

Talk: Mangabeys (*Cercocebus torquatus*) solve the reversed contingency task without a correction procedure: preliminary results

Anna Albiach-Serrano¹, Federico Guillén-Salazar¹ & Josep Call²

¹Unidad de Etología y Bienestar Animal, Universidad Cardenal Herrera, Valencia, E & ²Max Planck Institut für Evolutionäre Anthropologie, Leipzig, D;
fguillen@uch.ceu.es

To survive, animals need to solve problems like finding, processing or competing for food. Problem solving often relies on generating new responses while inhibiting others, particularly prepotent ones. A paradigm to study inhibitory skills is the reversed contingency task, in which two different quantities of food are offered to an individual who receives the array he did not choose. Since subjects spontaneously prefer to choose the larger of two quantities, mastering the reverse contingency task entails selecting the smaller quantity in order to get the larger one. This task has been investigated in several non-human primate species, and up to date only great apes have mastered it without correction procedures. Other primate species have mastered the reversed contingency task but only after introducing correction procedures such as large-or-none rewards, time-outs following errors, or the use of symbolic stimuli. Here, four mangabeys (*Cercocebus torquatus*) were presented with two stimulus arrays of one and four raisins in the context of the reversed contingency task. Three of them performed well without any correction procedure. Performance was maintained when presented with two stimulus arrays of zero and four raisins, showing that mangabeys are able to exhibit inhibition even when they have to choose a null quantity in order to obtain a reward. As far as we know, this is the first time a non-great ape species solves the reversed contingency task without any kind of correction procedure being applied.

Poster: Mobility and movement in chimpanzees (*Pan troglodytes*): preliminary approach to the landscape use of early *Homo* on a local scale

Tania M. Alcantarille

Department of Prehistory and Ethnography, University Complutense of Madrid, E;
T.M.Alcantarilla@soton.ac.uk

The movement behaviour in chimpanzees (*Pan troglodytes*) is rather more complex than has been proposed in the current literature on hominid ranging behaviour. The current idea is that one of the traits that define our genus in contrast to non-human hominoids is a novel use of resources. However, the analysis of ranging patterns in great apes is an intricate issue involving many factors which interact on different levels. We used published data from Kibale Forest Reserve, Budongo Forest Reserve, Gombe National Park, Tai National Park, Mahale Mountains, Kahuzi-Biega National Park, Kalinzu Forest Reserve, Mont Assirik, Semliki, and Ugalla to analyse the ranging patterns in chimpanzees. The results show that food availability, food distribution, grouping pattern and activity are in constant dynamic interac-

tion, and these factors cannot be ordered into a simple hierarchy. Our statistics show that none of the factors involved plays a predominant role; rather all four factors are intrinsically interconnected. With this analysis we propose that early *Homo* ranging patterns on a local scale have been overestimated while the chimpanzee pattern has been underestimated, and we suggest the need to review current interpretations of the archaeological data from Plio-Pleistocene early *Homo*.

Poster: Single nucleotide polymorphisms (SNPs) in the SMCY and PRKY introns of the chimpanzee

Olga Andrés¹, Montserrat Bosch¹, Ann-Christine Syvänen², Ann-Charlotte Rönn² & Xavier Domingo-Roura¹

¹Genètica de la Conservació, Institut de Recerca i Tecnologia Agroalimentàries - Centre de Cabrils, E & ²Department of Medical Sciences, Uppsala University, S; olga.andres@irta.es

Single Nucleotide Polymorphisms (SNPs) have been widely used in human genetic studies due to their high frequency, random genomic distribution and the possibility of being incorporated in high throughput technologies. SNPs might become the marker of choice in the fields of evolution, population ecology, and conservation genetics of wildlife species, such as primates. The objective of the present study is to describe new SNPs in the non-recombining region of the Y-chromosome of chimpanzee (*Pan troglodytes*) to explore the sociobiology, mating systems and male-specific evolution of this species. We searched for SNPs by Denaturing High Performance Liquid Chromatography (DHPLC) technology in 8 kb of the intron sequences of SMCY and PRKY genes from 50 male chimpanzees. Once a nucleotide variation was detected by DHPLC, we sequenced several individuals until the SNP was characterized. We have described ten new SNPs 7 in the SMCY gene and 3 in the PRKY gene that, together with 19 additional Y-chromosome SNPs previously described in the literature, should allow the identification of chimpanzee males.

Poster: Cytogenetic and molecular study of *Propithecus diadema diadema* and *Propithecus diadema edwardsi*

Volasoa Nicole Andriaholinirina¹, Jean-Luc Fausser² & Joseph Clément Rabarivola³

¹Faculté des Sciences, Département de paléontologie et d'Anthropologie biologique, Université d'Antananarivo, Madagascar, ²Faculté de Médecine, Institut d'Embryologie, Université Louis Pasteur, Strasbourg, F & ³Faculté des Sciences, Département de Biologie Animale, Université de Mahajanga, Madagascar; nicole-ludes@netcourrier.com

A comparative cytogenetic and molecular study based on mtDNA sequencing from the different *Propithecus* from the eastern forest has been performed. Based on samples from animals caught by the authors in different areas south of the Manangarivo River or originating from Museum collections, mtDNA sequences show that

P. d. edwardsi form a well-determined subclade in which the patterns are mixed. Despite the low genetic distances between *P. d. edwardsi* and *P. d. diadema*, a centric fusion distinguishes the two taxa, and thus *P. d. edwardsi* has to be considered as a full species, *P. edwardsi*, according to Groves (2002). Our preliminary results show that the Mangoro River is the north-eastern limit of *P. edwardsi*, but the north-western limit remains uncertain as the area between Nosivolo and Onive Rivers has not been completely explored. North of the Onive *P. diadema* show intermediate morphology between *P. diadema* and *P. edwardsi*, despite having the same karyotype as *P. diadema*, and cluster with the typical *P. diadema* caught in more northern parts of their distribution area.

Poster: When the nose goes: olfactory decline as a marker of aging in the gray mouse lemur

Fabienne Aujard, Florence Némoz-Bertholet & Florence Cayetanot
Ecophysiology, CNRS, National Museum of Natural History, Brunoy, F;
fabienne.aujard@wanadoo.fr

No data are available to date on changes in olfactory sensitivity with age in non-human primates. The male gray mouse lemur (*Microcebus murinus*), a nocturnal and arboreal primate, has highly developed sensory modalities to ensure adaptive locomotor and feeding behaviours in dense forest biotope, but also social communication between solitary-living individuals. In this species, like in many other prosimian primates, the sense of smell is of high relevance for the modulation of both behavioural and physiological functions. Previous studies have demonstrated that aging was associated with a reduction of olfactory behaviours and sexual stimulation in male mouse lemurs. Thus, our aim was to investigate the effect of aging on olfactory function using both a chemosensory discrimination test on freely behaving animals and an immunohistological study of neuronal activation within the olfactory bulbs, by measuring the *c-fos* expression in the main and accessory olfactory bulbs of adult and aged mouse lemurs following exposure to the volatile phase of urine from pre-oestrous females. Our results indicate that chemosensory function shows a progressive decline with age. In adults, the pheromone exposure increased the number of *fos*-positive neurons in the main olfactory bulb without changes in the accessory olfactory bulb. *Fos* expression was not increased by the odorant stimulation in aged mouse lemurs. The present results have several implications with regard to the effect of aging on chemosensory functions. First, aging of the olfactory system could explain the age-related decrease in behaviours associated with olfactory stimulation in this primate. Second, the absence of cell activation in the main olfactory bulbs of aged animals following odorant stimulation may bring new insights into deciphering the aging of chemosensory structures and into understanding the behavioural and physiological impairments related to chemosensory function in this aged primate

Talk: Prevention of mortality in New World monkeys due to *Yersinia* spp. by vaccination

Jaco Bakker¹, I. Kondova¹, C.W. de Groot¹, E. Remarque² & Peter J. Heidt¹

¹Animal Science Department & ²Department of Parasitology, Biomedical Primate Research Centre, Rijswijk, NL; bakker@bprc.nl

An outbreak of acutely fatal disease with high rates of morbidity and mortality occurred during three consecutive years in our indoor breeding colonies of cotton-top tamarins (*Saguinus oedipus*) and common marmosets (*Callithrix jacchus*). The clinical signs, specific gross and histopathological findings were suggestive of aetiology consistent with *Yersinia* spp. Bacteriological results confirmed the aetiology of *Yersinia pseudotuberculosis* and *Yersinia enterocolitica*. As a preventive measure, annual vaccination of both colonies with Pseudovac[®] has been instigated. Subsequently, no *Yersinia*-related clinical symptoms or mortality have been observed.

Talk: Adrenal activity, social withdraw, and maternal behaviour across parturition in macaques

Massimo Bardi¹ & Silvana M. Borgognini-Tarli²

¹Department of Comparative Medicine, Southwest Foundation Biomedical Research, San Antonio TX, USA & ²Department of Ethology, Ecology, Evolution, University of Pisa, I; mbardi@icarus.sfbr.org

Due to the inherent complexity of the processes involved, the study of the relationship between peripartum hormonal fluctuations and mother-infant interactions has been especially problematic, both in human and non-human primates. Adrenocortical activity, in particular, is affected by both changes in physiological status and social interactions that occur during pregnancy, parturition, and lactation. In this study, we assess how adrenocortical activity is related to mother-infant interactions and maternal interactions with other group members in macaques. A sample of mother-infant pairs (Japanese macaques, n=14; rhesus macaques, n=10) was observed during the first month of infant's life. Social interactions between the mother and other group members were recorded during the last month of pregnancy and the first month of infant's life. Time spent in contact, maternal responsiveness, latency of response, and maternal rejection were measured and correlated with peripartum excreted cortisol and estradiol metabolite levels and social activity. Postpartum cortisol levels showed a positive correlation with maternal rejection. The cortisol/estradiol ratio was positively correlated with rejection and latency of response, and negatively correlated with maternal responsiveness. These findings were paralleled by a general tendency to withdraw from social life across pregnancy in both species. Our findings suggest that hypothalamic-pituitary-adrenal (HPA) axis activity is functional to enhance the ability of mothers to cope with social withdrawal and intense infant care, especially when in conjunction of high estrogen levels prior to parturition.

Talk: Hair stable isotope ratios (^{13}C and ^{15}N) in relation to diet and adaptive strategies of lemurs in Madagascar and in captivity

Francoise Bayart¹, Issam Moussa³, Ilhem Bentaleb³, Laurent Tarnaud², Bruno Simmen², Fabien Génin¹ & Martine Perret¹

¹CNRS-UMR5176, ²CNRS-UMR5145, Laboratoire d'Ecologie Générale, Muséum National d'Histoire Naturelle, Brunoy & ³CNRS-UMR5554, Laboratoire de Phylogénie, Paléontologie, Montpellier, F; fbayart@mnhn.fr

Recently, Schoeninger et al. (1997, 1998, 1999) have shown that ^{13}C and ^{15}N in primates' hair reflect some forest characteristics of their habitats (deciduous to evergreen, canopy level, degree of openness) as well as gross dietary tendencies (frugivore, folivore, omnivore). In these studies, diets are measured using time sampling methods, and seasonal or individual variation in diet is rarely mentioned. Elsewhere, it has been shown that metabolic factors such as water or caloric stress, starvation (low protein intake), and body weight loss or nursing could increase ^{15}N values in animal tissues. Lemurs in Madagascar represent a great diversity of species living in a variety of habitats and show seasonal variation in diet and metabolism. Thus, they are interesting to study their hair isotopic composition and to compare findings with other primates. In our study, isotopic analyses of both mixed diet (with different proportions of food items from quantitative observations) and hair of wild lemurs [16 *Eulemur fulvus mayottensis*, 2 *Lemur catta* (frugivore-folivore); 1 *Propithecus verreauxi verreauxi* (folivore-frugivore) and 39 *Microcebus griseorufus* (insectivore-gummivore-frugivore)] permit us to classify the species according to their trophic level and to calculate carbon and nitrogen isotopic enrichment between diet and hair. In order to control for the effect of seasonality, we analysed the isotopic composition of hair from 62 *Microcebus murinus* reared in captivity under controlled photoperiodic conditions and fed with a standard diet of known isotopic value. Our results confirm that ^{13}C and ^{15}N values in lemurs' hair discriminate between species according to their forest habitats (dry to semi-arid, with dominant C3 plants or CAM plants) and their diet tendencies. Moreover, within species, inter-individual variability in hair isotopic composition is more important in lemurs than in other primates and the enrichment between natural diet and hair is higher compared to experimental data from the literature. This variability is not due to different feeding strategies per se but rather to seasonal fluctuations in isotopic enrichment between diet and hair and probably to the specific fractionation pattern of each species. Indeed, in captive *Microcebus* fed with a standard diet, there exists a significant difference in hair isotopic composition according to the photoperiod. Thus, it is possible that in lemurs, other seasonal factors of metabolic origin could influence nutrient assimilation and the use of amino acids of ingested proteins. This adaptive strategy would allow lemurs to anticipate the seasonal reproductive period and to conserve homeostatic equilibrium whatever the resource availability in a harsh and unpredictable environment.

Poster: Does female sexual behaviour indicate the fertile phase in Barbary macaques (*Macaca sylvanus*)?

*Katrin Brauch*¹, *Dana Pfefferle*², *Michael Heistermann*¹ & *Keith Hodges*¹

¹Abteilung Reproduktionsbiologie & ²Forschergruppe Kognitive Ethologie, Deutsches Primatenzentrum, Göttingen, D; kbrauch@dpz.gwdg.de

One of the key questions for better understanding reproductive strategies of primates living in multimale-multifemale groups is whether females advertise the timing of ovulation and thereby provide males with information about when to monopolise them. In female long-tailed macaques, a species with a low degree of reproductive seasonality and a high degree of male monopolisation, it has recently been shown that specific sexual behaviours are a reliable indicator of the female fertile phase. Whether this is a general pattern throughout the macaques, also applying to those species that show a high degree of reproductive seasonality and a low degree of male monopolisation, is unknown. Here we describe a study in the Barbary macaque, a species with a highly seasonal reproduction, to examine the extent to which changes in female sexual behaviours reliably indicate the timing of the fertile phase. We addressed this question in six free-ranging females of the Gibraltar population by combining observations on specific sexual behaviours (presenting, solicitations, grabbing, copulation calls) with faecal hormone analysis to determine the time of ovulation based on a defined rise in progesterone metabolites. Individual patterns of female behaviours during five conception and one non-conception cycle were tested for frequency differences between the pre-fertile, fertile and post-fertile phase (fertile phase = three days before to the day of ovulation). The frequencies of all four behaviours varied considerably between females and cycle phases. In three of the four behaviours (presenting, grabbing, copulation calls) highest frequencies (median) were found during the fertile phase, although, the differences between the three phases were not statistically significant. These preliminary data suggest that female sexual behaviour does not provide reliable information on the timing of the fertile phase in female Barbary macaques, which would be consistent with a female strategy for paternity confusion in this species.

Talk: Experimental autoimmune encephalomyelitis in the common marmoset modelling multiple sclerosis

*Herbert P.M. Brok*¹, *J.D. Laman*^{2,3}, *M. van der Wiel*⁴, *R.E. Bontrop*⁴, *J. Bauer*⁵, *E.L.A. Blezer*⁶ & *Bert 't Hart*^{3,7}

¹Department of Animal Science, ⁴Department of Comparative Genetics and Refinement, ⁷Department of Immunobiology, Biomedical Primate Research Centre, Rijswijk; ²Department of Immunology, Erasmus Medical Centre, Rotterdam, ³ErasMS Centre, NL; ⁵Division of Neuro-immunology, Brain Science Institute, Medical University Vienna, A & ⁶Department of experimental *in vivo* NMR, Image Science Institute, University Medical Centre, Utrecht, NL; brok@bprc.nl

Multiple sclerosis (MS) is a chronic progressive inflammatory disease of the central nervous system (CNS). The disease affects 1 in 1000 young adults in Europe and

the USA, progressing to serious and irreversible neurological disability later in life in most cases. No definite cure for MS exists and the current disease models in rodents might not sufficiently predictive for the screening of new potential therapeutics. Chronic MS in the common marmoset, *Callithrix jacchus*, is induced by immunizing brain homogenate and/or purified (recombinant) CNS-specific proteins or specific peptide-sequences. Here we will describe this model, known as experimental autoimmune encephalomyelitis (EAE), in all its clinical, anatomical and neuro-pathological aspects and present the latest results of newly developed non-invasive techniques to characterize this unique non-human primate model in more detail. In addition, the latest immunological and genetic findings will be discussed which have increased our understanding of the pathogenic mechanisms involved in the formation of lesions and the induction of neurological deficit.

Poster: Major Histocompatibility Complex class II polymorphisms in the common marmoset

Herbert P.M. Brok¹, M. van der Wiel², Bert 't Hart³, G. Doxiadis² & R.E. Bontrop²

¹Department of Animal Science, ²Department of Comparative Genetics and Refinement, & ³Department of Immunobiology, Biomedical Primate Research Centre, Rijswijk, NL; brok@bprc.nl

The common marmoset (*Callithrix jacchus*), having its natural habitat in the Atlantic rain forest of the North-Eastern parts of Brazil, is used as an animal model to study depressive disorders, Parkinson's and Alzheimer disease and stroke. Furthermore, common marmosets serve as highly relevant models to investigate several chronic and infectious diseases as for example experimental autoimmune encephalomyelitis (EAE), modelling multiple sclerosis and to characterise the immunopathogenic or -suppressive effects of herpes-like virus and their proteins. The cell surface glycoproteins encoded by the polygenic major histocompatibility complex (MHC) region for class I and class II genes plays an important role in initiating adaptive immune responses. Genomic analysis of exon 2 sequences documented the existence of only one *DRB* region configuration harbouring three loci. Two of the loci, *Caja-DRB1*03* and *-DRB*W16* display low or moderate levels of polymorphism, whereas the *-DRB*W12* locus appears to be monomorphic. Allelic sequences of all three loci were also present on the transcription level as shown using cDNA analysis. By gDNA sequencing the *Caja-DRB*W12* locus was thought to be monomorphic, and that holds also true for the transcripts with one more *DRB*W12* allele only detected on the cDNA level. For the other two loci, *Caja-DRB1*03* and *-DRB*W16*, approximately the same degree of variation has been observed by exon 2 sequencing with a total of 16 and 20 alleles, respectively. However, not all variants encoded by the *-DRB1*03* locus are detected on the transcript level, which is in contrast to the *-DRB*W16* gene of which all variants seem to be expressed. Detailed analysis shows that in the common marmoset some members of the *-DRB1*03* lineage are rescued from a pseudogene by a double cross-over event, known as exon shuffling. The implications of this phenomenon for immunological studies will be discussed.

Poster: Do captive-born grey mouse lemurs (*Microcebus murinus*) recognize their natural predators by acoustic cues?

Esther Bunkus, Marina Scheumann & Elke Zimmermann
Institut für Zoologie, Tierärztliche Hochschule Hannover, D;
elke.zimmermann@tiho-hannover.de

The threat of predation and behavioural strategies associated with predator avoidance play a fundamental role in primate socioecology. Various studies of anthropoid primates suggested that acoustic predator recognition has to be learned during ontogeny. No information exists so far for nocturnal primates. Mouse lemurs are small-bodied nocturnal prosimians with a highly developed hearing system living in the tropical forests of Madagascar. In their natural environment they are confronted with ground, arboreal and aerial predators to which they show strong antipredator responses. We have explored to which extent captive-born, predator-naïve grey mouse lemurs (N=22) recognize their natural predators based on acoustic cues. In a standardized acoustic predator playback paradigm in a sound-damped chamber, a mouse lemur getting a reward at a fixed location was exposed to one of four acoustic stimuli: (a) historical predator, (b) introduced predator, (c) historical non-predator, (d) control. Stimuli (a) to (c) were unknown, stimuli (d) known. Reactions of mouse lemurs towards the stimulus categories were videotaped and quantified. We tested the hypothesis that predator-naïve mouse lemurs do not differentiate between acoustic cues of their natural predators, but do so between known and unknown acoustic stimuli. First results indicate that mouse lemurs show avoidance behaviours towards all unknown acoustic stimuli suggesting that experience may shape acoustic recognition of their environment. Supported by the DFG.

Talk: Behaviour reading, not perspective taking in common marmosets (*Callithrix jacchus*)

Judith Burkart¹ & Adolf Heschl²
¹Anthropologisches Institut, Universität Zürich, CH & ²Zoologisches Institut, Universität Graz, A; Judith.Burkart@aim.unizh.ch

Any form of gaze following carries obvious adaptive benefits in that it allows an individual to direct its own focus of attention to those stimuli that have previously attracted the attention of other individuals in its group. However, only a mentalistic understanding of gaze permits an individual to actually infer what other individuals are seeing or not, thereby enhancing the amount of information that can be acquired. Moreover, understanding the mechanisms involved in gaze following in non-human primates sheds light on the emergence of forms of social-cognitive abilities that, in their fully-fledged form, are exclusively human. We present a series of experiments aimed at identifying the mechanisms that underlie gaze following abilities in common marmosets (*Callithrix jacchus*). In a first experiment, we investigated whether marmosets know what conspecifics do and do not see, using a food competition paradigm initially introduced by Hare et al. (1999). Subordinate mar-

marmosets consistently chose a piece of food only visible to themselves, suggesting a mentalistic understanding of visual access. However, subsequent experiments in a different context could not replicate a mentalistic understanding of gaze in marmosets. A solution to these contradictory results is proposed in the last experiment which unveils a non-mentalistic mechanism which could explain the positive outcome of the initial findings. In sum, the results suggest that the marmosets' high proficiency in extrapolating gaze direction reflects sophisticated behaviour reading, but no consistent and context-independent perspective taking abilities.

Talk: The hormonal basis of post-conflict reunion in humans

Marina L. Butovskaya

Center of Evolutionary Anthropology, Institute of Ethnology and Anthropology, Moscow, Russia; m.butovskaya@rambler.ru

Natural conflict management mechanisms in non-human primates and humans have received the attention they deserved only recently, although they are central to the functioning of every social system (Aureli & de Waal, 2000; Aureli & Schino, 2004; Butovskaya, 1999, 2003; Butovskaya & Kozintsev, 1999; de Waal 1993, 2000). Peacemaking perspectives in social animals and humans provide a complementary approach to the ways the social system functioning and of the regulation of social relationships on a natural basis. The development of effective behavioural and psychological mechanisms for coping with social stress was very important in human evolution because humans evolved as social beings. It has been suggested that post-conflict reunion serves as important stress-reduction mechanism for gregarious non-human primates (Aureli & Smucny, 2000) In this paper we demonstrate the hormonal basis of stress reduction in post-conflict reunions in humans. Aggressive and post-aggressive behaviour of 30 boys aged 7-11 years was observed during free play in a summer camp with standard "post-conflict – matched control" method. Victims of the conflict were the focal subjects. Five saliva samples for the analyses of cortisol and dehydroepiandrosterone sulfate levels were collected from each boy: after a 10-min period in post-conflicts with and without reconciliation, matched-control samples next days and three morning samples for estimation of basal levels. Every boy filled in a sociometry form, Buss-Durkee Hostility Inventory, Eysenk Personality test and the Revised Children's for Manifest Anxiety Scale. The stress-reduction role of peacemaking was supported on physiological level. Stress-related hormone levels were higher when no reunion occurred. Supported by RFBR, grant #04-06-80166r, grant from RAS "Ethnocultural interactions in Eurasia".

