

Paper and Poster Sessions
(Abstracts 0020-0252B)

0020

SOCIAL SUPPRESSION OF REPRODUCTION IN SUBORDINATE TALAPOIN MONKEYS, *Miopithecus talapoin*.
 D.H. Abbott & E.B. Keverne, G.F. Moore and U. Yodyingyuad, Dept. of Anatomy, Downing St.,
 Cambridge CB2 3DY, England.

Behavioural and endocrine suppression of reproduction in subordinate male and female talapoin monkeys was investigated in seven laboratory groups. Behavioural observations (100 min/day, 2-5 times/week), in 8-week blocks, were made at intervals from group formation until 12-18 months later. Blood samples were taken 2-3 times/week. Sequential behavioural analysis showed that on approximately 70% of all occasions ($p < 0.05$) when males of Rank 2 and below 'approach' or 'follow' a female, or 'look at' or 'inspect' her genitalia, they were attacked by the dominant male (Rank 1). All males were otherwise fertile. Low-ranking females were not similarly deterred from males, but they received no ejaculatory mounts unless (i) the dominant female became pregnant or (ii) the dominant female was removed and a previously low-ranking female took over the Rank 1 position. Two low-ranking females (Ranks 4 and 6) in two separate groups stopped showing ovarian cycles (serum progesterone < 1 ng/ml). In both cases, serum prolactin concentrations were significantly reduced. These results suggest that, in talapoin monkeys, the sexes manipulate different behavioural and endocrine mechanisms to impose social contraception on subordinates.

0021

EXPLORATORY AGGRESSION IN CHIMPANZEES.

Q.M. Adang, Lab. of Comparative Physiology, State Univ. of Utrecht and Burgers' Zoo, Arnhem, The Netherlands.

Young chimpanzees in the Arnhem Zoo chimpanzee colony often "tease" adult groupmembers. First data from a long-term study concerning this so-called "quasi-aggressive behaviour" suggested the hypothesis that the behaviour might be caused by exploratory impulses and functions as a mechanism for youngsters to learn and expand social limits. Further observations were carried out to specify and test this hypothesis. To investigate which effects of their behaviour the youngsters seek to maximize, the temporal patterning of the behaviour was analyzed by means of log-survivor curves. In this way factors influencing bout length as well as length of intervals between bouts could be determined. The results indicate, for instance, that bout-length is longest when a youngster received an aggressive response. Also, bouts directed towards targets reacting strongly tended to last longer. The length of the intervals between bouts is dependent on the length of earlier bouts by the same actor: longer bouts lead to shorter intervals. In this the response of the target animal plays a role too. The data will be discussed in the light of the social exploration hypotheses versus alternative hypotheses. The results favour the first hypothesis.

0022

HUMANS LIVING NEAR PARKS: THE AGASTYAMA LAI CASE.

R. Ali, Dept. of Biology, Fac. of Science, Mahidol University, Rama VI Road, Bangkok 10400, Thailand.

A case study is presented of the problems created by villagers living in and near the Mundanthurai and Kalakad Sanctuaries, Tamilnadu, India. This area contains the largest known population of the endangered liontailed macaque. Impacts include forest fires, illicit logging, grazing and firewood collection. In this situation any management plan oriented towards managing the animal species only will fail. Current policies towards villagers emphasise punitive deterrence, and are largely unsuccessful because of understaffing and excessive pressures. Policies must change to benefit villagers living in and near parks, and new initiatives could include dairy farming and afforestation schemes. Recently afforestation of degraded land on the boundary has begun.

0023

SEXUAL BEHAVIOUR IN THE SOUTHERN BONNET MACAQUE, *MACACA RADIATA DILUTA*.
R. Ali, Dept. of Biology, Fac. of Science, Mahidol University, Rama VI Road,
Bangkok 10400, Thailand.

An 18-month study was conducted on the social behaviour of the bonnet macaque at Mundanthurai, Tamilnadu, India. The study group contained 4 adult females. 70 copulations were observed, and notes were taken in 38 cases where the entire sequence was observed. No consort relations were formed until new males joined the group, and subdominant males would copulate with a female in the absence of any dominant male in the vicinity. Males initiated all encounters, usually by approaching the female and 'probing'. Copulations occurred routinely with pregnant females as well, and in this case females were more likely to vocalise, and run away from the male after copulation, than otherwise. Females also tended to vocalise more when the two most dominant males copulated with them.

0024

DETERMINANTS OF ACTIVITY BUDGETS AND SPATIAL AFFINITIES OF ADULT FEMALE BABOONS (*Papio cynocephalus*) IN AMBOSELI NATIONAL PARK, KENYA. J. Altmann* and R. Sussret Mututua*, Dept. of Biology, University of Chicago, IL, USA 60637, and Institute of Primate Research, National Museums of Kenya.

All adult females of two social groups were studied for almost two years to determine activity budgets and neighbor relationships. Data were gathered by point (instantaneous) sampling on a random rotation during all daytime hours. Records were made of the female's activity--feeding, moving, resting, grooming, being groomed, and engaging in other social interactions, and of the position, standing or sitting, in which these activities were performed. Simultaneously, we recorded whether an infant was in dorsal contact, ventral contact, or other contact with its mother. Nearest neighbor data and identity of adult males within five metres were also noted. These data allow both longitudinal analyses for each female and cross-sectional analyses for all females at any given time, to elucidate the roles of ecological, reproductive, and social factors.

0025

ADAPTATIONS OF BABOONS FOR FORAGING. S. Altmann, Dept. of Biology, Univ. of Chicago, IL, USA 60637.

The success of baboons hinges on their ability to exploit most of the most nutritious foods in their habitat. This exploitation depends on a constellation of traits. Adaptations for terrestrial locomotion enable baboons to get at remote but locally abundant foods. Yet baboons retain an ability for arboreal locomotion. Thus they can utilize foods anywhere in the habitat. On the ground, large size, long canines and other attributes enable baboons to ward off predators. Large body size also enables baboons to utilize foods that require considerable strength, such as subterranean grass corms. Acute color vision, smell, taste, and fine manipulation enable baboons to select food items on the basis of small perceptual differences and to extricate the most nutritious parts of plants. Large social groups with stable matrilineal associations facilitate familiarity with local resource sites, conspecific cueing on ephemeral foods, and cross-generational learning about edible foods. The abilities of baboons to exploit both terrestrial and arboreal habitats adapt them to savannah habitats, which now occupy most of Africa. Thus baboons are abundant because they are successful at exploiting an abundant habitat.

0026

PLACENTA ABRUPTIO IN CAPTIVE NONHUMAN PRIMATES. J.H. Anderson,* B. Ford, P. Fischer, S. Line, California Primate Research Center, University of California, Davis.

Premature separation of the placenta (Placenta abruptio) was diagnosed in 10 macaques and 1 squirrel monkey between 1977 and 1984 at the California Primate Research Center. Seven cases occurred during the third trimester of pregnancy and four cases during the second trimester. Five animals were found dead or comatose in their cage. Three of the five animals that were treated survived. Presenting clinical signs ranged from abnormal vaginal bleeding to depression, abdominal pain, hypovolemia and shock. Concealed hemorrhage without vaginal bleeding was observed in several animals. Real-time ultrasound was of value in confirming diagnosis. Placenta abruptio is often a medical emergency requiring immediate diagnosis and treatment.

0027

IRON DEFICIENCY IN OUTDOOR CORRAL HOUSED JUVENILE RHESUS MONKEYS. J.H. Anderson,* C.L. Keen, B. Lonnerdal, R. Leininger, B. Joseph, J. Reeves, B.F. Feldman, and D.G. Smith. California Primate Research Center, University of California, Davis.

Iron deficiency manifested by microcytic anemia was diagnosed in juvenile rhesus monkeys born and raised in half-acre outdoor corrals. Animals were fed a standard commercial diet containing adequate iron by analysis. A prevalence of 20% was obtained in one survey of six corrals containing 172 animals between the ages of 6 months and 2.5 years. Eleven animals studied for a period of 18 months were consistently iron deficient. Affected animals appeared clinically normal. The iron deficiency could not be attributed to chronic blood loss, parasitemia, or infection. Affected animals had decreased serum iron [\bar{X} :37 $\mu\text{g/dl}$; \bar{X}_c (control):119], elevated total iron binding capacity [\bar{X} :496 $\mu\text{g/dl}$; \bar{X}_c :406], low MCV's [\bar{X} :50; \bar{X}_c :71], and decreased liver iron stores [\bar{X} :53 $\mu\text{g/g}$; \bar{X}_c :195]. Iron absorption tests performed on eight affected animals demonstrated decreased function of intestinal iron uptake. Iron deficient animals moved to indoor housing and fed the same diet subsequently became iron replete. It is suggested that factor(s) consumed by the animals in the outdoor cages interfere(s) with normal iron bioavailability in the commercial diet.

0028

A NEW MARKER OF T LYMPHOCYTES IN HUMAN AND MACAQUES. K. Ben,* C. Wang, W. Dai and Y. Huang, Kunming Institute of Zoology, Academia Sinica, Kunming, Yunnan, PRC.

Red blood cells of tree shrew (*Tupaia belangeri*) (TRBC) formed rosettes with peripheral blood lymphocytes of human (32.4 ± 2.9 percent of lymphocytes), rhesus monkey (75.2 ± 4.3 percent), pig-tailed monkey (75.6 ± 10.0 percent) and assamese monkey (75.8 ± 3.8 percent). Both double marking with TRBC and zymosan-yeast-complement complex and thymocyte rosette formation with TRBC showed that TRBC-rosette forming lymphocytes were T cells in human and macaques. The affinities between 2-s-aminoethyl isothiocuronium bromide-treated erythrocytes of sheep (EAET) and T lymphocytes of human and rhesus monkey were much weaker than those between TRBC and T lymphocytes of these species when double marking simultaneously with EAET and TRBC. In contrast to sheep erythrocyte rosette formation, after TRBC was treated with neuraminidase, the rosette formation decreased significantly, and when TRBC-rosettes or human lymphocytes were incubated at 45° C for 30 min., the rosette formations were not influenced. Therefore T lymphocyte rosette formations with TRBC possess particular physico-chemical properties. Clinical and experimental studies should be further done.

0029

NORMAL VALUES OF THYROID FUNCTION TESTS IN ADULT RHEBUS MONKEYS. K. Ben, L. Zhao, M. He, B. Tian, Y. Wu, P. Dai, C. Gu and J. Han, Kunming Institute of Zoology, Academia Sinica and General Hospital of Kunming Military Region, Kunming, Yunnan, China.

Normal values of thyroidal radioactive iodine uptake at 2, 6, 24 and 48 hour after oral administration are 6.5 ± 3.1 , 13.8 ± 6.9 , 25 ± 7.7 , 26 ± 10.3 percent, respectively, in 23 normal adult rhesus monkeys (*Macaca mulatta*) ($n=16, 27$), given $2-4 \mu\text{Ci } ^{131}\text{I}$ 3 hours before feeding. Serum triiodothyronine (T_3) (double-antibody method), thyroxine (T_4) (PEG) and f_3 uptake (macroalbumin precipitated albumin, MAA) were determined in 20 rhesus monkeys ($n=12, 28$). Radioimmunoassay kits and $^{125}\text{I}-\text{T}_3$ (MAA) reagents are made by Shanghai Institute of Chemicals. Serum T_3 level of female monkey ($39 \pm 110 \text{ ng/dl}$) is significantly higher than that of male monkey ($273 \pm 124 \text{ ng/dl}$) ($P < 0.05$), but T_4 level of female ($4.2 \pm 1.4 \mu\text{g/dl}$) is lower than that of male ($5.9 \pm 2.9 \mu\text{g/dl}$) ($P > 0.05$). The value of $^{125}\text{I}-\text{f}_3$ uptake (MAA) is 0.787 ± 0.048 in male and 0.759 ± 0.112 in female. There are no significant differences between sexes in serum T_4 , T_3/T_4 , T_3 uptake (MAA) and thyroidal radioactive iodine uptake.

0030

SPONTANEOUS BILATERAL EXOPHTHALMOS IN ADULT MALE RHEBUS MONKEYS, MACACA MULATTA. K. Ben, L. Zhao, M. He, B. Tian, Y. Wu, S. Zhang, P. Dai, C. Xia and Z. Zhang, Kunming Institute of Zoology, Academia Sinica, Yunnan Provincial First People's Hospital and General Hospital of Kunming Military Region, Kunming, Yunnan, PRC.

Three cases of bilateral exophthalmos in adult male rhesus between the ages of 6-8 years are reported. The proptosis with periorbital edema and stretching of the upper eyelids ranged from 8 to 13.5 mm. There was slight paraplegia in 2 cases at the early stage. Serum levels of T_3 , T_4 , T_3/T_4 and f_3 uptake (MAA) were $395-508 \text{ ng/dl}$, $3.8-5.85 \mu\text{g/dl}$, $71-134$, $0.773-0.901$, respectively. Thyroidal radioactive iodine uptake at 24 and 48 hour were $25.0-37.8$ and $18.1-22.8$ percent, respectively. T_3 suppressibilities were normal in all cases. B-scan ultrasonographies did not show neoplastic space-occupying orbital lesion in globes and orbits. During intramuscular administration with dexamethason (5 mg/day) for 10 days in 2 cases, the proptosis were rapidly decreased to normal or near normal. The weights of thyroid glands of 2 cases were 0.7 and 1.5 g . The papillary proliferation of follicular epithelial cells and lymphocyte infiltration occurred in thyroid. Extraocular muscle demonstrated edema, degeneration and lysis of muscle fiber, phagocytosis and lymphocyte infiltration. Femoral muscle also showed local infiltration with lymphocytes and degeneration of muscle fibers. No remarkable changes were observed in other organs. These results suggest that Graves' disease may occur in rhesus monkeys.

0031

BEHAVIORAL STRATEGIES TO INDUCE INTOXICATION BY SEMI-VOLUNTARY INGESTION OF ETHANOL IN THE BABOON. Efraim Benhar* & David Samuel, Dept. of Isotopes, Weimann Institute of Science, Rehovot 76100, Israel.

Unlike man, nonhuman primates generally will not ingest ethanol solutions above a certain concentration, irrespective of the carrier. In pursuance of a suitable model of ethanol intoxication and withdrawal symptoms, ten baboons were used. Various strategies to induce semi-voluntary ingestion of ethanol solutions were tried with the aim, should intoxication be achieved, to test drugs that may counteract the pharmacological properties of ethanol. Intoxication and withdrawal symptoms were observed in only a few cases, but a number of behavioral observations and procedural conclusions made during this experiment, such as: A preference for low concentration ethanol solutions versus tap water, unreliability of BAC measurements for freely drinking animals, absence of psychological dependence, withdrawal symptoms different from those reported in the literature etc.

0032

RESPONSE OF EAST BORNIRAN MACACA FASCICULARIS TO DROUGHT AND FIRE
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During a two-year study of behavior and ecology of Macaca fascicularis in the Kutai Game Reserve of East Kalimantan, Indonesia, a severe drought culminated in a forest fire of perhaps unprecedented magnitude for the perhumid region of Asia. Long-tailed macaques responded to habitat destruction and reduced food availability by decreasing daily ranging, increasing time spent on the ground, and increasing the dietary proportions of foliage and other herbaceous items. Informal observation of orangutan (Pongo pygmaeus) and gibbons (Hylobates muelleri) indicated similar dietary changes for these species. Over a year-long drought followed by a five-month post-fire period of growing habitat destruction there was no apparent decline in macaque, orangutan, or gibbon densities. Sightings of many other animal species, including hornbills, understory birds, squirrels, and deer, declined dramatically in frequency.

0033

ELECTROPHYSIOLOGICAL CORRELATES OF COGNITION IN GREAT APES. G. G. Berntson^{*} & S. T. Boysen
Laboratory of Comparative/Physiological Psychology, The Ohio State University, Columbus, Ohio 43212.

Electrophysiological methods are increasingly being brought to bear on questions concerning the nature and characteristics of information-processing in humans. While these methods, including the measurement of brain event-related potentials and psychophysiological responses, also offer considerable promise for an understanding of cognitive processes in primates, there has been virtually no application of these techniques to the Great Apes. As part of an initial effort to generate critical normative data, visual event-related potentials (VEPs) in response to stroboscopic flash stimuli, and cortical auditory evoked potentials (AEPs) in response to a click, were recorded from surface electrodes in neonatal chimpanzees and gorillas. In addition, we have investigated patterns of autonomic reactivity to a range of environmental stimuli. Our results provide the first measurement of such neuro-physiological events in unanesthetized apes, and reveal inherent patterns of reactivity associated with startle responses, orienting responses, and habituation. These data have broad implications for the application of autonomic and electrophysiological measures to the evaluation of cognitive processing in the Great Apes, and offer great promise for gaining new insights and understanding of the correlates of neural function and behavior.

0034

GIRNEY VOCALIZATIONS BY ADULT FEMALE JAPANESE MACAQUES (MACACA FUSCATA): EFFECTS OF INFANTS AND RANK. B. G. Blount, Dept. of Anthropology, Univ. of Georgia, Athens, GA USA 30602.

Vocal behavior of a sample of 20 adult female Japanese macaques was observed at Arashiyma West Research Institute, Dilley, Texas. Categories of vocalizations directed and received by the females were recorded following the birth season and prior to the breeding season. Ten of the females had infants from the birth season. Comparisons of females with and without infants for total vocalizations yielded significant results. Females with infants received more vocalizations than they directed, and they received more vocalizations than did females without infants. Females without infants directed more vocalizations than they received. Those effects are due largely to girneys, the most frequent vocalization. Females with infants receive significantly more girneys than those without infants. Comparisons of females according to relative rank in the troop (high vs. low) showed that high ranking females with infants received more vocalizations than they directed. High ranking females without infants directed more girneys than they received, and they received more girneys than did low ranking females without infants. Low ranking females without infants directed both more vocalizations and girneys than they received. The frequency of girneys is thus affected by the presence of infants and by relative rank.

0035

ECOLOGY OF AGGRESSION: FITNESS RETURNS FROM RESOURCES AND THE OUTCOME OF CONTESTS. N. G. Blurton-Jones, University of California, Los Angeles, Graduate School of Education and Departments of Anthropology & Psychiatry.

The outcome of contests over resources can be determined by asymmetry in the fitness value of the resource contested. The shape of the curves of fitness benefit gained from a resource against the amount of the resource held can determine whether contests over additional resources are symmetrical or asymmetrical, and thus whether they will be won by the "richest," the "poorest," or the strongest. It is proposed that this principle is relevant to understanding the origin and occurrence of food sharing, rank orders, and the various outcomes of contests among males over females.

0036

BIRTH SPACING AND !KUNG REPRODUCTIVE SUCCESS. *N. G. Blurton-Jones, University of California, Los Angeles, Graduate School of Education and Departments of Anthropology & Psychiatry, N. Howell, University of Toronto, Department of Sociology.

Lee's data on the !kung foragers of the Kalahari enables us to calculate the work involved in raising a family. A shortfall in food, or exhaustion of mother, can easily arise from short inter-birth intervals and increase mortality. In this case mortality should closely follow the curve of calculated workload against interval. If we suppose that the reproductive system maximises descendents we can make more predictions. Factors which reduce load (e.g. birth order, cattlepost food, and deaths of babies) should reduce mortality and inter-birth interval. Observed intervals should be distributed about an optimum interval, at the combination of mortality and number of births that maximises the number of surviving offspring. The paper will report analyses of Howell's data on !kung reproductive histories. Many of these predictions were confirmed.

0037

THE NUT-CRACKING BEHAVIOR AND ITS NUTRITIONAL IMPORTANCE IN WILD CHIMPANZEES IN THE TAI NATIONAL PARK, IVORY COAST, C. Boesch and H. Boesch, Department of Ethology and Wildlife Research, University of Zurich, Switzerland.

Wild chimpanzees in the Tai National Park crack 5 species of nuts by placing them on anvils, prominent roots or outcrop rocks, and by pounding them with a stone or a wooden club as a hammer. This behavior is illustrated in a documentary film by an adult and an adolescent male cracking nut of Coula edulis and Panda oleosa. An evaluation of the daily intake of nuts was made by recording the performance (hits/nut and nuts/min) and the duration of nut-cracking sessions of individuals on specific days. We calculated the calorific intake this represents, i.e. for Coula edulis, the chimpanzees eat 2616 kcal and 39 g of protein per day. Panda nuts are cracked less often but they provide 352 to 754 kcal and 16 to 34 g of protein per cracking session. Thus, the Tai chimpanzees depend or at least heavily rely on tool use for their survival during the 4 months of the Coula season. They are the first animal population on which it was possible to prove the key role of tool use for their survival, an aspect often considered unique to man.

0038

A NEW HYPOTHESIS CONCERNING THE EVOLUTION OF THE SPECIES HOMO SAPIENS.
G. Bräuer, Anthropologisches Institut, University of Hamburg, W. Germany.

This paper presents the results of a new comparative study of the cranial remains of African Homo dating to the Middle and Upper Pleistocene. The comparison encompasses a large number of non-metrical and metrical characters. Principal components analyses were computed for various parts of the skull. This analysis of the morphological affinities among the hominids, seen in the light of the dates currently considered to be most likely, have resulted in the 'Afro-European sapiens hypothesis'. Its salient points are: 1. Early anatomically modern Homo sapiens evolved, via late archaic forms, out of Eastern and/or Southern African early archaic Homo sapiens (e.g., Broken Hill, Ndutu). This process occurred during the late Middle Pleistocene. -- 2. Early anatomically modern Homo sapiens, represented by Omo 1, Klasies River, etc., may have been widely spread throughout Africa as early as the early Upper Pleistocene. -- 3. During the Würm, anatomically modern humans expanded farther into the North - apparently moving out of Eastern Africa. Then, they mixed and finally replaced the Neanderthals living in South West Asia and Europe.

0039

THE STATUS OF KENYA'S DE BRAZZA MONKEY POPULATION: A NEED FOR IMMEDIATE CONSERVATION EFFORTS. E.J. Brennan* and J.G. Else, Institute of Primate Research, National Museums of Kenya, Nairobi, KENYA.

This paper presents the results of a survey of the De Brazza monkey (*Cercopithecus neglectus*) population in western Kenya. The aim of the research was to determine the status of this shy and little known animal, and to make recommendations regarding its conservation. The work involved both census and habitat evaluation. Data suggest that the total De Brazza population in Kenya is just over 100 animals. This remnant population is doomed habitat loss and decline in numbers from hunting and trapping by local people. Immediate translocation is recommended as the first step in trying to save the remaining Kenyan population of De Brazza monkeys.

0040

ECOLOGY AND BEHAVIOUR OF VERVET MONKEYS IN A TOURIST LODGE HABITAT.
J. Brennan, J. Else, J. Altmann and P. Lee *. Institute of Primate Research, Nairobi, Kenya and Dept. of Biology, Univ. of Chicago, Ill., USA.

The ecology and behaviour of vervet monkeys living near a tourist lodge were studied during the peak season in Amboseli National Park, Kenya. Lodge vervets differed from unhabituated groups. They occurred at higher population densities, had higher rates of intra-group aggression and fed on food and garbage provided through human contact. There were also some infants born out of the typical birth season. Monkeys attacking and injuring tourists is a major concern for wildlife managers. Restricting vervet access to garbage, reducing proximity to tourists and trapping have all been attempted as solutions to this problem. Trapping is the least effective long-term solution, since groups are rapidly replaced. Restricting the proximity of vervets to tourists has been relatively successful. The composition of the group and its size influence the effectiveness of different management solutions.

0041

DEVELOPMENTAL CHANGES IN SERUM CONCENTRATIONS OF GONADOTROPINS IN PREPUBERTALLY CASTRATED MALE RHESUS. W.E. Bridson, R.W. Goy, J.A. Robinson and S.G. Eisele, Regional Primate Research Center, Univ. of Wisconsin, Madison, WI, USA 53715-1299.

Blood samples were collected weekly at 0900 hrs and biweekly at 2100 hrs from 9 prepubertally castrated males beginning at 121 weeks of average age. Lights were on from 0700 to 1900 hrs. Confidence limits ($p < .05$) were established for prepubertal values of LH (7.11 ng/ml) and FSH (670.8 ng/ml) and also for adult castrate values, LH (12.39 ng/ml) and FSH (1246.1 ng/ml). Concentrations of LH first surpassed prepubertal limits at 138.2 ± 21.5 wks. and first attained adult levels at 144.7 ± 15.3 wks. ($t = 2.39$, 8 df, $p < 0.5$). FSH first surpassed prepubertal limits at 146.1 ± 21.4 wks. and first attained adult levels at 157.2 ± 23.2 wks ($t = 2.97$, 8 df, $p < .02$). The first time that prepubertal limits were surpassed was usually followed by variable and sporadic return to prepubertal values for either or both gonadotropins. In contrast, meeting the adult criterion was usually followed by consistent maintenance of these high levels. Prior to surpassing the prepubertal limits, morning and evening concentrations for LH were 3.69 ± 1.38 ng/ml and 4.50 ± 1.06 ng/ml ($t = 4.908$, 71 df, $p < .001$) and for FSH were 217.9 ± 76.6 and 248.4 ± 112.7 ng/ml ($t = 3.327$, 78 df, $p < .01$). Morning and evening concentrations of LH and FSH surpassed prepubertal limits and attained adult levels at the same ages. (Supported by Grants RR00167 and MH 21312).

0042

DETERMINANTS OF HAND PREFERENCE IN *Macaca fascicularis*.

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The handedness of adult crab-eating macaques (2 males and 15 females, in 2 harem-type groups) and of their offspring (n=48, 1-6/female, aged 8-24 months when studied) was tested. Handedness was defined by more skilful and faster movements, with better coordination, in a test which required the use of discrete, relatively independent finger movements. All animals were left- or righthanded, but there were individual differences in the strength of preference. Of 22 offspring of parents with the same preference, 19 showed the same preference. In contrast, of 26 offspring of parents with different hand preferences, 23 had the same preference as the female, and different from that of the male, rather than showing a distribution of preferences expected on the basis of possible genetic influences. Within groups of a female and her offspring (not always all full siblings), the way of executing the movements during the test was very similar and resembled that of the female. This was also the case with other types of movement, such as facial expressions (lip-smacking). The results suggest that hand preference in macaques may be a result more of postnatal learning than of genetic predisposition, although some genetic component seems to be involved as well.

Supported by the National Health and Medical Research Council of Australia.

0043

A BROADENED APPROACH TO PRIMATE CONSERVATION IN SOUTHEAST ASIA.

W. Y. Brockelman, Dept. of Biology, Faculty of Science, Mahidol University, Rama VI Road, Bangkok 10400, Thailand.

Southeast Asia has a rich primate fauna containing many endangered species in need of conservation measures. In some cases projects centered around individual species are needed to conduct surveys or study basic socioecology to further conservation. In most cases, however, conservation efforts aimed at particular species cannot easily draw sufficient funding or cannot use funding effectively if obtained. To be successful, species conservation efforts should be broadened in the following ways:

(1) Projects should be broadened into community or ecosystem approaches and consider all species and habitats. Those generated within the SSC of IUCN should enlist the support of all affected specialist groups. (2) Primate conservation projects should concern themselves with the special social, economic and management problems peculiar to each protected area and seek a widened base of support, and enlist the help of agencies such as FAO, UNEP and UNDP. Khao Yai Park and Huai Kha Khaeng Sanctuary in Thailand are cases in point.

0044

AGONISTIC DOMINANCE STRUCTURE IN A TROOP OF FREE-RANGING STUMPTAIL MACAQUES (*Macaca arctoides*). M. Caba-Vinagre, Centro de Inv. Biológicas, Universidad Veracruzana. A.p. 57, Catemaco 95870, Veracruz, México.

It is generally accepted that a stable asymmetry in agonistic behavior is a fundamental element in the definition of dominance in groups of animals. Four aggressive behaviors and five frequent responses were recorded *ad libitum* (99 hours during 5 months) in 30 macaques older than 3 years of a troop (n=54) ranging on an island of the lake of Catemaco in México. A quantitative model of social structure based in the frequency of emissions and receptions of each behavior from directional matrices indicated that individuals express some categories with a high degree of predictability in terms of sex, age, and kinship in diadic aggressive encounters. Except for the dominant female which ranked just below the alpha male, males were more aggressive than females and received more submissive behaviors. Of all behaviors analyzed, reception of "pubudal presentations" correlated more strongly with rank.

0045

VISUAL DISCRIMINATION UNDER DIFFERENT ILLUMINATION IN THE TREE SHREWS (*Tupaia longeri chensis*), SLOW LORIESES (*Nycticebus couang*) AND RHESUS MONKEYS (*Macaca mulatta*). J. Cai, P. Kuang, G. Sun, Y. Tian, W. Chang, X. Li, Z. Luo, Kunming Institute of Zoology, Academia Sinica, Institute of Psychology, Academia Sinica, Guiyang Medical College, PRC.

The visual discrimination of three species of primate under several kinds of illumination was reported. The visual discrimination of adult tree shrews was tested with the method of conditioned avoidance reflex under four kinds of illumination. Four adult slow lorises and four adult rhesus monkeys were tested with the Wisconsin general test apparatus under five kinds of illumination. The experiments show that tree shrews can't discriminate the difference between bigger circle and smaller circle when the illumination is below 0.2 Lux; the slow lorises are able to discriminate the difference between the triangle and the square when the illumination is below 50 Lux. As the illumination is above 100 Lux the slow lorises aren't able to see anything; the rhesus monkeys are able to discriminate the difference between the triangle and the square whether the illumination is 1000 Lux or zero Lux. These results conform to their circadian rhythm. That is the tree shrews only move by day, the slow lorises only move by night, and the rhesus monkeys adapt to both day and night. The visual characters of the diurnal and nocturnal primates depend on their morphologic organization of retinae.

0046

IMPACT OF SELECTIVE LOGGING ON FOOD DISTRIBUTION OF WESTERN GORILLAS, *G.g.gorilla*, IN CAMPO RESERVE, CAMEROON. J. Calvert, Dept. of Anthropology, UCLA, L.A., Ca. 90024, USA.

In coastal Cameroon gorillas consume plants from mature forest, subsistence farms and forest which has been selectively logged. One factor of possible import in gorilla food selection is the shifting abundance of major foods. Plant distribution is thought to change in a dynamic pattern with disturbance, particularly with time elapsed since disturbance, and the physical nature of the disturbance (soil compaction, scale of disturbance). In 1400 plots (1m. radius), data were collected on vegetation structure and composition, including the abundance of 10 major gorilla food plants. Plots were located in fields, mature forest and forest logged 1, 2 and 4 years earlier. Several habitats were sampled for each logged area e.g. tractor trails, tree fall gaps and roadsides. At the end of years 1 and 2 following logging, the abundance and diversity of foods in logged habitats are greater than in fields or mature forest. Thereafter the abundance and diversity of foods in logged areas decreases markedly. By the end of year 4, the abundance and diversity of major foods in logged areas is very similar to that of fields and mature forest. These data on food abundance and diversity are analyzed in relation to food preference of gorillas, forest succession and structure, and alternative plans for gorilla conservation.

0047

A COMPARISON OF THE EFFECTS OF SHORT-TERM SEPARATION FROM CAREGIVERS AND OF CAREGIVER INDIFFERENCE ON INFANT BEHAVIOURAL DEVELOPMENT IN CAPTIVE MARMOSETS, CALLITHRIX JACCHUS JACCHUS.

N.R. CHALMERS AND J. LOCKE-HAYDON, BIOLOGY DEPARTMENT, THE OPEN UNIVERSITY, ENGLAND.

Four-week-old infants were housed with their twins away from their families for 8 days before being re-united with their families. Other four-week-old infants were housed with their families who were administered the long-acting tranquillizer fluphenazine decanoate over 8 days, a treatment which reduced the amount of active care offered by the caregivers. Both treatments produced comparable post-treatment effects, in relation to untreated controls, including an increase in the frequency with which the infants climbed on to the parents, a decrease in the frequency with which the parents rejected such attempts by infants, and a depression in infant play. Thus short-term separation and parental indifference can have comparable effects on behavioural development.

