Macaca fuscata yakui*) on Yakushima Island, Japan. Maruhashi, T. (Primate Res. Inst., Kyoto Univ., Inuyama, Aichi, 484 Japan) *Primates*, 1980, *21*, 141-160.

Feeding behavior in a troop of one subspecies of the Japanese monkey, the Yakuzaru (*Macaca fuscata yakui*), was observed for 407 hr on Yakushima Island between March and December, 1976, after a three-month preliminary survey in 1975. The troop dwells in a mature warm temperate forest at a density of over 30 animals/km^2. The 5-min scanning technique was employed from August to December, 1976, to detect the quantitative features of feeding behavior. The members of this troop fed on 76 plant species: on the leaves of 26, the fruits of 45, and other parts of 12 species. The Yakuzaru is essentially frugivorous. The pattern of food selection is discussed in relation to fruit production. The animals fed much more on the leaves of deciduous than of evergreen woody plants. "Selection ratio" the percentage of time spent feeding on each species to the percentage abundance of each species in the sample strip, was calculated in order to evaluate

food selection from the plant community. In addition, the food habits of this subspecies were compared with that of six other populations in various habitats in Japan, by computing the similarity index for the woody plant community, all woody plant food species, and all major woody plant food species.

Sexual maturation and seasonal changes in reproductive phenomena of male Japanese monkeys (*Macaca fuscata*) at Takasakiyama. Nigi, H., Tiba, T., Yamamoto, S., Floescheim, Y., & Ohsawa, N. (Japan Monkey Ctr., Inuyama, Aichi, 484 Japan) *Primates*, 1980, *21*, 230-240.

The authors examined testis tissues and blood which were collected from free-ranging Japanese monkeys of the Takasakiyama troop during four periods in 1971 (mating season: late January-early February; early birth season: June; late birth season: August; and intermediate season between birth season and mating season: October), and studied their sexual maturation and seasonal changes in reproductive phenomena. Results of observations on the testis and plasma testosterone concentration were in agreement with each other. Except in a few cases, the testis was infantile until October at 4 years of age and developed rapidly during the following two months, and spermatogenesis started in the mating season at 4 years of age (in exceptional cases, it started one year earlier). After the following two-year process of sexual maturation, monkeys attained full maturation in the mating season at 6 years of age. For seasonal changes in reproductive phenomena also, results of observations on the testis and the plasma testosterone were in agreement with each other. Activity of the testis repeated an annual cycle of being maximal in the mating season, regressing in the birth season, and redeveloping toward the following mating season. Such seasonal changes were noticeably observed with 4- to 6-year-old animals, which are in the process of sexual maturation.