Talks: How apes interpret their worlds

Josep Call

Max Planck Institut für Evolutionäre Anthropologie, Leipzig, D; call@eva.mpg.de

Animals perceive and react to a variety of stimuli in their environment. One of the most important functions of cognition is to make sense of perceptual inputs. In

many occasions this involves interpreting the phenomena that they observe, particularly when the perceptual inputs contains incomplete or inconsistent information. In this talk I will propose that at least the great apes go beyond input-output routines and they also interpret and perhaps even try to explain to some extent their worlds. Recent evidence from both physical and social domains supports this conclusion. In the physical domain, apes make inferences about the location of food based on logico-causal principles. In the social domain, they make inferences about the perceptions and actions of others consistent with the psychological principles of attention and intention. I will argue that these data are not easily explained by only invoking the use of observable information but they represent one step beyond the 'information given'.

Poster: Social relationships in zoo-living Bornean Orang-utans (*Pongo pygmaeus*)

Dorothee Claßen^{1, 2}, Werner Kaumanns¹ & Stefanie Kießling¹

¹Arbeitsgruppe Primatologie, Zoologischer Garten Köln & ²Universität Köln, D; Dorothee.Classen@gmx.de

This study is part of an ongoing project which investigates patterns and mechanisms of social relationships in captive Bornean orang-utans and bonobos. These species are assumed to live in fission-fusion systems in the wild. Captive studies may provide models and hypotheses. The study presented here focuses on social relationships in captive groups of Bornean orang-utans. Field studies reveal that orang-utans spend much of their time solitarily. Occasionally they are found in feeding and travel parties which may last for hours or maximally weeks. In zoos, orang-utans are traditionally kept in permanent groups. Orang-utans are supposed to have individualized relationships the nature of which has not been intensively investigated so far. Previous studies indicate that captive orang-utans can cope with a permanent presence of partners. It is expected, however, that relationships should reflect traits of the species-specific fission-fusion system. This may include a tendency to reduce spatial and social intimacy. Physical interactions should be rare. Relationships should be mainly regulated by spacing behaviour. Our study actually focuses on a group of orang-utans at Cologne Zoo ranging in size from 11 to seven individuals and two small groups of three and two individuals at Chester Zoo. Preliminary results will be presented. They support our assumptions: Individuals had mean distances of about 6 to 8 metres. They approached each other only sporadically. Physical contact was rare and usually brief. Agonistic interactions occurred very rarely, sociopositive ones ten times more often. In consecutive 10-min intervals individuals usually had new neighbours (except mothers and infants).

Talk: Polyadicity and networking in a group of chimpanzees: complexity, sociality and cognition

Fernando Colmenares^{1, 2}

¹Departamento de Psicobiología, Facultad de Psicología, Universidad Complutense de Madrid, E & ²Abteilung für Vergleichende und Entwicklungspsychologie, Max Planck Institut für Evolutionäre Anthropologie, Leipzig, D; colmenares@psi.ucm.es

Most theories of primate sociality and social cognition rely mostly on the consideration of dyadic interactions within groups and the cognitive demands associated with the maintenance of valuable relationships with a subset of group members (i.e., networks). However, in many primate species, social interactions between individuals tend to be triadic (or higher-order) events in which participants (and bystanders) have to make short-term tactical decisions based on the assessment of what others are currently doing or what non-involved third-parties might be likely to do in the immediate future. Managing successfully this complex "social maze", where individuals have to anticipate and manipulate the behaviour of several others simultaneously, is thought to be highly demanding psychologically. However, the link is not clear between the complexity of observable inter-individual interactions (e.g., level of polyadicity), the complexity of the inferred relationship networks that emerge within groups (e.g., patterns of sociality), and the complexity of the cognitive abilities involved. It has been argued, for example, that complex emergent outcomes at the relationship level can result from the operation of relatively simple psychological processes at the level of interactions. Here I use data on grooming interactions collected in a captive group of 18 chimpanzees (*Pan troglodytes*) to explore these links. I analyse rates and duration of grooming bouts, their patterning (mutual or unilateral versus bilateral), number of parallel grooming cliques, and size of grooming cliques and clusters. I argue that these different behavioural measures can be used to index complexity at various levels (interactions, relationships and group structure) and investigate how different patterns of sociality emerge and how they are worked out and supported both behaviourally and psychologically. Supported by project grant BSO2002-00161 and scholarship PR2004-0015 from the MEyC, E.

Talk: Why consolation? Its possible roles in captive chimpanzees

Giada Cordoni^{1, 2}, *Elisabetta Palagi*¹, *Silvana M. Borgognini Tarli*²

¹Centro Interdipartimentale Museo di Storia Naturale e del Territorio & ²Dipartimento Etologia, Ecologia ed Evoluzione, Unità di Antropologia, Università di Pisa, I; betta.palagi@museo.unipi.it

The term "consolation" contains a hypothesis about function, which is distress alleviation. However, formulating general patterns on consolation is clearly difficult, given its strong dependence from a wide range of variables (e.g. social context, high individual variability). The present study, carried out on a group of *Pan troglodytes* housed in the ZooParc de Beauval (F), aimed to confirm the occurrence of consolation in captive chimpanzees and to suggest its possible roles. Collecting 273 PC-MC

pairs, we confirmed the presence of consolatory contacts in this colony (mean TCT $49.5\% \pm 22.3\text{SEM}$). The rates of consolation were significantly higher than those of reconciliation (mean CCT $28.9\% \pm 16.8\text{SEM}$). Consolatory contacts increased in the absence of reconciliation rather than in the presence of it, thus suggesting that consolation might be an alternative behaviour. As friendship and relatedness did not influence the occurrence of consolation, they did not seem to be the best pre-requisites for this behavioural mechanism, at least in the Beauval colony. Affinitive contacts with third parties were significantly more frequent when the victim called attention to itself during severe aggressions by screaming. These high-pitched sounds could be useful in eliciting empathy and aid from conspecifics as it occurs in young humans. The occurrence of consolation reduced the likelihood of further attacks among group-members. In this view, both victims and consolers gain potential advantages by triadic contacts, when aggression is particularly severe, reconciliation is not immediate, and consequently social stress reaches high peaks.

Poster: Influence of tamarin behaviour (*Saguinus fuscicollis*, *Saguinus mystax*) on post dispersal seed fate: Dung beetle activity, secondary seed dispersal and predation pressure

Laurence Culot¹, Marie-Claude Huynen¹ & Eckhard W. Heymann²

¹Behavioral Biology Unit, University of Liège, B & ²Abteilung Verhaltensökologie und Sociobiologie, Deutsches Primatenzentrum, Göttingen, D;

laurence.culot@student.ulg.ac.be

Most previous studies focused on post-dispersal fate of seeds dispersed by large primates, but little is known about this process in small frugivores like tamarins. This study conducted in the Amazonian forest of Peru (Estación Biológica Quebrada Blanco) aimed at investigating how tamarins influence the post-dispersal seed fate based on combined data on feeding and ranging behaviour, primary seed dispersal characteristics, secondary seed dispersal and predation pressure. We analysed the tamarins' home-range use, feeding behaviour and faeces seed content (species, number and size) and the activity of dung beetles attracted to tamarin faeces, based on observations in situ. We then examined the post-dispersal seed fate by marking and regularly monitoring the seeds in faeces. We finally focused on secondary seed dispersal and predation using semi-controlled experiments. The results show that tamarins enter into secondary forest and sometimes feed on fruiting trees there. Most tamarin faeces contain low seed density, most of them intact and relatively large. 35 % of faeces are visited by dung beetles, arriving quickly (i.e. within 2.5 minutes), and frequently forming dung balls likely to contain seeds and to be buried. Despite their small size, tamarins disperse large seeds. The low seed density in their faeces is favourable to the post-dispersal fate because it entails a relatively low predation rate compared to this found for the seeds in larger primates' faeces. Furthermore the small amount of faecal matter has no negative effect on the secondary seed dispersal rate. Finally, the feeding pattern of tamarins and their use of secondary forest suggest a profile of seed dispersion favourable to their germination and thus to the regeneration process of the Amazonian forest. Supported by Foundations Alice Seghers and Docquier (ULg), and by a FRIA grant to Laurence Culot.

Talk: Embryonic and foetal development in relation to faecal hormone profiles in the grey mouse lemur (*Microcebus murinus*)

Barbara L. Daffner¹, Ann-Kathrin Oerke¹, Ute Radespiel², Elke Zimmermann², Michael Heistermann¹, Ann MacLarnon³ & J. Keith Hodges¹

¹Abteilung Reproduktionsbiologie, Deutsches Primatenzentrum, Göttingen, ²Institut für Zoologie, Tierärztliche Hochschule Hannover, D & ³Centre for Research in Evolutionary Anthropology, School of Human & Life Sciences, Roehampton University, London, UK; barbara.daffner@gmx.de

In comparison to haplorrhine primates, information on most aspects of the physiology of reproduction in strepsirrhines (lemurs and lorises) is extremely limited. We report here results of a study on endocrine profiles in relation to embryonic development and foetal growth during pregnancy in a cheirogaleid species, the grey mouse lemur (*Microcebus murinus*). Data were collected on eight pregnancies in five adult females. Transabdominal real-time ultrasonography was performed weekly following oestrus on unsedated animals (two complete, six incomplete pregnancies monitored). Faecal samples, collected 3-4 times per week until 1 week after parturition were measured for immunoreactive progestagen (P) and oestrogen (E) metabolites using established enzymeimmunoassays. Median total gestation length (TGL) was 64 days. Diagnosis of pregnancy (indicated by a fluid-filled lumen in either uterine horn) was possible by day 13 (20 % TGL), visualization of the embryo by day 20 (31 % TGL), detection of embryonic heart beat by day 27 (42 % TGL), and initial measurement of foetal biparietal diameter (BPD) by day 34 (53 % TGL). Ultrasound measurements of embryonic/foetal size indicated a linear growth from ~2.4mm in length on day 20 to a crown-rump-length of ~29.7 mm on day 47 (last measurement taken). The BPD also increased linearly from ~5.2 mm on day 34 to ~11.6 mm on day 53. Faecal P and E concentrations remained at non-pregnant levels for at least the first half of pregnancy, after which (around day 40, 58 % TGL) both hormones showed a marked rise (up to 50 fold) to reach maximum levels 5-10 days before birth. By indicating an embryonic/foetal shift around day 30-34 (50 % TGL), the data suggest a period of relatively slow embryonic growth compared to haplorrhine primates. The relatively late increase in hormone excretion, occurring shortly after the projected time of the embryonic-foetal shift, suggests a placental and/or foetal, rather than ovarian origin of gestational hormones.

Poster: Feeding ecology of the world's smallest primate, the pygmy mouse lemur (*Microcebus berthae*, Cheirogaleidae) and sympatric *Microcebus murinus*

Melanie Dammhahn¹ & Peter M. Kappeler^{1, 2}

¹Abteilung Verhaltensökologie und Soziobiologie, Deutsches Primatenzentrum & ²Institut für Zoologie und Anthropologie, Universität Göttingen, D; mdammha@gwdg.de

The goal of this ongoing comparative study is to illuminate the feeding ecology, population dynamics and spatial patterns of two sympatric mouse lemur species in

the dry deciduous forests of western Madagascar. The newly described pygmy mouse lemur (*Microcebus berthae*) is restricted to Kirindy forest and a nearby reserve, where it occurs in sympatry with the much more widely distributed grey mouse lemur (*Microcebus murinus*). The ecological niche separation of these two closely related species is not understood; partly because only preliminary data on ecology, population dynamics and distribution of the pygmy mouse lemur are available. Between August and December 2004 we regularly (re-)captured, marked and radio-tracked females of the two species. Data on feeding ecology was recorded through direct observation and faecal analysis. The main results are that *M. berthae* and *M. murinus* females differ tremendously in their space use with the larger species using smaller home ranges which overlap particularly with sleeping group members. Direct observations of feeding behaviour and analysis of fecal samples indicate that both species are omnivorous and feed mainly on homopteran secretions and arthropods during the dry season with *M. murinus* occasionally using fruits. Resource use patterns of pygmy and grey mouse lemurs broadly reflect resource availability within the strongly seasonal dry forest of western Madagascar. Supported by Margot Marsh Biodiversity Foundation, Christian-Vogel-Fond and German Primate Center (Göttingen).

Poster: Social proximity and self-directed behaviours among captive female vervet monkeys (*Cercopithecus aethiops*)

João Daniel & António José dos Santos

Instituto Superior de Psicologia Aplicada, Lisboa, P; joao_daniel@ispa.pt

Rates of self-directed behaviours (SDB) in primates have been shown to rise in situations assumed to cause some degree of anxiety. The presence of a high-ranking partner close-by is one of these situations since the proximity of dominant animals increases the risk of receiving aggression, and as such higher anxiety levels should be expected. The present study examined the effect of proximity partners' relative dominance status on the rate of SDB (scratch, self-groom, yawn, self-touch and body-shake) of seven female vervets (*Cercopithecus aethiops*), living in captivity at the Lisbon Zoo. Data collection consisted of 10.5 hours of individual focal sampling to record approach/withdrawal interactions and SDB. Proximity partners distancing less than 2 m of the focal subject were also recorded following the occurrence of SDB. Further 100 point samples of proximity per individual were finally collected, in order to control for the time females spent together. Results indicated that SDB rates were not significantly correlated with rank (except for self-grooming which was performed more by low-ranking females), and that for all SDB, average rates were not higher in the presence of dominant females than in the presence of subordinate females. When we combined the five SDB, the exclusive presence of a dominant female in proximity seemed to have more influence on SDB rates than the sole presence of a subordinate female, although this influence was not significant when results were analysed separately, with the exception of self-groom. These findings suggest that the presence of a high-ranking female is not a cause for anxiety itself in this captive group, which can be interpreted considering the low rate of conflicts observed and/or the fact that the animals are well habituated to a high-density captive setting.

Poster: Teeth flossing in captive hamadryas baboons

Rebekka Deleu, Iris Leinfelder & Mark Nelissen

Research Group Behavioural Biology, University of Antwerp, B; rebekka.deleu@ua.ac.be

The use of tools in dental hygiene has so far only been reported for great apes that were observed using toothpicks (*Pan troglodytes*: McGrew and Tutin, 1973; *Pan paniscus*: Ingmanson, 1996). Here we report teeth flossing behaviour in two groups of captive hamadryas baboons (*Papio hamadryas hamadryas*) at Antwerp Zoo (Belgium) and Safari Beekse Bergen (NL) respectively. Teeth flossing was observed almost daily and in all adult animals in Antwerp Zoo, whereas the behaviour was observed only occasionally and only in some adult animals in Safari Beekse Bergen, which might be a consequence of different feeding regimes. Pieces of straw are used to floss teeth in both groups, but in Antwerp Zoo hairs (preferably from the adult males' cape) are used as well, which might reflect social learning. The technique used for flossing is the same in both groups irrespective of the tool used: with a piece of straw or a hair a loop is created that is subsequently put around a tooth and moved up and down and/or back and forth rapidly. Because teeth flossing was observed in two captive groups that probably originated from different wild populations and because seeds – that can get stuck between teeth easily – are important in their natural diet, it is not unlikely that teeth flossing is part of the normal behavioural repertoire of hamadryas baboons.

Talk: Number of cycles to conception in female chimpanzees: variation within and between populations

Tobias Deschner & Christophe Boesch

Max-Planck Institut für Evolutionäre Anthropologie, Leipzig, D; deschner@eva.mpg.de

Sexual swelling patterns differ between East and West African chimpanzee populations. Parous East African chimpanzee females have an average of less than nine cycles between births, while West African chimpanzee females have an average of 29 cycles between births. In East African chimpanzees, nulliparous females have many more cycles to conception and are less attractive to adult males than are parous females, leading to the formulation of the "cost-of-sexual-attraction" hypothesis, which states that parous females cannot afford a high number of cycles to conception because the resulting affiliation with males would compromise their food intake. To date there has been little research into the factors affecting the number of cycles to conception in West African chimpanzees. Here we use long-term data from two habituated chimpanzee communities in the Taï National Park in Côte d'Ivoire to test whether the "cost-of-sexual-attraction" hypothesis explains the number of sexual cycles to conception in West African chimpanzees. In contrast to East African females, we found that not only do Taï females exhibit a higher number of swellings per inter-birth interval, but the number of swellings does not decrease abruptly after the birth of the first infant. Instead, the number of swellings to conception decreases gradually with increasing age and parity. We therefore conclude that the "cost-of-sex-

ual-attraction" hypothesis alone is not sufficient to explain swelling patterns in female West African chimpanzees and discuss additional factors that might account for the observed patterns.

Poster: Discrimination of species of different primate genera in brown capuchin monkeys (*Cebus apella*) assessed with a visual paired comparison paradigm

Valérie Dufour¹, Oliver Pascalis² & Odile Petit¹

¹Biomedical Primate Research Center, Rijswijk, NL, ²Department of Psychology, University of Sheffield, UK & ³CNRS, CEPE, UPR 9010, Strasbourg, F; Dufour@BPRC.nl

For most primates, face indicates the identity and the emotional state of others. A crucial ability is to determine whether a face belongs to one own's species (then recognition processes can be engaged) or whether it belongs to another, potentially dangerous species. Previous studies have shown that the visual paired comparison task allowed investigating discrimination between two faces of individuals of the same species. In this study, we explore the adequacy of this paradigm for testing species discrimination in non-human primates. We tested the ability of four brown capuchin monkeys (*Cebus apella*) to discriminate, without training, between faces of different primate species, using a visual paired comparison task. Subjects were shown a face from an individual of one species for 5 seconds. After a brief delay, a different face from the same species (familiar species) was shown paired with a face of a new species. Discrimination between the familiar and the new species was assessed by measuring the time spent looking at faces from both species. Discrimination abilities were tested for faces of brown capuchin, white-faced capuchin (*Cebus capucinus*), long-tailed macaque (*Macaca fascicularis*) and stump-tailed macaque (*Macaca arctoides*). We studied intra-genera discrimination (new and familiar faces from the same genus) and inter-genera discrimination (new and familiar species from different genera). We did not observe intra-genera discrimination, however, the results showed that brown capuchin monkeys looked longer toward the familiar species in inter-genera discrimination trials. They discriminated between faces that belonged to different genera. This result suggests that the visual paired comparison task is a technique that can be adapted to the study of natural categorisation of social stimuli in non-human primates.

Talk: Determinants of male reproductive success in wild long-tailed macaques (*Macaca fascicularis*) - alpha male mate guarding, female mate choice or post-copulatory mechanisms?

Antje Engelhardt^{1, 2}, Michael Heistermann¹, J. Keith Hodges¹, Peter Nürnberg³ & Carsten Niemitz²

¹Abteilung Reproduktionsbiologie, Deutsches Primatenzentrum, Göttingen, ²Humanbiologie und Anthropologie, Freie Universität Berlin & ³Institut für Medizinische Genetik, Charité, Humboldt-Universität Berlin, D; aengelhardt@dpz.gwdg.de

One of the basic principles of sexual selection is that male reproductive success should be skewed towards strong males in species with anisogamous sex. In multi-male primate groups however, factors other than male fighting ability also seem to be important, although the proximate mechanisms involved remain largely unknown. In the present study, we examined the relative importance of male monopolization, female direct mate choice and post-copulatory mechanisms for paternity determination in a group of wild long-tailed macaques. We used an integrated approach combining behavioural observations with faecal hormone analysis to enable timing of the females' fertile phase (11 cycles, seven females) and genetic analysis for the assessment of paternity ($n = 6$). All infants were sired by high-ranking males (alpha and beta males). Nevertheless, only 50 % of paternities were achieved by monopolization of females through continuous mate guarding by dominant males during the fertile phase. In cycles in which continuous mate guarding did not occur ($n = 5$), all females mated with several males ($\bar{x} = 5.2$) and male reproductive success was determined on the post-copulatory level. The incidence of female direct mate choice was low (female initiated copulations: $\bar{x} = 19.5$ %, refusals of mating attempts: $\bar{x} = 25$ %). We therefore conclude that in contrast to female mate choice, post-copulatory mechanisms (either sperm competition or female cryptic choice) as well as male monopolization are the main determinants of male reproductive success in long-tailed macaques. The results also suggest that these determinants operate in favour of high-ranking males, thus reinforcing the reproductive skew in this species.

Poster: Identification of sex differences across different age classes in chacma baboon clear calls

Elodie Ey, Kurt Hammerschmidt & Julia Fischer

Forschergruppe Kognitive Ethologie, Deutsches Primatenzentrum, Göttingen, D;
ey_elodie@hotmail.fr

There is ample evidence that acoustic features of vocal signals change when individuals grow in size. Sexual differences also are reported, but these variations have mainly been studied in adult subjects. In our study, we investigated at which age sexual differences become apparent in the vocalizations of male and female chacma baboons (*Papio cynocephalus ursinus*). We conducted our analysis on clear barks recorded from 47 free-ranging individuals living in the Moremi Wildlife Reserve, Botswana. We chose one or two high quality calls per individual for this analysis and extracted several variables related to the fundamental frequency, as well as an additional suite of variables such as call duration and peak frequency, using the custom software package LMA 2005. The statistical analysis was realized with the software SPSS 12.0. We established four age classes: up to one year of age, two and three years of age, four to six years of age, and adults. Several variables changed with age, such as call duration, fundamental frequency and peak frequency. While recordings from individuals in the two youngest age classes did not differ significantly in relation to sex, they began to show marked differences between males and females at age class 3. This age class seems to be critical for the emergence of significant sexual dif-

ferences. Age- and sex-related differences may be partly explained by changes in body size, which affects vocal tract features and lung capacity, but also effects of sex hormones such as testosterone which has been related to the growth of the larynx in humans.

Talk: Impact of bushmeat hunting on the fate of moist forest primates in Africa

John Emmanuel Fa

Conservation Programme, Durrell Wildlife Trust, Jersey, UK; jfa@durrell.org

The loss of tropical forest wildlife through the bushmeat trade is an even greater threat than deforestation. Most wild meat consumed by humans is derived from mammals, and a large proportion of this from primates. In moist forests in Africa, all primates are hunted. The consequence of this is that primate species, including the great apes, are under increasing threat because of hunting. Resolution of this problem is complex, because of linkages between socio-economics, food security and poverty issues that lead consumers and hunters, to depend on hunted species. In this paper, I review patterns of primate harvests and other mammals in African tropical moist forests from published and new field studies. Using these data, I will assess sustainability and predict extinction trends for all species. Recommendations for the conservation of primate species in African moist forests will be discussed in the context of human and wildlife needs.