0048

ADAPTATION OF VERVETS FROM KENYA TO ARTIFICIAL CONDITIONS AND TO THE NATURE OF NEAR-MOSCOW REGION. V.I. Chernyshev, Moscow, USSR.

During fifteen year period we studied over ten thousand vervets from Kenya. The monkeys were admitted to experimental monkey clinics of the USSR AMS Institute of Poliomyelitis and Viral Encephalitis for preparation of poliovaccine. Most of the vervets were maintained in artificial conditions in special premises; another group was kept free and in volières for six years, all the year round, under the conditions of the near-Moscow region. In extreme situations the vervets did not lose their ability to multiply. Monkeys born in volières reached puberty and reproduced. They also adapted to the climate of northern latitudes as follows: improvement of the heat-protecting properties of the hair, increase in energy metabolism and behavior. Monkeys living free quickly mastered the ability to climb trees in a northern forest.

0049

NATURAL FOODS AS A GUIDE TO THE NUTRITION OF HIGHER PRIMATES

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Diet should be one of the basic considerations when managing captive primates. Difficulties in quantifying natural diets have impeded this process until recently. We aim to help redress the balance by outlining the food preferences of different species, and ascertaining whether one can generalise at the level of the family or sub-family, so as to indicate more clearly suitable foods for captive primates. The recent studies of the biochemical influences on food choice enable us to consider diets in these terms, rather than the traditional list of plant species names. Among Old World primates the main contrast is between the colobine monkeys with compound stomachs, and the cercopithecin monkeys and apes with simple stomachs. Smaller colobines select energy-rich easily digestible seeds, while the large ones eat more foliage. Smaller cercopithecines eat many invertebrates, but the larger species tend to obtain their protein from foliage; all species rely on ripe fruits, at least for part of the time. The apes also prefer fruits, but the larger species feed extensively on foliage. We intend to show how New World monkeys of different sizes fit into these patterns. Such information should help promote the healthy maintenance and breeding of primates in captivity, as well as assisting in their conservation in the wild.

0050

NATURAL AND SYNTHETIC DIETS OF MALAYAN GIBBONS. D.J. Chivers* and J.J. Raemaekers, Sub-dept. of Vet. Anatomy, University of Cambridge, Tennis Court Road, Cambridge CB2 1QS, U.K.

The ecology of each of the nine gibbon species dispersed around S.E. Asia are rapidly becoming known. We focus here on three species at the centre of the range - the siamang (*Hylobates Syndactylus*), the lar gibbon *H. lar* and the agile gibbon *H. agilis*). These have been studied in the Malay Peninsula for varying lengths of time over the last 15 years, and considerable information is available on their diets in captivity. The smaller gibbons focus on small (and dispersed) sources of pulpy fruits, apparently to avoid competition with monkeys which exploit the larger food sources. In contrast the siamang, while preferring pulpy fruit, which it obtains from small and large sources (exercising its dominance of size and skill in the latter), is more sedentary and supplements these foods with large quantities of young foliage. With data on feeding rates, food intake in terms of feeding time was converted into feeding weight for the principal food types - fruit, leaves and animal matter. These results are compared with the published diets given to the same species in captivity. One finding is that energy intake may be similar in wild and captive individuals, which is curious considering their different energy expenditures.

0051

FOSSIL ADAPIDS FROM KANGRA DISTRICT OF HIMACHAL PRADESH, INDIA

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Field explorations by the authors in the hominoid bearing Neogene Sivalik deposits exposed in and around Banwal village in the Kangra district of Himachal Pradesh, India, have resulted in the recovery of an adapid primate fossil. A detailed account of the find - a left mandibular fragment (PMA 139/80 bw) with M₁-M₂ has been attempted. It has been assigned to the primate fossil taxon *Proconocladia sivali*. The earlier reports deal with recoveries made from the Indian Sivaliks in and around Hamirpur (J&K) and Haritayagar (H.P.). The present find from the Kangra district (H.P.) besides indicating the expanse of the stratigraphical and geographical range of the family Adapidae, also throws light on its migration and evolution in the Indian Sivaliks.

0052

EXPERIMENTAL DEMONSTRATION OF CELLULOSE DIGESTION BY TROGLODYTELLA GORILLAE, AN INTESTINAL CILIATE OF LOWLAND GORILLAS (GORILLA G. GORILLA). J.-Y. Collet, E. Bourreau, R.W. Cooper, C.E.G. Tutin* and M. Fernandez, Centre International de Recherches Médicales de Franceville, BP 769, Franceville, Gabon.

Trogodytella gorillae, a large intestinal ciliate widespread among wild lowland gorillas in Gabon, was observed to ingest large plant particles in fresh feces and cellulose fibres in in vitro culture. Filtrates of cell-free homogenates of Trogodytella gorillae, from fresh feces of a captive lowland gorilla at the Centre de Primatologie of the Centre International de Recherches Médicales de Franceville (Gabon), had a hydrolytic effect on cellulose, independent of intracellular bacteria. Hydrolytic activity was lower with native cellulose (enzyme C1) than with derivatives of native cellulose (enzyme Cx). The possibility that Trogodytella gorillae is a symbiont of wild lowland gorillas in Gabon must be considered.

0053

FACTORS AFFECTING MATING SUCCESS OF MALE YELLOW BABOONS IN RUAHA NATIONAL PARK, TANZANIA. D.A. Collins. Zoology Department, Edinburgh University, Edinburgh EH9 3JT. U.K.

A wild troop of Papio c. cynocephalus was observed over 3 months to assess male differences in mating frequency with potentially fertile females, to identify the proximate causes of such differences. The adult males which achieved relatively more matings were the higher rankers, which were also younger. This was because they were more successful in one-to-one competition, and because females appeared to prefer them, especially the alpha-male. Also in allied challenges against consort males, the higher-ranking ally tended to benefit more. However, middle rankers did better than expected from their rank, by challenging in alliance more frequently (the highest rankers, both newcomers, seldom formed alliances) and by taking advantage of lapses in the higher rankers' consorting activity. Also, a number of their consortships began without overt competition: this might suggest they were prepared to consort the less attractive females, but there was some evidence that frequent interaction with the female early in the cycle could deter other males, even of higher rank, from attempting to consort nearer ovulation. It was concluded that male mating success was not only determined by male-male competitive relations, but also by male-female relations, particularly females' preferences and males' possessiveness.

0054

GROOMING AND THE ROLE OF THIRD NON-INVOLVED INDIVIDUALS IN DYADIC CONFLICTS IN BABOONS. F. Colmenares and H. Rivero, Dpto. Investigación, Ctr. 'Ramón y Cajal', Madrid 34, Spain.

Systematic observations were conducted on the social interactions of aggression and grooming of 4 adult male, 19 adult female, 10 subadult male and 14 subadult female colony living baboons (Papio sp.) of known age, and social and genetical affiliation. A preliminary analysis of a sample of 253 and 139 triadic interactions in which a third non-involved animal was either groomee or groomer, respectively, is presented here. The victims groomed more frequently those non-involved animals more affiliated to them than to their opponents. In contrast, there were no significant differences in the frequency for aggressors grooming non-involved animals to whom they were more affiliated than their opponents. Non-involved animals that intervened by grooming the aggressor were more affiliated to the victim than to the aggressor. Likewise, when the former intervened by grooming the victim, they were more affiliated to them than to the aggressor. In all cases, social affiliation rather genetical relatedness was the most important variable determining the direction of grooming. These findings suggest that the baboons are able to discriminate relationships between group members, and manipulate them for their own benefit and that of their allies. Grooming can be used by different individuals as a powerful non-aggressive strategy serving different functions in different contexts, depending on the identities and on the roles of the other interactants.

0055

MIXED SPECIES GROUPS OF BLUE AND REDTAIL MONKEYS IN THE KAKAMEGA FOREST, KENYA Marina Corda, Zoology Dept., Univ. of California, Berkeley, CA 94720 / USA

Cercopithecus mitis and C. ascanius in the Kakamega Forest, western Kenya, spend more than half of their time in mixed groups. The behavior and ecology of a group of each species, both alone and with the other, is examined to evaluate several hypotheses concerning the significance of these associations. Mixed species groups of these monkeys are not chance phenomena, but rather appear to benefit their members in different ways.

0056

BIOMECHANICS OF SIZE-RELATED SHAPE CHANGES IN HOMINOID CRANIA. N. Creel, B. Demes*, H. Preuschoft, Dept. of Anatomical Sciences, State University of New York at Stony Brook, USA 11794 and Arbeitsgruppe Funktionelle Morphologie, Ruhr Universität Bochum, GFR 4630.

Allometric regression techniques were employed to identify changes in the shape of hominoid crania with increasing size. Although some alterations in skull proportions with increasing size differ between great apes and lesser apes, much morphological transformation in the two groups is very similar in nature. Among other changes, the skull in larger species is smaller relative to body mass, particularly in females and is also longer relative to height and width. The nonproportional increase in cranial length is restricted to the snout and that part of the neurocranium anterior to the external auditory meatus; that portion behind the meatus is a smaller part of total length. The foramen magnum is shifted rearward and rotated to a more vertical orientation; the nuchal plane is also closer to the perpendicular. Postorbital constriction of the neurocranium is more pronounced and the vertical diameter of the zygomatic arch is proportionally greater. Molar teeth are larger relative both to body mass and other cranial dimensions. Biomechanical analysis indicates that many of these morphological tendencies are explicable in terms of simple mechanical principles and serve to maintain equivalent function in animals of varying size.

0057

OBSERVATIONS ON EFFECT OF PAIN AND MORPHINE ON THE SINGLE UNIT ACTIVITY IN PREFRONTAL CORTEX OF CONSCIOUS RHESUS MONKEYS.

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In order to assess the effect of pain and morphine on the CNS, experiments were carried out on 3 conscious, movable adult monkeys (*Macaca mulatta*). The animals were trained in a restraining chair to pull a lever to escape noxious stimuli. Noxious stimulation was obtained by means of ionophoretic K^+ on the tail of the monkey. The dose of morphine amounted 1-2 mg/kg (IV). The single unit discharge was recorded in the meantime with a tungsten microelectrode in the dorsolateral prefrontal cortex. A total of 55 units were recorded. Responses to the noxious stimuli are as follows: 14 neurons, 6 were activated, 8 inhibited. Altogether the responses of 10 neurons of the prefrontal cortex to morphine were observed. The firing rate of 9 neurons showed a marked increase and one no significant change. The response of 3 neurons to the noxious stimuli disappeared. However, 19 min. after morphine injection the inhibitory effect was partly recovered. It was suggested that the dorsolateral cortex might play a role in the physiological aspect of the morphine analgesic effect.

0058

THE MATCHING CONCEPT IN MONKEYS, CEBUS APELLA

M. R. D'Amato* and David P. Salmon, Dept. of Psychology, Rutgers Univ., New Brunswick NJ, USA 08903.

Seven of eight cebus monkeys trained to match-to-sample with a small number of two-dimensional visual stimuli (colors or forms) generalized matching to new pairs of stimuli, four after experience with only two exemplars. This rapid development of the matching concept in monkeys contrasts with the difficulty experienced in demonstrating the concept in non-mammals such as birds. However, the range of the concept in monkeys is restricted in that it does not appear to generalize to the auditory modality nor to visual stimuli that require temporal processing, e.g., steady vs. flashing green disks. These and other data, particularly those from language-trained chimpanzees, indicate that the matching concept is represented in animals at quite different levels of abstraction.

0059

PLASMA HORMONE LEVELS OF BABOONS, *PAPIO ANUBIS* DURING EARLY PREGNANCY.

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Pregnant female baboons were analyzed for plasma estrogen, progesterone, testosterone and chorionic gonadotropin during early period of gestation. Data were obtained for 10 animals. Leydig cell bioassay was employed to measure chorionic gonadotropin and radioimmunoassay for the three steroid hormones. Chorionic gonadotropin was first detectable around day 14 to 16 of gestation taking the first day of deturgescence as day 4 of pregnancy. The hormone could not be detected beyond days 55 to 60 of pregnancy. Plasma progesterone levels rose sharply during the first few days of conception, plateauing thereafter to a level of 15 to 20 ng/ml. Plasma testosterone also showed a definite profile. The correlation between testosterone level and sex of the fetus would be discussed.

0060

NEW APPROACH TO THE CYTOGENETIC OF PRIMATES. D.F. De Stefano*, L. Ferrucci and E. Romano
Dept. of Biology, 11nd University of Rome (Tor Vergata) 00173 Rome, ITALY

Restriction endonucleases have proved useful to detect and localize specific DNA sequences in fixed metaphase chromosomes of a number of species, both Mammalian and Diptera. Furthermore, specific fluorochromes provide information about DNA base composition of particular chromosome areas. In the present study fixed metaphase chromosomes of four species of the genus *Macaca* (*M. fascicularis*, *M. nemestrina*, *M. mulatta*, *M. arctoides*) two species of *Cercopithecus* (*C. patas*, *C. aethiops*) and one Marmoset species have been studied by these techniques in an attempt to clarify aspects of karyotype evolution so far undefined and, in some cases, contradictory. Attention has been focused on the structure and DNA content of the heterochromatic areas (i.e. on the presence and characterization in these chromosome segments of highly repetitive DNA sequences) in view of the hypothesis on their role in speciation. First results suggest the wide usefulness of this approach in clarifying these problems.

0061

MORPHOMETRY OF THE DEVELOPING BRAIN IN *MACACA NEMESTRINA*. J.L.DeVito*, J.Graham, G.Schultz, J.W.Sundsten, and S.W.Prothero, Department of Biological Structure and Regional Primate Center, University of Washington, Seattle, Washington 98195.

We are compiling normative data on the developing fetal brain of *Macaca nemestrina* to use as a basis for assessing developmental abnormalities related to prematurity. In a series of 24 fetal brains (1.25-67.1 gms.) brain weight was found to scale with body weight with a slope of 0.976 ($r=0.995$). Brains were embedded in celloidin and stained for Nissl substance and myelin. A computer-based morphometric system (Sundsten and Prothero, Anat. Rec., 207:665-671, 1983) was used to digitize serial sections and to calculate areas and volumes of the whole brain and certain substructures over a gestational age span of 105 to 163 days. With increasing fetal age the following structures increased in volume relative to total brain volume: cerebellum, dentate nucleus, pyramid, inferior cerebellar peduncle. Structures such as the diencephalon, mesencephalon, pons and medulla showed no proportionate increases in volume. Thus, fetal brain weight increases allometrically with body weight in support of the one power rule for ontogenetic growth. Furthermore, there are differential rates of growth for various brain subdivisions. Supported by NICHD grant HD08633, MR Branch, USPHS grant HL29761 and NIH grant RR00166.

0062

HOW SLOW IS EARLY POSTNATAL DEVELOPMENT IN HUMANS?

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It is well known that the period of infancy became longer during human evolution. At first sight, this seems to imply that development became slower. However, this might only apply to a few characteristics. Developmental speeds of the rhesus monkey, chimpanzee and man are considered. Milestones used for comparison are ages at which novel characteristics appear. Data concern brain growth, motor skills, daytime sleep, mother-infant body contact and social stimulations. Both the early appearance of milestones and the brief intervals between them contribute to the rapid development of rhesus infants. In the chimpanzee, milestones appear earlier than in man; in contrast, the intervals, where known, are surprisingly equal. However, human infants develop a larger repertoire between similar milestones. In addition, human mothers interfere much more in the infant's affairs (notably in countries with empirical science). The general outcome is that human milestones appear more slowly, but that the rates at which repertoire items (being more numerous) and brain weight develop are faster. This contrast does not allow the general statement that humans develop more slowly than other primates.

0063

SEXUAL DIFFERENCES IN THE SKULLS OF *Pan troglodytes verus* FROM LIBERIA. A Dierbach,

Klinikum der Johann Wolfgang Goethe-Universität, Zentrum der Morphologie, Frankfurt am Main, F.R.G.

A collection of 277 skulls of *Pan troglodytes verus* originating from northeastern Liberia has been evaluated with respect to sexual dimorphism. Measurements have been taken to show the entire range of intra-specific differences within this collection. To characterize the morphologic divergence between the male and the female a Penrose analysis has been accomplished. The sex could be determined in nearly all of the adult individuals by using various morphologic characters such as the alveoli of the canines. Some characters, however, show a high variability so that a determination of sex is only reliable when as many characters as possible are considered.

0064

BEHAVIORAL STUDY OF CHIMPANZEES (*PAN TROGLODYTES*) UNDERGOING REHABILITATION IN THE WILD. M.A. Donnelly, * A.M. Prince, B. Brotmann, K.M. Hentschel, New York Blood Center, New York, N.Y. USA 10021 and The Liberian Institute for Biomedical Research, PO Box 31, Robertsfield, Liberia.

Observations were made on a wild-born but previously captive group of chimpanzees eight months after their release. These animals have been used for research in hepatitis viruses and are immune. The release site is an isolated 24 acre island on the Little Bassa River near Robertsfield, Liberia. The group consists of seven males and eight females, aged from 5-9 years. Individual and group behavior is normal, with subgroups forming and changing over time. The animals forage independently with supplemental food being provided several times per week. Nesting behavior was observed daily. Sick animals have been temporarily removed and successfully returned. Eventual placement in a West African national park is contingent on sufficient group maturity and cohesiveness to ensure that they will be able to defend themselves against wild populations.

0065

MNEMONIC INTERACTION BETWEEN AND WITHIN CEREBRAL HEMISPHERES IN MACAQUES. R.W. Doty*, J.D. Lewine, and J.L. Ringe, Center for Brain Research, University of Rochester, Rochester, New York 14642, U.S.A.

How can one cerebral hemisphere "know" what has transpired in the other? To examine questions of this nature five macaques with optic chiasm transected transphenoidally have been observed for their ability to use the same versus the other eye and hemisphere for recognizing previously viewed images. For instance, the monkey is shown a "sample" image for 2-4 sec using one eye, and 2-15 sec after its extinction must choose it via the other eye when it is paired against a second image. Fifty different pairs of images are used per session. All types of material, e.g., pure color, black and white or colored objects, human or monkey faces, number of identical items, alphanumeric symbols, could be accurately compared (85-100% correct) between hemispheres when only the anterior commissure (AC) or the splenium of the corpus callosum (CC) were intact; but interhemispheric performance fell to chance levels if both forebrain commissures were cut. In the "list" procedure a series of images was presented, and the monkey was required to signal any recurrence of a given image, after 0-46 other images had intervened, with a time lapse of 8-718 sec. First results show that such comparisons using the same eye are significantly better than when initial and subsequent viewing is performed via different eyes. In one macaque with AC cut and CC intact, performance by the left hemisphere was affected only by number of intervening images and not by elapsed time; whereas for the right hemisphere performance also diminished as a function of time as well as intervening images. General confirmation of such effects would suggest that the cerebral hemispheres in primates differ fundamentally in regard to mnemonic processing. (Supported by Grant BNS-8208583 from the National Science Foundation.)

0066

IMMUNOGLOBULIN ALLOTYPES IN NON HUMAN PRIMATES. PHYLOGENIC INCIDENCES. J.M. DUGOUJON*, M. BLANC, G. LARROUY, Hémostyptologie Center of CNRS, Purpan Hospital, Av. Grande Bretagne, 31300 TOULOUSE, France.

Twelve allotypic specificities G_m(1,2,3,17), G_m(5,10,11,13,14,21,28), Km(1) and eight recently described antigens of Bm system, Bm(1,2,3,4,5,6,7,8) were studied in more than 700 non-human primates belonging to 42 species and subspecies. We used the classical method of hemagglutination inhibition with human red blood cells coated with human and baboon IgG. All antiglobulins were of human origin. Our findings reveal that all samples were negative for G_m(2,3,5,21) and Km(1). Polymorphism was present in some species for other G_m and Bm markers. It was most important in Hominoidea, particularly in Chimpanzees. Based on the presence or absence of certain allotypes, we can for example distinguish Bornean and Sumatran orangutans. Antigenic sites similar to those in humans occur in some species of Cercopithecoidea. Moreover, species of the genus Cercopithecus show an important polymorphism of the Bm allotypes permitting to differentiate species phylogenetically near. Most species of Ceboidea and Prosimii have no allotypes. The study of the various immunoglobulin epitopes is thus of interest for the phylogenetic relationship between primate species, and information about evolutionary origin of immunoglobulin were obtained.

0067

A COLLABORATIVE PRIMATE PROGRAM FOR IN VITRO FERTILIZATION AND EMBRYO CULTURE TO STANDARDIZE RESEARCH TECHNIQUES AND INCREASE RESEARCH EFFICIENCY.

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Workers in a number of laboratories have studied primate in vitro fertilization and embryonic development. These studies are important but often suffer from a lack of standardization. Accordingly, a Multicenter Program for Early Primate Biology was established between our three laboratories in an effort to standardize procedures. Culture data and media samples are interchanged between the three laboratories to allow analysis of media by type and lot number, analysis of spent media and standardization of methods of follicular development induction.

Initial experiments have just been completed on medium culture techniques using a standardized mouse embryo development system. The data has been interchanged between the cooperating laboratories. Embryos going from 2 to 4 cells averaged 53.7%, 64.0% and 90.0% for TC 199 + 20% HCS, TC 199 + 20% FCS and a modified Tyrodes medium respectively. Embryos going from 4 to 8 cells were 13.0% and 76.1% for the latter two media respectively.

0068

SEX DIFFERENCES IN THE BEHAVIOR OF INFANT JAPANESE MACAQUES (*MACACA FUSCATA*) LIVING IN A CONFINED TROOP. G. G. Eaton*, D. F. Johnson, B. B. Glick, and J. Worlein. Department of Reproductive Biology and Behavior, Oregon Regional Primate Research Center, Beaverton, OR, USA 97006 and Department of Psychology, Rutgers University, New Brunswick, NJ, USA 08903

Behavioral interactions of 10 male and 12 female infants were recorded from birth to 52 weeks of age. Males played more frequently and played in larger groups than females. Both sexes played more with relatives than with nonrelatives. Males mounted more than females, and both sexes mounted females more than males. Both sexes mounted relatives more than nonrelatives. Females groomed more than males, and groomed female relatives most frequently. Males did not show a preference for partner gender, but did groom relatives preferentially. Other monkeys punished (contact aggression) female infants more than male infants, but both sexes were punished most frequently by female relatives (other than the mother). Mothers displayed differential treatment toward male and female infants: they broke contact with male infants more than with female infants. Infants of both sexes broke contact with their mothers at the same rate. These findings indicate that sexually dimorphic behaviors emerge very early in Japanese macaque development, and the differential treatment of male and female infants by their mothers and other female relatives contributes to these early sex differences.

0069

KINSHIP AND AFFILIATIVE INTERACTION IN ADULT FEMALE SOOTY MANGABEYS (*Cercocebus atys*). C. L. Ehardt, Department of Anthropology, University of Georgia, Athens, GA USA 30602, and Yerkes Regional Primate Research Center, Emory University, Atlanta, GA USA 30322.

A 14-month study of 30 adult female members of a captive group of sooty mangabeys, housed at the Field Station of Yerkes Regional Primate Research Center, investigated the influence of matrilineal relatedness upon social organization. Rates of affiliative behavior were compared between kin and nonkin to determine whether, as in closely related taxa such as baboons, interactions among matrilineal relatives significantly exceed interactions among nonrelatives. Adult females groomed, were approached by, were in contact with and in proximity to kin significantly more than nonkin. However, for approach performed by the females and grooming received by them, kin and nonkin interactions were not significantly different and the females did not interact more than expected with their relatives. Further examination of the data suggested that the significant kin effects were predominantly due to interaction with infant offspring. Analysis of rates other than that between mothers and infants indicated that adult females did not interact significantly more than expected with their kin for any behavioral category. As such, mangabey social organization appears less structured by kinship than in other species. (This work supported in part by NIH core research grant #RR00165 to the Yerkes Regional Primate Research Center.)

0070

PRIMATE PEST PROBLEMS IN KENYA HOTELS AND LODGES. D. Eley* and J. Else, Institute of Primate Research, National Museums of Kenya, NAIROBI, KENYA.

The presence of nonhuman primates, as pests, in and around tourist facilities is a frequent complaint and poses many problems. Tourists being attacked or intimidated, food raiding in dining areas and disturbance of garbage disposal constitute a public health hazard. However the majority of Hotel Managers treat the presence of primates more as a tourist attractant than a deterrent. Basic information about the problem was obtained by means of a questionnaire sent to 74 tourist facilities throughout Kenya. Of the 64 responses, 44 reported primate pest problems with baboons and vervets as the primary culprits. Particular attractants include facilities with partially enclosed dining areas, where food is in view, and tourists offering or teasing the primates. The type of garbage disposal is also a factor in some areas. Over half of the hotels surveyed make some attempt at controlling the primates. A follow-up at those facilities with serious problems shows that regardless of control measures, the tourist interest in the primates and feeding them perpetuate the situation. A preventative program is being developed to educate the public as to the resultant problems and hazards of such actions.

0071

REPRODUCTIVE SEASONALITY IN CAPTIVE VERVET MONKEYS, *Cercopithecus aethiops*. R.M. Eley, A.S. Hutchinson* and J.C. Else, Insititute of Primate Research National Museums of Kenya, Nairobi, Kenya.

Seasonal effects upon reproduction were evaluated over a four year period in vervet monkeys either caged individually or in single male harem groups. In the harem groups a birth peak existed between October and February, when over 75% of births (62 of 80) occurred. This corresponds to fertile matings between May and September. Births in July, August and September (n=11) were in part a response to early death of the previous infant. The ability to conceive "off season" was further shown when males were first introduced into all-female groups in October. Of 22 females 12 conceived and 10 gave birth between April and August. Individually caged females (n=16) were shown to cycle throughout the year with the greatest incidence of normal cycles (length 20-50 days) during the period July to October. Testicular size of males in individual cages was greatest between June and September but no annual effects upon plasma testosterone nor spermatogenesis were observed. Results indicate that although some seasonal effects are demonstrable in the physiology and endocrinology of the vervet, the seasonality of births may be due to additional factors.

0072

The Prolonged Intermenstrual Interval in the Vervet Monkey, *Cercopithecus aethiops*. R.M. Eley and R. Tarara, Institute of Primate Research, National Museums of Kenya.

Intervals between menstruation in excess of 50 days constituted 17.4% (98 of 562) of all intervals and 37.2% of time over a four year period in 29 individually caged animals. In a subgroup of 10 animals contributing 442 months of data the prolonged "menstrual cycles" amounted to between 21% and 51% of all cycles ongoing in any one month. These prolonged cycles started during any month of the year, however, the least incidence occurred in July to October which closely corresponds to the time of the breeding peak in the Institute's outdoor harem groups. Analysis of weekly blood samples showed that in many cases plasma steroids rose and fell throughout the period and the apparent amenorrhea was not associated with ovarian shut down. In a more detailed study blood was harvested bidaily. Results showed that in at least 50% of cases progesterone profiles and estradiol peaks were not different than in normal (20-50 days) cycles. The degree of endometrial development and its subsequent responsiveness to luteolysis is currently being investigated in order to determine why menstruation failed or was so reduced so as not to be detectable by gross examination of vaginal swabs.

0073

CLOMIPHENE CITRATE EFFECTS UPON PERIOVULATORY ENDOMETRIAL DEVELOPMENT AND PERIPHERAL HORMONES IN THE BABOON. R.M. Eley*, R. Tarara, M. Suleman, D.S. Eley and K.G. Gould. Institute of Primate Research, National Museums of Kenya, Nairobi, and Yerkes Regional Primate Research Center, Emory University. Atlanta, 30322.

Clomiphene citrate is used to synchronize ovulation for *in vitro* fertilization or artificial insemination. Drug action upon endometrial development was assessed in 12 regularly cycling baboons (*P. anubis*). Animals were treated with 100mg on either days 6-10 (T₁, n=8) or 10-14 (T₂, n=4) of the menstrual cycle and induced to ovulate with hCG two days after cessation of treatment. Endometrial histology was assessed by biopsies taken 1 and 5 or 3 and 7 days after hCG. Biopsies were taken from non-treated cycles for comparisons. Treatment had an antiestrogenic effect on perineal skin causing deturgescence on days 11.6±1.7 and 14.2±1.8 as compared to 19.0±2.2 in controls. Treatment or biopsy had little effect on hormone concentrations or cycle length. The endometrium of treated animals had fewer mitotic figures, decreased tortuosity of glands and decreased vacuolation of glandular epithelium when compared with time-matched control tissue. Results indicate that inadequate endometrial development could contribute to a lower success of pregnancy following clomiphene treatment.

0074

SOCIAL FACILITATION OF AGGRESSIVE BEHAVIOR IN PAIRS OF SAGUINUS FUSCICOLLIS.

G. Eppler* and M.C. Alveario, Monell Chemical Senses Center, Philadelphia 19104, USA and German Primate Center, 3400 Göttingen, Germany.

The effect of the presence or absence of the mate on the display of aggressive behaviors directed at strange conspecifics was tested in adult, permanently cohabiting male-female pairs. Each male and each female subject was allowed to interact with a strange male or a strange female for 10 minutes. The subjects were tested both, when alone with the stranger in a familiar test room, and when residing in the testroom with their mates. Each subject encountered 2 different strange males and 2 different strange females, both in the absence and in the presence of the mate. Male and female subjects showed higher levels of aggressive behavior when encountering the stranger in the presence of their mates than when alone with the stranger. It is concluded that the presence of a familiar living partner facilitates the display of aggression against unfamiliar conspecifics.

0075

CHARACTERISTICS OF CIRCADIAN RHYTHMS IN CEBID MONKEYS: *Aotus trivirgatus griseimembra* and *Callithrix j. jacchus*. H.G. Erkert* and A.Thiemann-Jäger, I.f.Biologie III, Univ.Tübingen, Morgenstelle 28, D-7400 Tübingen, W.Germany

In 11 night monkeys and 5 common marmosets held under different constant lighting conditions and LD-schedules, electroacoustic recordings of the activity rhythm and some telemetrical body temperature measurements were conducted in order to characterize the features of the underlying endogenous (circadian) timing systems. Depending on light intensity and the duration of experiment the period length of the freerunning circadian activity rhythm (CAR) varied between 24.3 and 26.3 hrs in *Aotus*, and from 22.8 - 23.9 hrs in *Callithrix*. High LL-intensities in one *Aotus* led to an internal desynchronization between body temperature (\bar{T} =24.4 h) and CAR (\bar{T} =25.5 h) whereas the feeding rhythm disappeared. Some of the *Callithrix* in LL showed a socially induced pseudo-splitting of their freerunning CAR. In *Aotus* the CAR could be entrained by LD-cycles varying from 22:2 to 0.5:23.5 h, but not by 5-min. photoperiods and 30-min. D-phases. Light pulse experiments with *Aotus* led to a phase response curve shaped as in other nocturnal mammals: i.e. delays from 0-100°, and advance shifts from 100-360° (activity onset=0°). The results indicate in both species a well developed circadian timing system of a moderate degree of plasticity.

0076

HILLTRIBE PEOPLES AND PRIMATE CONSERVATION IN THAILAND. Ardith A. Eudey, Department of Anthropology, University of Nevada, Reno, NV U.S.A. 89557

In Thailand there are more than 300,000 hilltribe people, most of whom practice some form of slash-and-burn agriculture in marginal areas where forest habitat and populations of primates and other wildlife may have remained relatively intact. The Hmong (Mèo) people, the second-most numerous population, entered Thailand from Indochina during the past hundred years, and their expansion into the western mountains is contributing to the loss of lower montane forest over 800 meters in wildlife sanctuaries including Huai Kha Khaeng and Thungyai due to the practice of true shifting cultivation in the illegal production of opium. The increase in Hmong population numbers may be associated with their economic success based on this cash crop. Hunting of primates for food or as agricultural pests also characterizes Hmong behavior. Resettlement of the Hmong may threaten them with cultural disintegration and would not necessarily lead to reduction of habitat destruction: resettlement programs have themselves been implicated in forest loss. Development of local management programs by which the Hmong people may benefit from agricultural reforms and be incorporated into the conservation of the sanctuaries appears to be a more effective solution to the problem.

0077

Mothers and daughters in Callitrichid families. S. Evans, Department of Psychology, University of Stirling, Stirling, FK9 4LA, Scotland, UK.