Talk: Formation of an all-male group of white crowned mangabeys (*Cercocebus atys lunulatus*): preliminary comments on social behaviour and space use

María Fàbregas Hernández¹, Federico Guillén-Salazar², María Dolores Carbonell¹ & Ignacio Docavo¹

¹Zoológico de Valencia & ²Unidad de Etología y Bienestar Animal, Universidad Cardenal-Herrera, Valencia, E; maria_fabregas11@yahoo.es

White-crowned mangabeys live in large multi-male multi-female groups. However, in captivity, due to space limitations and incompatibility among males, mangabeys are housed in breeding units comprised by one adult male, several adult females, and their offspring. Since the sex ratio of the newborns is close to 1:1, surplus males are generated in most captive populations of mangabeys, and are a common problem for zoo managers. The study presented here reports for the first time the successful formation of an all-male group of white-crowned mangabeys (*Cercocebus atys lunulatus*) in order to find appropriate keeping conditions for surplus males in this species. A four-step protocol was followed to resocialize two subgroups of two male mangabeys each. We recorded social behaviour before and after group formation for a total of 129 hrs. Data analysis shows an increase in both affiliative and agonistic behaviours following group formation, and therefore a decrease in social

inactivity. Contact aggression was observed at low rates during the whole study and did not require medical care. Twice Weight Association Indexes were calculated to assess group cohesion, obtaining low values in almost every case, similar to what has been observed for all-male groups in other species. Every individual showed a preference for the above ground level structures, especially for the upper level of the enclosure. The group remained stable up to seven months after the resocialization process, suggesting that the formation of groups with this sex and age composition is possible for this species. However, more data are needed to fully evaluate the behavioural dynamics of all-male groups in this species, and the feasibility of such groups as a management strategy.

Talk: Development of conspecific and heterospecific alarm call recognition in Verreaux's sifakas (*Propithecus verreauxi verreauxi*)

Claudia Fichtel

Abteilung Verhaltensökologie und Soziobiologie, Deutsches Primatenzentrum, Göttingen, D; claudia.fichtel@gwdg.de

I studied the development of alarm call recognition infant Verreaux's sifakas'. I investigated their recognition of conspecific alarm calls and those of sympatric redfronted lemurs (*Eulemur fulvus rufus*) in Kirindy forest, western Madagascar. Verreaux's sifakas as well as redfronted lemurs have functionally referential alarm calls only for aerial predators and general alarm calls for several threats. General alarm calls are given in response to a wider range of disturbances such as aerial and terrestrial predators as well as inter- and intra-group encounters. Because the usage and comprehension of primate vocalizations is influenced by learning, I conducted field playback experiments to determine the age at which infant Verreaux's sifakas discriminate between conspecific alarm calls, heterospecific alarm calls and non-alarms vocalizations of the little Vasa parrot (*Coracopsis nigra*). I presented five different playback stimuli to nine infants from six groups at different ages. Most infants younger than five months fled towards their mothers after hearing any playback stimuli. However, infants responded with a significant longer latency to parrots songs, indicating that their emerging ability to discriminate between alarming and non-alarms stimuli. At an age of about six months, infants discriminated reliably between conspecific and heterospecific alarm calls as well as the parrot. Thus the ability to categorize alarm calls developed later than the ability to discriminate between alarming and non-alarms stimuli.

Talk: Advertising fighting ability: information content of male baboon "wahoo" calls

Julia Fischer¹, Dawn Kitchen^{2,3}, Dorothy Cheney² & Robert Seyfarth²

¹Forschergruppe Kognitive Ethologie, Deutsches Primatenzentrum, Göttingen, D,

²Departments of Psychology and Biology, University of Pennsylvania, Philadelphia PA, & ³Department of Anthropology, Ohio State University, Columbus OH, USA;

jfischer@dpz.gwdg.de

Sexual selection has favoured the evolution of exaggerated male traits, such as distinctive vocalizations, in numerous species. We analyzed the loud calls given by free-ranging male baboons (*Papio cynocephalus ursinus*) to test whether the usage or the structure of these signals vary in relation to several measures of male condition, including body size, dominance rank, age, and a male's apparent exhaustion after a lengthy display. We found no consistent relation between a male's dominance rank and either tooth score (a measure of age) or shoulder height (a measure of body size). Although all males judged to be old by tooth wear or long-term demographic data were either low- or middle-ranking, not all young males were high-ranking. Higher-ranking males gave more wahoos per bout, called for longer bouts, and gave wahoos at faster rates than lower-ranking males. Bouts involving males of similar ranks occurred more often, contained more wahoos, involved calling at higher rates, and were more likely to lead to physical fighting, than other bouts. Several acoustic features of wahoos were also correlated with male competitive ability. High-ranking males gave wahoos with higher fundamental frequencies (F0) and longer 'hoo' syllables. Within-subject analyses revealed that as males fell in rank over a period of months, 'hoo' syllables shortened. As males continued to age and fall in rank, F0 declined, 'hoo' syllables were shortened, and formant dispersion decreased. Independent of age and rank, within bouts of calling, F0 declined and 'hoo' syllables became shorter. Furthermore, males with teeth in poor condition, who were typically old and low-ranking, produced wahoos with lower formant dispersion than those produced by higher-ranking males. Both call usage and call structure, therefore, may function as honest indicators of a male's condition and stamina and therefore serve as effective deterrents to physical challenges.

Talk: Material culture in Nigerian chimpanzees: a contribution to cultural primatology

Andrew Fowler & Volker Sommer

Department of Anthropology, University College London, UK; v.sommer@ucl.ac.uk

A trademark of *Homo sapiens* is the enormous variation in behavioural patterns between populations. An understanding of how human cultures developed can be aided by studies of *Pan* communities across Africa, which tend to display unique combinations of social customs, communication, territorial aggression, hunting strategies, and tool use. Only cross-population comparisons can reveal the sources of this diversity, which include differential genetic make-up, environmental constraints, and individual or social learning. However, the recently recognised and most endangered subspecies *Pan troglodytes vellerosus* remains completely unstudied in this respect. We report first evidence from a new long-term study of Nigerian chimpanzees at Gashaka. At this site, diet composition is highly varied and the apes have to cope with high concentrations of anti-feedants. It might therefore not be surprising that the Gashaka chimpanzees use a varied tool-kit for extractive foraging. For example, they harvest insects throughout the year, employing digging sticks and probing sticks to obtain honey from stingless-bee and honey-bee nests, dipping wands to prey on army ants and fishing rods to eat arboreal ants. Tools appeared to be custom-

made with a considerable degree of standardization in length, diameter and preferential use of distal ends. Moreover, compared to the rainy season, tools were longer during the dry season when insects retreat further into their nests. Many of these expressions of subsistence technology seem to reflect environmental constraints, whereas others seem to represent cultural traits. Most notably, despite an abundance of mounds, termite eating seems to be absent. Similarly, two types of hard-shelled nuts found in the habitat are not hammered open with tools, unlike what has been observed in West-Africa. The prevalence of elementary technology may indicate that the material culture of Gashaka chimpanzees is most related to the "core cultural tendency" of some Central African populations.

Poster: Microsatellite analyses reveal fine-scale genetic structure in grey mouse lemurs (*Microcebus murinus*)

Tina Fredsted¹, C. Pertoldi^{1, 2, 3}, M.H. Schierup^{1, 4} & Peter M. Kappeler^{5, 6}

¹Department of Ecology and Genetics, Institute of Biological Sciences, University of Aarhus, ²Department of Wildlife Ecology and Biodiversity, National Environmental Research Institute, Rønde, DK, ³Department of Applied Biology, Estación Biológica Doñana, CSIC, Pabellón del Perú, Seville, E, ⁴BiRC - Bioinformatics Research Center, Department of Computer Science, University of Aarhus, DK, ⁵Abteilung Verhaltensökologie und Soziobiologie, Deutsches Primatenzentrum, Göttingen & ⁶Institut für Zoologie und Anthropologie, Universität Göttingen, D;
tina.fredsted@biology.au.dk

Information on genetic structure can be used to complement direct inferences on social systems and behaviour. We studied the genetic structure of the solitary grey mouse lemur (*Microcebus murinus*), a small, nocturnal primate endemic to western Madagascar with the aim of getting further insight on its breeding structure. Tissue samples from 167 grey mouse lemurs in an area covering 12.3 km² in Kirindy Forest were obtained from trapping. The capture data indicated a non-continuous distribution of individuals in the study area. Using 10 microsatellite markers, significant genetic differentiation in the study area was demonstrated and dispersal was found to be significantly male-biased. Furthermore, we observed an overall excess of homozygotes in the total population ($F = 0.131$), which we interpret as caused by fine-scale structure with breeding occurring in small units. Evidence for a clumped distribution of identical homozygotes was found, supporting the notion that dispersal distance for breeding was shorter than for foraging, i.e. the breeding neighbourhood size is smaller than the foraging neighbourhood size. In conclusion, we found a more complex population structure than previously reported in studies performed on smaller spatial scales. The non-continuous distribution of individuals and the effects of social variables on the genetic structure have implications for the interpretation of social organization and the planning of conservation activities that may apply to other solitary and endangered mammals as well.

Talk: Social relationships in all-male groups: a comparison of rhesus macaques and hamadryas baboons

Sabine Freitag¹, Cornelia Franz¹, Karl Crailsheim¹ & Signe Preuschoft²

¹Institut für Zoologie, Karl-Franzens-Universität, Graz & ²hopE – Home of Primates Europe, Gänserndorf, A; sffreitag@gmx.net

Cercopithecine species differ in dominance styles, but female-female relationships are not necessarily predictive of male-male relationships. Female-bonded species with strict dominance hierarchies such as rhesus monkeys communicate rank relationships by uni-directional agonistic signals. Conflict management may take different forms in male-bonded species such as hamadryas baboons that are known for competitive inhibition between rivals, and mutual appeasement. In this study we investigated the distribution of agonistic and socio-positive signals and behaviours among members of two all-male groups: hamadryas baboons (six adult males), and rhesus macaques (10 adult and one subadult male). We expected to find uni-directional signals and behaviours indicative of a linear dominance structure in the rhesus, but no linear rank order and bi-directional exchanges of agonism in the baboon males. Results are based on focal observations (rhesus: 88 h, baboons: 48 h), scan sampling (48 h each), and all occurrence sampling (19.5 h in each group). Among the rhesus males, induced and spontaneous avoidance, ano-genital presentation and received mounting, and silent baring of the teeth were all distributed uni-directionally, and correlated amongst each other. By contrast, among the baboon males ano-genital presentations and mounting were distributed bi-directionally, avoidance was characteristic for relationships between sub-groups, and silent baring of the teeth did not occur. The results thus indicate a clear-cut linear dominance hierarchy among the rhesus males, independent of grooming bonds that existed between certain individuals. Among the baboon males, no clear rank order could be discerned, agonistic behaviour and presentations occurred between groups of males which were delimited by grooming bonds and other socio-positive interactions (e.g. mounting). These findings show that under artificial conditions monkeys draw on evolved social mechanisms, and therefore respond differentially to identical challenges.

Talk: Behavioural endocrinology of maturing, wild gibbon males (*Hylobates lar*)

Ines Fürtbauer¹, Eva Millesi¹, Erich Möstl² & Ulrich H. Reichard³

¹Abteilung Neurobiologie und Verhaltenswissenschaft, Universität Wien, ²Abteilung Biochemie, Veterinärmedizinische Universität Wien, A & ³Abteilung Primatologie, Max Planck Institut für Evolutionäre Anthropologie, Leipzig, D; a9802036@unet.univie.ac.at

In wild gibbons, male offspring sometimes remain with their natal group for several years after reaching full adult body size and presumably sexual maturity. Delayed offspring dispersal may be costly to parents (resource depletion, sexual competition for territory ownership), but also beneficial (assistance in territorial defence,

increased parents' fitness). From an offspring's perspective, delaying dispersal may be beneficial in terms of resource access and reduced mortality during dispersal. Costs include delayed reproduction and potential parent and offspring conflicts, resulting in elevated stress levels. Socio-endocrinological suppression of reproductive function may play an important role in regulating dispersal in socially monogamous primates. This is the first physiological study to examine the links between maturing males' hormonal status and behaviour to better understand the functions and mechanisms of offspring retention versus dispersal in this species. We investigated whether those males delaying dispersal are sexually mature and whether father-son conflicts were expressed behaviourally and/or endocrinologically. Behavioural data were collected during 768 focal-hours on 105 days from four habituated, maturing males (6-11 years old) at Khao Yai National Park, Thailand. Faecal samples were collected from focal animals and adult males to compare reproductive conditions and adrenal activities. Prior to hormone analysis via enzymeimmuno assays, faecal steroid metabolites were characterised using high performance liquid chromatography analysis. Preliminary endocrine analyses revealed no differences in hormone activities, whereas behaviour differed clearly. The three younger males were rarely seen without their natal groups, whereas the oldest male offspring spent almost 50 % of observation time alone. This male preferred home-range areas that overlapped with the home-range of neighbouring groups, which he repeatedly encountered. When in his natal group, he only groomed with his sister, whereas the younger males groomed with most group members, including the social father. Agonistic behaviour was rare. Our preliminary analyses do not support the 'reproductive-suppression-hypothesis': parent and male offspring interests apparently do not conflict and male dispersal appears to be voluntary.

Talk: Primate ecology: where are we and where do we go from here?

Jörg U. Ganzhorn¹ & Eckhard W. Heymann²

¹Zoologisches Institut & Museum, Universität Hamburg & ²Abteilung Verhaltensökologie & Soziobiologie, Deutsches Primatenzentrum, Göttingen, D;
ganzhorn@zoologie.uni-hamburg.de

Studies of primate ecology focus on two major aims: (1) understanding primate adaptations to their environment, and (2) understanding the ecological roles and functions of primates. These two differ conceptionally, but are nevertheless interrelated. The last decade has seen advances with regard to both aims. With regard to primate ecological adaptations, sensory ecology (e.g. colour vision) and ecophysiology (e.g. thermoregulation) have been major topics. With regard to ecological roles and functions, the study of primate seed dispersal is an increasingly important topic, with implications for the management and conservation of primate habitats. Finally, we expect that the study of primate-parasite interactions and their implications for primate ecological and behavioural strategies will be an exciting field for research in the future that has also strong implications for primate conservation and sociobiology. Many gaps remain, however, in our comprehension of these and other aspects of primate ecology. A still largely neglected area is intraspecific variability

(e.g. diet, habitat use) and its consequences for the understanding of primate ecological strategies. This will require, amongst others, technical advances for high resolution analyses of the availability of nutrients in primate habitats. Furthermore many of the descriptive relations need to be tested experimentally under field conditions.

Talk: Chimpanzee and bonobo facial behavior compared – four levels of analysis

Augusta Gaspar

Laboratory of Social Ethology and Center for Studies in Cognitive and Developmental Psychology, Department of Psychology, Lusofona University, Lisboa, P;
augusta.gaspar@ulusofona.pt

Chimpanzee and bonobos reflect distinct evolutionary constraints, including social environments. Their extensive and well known differences in social behaviour are likely to have promoted differences in signaling repertoires. In order to study *Pan* facial communication and assess possible species differences in repertoires, four levels of analysis were undertaken: (1) frequency of Facial Action Units (AUs); (2) proportion of different AU composed *Gestalten*; (3) contexts associated with *Gestalten*; (4) social interaction predictions from the use of AUs (a way of validating the action unit signaling value). Data is based on video recordings of zoo bonobos and chimpanzees. AUs used for coding behavior were withdrawn from a system of Action Units and appearance descriptors used previously by Gaspar (2001), currently converging and being adapted towards compatible standardized coding systems for chimpanzees - the ChimpFACS by Vick, Waller, Parr, Pasqualini & Bard (in prep.) and bonobos - the BonoboFACS by Gaspar & Bard (in prep.). Results show an almost total absence of qualitative differences in chimpanzee and bonobo AUs. However, there are significant quantitative differences in the frequencies of given action units and *Gestalten*, and, in some cases, of the *Gestalten* typical context. Predictions from AUs also differ. The Power Asymmetry Hypothesis (Preuschoft & Van Hooff, 1997) is helpful in attempting to explain some of these differences.

Poster: Chimpanzee (*Pan troglodytes verus*) and baobab (*Adansonia digitata*) at Fongoli, southeastern Senegal: preliminary results on percussive technology

Maja Gašperšič¹ & Jill D. Pruetz²

¹Department of Social Anthropology, Institutum Studiorum Humanitatis, Ljubljana, SLO & ²Department of Anthropology, Iowa State University, Ames, Iowa, USA; Afnca@volja.net

Chimpanzees inhabiting an arid savanna environment have often been used as referential models in reconstructing the adaptation of early hominins to similar habitats. One aspect of savanna diet expansion may be an increased reliance on tools for extracting or processing "hard-to-get" foods such as tubers, nuts and embedded

fruits. Use of stone or wooden anvils to smash open hard-shelled fruits is widespread among chimpanzee subspecies. However, only on West African savannas are chimpanzees (*Pan troglodytes verus*) sympatric with baobab (*Adansonia digitata*). Before this study, baobab smashing had been studied only at Mt. Assirik, Senegal. This research aimed at reconstructing the techniques of baobab cracking at Fongoli, using similar surface archaeological methods. The study has three components: comparison of arboreal vs. terrestrial techniques; hammer-and-anvil use vs. anvil use only; and fruit transport from the tree to anvils.

We recorded the phenology and feeding remains of 19 baobab trees in 37 surveys. Nine of the trees were associated with laterite rocks, roots and logs, used for smashing the fruits. We measured and mapped stones and fruits at three of those sites. The spatial distribution of fruit remains indicates that the terrestrial anvil technique dominated (mean=70 % of fruits, range: 60-86 %). The arboreal technique is intriguing in terms of anvil definition and its vertical or horizontal orientation. Analysis of fruit transport shows that nearly half of the fruits were transported to anvils beyond the fruit-fall zone. The surface surveys revealed that chimpanzees used at least 41 natural objects as anvils. Stone dominated over wood, and most of the anvils were embedded. No evidence of hammer use was found. Such percussive technique provides additional insights into the origins of elementary technology (perhaps preceding hammer-and-anvil use) before the intentional modification of tools in hominin evolution.

Talk: Hand preference in ring-tailed lemurs (*Lemur catta*): simple and complex tasks

*Donata Grassi*¹, *Maura Rizzo*², *Caterina Spiezio*³ & *Laura Guidolin*²

¹Parco Natura Viva – Garda Zoological Park, Bussolengo (VR), ²Dipartimento di Biologia, University of Padua & ³Cognitive Neuroscience Sector, ISASS-SISSA, Trieste, I; ricerca@parconaturaviva.it

Conceptual knowledge of language, communicative gestures, tool use and the related motor patterns (right handedness) are segregated in the left-hemisphere. Observation of these peculiar human abilities is correlated with activation of areas in the left hemisphere. To investigate the evidence of the same abilities in non-human primates it is important to address the adaptive value of human specialisation. The most common approach to evaluating whether non-human primates exhibit hemispheric specialization in motor functions has been to test for population-level handedness. Thus, hand-preference patterns of ring-tailed lemurs (*Lemur catta*), hosted at Parco Natura Viva, Bussolengo, (Vr, I) were assessed. The subjects were tested in four different experimental sessions: the spontaneous, the tactile, the postural and the bimanual session. The hand preference was assessed for the following behavioural categories: "first action", "support action", "reach for food action" and "obtain action". Most of the lemurs presented an individual hand preference for all the behavioural categories. However, the subjects of Parco Natura Viva showed a symmetrical hand use pattern at a population level for the behavioural categories in the spontaneous session and for "first action" in the bimanual session. The subjects

showed a significant hand preference at a population level in all the other three experimental sessions: a right hand preference for "reach for food" and for "obtain a pellet" and a left hand preference for "support action". These results seem to differ from most of the captive literature that shows left hand preference for foraging categories in lemurs.

Talk: Chimpanzee, *Pan troglodytes*, social play: determinants and function

Elizabeth Greengrass

Department of Biological Sciences, University of Bristol, UK; EJGreengrass@mac.com

This talk is based on 18 months of data collected on the Kasekela community of chimpanzees, *Pan troglodytes*, at Gombe National Park, in Tanzania. Previous research has shown that Gombe females have well-defined relationships ordered into a dominance hierarchy (Williams et al., 1997). Mothers of similar rank associate most together probably as a consequence of contest competition (Williams et al., 2002) and females are attracted to both kin and to high-ranking females. If there are large differences in the social experiences of mothers, then these are likely to affect the behaviour of their offspring. Here I examine the effect of diet quality and a mother's sociability on patterns of play and investigate the occurrence of aggression during play. I found a positive relationship between the percentage of ripe fruit in the diet of both mother and offspring and play frequency of the offspring. I also found that a mother's associations influence her offsprings' play patterns; offspring whose mothers are similarly ranked and who associate together more often, play together more frequently. For immature chimpanzees, aggression is an important consequence of play behaviour. Aggression occurs most frequently within the play context, occurs more frequently between males than females and increases in frequency with age. I discuss the possibility that dependent offspring, in particular late juveniles/early adolescent males, might use play to assert and establish dominance relationships, as observed in human adolescent males and learn complex social skills related to conflict management.

Talk: Genetic differentiation and phylogeography of Red Sea baboons

Linn Groeneveld¹, Christian Roos² & Dietmar Zinner³

¹Abteilung Verhaltensökologie und Soziobiologie, ²Forschergruppe Primatengenetik & ³Forschergruppe Kognitive Ethologie, Deutsches Primatenzentrum, Göttingen, D; dzinner@gwdg.de

The phylogeography of baboons in NE Africa and western Arabia is complex and controversial. At least two parapatric taxa (hamadryas and olive baboons) are found in the region; a narrow hybrid zone is well documented and hamadryas baboons are also found on either side of the Red Sea. We investigated the phylogeography of

hamadryas and olive baboons from NE Africa and western Arabia, by sequencing a part of the mtDNA control region (337bp). We included 235 samples from 36 sites in Saudi Arabia, Yemen, Eritrea, Ethiopia and northern Tanzania. We found 121 haplotypes that were grouped in three major clades that did not follow a general geographic pattern. Clade A consists of only hamadryas baboons from Eritrea and Ethiopia, clade B consist of hamadryas baboons from Eritrea, Ethiopia, Saudi Arabia and Yemen and also of olive baboons from Eritrea and northern Ethiopia. Clade C consists of Ethiopian and Arabian hamadryas baboons. Olive baboons from southwestern Ethiopia and Tanzania grouped in their own clades. At the haplotype level current taxonomy does not correspond well to molecular genetic structure. More genetic variation was found within hamadryas baboons than between hamadryas and olive baboons. Traditional methods used to analyze population substructuring do not include evolutionary genealogical information. In order to include any temporal information given by haplotype trees on account of coalescent theory, a nested clade analysis was conducted. Our findings so far also contrast to the scenario Winney et al. (2004) presented, because we did not find a pure Arabian hamadryas clade.

Poster: Genetic diversity of endemic Malagasy dwarf lemurs, *Cheirogaleus* (Cheirogaleidae: Primates)

Linn F. Groeneveld¹, Rodin Rasoloarison¹, Hans Zischler² & Peter M. Kappeler^{1,3}

¹Abteilung Verhaltensökologie und Soziobiologie, Deutsches Primatenzentrum, Göttingen, ²Abteilung Anthropologie, Universität Mainz & ³Institut für Zoologie und Anthropologie, Universität Göttingen, D; lgroene@gwdg.de

Madagascar is one of the top global biodiversity hotspots with extremely high endemism rates for both flora and fauna. The diversity of endemic primates is higher than previously assumed. Especially within the small and nocturnal taxa a number of new species have lately been described; in part due to new molecular methods, but also through reexaminations of museum specimen. In our study we want to characterize the genetic diversity within the genus *Cheirogaleus*, currently consisting of up to seven species. We will assess the phylogenetic relationships of the sampled populations, test present phylogeographic hypotheses and possibly outline recommendations for conservation management. For this purpose, we have chosen a maternally (cytochrome b) and a paternally (SNPs on the Y chromosome) inherited marker, in order to analyze effects of female and male migration and gene flow. New insights into cheirogaleid diversity will be presented, including phylogenetic reconstructions based on cytochrome b sequences.

Talk: Remarkable genetic diversity among the populations of the golden-brown mouse lemur, (*Microcebus ravelobensis*), in North-western Madagascar

Katerina Guschanski, Gillian Olivieri & Ute Radespiel

Institut für Zoologie, Tierärztliche Hochschule Hannover, D;
ute.radespiel@tiho-hannover.de

The exceptionally high diversity of Malagasy flora and fauna has long been known but is still underestimated. Nowadays the wide use of molecular methods allows identifying unexpected genetic splits that may lead, for example, to the discovery of cryptic species. The golden-brown mouse lemur, *Microcebus ravelobensis*, is a nocturnal lemur that has been classified as endangered. Its assumed distribution range comprises only north-western Madagascar where its habitats are heavily threatened by deforestation. Using the mitochondrial D-loop as a genetic marker we analyzed 114 samples from nine populations sampled from the northwestern biogeographic zone in order to investigate the levels of genetic differentiation over the whole distribution range of this species. We paid special attention to populations sampled from continuous forests versus isolated forest fragments, as well as to the isolating effects of the two big rivers Mahajamba and Sofia that subdivide the North-west into three inter-river systems. We found that all populations from isolated forests fragments were strongly differentiated and also genetically depleted, showing only few unique haplotypes, whereas populations from continuous forests displayed higher genetic diversity and shared haplotypes in some cases. Furthermore, the rivers Mahajamba and Sofia induce high levels of genetic differentiation among the populations that are comparable to those seen on the species level within the genus *Microcebus*. We thus argue that we have detected a deep and so far unknown phylogenetic split within the genus *Microcebus* that coincides with the three inter-river systems in northwestern Madagascar. Due to the strong genetic differentiation revealed by the mitochondrial marker the three inter-river systems need to be treated as distinct management units and deserve separate and intensified conservation efforts.

Talk: Sound transition and its implication for the assessment of acoustic features

Kurt Hammerschmidt & Julia Fischer

Forschergruppe Kognitive Ethologie, Deutsches Primatenzentrum, Göttingen, D;
kurt.hammerschmidt@dpz.gwdg.de

Different habitats differ in terms of background noise and lead to differences in signal attenuation and reverberation. A number of studies have explored the design of acoustic signals in relation to the habitat the animal lives in. However, little is known about the effects of different habitat characteristics, i.e. varying recording conditions, on the reliability of the assessment of different acoustic features in acoustic analyses. To describe the acoustic features of animal sounds, quantitative computer-based analyses are common. They rely on various algorithms to extract different features of the amplitude waveform or, more commonly, from the frequency-time matrix. In addition, an increasing number of studies used linear prediction (LP) analyses to extract the formant frequencies. To assess the reliability of the determination of different acoustic features in relation to different recording conditions we broadcasted and rerecorded a set of different call types from Barbary macaques (*Macaca sylvanus*). Specially, we examined the influence of habitat type (open field or deciduous forest), broadcasting height, and recording distance on the

reliability of variable determination. First, we could confirm the already known influences of habitat type and broadcasting distances on amplitude and frequency-specific attenuation. Further, we found that the reliability of the determination of acoustic features was highly dependent from the structure of the call types. Fundamental frequency measures worked well with sounds with a high fundamental or at higher broadcasting heights. Linear prediction analyses mostly failed because the call types of Barbary macaques had no appropriated structure to get a meaningful result. Peak frequency measures were the most reliable acoustic features. Because perceptual mechanism should also favor those sound parameters, which are more resistant to propagation related changes of an acoustic signal, the results have also implications for the search for meaningful acoustic features.

Poster: Assessing stress in primates using faecal glucocorticoids: the importance of validation

Michael Heistermann¹, Rupert Palme² & Andre Ganswindt¹

¹Abteilung Reproduktionsbiologie, Deutsches Primatenzentrum, Göttingen, D & ²Institut für Biochemie, Abteilung Naturwissenschaften, Veterinärmedizinische Universität Wien, A; mheiste@gwdg.de

To date, most studies using faecal glucocorticoid measurements for assessing adrenocortical activity as part of the stress response in primates have relied on a specific cortisol or corticosterone assay. Since, however, these native glucocorticoids are virtually absent in the faeces of most vertebrates, including primates, the validity of this approach has recently been questioned. The aim of this study was therefore to compare the suitability of a specific cortisol and corticosterone assay with that of two group-specific assays developed to measure a variety of faecal glucocorticoid metabolites (GCM) for monitoring adrenocortical activity from faecal samples in 6 selected primate species of the major taxa (sifaka, marmoset, long-tailed macaque, Barbary macaque, chimpanzee, gorilla). Using physiological stimulation of the hypothalamo-pituitary-adrenal axis by administration of exogenous ACTH or performance of anaesthesia we demonstrate that at least two assays detected the predicted increase in faecal GCM levels in response to treatment in each species. The magnitude of response, however, varied between assays and species and none of the assays was applicable to all species. While the faecal corticosterone assay was generally of only limited suitability for assessment of glucocorticoid output, the cortisol assay was of value in those species which, according to HPLC analysis data, excreted clearly detectable amounts of authentic cortisol into the faeces (marmoset, long-tailed macaque, gorilla). In contrast, in species in which cortisol was virtually absent in faeces group-specific assays provided a much stronger signal, and these assays also performed well in all other species tested (except the marmoset). The data suggest that the reliability of a given faecal glucocorticoid assay in reflecting adrenocortical activity in primates depends on the species in question. They also indicate, however, that group-specific assays appear to have a high potential for cross-species application. Nevertheless, whatever GC antibody is chosen, our study clearly reinforces the necessity of appropriately validating the respective assay system before its use.

Talk: Environmental enrichment objects for the improvement of locomotion of caged rhesus macaques (*Macaca mulatta*)

Judith Heller-Schmidt¹, Roland Plesker¹ & Hansjoachim Hackbarth²

¹Paul-Ehrlich-Institut, Langen & ²Institut für Tierschutz und Verhalten, Stiftung Tierärztliche Hochschule Hannover, D; plero@pei.de

This study focussed on two aims: first, to examine whether the locomotion behaviour of caged rhesus macaques at the Paul-Ehrlich-Institut was reduced compared to rhesus macaques in their natural environment. Second, to investigate whether locomotion of caged rhesus macaques could be improved by using two locomotive objects: tread-mill and rotary barrel. For this purpose two groups of caged laboratory monkeys (5/6 individuals, mixed sex and age) were used. A time schedule revealed that the reduction of locomotion in caged rhesus monkeys was considerably less than expected compared to free living individuals. Using either a metal treadmill or a rotating wooden barrel, both objects were able to increase the locomotion of the examined groups. Although all animals used both, the wheel and the barrel, the adult animals did so to a considerably lesser extent than the young monkeys. None of the objects were used preferentially. A continuous supply of the objects, as opposed to a discontinuous supply, did not influence the frequency of use. A frequently available object remained of steady interest. The increase in locomotion due to the objects resulted in both a reduction in social interaction and in aggressive behaviour.

Talk: Olfactory discrimination in the gorilla

Peter Hepper, Deborah Wells & Patrick McArdle

School of Psychology, Queen's University of Belfast, UK; p.hepper@qub.ac.uk

Great apes have reduced brain volume in those areas dealing with olfactory stimuli relative to other brain areas. This has led to a view that the olfactory abilities of great apes are so diminished as to provide little useful information and hence odours have little functional significance in these species. This study forms part of a programme of work examining olfactory abilities and functions in the western lowland mountain gorilla (*Gorilla gorilla gorilla*). Study 1 examined the ability of the gorillas (n=6) to detect and discriminate familiar and unfamiliar food odours placed, either on existing structures or on new objects, in their cage. When the odours were placed on existing structures, only familiar odours were responded to. However when placed on new objects in the cage, e.g. cloths, subjects displayed more investigation for both odour types compared to unscented cloths. Subjects habituated to the odours, evidenced by decreased handling and nose contact, and when replaced with a novel odour subjects increased handling and nose contact indicating they had detected and discriminated the novel odour. Gorillas possess apocrine and eccrine glands and, to the human nose, produce a distinct smell. In common with other animals that emit odours this may be used in social recognition. A second study examined individual odour recognition in the gorilla (n=6) using body odours obtained from the gorillas on absorbent cotton cloths. These were able to be discriminated at

the level of the individual by humans and dogs. Importantly, using a habituation paradigm, the odours were able to be individually discriminated by the gorillas themselves. The study reveals gorillas have a functioning olfactory sense that is able to perform fine olfactory discriminations and that the environmental context may determine the role of olfactory cues in any given situation.

Talk: Multilevel modelling of behavioural change in mother-offspring relationships: developmental pathways, partner contribution and continuity

María Victoria Hernández-Lloreda¹ & Fernando Colmenares²

¹Departamento de Metodología de las Ciencias del Comportamiento & ²Departamento de Psicobiología, Facultad de Psicología, Universidad Complutense de Madrid, E; vhlloreda@psi.ucm.es

Social relationships are inherently dynamic. The level of change is especially dramatic in the early ontogeny of mother-offspring relationships, when mothers in mammals in general and in primates in particular are heavily involved in the care of their offspring. This paper presents a summary of our recent work aimed at applying multilevel statistical methods to come to terms with the nature of behavioural change in early mother-offspring relationships in non-human primates. The utility of the multilevel analysis techniques described for unravelling principles of behavioural and relationships change is illustrated by applying them to examples on the time course of mother-offspring interactions in a colony of hamadryas baboons (n = 23 pairs, 100-220 waves of data pooled by two-week age blocks, from birth to 380 days of life). First, multilevel models allow estimating each individual's developmental trajectory, a group's average development trajectory, individual variation around the average trajectory, and the analysis of the correlates of developmental change. Second, the piecewise version of multilevel models can be useful to explore the occurrence of discontinuities in developmental pathways that is when a major reorganization in the outcome-process relationship takes place. Finally, multivariate multilevel models can help tease apart and relate the joint contribution of each partner to the course of their ongoing relationship. The various multilevel techniques described in this work represent powerful statistical tools for investigating and adequately testing hypotheses that seek to understand developmental change and their underlying processes.

Poster: Usage of gestures in Barbary macaques

Nana Hesler, Roger Mundry, Julia Fischer

Forschergruppe Kognitive Ethologie, Deutsches Primatenzentrum, Göttingen, D; nhesler@dpz.gwdg.de

Gestural communication in monkeys has received relatively little attention compared to their vocal communication. In this study we investigated the usage of facial

expressions, manual gestures and body postures (hereafter "gestures") in Barbary macaques (*Macaca sylvanus*). We conducted focal observations on 12 focal animals living in the monkey park "La Forêt des Singes" in Rocamadour, F. We determined individual rates of gesture usage and found significant differences related to dominance rank for several patterns. However, we identified only one significant difference in signal usage between the sexes. Facial expressions turned out to be the most frequently used signal category. In order to develop a better understanding of the signals' functions, we analysed the immediate responses of the receivers to the various signals. We found that regulation of inter-individual distances is likely to be a major function of several gestures. Since flexible gesture usage has frequently been linked to the question of intentional signalling, we also investigated how the animals combined different signals. The analyses revealed that several gestures were combined with different other gestures, indicating a certain degree of flexibility in signal usage.

Talk: The Bili chimpanzees - are they special?

Thurston C. Hicks

Universiteit van Amsterdam, NL

The apes inhabiting the forest/savanna mosaic NW of Bili, DRC, have in recent years found themselves at the centre of much international media attention. Sensationalistic and premature reports to the press that these apes are possibly a new species of giant chimpanzee, or even a chimpanzee-gorilla hybrid, and that they seem to show particularly aggressive behaviour, have led to much confusion and speculation. Over the past year a systematic study of the Bili apes was undertaken, including over 12 hours of direct observation and contact time, in addition to more than 100 km of transect work. Genetic analysis in combination with field observations has shown that this is unambiguously a population of Eastern chimpanzees (*Pan troglodytes schweinfurthii*), but it is no less an interesting one for that. I shall present preliminary results on a new chimpanzee culture, including: ground nesting; the use of ant dip sticks to acquire two different species of ants (for one of which exceptionally long tools are fabricated); and the use of buttresses, roots, and rocks as a substrate for the pounding open of termite mounds and turtle shells. Evidence for the possible large body size of some of these chimpanzees is discussed. Preliminary findings from the extensive transect work are presented, and their implications for chimpanzee conservation are discussed. Finally, comparisons are made of the reactions towards observers of chimpanzees living near to and far from human villages.

Poster: 4 years of rainforest baboons at Gashaka

James Higham¹, Caroline Ross¹, Ymke Warren¹, Ann MacLarnon¹, Volker Sommer² & Jeremiah Adanu^{3}*

¹Centre for Research in Evolutionary Anthropology, Roehampton University, ²Department of Anthropology, University College London, UK & ³Department of Forestry and Wildlife, Federal University of Technology Yola, Adamawa State, Nigeria; j.higham@rus.roehampton.ac.uk

Baboons (*Papio* spp.) are the most successful and ubiquitous African primate, renowned for their behavioural and reproductive flexibility. These qualities have enabled them to extend their range into a wide variety of habitat types over much of Africa, including desert, savannah and forest environments. Despite this they appear to be excluded from the wet, forested areas of Central and West Africa. Here we present four years of demographic data from a group of *Papio anubis* inhabiting lowland rainforest and guinea savannah mosaic at the southern-most tip of the Anubis range. Rainfall in the study area is high, averaging over 1900 mm and reaching a maximum of over 2300mm per annum, making it by far the wettest baboon site studied to date. Infant mortality in the study group (Kwano troop) is high, and these deaths are clustered in time, suggesting localised outbreaks of disease. Deaths are more likely to occur during the rains (April-October). Age at death varied from 0 - 9 months. Data from a sympatric group of baboons (Gashaka troop) that supplement their diet by crop raiding show substantially lower infant mortality, demonstrating that improved nutrition may help to buffer against environmental conditions. This suggests that the clearing of forests in Central and West Africa for agricultural land may allow baboons to extend their range into regions from which they are currently excluded.

Talk: Life history traits and infant care in red-tailed sportive lemurs (*Lepilemur ruficaudatus*)

Roland Hilgartner^{1, 2}, Dietmar Zinner³ & Peter M. Kappeler^{1, 4}

¹Abteilung Verhaltensökologie und Soziobiologie, Deutsches Primatenzentrum, Göttingen, ²Abteilung Experimentelle Ökologie, Universität Ulm, ³Forschergruppe Kognitive Ethologie, Deutsches Primatenzentrum, Göttingen & ⁴Institut für Zoologie und Anthropologie, Universität Göttingen, D; hilgartner@gmx.de

Red-tailed Sportive lemurs (*Lepilemur ruficaudatus*) are small nocturnal folivorous lemurs that are socially organized in pairs. Pair-living, which is difficult to explain in mammals, has been explained as a result of the importance of direct paternal care (e.g. guarding of sleeping holes or infant warming) in closely related Fat-tailed dwarf lemurs (*Cheirogaleus medius*). The aim of this study was to collect basal life history data for *L. ruficaudatus* to test the direct infant care hypothesis. Between 2000 and 2005, a total of 14 pairs of sportive lemurs were captured and radio-collared in Kirindy forest, western Madagascar. In nine pairs behavioural and spatial data were collected during simultaneous focal observations of both pair partners. Examination of vulval morphology and male mate guarding behaviour allowed us to identify the onset and end of the annual mating season. In 2003 and 2004 all mating activity was limited to the months of May and June. After about five months of gestation, which is much longer than expected for a lemur of this body mass, singletons were born in November. Infants were carried by mothers in the mouth and never left behind in their daytime sleeping holes; instead, they were parked in dense vegetation. Lactation lasted about 50 days, during which males were rarely observed in close proximity to infants and never observed to groom or carry the infants. Our data indicate that direct infant care did not play a role in the evolution of pair

living in Red-tailed Sportive lemurs. Instead alternative hypotheses for pair living, such as resource defence, female defence, mate guarding or infanticide avoidance need to be tested.

Talk: Foraging in agent baboons: a preliminary model

Russell Hill¹, Bill Sellers² & Brian Logan³

¹Evolutionary Anthropology Research Group, Department of Anthropology, University of Durham, ²Department of Human Sciences, Loughborough University & ³School of Computer Science and Information Technology, University of Nottingham, UK; r.a.hill@durham.ac.uk

An efficient foraging strategy is an essential element of any animals' behaviour, since without access to adequate energy reserves an individual's ability to reproduce successfully might be significantly compromised. As a consequence, animals are anticipated to forage so as to maximise their rate of nutrient intake. Here we present data on the foraging patterns of the chacma baboons (*Papio hamdryas ursinus*) at De Hoop Nature Reserve, South Africa. We then introduce an agent-based model of baboons foraging in the De Hoop environment. The output of this model is contrasted with the data and explanations for the deviations from the observed data are presented alongside the results of a sensitivity analysis evaluating the key parameters within the model. Finally, the utility of agent-based modelling in studies of primate behaviour is discussed.

Talk: Is regurgitation and reingestion of food a potentially injurious behaviour in western lowland gorillas (*Gorilla gorilla gorilla*)?

Sonya P. Hill

Department of Veterinary Medicine, University of Cambridge, UK;
research@chesterzoo.org

It is known that animals that have to resort to potentially injurious measures to fulfil their needs for behaviour and resources have poorer welfare than do animals that can use more appropriate coping strategies. Similarities have previously been drawn between an eating disorder known as human rumination syndrome (HRS) and an abnormal behaviour that may be observed in captive gorillas and other apes, regurgitation and reingestion of food or faeces (R/R); R/R has never been observed in wild gorillas. It can be reduced in some captive apes by using a variety of enrichment efforts, including those related to a more complex feeding environment that more closely mimics the opportunities for feeding and foraging in the wild. Whilst it is known that HRS has potential consequences for health, including clinical problems of dental erosion, oesophageal motor disorders, ulcers, oesophageal strictures and pulmonary aspiration, very little is known about the consequences of R/R. For example, prior to this study it was not known if apes regurgitate stomach acids with the food, as occurs in HRS patients. Health problems such as dental erosion and skin

sores have been reported anecdotally in gorillas known to do R/R, but the causal factors have not yet been identified. In this study, the acidity of food regurgitated by gorillas was measured non-invasively and compared with the acidity of the meal that was ingested prior to R/R. Saliva samples were also measured non-invasively for pH. Results showed that regurgitated food has a lower pH than both the original meal and saliva, indicating that stomach acids are also being regurgitated. R/R should be considered potentially injurious in captive apes, as is the similar condition of HRS in humans. Captive ape facilities should take measures to try to reduce the frequency of R/R and to monitor the potential effects of this behaviour on ape health in the long-term.

Talk: Female contributions to harem formation and maintenance in hamadryas baboons (*Papio hamadryas*)

Christine Hrubesch^{1,2}, *Hans Winkler*² & *Signe Preuschoft*¹

¹hopE - home of primates Europe, Gänserndorf & ²KLIVV - Konrad Lorenz Institut für Ethologie, Wien, A; christine_hrubesch@gmx.at

Females within hamadryas harems are considered non-bonded, and this is in contrast to all other baboons, geladas and macaques. As males are habitually using aggressive herding techniques it is plausible that harems are the product of male coercion of females. Our study was designed to solve a practical problem of captive management but it revealed important contributions of the females to the social system: We introduced six males to 15 females that had previously lived together in one large harem. Observations covered one month in the original harem, the first seven months in the new groups, and a follow-up two years later. At the onset of group formation we conducted a female choice experiment during which males were restrained in individual cages, and females were permitted to move freely between males. Females did show significant preferences for individual males by socio-positive interactions and proximity. After introduction to these males, females neglected female-female relationships in favour of seeking proximity to their new harem males. The degree of preference for a male that a female had shown correlated significantly with cross-sexual proximity within the harem units. Females spontaneously approached males and actively maintained proximity with them. Males frequently used non-aggressive herding techniques that we labelled "enticing". However, female-female bonds also influenced female harem membership. Moreover, females who had many female friends in their harem sought proximity to their harem male more than those with fewer or without female friends. In sum, female hamadryas baboons did show initiative in forming and maintaining bonds with individual males and female-female bonds did influence harem membership and female-male proximity. We hypothesize that while association with a male is top priority to hamadryas females, female-female competition for access to a harem male can be minimized when females establish friendly relationships with each other.

Talk: Helping in co-operatively breeding moustached tamarins

Maren Huck, Petra Löttker & Eckhard W. Heymann

Abteilung Verhaltensökologie und Soziobiologie, Deutsches Primatenzentrum, Göttingen, D; mhuck@dpz.gwdg.de

Various hypotheses about adaptive and non-adaptive mechanisms of non-parental infant care have been put forward for different taxa (Emlen et al., 1991). The Neotropical callitrichine primates are renowned for their co-operative care of the twin litters. We studied two groups of wild moustached tamarins, *Saguinus mystax*, with known genetic relationships over a one-year period to examine individual time-budgets and contributions to infant carrying and food-transfer. With these data we tested whether helping behaviour might be a non-adaptive trait and, if not, whether indirect benefits via kin-selection could be excluded as an evolutionary force maintaining it. Some hypotheses on direct fitness benefits were discussed as far as (anecdotal) data permitted. Changes in time-budgets suggest costs, thus clearly refuting hypotheses assuming non-adaptivity. High within-group relatedness suggests kin-selection to be one driving force of maintaining the trait. However, non-parental individuals may help despite low relatedness. Data were not sufficient to decide which possible direct benefits most likely play a role in inducing non-relatives to help. Yet, two (non-exclusive) explanations seem to be the most probable ones: The chance to inherit the main-breeding position, and a certain chance of own direct reproductive success (the latter only for male helpers) due to polyandrous mating by the female. Other adaptive mechanisms may enhance benefits but are unlikely to be major selective forces since fitness gains are presumably rather small or uncertain. Possible incentives for different reproductive classes to help, or to permit residence or matings of other members (for potential breeders/non-breeders and breeders, respectively) are briefly discussed.