It is a well established fact that in Callitrichid social groups only a single female breeds. Urine samples were collected from six common marmoset daughters living in their family groups and levels of urinary pregnanediol were measured by radio-immunoassay to establish whether these females showed ovarian cyclicity. Daughters did not show ovarian cycles when housed with their families but cyclicity was quickly established when the females were removed. Extensive observations on common marmoset families have not revealed any obvious behavioural ways in which mothers suppress their daughters and the mother/daughter relationship is for the most part amicable. However, twin daughters often engage in a 'twin fight' at approximately seven months and there is frequently an obvious dominance relationship between them by the time they are subadults. On pairing dominant twins bred significantly earlier and when twins were housed together with an unrelated male the dominant twin was the one that bred. These findings indicate how the status of a daughter in her family can influence her future reproductive success.

0078

THE CARIBBEAN PRIMATE RESEARCH CENTER. D. Falk, Dept. Anatomy, Univ. of Puerto Rico Schl. of Medicine, San Juan, Puerto Rico 00936.

The Caribbean Primate Research Center (CPRC), which is affiliated with the University of Puerto Rico School of Medicine in San Juan, offers a variety of resources for primatologists. Behavioral and demographic data may be collected from the colony of 650 free-ranging rhesus monkeys that inhabit Cayo Santiago. Biomedical research, on the other hand, may be carried out at the Sabana Seca facility of the CPRC, which houses caged and corralled monkeys of the genera Cebus, Saimiri, Aotus, Macaca, and Erythrocebus. A third facility at the School of Medicine provides a repository for over 600 M. mulatta skeletons that derived from the Cayo Santiago colony. These skeletons are particularly valuable for genetic studies since maternal genealogies are known for most of them. Researchers wishing to learn more about the CPRC should contact its Director, Dr. Delwood Collins.

0079

NON-OCCLUSIVE COPPER INTRA-VASAL DEVICE (IVD) FOR CONTROL OF MALE FERTILITY.
A. Farooq, S. Mokkalati, M.M. Kapur and K.R. Laumas, Departments of Reproductive Biology and Surgery, All India Institute of Medical Sciences, New Delhi, INDIA 110029.

With the objective of developing a long term, reversible and non-occlusive method of male contraception, a 2.5 cm long copper wire (0.25 mm diameter) was inserted in the vas deferens of rhesus monkeys. Examination of semen samples obtained by electro-ejaculation showed that the copper IVD caused a remarkable decrease in sperm motility and increase in the percentage of dead and decapitated sperm. Seven male rhesus monkeys of proven fertility were inserted with the IVD bilaterally and were subjected to fertility tests after one month of post operative rest. Out of 60 matings with cycling females of known fertility, 50 were infertile while 10 were fertile. Eight of the fertile matings were between 13 and 20 months after the insertion of IVD. The overall results, when compared with fertility in the breeding colony, showed that the fertility inhibition produced by the copper IVD was highly significant ($p < 0.001$). The results will be discussed with reference to the possible mode of action of the copper IVD in rendering the spermatozoa immotile.

0080

DEMOGRAPHIC TRENDS IN THE ALOUATTA PALLIATA AND CEBUS CAPUCINUS POPULATIONS OF
SANTA ROSA NATIONAL PARK, COSTA RICA

L.M. Fedigan, Dept. of Anthropology, Univ. of Alberta, Edmonton, Alberta, Canada T6G 2H4

Exhaustive census in 1983-84 by a modified home range technique yielded data on 22 groups of howler monkeys and 22 groups of cebus monkeys in the 100km² Santa Rosa Park, which were used to analyze current demographic patterns of the park's primate populations. Statistics previously used to indicate whether neotropical primate populations are stable declining, or increasing, include mean group size, socionomic sex ratio, proportion of females with infants, and the ratio of immature to mature individuals in the population. Such data are available on other populations of Alouatta palliata, and comparisons with them suggest that the howler population in the park is stable. Few demographic analyses for cebus are available, however aspects of Cebus population characteristics can be compared to those of Alouatta in the park, and to a previous census by Freese in 1973. Although both species now have similar total populations, mean group sizes, and density estimates, the vital statistics differ, including fecundity and survivorship, as well as the socionomic ratios described above. The overall indication is that the cebus in Santa Rosa Park represent a younger and expanding population than the howlers. These differences between the two species are evaluated in relation to their different lifehistory parameters, social systems, and habitat preferences.

0081

ANOREXIA NERVOSA: A HUMAN FEMALE REPRODUCTIVE STRATEGY? J.R. Feierman, Vista Sandia Hospital, Albuquerque, NM, USA 87113.

Anorexia nervosa (AN) is a human behavioral variant described in a small subset of upper socioeconomic status (SES) adolescent females characterized by the relentless pursuit of thinness in the presence of food abundance. Body fat is reduced to the point at which amenorrhea develops; this reduced weight is maintained for several years, after which weight is regained, menses resumes, and conception may occur. Although currently conceptualized as a psychiatric illness, AN also has characteristics compatible with a sex-specific reproductive strategy. AN affects females near their peak of fertility and permits female choice regarding conception, although not copulation. Female choice implies a choice to a male offer. AN may represent a female counterstrategy to actual or perceived threat of male choice when that choice could lower female fitness. Although male choice currently may be the exception rather than the rule, it may have played a more significant role in our evolutionary past. The relationship between AN and SES is intriguing. The psychiatric literature assumes upper SES leads to AN, although a competing sociobiological hypothesis suggests AN, as a reproductive strategy, may have led to upper SES. The existing literature does not allow us to differentiate between these two competing hypotheses.

0082

FOOD-OFFERING IN COTTON-TOP TAMARINS, SAGUINUS O. OEDIPUS.

A.T.C. Feistner, Psychology Dept., Univ. of Stirling, Stirling FK9 4LA, Scotland, U.K.

Cotton-top tamarins appear to share food more than any other species of primate. Quantitative data were collected from 4 families of cotton-tops and 2 of common marmosets (Callithrix j. jacchus). The families ranged in size from 6-12 animals and lived in spacious indoor-outdoor housing. A brief description of the posture and vocalisation involved in food-sharing among S.oedipus will be given. The main direction of donor-initiated food exchange was from breeding adults to their youngest offspring. Litter-mates were never observed to share food with one another. The older sets of offspring infrequently offered food but often allowed food to be taken from them by the youngest set. Sharing between adults appeared to vary with the state of the female's reproductive cycle. All family members are related to the same degree ($r=0.5$) so food distribution is probably a function of need. A wide range of foods was observed being offered including fresh fruit and peanuts (from their usual diet), prized proteinaceous food (live locusts) and high-calorie artificial food (rusk). In a nuclear family with paternal and sibling participation in care-giving, sharing food may be a means of increasing inclusive fitness.

0083

EARLY ANTHROPOIDS IN AFRICA AND SOUTH AMERICA. J. G. FLEAGLE, Dept. of Anatomical Sciences, State University of New York, Stony Brook, New York.

The earliest higher primates are from Oligocene deposits in Egypt, Colombia, and Argentina. There is considerable debate over the phyletic relationships between the early African anthropoids and those from South America. Many authorities have argued that platyrrhine monkeys evolved from some group of prosimians or an unknown group of higher primates that entered South America from North America. Others have suggested that platyrrhines evolved from an African anthropoid stock that rafted across the South Atlantic.

New primate fossils from both Egypt and South America have greatly increased our understanding of Oligocene anthropoid morphology. In many aspects of their dental, cranial, and skeletal anatomy, the Egyptian anthropoids are far more primitive than living catarrhines and resemble platyrrhines. Furthermore, recently discovered teeth of late Oligocene platyrrhines from Argentina are strikingly similar to the Egyptian anthropoids and more primitive than any living New World monkey. All of this evidence supports an African rather than a North American origin for platyrrhines.

This research was funded in part by BNS 8210949 from the National Science Foundation and 2440-82 from the National Geographic Society.

0084

EFFECTS OF THE CONSUMPTION OF HUMAN FOODS ON THE ACTIVITY BUDGETS OF TWO TROOPS OF BABOONS, PAPIO ANUBIS, AT GILGIL, KENYA. D. L. Forthman Quick, Research Dept., L. A. Zoo, Los Angeles, CA USA 90027.

The relationship between activity and consumption of human foods was studied during the 1981 crop season in 40 baboons from PHG and WBY troops. 6 h of data on location, activity and consumption of human vs. natural forage were obtained for each subject. Although for both troops, human foods were eaten infrequently compared to natural forage, the frequency of human food consumption was higher for WBY, which ranged in an area of higher human population density. WBY often consumed high calorie, cooked maize meal, while PHG ate mostly unprocessed crop foods. There was a significant difference between the overall activity patterns of the two troops. PHG spent 41% of their time foraging/feeding and 26% resting. In contrast, WBY foraged 27% and rested 41% of the time. It is concluded that although the Gilgil baboons studied invested little time in the consumption of human foods, even low levels of consumption could produce profound alterations in activity patterns. Variability between the troops may result from differences in caloric density of the foods more than from differences in spatial concentration or frequency of consumption.

0085

MATRILINES, MULTI-MALE GROUPS, AND POLYGYNY: THE MONKEY-LIKE SOCIAL SYSTEM OF THE SPOTTED HYENA (Crocuta crocuta). L.G.Frank, Museum of Vertebrate Zoology, University of California, Berkeley, CA, USA 94720.

A four year study of spotted hyenas in Kenya's Masai Mara National Reserve has revealed a form of social organization unique among carnivores but markedly similar to that of many monkeys: females stay in their natal clan to breed while males disperse at puberty and become transients before eventually settling in a new group. Dominance hierarchies in both sexes are consistent across different measures of rank and appear to be significant in determining reproductive success. Only the alpha male was seen to mate and all evidence suggests a high degree of polygyny. Daughters of high-ranking females retain close ties to their mothers, and female rank appears to be socially inherited. Sons of the alpha female were the only males not subordinate to females and dispersed at a later age than other males; the alpha female raised only males over a five year period. The unique social status of these males, in the context of a highly polygynous mating system, suggests that the selective advantage of high rank among females may be realized through the reproductive success of sons. Ecological and behavioral factors underlying this system in a large predator will be discussed in relation to theories of primate social evolution.

0086

FOOD SELECTION OF LEMUR CATTA AND LEMUR FULVUS.

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 Abt. Verhaltensphysiologie, Univ. Tübingen, W-Germany.

Food selection of a group of Lemur catta and a group of Lemur fulvus has been studied in a 1.4 acres "Natural Habitat Enclosure" at the Duke University Primate Center. 77 different parts of 22 plant species have been analysed for their mineral contents and their concentrations of primary and secondary plant compounds.

Lemur catta feeds as a generalist and its food choice is little influenced by different plant compounds. L. fulvus feeds more selectively and chooses its food depending on the cumulative effects of proteins, alkaloids, tannins, and possibly soluble sugars. This study on captive animals is compatible with Sussman's field work and can explain his findings by the different reactions of these two lemur-species to chemical plant compounds.

0087

VOCALIZATIONS OF Allenopithecus nigroviridis AND PHYLOGENETIC AFFINITIES WITH CERCOPITHECINAE AND PAPIONINAE. J.P. Gautier, Univ. de Rennes, Station biologique de Paimpont, France.

Allenopithecus nigroviridis (Lang 1923) has been previously described as a species belonging to the genus Cercopithecus (Pocock 1903). Further analysis of different morphological and anatomical characters brings him nearer either to the genus Cercopithecus or the g. Erythrocebus, Cercocebus, Fapio or even g. Macaca (Hill 1966). More recently, a study of chromosomal evolution has led Dutrillax (1982) to consider this species as the closest one to the hypothetical ancestor of the Cercopithecinae which is itself slightly more evolved than the Papioninae. The study of vocal repertoire has been conducted on a captive group of this species in order to confirm these phylogenetic affinities. Results show that: 1/ most common vocalizations of Allenopithecus possess a physical structure close to that of the calls of arboreal Cercopithecus species, especially C. nictitans and C. cephus.; 2/ loud calls of the adult male differ from all types of loud calls currently known in Cercopithecus species and display some structural affinities with those of Cercocebus species.

0088

FRUIT CHOICE BY FRUGIVOROUS FOREST MONKEYS: RELATIONS WITH FRUIT MORPHOLOGY AND NUTRIENT CONTENT. A. Gautier-Hion, C. Sourd, R. Ouris. Station biologique de Paimpont, Univ. of Rennes, France.

The objective of the study was: 1/ to demonstrate the existence of fruit choice by monkeys among fruit species eaten by frugivorous Vertebrates, 2/ to analyse the specificity of selected fruit species in terms of fruit physiognomy and nutrient content. 122 fruit species have been described in terms of size, color, quality of the edible flesh, presence/absence of husks and stones. The nutrients of 30 fruit species have been analysed. Results show that: 1/ four classes of fruit may be defined according to their decreasing selection ratio: highly selected; neutral; avoided; totally rejected; 2/ it is possible to define a morphological syndrome of "monkeys fruit" which significantly differ from syndromes of other consumers. A tentative analysis is made to relate morphological characteristics of fruit to their nutrient content. The discussion considers how such a morphological syndrome could have evolved under the pressure of their consumers, which play a prime role as seed-dispersers.

0089

PAIR-BONDING FUNCTION OF SIAMANG (*HYLOBATES SYNDACTYLUS*) DUET SONG.

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Siamang gibbons produce long and complex duet songs. Although hypothetical mechanisms have been set forth to explain the evolutionary constraints for the development of duetting, only one of them could reasonably account for the tremendous complexity of the siamang duet song. The hypothesis that duetting might act as a reinforcement of the pair bond has repeatedly been suggested for several duetting bird and primate species. Until now, investigations which actually could demonstrate the premises underlying the pair-bonding hypothesis were lacking. Two newly formed pairs of captive siamangs have been observed. Qualitative and quantitative investigations of duet songs have been carried out in different temporal stages of pair formation. The results proffer concrete data, that a pair-bonding effect has actually to be assigned to the siamang duet song.

0090

WIDESPREAD PAPILLOMA IN THE ORAL MUCOSA IN A CHIMPANZEE, *Pan troglodytes*.

W.R. Glad, MD, Primate Section, Kristiansand Zoo, 4600 Kristiansands Norway.

A relative rapid onset of widespread papillomatous tissue in the oral mucosa in a 7 year old male chimpanzee was observed. Affected tissue include major parts of the mucosa of vestibulum oris and parts of gingiva and tongue. Changes remain unaltered over the past year and does not seem to affect the individual. Onset occurred during a period of marked stress. Electron microscopic examination ("negative staining" - techniques) has not disclosed viral/viral-like particles. Histological examination shows epithelial hyperplasia of papillomatous character with no indications of surface space cornification or reactive changes. Further EM - and histological work up will be completed shortly. Reports on papilloma in the chimpanzee seem sparse as compared to the frequency of occurrence in man. Comparison with papillomatous diseases in man is made and the question of whether physical and/or psychological stress may be a precipitating factor in the development of this condition is addressed.

0091

WHAT APES PAINT AND WHY--BEHAVIORAL ORIGINS FOR GRAPHIC PATTERNS.

H. S. R. Glaser, FB. Biologie, J.-Liebig-Univ., K.-Glöcknerstr. 21, D-6300 Giessen, West Germany.

Paintings made by 6 chimpanzees and 5 orangs on 1180 sheets under standard conditions and the behavior related to their production have been evaluated. Painting in chimpanzees is derivable in large part from grooming activity and representative of its appetitive phase. Systematic scanning movements (exploratory) and approach-withdrawal motor patterns, among others, are recruited for the production of repetitive and symmetrical graphic configurations, such as fans, crossed circles and approaches to the "mandala" and "cephalopod" stages in child art. The "reversed fan" is seen to be based on the rejection of an object, the brush, a satiation effect at the end of a session; it need not require a "fan image" in the chimpanzee, as Desmond Morris hypothesized. Other graphic innovative patterns, under visual control, may be considered to lie within the fuzzy set confines of art. The general parsimonious assessment does not negate the emergence in chimpanzees of rudimentary aesthetic faculties.

0092

THE RELATION OF INTRACORTICAL BONE REMODELING AND CORTICAL THICKNESS TO CHRONOLOGICAL AGE IN ADULT SADDLE-BACK TAMARINS. D.M. Glassman*, Behavioral Medicine Laboratory, Smith West Foundation for Biomedical Research, San Antonio, TX USA 78284

Intracortical bone remodeling and cortical thickness data were collected from thin-sections of the humerus, ulna, and tibia for 47 specimens of Saguinus fuscicollis ranging in age between 1 and 15 years. Haversian and non-Haversian structures were counted using polarized light under 100 power magnification. Counts were made of the entire cortex surface and standardized as frequency per square millimeter. Eight sites were selected for measurement of cortex thickness and general bone diameters. Pearson correlation, bivariate plotting, and regression analysis indicated that for intracortical remodeling, the humerus and ulna exhibited a significant pattern whereby increased frequencies of Haversian structures were associated with increasingly older-aged specimens. Conversely, a significant pattern of fewer non-Haversian structures were associated with older age. For tibial cortical thickness, a significant trend was exhibited towards decreased cortex size in all dimensions in relation to increasingly older specimens. Subsequently, tibial medullary cavity diameters were found to increase. These results are consistent, in part, with the patterns of bone remodeling and bone loss characteristic of adult humans.

0093

EFFECTS OF INJECTABLE ANESTHETIC AGENTS ON CELL-MEDIATED IMMUNITY IN RHESUS MONKEY (MACACA MULATTA). J.C. Gonder*, J.M. Thomas and F.H. Carver. East Carolina University, Greenville, NC, USA 27834.

Anesthetic agents have been implicated as a cause of post-surgical immune depression. Cell-mediated immunity was studied in rhesus monkeys following a single, low dose administration of five injectable anesthetic agents; ketamine HCl, meperidine, phencyclidine, pentobarbital Na or fentanyl/droperidol. Mitogen-induced lymphocyte proliferative response to PHA, concanavalin A and staphylococcal protein A were depressed to varying degrees with all agents except ketamine. Cytolytic effector function measured by antibody-dependent cell-mediated cytotoxicity (ADCC) and spontaneous cell-mediated cytotoxicity (SCC) was unaffected by meperidine treatment. Phencyclidine caused a moderate decrease in effector function as early as 30 minutes after treatment, which returned to normal by 48 hours post-treatment. Ketamine or pentobarbital treatment resulted in severe depression of ADCC and SCC within 30 minutes, with only partial recovery of ADCC 48 hours post-treatment. Administration of these five injectable agents at low doses brought about significant reduction in functional capabilities of peripheral blood lymphocytes. Since suppression of cellular immune function persisted for at least two hours in anesthetized, normal rhesus macaques, prolonged anesthetic exposure and higher doses would likely exacerbate these immunosuppressive effects. Thus, prolonged anesthesia may aggravate clinical conditions where immune system is already compromised.

0094

THE ROLE OF CYCLIC ISLET SECRETION IN HEPATIC METABOLISM. Charles J. Googner*, Donna J. Koerker and David S. Weigle. University of Washington School of Medicine and Regional Primate Research Center, Seattle, WA, USA.

We have reported that insulin and glucagon are secreted in discreet pulses in 3 non-human primate species. These pulses are usually regular at intervals of 8-12 minutes. The phase relationship between insulin and glucagon is often fixed at 200-220°. Studies in fasting M. mulatta have demonstrated that hepatic glucose production is entrained to this alternating on-off signal in the portal circulation. Glucose production rose and fell by 60% every 10 minutes and caused a small oscillation in peripheral plasma glucose concentration. The physiologic advantage of this mode of secretion has been investigated in vitro using perfused isolated rat hepatocytes. Pulsed delivery of glucagon leads to enhanced glucose production compared to continuous delivery of the same amount of hormone. At the mid-point of the physiologic dose-response range a two-fold enhancement of response can be demonstrated. These data suggest that as in the reproductive system, endocrine control of metabolism is importantly conditioned by episodic secretion of hormones. The non-human primate appears to be a particularly good model for studying this physiologic phenomenon and its pathogenetic importance in metabolic diseases such as diabetes mellitus.

0095

SCIENTIFIC MANAGEMENT OF A BABOON BREEDING COLONY. W. J. Goodwin*, J. L. VandeBerg and A. M. Coelho, Jr., Southwest Foundation for Biomedical Research, San Antonio, TX, USA 78284.

A defined program for large-scale breeding of five sub-species of Papio cynocephalus has been established providing pedigreed baboons for biomedical research in the United States. A unique facility consisting of two 6.0 acre corrals, outdoor cages, and support areas has been developed. Scientific management techniques have been implemented including primate medicine, biochemical and population genetics, growth and development and behavior. A strategy for the long-term genetic management of the colony is being implemented and a computerized data management system has been established. Approximately 200 infants are produced annually and infant, juvenile, adult and time-pregnant female baboons are available for research purposes.

0096

ABNORMAL BEHAVIOUR IN RHESUS MONKEYS AND HUMAN MENTAL DISORDER
C. Goosen, Primate Center TNO, P.O. Box 5815, 2280 HV Rijswijk, The Netherlands

Rhesus monkeys which experienced periods of social isolation early in life often show persistent abnormal behaviour, i.e., activities which are not known from feral monkeys and which are often highly idiosyncratic. Study of the morphology of the abnormal activities has shown that they can be interpreted as disturbed, misdirected social behaviour. This interpretation is reminiscent of that of human mental disorders like depression and schizophrenia. In order to investigate whether the similarity in abnormal behaviour between monkeys and humans extends also to the pharmacological aspects, we investigated whether clinically effective psychopharmaceuticals are also active in the monkeys. To this end we studied the effects of the antidepressant clomipramine (5 mg/kg per os twice daily during 20 days) and neuroleptic haloperidol (.05-.8 mg/kg per os twice daily during 20.5 days) in 16 laboratory raised adult females, all of which had some abnormal activities in their repertoire. Results showed that both drugs did decrease the amounts of abnormal behaviour in a majority of the subjects. It is likely therefore, that study of abnormal behaviour in rhesus monkeys could significantly improve our understanding of major mental disorders in man.

0097

BINAURAL TIME DISPARITY IN SOUND LOCALIZATION OF COMPLEX SIGNALS IN OLD WORLD MONKEYS (M. NEMESTRINA). G. Gorrevitch and R. Abrea, Hunter College, City University of New York, New York, NY, USA.

The binaural system extracts directional information about acoustic signals from the amplitude and time differences of the signal that develop between the ears. Under natural conditions these cues act in concert. However, some are more effective than others along particular segments of the audible spectrum. Auditory signals were delivered to the ears through earphones and sensitivity of the binaural system to one cue alone was determined. Monkeys were trained to turn on noise signals characterized by an ongoing interaural time difference and to report the side on which the signal appeared to originate. By varying the magnitude of the time difference from trial to trial thresholds were determined.

Results indicate that ongoing interaural time differences in complex signals can serve monkeys as a localization cue. The sensitivity of the monkey's binaural system for this cue is greatest at midrange frequencies, where it appears to be the predominant cue. At higher frequencies, sensitivity to this cue is diminished.

(NSF grant BNS 7915834 and NIH grant RR08176)

0098

BEHAVIOR OF GROUP-LIVING RHESUS MOTHERS TOWARD MALE, FEMALE, AND PSEUDOHERMAPHRODITIC FEMALE INFANTS. R. W. Goy*, G. DiGregorio and M. McBrair, Regional Primate Research Ctr. and Dept. of Psychology, University of Wisconsin, Madison, WI, USA 53706.

Daily observations of mothers and infants (between 3 and 12 months of age) revealed that mothers of males and pseudohermaphrodites explored their own infants' genitalia more often than mothers of females ($p < .01$). Mothers of males and pseudohermaphrodites also presented to their own infants more often than mothers of females ($p < .001$). Analyses of behavior shown toward infants not their own revealed that mothers 1) explored male and pseudohermaphroditic genitalia more often than those of females, and 2) threatened females more often than males or pseudohermaphrodites ($p < .01$). Negative behaviors of mothers to infants not their own were displayed equally toward male and female infants. However pseudohermaphroditic infants received more of such behavior from mothers of male than from mothers of female infants ($p < .01$). We conclude that the behavior of mothers toward infants provides for differential developmental experiences of males, females and pseudohermaphrodites. (Supported by grants RR00167 and MH 21312).

0099

MONITORING TROPICAL FOREST ECOSYSTEMS USING REMOTE SENSING TECHNOLOGY. K.M. Green, Science Applications Research, Riverdale, MD, U.S.A. 20737.

Tropical and subtropical forests have been declining as a result of numerous factors described extensively in the literature. A shortcoming for many tropical ecologists has been the paucity of quantitative information available to document this loss. An essential need for management of tropical ecosystems is reliable, relatively inexpensive inventory data. The potential use of remote sensing from satellites for surveying natural resources in the tropics has been recognized by numerous authorities. In general, the available information on the status of tropical forests in conjunction with land use changes of converted forest areas is far from satisfactory. Examples of Landsat analysis in the tropics will be presented for areas in South America, Asia, and Africa. Discussion will detail the problem of monitoring the rate or quantifying the trend of tropical forest conversion with regard to an acceptable inventory system. Finally, the need to pursue such applications in conjunction with an overall Land Resources Information System as envisioned by NASA will be highlighted.

0100

CHANGE FROM MULTIMALE - TO UNIMALE - SOCIAL ORGANIZATION IN A TROOP OF HANUMAN LANGURS, *Presbytis entellus*, NEAR HARIDWAR, U.P., INDIA. B.S. Grewal, Dept. of Biology, Guru Nanak Dev University, Amritsar, Punjab, INDIA 143005.

Observations on age-sex composition of a troop of Hanuman Langurs, *Presbytis entellus*, at Mansa Devi Temple near Haridwar, U.P., India were made in December 1982 and December 1983. During this one year, the total number of animals declined from 22 (3 adult males, 7 adult females, 5 subadult/juvenile males, 2 subadult/juvenile females and 5 infants) to 11 (1 adult male, 6 adult females, 1 subadult/juvenile male, 2 subadult/juvenile females and 1 infant). A well established rank order existed among 3 adult males in December 1982. Only a first ranking adult male was seen in the troop in December 1983. Results suggest that this species may not strictly adhere to multimale structure.

0101

A COMPARISON OF KENYAN AND SOUTH AFRICAN GALAGOS - ARE THEY THE SAME SPECIES?
C.S. Harcourt, Department of Zoology, Cambridge University, Cambridge CB2 3EJ, U.K.

Two species of bushbaby were studied in Kenyan coastal forest at Diani, 30kms south of Mombasa. The methods of trapping and radio collaring were similar to those used by myself and others when working on galagos in South Africa. Both of the Kenyan species are smaller and of a different colour from those in South Africa. Their calls, diet, locomotion, nesting habits, litter size and social organisation are also not the same. Though these bushbabies are often regarded as sub-species of the better known galagos in South Africa (Galago senegalensis and Galago crassicaudatus) this study strongly suggested that this is not the case. I consider that it would be more useful if both the Kenyan coastal galagos be given specific status, the smaller one to be known as Galago zanzibarcicus and the larger as Galago garnettii as suggested by some earlier authors.

0102

SEASONAL CHANGES IN RANGING AND GROUPING PATTERNS OF WILU CHIMPANZEES IN MAHALE, TANZANIA]
T. Hasegawa*and M. Hiraiwa-Hasegawa, Dept. of Psychology and Dept. of Anthropology, the Univ. of Tokyo, Hongo, Tokyo, Japan.

Ranging and grouping patterns of habituated chimpanzees (Pan troglodytes) were observed for 28 months in the Mahale Mountains, Tanzania. The subject unit-group consisted of over 100 members. Their ranging and grouping patterns changed seasonally corresponding to transition of their major food. In the season when only a few food species made up the bulk of feeding bout, i.e., the major food seemed abundant, the chimpanzees formed big-sized subgroups and used wide area. When they fed on variety of food, i.e., overall food availability was expected to decrease, they moved in small-sized groups or individually and each animal's range was reduced. In each season, adult males apparently used wider ranges than adult females did. These results are mostly similar to those reported in Gombe, although the seasonal shift of ranges is more clearly demonstrated in Mahale than in Gombe.

0103

AN ANALYSIS OF SOME MANDIBULAR AND DENTAL DIMENSIONS IN TWO SPECIES OF CERCOPITHECINAE, PAPIO ANUBIS AND CERCOPITHECUS AETHIOPS. J. Hassanali¹, D. Mwaniki² and F. Manji². ¹ - Dept. Human Anatomy, Univ. of Nairobi, Box 30197, Nairobi. ² - Kenya Medical Research Inst., Med. Res. Centre, Box 20752, Nairobi.

Selected biometric measurements of 53 Papio anubis and 84 Cercopithecus aethiops mandibles were analysed. The following measurements were made, intercondylar width (IDW), intercoronoid width (ICRW), intermolar width (IMW), the mesio-lateral widths of condyles (COND), height of occlusal table (OCH), and antero-posterior length of chewing surface from P⁴ - M³ (CL). For all six variables the males were significantly larger ($P < 0.01$) than females. However, there was no difference between males and females in the ratio of IMW: ICW. This ratio was significantly larger in Cercopithecus aethiops than in Papio anubis ($P < 0.01$). Correlation matrices between the six variables were calculated. There appeared to be differences between the sexes in both species. Generally, in males of both species, the condyles appeared to be more commonly associated with other variables whilst in females IMW was more often associated with other variables. Sexual dimorphism and interspecies differences are discussed.

0104

A PRELIMINARY REPORT ON THE STEREOLOGICAL ANALYSIS OF THE DEVELOPING MIDBRAIN OF THE BABOON WITH SOME OBSERVATIONS OF THE MESENCEPHALIC NUCLEUS OF THE TRIGEMINAL NERVE. *J. Hassanali¹, R. Tarara², J. Maina³.
 1 - Dept. Human Anatomy, Univ. of Nairobi, Box 30197, Nairobi. 2 - Inst. of Pr. Res., Box 34505, Nairobi. 3 - Dept. Vet. Anatomy, Univ. of Nairobi, Box 30197, NRB.

Brains of 35 day, 50 day, 70 day, 100 day, neonate and adult baboons were fixed and serially sectioned (7 μ) from the superior colliculi to the anterior medullary vellum. The sections were stained with H/E. Stereological method of point counting was used to obtain values of relative volume densities of the various components of the midbrain, namely, the tectum, tegmentum, central gray matter, cerebral aqueduct, nuclei of cranial nerves and basis peduncle. Cell counts of the total number of mesencephalic neurons in the different embryo, neonate and adult brains were made and their relative position and density along the extent of the mesencephalic nucleus determined. Some characteristic features of the mesencephalic nucleus such as cell clustering, size of neurons, and cell morphology were noted. Relative changes in the volume densities of the various components in the developing, neonate and adult midbrains are discussed. The findings of the embryonic mesencephalic nucleus are discussed in relation to the changes from the embryonic to the adult state.

0105

MALE RESPONSE TO INFANT VOCALIZATIONS IN VERVETS; PATERNAL RECOGNITION AND THE EXPRESSION OF A CHARACTERISTIC TRANSFER MALE TRAIT. H.D. Hauser, Dept. of Anthropol., Univ. of California, LA, Ca, 90024, USA; Institute of Primate Research, Nairobi, Kenya.

This paper presents results from two experiments designed to address the following issues. First, research on a variety of species has shown the importance of kin recognition in the organization of social behavior. Typically, such kin recognition systems have been examined through maternal lines of descent, thereby leaving questions of paternal recognition unresolved. To examine the possibility of paternal recognition, playback experiments were conducted on vervet monkeys in Amboseli National Park, Kenya. The infant "lost wrr" was presented to adult males in five ecologically distinct groups, and response duration and latency recorded. Males were ranked in terms of paternal certainty based on five criteria: 1) number of copulations observed between a given δ and f , 2) ratio of breeding f to breeding δ , 3) δ rank, 4) δ tenure in a group, and 5) frequency of "floater" δ present during the breeding season. Results suggest that male vervets respond to infant "lost wrrs" based on the degree of paternal certainty. The second playback experiment addressed the following question: How should recently transferred males respond to infant vocalizations given the high improbability of their having sired such infants? For these experiments, the infant "scream" was presented to transfer males in the five groups. Only males who had attained or were in the process of attaining high rank responded. This result is discussed in light of some possible mechanisms and outcomes of a transfer male's admission into a new group.

0106

LEFT-HEMISPHERIC DEPENDENCY OF MACAQUES FOR THE PERCEPTION OF VOCALIZATIONS, H. E. Heffner and R. S. Heffner, Lab. of Comparative Hearing, Univ. of Kansas, Parsons, KS, USA 67357.

The possibility of left hemispheric specialization in macaques was investigated by use of the ablation-behavior technique. Seven monkeys received lesions of either left (4 animals) or right (3 animals) primary and association auditory areas. Following testing and retraining on the discrimination of their species "coos", 4 of the animals received similar lesions of the other hemisphere. Unilateral ablation of left auditory cortex consistently resulted in an initial impairment in the ability to discriminate the vocalizations. In contrast, unilateral ablation of right auditory cortex had no measurable effect. Bilateral lesions, however, totally and permanently abolished the ability to perform the discrimination.

These results demonstrate that the perception of at least some species-specific vocalizations is mediated by cerebral cortex. Further, since left auditory cortex plays a primary role in this perception, macaques may possess at least a rudiment of an area homologous to Wernicke's area in humans.

(NIH grants NS12992 and HD02528)

0107

CORTICALIZATION OF HEARING IN PRIMATES: DEAFNESS IN JAPANESE MACAQUES FOLLOWING BILATERAL AUDITORY CORTEX ABLATION, R. Heffner¹ and H. Heffner, Lab. of Comparative Hearing, Univ. of Kansas, Parsons, KS, USA 67357.

In humans, bilateral lesions involving auditory cortex result in a hearing loss--so called cortical deafness. This phenomenon is not seen in neurologically primitive mammals (e.g., opossum rats) nor in neurologically specialized non-Primates (e.g., cats, dogs).

Immediately after bilateral auditory cortex lesions macaques show a hearing loss of up to 60 db. The hearing thresholds of two animals were followed over a period of several months, during which a gradual improvement in sensitivity was noted. In contrast, one macaque whose lesions spared auditory cortex showed no evidence whatever of hearing loss. Thus, bilateral auditory cortex lesions in macaques result in a phenomenon strikingly similar to cortical deafness in humans, while non-auditory cortex lesions no measurable effect on hearing. The possibility of an early Primate specialization of auditory cortex is raised.

(NIH grant NS 12992 and HD 02528)

0108

SIMIAN ACQUIRED IMMUNODEFICIENCY SYNDROME (SAIDS). R.V. Henrickson, D.H. Maul, N.W. Lerche, P.A. Marx, K.G. Osborn, L.J. Lowenstine, California Primate Research Center, University of California, Davis; M.B. Gardner (Chairman), Department of Pathology, University of California Davis Medical Center.

A spontaneously occurring acquired immunodeficiency syndrome (SAIDS) has been recognized in one group of rhesus monkeys housed outdoors in a .5 acre corral at the California Primate Research Center. The disease has been transmitted experimentally to healthy rhesus monkeys using tissue extracts, blood, serum and filtered plasma (0.45 μ m). A type D retrovirus related to but distinct from the Mason-Pfizer Monkey Virus (MPMV) has been isolated in vitro from animals with SAIDS. Tissue culture fluids containing this virus has induced SAIDS in healthy rhesus monkeys. The clinical and pathological features of SAIDS and the natural history of the spontaneous outbreak will be presented.

0109

ENVIRONMENTAL INFLUENCES ON THE GASTRO-INTESTINAL PARASITES OF *Papio ursinus* IN THE DRAKENSBURG MOUNTAINS, R.S.A. S.P. Henzi^{*}, C. Appleton and A. Whitten, University of St. Andrews, Scotland.

The scats obtained from two troops of baboon living at different altitudes were analysed in order to assess the possible effects of a parasite burden on their behavioural ecology. The eggs of five species of nematode and the cysts of several species of protozoa were recovered. Parasite loads were greater in the lower troop while, for both troops, there was a seasonal fluctuation of those species which have free-living larval stages but not for *Trichuris* which does not. These loadings, which differed from those of baboons sampled in bushveld, were judged to be concomitant with life in a subalpine environment.

0110

INNATE AND LEARNED COMPONENTS OF RESPONSES TO TWO WARNING CALLS IN SQUIRREL MONKEYS.

M. Herzog, S. Hopf and D. Ploog⁺, Max Planck Institute for Psychiatry, Munich, West Germany.

Squirrel monkeys were separated from their mothers on the day of birth and surrogate-reared. They responded differentially to playbacks of two species-specific alarm calls. The reaction to the alarm peep, the warning call for bird predators, was prompt flight to the mother surrogate and essentially resembled the respective behavior of mother-reared infants. The responses to yapping, the alarm call for terrestrial predators, were less clear-cut and habituated soon. However, when yapping was played back in connection with the presentation of a reference object, both subjects tested in this way avoided the object while they thoroughly explored an object presented with a control tone. From this it can be concluded that the perception of both alarm calls is innate. However, the persistent response to yapping, but not to the alarm peep, requires a visual object that has to be learned.

0111

CORTISOL AND MOVEMENT PATTERNS IN PROTEIN DEPRIVED RHESUS INFANTS. S. Hill*, Dept. of Psychology, University of New Orleans, La., USA 70148; R. Chinn, Dept. of Psychology and S. Bucu, Dept. of Experimental Statistics, Louisiana State University, La. 70805.

Data were obtained for 4 infants over the first 8 months of life. Each monkey was separated from its mother at birth and reared in an individual cage. All were placed on isocaloric diets with 3.35% protein during the first 120 days of life. Protein was restored to 13.4% (adequate) during days 121-240. Morning and afternoon blood samples were taken beginning in the first week of life and continuing through day 240. Movement bouts were observed in two-hour blocks by video tape during these 240 days. There were individual differences in the development of the expected higher morning cortisol levels for the 4 animals. One infant showed the expected pattern during the first months of life and maintained it throughout the periods of diet restriction and restoration. A second animal established the pattern during the third month of life and maintained it over the remaining period of deprivation and the period of protein restoration. One animal developed the pattern only after diet restoration and the fourth did not develop a clear pattern during the 240 day period. All animals, on the other hand, developed a pattern of higher afternoon movement levels by 60 days which they maintained. These findings indicate substantial variation in the infants' response to protein deprivation and/or in the development of rhythmicity.

0112

EXCRETION OF URINARY STEROID METABOLITES DURING EARLY PREGNANCY IN THE BABOON; EFFECTS OF EMBRYO REMOVAL. J.K. Hodges, R. Tarara and J.G. Else, Institute of Zoology, Regents Park, London NW1 4RY, U.K. and Institute of Primate Research, P.O.B. 34505, Nairobi, Kenya.

Changes in the patterns of urinary steroid metabolites during the first 3 weeks of pregnancy were examined in 10 female Olive baboons in which embryos were surgically removed between 10 and 20 days of gestation (day 0 = day of serum LH surge). Oestrone conjugates and pregnenediol-3 α -glucuronide (PdG) were measured by direct assays in overnight urine samples collected from before day 0 until 5 days after surgery. Mean-s.e.m. levels of PdG rose from 52.3-19.5 ng/mg Creatinine (Cr) on day -1 to a maximum value of 585-133 ng/mg Cr on day 9. The duration of elevated PdG (14-23 days) varied between individuals depending upon the stage at which the embryo was removed. Mean-s.e.m. levels of conjugated oestrone fell from 90.8-33 ng/mg Cr 1 day before ovulation to a baseline of 20-30 ng/mg Cr between days 3 and 12 of pregnancy. There was a marked increase in the excretion of conjugated oestrone in 8 of 10 animals beginning on days 13-17, irrespective of the time of embryo removal. Mean data for these animals showed a significant increase on day 15, reaching maximum values of 168.9-31 ng/mg Cr on day 18. The importance of the observed increase in conjugated oestrone in the control of early pregnancy is not clear. However, the findings demonstrate a rapid and practical approach for monitoring ovulation and implantation by a single assay technique.

0113

PERMANENT ADOPTION EFFECTED IN A CAPTIVE RHESUS MONKEY GROUP. S.D. Holman,* R.W. Goy and D. Yoshihara, Wisconsin Regional Primate Research Center, Madison, USA and Dundee College of Technology, Dundee, U.K.

Subsequent to parturition, the babies of four multiparous females in a troop (69 adults and juveniles) were exchanged with like-sex babies born to non-troop mothers. The original troop babies were aged approximately 24, 24, 72 and 96 hours and were interchanged respectively with non-troop babies aged 120, 96, 24 and 48 hours. The relationship between the foster-mothers (FM) and their unrelated babies generally appeared normal: the mother suckled and formed affectionate bonds with the baby, while the baby allowed this development to take place. However, comparisons of behavioural interactions and patterns recorded for other multipares which had also recently given birth, or for the FMs themselves recorded in previous years, with FM-infant pairs, revealed that the values of, for example, infant 'fidgetiness' and tantrums and maternal restraining and retrieving, were higher in FM-infant pairs. In addition FMs completely relinquished contact with the infant for the first time later than natural mothers. Thus, these preliminary data indicated an over-protective tendency of the FM towards the adopted infant. It is suggested, therefore, that there was recognition between the FM and/or the infant of the non-relatedness of the other but that in spite of this, the FM was compelled, to nurture the unrelated infant.

0114

MOUNT-SEQUENCE INTRUSION AND MALE-MALE COMPETITION IN MACACA FUSCATA. Michael A. Huffman Laboratory of Human Evolutionary Studies, Kyoto University, Kyoto, Japan 606.

Mount-sequence intrusion as a form of δ - δ competition has been attributed to the maintenance of social class preference in Macaca fuscata. 58 M/S intrusion events were observed in the Arashiyama B Troop, Kyoto, Japan during the first half of the 1983-84 mating season. M/S intrusions were directed toward the Q ($n=48$), the S ($n=8$), or both S - Q ($n=2$). The pairs most intruded upon were middle ranking females and their sub-leader or peripheral male partners. In 42 of 47 M/S intrusions for which data subsequent to the intrusion could be recorded the intruded upon pair resumed the mounting sequence; 50% ending in ejaculation. Out of 58 events, leader class males were responsible for 37, all but 1 were directed towards higher ($n=17$) to middle ($n=16$) ranking females. The "Peculiar Proximate Relationship" (PPR) observed among M. fuscata, in which certain S - Q pairs avoid mutual sexual activity, was found present among certain intruding-intruded leader class S - Q pairs. This preliminary report suggests that M/S intrusion is an ineffective means of maintaining social class preference, and that it does not indicate competition for sexual access to females but perhaps female control of reproductive activity.

0115

NON-KIN CAREGIVING TO MALE INFANT VERVETS. S.M. Hunt and J.S. Lockard*, Dept. of Psychology, Univ. of Washington, Seattle, WA, USA 98195.

A group of 29 Cercopithecus aethiops plus the 7 focal infants (6 males and 1 female) born during the study period on St. Kitts Island, West Indies were observed for 226 hours. The situation before, during and after a caregiving interaction took place was recorded in order to access the mother, infant and aunts's behaviour during allomother initiations. Observations were divided into three successive 6-week periods from birth of the infant (I, II, III). All 7 infants were observed, but only the data of the 6 male infants are presented in the analyses. Chi square tests of significance support the results: a) Kin relationships were not a major determinant of amount of care given to male infants; b) reproductive state of a female was a factor in determining the amount and type of aunting exhibited; c) mothers acted differently toward their own young than they did toward other infants; d) mothers had preferences for specific aunts; and e) young males allomothered considerably. (Appreciation is extended to the Behavioral Sciences Foundation Primate Research Center on St. Kitts Island, West Indies for permitting this research.)

0116

FUNCTIONAL AND MORPHOLOGICAL STUDIES OF UPPER EXTREMITY MUSCLES IN PRIMATES IN REFERENCE TO THE COMPARISON WITH PIG-TAILED MACAQUE. Seichiro Inokuchi and Ryosaku Ito, Yoko Matsuyama, Otsuma Women's University, Japan.

In order to clarify the functional development of the upper extremities, the skeletal muscles from one adult pig-tailed macaque (P), one infant chimpanzee (C), and seventeen adult humans (H) were studied for relative muscle weight and muscle fiber organization. The results were: (1) Comparison of the ratio of muscle weight for all muscles of upper extremities showed H>P>C in triceps brachii; P>H>C in biceps brachii; C>P>H in flexor digitorum profundus and superficialis; H>C>P in brachialis; and P>C>H in brachioradialis. 2) Comparison of the muscle fiber in upper extremity muscles of the macaque showed triceps brachii > biceps brachii > brachialis > flexor digitorum profundus > flexor digitorum superficialis > brachioradialis. 3) The size of muscle fibers in the pig-tailed macaques were relatively larger in the triceps brachii and flexor muscle group in antebrachii; large in flexor muscle group in brachii; and smaller in extensor muscle group in antebrachii.

0117

MANAGEMENT OF REPRODUCTION IN A BREEDING COLONY OF BUSHBABIES. M.K. Izard* and E.L. Simons, Duke University Primate Center, Durham, North Carolina, 27705.

Most prosimian primates either are endangered, breed poorly in captivity, or are unobtainable in large numbers. For these reasons, bushbabies (*Galago ssp.*), which have the potential for high reproductive output, and are easy to handle, feed and house, are becoming increasingly important as a model for the early stages of primate evolution and as a biomedical model. With the decreasing availability of these primates from the wild and growing reluctance to exploit wild stocks, captive propagation is a necessity. A breeding colony of 3 species of *Galago*, funded by NIH, was established at the Duke University Primate Center in 1981, with the objective of determining management techniques to optimize reproduction in captivity. A management program for reproduction, including biweekly vaginal smear, monthly pregnancy palpations, and isolation of pregnant females prior to parturition, was designed and implemented. Isolation of pregnant females results in a significant decrease in neonatal mortality. Monitoring reproduction results in a decrease in interbirth interval. In addition to improvements in reproduction that have occurred as a result of the management program, data have accumulated on parameters of reproduction, including cycle length, gestation length, lactation length and age at puberty. This information is used to modify the management program. A workable management program for reproduction can contribute to the success of a captive conservation effort.

0118

THE HAND OF THEROPITHECUS BRUMPTI. N.G. Jablonski, Dept. of Anatomy, Univ. of Hong Kong, Hong Kong.

Theropithecus brumpti is known from Pliocene-aged deposits of the Kubi Algi and the Shungura Formations of East Turkana and the Omo, respectively. A partial skeleton of an adult male *T. brumpti*, recovered from Member E of the Shungura Formation, includes most of the elements of the digital rays of the right hand. Comparison of these elements with those of the hand skeleton of *T. gelada* reveals great similarities between the two species in the morphology of the individual rays, the relative proportions of the digits, and the calculated opposability indices. In *T. gelada*, a high opposability index is correlated with the habit of "manual grazing," an important feature of the species' feeding behavior. A similar behavior is, thus, proposed for *T. brumpti*. *Theropithecus brumpti* and *T. gelada* belong to separate lineages, which appear to have diverged early in the history of their genus. Similarities in the cranial and postcranial features of the feeding apparatuses of the two species suggest that these features were present in the common ancestor of their respective lineages. The emergence and subsequent diversification of species of *Theropithecus* can, thus, be linked to the evolution of a distinctive feeding adaptation, characterized today in the *gelada* by the efficient harvesting and mastication of large amounts of fibrous vegetation.

0119

SIZE AND SHAPE OF THE ORBITAL OUTLINE: A MULTIVARIATE COMPARISON AND ALLOMETRIC ANALYSIS IN FOUR HOMINOID SPECIES. Burkhard Jacobshagen, Anthropogisches Institut der Universitat Giessen, 63 Giessen, den Wartweg Netherlands.

Numerical data of the orbital contour collected by the use of stereophotogrammetry and transformed with Fourier analysis were the basis of different computations. First, multiple Discriminant Analysis was performed showing the morphometric affinities between the four species *Pan*, *Gorilla*, *Pongo* and *Homo*. Second, for each species separately, the correlations were examined by Factor Analyses and Regression Analyses. The latter were calculated between size and shape parameters to determine the intraspecific allometric trends among adults. These were compared and discussed with reference to taxonomy and function.

0120

SOCIAL AND ENVIRONMENTAL DETERMINANTS OF REPRODUCTIVE CYCLES IN PATAS MONKEYS. P.G. Johnston* and T.E. Rowell, Zoology Dept., University of California, Berkeley, CA 94720 USA.

Patas monkeys in captivity in Berkeley, California show breeding seasonality, usually mating and conceiving in the Fall. A group of females kept without a male showed appropriate seasonal changes in their menstrual cycles. In addition their cycles became synchronized during the mating season. Males housed separately from females show changes in testis size, testosterone level, aggressive interactions and vigilance behavior somewhat earlier than the females at the beginning and end of the season.

0121

THE CONTRIBUTION OF DIFFERENT BRAIN AREAS IN VOCALIZATION. A LESIONING STUDY IN THE SQUIRREL MONKEY. U. Jürgens* and A. Kirzinger, Max-Planck-Institute of Psychiatry, Munich, West Germany.

In order to find out the brain areas involved in motor control of vocalization, bilateral lesions were placed in a systematic manner throughout the squirrel monkey's brain, and the effects of these lesions on the acoustic structure of the calls were determined spectrographically. It was found that, in contrast to man, cortical lesions, as well as lesions involving the basal ganglia and the thalamus, do not interfere with vocalization. Lesions of specific parts of the midbrain and pons tegmentum, however, as well as lesions within virtually the whole medulla (except the vestibular nuclei), affected phonation severely. From this it can be concluded that the motor coordination of monkey calls takes place in the brain stem. In its rostral part, the responsible structures lie in the ventral and lateral tegmentum, in its caudal part, they are distributed throughout the medulla.

0122

FEMALE MATE CHOICE IN VERVET MONKEYS (CERCOPITHECUS AETHIOPS). A. C. Keddar,
Department of Anthropology, U.C.L.A., Los Angeles, CA. 90024

Any study of female mate choice must address three questions: 1) Do females have preferences for particular males 2) Can females act upon these preferences or are they constrained by such factors as male-male competition and 3) Is female mate choice adaptive. To study these questions an examination of female reproductive behavior and mate selection was conducted on a captive colony of vervets in Sepulveda, CA from January 1983- March 1984. Vaginal swabs were collected three times a week from each female to determine her reproductive state. Male-female interactions were observed in group and dyadic situations to determine whether females mate with different males under the two conditions. Results suggested that all females preferred the dominant male in both groups and dyads. Dominant females, however, were more successful than subordinate females in rejecting the sexual solicitations of subordinate males. Thus female dominance status plays an important role in female mate choice.

0123

DIFFERENTIAL INFLUENCE OF VARIOUS SWEET SOLUTIONS ON CALORIC REGULATION BY RHESUS MONKEYS (Macaca mulatta). J.W. Kennitz* and M.M. Neu, Wisconsin Regional Primate Research Center, University of Wisconsin, Madison, WI 53706 U.S.A.

Consumption of sucrose (S), maltose (M), fructose (F) and glucose (G) solutions and of standard laboratory food was measured for adult male monkeys (n=8). Six concentrations of each sugar (0, .2, .4, .6, .8, 1.2 M) were used during 2-hr. tests (1 solution/test, 1 test/day). Monkeys drank more of all solutions containing sugar than of plain water; overall, the most preferred concentration was 0.4 M and the most preferred sugar was F. Aspartame solution (A; 4.7×10^{-3} M) was also preferred to water and was consumed in amounts comparable to that of sugar solutions. In all conditions the greatest rate of drinking occurred during the first 10 min. of the test. Intake of solute increased with increasing concentration of sugar solutions but tended to asymptote at higher concentrations. Food intake was reduced the afternoon of the sugar tests and varied inversely with sugar intake during the test for S ($r=-.96$), G ($r=-.96$), and M ($r=-.97$), but not for F ($r=-0.02$). Food intake was not affected by A intake. In summary, 1) rhesus monkeys drank large volumes of sweet solutions; 2) they compensated for calories taken in the form of S, G, and M by reducing subsequent intake of solid food; and 3) they consumed large quantities of F and A solutions, but these substances did not inhibit eating of solid food. (Supported by NIH RR00167 and an award from the Trewartha Honors Undergraduate Research Fund to M.M.N.).

0124

THE STRUCTURE AND INNERVATION OF THE CAROTID SINUS AREA IN THE VERVET MONKEY, CERCOPITHECUS PYGERYTHRUS AETHIOPS. J.K. Kimani, Dept. Human Anatomy, Univ. of Nairobi, P.O. Box 30197, Nairobi, Kenya.

The structural organization of the carotid arterial system of the vervet monkey has been studied with both light and electron microscopy. It has been demonstrated that the carotid sinus area located at the origin of the internal carotid artery has a preponderantly elastic structure. Sensory nerve terminals, which are characterized by an abundance of mitochondria are found in the deeper portion of the tunica adventitia and at the media-adventitia border, where they are closely related to the elastic fibres. It is concluded that the preponderance of elastic tissue in the carotid sinus area constitutes a morphological adaptation of the arterial wall to a baroreceptor function.

0125

ORGANISATION AND DISTRIBUTION OF ELASTIC FIBRES IN THE DURA MATER OF A FEW SELECTED NON-HUMAN PRIMATES. J.K. Kimani, S. Njoroge and A.H. Walji.
Dept. Human Anatomy, Univ. of Nairobi, Kenya.

Studies on the structural organisation of the dura mater in the baboon and vervet monkey have revealed that the spinal dura contains more elastic fibres than the cranial dura mater. Furthermore, the thicker dorsal aspect of the spinal dura mater contains more elastic fibres, which run in the most part longitudinally, than the thinner ventral part of the dura mater. Evidence is also presented on the attachment of the dura mater to the posterior arch of the atlas, and near the midline by a largely elastic fibrous strand. It is concluded therefore that the higher content of elastic fibres in the dorsal aspect of the spinal dura mater in these non-human primates is related to the increased flexibility and mobility on the dorsal part of the vertebral column.

0126

MICROSCOPIC ORGANISATION OF THE LATERAL COSTOTRANSVERSE LIGAMENTS IN THE VERVET MONKEY, CERCOPITHECUS PYGERYTHRUS AETHIOPS. J.K. Kimani and A.H. Walji, Dept. of Human Anatomy, Univ. of Nairobi, P.O. Box 30197, Nairobi, Kenya.

The segmental and zonal variations in the quantitative relationships between elastic and collagen fibres within the lateral costotransverse ligaments have been investigated in the vervet monkey. It has been demonstrated that the lateral costotransverse ligaments of the caudal segments have a largely elastic structure, in sharp contrast to those of the cranial segments which are characteristically collagenous. In the transitional zone extending from the 4th through to the 6th costotransverse joints, the lateral costotransverse ligaments show a zonal differentiation into a superficial collagenous portion and a deep elastic portion. It is noted that the craniocaudal structural differentiation in the lateral costotransverse ligaments corresponds with similar changes in the ligamenta flava, but much remains to be known about the underlying functional significance.

0127

STUDYING THE TREESCAPE. A. Kortlandt, Univ. of Amsterdam, 1018 WS Amsterdam, Netherlands.

In this presentation I intend to show, by means of slides, how one can look at tropical treescapes in order to see and understand:

(1) Tree architecture. Essentially, trees are ecological adaptations to compete for daylight and to avoid being foraged upon by ground-walkers and tree-climbers alike. For instance, the edible parts of trees grow on the ends of the thinnest twigs, apparently in order to protect them from being too easily eaten. Conversely, primate locomotor patterns show many adaptations to overcome such obstacles. Research on these aspects is still in its infancy. Yet the facts are readily observable.

(2) Natural vs. man-made habitats. Natural types of vegetation can often be recognized by the non-botanist by observing the physiognomy of the landscape, the architecture of the vegetation, the demographic equilibrium of the age classes of trees, etc. Conversely, anthropogenic landscapes are often (but not always) recognizable by the absence of certain features and the presence of others.

(3) Geographic and regional diversity. Travelling around and visiting local remnants of natural vegetation gives an opportunity to compare and analyse differences of habitat. Such features as, e.g., stratification of the forest, ramification patterns of branches, density of the canopy, presence of emergents, etc. have implications for primate locomotion and competition. All this can easily be observed and recorded.

0128

SEASONAL VARIATION OF SERUM LIPIDS IN THE VERVET MONKEY (*Cercopithecus Aethiops Pygerethrus*).

D. Kritchevsky*, L.M. Davidson and G.T. Goodman, The Wistar Institute of Anatomy and Biology, Philadelphia, PA 19104 U.S.A.

Seasonal variation of serum lipids has been observed in humans, some primates and other species. We have subjected data collected in South Africa during nutritional studies in Vervet monkeys to computer correlated analysis. Data from controls (94M, 38F) fed commercial pellets, fruit and vegetables were grouped by season. In males, total cholesterol (mg/dl) was 114 ± 3 in summer; 124 ± 3 in fall; 117 ± 6 in winter and 106 ± 4 in spring. Beta lipoprotein cholesterol (LPC) exhibited a similar pattern but alpha LPC was uniform. The alpha/beta LPC ratio was 0.83 ± 0.08 in winter and 0.66 ± 0.03 in the other seasons. Serum lipids of females exhibited similar patterns. The triglycerides in males did not vary but those of females were elevated in the summer (108 ± 7) compared to other seasons (83 ± 5). We have also been able to demonstrate significant interactions among diet, sex, weight and season in the experimental groups. Recognition of these variations will permit better planning of future studies.

0129

EFFECT OF FIBER ON LIPIDS, AORTIC SUDANOPHILIA AND AORTIC GLYCOSAMINOGLYCANS (GAG) IN VERVET MONKEYS FED SEMIPURIFIED DIETS

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A semipurified, cholesterol-free diet containing 40% carbohydrate is sudanophilic or atherogenic for Vervet monkeys (*Cercopithecus aethiops pygerethrus*) depending on the carbohydrate fed. We fed monkeys (6/gp) diets in which the carbohydrate was lactose and the fiber cellulose (C) or pectin (P). We also fed C and P plus 0.1% cholesterol (CC and PC). After 32 weeks serum total and LDL cholesterol (mg/dl) were: C - 156 ± 14 and 95 ± 5 ; P - 173 ± 15 and 112 ± 8 ; CC - 187 ± 27 and 122 ± 21 ; and PC - 155 ± 11 and 108 ± 7 . Aortic sudanophilia was: C - 7.0 ± 3.2 ; P - 13.5 ± 9.4 ; CC - 5.8 ± 2.7 and PC - 21.6 ± 10.3 . The data indicate that pectin is more sudanophilic than cellulose. Aortic galactosamine levels reflected sudanophilia: C - 7.8 ± 1.0 ; P - 11.1 ± 1.3 ; CC - 8.3 ± 1.2 and PC - 11.3 ± 1.1 . Hexuronic acid was elevated by 40% in groups P and PC. Heparan sulfate was not affected by cholesterol feeding. Dermatan sulfate and hyaluronic acid levels fell in CC and PC. The findings in the pectin-fed monkeys may be due to the availability of galacturonic acid from this fiber.

0130

ESTRADIOL AND PROGESTERONE RECEPTOR DYNAMICS IN THE EAST AFRICAN PRIMATES.

G.B. Kudolo*, M. Thiongo, R.M. Eley and J.G. Else. Institute of Primate Research, National Museums of Kenya, Nairobi, Kenya.

As estradiol (E) and progesterone (P) may be both antagonistic and synergistic to each other depending upon the physiological status, their mechanism of action remains intriguing. E and P binding was determined in the liver (the predominant site of steroid metabolism) and uterine tissues of *Cercopithecus* spp. Their binding characteristics such as dissociation constant ($K_d \times 10^{-10} M$), association rate $K_a \times 10^7 / \text{mol/h}$, dissociation kinetics (biphasic, with temperature altering the proportion of slow to fast dissociating components) satisfied the criteria for receptor classification. Cytosol estradiol receptor underwent degradation but both the nuclear receptor (NER) and 0.4M KCL extracted NER increased with temperature ($4-25^\circ C/90 \text{ min}$), suggesting that receptor stability might depend on its conformational form. A sulphhydryl (-SH) reducing agent stabilized binding, suggesting that an -SH bond may be adjacent to the steroid binding site on the receptor and probably its oxidation induces conformational change which then impairs steroid uptake and retention. (Supported by W.H.O. Special Programme of Research Development and Research Training in Human Reproduction).

0131

ASPECTS OF REPRODUCTIVE BEHAVIOUR IN A LARGE GROUP OF SEMI-FREE LIVING BARBARY MACAQUES

Macaca sylvanus

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Sexual activities in a group of 178 Barbary macaques were studied during the breeding season 1982/83. In addition to a continuous observation of 8 focal females during the whole breeding season, all observed copulations of the rest of the group were registered. Copulations were observed between the middle of August and the end of March. The peak of copulations (33%) was found in November. Females showed one to 5 estrus periods, most of them (67%) had 2 estrus periods. Of the 37 females which gave birth in 1983, 87% conceived during their first estrus. Postconception bleeding and one postconception estrus were observed regularly. Male mating success was dependent on the male's age, which positively correlated with social status, and on the female's reproductive state. During the week of conception, the 7 oldest males - out of 38 mature males - were partners in 55% of the observed copulations. Consequences of the strong breeding seasonality in this species on male and female reproductive success are discussed.

0132

BABOON (*PAPIO HAMADRYAS*) VISUAL PREFERENCES FOR SOCIALLY RELEVANT STIMULI.

R.C. Kyes* and D.K. Candland, Dept. of Psychology, Bucknell University, Lewisburg, PA, USA 17837.

Understanding the nonhuman primate's perceptions of its social environment is essential to an understanding of primate social behavior. Troop member preference/recognition and aspects of facial communication were investigated in four members of a captive troop of hamadryas baboons. Subjects were presented a series of photographic slides displaying individual troop members and slides depicting various facial areas of a troop member. The apparatus and procedure gave subjects control over slide selection and viewing time. The apparatus consisted of a two slide-screen/two button arrangement. A modified Method of Pair Comparison was used. We found that (1) the baboons were highly reliable in their choices, (2) dominance status appeared to be a primary factor in troop member preference, and (3) the slides of full faces were consistently chosen, with the eye region attracting greatest attention. These data reflect the baboons' perspectives of their environment and provide supportive evidence to theories of primate attention structure.

0133

THE CONTRIBUTION OF ZOOS TO PRIMATE BREEDING. D. Lindburg,* J. Berkson and L. Nighthenhelter, San Diego Zoo Research Department, San Diego, CA, USA 92112.

Records of primate births in zoos which were reported to the International Zoo Yearbook over the ten-year period ending in 1980 were analyzed. The number of births per year has increased by 75% over this period, but a mere ten species account for nearly half of all births reported. Predominant among these are species which are the most abundant in the wild state. Zoo contributions to conserving rare and endangered species are evident in the case of five which rank among the first 20 in number of infants born. Improved husbandry and the growing role of research into captive propagation of exotics offers hope that a number of self-sustaining populations can be established from brood stock currently on hand.

0134

HANDEDNESS IN A CAPTIVE GROUP OF LOWLAND GORILLAS. J. S. Lockard, Dept. of Psychology, University of Washington, Seattle, WA, USA 98195.

A study of handedness in a social group of 8 G. g. gorilla in a naturalistic outdoor grotto was conducted using a tested ethogram with left/right qualifiers for all manual social and nonsocial behaviors. The data were gathered over a two-year period and comprised systematic observations of two silverback males, two adult females, one subadult female, one juvenile male, one infant female and one neonatal male. Five of the seven independently mobile gorillas showed a right hand foraging and manipulative preference; only the subadult female was distinctly left handed; and the newborn was carried for the first three months predominately in the left arm and hand of its mother. These findings are consistent with those of Fischer et al. (1982) on four adult female lowland gorillas, and contrast with the results of Finch (1941) on chimpanzees and with the generally ambidextrous outcome in monkey (Horwich, 1974; langur; Deuell, 1980 and Gautrin & Ettlinger, 1970; rhesus; Rothe, 1973; marmoset). (Appreciation is extended to the staff of the Seattle Woodland Park Zoo for their cooperation.)