Poster: Proximate maintenance of the genetic mating system of moustached tamarins

Maren Huck, Petra Löttker & Eckhard W. Heymann

Abteilung Verhaltensökologie und Soziobiologie, Deutsches Primatenzentrum, Göttingen, D; mhuck@dpz.gwdg.de

In moustached tamarin (*Saguinus mystax*) groups, the single breeding female mates polyandrously with most or all non-related adult males. Nonetheless, paternity is monopolized in many groups by a single male. The proximate mechanisms of monopolization are poorly understood. The aim of this study was to investigate the possible impact of endocrine inhibition, agonistic interactions and mate guarding on monopolization of paternity in male moustached tamarins. Furthermore, we evaluated likely costs of these behaviours and whether olfactory cues might be used for its timing. We used behavioural data on proximity, agonistic interactions, time-budgets, and scent-marking behaviour from two groups of wild *S. mystax*, studied over a 1-year period, to answer these questions. Results suggest that neither endocrine in-

hibition nor direct agonistic competition play a prominent role. However, fertile females were consorted in some periods by one male, the sire of the previous and next litter. Consorting was instigated nearly exclusively by the male. It probably occurred during the female's periods of highest fertility and is thus likely to function as mate guarding.

Talk: Activity budget, proximity and space utilisation in three groups of former laboratory chimpanzees (*Pan troglodytes*)

Elfie Kalcher¹, Signe Preuschoft², Karl Crailsheim¹ & Cornelia Franz¹

¹Institut für Zoologie II, Karl-Franzens-Universität Graz & ²hopE – Home of Primates Europe, Gänserndorf, A; cornelia.franz@uni-graz.at

It is to be expected that chimpanzees in laboratories or zoos exhibit behavioural profiles deviating from those of wild chimpanzees, because rearing conditions, group composition, and availability of food and space are different. We investigated activity budgets, proximity to conspecifics, and space utilisation of 18 adult ex-laboratory chimpanzees in three groups of different composition: an all-male group (AM), a one-male bisexual (MS1) and a two-male bisexual group with three immatures (MS2). Group members differed in age, had different rearing conditions, and had spent different lengths of time in social deprivation. We expected more similarity to free-living chimpanzees in groups with a composition comparable to the age-graded bisexual parties in the wild, and in individuals who had more social experience and spent less time in social deprivation. The presented results are based on five-minute scan samples of three days per group. In comparison to data from the wild (Prütz & McGrew, 2001), the rehabilitated chimpanzees considered in our study rested more (range 24-29 %), showed more self-directed behaviour (9-21 %), and less feeding (3-8 %), and locomotion (5-8 %). Abnormal behaviours not observed in free-living chimpanzees occurred in 8-14 % of the scans. As expected, the MS2 group engaged in social interactions much more than the other groups. The proportion of time spent within 5 m was significantly higher in MS2 group (22.3 %) compared to either the MS1 (6.1 %) or AM (5.4 %) group. In line with these results, MS2 group members spent much time together in one preferred place, while members of the other groups distributed themselves more evenly in their enclosures, and altogether moved about less. However, the difference between older and younger individuals suggests that besides group composition also the duration or degree of past social deprivation continues to influence the behavioural profiles of ex-laboratory chimpanzees once rehabilitated.

Talk: Ectopic epithelial structures in the heart of cynomolgus monkey (*Macaca fascicularis*)

Joachim Kaspareit, Stefanie Friderichs-Gromoll, Eberhard Buse, Gunnar Habermann & Friedhelm Vogel

Abteilung Pathologie, Covance Laboratorien, Münster, D; Joachim.kaspareit@covance.com

Ectopic epithelial structures of the heart are exceedingly rare in man. All reported cases are cysts lined by different types of epithelium. Only approximately 25 cases have been published in the past 100 years. These cysts were lined by a cuboidal, columnar or squamous epithelium. They were observed either at necropsy of aborted and stillborn infants with further developmental malformations or as accidental findings at necropsy of elderly people that died due to other primary diseases. In animals cardiac epithelial lined cysts have only been observed in B6C3F1-mice and a tawny frogmouth which died in a zoo. Squamous cysts, squamous epithelial plaques and fluid filled epithelial cysts were observed in a total of sixty-one cynomolgus monkeys. Fifteen monkeys had exclusively squamous cysts, six revealed squamous cysts together with squamous plaques, thirty-six had exclusively squamous plaques, two had only fluid filled epithelial cysts, one had a squamous plaque and a fluid filled epithelial cyst and one exhibited all three types of epithelial structures. At necropsy, only squamous cysts were recognized as yellow-white nodules with a smooth surface that were located superficially along the interventricular septum, on the surface of the left ventricle or the apex of the heart. Microscopically, cysts were lined by a flattened epithelium and filled with keratin. A thin layer of connective tissue was present under the epithelium. Occasionally the epithelium was multi-layered or replaced by a rim of foreign body-type multinucleated giant cells. In one animal the cyst was filled by keratin, multinucleated giant cells and other inflammatory cells, while in another the keratin was mineralised. Squamous plaques were located on the surface of the heart or directly under the cardiac surface. Single plaques revealed a small central lumen or keratinisation. Keratinisation always provoked an inflammatory response of the surrounding tissue. Fluid filled epithelial cysts, seen in only four animals, were lined by a simple flat epithelium. All animals with squamous cysts came from Mauritius. Although those with squamous plaques came from Mauritius, China, D and Vietnam, the great majority of these animals (thirty-one of thirty-six) was bred in Mauritius.

Talk: Dominance Style and facial expressions of pigtail macaques (*Macaca nemestrina*)

Katharina Kienast & Signe Preuschoft

hopE – Home of Primates Europe, Gänserndorf, A; katharina_kienast@gmx.at

Earlier studies on laughter and smile-homologues in different species of macaques showed that species with a strict dominance style used morphologically distinct expressions in equally distinct contexts of submission, affiliation and play, whereas species with more relaxed dominance used morphological blends of the displays in overlapping contexts (Power Asymmetry Hypothesis: Preuschoft & van Hooff, 1995). However, in these studies phylogenetic relationships between species were inseparable from differences in dominance style. In the present study on pigtailed macaques it is possible to distinguish between these predictors, and we hypothesised that dominance style and not phylogeny is the driving force determining the social function of laughter (open-mouthed displays) and smile (silent bared-teeth display). Between November 2003 and April 2004 we collected 18 h of focal animal data on each

of 12 pigtail macaques living in one group at hopE, A. Results are based on analyses of interaction and intra-sender behavioural sequences, and on analyses of sender-receiver matrices. Dominance style was assessed by a set of criteria cf. de Waal & Luttrell (1989). We found that the dominance style of our group of pigtails was indistinguishable from a despotic, but significantly different from a relaxed dominance style. Pigtails used smiles uni-directionally, while avoiding and appeasing dominant group members, and never in affiliative interactions. Laughter faces took the form of the classical relaxed open-mouth play face. They were exchanged bi-directionally, solely in the context of contact play, and mainly by immatures. The social function of laughter and smile-displays in pigtails was thus very similar to that of the remotely related, despotic long-tailed macaques while contrasting sharply with that of the closely related but egalitarian Tonkean or lion-tailed macaques. We conclude that dominance style not phylogeny is the cause for motivational shifts in homologous facial displays.

Poster: Social relationships in zoo-living bonobos, *Pan paniscus*

Stefanie Kießling^{1, 2}, *Werner Kaumanns*¹, *Daniel Haase*¹ & *Dorothee Claßen*¹

¹Arbeitsgruppe Primatologie, Kölner Zoo & ²Universität Ulm, D;

stefanie.kiessling@gmx.de

This study is part of an ongoing project which investigates patterns and mechanisms of social relationships in captive Bornean orang-utans and bonobos. These species are assumed to live in fission-fusion systems in the wild. Field studies reveal that bonobos forage and travel in unstable parties. Individuals may form a party for hours or days and leave each other again. Patterns and proximate causes of splitting processes have not been studied intensively so far. The study presented here starts from the assumption that bonobos may have an "intrinsic motivation" and a "need" for social changes which makes it difficult for them to stay together constantly. Local food supply and other ecological factors as discussed by other authors should not play the only role. Captive studies may provide models and hypotheses. Our study focuses on social and spatial relationships in three zoo-living groups of bonobos kept under different conditions.

We investigate and compare a stable group in a medium sized enclosure in Cologne Zoo, a stable group in a large enclosure in Planckendael Zoo and a group at Frankfurt Zoo that is kept under limited spatial conditions but in an artificial fission-fusion system.

It is expected that there are group-specific changes in the interactive and spatial behaviour of the individuals after a period of staying as a party of a given composition, indicating fission–fusion tendencies. We expect that in groups with unchanged composition over long periods of time behavioural problems and serious conflicts may emerge. Preliminary results from the Cologne group and the Frankfurt colony will be presented. They support our hypotheses.

Poster: Re-establishment of interspecific associations after separation – effect of group size on initiation of contact in mixed-species troops of *Saguinus fuscicollis* and *Saguinus mystax*

Christof Koch^{1,2} & Eckhard W. Heymann²

¹Abteilung Soziobiologie und Anthropologie, Universität Göttingen & ²Abteilung Verhaltensökologie und Soziobiologie, Deutsches Primatenzentrum, Göttingen, D, ckoch1@gwdg.de

The objective of this study was to investigate the influence of group size on initiation of contact after separation of mixed-species troops of saddle-back tamarins, *Saguinus fuscicollis*, and moustached tamarins, *Saguinus mystax*. The study was carried out on three mixed-species troops at Estación Biológica Quebrada Blanco, Loreto, Peru. If one of the benefits of association is increased group size, it can be hypothesised that members of the species that contributes the smaller number of individuals to an association derive a larger benefit. It is therefore predicted that they invest more into the establishment of association after leaving sleeping sites in the early morning. As a quantitative measure for this investment, the emission of the first long call in the morning after leaving the sleeping site was chosen in this study.

Both species engaged in counter-calling prior to establishment of association on most of the days. *S. mystax* called first more frequently in all three mixed-species troops, independent of whether *S. mystax* contributed the smaller number of individuals or not. Thus, results showed no general effect of group size. Only for one troop (troop E) with the smallest proportion of *S. mystax*, the result was significant in the predicted direction, suggesting that group size may play a role here. With group sizes of both species ranging between four and eight individuals in this study, however, the difference in benefits gained through an increase in group size may not be sufficient to result in a measurable behavioural effect.

Talk: Ground nesting in the chimpanzees of the Nimba Mountains, Guinea, West Africa: environmental or social?

Kathelijne Koops¹, Tatyana Humle², Tetsuro Matsuzawa³ & Liesbeth Sterck¹

¹Department of Behavioural Biology, Utrecht University, NL, ²Department of Psychology, University of Wisconsin, USA & ³Primate Research Institute, University of Kyoto, J; k.koops@students.uu.nl

Nest building is a behaviour reported for all chimpanzee (*Pan troglodytes*) populations studied in the wild. Occasional construction of ground nests has been reported at several study sites. Chimpanzees (*P. t. verus*) in the Nimba Mountains, Guinea, West Africa, frequently construct nests on the ground, which can be as elaborate as tree nests. However, no studies to date have addressed the underlying factors influencing the occurrence of this behavior. This study focuses on examining the environmental variables that may account for the relatively high frequency of ground nesting among the unhabituated chimpanzees of the Nimba Mountains. Two hypotheses proposed to explain ground nesting are considered: 1) a lack of appropriate

nesting trees in areas where chimpanzees nest (e.g. steep slopes) results in the construction of ground nests, 2) climatic conditions, such as high wind speeds at high altitudes, may drive the chimpanzees to nest on the ground. This effect is expected to be stronger during the dry season due to the seasonal variation in wind speed. In order to test these two hypotheses we explore the effects of season, altitude, slope and tree availability on the proportion of nests constructed on the ground. Data collection took place between August 2003 and May 2004. Nesting data were collected monthly along transects as well as *ad libitum*. Quadrats (20 x 20 m) were constructed around ground nests in order to assess tree availability (tree density, tree size, tree species). Two fixed weather stations, at low and high altitude, provided data on daily rainfall and maximum wind speed. The environmental variables considered were not found to affect the occurrence and distribution of ground nests. Neither of the two environmental hypotheses was thus supported. Our results suggest that the underlying factors for ground nesting in the Nimba chimpanzees may be social rather than environmental.

Talk: Is consolation consoling? Post-conflict third party affiliation in captive chimpanzees

Sonja E. Koski & Liesbeth Sterck

Behavioural Biology, Utrecht University, NL; S.E.Koski@bio.uu.nl

Post-conflict third party affiliation has been described in various species. In most species, such contacts are initiated by former conflict opponents and directed to bystanders not involved in the previous conflict. However, in chimpanzees, bonobos and stump-tailed macaques post-conflict affiliation is initiated by a third party. This behaviour has been labelled as consolation. Consolation is presumed to alleviate stress in conflict participants, reduce the chance of receiving further aggression, and possibly substitute reconciliation when reconciliation with the opponent is too risky or not worthwhile. However, the suggested functions of consolation have thus far not been rigorously tested. It is unclear whether consolation indeed alleviates post-conflict stress and whether it functions as a substitute for reconciliation.

We investigated post-conflict third party affiliation in a chimpanzee (*Pan troglodytes*) colony at the Arnhem Zoo, NL, over a two-year period (June 2002-August 2004). We examined the hypothesis of consolation being a substitute for reconciliation by comparing triadic contact tendencies (TCT) and corrected conciliatory tendencies (CCT) of individuals and of sex classes, and assessed whether or not consolation occurs in the absence of reconciliation. In addition, we examined kinship of consolers in relation to consoled individuals and to opponents, as affiliation with opponent's kin may be another form of reconciliation. Furthermore, we examined the effect of consolation on stress alleviation. This study is the first one to address the effect of consolation in detail. We will discuss the implications of our results and shed new light on the effect and function of consoling behaviour.

Talk: Selectivity in baboon diet and implications for tree regeneration: considering fruit and seed size within a single plant species

Britta K. Kunz & K. Eduard Linsenmair

Abteilung Tierökologie und Tropenbiologie, Theodor-Boveri-Institut für Biowissenschaften, Universität Würzburg, D; kunz@biozentrum.uni-wuerzburg.de

While studies on fruit selection by primates mainly related fruit choice between plant species to specific fruit traits or (anti)nutritional values, selectivity within a single plant species has received little attention. However, many plant species show considerable inter- and intra-individual variation in fruit and seed size, thus offering the possibility for selection by frugivores. We investigated crop removal rates, and choice in fruit and seed size of the African locust bean (*Parkia biglobosa*, Mimosaceae) by olive baboons (*Papio anubis*) in the Comoé National Park (CNP), northern Ivory Coast.

P. biglobosa, a large savannah tree, is one of the most important edible wild plant species for humans in West Africa. Its pods are up to 35 cm long and each pod contains 5-20 seeds. In CNP, olive baboons are the most relevant consumers of *P. biglobosa*, acting both as seed predators and dispersers for the tree. Which *P. biglobosa* seeds are likely to be preyed upon or dispersed, respectively, seems to depend mainly on seed number and seed size. Pulp-seed ratio in unripe and ripe *P. biglobosa* fruits is disadvantageous for baboons. Unripe seeds, which are digested, account for only 10 % of the unripe fruit mass, while indigestible ripe seeds make up 28 % of the ripe fruit mass. With these constraints, baboons optimise their food gain by preferring unripe fruits containing a high number of large and heavy seeds. As a result, only fruits with fewer and smaller seeds remain for maturation. Subsequently, baboons exploit mature pods with more seeds to a greater extent than ripe pods with fewer seeds. They increase their net intake of fruit pulp by selecting ripe fruits containing the smallest seeds. As a consequence, *P. biglobosa* fruits with an intermediate seed number and small seeds contribute the most to successful dispersal by olive baboons.

Poster: Self-awareness and mirror reactions of cotton-top tamarins, *Saguinus oedipus*

Yvan Lledo-Ferrer, Carlos Gil-Burmann, Fernando Peláez & Susana Sánchez

Departamento de Psicología Biológica y de la Salud, Facultad de Psicología, Universidad Autónoma de Madrid, E; yvan.lledo@uam.es

To date, humans, chimpanzees, bonobos and orang-utans are the only primate species to show mirror self-recognition. Despite Hauser et al.'s (1995) claim for mirror self-recognition in cotton-top tamarins, *Saguinus oedipus*, no study has been able to replicate this finding. Eight cotton-top tamarins housed in three family groups at the Universidad Autónoma de Madrid were tested. We video-taped 15 hours of mirror exposure, using a two-way mirror. The tamarins did not react aggressively toward their mirror image, even in their first exposure to the mirror. Sur-

prisingly, two reproductive males directed tongue flicking with head shaking to their reflection 61 times. This behaviour was seen without piloerection, frowning, and vocalizations, and in one male was accompanied by penis erection. None of the individuals passed the mark test nor showed evidence of self-recognition, but they showed some behaviours corresponding to an earlier stage of mirror self-recognition, such as understanding of mirror correspondence (locating other animals using the mirror) and contingency testing (following one's movements in the mirror). These results suggest that cotton-top tamarins would be self-aware in Bekoff and Sherman's (2004) continuum of self-cognizance, which is supposed to have evolved along with cooperative breeding and sociality. Project supported by the Spanish Ministry of Science and Technology (MEC- BSO2002-02611).

Poster: Information in a dynamic model of male howler monkey (*Alouatta palliata*) interactions with conflict due to take-over attempts in a patchy environment

*Gabriel A. Lopardo*¹ & *Joaquín Veà Baró*²

¹Agents Research Lab, University of Girona & ²Department of Psychiatry and Clinic Psicobiology, Primate Research Center, University of Barcelona, E;
glopardo@euia.udg.es

This work describes a dynamic model of male-male interactions in howler monkeys (*Alouatta palliata*) inhabiting a patchy environment. Howler monkeys are folivorous primates living in groups with low levels of aggressive behaviour. Solitary males approach resident males to attempt a take-over. The male-male interactions are described and analyzed. The model can be run on laptop or desktop computers. At the heart of the model is a dynamic system that includes an easily model scenario for analysis of movements and providing its measurement. The entropy of the interactions was measured with two indices, the index of Shannon's entropy and Fisher's information index. Both measures of entropy are compared between and within a theoretical model. The theoretical model is constructed on the basis of the Zipf-Mandelbrot model. The behaviour of the interactions is studied analyzing the local and global components of the information. From this analysis the most suitable use for each one of the different types (local and global) of information is presented. In addition a possible predictive scenario for the analysis of the interactions between males is proposed.

Talk: Safety contra economy – gait kinematics of quadruped primates

David M. Loscher & Carsten Niemitz

Institut für Humanbiologie und Anthropologie, Freie Universität Berlin, D;
loscher@zedat.fu-berlin.de

The footfall patterns described as diagonal walk (Hildebrand, 1976) or forward crossed walk (Iwamoto & Tomita, 1966) differs profoundly from the lateral walk

used by the great majority of non-primate mammalian quadrupeds. All these species have in common that they use four-beat gaits at lower speeds and two-beat gaits at higher speeds. While synchronised movements of fore and hind extremities are advantageous to achieve higher velocities, four-beat gaits are more economic at lower speeds.

By delaying the movements of fore and hind extremities, the vertical displacement and hence, gravitational potential energy of the fore and hind quarters oscillate out of phase. This way four-beat gaits enable quadrupeds to use inverted pendulum movements to recover a substantial amount of mechanical energy required to elevate and accelerate the body twice during each locomotor cycle. The advantageous effect may be used in lateral as well as in diagonal sequence gaits. However, as it is based upon an alternating pulling and pushing of the anterior and posterior body part against each other, we hypothesised that one side effect should be a loss of stability during locomotion. We quantified the footfall kinematics of nine primate and 12 cursorial non-primate species by analysis of video films using the Ariel Performance Analysis System. The majority of non-primate mammals showed significantly larger relative delays between initial ground contacts of hind and fore extremities than the primate species. Among the primates, the terrestrial species tend to have larger delays with *Erythrocebus* and *Macaca* reaching the values of cursorial non-primates. In contrast, arboreal primate species tend to move diagonal opposite limbs more closely synchronized.

Talk: Grooming relationships between breeding females and other adult group members in a cooperatively breeding primate

Petra Löttker¹, Maren Huck¹, Dietmar Zinner² & Eckhard W. Heymann¹

¹Abteilung Verhaltensökologie und Soziobiologie & ²Forschergruppe Kognitive Ethologie, Deutsches Primatenzentrum, Göttingen, D; ploettker@dpz.gwdg.de

Social grooming is the most common form of affiliative behaviour exhibited by primates, and numerous studies stressed its importance for the animals' social life. Recently, the biological market theory was applied to explain grooming behaviour, proposing that grooming is a commodity that primates can trade, either for itself or in exchange for other services. So far only one study applied this new approach to the Neotropical Callitrichidae, whose members are characterized by a cooperative breeding system with only one breeding female, one or a few breeding male(s), delayed offspring dispersal and intensive helping behaviour exhibited mainly by non-breeding group members. We investigate grooming relationships of breeding females with three classes of partners (breeding males, potentially breeding males, adult non-reproductive offspring) during three reproductive phases (post-partum ovarian inactivity, ovarian activity, pregnancy) in two groups of wild moustached tamarins (*Saguinus mystax*). We aimed to answer the question whether interchange of grooming for services like infant care or prolonged tolerance (of offspring) in the group occurs. Behavioural observations were carried out from January to December 2001. Overall, grooming of breeding females with breeding males and non-reproductive helpers was more intense and balanced than with potentially breeding males, and

most grooming occurred during the breeding females' pregnancies. Grooming was skewed towards more investment by the breeding females with breeding males during the phases of ovarian activity, and with potentially breeding males during the pregnancies. The preference of different partners at different stages of the reproductive cycle suggests that grooming is a commodity that female moustached tamarins can trade to induce (preferred) mating partners to mate during ovarian activity, and to induce potential breeders to stay in the group and help with infant care.

Talk: Changes in breeding policy and its implications for management of a large breeding colony of Rhesus monkeys

Annet Louwerse, Andre van Vliet & Peter Heidt

Biomedical Primate Research Centre, Rijswijk, NL; louwerse@bprc.nl

Due to new EU-standards on housing and wellbeing of laboratory primates, BPRC changed its breeding policy radically. As a consequence of this change, formerly single caged experimental animals were resocialized to form the core of the social groups of the new breeding colony of the institute. Furthermore, enrichment and training programs were implemented. Over the last decade more than 30 social groups were created. We report on the effects of the changed housing conditions on wellbeing and breeding of the monkeys. The formation of the new social groups was not always easy, since several animals possessed poor social skills. The new housing conditions, however, reduced the amount of stress and stereotypic behaviour. In addition, the breeding success has increased. Therefore, the new housing conditions are an improvement for the animals.

Talk: Fast method to evaluate the environmental quality of a primate enclosure

Olga Martin-Carrera, Federico Guillén-Salazar & Josep Ferrando-Girbés

Unidad de Etología y Bienestar Animal, Facultad de Ciencias Experimentales y de la Salud, Universidad Cardenal Herrera, Moncada (Valencia), E; omartin@uch.ceu.es

Directive 1999/22/EC establishes that member states shall adopt measures for licensing and inspection of both existing and new zoos in order to ensure, *inter alia*, that animals are kept under conditions that satisfy the biological and conservational requirements of the individual species. This legal obligation introduces the need to develop evaluation methods to ensure that the requirement of providing species specific enrichment of the enclosures is accomplished. Here, we present a fast and reliable method to evaluate the *environmental quality* of primate enclosures under human control (i.e., zoos, sanctuaries, research centres, etc.). The proposed method is based on the simultaneous quantification of seven complementary items for each enclosure (which include size and complexity of the space, protection from fear and distress, social structure, temperature control, provision of water and humidity, etc.) and which can also be easily applied by a trained but not specialized observer. This

method can be used in a self-evaluating process, an on-site inspection or a peer review. Unlike other proposed forms of evaluation, our method analyzes the capacity of the enclosure to satisfy the biological needs of the housed animals. With the aim to appraise the method's effectiveness, we have evaluated 284 primate enclosures at 47 zoos (which represents 100 % of the primate enclosures in Spanish zoos). The evaluation was carried out from September 2003 until April 2004 by three trained observers. The results reveal an index of environmental quality of 80 %, which is far below the expected 100 %. Social environment and enclosure size and complexity are the variables that obtained the worst results.

Talk: Experimentally induced polygyny and etho-endocrinological dynamics in Goeldi's monkeys (*Callimico goeldii*)

Franziska Mattle & Gustl Anzenberger

Anthropologisches Institut, Universität Zürich, CH; frama@aim.unizh.ch

Although groups containing more than one breeding female are rather rare in callitrichids, they have been reported in the wild. In captivity, polygynous groups are usually unstable and hence not successful in terms of breeding. This is most likely due to high levels of socio-sexual competition between the females. As females of Goeldi's monkeys (*Callimico goeldii*) have only singletons, male assistance in infant care is not as crucial as in other (twinning) species. We therefore examined the stability of experimentally induced polygyny in captive *Callimico*. Three mature sister pairs of *Callimico* were followed by sex steroid monitoring for seven months through three consecutive social stages: (1) sister pairs ("socially neutral"; 3 months); (2) encounter with an unfamiliar mature male through wire mesh ("social competition" between sisters; 1 month); and (3) permanent housing as trio with full physical contact ("sexual competition" between sisters; 3 months). Total oestrone-3-conjugates and cortisol levels were measured in order to detect signs and patterns of ovarian activity, reproductive state and stress. We found that all 6 females showed regular ovarian activity and sisters largely synchronized their ovarian cycles during the first stage. Following the introduction of the male, all 6 females showed ovarian irregularities and ceased cycling altogether, but they did not show elevated cortisol levels. After this period of inactivity, each female conceived and gave birth to an infant, and all polygynous trios remained stable. We are currently examining additional trios to test the generality of these preliminary findings, however, they support the idea that the instability of polygyny in most callitrichids reflects female competition for help in rearing the young.

Talk: Science and zoos: how to get the message across to the zoo public

Constanze Melicharek

Apenheul Primate Park, Apeldoorn, NL; c.melicharek@apenheul.nl

Within the last few decades, the self-image of scientifically working zoos concerning the role they should fulfil in society has changed considerably. 'Conservation' is

more and more understood as also supporting in-situ projects for threatened species instead of just purely managing zoo populations of wild animals properly. The goal of conservation education is also becoming increasingly important. Along with the biological facts and explained elements of behaviour of the kept species, conservation education should be a main topic in the educational message of a zoo. The rapid development of knowledge in biological science is often difficult to link to the zoo world. Still, it is of great importance to inform the public about what is going on in our environment. Zoos provide a great platform for environmental issues as they are attended by many millions of visitors every year. Therefore, zoos and scientific institutions should cooperate more intensely. Through this, zoos could make sure that up to date information could be given and scientific institutions would have the chance to spread the results of their work to a much larger circle.

Apenheul is a Dutch zoo that specializes in keeping primates. Many of its 30 primate species roam freely in their own forest patches in as natural group compositions as possible. These factors are what make this park interesting for students who come from all over the world to study the primates in Apenheul. Two projects on how to 'translate' scientific results (in these examples on primate cognition and rain-forest conservation projects) in an interactive, playful but still educationally responsible manner, to zoo visitors will be presented in this talk.

Poster: How stable is the co-existence of two sympatric mouse lemurs (*Microcebus murinus* and *M. ravelobensis*) in northwestern Madagascar?

Sandra Mester, Elke Zimmermann & Ute Radespiel
Institut für Zoologie, Tierärztliche Hochschule Hannover, D;
Sandra.Mester@tiho-hannover.de

Closely related species with similar morphology and ecology may suffer from interspecific competition when sharing their habitat in a contact zone. This scenario may lead to the long-term exclusion of one competitor. Stable co-existence on the other hand is possible if resources are effectively partitioned or if the habitat is heterogeneous. The aim of this study is to analyse the stability of co-existence of two sympatric sibling species of mouse lemurs in a Max-Planck Institutjoroa, northwestern Madagascar. Both species did not differ in body mass. The population dynamics were investigated by analysing monthly mark-recapture data obtained during nine dry seasons (May-October) from 1995-2003 in a study area of 30 ha. 564 individuals have repeatedly been trapped in 11453 traps. These were 334 *M. murinus* and 230 *M. ravelobensis*. Based on the capture data, the relative representation of both species in the traps, monthly population sizes and seasonal coefficients of association were calculated. Capture results revealed a *murinus*-biased species ratio during the first five years, which shifted in favour of *M. ravelobensis* during the last four years. The monthly population size was estimated with the Jolly-Seber method and ranged from 25 to 59 for *M. murinus* and from 10 to 58 for *M. ravelobensis*. The population size of *M. murinus* decreased during the last five years whereas the population size of *M. ravelobensis* increased over the whole study period. The interspecific coeffi-

cients of association (Dice-index) of both mouse lemur species ranged from 0.23 to 0.53, indicating the lack of spatial exclusion and a high degree of spatial overlap between both species. The results of this study indicate a dynamic situation with a potential increase of *M. ravelobensis* and a decline of *M. murinus* over nine years favouring interspecific competition or changes in the supply of species-specific resources as an explanation.

Talk: Recruitment mechanisms in white-faced capuchin (*Cebus capucinus*): an experimental study

Helene Meunier^{1,2}, *G. Salmon*¹, *Jean-Louis Deneubourg*² & *Odile Petit*¹

¹Ethology of Primates, CNRS, Strasbourg, F & ²Unit of Social Ecology, Université Libre de Bruxelles, B; helene.meunier@neurochem.u-strasbg.fr

In animal societies, coordinated moves are major collective phenomena, which are nonetheless difficult to study in detail. This is especially true concerning communication between group members about what direction to follow when moving. We studied such recruitment mechanisms during provoked collective moves in a semi-free ranging group of white-faced capuchin (*Cebus capucinus*). Animals were trained to move when hearing a special sound and to choose between two opposite rewarded positions in their park (binary choice). Our results demonstrate the processes involved in the maintenance of the individuals' space cohesion during a collective movement: (1) Individuals emitted glances and pauses which seemed to aim at recruiting their conspecifics during the decision-making process; (2) the number of followers influenced the frequency of these behaviours; (3) the speed of the first individuals seemed to be influenced by the followers. In addition, larger groups maintained higher space cohesion and moved more quickly (both at individual and at the group level). These results clearly show the link between individual behaviour and collective dynamics.

Poster: Stumptailed macaque mothers are a social example to their offspring

Ricardo Mondragón-Ceballos

Ethology Department, Instituto Nacional de Psiquiatría Ramón de la Fuente, MEX; rmc@imp.edu.mx

Social learning is the mechanism by which knowledge spreads within and between groups of primates. Knowledge, therefore, can spread vertically, from older to younger animals, and horizontally, among peers. Knowledge transmission seemingly follows well-defined channels within the network of social relationships of the groups and populations, where confidence and identification with the expert enhances attention and further learning. Thus, bond strength, rather than proficiency or social success, underlies choosing a master from which to learn. Here I show that infant and juvenile stumptailed macaques learn a complex and risky social behaviour,

sabotage of third parties affiliations, by copying their mothers' sabotaging pattern. Rather than being an effect due to physical closeness, differences between female and male non-adults account for innate differences in social attention, adjusted to each sex's adult expectancies. Females' sabotage patterns matched significantly more thoroughly their mothers' patterning than males did. Such between-sexes differences matched the sex-role distinctiveness of matrifocal social systems, where males face a more uncertain future than females as they might be forced to leave natal groups upon reaching adulthood. On the other hand, females fare better socially by adhering to their female relatives patterning of social behaviour.

Poster: *Cercopithecine herpesvirus 1* - establishment of a Herpes B virus diagnostic

Thorsten Mühl, Corinna Boike & Gerhard Hunsmann

Abteilung Virologie und Immunologie, Deutsches Primatenzentrum, Göttingen, D;
tmuehl@dpz.gwdg.de

The Herpes B-virus (*Cercopithecine herpesvirus 1*) is a double stranded DNA virus that causes a latent enzootic infection in Asian monkey species of the genus *Macaca*. This virus persists in the sensory ganglia for the lifetime of the animal. In natural hosts, clinical manifestations of Herpes B-virus infections are generally mild. In several species other than macaques, Herpes B infections can cause severe diseases. In humans it often results in rapidly descending encephalitis or encephalomyelitis with a mortality rate up to 80 %. However B virus zoonosis can be effectively managed with early detection of the deadly agent. Therefore, we initiated to develop a specific enzyme linked immunosorbent assay (ELISA) for serological diagnostic. Recombinant Herpes B-virus glycoprotein D (gD) is considered as a suitable antigen because of high immunogenicity and little cross-reactivity with human Herpes simplex virus. Hence, we cloned the gD gene in different expression vectors. Currently, glycoprotein D will be expressed in baculovirus and eucariotic expression systems. Purified recombinant gD protein and peptides will be evaluated as antigens in ELISA based assays for the sensitive and specific detection of Herpes B-virus. Since nonhuman primates are important experimental animals in biomedical research, it is essential to reduce the risk of Herpes B-infections for animal handlers and keepers, laboratory workers and researchers. In addition, it is important to use healthy animals in biomedical research to exclude potential interference with the study results by virus infections, even when they are non-pathogenic in non-human primates. As a result, the establishment of a Herpes B diagnostic enables the founding of a Herpes B-virus-free breeding colonies and improves the occupational safety for all the staff working with possibly infected animals or samples.

Talk: Determinants of the diversity of intestinal parasite communities in sympatric New World Monkeys (*Saguinus mystax*, *S. fuscicollis*, *Callicebus cupreus*)

Britta Müller¹, Kerstin Mätz-Rensing², Christina Schlumbohm³ & Eckhard W. Heymann¹

¹Abteilung Verhaltensökologie und Soziobiologie, ²Abteilung Infektionspathologie & ³Cost Center Primatenhaltung, Deutsches Primatenzentrum, Göttingen, D; bmuller@dpz.gwdg.de

Wild primates can harbour a great variety of intestinal parasites, including nematodes, cestodes, trematodes, acanthocephalans and protozoa. Parasitic diseases represent a potential driving force in primate social evolution and can have an impact on the ecology of their hosts in terms of physical constitution, fitness, sexual selection and regulation of host population density. Host specific factors like body size, group size, ranging behaviour and diet have been proposed as determinants of parasite diversity.

In this study we focused on the helminth and protozoa diversity and the seasonal changes of parasite emission and prevalence of three sympatric New World primate species. We collected faecal samples from 41 individuals from three mixed species groups of *Saguinus mystax* and *Saguinus fuscicollis* and two groups of *Callicebus cupreus* at regular intervals over a 15 months period. We explored host specific factors influencing parasite species richness by collecting data on activity patterns, feeding and ranging, and by measuring different habitat parameters.

In preliminary examinations, we found that all individuals were infected by at least one parasite taxon (species or morpho-species). In 415 faecal samples from all individuals, we found propagules of seven different parasite taxa: eggs of one Acanthocephala (*Prosthenorchis* sp.), of two Cestodes (*Hymenolepis* sp., Cestode eggs with larvae), of three Nematodes (two morpho-species of Spiruroidea, one Rhabditean nematode) and Nematode larvae. Protozoa were not found in any of the faecal samples. The three host species differed in parasite richness: *Saguinus mystax* and *S. fuscicollis* harboured the same seven parasitic taxa, whereas *Callicebus cupreus* only had four parasite taxa. The prevalence of some parasite taxa of the tamarins varied both between species and between groups. The difference in parasite diversity and prevalence suggests that ecological as well as phylogenetic factors play a role in the composition of parasite communities. Supported by DFG (He 1870/13-[1,2]) and DAAD.

Talk: Father-daughter incest avoidance in wild white-faced capuchins, *Cebus capucinus*

Laura Muniz¹, Susan Perry^{1,2}, Joseph H. Manson^{1,2}, Julie Gros-Louis³ & Linda Vigilant¹

¹Max Planck Institut für Evolutionäre Anthropologie, Leipzig, D, ²Department of Anthropology and Center for Behaviour, Evolution and Culture, UCLA, Los Angeles & ³Department of Psychology, Indiana University, Bloomington, USA; muniz@eva.mpg.de

Animals have evolved behavioural and physiological inbreeding avoidance mechanisms to preclude high fitness costs associated with reproduction with close kin. Sex-biased dispersal, especially common in mammals and birds, is argued to be one such mechanism. Among primates, males usually disperse from their natal groups prior to reaching sexual maturity but the bias changes towards female dispersal in species in which male tenure exceeds the typical time span for the maturation of daughters. To date, results on whether co-resident father-daughter pairs systematically avoid incest are conflicting. To address this question, we assigned paternity to offspring in 3 social groups of wild white-faced capuchin monkeys from Lomas Barbudal Biological Reserve, Costa Rica, that were observed for 2-14 years. Individuals ($n \approx 185$) were typed at 16 polymorphic microsatellite loci using DNA extracted from non-invasive faecal samples. In general, alpha males sired a significantly higher proportion of group offspring than subordinate males. Three alpha males experienced long (>6 years) tenures, allowing us to evaluate the occurrence of father-daughter incest avoidance in this species.

Poster: The significance of grooming behaviour in former laboratory chimpanzees (*Pan troglodytes*)

*Doris Muszi*¹, *Signe Preuschoft*², *Karl Crailsheim*¹ & *Cornelia Franz*¹

¹Institut für Zoologie II, Karl-Franzens-Universität Graz & ²hopE – Home of Primates Europe, Gänserndorf, A; cornelia.franz@uni-graz.at

Social grooming (i.e. allogrooming) is considered to be important for the establishment and promotion of familiarity needed in order to develop and maintain relationships within primate groups. The amount of grooming may indicate the relationship quality, the strength of coalitionary bonds and may facilitate conflict management and resolution. We investigated grooming behaviour within a group of re-socialised former laboratory chimpanzees (*Pan troglodytes*) with limited social experience (2 adult males, 4 adult females, 3 immatures) in order to address the question of whether these individuals develop patterns of grooming behaviour comparable to normally raised individuals. We expected to find high amounts of self-grooming (i.e. autogrooming) due to former social deprivation but also distinctive allogrooming relations associated with dominance rank. We recorded 24 hours of 5-minute scans and 168 hours of focal observations (3 days per chimpanzee in each case). All but one individual spent much more time allogrooming (range from 2 to 23 % of total observation time) than autogrooming (0,3-2,4 %) with major inter-individual differences in social grooming investment (range among adults time given 0,1-16 %). Social grooming was distributed within 81 % of all possible relationships, 24 % of them unidirectional and 57 % bidirectional with the highest amount of mutual grooming between the adult males. Grooming was significantly less frequent between the sexes than within the sexes. The highest ranking female and the highest ranking male groomed most and the second ranking female and the second ranking male received most of their grooming. The dominance hierarchy, based on pant-grunts, is significantly linear, however, no overall association of dominance with allogrooming was found. The results suggest that ex-laboratory chimpanzees develop distinctive groo-

ming bonds with significant investment of the highest ranking individuals. Further analysis will reveal if these relations are based on social exchange or related to other functions of grooming behaviour.

Poster: Prey capture strategies and techniques of red titi monkeys (*Callicebus cupreus*) in comparison to sympatric tamarin monkeys, *Saguinus mystax* and *Saguinus fuscicollis*, in north-eastern Peru

Mirjam N. Nadjafzadeh^{1, 2} & Eckhard W. Heymann²

¹Studiengruppe Verhaltensbiologie, Ruhr-University Bochum & ²Abteilung Verhaltensökologie und Soziobiologie, Deutsches Primatenzentrum, Göttingen, D;
m.nadjafzadeh@web.de

Organisms that live sympatrically on the same trophic level should exhibit differences in their ecological niches in order to reduce or to avoid interspecific competition. For moustached (*Saguinus mystax*) and saddle-back (*Saguinus fuscicollis*) tamarins, which show a high overlap in the plant portion of their diet, it can be shown that they differ considerably in their prey capture strategies and their prey spectrum. While moustached tamarins mainly look for well exposed prey on the midstorey foliage, saddle-back tamarins predominantly forage in lower strata of the forest and on the ground and manipulate a variety of microhabitats in search of concealed prey. Red titi monkeys, *Callicebus cupreus*, live sympatrically with these two tamarin species. Previous observations suggest that they also include a high amount of prey in their diet. Therefore, we addressed the question if animal prey is of importance in niche differentiation between titi monkeys and tamarins. During a field study in the Amazon rainforest of north-eastern Peru, we examined which substrates, microhabitats and forest strata are used by *C. cupreus* for prey search and capture in comparison to the tamarins *Saguinus mystax* and *Saguinus fuscicollis*. In addition to direct observations, we collected faecal samples and the remains of prey dropped by the monkeys in order to differentiate the taxonomic composition of the prey spectrum of the titi monkeys from that of the two tamarin species. Preliminary results indicate that Hymenoptera constitute a major component of the animal prey of *C. cupreus* and winged insects play an important part in their prey capture strategies as they are captured directly from air. The consumption of vertebrates could not be observed. These findings differ obviously from the prey and the capture methods of moustached and saddle-back tamarins and can be understood as one aspect of niche differentiation. Supported by the Christian-Vogel-Fond.

Talk: Ranging behaviour and food selection in *Avahi laniger* (fot-sife) from the littoral forest of Sainte Luce (south-eastern Madagascar)

Ivan Norscia & Silvana M. Borgognini Tarli

Dipartimento di Etologia, Ecologia ed Evoluzione, Pisa, I; norscia@lunet.it

Here we present results of a seven-month study on *Avahi laniger* conducted in the fragment S9 of the pluvial littoral forest of Sainte Luce (south-eastern Madagas-

car). *Avahi laniger* is a poorly investigated nocturnal prosimian, living in monogamous pairs and characterized by a folivorous diet.

Five individuals of *Avahi laniger* belonging to two groups (2 adult females, 2 adult males, and 1 subadult female) were captured in June 2004. Animals were darted during the day on their sleeping trees using a blowpipe and pressured narcotic projectiles (Telinject®). Zoletil® 100 (100 mg Tiletamine and Zolazepam 1:1/ml) was used to anaesthetize the animals in the dose of 4mg/kg measured with a 100units/ml syringe.

From June to December 2004, 26 night follows were conducted via radio-tracking the parental pair (one individual/night) of each group. Continuous focal sampling was used and timing was stopped when the focal animal was lost.

Resting, sleeping, and feeding trees were marked, identified, and mapped using GPS. Phenology and vegetation diversity and abundance were recorded on a hundred plant morphospecies on a 1.5 km trail crossing the study area. 16 plots of 5 m² were also used to better evaluate vegetation characteristics in the home range of each group.

The preliminary results confirm that resting is the main activity of *A. laniger*, followed by feeding and moving. *A. laniger* fed almost completely on leaves of about 40 plant species and group home-range varied from approximately 1 to 2 ha. The results on *Avahi laniger*'s dietary profile, ranging behaviour and activity pattern will be reported here in order to shed more light on the behavioural ecology of this cryptic lemur species.

Poster: Effects of fragment size and degradation on population density of *Avahi laniger* in littoral forest fragments of south-eastern Madagascar: preliminary results

Ivan Norscia & Silvana M. Borgognini Tarli

Dipartimento di Etologia, Ecologia ed Evoluzione, Pisa, I; norscia@lunet.it

Habitat fragmentation and degradation are the main threats to the survival of vertebrate populations living in Malagasy forests. Among lemurs, vertical climbers and leapers such as *Avahi laniger* are particularly vulnerable as they rely on vertical supports to move. Thus, vegetation destruction and habitat reduction can create an impassable barrier to individual and group migration.

The density of endangered populations of *Avahi laniger* was evaluated in seven littoral forest fragments of variable size: fragments S9, S8, S17, S7 of Sainte Luce forest and fragments M15, M16 and M13 of Mandena forest (south-eastern Madagascar). In each fragment, eight walks were taken during eight different nights along a trail of 1 km (from approximately 20:00 to 22:00 h). Position and number of individuals encountered along the transect were recorded. Along each trail, 8 plots of 5 m² were used to evaluate vegetation characteristics by counting trees (DBH ≥ 10 cm) belonging to a hundred identified morphospecies and by recording crown volume (TCV), height, and diameter at breast height (DBH) of such trees.

This study was conducted from the beginning of October to the first half of December 2004 during the weaning period when infants are carried on the backs of

their mothers. This allowed recording not only of the number of individuals/fragment but also of the number of newborns encountered.

Preliminary results are presented as a first step to determine the effects of fragment size, degradation, and presence of key species for foraging on density and reproduction rates of threatened populations of *Avahi laniger*.