0135

THE CAREGIVING/CARE-SEEKING BALANCE IN CAPTIVE COMMON MARMOSETS CALLITHRIX JACCHUS
J. Locke-Haydon, Biology Dept., The Open University, Milton Keynes, England.

A hypothesis to explain differences in marmoset infant social development is tested experimentally. The hypothesis states that the distribution of an infant's time and activities amongst the individuals in its group is determined by the balance between the relative amounts of care-seeking by the infant and caregiving by the other members of the group. The hypothesis generates several predictions. For example, if the levels of caregiving are reduced, it would be expected that the infant's attention would be focussed on care-seeking activities and that it would spend less time in non-care-seeking activities. Compensation among caregivers for differences in each others' caregiving behaviour would not be expected to occur. Furthermore, since independence of infants from caregivers seems to be primarily due to a decline in care from caregivers, reduced caregiving could be expected to result in infants becoming independent at an earlier age than normal. These predictions are investigated by experimentally reducing the care available to a group of infant common marmosets (Callithrix jacchus), and comparing their interactions with caregivers with those by a control group of infants which experienced normal levels of care. The results bear out several predictions. Infants receiving less care than usual spend less time in non-careseeking activities, there are some increases in care-seeking behaviour, and no comp.

0136

EFFECTS OF CYPROTERONE ACETATE WITH COMBINATION OF TESTOSTERONE ENANTHATE ON SEMINAL CHARACTERISTICS, ANDROGENICITY AND CLINICAL CHEMISTRY IN LANGUR MONKEY
N.K. Lohiya* and O.P. Sharma, Reproductive Physiology Section, Department of Zoology, University of Rajasthan, Jaipur-302004, India

Daily oral administration of 1 mg/kg b.w. of cyproterone acetate and simultaneously administered testosterone enanthate (2 mg/kg b.w./15 days; i.m.) to adult male langur monkeys over a period of 90 days caused a gradual decrease in the count (to azoospermia) and motility of spermatozoa, concurrently with an increase in the percentage of non-motile as well as abnormal and immature sperm. Semen weight, volume, seminal fluid volume and circulating testosterone levels decreased nonsignificantly. Semen pH, libido and body weight remained unimpaired. The levels of SGOT, SGPT, serum alkaline phosphatase, LDH, bilirubin, Na, K and hematological values did not alter significantly. All the changes were reversible. The results indicate that the combination regimen seems to affect the fertility in two ways, i.e. by inhibiting spermatogenesis in the testis and maturation process in the epididymis without altering the androgenicity.

0137

SEASONAL INFLUENCES ON TESTICULAR FUNCTION IN FREE-RANGING LANGUR
 N.K. Lohiya and R.S. Sharma*, Reproductive Physiology Section,
 Department of Zoology, University of Rajasthan, Jaipur -302004

Seasonal changes in the histomorphological structure and biochemical composition of the testes have been studied in adult free-ranging male langurs, trapped from places around Jaipur, over a period of one year. Animals were spermatogenically active throughout the year with no period of quiescence during any season. The diameters of the seminiferous tubule, Leydig cell nucleus and Sertoli cell nucleus did not show marked changes. There were no appreciable changes in biochemical composition of the testes with respect to cholesterol, glycogen and sialic acid contents during different seasons of the year. In conclusion, the langurs did not display a marked circannual pattern in the seasonal spermatogenic cycle.

0138

SEMINAL CHARACTERISTICS IN LANGUR MONKEY (*PRESBYTIS ENTELLUS ENTELLUS*).
 N.K. Lohiya, R.S. Sharma*, J.S. Pruthi, G.F.X. David & T.C. Anand Kumar
 Department of Zoology, University of Rajasthan, Jaipur -302004, India
 and Department of Anatomy, AIIMS, New Delhi -110 029, India.

The characteristics of semen in langur monkeys maintained under natural captive conditions have been described, for the first time. Semen samples were obtained by electroejaculation throughout the year. Sperm count ranged from 35 to 180 million/ejaculate with 118 ± 34 mean value; semen volume from 0.5 to 3 with 1.6 ± 0.3 ml mean value; percent motility from 50 to 80 with 73 ± 8 mean value; live percentage of sperm from 50 to 80 with 60 ± 8 mean value; abnormal percent from 1.5 to 4.8 with 3.5 ± 0.9 mean value; semen weight from 0.5 to 3.5 with 1.6 ± 0.1 gm mean value and pH from 7.3 to 7.8 with 7.6 ± 0.1 mean value. Variations were observed in sperm count & semen volume during different months of the year, but the mean values of pooled data from different seasons did not differ significantly when compared with each other. No significant circannual variations in sperm motility, percentage of live & abnormal spermatozoa and pH of the semen were observed. Thus langur could be a suitable model for long-term testing of male contraceptives.

0139

CHARACTERISTICS OF MENSTRUAL CYCLE AND DETECTION OF OVULATION IN LANGURS
 N.K. Lohiya*, R.S. Sharma, M. Jajalakshmi, A. Sehgal, G.F.X. David and
 T.C. Anand Kumar, Dept. Zoology, Univ. Rajasthan, Jaipur, India and Dept. Anatomy,
 AIIMS, New Delhi, India.

Baseline data on menstrual cycles were collected in langur monkeys *Presbytis entellus entellus* Dufresne. Menstrual cycles range from 19-45 days with 26.12 ± 1.2 days mean value and 22 days mode. Menstruation lasts for 2 days. Maximum number of cornified cells were observed on day 10, whereas vaginal temperature nadir occurred on day 11. Monophasic vaginal temperature pattern was observed. Serum sialic acid levels directly reflect the estrogenic activity and show a significant peak on day 10 coinciding with estradiol peak and followed by a progesterone rise. A secondary estradiol peak coincides with the progesterone peak during luteal phase. Observation indicate day 10 as the probable day of ovulation. Female langurs menstruate throughout the year without showing any signs of summer amenorrhea. Because of the absence of seasonal variation in reproduction, the langur monkey is a suitable animal model for long-term testing of contraceptives.

0140

TESTICULAR AND ACCESSORY SEX ORGAN FUNCTIONS AFTER VASECTOMY IN LANGUR MONKEYS (PRESBYTIS ENTELLUS ENTELLUS DUFRESNE).
N.K. Lohiya, S.N. Tiwari* and N. Mathur, Department of Zoology, Reproductive Physiology Section, University of Rajasthan, Jaipur-302004

The testicular biopsies and semen samples were studied in 1-12 months vasectomized or sham operated langur monkeys. No quantitative and qualitative light microscopic alterations were observed in the seminiferous tubules after 3, 6 and 9 months of bilateral vasectomy. However, 1 of 3 animals studied after 6 months of vasectomy showed patchy degeneration and absence of sperms & spermatids. Testicular biopsies taken after 12 months showed increase in tubular diameter and disorganization of germ cells. Seminal plasma fructose did not change. Semen volume, magnesium and citric acid decreased transitionally up to 6 months. A significant decrease in LDH and transaminases (GOT, GPT) was noticed. No changes were observed in animals that received a sham operation. Whether the changes in testicular and accessory sex organ functions following short-term vasectomy are transitional is not known.

0141

SOME ASPECTS OF GASTRO-INTESTINAL ALLOMETRY IN PRIMATES AND OTHER MAMMALS.
A. MacLarnon, R.D. Martin, D.J. Chivers* and C.M. Hladik, Dept. of Anthropology, University College London, Gower Street, London WC1E 6BT, and Sub-dept. of Vet. Anatomy, University of Cambridge, Tennis Court Road, Cambridge CB2 1QS, U.K., and Museum National d'Histoire Naturelle, 91800-Brunoy, France.

Recent interest in inter-specific allometry has resulted in significant developments in both theory and practical applications. Complementing dental studies, we have been scaling the dimensions of the gastro-intestinal tract to body size. Recently we have added new mammals to our series, including humans, and refined our analysis in terms of calculating gastro-intestinal quotients (for each compartment) and using computer clustering techniques to group species according to quotient values, rather than by a priori dietary categories. Only the colon does not scale according to Kleiber's Law; species clustered by gut quotient values group according to broad dietary categories and not simply to body size. Here we test further the reliability of the apparently sturdy dendrograms and the problematic multi-dimensional scaling plots. The latter proves more reliable, and the use of logarithmic quotient values (rather than anti-logarithmic) is more practical and generates more biologically significant results. Cebus and Homo are unusual in resembling faunivorous mammals rather than other primate frugivores.

0142

EXPERIMENTAL INFECTION OF BABOONS (PAPIO SP) WITH ECHINOCOCCUS GRANULOSUS OF HUMAN, CATTLE, SHEEP AND GOAT ORIGIN. *Macpherson, C.N.L., Suleman, M & Else, J.
 AMREF, PO Box 30125, Nairobi, Kenya IPR, PO Box 34505, Nairobi, Kenya.

In different areas of the world, strain differences in Echinococcus granulosus have been described, which appear to vary in their infectivity to man. This phenomenon was evaluated in Kenya for hydatid material of human, camel, cattle, sheep and goat origin. Viable eggs, produced by experimental infections in dogs from all the above intermediate hosts were fed separately to four baboons in each case. The baboons were autopsied one year after infection. To date, material of sheep and camel origin have been found to infect baboons, and therefore, these strains could, by analogy, be also infective to man. This result corroborates well with epidemiological studies undertaken both in Kenya and elsewhere where these hosts occur. The results of the infections with the human, cattle and goat strains are unknown at present, but these will be presented and discussed in relation to their epidemiological significance.

0143

COMPARATIVE ANATOMY OF THE NASAL FLOOR CARTILAGES IN PRIMATES. W.Maier, Zentrum der Morphologie, Klinikum der Universität, Theodor-Stern-Kai 7, D-6000 Frankfurt/M. 70, Germany

The morphology of the nasal floor cartilages, which are functionally connected with the vomeronasal organ and the nasopalatine duct, is virtually unknown in most living primates. In a number of prosimian and simian taxa, their structure has been studied with the help of section series and plate reconstructions. It is most surprising that the platyrrhines show a regression of the vomeronasal organ but a great structural differentiation of the accessory cartilages; there exists considerable variation between the different taxa as well. Catarrhines have lost the vomeronasal organ of Jacobson altogether but still retain remnants of the nasal floor cartilages. This holds especially true for the cercopithecoids, where the nasopalatine duct of Stenson persists throughout life. Some functional and systematic hypotheses are derived from the presented morphological evidence.

0144

STEREOLOGY: QUANTITATIVE METHODS AND THEIR APPLICATION IN BIOMEDICAL RESEARCH. J. N. MAINA, Dept. of Veterinary Anatomy University of Nairobi, P.O. Box 30197, Nairobi.

Stereological methods can be applied on normal or pathological biological tissues to elucidate their structural and functional correlations. The acquired data thus largely tells us why animals behave the way they do. The constraints of life are so narrow that a deviation from the normal quantitative relationships of the functional components of the tissues of an animal, commonly precipitated by external factors, is defined as disease. Due to the immense energetic requirements curtailed in sustaining living tissues, superfluous structures normally atrophy, becoming vestigial and eventually disappear. The morphometric methods of stereology, which facilitate the extrapolation to three dimensional spatial configuration from a study of sectional profiles, can be used to estimate, grossly or at ultrastructural level, parameters like volume by point counting, surface areas by intersection counting and number and lengths by actual profile counting. Rigorous sampling, standardised tissue processing and analysis are crucial in acquiring unbiased meaningful data. The lung will be used as a model to illustrate how versatile and powerful these methods are.

0145

TIME BUDGETS AND ACTIVITY PATTERNS OF FREE RANGING RHESUS MONKEYS AT TUGHLAQABAD, INDIA Iqbal Malik, Univ. of Delhi, India.

A longitudinal study of free-ranging rhesus monkeys (*Macaca mulatta*) was undertaken at the ancient site of Tughlaqabad outside New Delhi. The study determined the distribution of time spent in various activities during different seasons and the effect of weather on the daily activity pattern. Rhesus monkeys spent relatively little time feeding; more time was spent resting, grooming, and playing. The percentage of time spent on resting, eating and drinking increased during the summer, whereas the percentage spent on locomotion, play, and grooming increased during the winter. Weather affected the daily activity pattern not so much in behavioral sequences but more in time spent on certain behaviours and their location in the territory. The study supports the theory, of Shukla, Seth and Seth, that the majority of activities are based on components of the ecosystem.

0146

TRIBAL PEOPLES AND CONSERVATION OF PRIMATES IN INDIA. J. Mangalraj Johnson, Wildlife Warden, Templeton Cottage, Vannarpet, Uthagamandalamooty 643001, INDIA

The traditional patterns of life and food gathering of many tribal communities in India did not adversely affect primates living in the same habitat. In some instances primates formed part of the diet of these people or they fired trees to collect honey, but these activities did not cause widespread conservation problems. Civilization has brought many changes to tribal peoples. Previously they depended on forest resources for food and other essentials: acquired needs are forcing them into towns to barter for articles with forest products, increasing exploitation of the forests. Their traditional knowledge of the habitat and wildlife also is not being used productively. Every field worker would benefit from the knowledge of a tribal guide, who also could be a primate observer in vulnerable areas. Unfortunately, poachers clandestinely use tribal peoples not involved in conservation programs for their activities. Effective conservation does require the support and cooperation of tribal peoples. Tribal communities in or nearby the habitats of endangered primates, their traditional food needs, changing patterns of life and present socioeconomic needs must be identified to ascertain how their behavior affects primate status. The results are the first step necessary to plan and design local conservation strategies.

0147

THROUGH THE TERRITORIAL BARRIER: HAREM ACCRETION IN PRESBYTIS SENEX
G. H. Manley, Dept. of Anthropology, Univ. of Durham, UK.

In the purple-faced leaf-monkey of Sri Lanka, new harems are created by processes such as the settling down of wanderers, the distillation of male troops which contain females, and (new in the sense of having a new adult male) take-over. A wholly different problem arises where females add themselves to already-existing harems. The female must overcome the normally indiscriminate aggression of an intensely territorial male; the latter must suppress behaviour which would intimidate a prospective mate. The goal may be achieved in two ways, (i) the female moving in at a time of take-over, when the defense system and insider-outsider discriminations are disrupted, and (ii) both female and male employing special behaviour characterised by a distinct quality of 'studied indifference'.

0148

INTERTROOP TRANSFER BY MALE PAPIO ANUBIS. D.L. Manzollilo
Institute of Primate Research, P.O. Box 34505, Nairobi, Kenya

A 32 month study of intertroop transfer was conducted on a troop of olive baboons at Gilgil, Kenya. Focal samples and ad lib data were obtained on 14 males. Male membership was relatively stable during the first half of the study. All immigrations occurred during the second half. Aggression rates were related to frequency of consort behavior in the troop. Average consort activity of emigrants did not differ from that of males who remained. Males left when availability of cycling females was low. Immigration occurred when availability of cycling females was high, which also happened to be times when consort behavior was at a low level. Rates of greeting behavior among males almost doubled when immigrants came into the troop, whereas aggression rates decreased slightly. It was concluded that immigrants met with little aggression as a result of the timing of their transfer during months when frequencies of consort behavior were low. Conditions in the troop at the time of immigration may not have presented an immediate source of competition.

0149

ANALYSING THE STRUCTURE OF PRIMATE VOCALIZATIONS REGARDING FUNCTION:
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München 40, FRG.

Recent studies of the vocal repertoire of nonhuman primates have shown that the animals differentiate far more subtly in their use of alarm and contact calls than has been assumed so far. In our experiments with squirrel monkeys we are concerned with this problem especially in the area of agonistic behavior. We segment the monkeys' vocalizations and classify the segments according to type. Then we describe the vocalizations on the basis of these classifications and the order of succession. The description of the vocal structure thus obtained is more detailed and more accurate than the ones obtained by traditional methods (e.g. sonagrams). Tests, in the course of which the animals were subjected to different social conditions, have revealed that the differentiations detected in the vocalizations are applied by the monkeys at varying degrees of frequency which is a strong indication that the differentiations play an important role in intraspecific communication.

0150

PARENTING WITHIN A MONOGAMOUS SOCIETY. S.P. Mendoza & W.A. Mason. California Primate Research Center, University of California, Davis, CA 95616.

In a series of studies we have examined parenting in a monogamous primate, Callicebus moloch. Observations indicate that the father spent substantial time carrying the infant, but that the transfer of the infant between parents was generally initiated by the infant with no active involvement by either parent. When presented with their separated, 1 - 3 wk old infant, both parents were observed to retrieve the infant, but this process was slow and often clumsy. The response of Callicebus parents to separation from their 2.5 mo infant and each other was assessed. Results indicate that the parents show physiological distress to separation from their mate but not from the infant, indeed mothers show the greatest signs of distress when left alone with the infant. Infants tested for parental preference at 6 mo of age show a clear preference for the father. Overall, the pattern of parenting displayed by Callicebus stands in sharp contrast to the general primate pattern where responsibility for caregiving lies primarily with the mother and is carried out within the context of a strong bond between mother and infant. Neither Callicebus parent forms a strong bond with the infant but is tolerant of its presence and mildly responsive to its distress. The infant appears to play a critical role in determining the parental division of labor and relies on the spatial proximity of parents as the enabling condition which permits the infant to transfer readily between the nurturant and the preferred parent.

0151

LONG TERM MAINTENANCE OF TERRITORIES BY TITI MONKEYS IN A 1 HECTARE FIELD CAGE.
C.R. Menzel, Dept. of Anthropology, Univ. of California, Davis, CA., USA 95616

The purpose of this research was to gather new information on the individual dispositions, social processes and environmental conditions supporting the maintenance of territories in Callicebus moloch. The subjects (N=11) lived as members of 2 small family groups that were given permanent and continuous access to a large outdoor enclosure at the Calif. Primate Research Ctr. Locational data for individuals and narrative descriptions of close range interactions between groups were collected under routine everyday conditions over a 3 yr. period. The small degree of home range overlap shown by these groups, in combination with the consistency of group membership across years and the daily confrontations of groups along the home range boundaries closely resembled the social arrangement typically observed in titis in nature and to my knowledge was the first instance in which any primate species had established and maintained stable territories in captivity. Experimental data obtained for these 2 groups suggest that adults were reluctant to expand their home range in the direction of a 'phantom group', i.e. toward areas in which they had previously encountered neighbors. The added presence of the neighbors served as a further deterrent to home range expansion, particularly when the neighbors were unconfined and could move directly toward the encroaching group.

0152

HUMAN PREDATION ON PRIMATES IN THE MENTAWAI ISLANDS, INDONESIA. Arthur H. Mitchell, Department of Anthropology, Yale University, New Haven, CT U.S.A. 06520

Four primate species are endemic to the small Mentawai Islands off Sumatra in Indonesia: a gibbon (*Hylobates klossii*), a macaque (*Macaca pagensis*), and two langurs (*Presbytis potenziani* and *Simias concolor*). Prior to the arrival of man, perhaps only 3000 years ago, the primates evolved in essentially a predator-free environment. Hunting since then has had an effect on the distribution and abundance as well as the behavior, and possibly the social structure, of these primates. They are hunted by the indigenous people in a manner closely linked with traditional religion. While animals killed during the hunt, using bow and arrow, do provide some protein for the diet, their traditional importance has been as sacrifices connected with invocations. Rituals and taboos have governed human social relations, land use, forest gathering and hunting to produce an equilibrium between man and resource exploitation. Recent expansion of the indigenous population coupled with immigration from the mainland and large-scale timber harvesting are having dramatic effects on both the island ecosystems and the traditional relations between man and environment. A large conservation area recently has been established on Siberut and management of hunting, in view of the breakdown of traditional controls, has been proposed.

0153

HUDDLING BEHAVIOUR OF HANUMAN LANGUR, *Presbytis entellus*. S.M. Mohnot, Department of Zoology, University of Jodhpur, Jodhpur-342001 INDIA.

For over a decade, eco-behavioural investigations were carried out on wild langur groups, around Jodhpur, at the fringe of Great Indian desert, Western India. A total of 353 huddling episodes in 4 unimale bands and an all male band were recorded from August to March. Most of the huddling cases were observed in mornings before 10 a.m. in the evenings and in the night. October to February present maximum cases huddling. The most frequent huddling behaviour (78%) falls in December and January, when the temperature goes down to 2°C, coupled with cold winds and the occasional appearance of clouds. In February 9%, March 4.2%, October-November 6.1% and 2.7% huddlings were observed during the rainy season (August-September). No huddling was seen from April to July. Huddling groups ranged from 3-18 individuals of different age and sex. It may last for a few minutes up to about 2 hours at a stretch, depending on the weather conditions. The usual pattern was ventro-dorsal in a single row of 3-9 animals. In bigger groups huddle columns differed in body contact. The formation of column seems to be random without any rank order and appears to provide warmth and security.

0154

SPONTANEOUS CHOLANGIOCARCINOMA IN A BLACK MANGABEY (*Cercocebus atrogeneus*)
Monirei, J.M. Tarara, R. and Suleman. M.A. Institute of Primate Research, National Museums of Kenya, Nairobi, Kenya.

An adult female Black Mangabey was reported dead 10 days after an abortion. She had had 3 previous abortions, all of them in late pregnancy. Necropsy revealed a markedly enlarged liver, firm, with multiple whitish spots throughout the parenchyma. Part of the diaphragmatic lobe was atrophied and fibrotic. Histology revealed hyperplastic blue ducts with neoplastic cells infiltrating the parenchyma with irregular formation of small acini and ductules. In some parts of the liver striking Schirrhous reaction was noted. A diagnosis of cholangiocarcinoma (Intrahepatic bile duct carcinoma) was made.

0155

COMPARATIVE HISTOPATHOLOGICAL FINDINGS IN VERVET MONKEYS (*Cercopithecus aethiops*) AND BABOONS (*Papio anubis*) INFECTED WITH SCHISTOSOMA MANSONI.

J.M. Monirei, R. Tarara, M.A. Suleman and J.G. Else. Institute of Primate Research National Museums of Kenya, Nairobi.

The most striking feature of schistosomal infections is the pathology associated with trapped ova in the tissues. Indeed the greatest damage in terms of tissue lesions is caused by host tissue - egg interaction which results in typical granulomas. In the vervet monkeys, liver granulomas were smaller in all stages of evaluation and involution of the egg lesion. In the exudative productive stage, eosinophils were characteristically absent in this species. Mononuclear cells and multinucleated giant cells were the predominant cell types observed. In the baboon, the same stage granulomas were bigger and numerous eosinophils were observed at all stages of evolution of the egg granulomas. These findings suggest that host-parasite interaction in vivo may affect the course and outcome of the disease.

0156

ERYTHROCYTE MORPHOLOGY OF HEALTHY COLONY-BORN OWL MONKEYS (*Aotus trivirgatus*). J.E.K. Mrema, S.L. Stockham, D.A. Schmidt, T. Green, College of Veterinary Medicine, University of Missouri, Columbia, Missouri.

It is believed that the Colombian Owl Monkey (*Aotus trivirgatus*) is the most suitable animal for studying human malaria which is caused by *Plasmodium falciparum*. Since the wild-caught *Aotus* is not readily available for biomedical research and is vulnerable to spontaneous anemias, the erythrocyte morphology of 20 healthy, colony-born *Aotus* monkeys was investigated. Thin blood smears from blood collected in EDTA tubes and stained with Wright's stain were examined. Morphologic findings in the following frequency (percentage of monkeys with these alterations): Anisocytosis, 70%; polychromatophilic cells, 100%; dacrocytes, 10%; codocytes, 5%; Howell Jolly bodies, 70%; and nucleated erythrocytes (rubricytes and metarubricytes), 50%. Basophilic stippling, schizocytes, and pseudoechinocytes were occasionally seen. Staining of erythrocytes with New Methylene Blue stain proved the polychromatophilic cells noted with Wright's stain were reticulocytes. Scanning electron microscopy confirmed some of the findings noted with the light microscope. Analysis of the erythrocyte morphology is fundamental in the understanding of the animal model, the pathogenesis of the anemias and in the interpretation of experimental therapy.

0157

THE ECOLOGY OF HOOLOCK GIBBON, *Hylobates hoolock*, OF TRIPURA, INDIA. R.P. Mukherjee, Zoological Survey of India, 8-Lindsay Street, Calcutta-16, India.

Tripura is a small eastern state of India. The terrain is divided into hills and plains and the forest belongs to the evergreen and semi-evergreen type. The forests may be dense and continuous or quite open. In spite of its small size this state contains as many as seven primate species. Some of these species share the food with the hoolock gibbon and there is overlapping of habitat of the hoolock gibbon with at least two species of langurs. When the different species of monkeys come close to each other while searching for food they disperse without showing much agonistic behaviour. The social group of hoolock gibbon consists of an adult pair and their offspring. A group usually consists of three members. Social relations among group members show a high degree of cohesion. The gibbon generally move through the main canopy and more than half of their active period is spent in feeding. The hoolock gibbon usually covers a small distance but at times it covers a long distance in a day. The discontinuity and clearance of the forest as well as shifting cultivation and hunting for food are the major factors for the conservation of the hoolock gibbon in Tripura.

0158

THERMOREGULATION AND BASAL METABOLIC RATE IN PRIMATES - PHYLOGENETIC AND ECOLOGICAL ASPECTS. E.F. Müller, Abt. Physiologische Ökologie, Univ. of Tübingen, Auf der Morgenstelle 28, D-7400 Tübingen, West Germany.

If compared to simian primates many prosimian species exhibit a lower body temperature and also have a reduced basal heat production. In the slow loris, e.g., the basal metabolic rate is among the lowest so far found in homeothermic mammals and dwarf lemurs seasonally enter deep torpor. The question arises whether these differences reflect the more primitive phylogenetic state of prosimians or whether they occur due to adaptive processes. Recent studies on thermoregulation in primates have shown that most prosimians are good thermoregulators and that the formerly believed deficiencies in their thermoregulatory capacities should rather be regarded as part of an energy saving strategy; moreover, a reduced basal heat production has also been found in specialized simian primates. It is, therefore, concluded that the peculiarities in the thermobiology of prosimians represent energy saving adaptations which evolved concomitant with ecological specialization rather than phylogenetic primitive characters.

0159

THERMOREGULATION IN THE SLENDER LORIS (LORIS TARDIGRADUS). E.F. Müller, U. Nieschalk-Meier and B. Meier, Abt. Physiologische Ökologie, Univ. of Tübingen and Institute of Anatomy, Univ. of Bochum, West Germany.

Thermoregulation was studied in a couple of slender lorises at ambient temperatures from 10-37,5°C. At air temperatures from 25-30°C the body temperature (T_b) was maintained between 34,5-36,5°C. With increasing air temperature T_b rose to about 38°C at 37,5°C ambient temperature, whereas at lower air temperatures T_b decreased to values between 30-34,5°C. The heat production was lowest at ambient temperatures from 32,5-35°C with about 0,38 ml $O_2/g \cdot h$; this basal metabolic rate is only 45% of the value expected from body mass. At low ambient temperatures the slender lorises could markedly increase the heat production but also saved energy by cooling large parts of the body and keeping only a relatively small core at a high temperature (partial heterothermy). In a hot environment the lorises greatly raised evaporative cooling by panting as well as by spreading saliva over the extremities. With regard to basal heat production and thermoregulatory abilities the slender lorises behave similarly to lorises with the differences being mainly due to the different body size.

0160

RESPONSE OF WILD BABOON TROOPS TO INCURSION OF AGRICULTURE AT GILGIL, KENYA. J.M. Musau* and S.C. Strum, Gilgil Baboon Project, Gilgil, Kenya, and Dept. of Anthropology, Univ. of California, San Diego.

A three year intensive study of ranging patterns, activity budgets, and food selection focused on the response of 3 baboon troops to agricultural development within the baboons' traditional home ranges. Shifts in foraging patterns and home range utilization differed in the three troops. Rainfall and the availability of natural foods had a significant effect on the extent to which crops were incorporated into the diet. Each troop solved the problem of the excision of land from their home range in a different way. These included dramatic "migratory" shifts to avoid settled areas and search for natural foods, incorporation of human foods into the diet at critical periods with a concomitant reduction of home range size, and extensive reliance on human food with a home range size appropriate for forest rather than savannah baboons.

0161

HORMONE RESPONSES TO CLOMIPHENE CITRATE IN YOUNG CHIMPANZEES. R.D. Nadler*, R.W. Cooper, C. Roth-Meyer, E. Bourreau and G. Affre, Cen. Int. Recherches Med. Franceville (CIRMF), GABON, and Yerkes RPRC (YRPRC), Emory Univ., Atlanta, GA. 30322, USA.

Gonadotropin and gonadal steroid responses to clomiphene citrate were studied in male and female chimpanzees ages 3.6 to 9.9 years. FSH was significantly reduced in prepubertal females (n=4) and in early pubertal males (n=2) but not in prepubertal males (n=5). FSH was unchanged or increased in early pubertal females (n=2) and late pubertal males (n=2). The response of FSH was related in part to baseline FSH values. There was no consistent response by LH in either males or females, not in 17 β -estradiol by the females. Testosterone was reduced only in the early pubertal males. The results provide some support for the hypothesis that negative feedback by gonadal steroids is operative in prepubertal chimpanzees and that puberty is accompanied by a reduction in the sensitivity of the hypothalamus to such feedback. Supported by CIRMF, USPHS Grant No. RR-00165 from NIH to the YRPRC and NSF Grant No. BNS79-23015 to RDN.

0162

SOCIAL ORGANIZATION OF TWO SYMPATRIC GALAGOS AT GEDI, KENYA. L. T. Nash, Department of Anthropology, Arizona State University, Tempe, AZ 85287 USA.

The social systems of Galago zanzibaricus and G. garnettii, as revealed in patterns of range overlap, were studied by trap-retrap and radio tracking in a 20-month field study. In both species, ranges of fully adult females showed little overlap and these females' ranges formed overlapping clusters with younger adult and subadult females. Young adult or subadult males of both species seemed to disperse more from their mothers' ranges than did daughters. G. garnettii male-female adult pairs shared coextensive ranges with young adults and subadults. Most adult male G. zanzibaricus had extensive range overlap with 1 or 2 fully mature females (as well as the younger females in a "cluster") and there appeared to be two size classes of sexually mature males. Coextensive ranges were rare between the larger males, but they overlapped smaller males. Though best viewed as different species, G. zanzibaricus resembles the South African G. senegalensis moholi in many aspects of social organization. G. garnettii appears to have more dispersed adult females than the closely related South African G. crassicaudatus umbrosus.

0163

DEVELOPMENT OF TOOL USE IN MACAQUE AND GORILLA. F. Natale, P. Poti' and G. Spinozzi, Inst. of Psychology, CNR, Rome, Italy.

The development of the use of a stick as a tool to recover an out-of-reach object is investigated in a longitudinal study of a macaque (Macaca fuscata) and a gorilla (Gorilla gorilla) infant. Results show that even at three years of age the macaque does not go beyond an extremely rudimentary understanding of the use of the stick: it fails even in systematically establishing contact between the stick and the target object. On the other hand, toward the end of its second year of life, the gorilla systematically establishes contact, but it often fails in recovering the object because of difficulties in mastering the physical constraints involved in the use of the stick, such as the strength and angle of impact of the stick. These difficulties persist into the third year of its life. These data sharply contrast with the development of the same ability in the human child, where both the logical and the physical components involved in the use of the stick are mastered by the end of the second year of life.

0164

DEVELOPMENT OF DOMINANCE RELATIONSHIPS IN IMMATURE *Macaca fascicularis*, W.J. Netto and J.A.R.A.M. van Hooff, Laboratory of Comparative Physiology, State University Utrecht, Jan van Galenstraat 40, 3572 LA Utrecht, The Netherlands.

The agonistic behaviour of 16 juveniles (1/2-2yr) is analysed to untangle the relative importance of rank acquisition mechanisms. Aggression received by juveniles, but not that initiated, is negatively correlated with maternal rank. Juveniles are supported by mothers (25%), other kin (14%), and non-relatives (61%) from higher (HF) and lower ranking (LF) families. Receiving support is correlated with aggression initiated by juveniles but not with maternal rank or aggression received. Joining against juveniles is negatively correlated with maternal rank: Supporters are not altruists but join in their own interests primarily against victims and follow established rank relations. Over half the support against HF comes from the alpha male. While becoming dominant, juveniles use the low-risk strategy of joining winners against large LF, but rarely against HF. HF females have access to LF infant and dominate them without restriction from LF mothers and Kin. As a result, juveniles rarely initiate aggression (or receive support) against HF females. The net support by non-relatives is negative against HF and positive against LF. In consequence juveniles seldom outrank their mothers.