Talk: Malaria infection rates in New World primates: the role of group size, body mass and sleeping habits

Charles L. Nunn¹ & Eckhard W. Heymann²

¹Department of Integrative Biology, University of California, Berkeley, USA &

²Abteilung Verhaltensökologie und Soziobiologie, Deutsches Primatenzentrum, Göttingen, D; eheyman@gwdg.de

Parasites are ubiquitous in free-ranging animals and affect host fitness but very little is known about factors that influence the risk of infection and disease, and the effectiveness of behavioural defences to reduce this risk. We investigated the effect of group size, body mass and sleeping behaviour on of the prevalence of malaria infections in Neotropical primates with data obtained from the literature. Malaria is transmitted to these primates through nocturnally active anopheline mosquitoes that use olfactory cues to find their hosts. Comparative tests using phylogenetic corrections confirm that malaria prevalence increases with group size in Neotropical primates, as suggested by a previous non-phylogenetic analysis (Davies et al., 1991, *Funct Ecol* 5: 655-662). This is consistent with the hypothesis that larger groups experience increased risk of attack by mosquitoes, and contrasts with the hypothesis that increasing group size leads to reduced insect attacks through an encounter-dilution effect. Body mass was significant in few phylogeny-based analyses, and primarily when group size was included as a covariate. We also tested the previous hypothesis (Heymann, 2001, *Folia Primatol* 72:153) that sleeping in closed microhabitats (tree holes, tangles of vines) reduces the risk of malaria by containing the host cues used by mosquitoes to locate hosts. This hypothesis was supported partially. In summary, risk of infection with malaria is likely to act as a cost of group living in Neotropical primates, while sleeping site selection may provide a benefit by reducing rates of attack by malaria vectors. Supported by NSF (grant DEB-0212096 to CN).

Poster: Forest fragmentation and its impact on lemur diversity in north-western Madagascar

Gillian Olivieri, Mathias Craul & Ute Radespiel

Institut für Zoologie, Tierärztliche Hochschule Hannover, D;

gillian.olivieri@tiho-hannover.de

The lemur fauna of Madagascar's protected areas has been intensively studied. The species inhabiting these forests are therefore relatively well known. However,

this is not the case for the unprotected forests of the island. In the last decades, few punctual studies have described new cryptic species based of morphological and molecular data. In north-western Madagascar, the distribution range of these new species is still vague. Furthermore, the habitats of the long known species have suffered from extreme fragmentation in the last century and it is still not clear how this affects survival probabilities of populations. To answer these questions, we visited 16 forest fragments in this region. In each fragment we chose trails, made census walks and, on hand of this data, calculated the population density of each species. We also systematically calculated the size of the fragment and established the degree of human exploitation. Interviews with local people allowed us to get an idea of the general sensibility towards conservation issues. The forest fragments ranged from 2 km² to 30 km² and harboured between 2-7 lemur species. Encounter frequencies varied between 0.44 and 23.33 ind./km for solitary foragers and between 0.18 and 4.17 ind./km for group living species. Precise distribution ranges and estimations of population densities are prerequisites to establish the conservation status of each species. These results will be used to identify valuable and important populations and sites that should receive intensified conservation efforts. Supported by DFG and VW.

Talk: Aggression, stress and steroids – testing the "Challenge Hypothesis" in redfronted lemurs

Julia Ostner¹, Peter Kappeler^{2,3} & Michael Heistermann⁴

¹Department of Anthropology, Stony Brook University, USA, ²Abteilung Verhaltensökologie und Soziobiologie, Deutsches Primatenzentrum, ³Institut für Zoologie und Anthropologie, Universität Göttingen & ⁴Abteilung Reproduktionsbiologie, Deutsches Primatenzentrum, Göttingen, D; jostner@notes.cc.sunysb.edu

The "Challenge Hypothesis", originally conceived for seasonally breeding birds, proposes that the association between androgens and reproductive aggression is strongest during periods of social instability. We tested this hypothesis for seasonally breeding redfronted lemurs (*Eulemur fulvus rufus*) by examining patterns of androgen–aggression relationships with respect to social stability and reproductive season. As social challenges constitute stressful situations, we also measured glucocorticoid concentrations across seasons and social settings. We combined over 2500 hrs of behavioural observations of adult individuals of 3 groups living in Kirindy Forest with hormonal analyses from faecal samples. Androgen and glucocorticoid excretion was determined using validated enzyme immunoassays. As predicted, phases of social instability during the mating season were characterized by both increased levels of androgens and male-male aggression. During stable mating seasons (without immigrations or rank changes), androgens increased without a simultaneous rise in aggression, indicating the solely reproductive function of androgens in this case. Since, in contrast to many bird species, primates live in stable groups, social challenges may also occur outside the mating season and heightened gonadal activity. In our study males, aggression rates increased while androgen excretion remained at baseline levels during these situations, indicating that in-

creased androgenic activity is not required for the expression of aggression. Finally, during the birth season, androgens increased sharply with aggression rates being at baseline levels. The social challenge in this situation may be infanticide risk imposed by extragroup males, requiring group males to maintain high levels of androgens in order to stay aggressive. The finding strengthens this interpretation that glucocorticoids follow the same seasonal pattern with pronounced increases both during the mating and the birth season. Our study shows that predictable stressful situations indicated by high glucocorticoids and involving the overt expression of aggression are associated with increased androgen excretion in accordance with the "Challenge Hypothesis".

Talk: Is termite-fishing too easy for captive chimpanzees? Hand-preferences in *Pan troglodytes* and *Pan paniscus* during different tool-use activities

Benjamin Ott¹, Andreas Elepfandt² & Carsten Niemitz¹

¹Institut für Humanbiologie und Anthropologie, Freie Universität Berlin & ²Abteilung für Sinnesbiologie, Institut für Biologie, Humboldt-Universität Berlin - in Kooperation mit dem Max Planck Institut für Evolutionäre Anthropologie, Leipzig, D; humanbio@zedat.fu-berlin.de

Studies on great apes concerning hand-preference in tool-use, especially in chimpanzees (*Pan troglodytes*), revealed inconsistent results. Wild ranging chimpanzees showed consistent hand-preferences in both unimanual tasks, e.g. termite-fishing, and bimanual tasks on the individual, but not the population level. In contrast, captive chimpanzees showed population-level right side bias in bimanual performances with very few ambiguously acting individuals, but, in unimanual tasks, there were many ambiguously acting individuals and the population-level side bias was inhomogeneous. Since the subjects' lateralization increases with the task complexity, we hypothesize that captive chimpanzees will more consistently show lateralized performances in unimanual tasks if this task is of higher complexity with consequences also for population-level assumptions. Therefore, we investigated the hand-preference in unimanual tool-use performances. We observed 20 captive chimpanzees (*Pan troglodytes*) and 9 captive bonobos (*Pan paniscus*) from two different colonies, in an effort to reduce genetic and cultural bias. *Ad libitum* tool-use was video-recorded in 3 tasks, differing in the level of dexterity, necessary to extract food items from a food hiding device. Applying "Noldus Video Analysis" we measured frequency and duration of left and right hand performances. We used z-scores and a handedness index for both bouts and performance-duration to determine the subject's laterality.

The individual lateralization increased with the difficulty of the task, as did the number of lateralized individuals. The chimpanzees showed a trend for a population-level bias towards the left hand, which is discordant with the findings in other studies. The bonobos were using their right hands consistently but there were too few datapoints to make assumptions about the population. We conclude that differences in lateralization for unimanual tool-use activities in wild ranging versus captive great apes might be more due to different task complexities than to environmental factors, the ability of the animals or varying organismic asymmetries.

Talk: A rare opportunity in mammals: a direct comparison of signal rules and design features between two different urine depositions in *Lemur catta*

*Elisabetta Palagi*¹, *Leonardo Dapporto*¹ & *Silvana M. Borgognini Tarli*²

¹Centro Interdipartimentale Museo di Storia Naturale e del Territorio & ²Dipartimento Etologia, Ecologia ed Evoluzione, Unità di Antropologia, Università di Pisa, I; betta.palagi@museo.unipi.it

In ring-tailed lemurs, urine deposition can be combined with different tail configurations: 1. Tail held up in an evident display (urinate tail-up, UT-up); 2. Tail slightly raised to avoid its impregnation with urine (urinate tail-down, UT-down). We used both signaller- and receiver-based approaches to search for differences between these two kinds of deposition. From the signaller perspective, UT-up, in contrast to UT-down, follows some general signal design rules (low quantity, seasonality, association with other marking, and selected sites for releasing) and is induced by the presence of a dummy. On the other hand, receivers show more interest in investigating UT-up than UT-down both in the presence and absence of visual cues, thus suggesting that UT-up may differ in composition from UT-down. Furthermore, a logistic regression analysis suggests that UT-up features are strictly selected and designed to optimize the ratio between benefits and costs for both senders and receivers. On the contrary, UT-down seems to have less strict and constant depositional features, not showing any particular discriminating rules. In conclusion, UT-up is a complex signal based on visual and chemical cues (multi-modal signal). Clearly, composite signals have additional costs. The visual display associated to scent deposition has probably not only the advertisement function that makes the scent more detectable and locatable, but also the function to make the signal appear honest by displaying the handicap related to the risk to be attacked. In fact, evolutionary theory suggests that costly signals are generally honest advertising of signaller's quality. On the other hand, low cost signals might be prone to cheating and receiver might be expected to be sceptical in investigating them. Therefore, the different kind of urine deposition in *Lemur catta* offers the possibility to directly compare the design features of a signal with those of simple urine elimination.

Poster: Play and society: a comparative analysis among African great apes

*Elisabetta Palagi*¹, *Daniela Antonacci*^{1, 2}, *Marco Grillo*^{1, 2}, *Fsca Ballo*¹, *Giada Cordoni*^{1, 2}, *Tommaso Paoli*^{1, 2}, *Zeudi Liew*^{1, 2}, *Elena Chiarugi*^{1, 2} & *Silvana M. Borgognini Tarli*²

¹Centro Interdipartimentale Museo di Storia Naturale e del Territorio & ²Dipartimento Etologia, Ecologia ed Evoluzione, Unità di Antropologia, Università di Pisa, I; betta.palagi@museo.unipi.it

Play is a common behaviour in primates and especially in great apes. However, a comparative analysis of play is still lacking in these species. Our study aims at com-

paring the play behaviour of four captive groups of great apes: two chimpanzee colonies (ZooParc de Beauval, F; Amersfoort Dierenpark, NL), a bonobo and a gorilla colony (Apenheul Primate Park, NL). The overall level of play did not differ among these groups even though, considering play modalities, gorillas performed rough sessions more frequently than chimpanzees. Nevertheless, we found differences in the choice of playmates. For instance, play frequencies among immature individuals were higher in gorillas than in the Beauval chimpanzees and Apenheul bonobos. Whenever an adult was involved in the play bout, the play rate was significantly lower in gorillas than in the *Pan* species. On the other hand, bonobos showed the highest level of adult-adult play among all study species. In light of our findings, we suggest that the peculiar social structure of each species is probably the main factor influencing the play activity. In fact, while gorillas show the most despotic social system among African great apes and they are characterized by a prevalent play among immature individuals, chimpanzees and bonobos, showing a more flexible social style, are characterized by a more complex play activity comprising individuals of all age-classes. Probably, the 'individualistic' society of gorillas (in which mother-infant pairs represent a micro-society) limits the choice of playmates. On the other hand, chimpanzees and far more bonobos are not so constrained by social rules in the choice of playmates.

Poster: The harassment effect: social benefits, social costs, and buffering mechanisms

Elisabetta Palagi¹, Marco Grillo^{1, 2}, Tommaso Paoli^{1, 2}, Giada Cordoni^{1, 2}, Leonardo Dapporto¹ & Silvana M. Borgognini Tarli²

¹Centro Interdipartimentale Museo di Storia Naturale e del Territorio & ²Dipartimento Etologia, Ecologia ed Evoluzione, Unità di Antropologia, Università di Pisa, I; betta.palagi@museo.unipi.it

It is well known that during older infancy and adolescence, immature males sometimes threaten adult females by teasing, annoying and pestering them. This phenomenon has been given various terms by different authors: playful behaviour, quasi-aggressive behaviour and harassment. We observed a captive group of chimpanzees during two different periods, one of which was characterized by high social tension due to harassment (H) by juvenile males towards adult females. We investigated the occurrence of social changes and the presence of tension-reduction mechanisms.

In contrast to the control period (NH), characterized by a prominent presence of play interactions, during the H period, juvenile males exchanged mostly quasi-aggressive interactions with adult females. This shifting was found to be very selective: harassers did not play less frequently with other group members during the H period. We also found that juvenile males over-ranked adult females in the H period with the occurrence of formalized submissive items (bobbing and pant-grunting) performed by adult females towards harassing juvenile males.

We found an increase in self-directed behaviours that is consistent with the view of harassment as a generator of tension. Accordingly, we were expecting the occur-

rence of tension-reduction mechanisms in the H period. In fact, allogrooming was found to increase. We also observed an increase in sexual presentations by adult females to juvenile males. Furthermore, during the H period, non-conceptive dyads increased their rates of genital manipulations, whereas conceptive dyads did not. Specifically, female homosexual activity increased.

In conclusion, harassment seems to predict an improvement of rank in juvenile males but it also predicts an increase in tension at the group level that is then balanced by an increase in allogrooming behaviour and sexual interactions.

Talk: Reproductive cycle and sexual behaviour in bonobos

Tommaso Paoli^{1,2}, Elisabetta Palagi^{1,2}, Giorgia Tacconi^{1,2} & Silvana M. Borgognini Tarli²

¹Centro Interdipartimentale Museo di Storia Naturale e del Territorio & ²Dipartimento Etologia, Ecologia ed Evoluzione, Unità di Antropologia, Università di Pisa, I; t.paoli@deee.unipi.it

Previous reports claim that the duration of the swelling cycle of female bonobos (*Pan paniscus*) is longer than that of chimpanzees and that bonobos show a markedly prolonged maximum swelling phase. Field data on inter-menstrual intervals (IMI) in female bonobos are largely restricted to inter-swelling intervals (ISI) as these are assumed to reflect the inter-menstrual interval even though a direct comparison between ISI and IMI durations is still lacking. Although bonobo sexual activity is evident during the entire perineal cycle, reports on its frequency as a function of the swelling phase are often in contrast. Furthermore, the meaning of female homosexual interactions (genito-genital rubbing, GG-rubbing) is still unclear. Our analysis (based on 51 ISI-IMI pairs) showed that ISIs are a fair depiction of the reproductive cycle. The cycle length was 35.6 ± 1.1 SE days based on the ISI, whereas it was 35.0 ± 1.1 SE days based on the IMI. This finding strongly resembles the cycle length generally reported for chimpanzees. Female homosexual contacts and copulation rates were higher during maximum tumescence, which suggests that sexual swellings are attractive to both males and other females. Finally, GG-rubbings were performed free of hierarchical asymmetries and they were not correlated with affiliative interactions. We infer that GG-rubbing, the most frequent female sexual interaction in general, is a means of social assessment among bonobo females.

Poster: Cued repetition of self-directed actions in macaques: evidence for episodic memory?

Annika Paukner¹, James R. Anderson¹, David I. Donaldson¹ & Pier F. Ferrari²

¹Department of Psychology, University of Stirling, Stirling, UK & ²Istituto di Fisiologia Umana, Università di Parma, Parma, I; ap14@stir.ac.uk

Episodic memory refers to the capacity to recollect events from one's personal past, which is accompanied by the experience of "mental time travel". Some cogni-

tive psychologists have claimed that this ability is uniquely human; however, recent work examining episodic memory abilities in non-human animals questions this assumption. One problem faced by comparative psychologists is the need for suitable non-verbal assessment methods of memory processes. In particular, animals need to be tested in recall rather than recognition paradigms in order to differentiate between episodic and semantic memory processes. Here, we report a new experimental recall paradigm to test episodic memory in monkeys. Two pigtailed macaques (*Macaca nemestrina*) were trained to perform three self-directed actions in response to distinct auditory cues, and subsequently to repeat two behaviours after hearing an abstract 'repeat' auditory cue. We tested the monkeys for multiple memory dimensions and long-term recall, which are defining characteristics of episodic memory, and for spontaneous transfer by pairing the repeat signal with novel behaviours. Both monkeys showed evidence of multiple memory dimensions, but failed to show evidence of long-term recall and spontaneous transfers. Even though the monkeys cannot be attributed with episodic memory abilities based on the current results, the paradigm reported here offers a new, non-verbal assessment method for comparative research, which could be easily modified for use with other species.

Talk: Social signals and their impact on mouse lemurs populations dynamics

Martine Perret

Department of Ecology, CNRS-MNHN, Brunoy, F; martine.perret@wanadoo.fr

The grey mouse lemur, a Malagasy prosimian, has been extensively studied both in the field and in captivity. This provides the opportunity to explore the link between socioecological and ecophysiological approaches. Mouse lemurs exhibit particular life history traits that represent adaptive responses to seasonal environmental constraints. Large variations in spatial distribution, density and degree of home-range overlap within and between the sexes have been shown. This suggests a high plasticity of social responses to ecological constraints. Moreover, all biological rhythms studied so far demonstrate high seasonal changes primarily entrained by photoperiodic variations but modulated by social communication, which, in this nocturnal species, mainly consist of chemical signals. Reproductive and energy balance strategies represent two main examples of functional interactions between environmental conditions and social signals. In mouse lemurs, reproduction is highly seasonal. Reproductive strategies are based on scramble competition polygyny, sperm competition, temporary mate guarding and possibly female choice. Chemical signals enhance sexual coordination between the sexes but also have a clear effect on individual reproductive fitness within the sexes. These effects go through pheromone modulation of sexual hormones leading to changes in sexual modification of males and in female offspring production. Chemical signals also have an impact on seasonal fluctuations in body mass, especially on autumnal fattening, which reduces individual survival during the winter season. Moreover, energy saving strategies, like the ability to enter daily torpor, which is crucial for survival, are adjusted to local conditions including social sleeping associations. Lastly, mechanisms linking sen-

sory information and metabolic/hormonal responses rely on neural pathways connecting sensory processes to biological clocks. In conclusion, social interactions that depend on population density have dominant modulating effects on population dynamics through individual physiological responses, explaining in part the socioecological diversity of wild mouse lemur populations. Among primates, crossing between ecophysiological and field studies would be very beneficial for the understanding of population dynamics.

Talk: Copulation calls as reliable indicators of reproductive state? A study in free ranging Barbary macaques (*Macaca sylvanus*)

Dana Pfefferle^{1, 2}, Katrin Brauch², Michael Heistermann², Keith Hodges² & Julia Fischer¹

¹Forschergruppe Kognitive Ethologie & ²Abteilung Reproduktionsbiologie, Deutsches Primatenzentrum, Göttingen, D; dpfefferle@dpz.gwdg.de

Whether or not signals provide honest information about the state of the signaler is a central question for understanding the evolution of communication. In this respect, primate copulation calls have been suggested to be sexually selected traits that function to incite male-male competition for females. Although temporal and structural differences between calls given during early and later stages of the menstrual cycle have been previously reported, it is unclear whether copulation calls reliably advertise the female fertile phase and form part of a female reproductive strategy to influence mating outcome. In the present study, therefore, we analysed the copulation calls of female Barbary macaques in the Gibraltar population in relation to female reproductive status. Timing of the fertile phase was assessed by oestrogen and progestagen measurements in faeces using validated enzymeimmunoassay procedures. Acoustic analysis included copulation call length, mean duration of call units and peak frequency. Preliminary results propose no clear change in acoustic features five days before and during the fertile phase, suggesting that copulation calls in the Barbary macaque do not reliably advertise the female fertile phase. This would be in accordance with the promiscuous mating behaviour of the species and would provide support of the hypothesis of paternity confusion.

Poster: Locomotor and positional behaviour of male and female chimpanzees at the zoological garden Berlin

Marion Pforr, Vanessa Zacher & Carsten Niemitz

Institut für Humanbiologie und Anthropologie, Freie Universität Berlin, D;
humanbio@zedat.fu-berlin.de

Chimpanzees and humans differ in just over one percent of DNA and thus, there are various similarities between the species. Due to their physical characters, there are differences between their locomotor and positional behaviour.

For this study, five chimpanzees (*Pan troglodytes*) at the Zoological Garden Berlin were observed. The group consisted of three females and two males between the

ages of 16 and 25. Various locomotor and positional patterns like standing, walking, sitting, climbing, lying etc. were observed. We differentiated between bipedal, tripodal, quadrupedal, sitting, lying and climbing behaviour. Behaviour was defined as bipedal, if the hind limbs supported all or most of the body weight.

The male individuals' time budget (4.0 %) showed 1/3 more locomotor behaviour than the females' (3.0 %; $p < 0,01$). Sitting was the most frequent behaviour for both sexes (60.0 %) while hand climbing was the least observed behaviour.

Both sexes performed strikingly different bipedal behaviour ($p < 0.001$). The males squatted (2.3 %) significantly more than the females (0.1 %, $p < 0.001$) and showed stooping (0.5 %) less frequently than the females (1.1 %). In contrast to the males (0.02 %, $p < 0.02$), the females never hopped.

Male individuals (0.3 %) spent less time standing quadrupedally than females (2.0 %; $p < 0.01$), which is similar to the bipedal difference between the sexes. The same difference was observed in tripodal standing (males 0.5 %, females 2.0 %).

Males (3.5 %) sat more asymmetrically than females (2.4 %; $p < 0.01$).

Both sexes showed lying (females 24.0 %, males 27.0 % $p < 0.015$) but females lied 4.0% of time in a face-down position supported by the arms, a position males never showed ($p < 0.001$).

Within climbing behaviour, the males showed more semi brachiation (0.1%) than females (0.05 %; $p < 0.01$) and they hanged (0.45 %) and climbed (0.9 %) more quadrupedally than the females (hanging 0.2 %, climbing 0.8 %).

All in all, we can conclude that the males showed more locomotion, squatting, hopping etc. than the females. This may be due to the dominance behaviour of the male chimpanzees.

Talk: Inferences about food location in Tonkean macaques

Odile Petit¹, Josep Call² & Bernard Thierry¹

¹Ethology of Primates, CNRS, Strasbourg, F & ²Max Planck Institut für Evolutionäre Anthropologie, Leipzig, D; odile.petit@neurochem.u-strasbg.fr

We carried out two series of experiments to investigate if Tonkean macaques (*Macaca tonkeana*) can make inferences from physical cues. In a first series of experiments, five subjects were presented with two boxes (one baited, one empty) and given visual or auditory information about the content of one or both boxes. Visual information consisted of removing the top of the box so that the subjects could look inside. Auditory information consisted of shaking the box so that it produced a rattling sound when containing food. When subjects were given information on both boxes, they correctly selected the baited cup in both conditions. When information was given for only one box (the baited or the empty), subjects still correctly selected the baited cup when given visual information. This shows that the subjects were able to choose without having seen the food but were unable to choose the correct box when supplied with auditory information only. In a second series of experiments, we tested if Tonkean macaques know that food takes up space. Four subjects were presented with two rectangular boards on a platform. One of the boards had a piece of food under it causing it to acquire an inclined orientation whereas the other re-

mained flat on the platform. Subjects preferentially selected the inclined board. When the two boards were both inclined by a piece of wood and only one baited, subjects selected one of the boards randomly. We may conclude that Tonkean macaques are able to reason about physical problems related to finding food.