0165

INHERITED ISOLATION CALL CHARACTERISTICS IN TWO SPECIES OF SQUIRREL MONKEY (*SAIMIRI*) AND THEIR HYBRIDS. J. D. Newman, Laboratory of Comparative Ethology, NICHD, NIH, Bethesda, MD, USA 20205.

The isolation calls ("Isolation Peep," IP) of two closely related species of squirrel monkey are distinctively different in certain features of their acoustic structure at all ages. Hybrids between these two forms of *Saimiri* bred in the laboratory were studied for the resemblance of their IP to those of their parents. Discriminant function analysis of parental IP based on parametric measures of sound spectrograms showed 100% correct classification of parental IP as to their species origin. Similar analyses of hybrid calls tested which parental species they resembled the most, and the degree of this resemblance. One parental type (the "Roman-arch variety" of MacLean; *Saimiri boliviensis* of Hershkovitz) was more commonly expressed in hybrid phenotypes, although the discriminant scores of hybrid IP were generally intermediate to those of the two parents. These findings provide the basis for the genetic analysis of a species-specific communication signal in primates.

0166

INFANTICIDE AND SOCIAL CHANGE IN FOREST GREY LANGURS, *Presbytis entellus*, IN KANHA TIGER RESERVE, INDIA. P.N. Newton, Dept. of Zoology, Univ. of Oxford

A two year field study of langurs in moist deciduous (sal) forest in the Central Indian Highlands was conducted from 1980-82. Of 18 groups censused 14 were bisexual (13 unimale, 1 trimale) and 4 were all-male bands. The feeding and ranging patterns and social change of a unimale troop ("C") were monitored for 18 months. The investigator observed infanticide three times in April 1981 carried out by adult males of a 16 member all-male band ("Q"). Two weeks later, in May, the "C" male was replaced by a male from "Q" who remained in the troop for at least 2 years. The occurrence of infanticide in a relatively undisturbed habitat supports the hypothesis that the behaviour is a male strategy and not an artifact resulting from human induced crowding.

0167

ON THE INFLUENCE OF SOCIAL VARIABLES UPON OBJECT DIRECTED BEHAVIOURS IN CERCOPITHECIDAE STUDIED IN CONFINEMENT

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As part of a long-term study on object directed behaviours (Zool. Beiträge 28, 151-161) in Cercopithecidae, juvenile and subadult spot-nosed monkeys (Cercopithecus petaurista), kept in our laboratory were presented to different wooden objects (balls, rings, cylinders, etc). Our hypothesis was that the "attractivity" of such objects would be determined not only by their particular characters but also by environmental factors. In particular we wanted to know whether and how social conditions would affect the duration and structure of object play. Experimental variables were the number of subjects involved in play and the number of objects presented to them. Test sessions were recorded audiovisually. Our results revealed that subjects tested during group sessions showed significantly more object directed behaviours than during solo sessions. It will be analysed whether some kind of social competition/facilitation may play a role here.

0168

BEHAVIOR OF AN ADULT MALE IN ONE-MALE UNIT-GROUP OF CHIMPANZEES IN THE MAHALE MOUNTAINS, TANZANIA. T. Nishida* and M. Hiraiwa-Hasegawa, Dept. of Anthropology, Univ. of Tokyo, Hongo, Bunkyo-ku, Tokyo, Japan 113.

A unit-group (K) of wild chimpanzees was observed for 17 years (1966-1983) and showed drastic demographic change. Between 1969-1975 the group lost adult males one by one. When only two adult males were left early in 1978, several cycling females began to associate with the males of a large neighboring unit-group (M). When K group lost one of the remaining adult males and became essentially "one-male" in 1979, all cycling females began to associate mostly with M group and changed their individual range. In this period, the "alpha" male tried to restrict the ranging of "his" females within his normal range by a variety of herding techniques. Since only one adult male remained in K group, the large-scale transfer of cycling females is regarded as a female reproductive strategy.

0169

WOOLLY SPIDER MONKEYS, BRACHYTELES ARACHNOIDES, IN MINAS GERAIS, BRAZIL. A. Nishimura, Biological Lab., Doshisha Univ., Kyoto 602, Japan

A 5-month observation was done on Brachyteles living in an isolated forest in a farm. There were also Alouatta guariba, Cebus apella and Callithrix flaviceps, and part of the observation was done on these monkeys for comparison. Brachyteles moved in groups consisting of 5-30 or more individuals. Members of any two of these foraging groups were found together in the other groups and/or both groups had members common to them. Thus, whole population, which was estimated to be about 50, was considered to form a unit group or community. Most groups were bisexual, while within the group adults of same sex, especially males, tended to gather together by themselves. Major diet of Brachyteles and Alouatta was leaves and fruit, while fruit consumption rate was much higher in Brachyteles. Home range was estimated to be 2.8 km², 23 and 7 times larger than those of Alouatta and Cebus respectively. These ecological and sociological characteristics of Brachyteles seems to be common with other Atelinae, especially with Ateles.

0170

REPRODUCTION AND CAPTIVE MANAGEMENT OF THE BROWN BUSHBABY (*Galago garnettii*). J.M. Rjuguna, R.M. Eley, M.A. Suleman and J.G. Else. Institute of Primate Research, National Museums of Kenya, Nairobi, Kenya.

A breeding colony of the brown bushbaby has been established through a grant from the Kenya National Council for Science and Technology. This is the first stage of a long term project to develop breeding groups of the various Kenyan-found galago species for comparative studies. From the 11 male: female pairings 41 singleton births have resulted since November 1980. Although births have been recorded in every month of the year, 21 (51%) have occurred in November to January. The vaginal orifice of female was noted to be open (VO) for 14.2 ± 4.4 days ($n=40$, range 4-26) of the cycle. Sexual receptivity was usually observed in the first 3 days following VO. If the day of VO of conception cycles is arbitrarily assigned to be day one of pregnancy, gestation length is calculated to be 133.2 ± 5.8 days ($n=22$, range 121-142). Three female progeny began cycling at 18 months of age and to date one has given birth at 22 months. Many females display extremely aggressive behaviour towards the males immediately after parturition and separating them for a few days is often necessary.

0171

SKULL STRUCTURE IN OLDUVAI HOMINID 9. A.T. NKINI, FRANKFURT/MAIN.

Most of the skull structures of the important hominid fossil OH 9 have been described before, and from these analyses it is concluded that this specimen, which may be as old as 1.1 Million Years, should be included in the *Homo erectus* group. In many respects, the skull anatomy of *H. erectus* is very similar to that of present man. What is very different, however, is the proportioning of the whole skull. By application of Computer Tomography (CT), the skull proportions are re-studied more accurately because OH 9 is the only known *H. erectus* with a fairly well-preserved basicranium. This structural complex was studied in particular. Its proportions and relative position differ distinctly from modern man. The implications of this marked feature are discussed. A reconstruction of the total skull will be presented.

0172

NEURAL CORRELATES IN PRIMATES ASSOCIATED WITH THE PHYLOGENETIC ACQUISITION OF SPEECH, C.R. Noback, Dept. of Anatomy, Columbia Univ., New York, N.Y. USA 10032.

Speech is the complex product of the finely tuned integration of the nervous system control systems with a responsive organ system (oral, pharyngeal, laryngeal, thoracic and abdominal muscular) capable of producing and controlling the emission of a vast variety of sounds. Modern evidence indicates that the central nervous system contains the required neural information essential for eliciting coordinated and synchronized motor actions (central control theory). Centrally generated patterns, known as motor programs, are both (1) hierarchically organized in many levels of the brain and spinal cord and (2) present in mammals as well as in other vertebrates. The neural circuitry associated with these programs comprises intricate feedback and feed-forward circuits involving the cerebellum, basal ganglia, thalamus, cerebral cortex and other neural centers of the central nervous system. The relation of these endogenous motor programs to the phylogenetic acquisition of speech will be discussed with emphasis on three neural levels, namely: (1) the peripheral apparatus, (2) the pattern generators and (3) the command systems.

0173

COALITION FORMATION AMONG MALES IN THREE FREE-RANGING BABOON GROUPS.
 R. Noë, Lab. of Comparative Physiology, State Univ. of Utrecht, Jan van Galenstr. 40 - 3572 LA Utrecht The Netherlands.

Data for this study were gathered in two groups of yellow baboons (*Papio c. cynocephalus*) in Amboseli National Park, Kenya in 1981-1982. A group of anubis-baboons (*P.c.anubis*), ranging near Gilgil, Kenya, is presently under study.

A coalition is defined as a temporary relationship between two non-related partners during which each of them interferes a number of times on behalf of his partner. As a result of the migration pattern the male section of a group consists of adult immigrants and sub-adult natal males. In both classes mutual support is to be expected among males of comparable status and with a certain degree of familiarity. Natal males of the same age (and thus of comparable status) are likely to be paternal sibs. The threshold of selection of behaviour needed for the formation of reciprocal relationships among non-related individuals may therefore have been passed by means of kin-selection. The results so far are in support of this theory.

0174

MALE MIGRATION AND TAKE-OVER OF DOMINANCE IN WILD LONG-TAILED MACAQUES.
 M.A. van Noordwijk* and C.P. van Schaik, Laboratory of Comparative Physiology, State University Utrecht, Jan van Galenstraat 40, 3572 LA Utrecht, The Netherlands.

Between Dec. '79 and March '83 a wild population of long-tailed macaques (*Macaca fascicularis*) was studied in the Gunung Leuser National Park, Sumatra, Indonesia. Fifty-two migrations by subadult and adult males from and into 6 study groups were observed. The younger (subadult) males migrated more often in the company of group mates and more often into adjacent groups than older males. Most males immigrated in an "unobtrusive" way, obtaining a relatively low position in the dominance rank order. Some young adult males attempted to take-over the highest dominance rank upon entering a group. The only other individuals attempting a take-over of the highest dominance rank were young "resident" males who had newly attained full body size during a semi-solitary period of several months. The latter were more often successful in taking-over than immigrants who only succeeded in taking-over small groups with ≤ 3 resident adult males. The results suggest that 1. young males cannot reach maximum body size while being "full-time" members of a social group and 2. for males attempting to take-over the highest dominance rank knowing the social characteristics of the other resident males is important.

0175

THE FUNCTIONAL SIGNIFICANCE OF LONG DISTANCE CALLS IN MIXED-SPECIES TROOPS OF NEW WORLD MONKEYS: *Saguinus mystax* and *S. fuscicollis*. (Callitrichidae) M.A. Norconk, Dept. of Anthropology, Univ. of California, Los Angeles, CA, USA 90024.

A study of social dynamics of tamarin monkeys was conducted in Amazonian Peru from November, 1982 - December, 1983. One aspect of this study of tropical forest ecology investigated the role of long distance calls in both intra-troop and inter-troop communication of mixed-species tamarin troops. The results of the study suggest that the calls serve to identify the location and the direction of travel of the sender and thus play a major role in coordinating the movement of a mixed-species troop. Further, the calls, though penetrating only a short distance (200m) relative to the size of the home range (c. 30 ha), serve to signal and to attract neighboring troops into areas of home range overlap. The interactions between two troops, which take place in overlap zones, further suggest that the calls play a major role in the attraction of mates and in the formation of new troops.

0176

ASSOCIATION BETWEEN OLIVE COLOBUS MONKEYS, PROCOLOBUS VERUS, AND CERCOPITHECUS SPECIES IN SIERRA LEONE. J.F. Oates, Dept. of Anthropology, Hunter College of CUNY, 695 Park Avenue, New York, NY, USA 10021.

The behavior of Procolobus verus, which in Sierra Leone is almost always seen in close proximity to Cercopithecus campbelli, C. diana or C. petaurista, was studied on Tiwai Island in January-August 1983. One social group of 2 adult males, 5 adult females and 3-4 immatures was observed on 55 days, on 25 of which its members' behavior was sampled in scans at 20-min intervals. Throughout this time the P. verus group associated closely with a group of 23 C. diana, and ranged over 27 ha. The P. verus were usually highly dispersed and spent much time in dense vegetation; the average number seen in any 5-minute scan period was 2. They were very selective feeders, ate plant material only, and concentrated heavily on young foliage (70% of samples). It is argued that the strong tendency of P. verus to associate with Cercopithecus monkeys is an adaptation which increases the probability of detecting predators, without significantly increasing competition for food. Such a strategy may be related to a small body size, small group size and dispersed foraging pattern, all of which may increase predation risk.

0177

THE STATUS OF THE NIGERIAN GUENON, CERCOPITHECUS ERYTHROGASTER. J.F. Oates* and P.A. Anadu, Dept. of Anthropology, Hunter College, New York, NY, USA 10021 and Dept. of Zoology, University of Benin, Benin City, Nigeria.

A survey of forests and wildlife in southwest Nigeria in February-May 1982 paid special attention to the area's endemic monkey, Cercopithecus erythrogaster. Museum studies have led to some confusion as to the characteristics of this species, and the status of wild populations has been unknown. We found that C. erythrogaster survives over a wide area of southwest Nigeria. All individuals seen had similar, distinctive coats, and adult males produced a characteristic loud call. It was concluded that C. erythrogaster is a valid species within the C. cephus group. There is intense hunting in southwest Nigeria and forests are being extensively felled and converted. All rain-forest monkeys are now rare. Although C. erythrogaster is under less immediate threat of extinction than some other species, its long-term prospects are poor if current trends continue. Conservation measures are recommended, especially the establishment of a wildlife sanctuary in the Okomu Forest Reserve of Bendel State. Okomu (1,200 sq. km) could support viable populations of C. erythrogaster and other rain-forest mammals.

0178

GUM FEEDING AS A DIETARY ADAPTATION OF WILD PATAS MONKEYS (ERYTHROCEBUS PATAS) IN KENYA. D.K. Olson* and J. Chism, Dept. of Zoology, Univ. of Calif., Berkeley, CA. 94720, USA.

The significance of gum exudates as dietary staples and gumivory as a dietary adaptation has long been recognized for some species of prosimians and callitrichids. It is only more recently that quantitative data revealing the importance of gum in the diets of certain cercopithecines such as patas monkeys have become available. Patas have been observed at a site in Kenya for more than 4200 hr. Data on the frequency and duration of gum feeding bouts as well as on patterns of gum foraging derive from focal animal samples. The distribution and abundance of gum deposits have been determined through systematic vegetation sampling. Patas infants begin to forage for and to ingest gum before they are 6 weeks old. Gumivory represents more than 20 % of all feeding activity for juveniles and adults; gum feeding episodes account for the majority of instances in which adults feed bipedally. Patas consume the gums of three acacia species but feed predominantly on the gum of Acacia drepanolobium. A sample of 2370 trees was examined to determine the likelihood of a given tree bearing gum deposits: 61 % of all trees had no gum whatsoever, 16 % had a single gum deposit and 23 % had more than one deposit. Since gumivory by patas is coupled with feeding on substantial quantities of arthropods, perhaps the dietary adaptations of patas may ultimately be best understood by seeking dietary analogues among the callitrichids and prosimians.

0179

THE ROLE OF ECONOMIC TIMBER SPECIES IN THE ECOLOGY OF BLACK-AND-WHITE COLOBUS AND DIANA MONKEYS IN BIA NATIONAL PARK, GHANA. D.K. Olson* and S. Curtin, Dept. of Anthropology, Univ. of Calif., Berkeley, CA. 94720, USA, and Dept. of Anthropology, S.F. State Univ., San Francisco, CA. 94132, USA.

Exploitation of timber resources and destruction of forests in the Tropics have had and continue to have profound and usually deleterious effects on the biota of these forests including primate communities. Studies of two tropical forest monkeys, Colobus polykomos and Cercopithecus diana, provide data on the dietary importance of Ghana's Class I and Class II economic timber species for these primates. Colobus and dianas were observed for more than 3500 and more than 2270 hr., respectively, in studies using comparable methods for collecting feeding, ranging, phenology and tree enumeration data. Dianas ate 153 plant species overall of which 95 species (62 %) were trees. Of all trees fed in by dianas, 20 % belonged to economic timber species. Colobus ate 120 plant species overall of which 91 (76 %) were trees. Of all trees fed in by colobus, more than 25 % belonged to economic timber species. Chlorophora excelsa and Antiaris spp. were the economic species of greatest dietary importance for dianas whereas those of greatest importance for colobus were Entandrophragma utile and Triplochiton scleroxylon. Feeding data presented for one rare, very dry year further emphasize the dietary significance of key economic timber species in the ecology of these two primates.

0180

EXPERIMENTAL ESTABLISHMENT OF TAENIA SAGINATA IN THE OLIVE BABOON (PAPIO ANUBIS)

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In an effort to overcome the unsatisfactory supply of Taenia saginata eggs from naturally infected persons, an attempt was made to establish this parasite in baboons. Two groups of four baboons were used in the trial. Two baboons in each group were maintained on their usual vegetarian diet and the other two in each group received a largely meat diet. After one month, group one was fed three viable Cysticercus bovis cysts each and group two was fed 14 viable cysts each. Group two was also immunosuppressed with cyclophosphamide for five days prior to and for two days following infection. Thirty days post infection (p.i.) faeces were checked for eggs daily and after 60 days p.i. all baboons were given an anthelmintic and a purgative. None of the baboons became infected, confirming the high degree of host specificity reported by other researchers for this parasite. The reasons for this remain unknown. The effect of bile on the cysts was examined and it was found that baboon bile evaginated C. bovis cysts normally in vitro. The search for a suitable laboratory host for T. saginata should continue using a similar protocol but with different primate species as baboons appear to be completely refractory to infection.

0181

SHIFTS IN FORAGING STRATEGIES AS A RESPONSE TO THE PRESENCE OF AGRICULTURE IN A TROOP OF WILD BABOONS AT GILGIL, KENYA. H.O.Oyaro* and S.C. Strum, Gilgil Baboon Project, Gilgil, Kenya, and Dept. of Anthropology, Univ. of California, San Diego.

We have studied the development of crop-raiding in the Gilgil population of baboons since 1979. Males are the major innovators in feeding on crops and other foods. These males are most often adolescent or young adults and operate in small groups, initially, but can be solitary raiders subsequently. Females are more conservative, do not initiate raiding but may join with raiding males or with the troop, if it decides to raid. Thus we can conclude that males play a critical role in shifting their own and the group's foraging strategies. The data demonstrate the time saving benefit of the new strategy. Raiders spend about half the time foraging (collecting, preparing and consuming food) as their non-raiding counterparts. Raider males resident in a non-raiding troop have profiles like that of males from a different but raiding troop and unlike that of non-raider males in the same troop. The pattern is consistent over the day and between months.

0182

INCEST AVOIDANCE IN SEMIFREE-RANGING BARBARY MACAQUES, *MACACA SYLVANUS*.
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During a long-term study on social behavior of semifree-ranging Barbary macaques data on group changing and sexual behavior were collected. A large population containing 5 groups living in a 14.5 ha outdoor enclosure was studied. Demographic data on the whole population are available for a period of 6 years, data on sexual behavior of members of one large group, collected by both focal animal and ad libitum techniques, for a period of 2 years. Matrilineal kinship relations of all except the oldest members of the close study group were known. Males changed groups 58 times, and more than 3000 copulations were observed. Males changed groups most frequently between age 3-5, i.e. the time males reach sexual maturity. While more than 30% of all males 3 years and older changed group during the study period, many males remained members of their natal group even after reaching adulthood. However, sexual interactions and especially matings between close matrilineal relatives were found to be almost absent, suggesting that Barbary macaques are not highly inbred as formerly supposed.

0183

LIVE-CAPTURE TECHNIQUES AND THEIR BEHAVIORAL CONSEQUENCES IN A WILD POPULATION OF RHESUS MONKEYS. M. Pearl* and D. Melnick, World Wildlife Fund - U.S., 100 Park Ave., New York, NY, USA 10017 and Dept. of Anthropology, Columbia Univ. New York, NY, USA 10027.

Primatologists are increasingly interested in testing aspects of evolutionary theory on wild primates. To do this, precise determinations of an animal's health, age and kin relatedness are required to assess the impact of these variables on behavior. Securing accurate data requires that animals be examined at close range, and that intrusive techniques be used, such as blood sampling and dental casting. A logical concern is that trapping and handling members of a primate social group may irrevocably alter each animal's behavior and the group's overall social structure. To assess the effects of live-capture on wild rhesus social behavior, quantitative estimates of rates of affiliative and agonistic behavior and records of dominance hierarchies and group composition were examined for one focal group prior to and following the period of habituation and trapping. The animals were also observed during their three days of captivity. We found no major differences in the behavior of group members before and after trapping. Group membership and dominance hierarchies remained stable, and observer-animal distance was not affected. The only cost of intervention was loss of data collection time for the month of trap habituation and capture/release.

0184

SOCIAL GROUPS AND GREETING MOVEMENTS AMONG MALES IN A COLONY OF BABOONS.
F. Peláez, Dept. Psicobiología, Univ. Autónoma de Madrid, Madrid-34, SPAIN.

A cluster and correspondence simultaneous analysis procedure was used in order to know the behavioural distribution of 21 all aged males. Frequencies of 7 agonistic, 3 cohesive and 6 greeting (face to face, mount, presentation, lip-smack, penile pull and touch rump) behaviours were obtained by a 15 minute focal sampling. Three groups could be identified clearly: the -- youngest individuals interacted cohesively while the behaviours of the -- oldest were mainly agonistic ones. Middle aged animals behaved in a very heterogeneous way. Every social group had characteristic greetings: individuals belonging to the young group were mainly mounted. Individuals belonging to the old group were lip-smacked, received most presentations and interacted by face to face greetings. Members of the heterogeneous group participated in the rest of greetings as performer and receiver. Greeting movements could be related with different roles played by individuals belonging to different social groups as a behavioural strategy or subterfuge in order to attain a more profitable social position or to maintain the actual one.

0185

VOCAL COMMUNICATION IN WILD FLORIDA MONKEYS (*MACACA MULLATA*). E. H. Peters, Dept. of Anthropology, Florida State University, Tallahassee, FL USA, 32306

Vocal communication in free-ranging rhesus monkeys was examined in order to provide baseline data on the social use of vocalizations in a complex but non-native environment. The subjects are a natural troop of feral monkeys inhabiting the banks of the Silver River near Silver Springs, Florida. Vocalizations were taped and accompanying behavioral data recorded for individually identifiable animals. Spectrograms were made of representative vocalizations and a catalogue was constructed which presents both the physical characteristics of the sounds and their social usage. Both the stereotypy of some calls and the graded nature of other calls were noted. All calls may be the result of position along a series of form gradients with stereotypic calls occupying relatively invariant positions and graded calls occupying variable positions along one or more gradients.

0186

SIGNIFICANCE OF MATING CALLS AND GESTURES IN THE BARBARY MACAQUE AND THEIR RELATION TO THE ESTROUS CYCLE OF FEMALES (*MACACA SYLVANUS L.*) R. Pohl and D. Todt; Abt. Verhaltensbiologie; Inst. f. Allg. Zoologie; Freie Univ.; Haderslebenerstr. 9; 1000 Berlin 41; West Germany

During the mating season, barbary macaque females perform acoustic signal patterns which are used exclusively for this period. We examined the structure and behavioural context of such vocal patterns and analysed whether the calls are correlated to other signal forms used in mating interactions. To answer these questions, we studied the sexual behaviours of 12 focal females living under semi-free conditions in 'La Montagne des Singes', France. Our results revealed that particular vocal interactions were related to the time of the estrous cycle. Parallel to their receptive time and the number of mountings and copulations with ejaculation by males, females modified the call and changed their clutching reactions. There is evidence that the onset of a female's call is triggered by the beginning of a male's pelvic thrusts, while the call itself shows an influence upon the success of copulation (e.g. in terms of ejaculation release). The biological significance of these findings will be discussed.

0187

PROBABLE EVOLUTION OF HOMINIDS IN QUATERNARY SIWALIKS AND NARMADA, INDIA. K.N. Prasad, Formerly Director, Geological Survey of India, Madras 600 028, INDIA.

Three decades of study on *Ramapithecus* remains recovered from two different localities in the Siwaliks (Ramnagar, J&K., and Haritalyangar, H.P. Simla Hills), has revealed the probable origin and evolution of *Ramapithecus* and other hominids in this part of the region. Analysis of 20 well-defined *Ramapithecus* dental elements indicate progressive trends including capacity to use tools. The recent recovery of a well-preserved skull of *Homo* sp., (1.67 m.y.?) from the Pleistocene Narmada Valley Conglomerates considered equivalent to Boulder Conglomerates of the Upper Siwaliks, for the first time indicate the possibilities of the origin and evolution of hominids during Neogene - Quaternary. Diversification of Dryopithecines, a feature during early Neogene, gave place to the dominance of hominids in late Neogene and Quaternary periods. The recent discovery of the hominid skull from Narmada Valley, India (evolved probably in a humid-pluvial climatic phase) provides a clue for dating the material between the Djetis and Trinil Bed of Java. It can not be established whether the beds were synchronous but could be assigned to the lower first interglacial.

0188

COMBINING SCIENTIFIC EXPERIMENTATION WITH SPECIES ADEQUATE HOUSING IN LABORATORY STUDIES OF NON-HUMAN PRIMATES. B. Preilowski*, M. Reger and H. Engele, Dept. of Psychology, Weissenau Field Station, Univ. of Tuebingen, D-7980 Ravensburg, FRG.

With regard to the housing of non-human primates used as experimental animals in behaviorally oriented laboratory studies a conflict arises between the demands of a strictly controlled environment and the demands of species adequate housing. We would like to report about our attempt to solve this conflict - at least partially - in an investigation of sensory-motor functions with rhesus monkeys. Our basic approach consists of making the testing apparatus available to an animal 24 hours a day. It is attached to the living cage and connected to a computer which controls the test and the distribution of regular monkey chow as reinforcement. The monkey is thus able to work whenever he wants to for whatever period of time he chooses in his accustomed environment. Besides obtaining very interesting data on the distribution of the activity as well as the quality of performance over extended periods of time, we also obtained more data, and data which appear to be more reliable than those obtained when animals were tested each day for only a limited time in an isolated test chamber. We also found that even with a rather simple and repetitive task behavioral abnormalities were significantly reduced. So far only one animal was allowed access to the apparatus at a time. Thus the social contacts of the experimental animal are still limited. However, testing and reliable identification of the working animal in group situations should be feasible and will be attempted in future studies. (Supported by the Deutsche Forschungsgemeinschaft through grant PR 117/7-1)

0189

JUVENILE/ADOLESCENT ROLE FUNCTIONS IN A RHEBUS MONKEY TROOP: AN APPLICATION OF HOUSEHOLD ANALYSIS TO NONHUMAN PRIMATE SOCIAL ORGANIZATION. D. Quiatt, Dept. of Anthropology, University of Colorado, Denver, CO, USA 80202.

In an 8-week study of free-ranging rhesus monkeys (Group L, Caño Santiago, PR -- Sept/Oct 1983), the contributions of young animals to maintenance of family systems were assessed. A combination of focal animal records of individual, subgroup, and group activities was employed to compare the contributions of 3 females and 3 males, aged approximately 2 1/2 years, with siblings 1 year older and with mothers. Observational units of behavior were assigned to 8 categories of "family role function" for purposes of comparison. Methodological questions guiding the study were whether the concept of the household as a basic unit of energy exchange and functional adaptation might apply to nonhuman primate behavior and whether analytic application of that concept might facilitate cross-specific comparison of organizational subsystems. Hence, data are reported in a framework of household analysis, and videotape sequences are presented to illustrate differences between family and nonfamily households.

0190

THE DEVELOPMENT OF FEEDING HABITS IN FREE-RANGING INFANT BABOONS (PAPIO CYNOCEPHALUS) OF MIKUMI NATIONAL PARK, TANZANIA. R.J. Rhine* and G.W. Norton, Dept. of Psychology, Univ. of California, Riverside, CA, USA 92506 and Dept. of Applied Biology, Univ. of Cambridge, Cambridge, CB2 3DX, England.

Free-ranging baboon infants were studied during their first year of life to determine the timing by which nursing is replaced by the use of 12 categories of solid foods, such as grass, insects and fruit. Feeding of 22 male and 24 female infants was observed using one-zero and instantaneous sampling. Well-habituated, individually-identified focal animals were followed in a savannah habitat for an average of 13.20 hours each. Each follow was divided into 10 to 18 five-minute sampling periods. The data are the percents of the total number of five-minute sampling periods during which a given food was eaten at least once (one-zero sampling) or was being eaten at the end of the interval (instantaneous sampling). Meat eating was non-existent among infants and quite rare among adults. On the other hand, insect eating was surprisingly frequent. By the sixth month, the time on the nipple was substantially decreased, with a corresponding increase in some, but not all, of the 12 food categories. On-nipple still occasionally occurred during the twelfth month, but to a large degree the yearling no longer depended upon its mother for nutrition. The two sampling methods yielded similar trends; however, for some food categories instantaneous sampling yielded too few data to be useful.

0191

THIRD-PARTY INTERVENTION, PROTECTION AND PLAYMATE USE IN SOCIAL PLAY AMONG YOUNG BABOONS. H. Rivero and F. Colmenares, Dpto. Investigación, Ctr. 'Ramón y Cajal', Madrid 34, Spain.

Systematic observations were conducted on the social play of 10 male and 14 female young colony-living baboons (Papio sp.), of known age. A sample of 116 triadic interactions in which an initially non-involved individual intervened 'non-aggressively', and interfered an ongoing dyadic play bout, is analysed here. This interaction typically occurred when in response to the third-party's approach, the dominant player changed play into actions such as grasping and/or embracing its playmate. The roles fulfilled were: 'harasser' (third-party), 'protector' (dominant player), and 'protégé' (subordinate player). The males were significantly more frequent 'harassers' and less frequent 'protégés', than the females. Likewise, the males 'harassed' most frequently male-female play dyads, whereas the females did so in female-female play dyads. It seemed as though both 'harasser' and 'protector' participants changed the play into a dyadic competition over a resource (the other player). Third-parties interfered play and its consequences for the relationship between 'protectors' and 'protégés', while 'protectors' used 'protégés' as a source of reassuring contact in the conflict. These findings show that many of the different strategies displayed by both male and female adult baboons can be recognised and its underlying mechanisms clarified, by studying the complex interactions of social play in young individuals.

0192

EFFECTS OF VARYING DURATION OF PRENATAL EXPOSURE TO ANDROGEN ON PUBERTY IN FEMALE RHESUS. J.A. Robinson*, S.G. Eisele, G. Scheffler, and R.W. Goy. Wisconsin Regional Primate Research Center, University of Wisconsin, Madison, WI 53706 U.S.A.

Pregnant rhesus were injected with 10 mg/day of testosterone propionate for either 15, 25, or 55 consecutive days beginning on the 40th day of gestation. Female offspring born from these pregnancies showed virilization of external genitalia and of juvenile social behavior, the degree varying directly with duration of treatment. Two aspects of puberty, menarche and the development of ovulatory capacity, were studied in these virilized females. Menarche occurred at 978.4 ± 11.56 , 1038.8 ± 80.95 , and 1065.1 ± 37.48 days in virilized females exposed prenatally for 15 days (n=7), 25 days (n=4) and 55 days (n=10) respectively. Menarche in untreated control females (n=26) occurred at 885.4 ± 31.78 days ($F = 4.425$; $df = 3,43$; $p = 0.009$). Birth weights and growth were not affected by prenatal androgen. There also were no effects of prenatal androgen on the development of ovulatory capacity. None of the controls or virilized females ovulated during the intermenstrual interval following menarche. However, during intervals 6-10, the incidence of ovulation was 45% for the controls and 42.5% for the androgen-exposed females. We conclude that the neuroendocrine substrate regulating the timing of menarche can be influenced by as little as 25 days exposure to androgen prenatally independent of androgenic effects on mechanisms regulating ovulation. (Supported by NIH and NIMH grants RR00167 and MH 21312, respectively.)

0193

ARE GUENONS ELEPHANT SEALS? T.E. Powell, J.B. Chism, M. Cords, B. Mitchell, D.K. Olson, H.M. Tsingalia. Department of Zoology, University of California at Berkeley, California 94720 U.S.A.

We have observed three species of monkey in Kenya, Cercopithecus mitis stuhlmanni, Cercopithecus ascanius and Erythrocebus patas. Contrary to the generally accepted descriptions, we did not see exclusively harem mating systems in any of these species. The systems that we did see will be reviewed. These observations lead us critically to evaluate the usefulness of the construct of harems or one-male groups in understanding social system of Cercopithecids, especially in view of the evolutionary speculation to which it has given rise. A comparison with the social behaviour of elephant seals, a quintessential harem-breeding species, will be used in the re-evaluation.

0194

CONCEPTION RATES IN *M. nemestrina*: TYPE OF MATING, DAM-SIRE ORIGIN, AND SEASONALITY.
G. P. Sackett, Regional Primate Research Center, University of Washington, SJ-50,
Seattle, Wa. USA 98195.

Harem mating (31,000 breeding opportunity months) and single-cage timed mating (3,200 opportunity months) were studied for conception rates by wild (WB) and colony (CB) born dams and sires. Data spanned the last 20 years of breeding at the Primate Center Medical Lake Field Station. No seasonality occurred with timed mating. In harem mating seasonality was not found for dams mated to CB males, nor for CB dams mated to WB sires. Seasonality did occur for WB dams mated to WB sires, but only for the first three years of mating in captivity. Overall, timed mating had a 24% conception rate, significantly higher than the 11% value for harem mating. Timed mating success was greatest for colony born breeders. CB females had an 11% higher rate than WB females, and CB males had a 7% higher rate than WB males. Harem breeding success was equal for all breeder combinations except CB males mated to WB females who yielded a 2% lower rate ($p < .01$). These data suggest that colony born pigtailed macaques reproduce as well as wild born in a captive social setting, but reproduce better than wild born breeders under the relatively stressful situation of confinement in single cages.

0195

FEEDING PATTERNS OF BABOON MOTHERS (*Papio cynocephalus*) IN AMBOSELI NATIONAL PARK, KENYA. B. Samuëls and J. Altmann, Dept. of Biology, Univ. of Chicago, IL 60637, USA, and Institute of Primate Research, National Museums of Kenya.

Foraging and processing food comprise the major proportion of the daily activity budget of a female baboon, and her time budget is clearly affected when she has a dependent infant. One period in which feeding behavior may be especially constrained is when the infant is simultaneously most attractive to others and totally dependent upon its mother for all its transport and nutritional needs. Throughout 1983, focal samples of 24 mothers from two groups were conducted as part of a longterm study of mothers and infants. Activities of the mother and her social interactions were recorded continuously using the MORE Interaction Recorder. From these data we derive two measures of maternal feeding behavior: feeding bout length and proportion of time spent feeding. We examine the ways in which maternal feeding patterns during the 3 months after parturition are influenced by a mother's dominance rank, the age and gender of her infant, her affiliative and agonistic interactions with others and the season of the year.

0196

Stress-induced suppression of testosterone titers in the freely-living olive baboon: role of glucocorticoids. Robert Sapolsky, Laboratory of Neuroendocrinology, Rockefeller University, New York, N.Y. 10021 USA

A 5-year study of individually-known olive baboons living freely in Kenya has been conducted to determine the relationship between social rank and the efficiency of endocrine function during stress. During capture stress, testosterone titers progressively decline in low-ranking males (ranked by reproductive criteria) whereas titers transiently rise in high-ranking subjects. The present study explores the endocrine mechanisms for these phenomena. 1) Suppression of testosterone titer is at least partially due to elevated glucocorticoid titer during stress. 2) Glucocorticoids inhibit secretion of testosterone, rather than increase its clearance rate. 3) Such inhibition is due to secretory blockage at the pituitary and/or testicular level. 4) Animals less sensitive to the suppressive effects of stress upon their testosterone titers are less sensitive to the suppressive effects of exogenous glucocorticoids. 5) Transient elevations in testosterone titer post-stress, observed in some males, is unlikely to be due to adrenal androgen secretion. It is concluded that stress-induced gonadal suppression in male baboons is in part mediated by glucocorticoids acting peripherally, and that considerable individual variation exists in the strength of this regulatory relationship.

0197

PLAY AND THE DEVELOPMENT OF SOCIAL SKILLS IN INFANT RHESUS MACAQUES.
C. E. Scanlon, Dept. of Biology, The Open University, Milton Keynes, England.

The functional significance of social play with regard to its effect upon the subsequent development of socially skilled behaviours is explored. Infant rhesus monkeys were observed from age three to seventeen months. They were members of the free-ranging colony of rhesus macaques (*Macaca mulatta*) on Cayo Santiago, Puerto Rico, and belonged to group I, one of the six social groups on the island. The first twenty male infants born into the group in 1981 were observed using a focal sampling technique. Play and behaviours which were considered as potentially socially skilled were recorded. Data were summarised in three 14-week time blocks: 9-23; 24-38; and 54-68 weeks. The relationship between the development of play and social skills was examined using cross-correlational analysis between the different time periods. Correlations were also run for play and skills with birth order, rank and genealogical affiliation in order to discover whether the development of social skills may have been affected by any of these factors. The results suggest that there is not a simple association between the development of social skills and any other single factor.

0198

REPRODUCTIVE SEASONALITY IN SUMATRAN LONG-TAILED MACAQUES (*MACACA FASCICULARIS*).
C.P. van Schaik* and M.A. van Noordwijk, Laboratory of Comparative Physiology, State University Utrecht, Jan van Galenstraat 40, 3572 LA Utrecht, The Netherlands.

In a three year field study of a population of *Macaca fascicularis* in northern Sumatra long-term data were collected on phenology, activity budgets and birth seasonality. It was found that the monkeys responded to increased fruit availability with an increase in activity. Births were seasonal and peaked during the annual fruit peak in some years but some months later in others. In many other primate species births tend to peak a few months before the annual fruit peak is reached. It is hypothesized that this deviant pattern is caused by the combination of a low mean and a great variance in the height of the annual fruit peak. A theoretical model supports this conclusion. The two types of reproductive seasonality are compared as to the predictions they make concerning infant mortality and physiological variables. The unpredictable alternation of poor years and mast years is peculiar to South-East Asia, and all primate species of this region seem to follow the same pattern.

0199

CIRCADIAN ACTIVITY RHYTHMS IN PROSIMIANS (*Lemuridae* and *Lorisidae*).
F. Schanz and H.G. Erkert, Institut für Biologie III, Univ. Tübingen, Morgenstelle 28, D-7400 Tübingen, W.Germany.

To get information about evolutionary differentiation of the circadian timing system regulating the activity rhythm in prosimians, comparative studies with 6 *Microcebus murinus*, 5 *Lemur fulvus* (*Lemuridae*), 5 *Galago senegalensis* and 3 *Galago crassicaudatus* (*Lorisidae*) were carried out. Criteria for judgement were the variability of the period length, the range of entrainment and the resynchronization behaviour of the circadian activity rhythms (CAR). Under different constant lighting conditions the period length of the freerunning CAR varied from 22.8 - 24 hrs in *G. senegalensis*, 22.0 - 23.5 hrs in *G. crassicaudatus*, 22.6 - 24.1 hrs in *M. murinus* and from 24.6 - 25.5 hrs in *L. fulvus*. The range of entrainment by LD cycles of about 100 : 0.1 lx reached from 22 - 26 hrs in *G. senegalensis*, and from 20 - 25/28 hrs in *G. crassicaudatus*. To re-entrain after 8 hrs advance and delay shifts of an LD 12:12 (100 : 0.1 lx) the *G. senegalensis* needed on an average 8.2 and 3.8 days, *G. crassicaudatus* 6.3 and 9.7 days, *M. murinus* 8 and 3.7 days, and *L. fulvus* 7 and 3.7 days. These results indicate slight interspecific differences which may reflect ecological adaptations.

0200

ASPECTS OF THE ONTOGENY AND MORPHOLOGY OF THE HYLOBATID CRANIUM.
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Frankfurt - 70, West - Germany.

On the basis of a chard - board - model of a young Hylobatid species (Hylobates moloch; head-length: 51 mm) some morphological features of special interest will be shown. Two of these features will be described in details:

First, the position, degree and development of cranial base angles are described. The decrease of angulation is proved to be located mainly in the sphenethmoidal synchondrosis and some histological arguments are given for that. Second, the nasal cartilages and the nasal floor are described and compared with other primates of hominoid stage. Furthermore the presence of a scleral cartilage (Cartilago scleralis) is demonstrated.

Some remarks on the auditory region will be added.

0201

NEW DATA ON MIOCENE HOMINOID HUMERI FROM PAKISTAN AND KENYA

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Anatomical comparative study of distal humeri including modern primates (Platyrrhini and Catarrhini) and Miocene fossils from the Potwar Plateau (Pakistan) points out the morphological proximity of the fossils to the African great apes and the dissimilarity with orang-utans. Computerized tomography by fine seriation confirms these results by comparison with line drawings of sections realized in extant apes. The features to which we refer are the lateral area to the fossa olecrani and the anterior lateral lip to the trochlea humeri. Some Miocene fossils from Rusinga Island in Kenya (especially KNM RU 7696) exhibit strong resemblances with Asiatic fossils and suggest a common origin. The preserved parts of the fossils from Pakistan evoke an animal with a partially quadrupedal locomotor pattern. These data suggest that some gorilla-like apes that later became extinct were living in Asia about 10 million years ago; alternatively they could imply that the orang-utans had terrestrial quadrupedal ancestors and thus their arboreality is a secondary development.

0202

ECOLOGY AND BEHAVIOUR OF RHESUS MONKEYS IN INDIA.

P.K. Seth and S. Seth, Dept. of Anthropology, Univ. of Delhi, Delhi 110007, India.

A field study of the naturally occurring populations of rhesus monkeys in India in diverse habitats has been conducted to illustrate their wide range of ecological and behavioural adaptability. Data is based on an intensive study of selected populations in different ecozones, and on extensive surveillance programs through the north and northwestern belt of the Indian subcontinent. Home range used depended upon the availability of food, weather conditions, and the behaviour of the nearby groups, if any. The study suggests that the habitat significantly influences their behaviour whereas the rapid urbanisation and industrialization is changing their home ranges.

0203

POPULATION TRENDS IN NATURALLY OCCURRING RHESUS MONKEY POPULATIONS IN INDIA.

P.K. Seth and S. Seth, Dept. of Anthropology, Univ. of Delhi, Delhi-110007, India.

Field surveys of free ranging rhesus monkey populations in the different ecozones in north and northwestern India have been conducted with a view to measure changes in their abundance over the years. Although rhesus monkeys in the past were tolerated by the local inhabitants, changes in social attitudes and environmental conditions are rapidly changing the human attitude. Free-ranging rhesus groups in the Indian sub-continent, by and large, increased in their overall size. In areas where forests have been under increasing pressure from timber cutting, the rhesus populations have moved into the hinterland. Along the roadside where construction works are in progress, the monkeys have moved deeper into the countryside. Data shows that as a consequence of these changes, the behaviour of these groups is influenced because their normal activity day or feeding repertoire is affected by changes in season and habitat. The study emphasizes the critical need for management and conservation of the rhesus monkey populations in their natural habitat.

0204

EVOLUTIONARY AND GENETIC MICRODIFFERENTIATION IN PRIMATES.

S. Seth and P.K. Seth, Dept. of Anthropology, Univ. of Delhi, Delhi 110007, India.

The evidence regarding the marked microdifferentiation among the relatively undisturbed monkeys using electrophoretic assays and other biological markers overcomes the traditional difficulties and settles the evolutionary problems in ways that are independent of any particular laboratory. The remarkable similarity in the behaviour and biology between the nonhuman primates which has long intrigued the members of our own species is better understood by the evolutionary systematics involving proteins, enzymes, biological, palaeontological and perhaps the morphological characteristics. A search for genetic differences to establish genetic divergences between nonhuman primate species reveals differential rates of molecular evolution in them. A comparison of the findings obtained using varying techniques and genetic parameters shows that the differentiation in the nonhuman primates from the ancestral lineage conforms with the palaeoanthropological evidences.

0205

NEW FOSSIL MONKEYS FROM THE LA VENTA FORMATION, COLOMBIA, SOUTH AMERICA. Takeshi Setoguchi, Kyoto University Primate Research Institute, Inuyama, Japan and A.L. Rosenberger, Dept. of Anthropology, University of Illinois at Chicago, IL USA.

Several new taxa pertaining to ateline platyrrhines have recently been discovered. One is diagnosed as a new genus having affinities with the living spider monkey, *Ateles*. Others are closely related to the *Stirtonia-Alouatta* clade; one is possibly related to the eastern Brazilian *Brachyteles*. These interpretations, though tentative, dispute the splitting times proposed by molecular clock advocates. The comparative dental anatomy of these fossils and the living atelines is illustrated, as are a variety of phylogenetic schemes treating the large-bodied New World monkeys.

0206

AGE-RELATED GROWTH PATTERN OF THE COLONY BORN RHEBUS MONKEYS. D.N. Sharma and K.C. Lal
Exp. Animal Facility, All-India Institute of Medical Sciences, Ansari Nagar,
Delhi-29 India.

The study was started on 35 monkeys (17 male and 18 females) born in the colony, and data collected over a period of one year have been reported. Both the male and the female show a rapid growth during the first three months, following which the gain in weight as well as the pattern of increase in length and girth decrease considerably. The data obtained by further study would establish certain basic norms by which the age of young monkeys caught in the wild can be determined.

0207

CHROMOSOMAL VARIATIONS IN MACACA MULATTA (RHEBUS MONKEY). M.E. Sharma and P.K. Seth,
Anthropological Survey of India, Central Region, 11, Seminary Hills, Nagpur-440006
and Department of Anthropology, University of Delhi, Delhi-110007.

The metaphase chromosomes of 130 Macaca mulatta were studied. The chromosomes were obtained from lymphocyte culture and stained by GAG, QFH and CBG banding. The mechanism causing chromosomal variations can easily be detected because each chromosome can be identified by its specific banding pattern. A few structural and numerical variations were reported during the analysis. In two animals 30% of the cells were tetraploid. The mosaic cell line with chromosome 42, XY (65%), 41, XY (35%) was reported in one animal. A dicentric chromosome was observed in 5% of cells in one animal, while the marker chromosomes and Y-Chromosomes were found to be polymorphic. The mechanisms and the effect of such variations on the individual animal has been discussed.

0208

POPULATION TRENDS OF RHEBUS MONKEYS (MACACA MULATTA) IN INDIA.
A.K. Shukla, 365 Civil Lines, Jhansi; P.K. Seth and S. Seth, Dept. of Anthropology
Univ. of Delhi, 110 007 INDIA

A longitudinal field study, beginning in the year 1975, of population trends was conducted on 9 groups of free ranging rhesus monkeys in tropical and arid habitats of India. Data were collected for about 6000 hours, during various weather conditions of the year. At the time of provisioning the groups in the initial stages of the study, the population of the 9 groups was 400. It increased to 650 in the last phase of the data collection. This is a 62.5% increase in the population from the time of initial provisioning. These study groups are free from the trapping pressure. This study emphasizes the urgent need for a detailed conservation programme in the country for the protection of this species.

0209

THE INTERACTION BETWEEN PREHENSION AND LOCOMOTION IN MACAQUE'S, GORILLA'S AND CHILD'S COGNITIVE DEVELOPMENT. G. Spinozzi, F. Natale and F. Antinucci, Inst. of Psychology, C.N.R., Rome, Italy.

Three species of infant primates (macaque, gorilla and human) were compared in order to investigate the interaction between rates and timing of growth and cognitive development. A special interest assumes in this context the relative time of onset of the capacities for independent locomotion, which is progressively retarded in the three species. While the macaque walks almost immediately after its birth, the gorilla does so only at 3 months of age and the human at 9 months. These differences have a strong influence on the development of prehension activities as described by Piaget. In particular, patterns of hand-prehension, buccal-prehension, hand-sight and hand-mouth coordination develop differently in relation to the different possibilities offered by locomotion in the three species. These differences seem to affect the modes of interaction with the external objects: the slower the growth, the more articulate and discriminative is the exploration and functional differentiation of objects.

0210

ETHOLOGICAL INFLUENCES ON PERCEPTION IN OLD WORLD MONKEYS. W. C. Stebbins, B. May, and D. B. Moody, Dept. of Psychology, Univ. of Michigan, Ann Arbor, MI, USA

A variety of evidence now strongly suggests effective selection pressures on perceptual mechanisms and perceptual processing for the reception of biologically relevant sounds--particularly those uttered by conspecifics. Previous findings indicate that Old World monkeys discriminate and categorize human speech sounds in much the same manner that we do and are perceptually specialized for the signals of their own species. In both human speech and animal communication signals certain key features play a significant role in this perceptual specialization. As one example, frequency modulation (FM) is an important information-bearing element in human speech, in the echoranging signals of microchiroptera bats, and in the "coo" calls of Japanese monkeys. In the latter, the particular function of the "coo" call depends on the temporal location of the FM element within the call.

We have been examining perceptual properties of FM signals in experiments on sound localization and discrimination in Old World monkeys. Its acoustic structure--that is, its frequency range, rate of change, and duration all appear to be important parameters determining the accuracy with which it is localized and with which it is discriminated from non-modulated signals. These experiments are designed to enhance our understanding of FM as a key feature in biologically meaningful signals.

0211

POSTPARTUM RESUMPTION OF SEXUAL ACTIVITY IN AMERICAN WOMEN: EFFECTS OF ABSENCE OR FREQUENCY OF BREASTFEEDING. J.M.Stern and S.Leiblum, Dept. of Psychology, Rutgers University, New Brunswick, NJ 08903 and Dept. of Psychiatry, UMDNJ-Rutgers Medical School, Piscataway, NJ 08854.

Although human females are more emancipated from hormonal influences on their sexual activity than other primates, little is known about the effects of lactation, which is accompanied by hyperprolactinemia and prolonged amenorrhea. Weekly sexual activity and desire, mood, physical state, and baby feeding activities over a 9 month period after the birth of the 2nd baby has been collected from over 20 women. To date, Breast- and bottlefeeding women do not differ in pre-pregnancy coital rate/week (2.5) or in mean week to resume coitus postpartum (PP) (5.8 and 5.3), but the Breastfeeding women had a lower coital rate during weeks 5-8 PP (0.5 vs 1.4 $p < .02$) and a longer PP amenorrhea (25 vs 9 weeks). Thereafter, the mean coital rate for all subjects was 1.25. Of women who continue to nurse, in every 4 week period there is a negative correlation between coital and nursing frequency. Levels of prolactin and/or steroids (obtained from blood samples at 1,2,4,6 and 9 months PP) and/or nonhormonal influences may be related to the sexual behavior effects.

0212

CAPTIVE BREEDING OF CALLITRICHIDS: A COMPARISON OF MANAGEMENT, REPRODUCTION AND PROPAGATION IN DIFFERENT SPECIES. M.F. Stevenson, Royal Zoological Society of Scotland, Murrayfield, Edinburgh EH12 6TS., U.K.

This review compares and contrasts three main aspects of the biology of captive Callitrichids. Data are compiled from published reports and from the results of a questionnaire sent by the author to major institutions breeding Callitrichids. This primate group comprises some of the most commonly utilised species in medical research, and some of the most endangered in the wild. Successful captive propagation is important, but little is known of the comparative reproductive potential of different species: e.g. *Callithrix jacchus* is easier to breed than *Callithrix argentata* and *Saguinus fuscicollis* easier than *S. oedipus*. This work examines why this should be and presents data on the reproductive potentials and interbirth intervals of the species bred in captivity. The third aspect of the work utilises the data provided each year in the International Zoo Yearbook, to analyse which species are successfully propagated in captivity. Of 20 species currently bred in captivity, only 11 are propagated successfully so that they comprise a self-sustaining captive population. In conclusion it is suggested that closer cooperation between those breeding Callitrichids might improve the situation.

0213

GROWTH CHANGES, SEXUAL DIMORPHISM AND VARIATION OF THE GORILLA SKULL. Z. Stratil* and P. Schmid, Anthropological Institute and Museum, Univ. of Zurich, Switzerland

A series of 85 measurements were taken on a sample of 131 gorilla skulls of different dental ages to analyze the growth, the development of the sexual dimorphism, and the variation of the gorilla skull. The rates of growth are dissimilar in the different skull regions. The same is true for the degree of sexual dimorphism and variability. The growth and sexual dimorphism is greater in the sagittal than in the transversal dimensions. The sexual dimorphism remains insignificant until the last stage of ontogeny is reached. The skull variability seems to be greater in males than in females. The results show that there is a relation between the intensity of growth, the degree of sexual dimorphism and the variability.

0214

ALIMENTARY TRACT DISEASE IN CAPTIVE NON-HUMAN PRIMATES IN KENYA. M.A. Sulwan, J. Monrei, R. Tarara, J.G. Else, Institute of Primate Research, National Museums of Kenya, Nairobi, Kenya.

Alimentary tract disease is the most common cause of colony morbidity and mortality at the Institute of Primate Research. The vervet (*Cercoptes aethiops*) is the most frequently and severely affected. Diarrhoea is the primary manifestation of this disease state and can be semi-solid, watery, with or without blood and/or mucous. Diagnostic procedures have included bacterial culture and parasitologic examination of stool samples, rectal swabs and material harvested at post-mortem examination. Protocols for virologic examination of stool and tissues, and a culture procedure for *Campylobacter* sp. are being initiated. A complete necropsy is performed on all dead animals. Focal or diffuse lesions are seen in the small and/or large intestine, and can be characterized as inflammatory, proliferative, necrotic, or ulcerative. Bacteria isolated include *Shigella* group B, *Yersinia enterocolitica*, and *Klebsiella ozaenae*. Parasites identified include *Entamoeba histolytica*, *Entamoeba coli*, *Balantidium coli*, *Chilomastix mesnili*, *Trichuris*, *Trichomonas* and *Trichostrongylus*.

0215

GASTRIC ULCERS IN VERVET MONKEYS (*Cercopithecus aethiops*)

M.A. Suleman, Ross Tarara and P.D. Sayer, Institute of Primate Research, National Museums of Kenya, and Kenya Trypanosomiasis Research Institute, Nairobi, Kenya.

Multifocal mild to severe gastric ulcers and erosions and ulcerative colitis have been documented in 11 vervet monkeys. This accounted for 44% of the vervet deaths during the same period. The ulcers, which were found at autopsy, affected both the body and fundus of the stomach. Two of the 11 monkeys had been experimentally infected with *Schistosoma mansoni* eight weeks before death, 2 had sustained multiple fight wounds from cage mates, 2 died suddenly without prior history of ill-health and the remaining 5 had been under treatment for various ailments before death. One of the sudden deaths had been regrouped for breeding 4 days before it died. Diarrhoea and depression were common clinical signs in the majority of the cases. None of the animals was treated with pharmaceutical drugs that had been documented to cause gastric ulceration. Six monkeys were colony born and 5 had been in the colony for more than 2 years. Nematodes and both psychologic and trauma stresses could lead to gastric ulceration and erosions. It is proposed that vervet monkey would make an excellent model for studying gastric ulceration in man.

0216

A BENIGN MESENCHYMAL TUMOR IN A BLACK MANGABEY. M.A. Suleman, R. Tarara and P. Sayer, Institute of Primate Research, National Museums of Kenya, and Kenya Trypanosomiasis Research Institute, Nairobi, Kenya.

A wild-caught adult female black mangabey was noted clinically to have a swelling on the right ventro-lateral aspect of the face. On examination it was found to be a hard mass attached to the mandible by a broad base in the area of the cheek teeth. The mass was surgically excised, fixed in 10% formalin, and a representative sample was embedded in paraffin, sectioned at 7µm and stained with hematoxylin and eosin for light microscopy. Histologically the tissue consisted of thin trabeculae of lamellar bone, separated by loose fibrous connective tissue. A diagnosis of epulis, a benign oral tumor of mesenchymal origin, was based on histological appearance. There has been no recurrence of the tumor.

0217

DEVELOPMENTAL CONTINUITY OF INDIVIDUAL DIFFERENCES IN RHESUS MONKEY STRESS REACTIVITY
S. J. Suomi, Laboratory of Comparative Ethology, National Institute of Child Health and Human Development, Bethesda, Maryland, USA 20205.

Twelve rhesus monkey infants were reared in peer groups until puberty, except for short periods of repeated peer separation during the subjects' first, second, and third year of life. Observational data were collected both during every separation and throughout the longer periods of peer group housing, while physiological measures of reactivity were obtained from each subject prior to peer group formation, during separations, and under baseline conditions of stable group housing in order to assess individual differences at different stages of development. Time series analysis revealed that (a) although behavioral reactions to separation changed dramatically throughout the study, individual differences in the intensity of separation reaction were remarkably stable, (b) physiological measures of reactivity obtained during any one separation were predictive of individual differences in both behavioral and physiological reactions to the other separations throughout the study, indicating developmental consistency of relative stress reactivity in these subjects, and (c) in contrast, neither behavioral nor physiological measures obtained during periods of group housing were predictive of either relative stress reactivity or baseline behavior at other stages of development.

0218

THE MENSTRUAL CYCLE OF THE VERVET MONKEY, *Cercopithecus aethiops*. R. Tarara, J.G. Else and R.M. Eley, Institute of Primate Research, National Museums of Kenya, Nairobi, Kenya.

Menstrual cycles of 29 individually caged vervet monkeys were followed for four years. Normal cycles (n=435, 20-50 days, \bar{x} =325 days) accounted for 77.4% of all cycles. Plasma hormone concentration, vaginal cytology, perineal skin colouration and endometrial histology were evaluated from a subsample of animals (n=13). The luteal phase (Progesterone, P 5 nmol/l) of 15.6 ± 1.9 days was characterized by a rise in P 2-3 days after the estradiol (E) peak to achieve a maximum concentration of between 13 and 30 nmol/l. The preovulatory E peak (800 to 3500 pmol/l) occurred on day 10.8 ± 2.4 (range 7-15). Perineal skin colouration was highly variable and not a good indicator of reproductive status. Superficial cells in the vaginal lavage were maximum and intermediate cells minimum around the expected time of ovulation. Follicular phase endometrial biopsies exhibited straight glands in a densely cellular stroma. Mitotic figures were present in the columnar glandular epithelium and in the stroma. During the luteal phase there was tortuosity of glands with apical vacuolation within the glandular epithelium. Results corroborate a previous report that the vervet monkey may be an alternative model for the study of reproductive biology in humans.

0219

IMPLANTATION IN THE OLIVE BABOON: STAGES V, VI and VII. R. Tarara, J.G. Else, A.C. Enders, A.C. Hendrickx and K. J. Hodges. Institute of Primate Research, National Museums of Kenya, Nairobi; California Primate Research Center, University of California, Davis 95616; Institute of Zoology, Regents Park, London.

Implantation from stages V, VI, and VII of embryonic development were surgically excised and fixed in 3% glutaraldehyde. Tissues were post-fixed with Osmium Tetroxide, embedded in Epon-araldite, and 1 μ m sections were stained with Azure B. Change in the embryo consisted of increased size of the amnion, and thickening of the bilaminar epiblast plate with assumption of a convex-concave shape. There was variation in the appearance of the visceral endoderm. In the placenta, syncytiotrophoblast-lined lacunae were present in the trophoblast plate by stage V, and there was early secondary villus formation. These villi increased in number and length stages VI and VII, and there was villus branching at stage VII. In the endometrium, there was an epithelial plaque reaction which varied in intensity, and an early decidual reaction was present at stage VII.

0220

AN ADEMONA IN THE LARYNX OF A SYKES MONKEY (*Cercopithecus mitis albogularis*). R. Tarara, M.A. Suleman and P.D. Sayer, Institute of Primate Research, National Museums of Kenya and Kenya Trypanosomiasis Research Institute, Nairobi, Kenya.

An adult male sykes monkey was presented with severe respiratory distress. Treatment was initiated but the animal was found dead the following morning. At necropsy, a firm nodule measuring 14mm in diameter was found to be attached to the floor of the larynx. Histologically this was an oval section of tissue with a narrow tapered end toward the floor of the larynx. The perimeter was lined by stratified squamous non-keratinizing epithelium. Subjacent to the epithelium was a layer of loose fibrous connective tissue. The tissue was separated into lobules by thin fibrous connective tissue septae which contained interlobular ducts, and a mixed inflammatory cell infiltrate. The lobules were composed of intralobular ducts and small regular acinar structures composed of cuboidal cells. The cells of approximately one half of these acini had eosinophilic granular cytoplasm (serous) and one half were composed of cells with pale basophilic cytoplasm (mucinous). A predominantly mononuclear cell infiltrate was present diffusely in the stroma of the lobules with scattered aggregation into small nodules. A diagnosis of adenoma was based on morphologic features.

0221

EVOLUTIVEScheme OF THE KNEE INTERARTICULAR MENISCI IN PRIMATES AND IN SOME FOSSIL HOMINIDS. C. Tardieu CNRS 246 (Locomotion Animale), Museum nat. d'Hist. naturelle, 55, rue Buffon, 75005 Paris, France.

Dissections of primate knee-joints made by H. Vallois (1914) and myself show that the external meniscus displays three different morphologies in extant primates: crescent-shaped meniscus with one anterior tibial insertion in Strepsirhini, Tarsius, Platyrrhini and Pongo; ring-shaped meniscus with one anterior tibial insertion in Cercopithecoïds, Hylobatids, Pan and Gorilla; crescent-shaped meniscus with two tibial insertions in Homo. This distribution allows the construction of two evolutive schemes. The single or double insertion of the meniscus corresponds to two different morphologies of the proximal dry tibia, permitting the interpretation of some tibial fossils of plio-pleistocene hominids: KNMER 1481 B, 1476 B, AL 129 1b, 288 1Aa, 333 x 26. The interpretation of tibial fossils of oligocene and miocene primates is not possible by this feature, because the crescent or ring shape of the meniscus cannot be distinguished on the dry tibia.

0222

MOTHER-INFANT INTERACTION DURING AN EARLY PERIOD OF THE INFANT'S DEVELOPMENT IN A GROUP OF MACAQUES, Macaca mulatta. A. Tartabini* Dipart. Scienze dell'Educazione, Univ. Calabria, Cosenza, Italy, 87036.

Mother-infant interactions were studied in the early development of rhesus monkey infants. The mean frequency and duration of behaviours (On-mother, Off-mother, Nipple contact, Immobile and Grooming by the mother while on or off mother) were compared between males and females. Correlations between frequencies and duration were made between the different sexes and for individual subjects. The only significant correlations for each sex ($P < .01$) were found when frequencies were compared with durations. Off-mother was an exception from these results. When individual infants were considered, the frequencies of on mother and Nipple for females were significantly correlated with the durations of males. There were no sex differences in Immobile and Grooming by the mother during time On. Other comparisons were not significant. These findings suggest that male infants tend to leave mothers (measured by On-mother and Nipple) earlier than do females.

0223

MOTHER'S REJECTING BEHAVIOUR TOWARDS NEWBORN RHESUS MONKEYS, MACACA MULATTA, LIVING IN SMALL GROUPS.

A. Tartabini and M.J.A. Simpson, Dept. Sciences of Education, Univ. of Calabria, ITALY 87036 and Sub-Dept. of Animal Behaviour, Univ. of Cambridge, ENGLAND CB3 8AA.

The social and other activities of rhesus macaque infants (Macaca mulatta), after being roughly rejected by their mothers, were contrasted with the activities after the infants had broken contact with their mothers without being rejected. Eight infants, living in six different small family groups, were observed for about three months, starting at ages between two weeks and three months. The two infants that did not accept maternal rejection had primiparous mothers living in the same group with one adult male. One of these infants was punished (by maternal hitting, biting and pushing) most often of all when it attempted to make contact with its mother after being rejected. In contrast, infants of multiparous mothers accepted their mothers' acts of rejection. With special reference to maternal rejection we shall discuss how the mother-infant relationship affects the manner in which the infants establish relationships with other group members.

0224

MALE CARETAKING AMONG OLD WORLD PRIMATES. D.M. Taub, Yemassee Primate Center, Yemassee South Carolina U.S.A.

Interactions between sexually mature males and infants have been observed for many species of Old World Primates. Male-infant interactions among these species can be characterized by fundamental differences in structure, in the context of occurrence, in the frequency and rate of exhibition, in differential distributions among the care-taking males and the cared-for infants, and in various biosocial characteristics of the care-taking males (e.g.). Dyadic and triadic male-infant interactions range from the extensive, well-developed system characteristic of the Barbary macaques, to the triadic system common among savannah baboons and to the attacks upon infants among langurs. Because of these variations, a number of competing and sometimes mutually exclusive theoretical positions have been developed as functional and evolutionary explanations of these "paternal" systems. In this paper, we examine the empirical data accounting for the occurrence of male-infant interactions among cercopithecoïd primates; review the competing explanatory hypotheses and assess how well the empirical data accommodate them; and reevaluate this phenomenon in light of previous theories.

0225

DENTAL MICROWEAR AND DIET IN TWO SPECIES OF Colobus. M.F. Teaford, Dept. of Cell Biology & Anatomy, The Johns Hopkins U. School of Medicine, 725 N. Wolfe St., Baltimore, MD, USA, 21205.

Recent analyses have established differences in dental microwear among primate species with different diets (Teaford & Walker, in press). In short, the relative proportions of microscopic pits and scratches on molar occlusal surfaces may be used to distinguish between primate hard-object feeders and leaf-eaters. To see if finer dietary inferences might be made through similar analyses, dental replicas of Colobus guereza and Colobus badius from the Smithsonian Institution were examined using scanning electron microscopy. Differences between crushing facets and shearing facets were similar to those documented by Gordon (1982) for chimpanzees. Colobus guereza generally exhibited more microwear features per field of examination than Colobus badius. Finally, while there were no significant interspecific differences in the shape of microwear features on facet 3, there were significant differences on facet 9 - i.e., as might be expected from Teaford & Walker's analyses, Colobus badius exhibited relatively more microscopic pits than Colobus guereza.

0226

A COMPARATIVE STUDY OF AGGRESSION AND RESPONSE TO AGGRESSION IN THREE SPECIES OF MACAQUE. B. THIERRY, Laboratoire de Psychophysiologie, Université Louis Pasteur, 7 rue de l'Université, 67000 Strasbourg, France.

Patterns of agonistic interactions were studied in three groups of macaques living in semi-liberty: rhesus (Macaca mulatta), long-tailed (Macaca fascicularis) and Tonkean macaques (Macaca tonkeana). In rhesus macaques, interactions were intense (i.e., biting was relatively frequent) and very asymmetric; the aggressor most often fled, screamed and/or redirected aggression, and reconciliation (non-agonistic contact between previous antagonists) rarely occurred in the twenty minutes following aggression. In Tonkean macaques, in contrast, biting was exceptional and the aggressor frequently counter-attacked; both individuals often displayed appeasement behaviours (lip-smacking, clasping) and reconciliation occurred following most instances of aggression. Compared to the previous two species, long-tailed macaques showed intermediate patterns: medium-intensity aggression with little symmetry, frequent mild submission patterns (teeth-chattering, bared-teeth) and a medium rate of reconciliation between antagonists. An inverse relationship was found between intensity of aggression, and symmetry of aggression and development of behaviours ending aggression.

0227

CYTOTOXIC EFFECTOR CELL ACTIVITY IN MACACA MULATTA RENAL TRANSPLANT RECIPIENTS. J.M. Thomas, J.C. Gonder*, F.M. Carver, East Carolina University, Greenville, NC, USA 27834

The specific immune mechanism which leads to rejection or long term acceptance of MHC incompatible allografts is unclear. Cytotoxic effector activity was studied in three groups of rhesus monkeys receiving renal transplants. Group I (n=8) received no immunosuppression. Group II (n=7) received rabbit anti-human thymocyte globulin (RATG) on days 1 to 5 posttransplant. Group III (n=7) received RATG as in Group II, and donor bone marrow cells (DBM) on day 12. All recipients in Groups I and II succumbed to rejection at a mean of 9.2 days and 36.3 days, respectively. Animals in Group III survived to a mean of 216 days, with rejection occurring in only one animal at 42 days. Direct lymphocyte-mediated cytotoxicity to donor cells (D-LMC) became positive in 86% of Group I animals at 0.5-2.0 weeks, but none developed specific antidonor antibody dependent cytotoxicity (D-ADCC). D-LMC and D-ADCC was delayed until 4-6 weeks in Group II. No Group III animals developed D-LMC. One developed D-ADCC at 4 weeks and underwent rejection at 42 days. Of the other animals in Group III, none developed D-ADCC within 5 months posttransplant. Those surviving > 5 months eventually developed D-ADCC but did not undergo graft rejection. Development of D-LMC is associated with acute renal allograft rejection in non-immunosuppressed and RATG-treated rhesus monkeys. Animals treated with RATG and DBM failed to express D-LMC and had a high incidence of long term tolerance. Late antidonor ADCC occurring in tolerant animals does not precipitate graft rejection.

0228

PERFORMANCE CHARACTERS AND SIGNIFICANCE OF THE DUSK CHORUS IN THE BARBARY MACAQUE (MACACA SYLVANUS L.)

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When assembling near their arboreal sleeping places, barbary macaques perform a dusk chorus which can be heard over long distances. Chorussing behaviour was studied in semi-free ranging groups (Rocamadour and Kintzheim, France), in agreement with W. Angst and E. Merz. In particular, we examined (1) features and parameters of chorussing (e.g. onset and duration, sound pressure level, frequency range and power spectrum) (2) variables affecting them, and (3) the influence of this signalling upon group members. Variables affecting chorussing were group size, group structure and sleeping place properties. Our results revealed that dusk chorussing is basically achieved by the younger individuals (incl. infants), and that it plays a role in attracting rather than in repulsing particular group members during the formation of sleeping parties. The dusk chorus of barbary macaques seems not to serve as a signalling used in territorial interaction between neighbouring groups (as e.g. in Presbytis cristatus.)

0229

GROUP FORMATION IN GIBBON THROUGH DISPLACEMENT OF AN ADULT.

*U. Treesucon and J.J. Raemaekers, Dept. of Biology, Mahidol Univ., Bangkok 10400, Thailand.

The white-handed gibbon (Hylobates lar) lives in monogamous family groups, with an adult male, adult female and 0-4 offspring. Groups have territorial home ranges. All activities are confined to their territories. Subadults leave the family group and form new family groups when they are about 8 years old. Three families of gibbons were observed from February 1981 to January 1984 at Khao Yai National Park, Thailand. New family groups are usually reported to form when subadult males establish territories and obtain new mates, or by replacing the like-sexed adults which die in existing family groups. In this study a new group was formed when a subadult male displaced an adult male of the neighboring family group and took it over. Two juvenile siblings of the male joined their brother's family group when they lost their mother. This is the first reported instance of natural group formation through displacement of an adult in an existing family group.

0230

SOCIAL BEHAVIOR OF AN INFANT-ABUSING JAPANESE MACAQUE MOTHER. A. Troisi* & F.R. D'Amato, Dept. of Genetics and Molecular Biology, Univ. of Rome La Sapienza, 00185 Rome, Italy.

This study was designed to analyze the social behavior of an infant-abusing Japanese macaque female by comparing it with that of normal females from the same colony. Data reported here were collected in the 1980 birth season and relate to the social behavior of the abusive mother and of three control mothers throughout the first two weeks of their infants' lives. Allogrooming, agonistic behavior, and interindividual distances were recorded by using focal-animal sampling combined with all occurrences and instantaneous sampling. The result confirmed the impression that the abusive mother possessed the complete repertoire of social abilities and that she displayed it appropriately. The abusive female showed no tendency to hyperaggressiveness and/or to social avoidance. Instead, her social integration, measured in terms of grooming relationships and spatial proximity, proved to be greater than that of the control females. The result support the view that abusive behavior may fail to be associated with other obvious behavioral abnormalities.

0231

MATING BEHAVIOR OF BLUE MONKEYS (Cercopithecus mitis) IN THE KAKAMEGA FOREST, KENYA M.H. Tsingalia*, M. Cords, B. Mitchell, and T. Rowell, Zoology Department, Univ. of California, Berkeley, CA 94720/USA

In the mating season of 1983, nineteen adult males joined the main study troop of blue monkeys and ten of them were seen to mate. Eleven of the seventeen mature females in the troop became receptive. Both males and females mated promiscuously. Frequent fights were seen between males and it was possible to rank them on the basis of the outcome of these encounters. The relationship between agonistic rank and sexual activity for males will be evaluated.

0232

GENETIC AND MORPHOLOGICAL STUDIES ON TWO SPECIES OF KENYAN MONKEYS, CERCOPITHECUS AETHIOPS AND CERCOPITHECUS MITIS T.R. Turner* and C.S. Mott, University of Wisconsin, Milwaukee, Department of Anthropology, Milwaukee, WI 53201

Genetic studies were conducted on four populations of a single subspecies of C. aethiops in 1978 and 1979, and on three populations representing three subspecies of C. mitis in 1982. These studies were designed to determine whether differentiation was occurring among these monkey populations and to measure the extent of this differentiation. Genetic markers in blood proteins as well as morphological data were used. F_{ST} , the fixation index, a measurement of population differentiation using gene markers indicated that vervets exhibited very little inter-site variation in spite of the significant morphological differences between populations at the different sites. However, the sykes showed significant differentiation in both genetic ($F_{ST} = 0.330$) and morphological parameters. The geographic isolation and minimal gene flow of the sykes subspecies may explain the divergence of genetic markers. The vervets have continuous gene flow among their populations, counteracting the effect of genetic drift and population differentiation. The morphological differences, on the other hand, may reflect local adaptation to varying environmental zones.

0233

FOODS CONSUMED BY SYMPATRIC POPULATIONS OF GORILLA G. GORILLA AND PAN T. TROGLODYTES IN GABON. C.E.G. Tutin*, M. Fernandez, A.H. Pierce and E.A. Williamson, Centre International de Recherches Médicales de Franceville, BP 769, Franceville, Gabon and Dept. of Psychology, University of Stirling, Stirling FK9 4LA, Scotland.

Data on foods consumed by gorillas and chimpanzees were collected, by examination of the contents of faecal samples, during a 2½ year census of ape populations throughout Gabon. These preliminary data are supplemented by ongoing observations of gorillas and chimpanzees which began in October 1983 in the Lopé Reserve (central Gabon). The preliminary data showed that: 1) gorillas ate fruit regularly (98% of faecal samples contained fruit remains) in addition to leaves, stems and pith; 2) chimpanzees ate fruit consistently (100% of faecal samples contained fruit remains) but ate leaves, stems and pith less frequently than did gorillas; 3) 60% of all identified foods recorded for gorillas were also recorded for chimpanzees. These results are confirmed and extended by ongoing research and allow the following conclusions: 1) significant differences in diet exist within the genus *Gorilla*, as mountain and eastern gorillas are known to eat almost no fruit; and 2) the large qualitative overlap of the diets of sympatric gorillas and chimpanzees in Gabon indicates that a potential for ecological competition between the two species exists.

0234

SEX DIFFERENCE IN FEEDING ON *CAMPONOTUS* ANTS AMONG WILD CHIMPANZEES IN THE MAHALE MOUNTAINS, TANZANIA

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Over 400 fecal samples were collected from individually identified wild chimpanzees of the large-sized M group (ca. 100 hds.) from September 1983 to January 1984, and presence/absence of remains of the *Camponotus* ants, the bulk of which is known to be consumed by using fishing probes, was checked. 56 (39.2%) out of 143 samples from adult females contained ant remains, while so did only 8 (5.3%) out of 151 samples from prime adult and old males. Since no such sex difference was obvious in the neighboring small-sized K group (ca. 30 hds.) up to 1978, both social and ecological factors seem responsible for the difference.

0235

SOME CLINICAL SIGNS OF NUTRITIONAL DEFICIENCY IN A COLONY OF OWL MONKEYS *Aotus lemurinus griseimembra*. J.A. Umana, J. Ramirez*, C.A. Espinal, R. Gutierrez, Instituto Nacional de Salud, Bogota, Colombia, Apartados Aéreos 80080 and 80334.

Twenty cases of rickets in captive-born infants and five cases of spontaneous limb fracture in adult individuals were observed in a colony of owl monkeys *Aotus lemurinus griseimembra* used for research malaria immunology, as a consequence of an imbalanced diet. Clinical signs included limb malformation, arrested growth, and dental disorders, among others. This dietary imbalance was evidenced by blood chemical analysis in which the normal 2:1 Calcium-Phosphorus proportion was lost, and the alkaline phosphatase was excessively high. Bromatologic analysis of the colony-made diet by a commercial certified one was responsible for the eradication of the problem.

0236

"TOOL USE" IN THE EXPLOITATION OF FOOD RESOURCES BY *CEBUS APELLA*. E. Visalberghi* and F. Antunucci, Istituto di Psicologia, C.N.R., Via Monti Tiburtini 509, 00157 ROMA ITALY.

Among Primates true tool use, (i.e. the use of an independently manipulated object (the tool) to change the state and/or position of another object) has been observed only in Apes, with one notable exception, that of New World *Cebus*. Both in the wild and in captivity *Cebus apella* has been sporadically observed utilizing stones or similar objects to crack open hard-shelled fruits and Molluscs. An experiment on two captive adult Capuchins was conducted in order to obtain a detailed description of tool use and choice, and to evaluate the efficiency of tool use in exploiting food resources. Results showed that (a) there was a consistent choice of the most efficient among three different pounding tools, (b) tool use sharply reduced the time needed to crack a nut open in comparison with either using the teeth or pounding the nut against a hard substrate, (c) contrary to the last two techniques, tool use efficiency is not conditioned on the relative hardness and dimension of the nut.

0237

COOPERATIVE AND COMPETITIVE ASPECTS OF ALLOMOTHERING WITHIN TROOPS OF FREE-RANGING LANGURS (*PRESBYTIS ENTELLUS*).
C. Vogel, Institut für Anthropologie, Universität Göttingen, D-3400 Göttingen, FRG.

The complex system of infant transfer in colobines covers both cooperative as well as competitive facets. Cooperation involves carrying, cradling, protecting and grooming the infant on behalf of the mother. Competitive elements are indicated by deserting, endangering, harming or even injuring infants of other troop mates. Results of 112 hours of focal animal sampling observations of 6 individually identified mother-infant pairs and their respective allomothers within 2 well known free-ranging langur troops near Jodhpur revealed characteristic individual patterns of allomaternal treatment of particular infants by particular troop mates, including mistreatment particular adult female allomothers. These patterns seem to reflect the specific interindividual relationships among troop members. In any case, various allomothers follow different motivations and distinct strategies under peculiar sets of social and reproductive circumstances. Among others, harming a troop mate's infant and thus negatively affecting the fitness of consensual competitors may well pay off in terms of relative reproductive success.

0238

ADJUSTMENT OF FEEDING STRATEGIES IN LEMURS, *LEMUR FULVUS ALBIFRONS*, UNDER EXPERIMENTAL CONDITIONS. A. Vössing, AG Verhaltensbiologie, Inst.f. Allgem. Zoologie, FU Berlin Haderslebener Str. 9 D - 1000 Berlin 41, Germany (West)

A scarce food supply normally forces a free ranging primate group to learn and apply new strategies of searching for food. In an experiment with captive lemurs such a situation has been simulated. A few strategies allowed the animals to gain access to food, and the cooperation of the group members in using these strategies was studied. Two animals, called "worker", provided the rest of the group with food. Whether the animals would adjust their feeding behaviour to the different profitability of the food searching strategies induced by the investigator was analysed. The results show that an animal that has learned one strategy has more difficulty learning a second one than a "naive" member of the group. Hence different animals learned different strategies. This labour division seems to be an adequate response to a complex by a prosimian group.

0239

OBSERVATIONS ON THE CERVICAL VERTEBRAL COLUMN IN PRIMATES WITH SPECIAL REFERENCE TO THE VERTEBRAL ARTERY. A.H. Walji and J.K. Kimani, Dept. Human Anatomy, Univ. of Nairobi, P.O. Box 30197, Nairobi, Kenya.

The osteologic features of the cervical vertebrae of primates and the functional significance of their relation to the cervical portion of the vertebral artery have been investigated. In most non-human primates the vertebral artery is contained in a bony canal within the lateral masses of the atlas, while in man it lies in a groove. This modification is closely related to the reduced obliquity of the cranial articular facets of the atlas. Its significance is not of a regressive type but expression of co-ordinated adaptations toward a completely upright posture.

0240

THE SOCIAL POSITION OF THE INDIVIDUAL IN A PEER-GROUP OF THE CRAB-EATING-MONKEY *MACACA FASCICULARIS*. C. Welker, Zoology and Comp. Anatomy, Primate Ethology, Univ. of Kassel, FRG.

During the last two years twenty newborns of our breeding group of the crab-eating-monkey were separated from their mothers some hours after birth for hand-raising. The animals were kept isolated from the others for the first four weeks of life. After this, the young were kept for one week in a separate cage within the peer-group cage, providing contact with the other peers; at the early age of five weeks they were introduced into the rest of the peer-group. First I report upon the difficulties and advantages of this unusual procedure. Secondly I give some data on the social development; then I report on the establishment of the rank order and on the parameters on which the latter depends. The results of the last two years of the study demonstrate clearly that this order was independent of sex and weight. In the first months of life the only important parameter is the age of the animals. Older ones are higher than younger ones. The rank order was stabilized by close relations among animals of nearly the same age. Alterations of this order can be explained by the rank of the mother in the breeding group.

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0241

COPULATORY CALLS OF WILD MACAQUES, *MACACA FASCICULARIS*, IN KUTAI NATURE RESERVE, EAST KALIMANTAN, INDONESIA. B.P. Wheatley, Dept. of Anthropology, Univ. of Alabama in Birmingham, AL, 35294. USA

A two-year study of the behavioral ecology on wild macaques revealed the possibility that females may affect the quality of their mates by advertising their sexual receptivity by giving an individually recognizable call unique to copulation. A total of 486 calls were heard. The highest monthly rate of calls/hour was 3.3 and they occurred in two contiguous troops within auditory range when immigrant adult males were first sighted. The calling rate increased to 3.9/hour the next month during a male replacement at the alpha rank. These calls appeared to precipitate branch bouncing displays and searches for the source of the call by other males. The data support the hypothesis that the advertisement function of these calls is to incite male-male competition. Research was supported by NSF Grant BMS 74-14190; The Explorers Club; and a Sigma Xi Grant-in-Aid of Research.

0242

THE U.S. REGIONAL PRIMATE RESEARCH CENTERS PROGRAM

L. A. Whitehair, Division of Research Resources, National Institutes of Health, Bethesda, Maryland U.S.A. 20205

The Regional Primate Research Centers (RPRCs) Program was established by the National Institutes of Health during the period of 1961-65. The 7 Centers and their locations are: Delta RPRC, Covington, Louisiana; California RPRC, Davis, California; New England RPRC, Southborough, Massachusetts; Oregon RPRC, Beaverton, Oregon; RPRC at University of Washington, Seattle, Washington; Wisconsin RPRC, Madison, Wisconsin; and Yerkes RPRC, Atlanta, Georgia. Each Center is affiliated with a host academic institution. The Centers have extensive resources, including a total of 13,500 nonhuman primates of 40 species, large domestic breeding programs and unique research environments. Through the use of nonhuman primates and other resources available at the 7 Centers, significant biomedical studies are being conducted by over 650 investigators (core staff, affiliates, collaborators and visiting scientists).

0243

LIFE-HISTORY OF LANGURS, *PRESBYTIS ENTELLUS*, AT JODHPUR, INDIA: REPRODUCTIVE PARAMETERS AND INFANT MORTALITY.

P. Winkler, Institut für Anthropologie, Universität Göttingen, 3400 Göttingen, FRG.

Longitudinal data from a population of Hanuman langurs, *Presbytis entellus*, are presented which derive from observations at the study site around Jodhpur, India, between 1977 and 1982. Female reproductive parameters show considerable differences to other study sites, above all the interbirth interval is much shorter than reported elsewhere. Based on the demographic data of two focal troops with individually known members a life table was constructed for the first 2 years of life. It can be demonstrated that survival differs with sex and troop membership. Generally only 36 % of all infants complete their 2nd year of life with females living at a higher risk than males. Premature death of an infant shortens the interbirth interval, hence the age of the infant at death is the decisive factor for the length of the respective interval. It is shown that these data have important consequences with regard to the sociobiological discussion on infant-killing and male reproductive strategies.

0244

LUTEINIZING HORMONE-RELEASING HORMONE (LHRH) IN PRIMATE OLFACTORY BULB J. W. Witkin* and A.-J. Silverman, Dept. Anat. & Cell Biol., Columbia Univ., N. Y., NY, USA 10032

Olfactory bulbs of adult male squirrel monkeys (*Saimiri sciureus*) and female macaques (*Macaca mulatta*) were sectioned and treated for the immunocytochemical demonstration of LHRH. Considerable LHRH immunoreaction product was found in fibers within the lateral olfactory tract as well as the olfactory bulb in both species. There were more reactive fibers in the olfactory bulbs of the squirrel monkey than in the macaque. The squirrel monkey has a well-defined accessory olfactory bulb in which many fibers were found, particularly around the glomeruli. In the macaque the fibers were mainly in the external plexiform layer of the main olfactory bulb. LHRH neurons were rarely observed. In the squirrel monkey, they were found along the lateral olfactory tract and in the macaque, near the ependyma of the ventricle in the olfactory bulb. Behavioral studies combined with radioimmunoassay suggest a role for LHRH in modulating olfactory cues related to reproductive behavior in voles and mice (Dluzen et al., Sci. 212: 573-575, 1981; Dluzen and Ramirez, Horm. & Behav. 17: 139-145, 1983). The present observations of LHRH within the olfactory bulbs of primates suggest the possibility of such mechanisms within these species as well. Supported by USPHS AG05290 and Whitehall Foundation.

0245

WITHDRAWN

0246

COMPARISON OF THREAT, FRIENDLY AND FEARFUL COMMUNICATION PATTERNS IN MACACA SYLVANUS OF GIBRALTARA.C. Zeller, Dept. of Anthropology, Univ. of Waterloo, Waterloo, ON, Canada, N2L 3G1

The underlying data for an analysis of threatening, friendly, and fearful facial gestures in Macaca sylvanus of Gibraltar were provided by a frame by frame film analysis. Thirty-three expression elements (components) of the face and head were scored for frequency and intensity in relation to the animal's Age, Sex, Age/Sex, and Kin group, as well as by individual. Comparison of these three functionally diverse gestures revealed marked overlap of component use, contradicting the Darwinian hypothesis of antithetical expressions. Component frequencies vary among gesture types, but three of the four most frequent components occur at high levels in all gestures. These three are centred around the eyes which thus provide a stable focus of gesture transmission which is then modified by variability in the mouth region. Although not all individuals exhibited fearful responses the trend observed in earlier work towards differentiation by kin group is clearly supported. Recognition of complex levels occurring in primate communication may alter the theoretical base from which we study it, while the information revealed by analysis of its structure may enable us to comprehend more of the social basis from which it springs.

0247

THE SYSTEMATIC RELATIONS OF TREE SHREWS: EVIDENCE FROM SKULL MORPHOGENESIS.

U.A. Zeller, Dept. of Anatomy, University of Goettingen, Kreuzberggring 36, 3400 Goettingen, West - Germany.

The morphogenesis of the skull of Tupaia belangeri has been investigated using an almost complete set of dated embryos. For comparison a fetus of Ptilocercus lowii (30 mm CRL) was available. - A number of synapomorphies (lack of I3, Foramen acusticum medium for Nervus sacularis maior, Fenestra malaris in Jugale, M. tensor tympani absent) include Ptilocercinae and Tupaiinae in one family Tupaiidae. Besides, Ptilocercinae and Tupaiinae share many plesiomorphic eutherian characters. But there are also remarkable differences in skull morphology between Ptilocercus and Tupaia. Principally, these differences concern the caudal Recessus ethmoturbinalis, the Alisphenoid, the Tegmen tympani, the Bulla tympanica and the Lamina parietalis. They are autapomorphic for the Ptilocercinae and for the Tupaiinae, respectively. These features are known to have also evolved independently within several other mammalian orders. They are therefore not valid for assessment of relationships of the tree shrews among the eutherian taxa. - Other shared derived features (postorbital bar, reduction of Cartilago paraseptalis) of Ptilocercinae and Tupaiinae provide no evidence for tupaiid relationships, because they occur widely scattered among many eutherian groups. Therefore skull morphogenesis does not provide any evidence for Primate relationships and strongly supports the classification of the Tupaiidae as a separate order Scandentia.

0248

CALL-SYSTEM SIMILARITY AND DIVERGENCY IN TWO NOCTURNAL ARBOREAL PROSIMIANS. E. Zimmermann, Inst. of Zoology, Univ. Stuttgart-Hohenheim, 7000 Stuttgart 70, WEST GERMANY.

The vocal repertoires of the West African bushbaby *Galago senegalensis* s. and the South East Asian Slow loris *Nycticebus coucang* were analyzed by context and acoustic structures. Repertoire comparison revealed striking similarities in structures of vocalizations which accompanied agonistic interactions. Both species indicate their readiness for attack by noisy vocalizations with broad band low frequency spectra and for defence by noisy narrowband vocalizations. Rapid frequency-modulated calls with harmonic spectra signalize submission. Great divergence exists in sounds for long distance communication. In both species contact calls show harmonic spectra and slow frequency modulations, but whereas bushbabies vocalizations have low frequency fundamentals and are repeated in rhythmical sequences, slow loris calls are given singly or in an irregular rate and possess high frequency fundamentals. Only bushbabies announce strange situations by sounds with broadband noisy and harmonic spectra and low frequency fundamentals. Slow loris lack hearable calls in this context, they demonstrate a combined visual-olfactorial warning signal. Environment, habits and morphology may have favoured the evolution of these communication systems.

0249

NONHUMAN PRIMATE RESEARCH MODELS AND POPULATION CONSERVATION: THE FETAL ALCOHOL SYNDROME. H. L. Altshuler*, J. Amirian and J. Osei-Frimpong, Neurosychopharmacology Section, Texas Research Institute of Mental Sciences and Department of Pharmacology, Baylor College of Medicine, Texas Medical Center, Houston, Texas USA 77030

A nonhuman primate model of the Fetal Alcohol Syndrome (FAS) model has been established in rhesus monkeys, *M. mulatta*. The unique advantages of this model include isocaloric, pair-fed control animals that were full siblings to the alcohol exposed animals. The entire research plan was formulated with a major goal of preserving the rhesus monkey population. Three dose levels of alcohol exposure were maintained on the basis of maternal blood alcohol concentration. Optimum maternal nutrition was established by maintaining 110% of MDR of nutritionally balanced calories throughout pregnancy. ALC neonates (n = 15) were smaller (length, weight) and exhibited gross and radiographic craniofacial abnormalities that resembled the craniofacial mandibular dysmorphia syndrome in monkeys. The breeders in this study had been subjects in earlier, noninvasive research. The overall design required that each female serve as a subject in 2 control and one alcohol exposed pregnancies. Therefore, each adult research subject produced a net positive contribution to the total primate population. We suggest that conservation oriented designs such as this can be utilized for many diverse projects.

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0250

OBSERVATION ON UNIT ACTIVITY AT SUPERIOR COLLICULUS OF CONSCIOUS, UNRESTRAINED TREE SHREW (TUPAIA BELONGENI). Sun Gongduo, Li Xumin, Luo Zhongying, Zhen Wanglin; Chai Jingxia*, Tian Yunfen*, Kuang Peizhi**, Zhang Wutian**, Dept. of Physiology, Guiyang Medical College; Guiyang, China. Kunmin Inst. of Zoology*, Acad. Sinica. Kunmin., Inst. of physiology* Acad. Sinica. Beijing.

With a chronic microelectrode and a TQ-19 computer, the spontaneous activities and evoked responses in 65 units of superior colliculus were recorded in 11 awake tree shrew (TUPAIA BELONGENI). Five types in un-sequence interspike histograms were found as follows: I, 13, (26.5%); II, 8, (16.3%); III, 6, (12.2%); IV, 20, (40.8%); V, 2, (4.1%). The effects of off-light were recorded in 51 units, among which, 14 were activated, 22 inhibited and 15 unchanged. The responses of 19 units to off-light, feeding and touch given alternately were analyzed. The results showed single-model (responding to one of three stimuli) in 8; bi-model (responding to both off-light or feeding) in 7 and tri-model (responding to all three stimuli) in 4. It was noted that most of the units modulated by off-light (84.2%) were of IV type and the units unchanged were mostly of II type (85.7%). The results indicate that there are different units in superior colliculus and they may play an important role in the head-eye following behavior.

0251

A CHRONIC MICROELECTRODE TECHNIQUE FOR AWAKE TREE SHREW (TUPAIA BELONGENI).

Sun Gongduo, Li Xumin, Luo Zhongying, Zhen Wanglin; Kuang Peizhi*, Zhang Wutian*; Chai Jinxia**, Tian Yunfen**. Dept. of Physiology, Guiyang Medical College, Guiyang, China. Inst. of Psychology, Acad. Sinica*, Beijing. Kunmin Inst. of Zoology, Acad. Sinica**, Kunmin, China.

A new technique for recording unit activity in conscious, unrestrained tree shrew (TUPAIA BELONGENI) was reported. A mechanical microdriver designed by the authors was used in the experiments. The main parameters were as follows: weight, 8.8 gm; height x width x width, 51 x 13 x 13 mm. The experiments were carried out in a special box. A glass-microelectrode was used to record the extracellular electrical activities. The activities of single neuron could be steadily recorded more than one hour by this technique, even though the animal was given different kinds of stimuli e.g. light, touch, nociceptive means, moving body, feeding ect.. This new technique is available in studying the unit activity of superior colliculus, hippocampus ect. in awake tree shrew.

0252A

PARATUBERCULOSIS IN STUMP-TAILED MACAQUES (MACACA ARCTOIDES). H. McClure*, R. Chiodini, D. Anderson and B. Swenson, Yerkes Primate Research Center, Emory Univ., Atlanta, GA. and Univ. of Connecticut, Storrs, CT., U.S.A.

Mycobacterium paratuberculosis infection was documented in a colony of stump-tailed macaques. To date, 7 fatal cases of paratuberculosis have occurred and 12 additional cases have been diagnosed by biopsy and/or culture (colony incidence of 38.8%). Clinically, the disease was characterized by chronic diarrhea and weight loss. Gross lesions, when present, were limited to mesenteric lymphadenopathy and thickening of the mucosa of the small intestine and colon. Microscopically, there was a diffuse infiltrate of histiocytes in the lymph nodes and intestinal mucosa and occasional hepatic granulomas were evident. Histiocytes contained large numbers of acid-fast bacilli. Lesions were indistinguishable from those reported in M. avium infection in monkeys; diagnosis depends upon isolation and identification of the organism. Paratuberculosis is a chronic debilitating disease of ruminants, primarily cattle, sheep, and goats. The causative organism, Mycobacterium paratuberculosis, has not previously been isolated from nonhuman primates. (Work supported by Grant No. RR00165 from NIH).

0252B

PALAEO-ENVIRONMENT OF PLEISTOCENE GIGANTOPITHECUS BLACKI OF CONTINENTAL SOUTH-EAST ASIA. H.-D. Kahlke, Inst. Quartärpaläont., Weimar, GDR

In the Early Pleistocene Gigantopithecus reached a northernmost distribution as far as southern Central-China. The associated fauna indicates a tropical/subtropical forest environment as far as to the contact zone of steppe environments. In the Middle Pleistocene climate changed to more dry conditions and the distribution area of the large pongids Gigantopithecus and Pongo was reduced (Tahsin, Wuming, Pama, Viet Nam). According to the present fossil record Gigantopithecus has been living within a tropical/subtropical forest environment associated with Pongo, a typical forest element of South-East Asia.