Talk: Gestural signalling in great apes: a comparison

Simone Pika¹ & Katja Liebal²

¹School of Psychology, University of St. Andrews, Scotland, UK & ²Max Planck Institut für Evolutionäre Anthropologie, Leipzig, D; spika@ualberta.ca

The primary goal of the present study was to enhance the knowledge and understanding of gestural communication concentrating on our closest living relatives, the great apes. The present study is based on the observations of Tomasello and colleagues [1994; 1997; 1985; 1989] on the gestural signalling of a group of captive chimpanzees (*Pan troglodytes*) and observations of two groups of gorillas (*Gorilla gorilla*), two groups of bonobos (*Pan paniscus*) and two groups of orangutans (*Pongo pygmaeus*) in captivity. Our goal was to document the gestural repertoire and to focus on processes underlying social cognition, including learning mechanisms, and to look at the flexibility of gestural use, such as adjustment to the attention state of the recipient. The results enabled us to draw inter- and intra-species comparisons. The most intriguing differences between the four species were concentrated within two categories, 1) the variety of auditory gestures, and 2) the average number of gestures used.

These differences seem to indicate general communication differences between the four ape species and are discussed in relation to their different ecological settings and social systems.

Talk: Pair living and 'fidelity' in *Lepilemur ruficaudatus*

Katharina Platner^{1,2}, Roland Hilgartner¹, Christian Roos², Dietmar Zinner³ & Peter M. Kappeler^{1,4}

¹Abteilung Verhaltensökologie und Soziobiologie, ²Forschergruppe Primatengenetik, ³Forschergruppe Kognitive Ethologie, Deutsches Primatenzentrum, Göttingen
⁴Institut für Zoologie und Anthropologie, Universität Göttingen, D;

katharina.platner@gmx.de

Nocturnal lemurs were for a long time thought to be mainly solitary. During the last decades, studies on the social organization of several species showed that there is an astonishingly high number of pair living species among nocturnal lemurs. Being socially pair-living does not imply strictly monogamous reproduction. Recent studies on *Phaner furcifer* and *Cheirogaleus medius* revealed a relatively high number of extra pair paternities (EPPs). *Lepilemur ruficaudatus*, from the west coast of Madagascar, is another nocturnal lemur that is socially organized in pairs, i.e. an adult male and female share a common home-range year round. Continuous mate

guarding during the short mating season by the male predicts monogamy or low rates of EPPs. This assumption was tested in a paternity analysis with the help of microsatellite markers. Ten polymorphic markers were developed and employed in the study. The analysis of the genetic relationships among 19 offspring, their social parents and the individuals from the respective adjacent home-ranges revealed an EPP rate of 10%. This rate is low compared to the sympatric *Phaner furcifer* and *Cheirogaleus medius*, and is possibly a result of vigorous mate guarding by the male.

Poster: Preliminary results on dry matter intake and body weights of captive blue-eyed black lemurs (*Eulemur macaco flavifrons*)

Sandra Y. Polowinski & Christoph Schwitzer
Zoologischer Garten Köln, D; s.polowinsky@worldonline.de

The blue-eyed black lemur (*Eulemur macaco flavifrons*) is a highly endangered, medium-sized lemur from north-west Madagascar with a mean body weight of 1793 g (Terranova & Coffman, 1997). The nutritional ecology of the blue-eyed black lemur has so far not been studied in the wild but, generally, *Eulemur macaco flavifrons* is classified as being mainly frugivorous.

Under captive conditions, lemurs, especially blue-eyed black lemurs, seem to be prone to obesity. Terranova & Coffman (1997) as well as Schwitzer (2003) found obesity rates as high as 80 % in this subspecies. It is unknown whether this high susceptibility to obesity can be exclusively attributed to a high-energy intake and a reduced necessity for locomotion in captivity or, if it is a result of these factors in combination with a comparatively high digestive efficiency.

This study deals with aspects of the feeding ecology of blue-eyed black lemurs kept at different European zoos. Its aim is to reveal possible correlations between food intake, energy and nutrient digestibility and body weight development, and to evaluate factors that influence such correlations.

The poster presented shows preliminary results on the dry matter intake and body weight development of a group of four *Eulemur macaco flavifrons* living at the Cologne Zoo. Overall, more than 70 different food items were fed to the lemurs. The four lemurs each consumed a mean of 56.54 g DM/day. Body weights showed individual variation (adult male \pm 3100 g; adult females \pm 2790 g; juvenile female \pm 1860 g). Samples of feeds and feces are currently being analyzed for gross energy and nutrient content but these data are not yet available.

The underlying study is part of a comprehensive project investigating the feeding ecology of free-ranging blue-eyed black lemurs in the Sahamalaza region of north-west Madagascar. It aims to combine data from captive and wild *E. m. flavifrons* in order to gain a better understanding of the energy metabolism as well as patterns of food selection in this subspecies of lemur.

Poster: How the Milne Edwards sportive lemur (*Lepilemur edwardsi*) reacts to a fossa encounter

Z. Andriatahiana Rabesandratana^{1, 2}, Noro Raminosoa² & Elke Zimmermann²

¹Faculté des Sciences, Université d'Antananarivo, Madagascar & ²Institut für Zoologie, Tierärztliche Hochschule Hannover, D; elke.zimmermann@tiho-hannover.de

Predators pose a major threat to the survival of all smaller-bodied primate taxa and have shaped, as an important selective force, the evolution of primate sociality, communication and cognition. Direct predator-prey interactions have been seen only rarely in primates and thus, even occasional observations may provide important insights into antipredator strategies, in particular of nocturnal taxa.

The fossa (*Cryptoprocta ferox*) is a Malagasy viverrid assumed to be an important lemur predator (Goodman 2003). We observed for the first time an encounter between a fossa and a nocturnal Malagasy lemur, the Milne Edwards sportive lemur, in the dry deciduous forests of the National Park Ankarafantsika in north western Madagascar. During more than 400 hours of focal animal observations of radio-collared sportive lemurs, we observed a direct confrontation of one of our focal animals (N=22) with a fossa. The lemur stared at the fossa and emitted sequences of alarm calls. These calls seemed to attract the attention of other sportive lemurs in the vicinity who responded by giving alarm calls. The fossa finally retreated. We quantified alarm calling behaviour. First results indicate that the frequency contour of the alarm call is quite similar to one of the call types given during territorial displays. Alarm calling rate seems to vary according to arousal. Results will be compared with acoustic antipredator behaviours of other primates. Supported by DAAD and VW.

Poster: For how long can capuchin monkeys wait for a return?

Amandine Ramseyer, Marie Pelé, Valérie Dufour & Bernard Thierry

Centre d'Ecologie, Physiologie et Ethologie, Centre National de la Recherche Scientifique, & Centre de Primatologie, Université Louis Pasteur, Strasbourg, F; thierry@neurochem.u-strasbg.fr

When addressing the existence of calculated reciprocity among animals, we usually mean their abilities to keep track of what they give and to anticipate what they receive. But for reciprocal altruism to occur, individuals must be able to wait for the commodities returned by the partner. We tested the ability of brown capuchin monkeys (*Cebus apella*) to delay gratification in experiments where subjects could exchange food items with a human experimenter. The subjects were one female and five males. When they were allowed to nibble the food item before returning it, they could wait between 1 and 10 minutes according to individuals and food nature. When they were required to give back the whole item, they would not wait for more than 10 seconds. The failure of capuchin monkeys to perform genuine exchanges after a limited time period cannot be explained by memory or anticipation limitations. Reduced self-control is the most likely cause of their failure. This may account for the absence of reciprocal altruism in many other species.

Poster: Uniqueness of the craniofacial complex in *E. rubriventer* (Lemuridae) demonstrated from an original approach based on surface analysis.

Herimalala Raveloson, Matthieu Schmittbuhl, Jean-Marie Le Minor & Yves Rumpler

Louis Pasteur University, Strasbourg, F; Herimalala.Raveloson@medecine.u-strasbg.fr

The study of the craniofacial complex provides a basis regularly used for depicting the morphological differences between Lemuridae taxa. Among all these approaches, the morphological characterization of the skull in superior view has surprisingly received less attention. In the present work, we attempt to compare the cranial morphology in Lemuridae using an original approach based on the surface calculation of the principal parts of the skull in a superior perspective. The area of the neurocranium, splanchnocranium, temporal fossae, and the whole skull in superior view were quantified in an osteological sample composed of 213 Lemuridae (90 *Eulemur*, 45 *Hapalemur*, 26 *Lemur*, and 52 *Varecia*) and compared using statistical techniques.

Interspecific differences were particularly marked for *Hapalemur simus* and *Eulemur rubriventer*.

Surface: the total skull area of the different Lemuridae species is related to the body weight of the species except in *Hapalemur simus* and *Eulemur rubriventer*. Indeed, in *Hapalemur simus* and *Eulemur rubriventer*, the skull area is proportionally higher in relation to their body weight and the temporal fossae more extended.

Results of the allometric comparisons indicate that except for *Eulemur rubriventer* and *Hapalemur*, all other taxa exhibit similar relationships between the area of the temporal fossae and the skull size. Indeed for a given skull size, *Eulemur rubriventer* and to a lesser degree *Hapalemur*, display very large temporal fossae. This peculiarity confers to *Eulemur rubriventer* a very special cranial architecture differentiating it from the other *Eulemur* species. Such a morphological disposition seems not to be linked with dietary adaptations but it might rather have evoked a particular phylogenetic signal. As some authors noticed that *E. rubriventer* are clearly different from the other *Eulemur* in locomotion and vocalization traits, its systematic position among the other *Eulemur* appears a bit controversial.

Poster: Play signalling and social rules in orangutan play

Marina Davila Ross & Elke Zimmermann

Institut für Zoologie, Tierärztliche Hochschule Hannover, D;
marinadavila28@hotmail.com

Great apes emit play faces and play vocalizations as metacommunicatory tools that indicate, "this is play". While studying juvenile chimpanzees, Flack et al. (2004) found that social rules of play signaling and play intensity are present in dyadic play bouts and argued that conspecifics are able to perceive these rules. Social rules are regularities of social interactions, which when perceived, might involve the ability to

anticipate reactions of others. To explore to what extent similar rules govern social play of other ape species, we are currently investigating the usage of play signals and play intensities, as well as of dyadic play sequences, in orangutans according to Flack et al. (2004). We found that orangutans emit play signals prior to play initiation and contact play and that older playmates self-regulate themselves by reducing their play intensity. Since our results suggest that orangutans play less roughly than chimpanzees, a comparison between these two species could reflect the importance of play intensity in the manifestation and perception of social rules in ape play.

Talk: Analysis of the acoustical patterns of the short bark sounds in chimpanzees (*Pan troglodytes*)

Hartmut Rothgänger

Medizinische Fakultät der Humboldt-Universität Berlin (Charité), ZHGB, Institut für Medizinische Anthropologie, D; hartmut.rothgaenger@charite.de

Bark sounds were defined by Goodall (1986) as well as by Marler and Tenaza (1977) as loud sharp calls that vary considerably in pitch. They are associated with annoyance or mild aggressiveness towards other individuals though it may also occur in generalised excitement or while threatening. Chimpanzees exhibit these sounds as part of social behaviour.

In a recent investigation, it turned out that the short bark sound is separated into different types depending on social behaviour. To get an insight into this topic, we recorded 613 barks of 21 adults between the ages of 11 to 40 years and 12 infants from the age of zero to ten years at the Burgers' Zoo Arnhem (Netherlands). This data was analysed with high resolution fundamental frequency analysis. To order to describe the social behaviour belonging to the barks, we evaluated video recordings.

The results show that short barks have to be divided into four separate types called BHA (42,41 %), BHU (20,39 %), BHO (19,90 %) and BHE (17,29 %). They are characterised by clear structural differences (BHA Fo 944,2 Hz; t1 123,5 ms; t2 281,2 ms; BHO Fo 711,2 Hz; t1 105,5 ms; t2 319,3 ms; BHU Fo 388,5 Hz; 140,57 ms; t2 123,6 ms and BHE Fo 999,8 Hz; t1 76,2 ms; t2 249,6 ms; Fo= fundamental frequency, t1 = duration, t2 = pause duration).

The results show that short barking can divide into four separate calls with four different contexts. BHA bark appears in subdominant situations if the chimpanzee approaches a dominant chimpanzee, BHO in subdominant situations if the chimpanzee turns away from the dominant chimpanzee, BHU in point to situations if a chimpanzee calls a dominant chimpanzee and BHE in aggressive situations if the chimpanzee rejects another chimpanzee.

Poster: Acoustical analysis of the sounds in chimpanzees (*Pan troglodytes*)

Hartmut Rothgänger

Medizinische Fakultät der Humboldt-Universität Berlin (Charité), ZHGB, Institut für Medizinische Anthropologie, D; hartmut.rothgaenger@charite.de

Chimpanzees have a rich repertoire of different sounds. Jane Goodall (1986) specifies 17 and Peter Marler and Richard Tenaza (1977) specify 13 in this species. Current studies show that the present classification of these sounds needs a new interpretation. This study would like to provide a new interpretation of the cries and sounds in infant and adult chimpanzees.

In five years, a large number of sounds were recorded in Burgers' Zoo Arnhem (Netherlands). The sounds of the chimpanzees were analysed by means of video analysis, sonagraph and high-resolution fundamental frequency analysis. The acoustical analysis of chimpanzee sounds reveals 23 different sounds that can be classified into 16 categories. The most frequent sound is crying, which can be divided into three categories. Short barking and food calls are other sounds in chimpanzees and are split into four, respectively two categories. Furthermore, the chimpanzees show a number of other sounds like pant hoots, howling and Hau-attack calls. These forms of sounds vary in respect to age and sex. For example, crying in infants 29,2 (sounds per animal), females 28,8 and males 22,9 sounds, short barking in females 28,2, males 17,9 and infants 6,0 sounds, food call in female 14,8, male 6,8 and infants 5,1 sounds and pant hoot in males 49,5, female 1,6 and infants 0,8 sounds. The results provide a novel possibility to differentiate the sounds of captive chimpanzees. Above all, we assume that this classification represents the situation in wild chimpanzees as well.

Talk: An "indirect reputation" experiment in four great ape species

Yvan I. Russell¹, Josep Call² & Robin I.M. Dunbar¹

¹School of Biological Sciences, University of Liverpool, UK & ²Abteilung für Vergleichende und Entwicklungspsychologie, Max Planck Institut für Evolutionäre Anthropologie, Leipzig, D; yrussell@liv.ac.uk

Reputation is defined as knowledge of a person's typical behaviour based on that person's past behaviour. *Indirect reputation* refers to knowledge gained from observing events between third parties. This experiment was devised as a methodology for learning about indirect reputation in non-human apes (inspired by a recent body of human experiments). Four great ape species (*Pan troglodytes verus*, *Pan paniscus*, *Gorilla gorilla gorilla*, *Pongo pygmaeus abelii*) were tested on a simple paradigm where every subject passively observed two types of food sharing incident that occurred between human actors. One (1) was a *nice person* incident (a "nice" person gave some of her grapes to a human who begged for them). The other (2) was a *nasty person* incident (a "nasty" person refused to allow the beggar to take any grapes). After observing both incidents, the subject was allowed into a compartment where both nice and nasty persons were sitting side-by-side at plexiglas windows (with open food holes). Both humans were holding a container of grapes but neither fed the subject. This was a test of which human (nice/nasty) the subject prefers to approach. One measure of preference was the percentage of seconds that the subject spent at either window. Only chimpanzees (n = 17) spent significantly more seconds at the nice person's window than the nasty person's. The results were not significant for bonobos (n = 5), orangutans (n = 5), or gorillas (n = 5). One interpretation of these

data is that chimpanzees were using the passively observed incident to guide their subsequent food seeking behaviour.

Talk: MHC class I genes of rhesus and cynomolgus macaques

Ulrike Sauerma¹, Roman Siddiqui², Nadine Hehne¹ & Gerhard Hunsma¹

¹Abteilung Virologie und Immunologie, Deutsches Primatenzentrum, Göttingen &

²Abteilung Genomanalysen, Institut für Molekularbiotechnologie, Jena, D;

usauer¹@dpz.gwdg.de

The polymorphic genes encoded in the major histocompatibility complex (MHC) play a pivotal role in the inherited resistance against pathogens. The recent published rhesus MHC DNA-sequence demonstrates that the rhesus MHC region is much more complex than that from humans. Information about the MHC haplotype polymorphisms and recombination frequencies, however, can be only obtained by the analysis of populations.

Cloning and sequence analysis combined with rapid MHC-typing techniques and pedigree analysis of the rhesus monkeys kept at the DPZ allowed us to deduce several rhesus haplotypes. In addition, cynomolgus MHC class I sequences were characterised.

We were able to deduce 28 distinct MHC haplotypes spanning the MHC class II DQA-DQB-DRB-class I region. 13 MHC class I haplotypes were characterised in more detail by sequence analysis of more than 1000 cDNA clones of selected monkeys. Per haplotype up to the 3 *A*- and up to 6 *B*-sequences were identified. Likewise, in cynomolgus macaques multiple *A*- and *B*-genes were detected. On the basis of these sequences a more detailed typing protocol is currently established. Data of the recombination frequency will be presented. Preliminary evidence suggests that the macaque MHC class I region shows enormous combinatorial diversity, while displaying at the time a low allelic polymorphism compared to humans. Thus, macaques have developed other means than humans and great apes to maintain MHC polymorphisms.

Poster: Influence of arousal on multimodal signalling in tree shrews (*Tupaia belangeri*)

Simone Schehka & Elke Zimmermann

Institut für Zoologie, Tierärztliche Hochschule Hannover, D;

Simone.Sch¹ehka@tiho-hannover.de

In their natural environment, the tropical forest of Southeast Asia, diurnal tree shrews forage mostly in pairs or family groups. The individuals keep track to each other by multimodal signalling (tail flicks, calling), often from the safety of trees (Emmons, 2000). We studied in captive tree shrews whether this conspicuous signalling behaviour requires the audience of social partners and to what extent it conveys information upon the caller's emotions. Two different arousal states were induced in

an animal in a separation paradigm by exposing it to i. a new environment (high arousal) ii. an already known environment (low arousal). Tests lasted 30 min, were video- and audio taped and quantified. All individuals (N=21) showed a significant increase in multimodal signalling in the unknown environment compared to the known environment. Whereas frequency contour of the respective calls did not change between the two conditions, there was a significant difference in calling rate. Results suggest that audience is not a prerequisite for multimodal signalling and that the arousal dimension of the expression of an emotional state is conveyed by calling and tail flick rate.

Talk: Baby market in vervet monkeys

Christelle Scheid & Ronald Noë

Ethologie des Primates (CEPE CNRS UPR 9010), Université Louis-Pasteur, Strasbourg, F; christelle.scheid@ulp.u-strasbg.fr

In many primate species, newborn infants attract a lot of attention of other members of the group. Notably, females like to inspect and handle newborns. Often enough the mother only allows the would-be handler access to her infant after she has been groomed first. When this 'grooming before handling' is indeed a kind of payment to obtain permission, the length of the grooming bout should depend on the value the handling of the infant has to the groomer. The idea of testing the law of supply and demand on primate 'baby markets' stems from Henzi & Barrett (2002; *Animal Behaviour* 63(5): 915-921). They showed that the fewer infants there are in chacma baboon groups, the longer would-be handlers have to groom the mother. Independent of this 'market effect' the authors found a relationship between grooming bout length and the rank difference between mother and handler. Handlers that are subordinate to the mother have to groom longer, on average, than dominant handlers. These findings have recently been corroborated in a more extensive study by the same authors (In: Kappeler & van Schaik, 2005, in press). We have tested the same idea in vervet monkeys (*Chlorocebus aethiops*) both in captive (Centre de Primatologie, Niederhausbergen, France) and free-ranging groups (Loskop Dam Nature Reserve, South Africa). We basically found the same market effects, but no significant effect of the rank of the handler relative to the mother. This difference when compared to baboons is likely to be due to the more relaxed dominance relationships of vervets. In vervets, however, low-ranking mothers sometimes have to groom dominant handlers in order to get their infants back. We further found that mothers receive most grooming from females that have no infant themselves and that low-ranking mothers are more popular targets than high-ranking ones.

Talk: Do mouse lemurs show asymmetries in handedness and the perception of communication calls?

Marina Scheumann & Elke Zimmermann

Institut für Zoologie, Tierärztliche Hochschule Hannover, D;
marina.scheumann@tiho-hannover.de

In humans, speech processing mechanisms and other control mechanisms for fine motor tasks are lateralized predominantly to the left cerebral hemisphere. Monkeys have also showed a right ear bias for species-specific calls, which indicates a left hemispheric perception (Weiss et al., 2002). The evolutionary origin of these cerebral asymmetries is controversial. Therefore, we used the nocturnal arboreal grey mouse lemur (*Microcebus murinus*) as a model for ancient primates.

We investigated handedness and auditory perception asymmetries in 17 individuals in a combined manual and auditory perception task in a sound-damped room. During the first part of an experimental session, an individual performed a food grasping task, during the second part, it was exposed to different acoustic stimuli out of four categories: communication calls of (1) their own species, of (2) an unknown species, of (3) a known species and (4) control calls. Playbacks started when the subject was keeping its head at a fixed position so that the loudspeaker was 180° directly behind its back. In the manual food grasping task, 35 % of the tested individuals were ambilateral whereas 65 % showed a lateral bias in hand use. From the latter group, more than 90 % were right-handed. In the auditory perception task, only 43 % of the tested individuals showed an orientation response to the control category whereas more than 64 % showed a response to communication calls of their own species, a known species, or an unknown species. However, a significant orientation bias was neither found between the different stimulus categories nor within the species-specific communication calls. Orientation responses and handedness do not seem to be correlated. Results will be discussed with regard to recent models of lateralized sensory and motor functions in primates. Supported by the DFG.

Talk: The importance of ingestion rates for estimating food quality and energy intake

Oliver Schülke¹, Mukesh K. Chalise², Jörg U. Ganzhorn³ & Andreas Koenig¹

¹Department of Anthropology, Stony Brook University, USA, ²Natural History Society of Nepal, Katmandu, Nepal & ³Zoologisches Institut & Museum, Universität Hamburg, D; oschuelke@notes.cc.sunysb.edu

Optimal foraging theory proposes that natural selection favours individuals maximizing net energy gain per unit feeding time. Hence, animals are expected to feed on food containing high levels of energy or relevant nutrients and on food allowing for high ingestion rates. While the first prediction has been investigated in countless field studies on primates, the latter has been largely ignored. We investigated the relative importance of nutrient content and ingestion rates for item-specific energy ingestion rates in two ecologically different populations of Hanuman langurs (*Semnopithecus entellus*) from Jodhpur and Ramnagar. We used the same protocol to sample data on feeding time budgets, bite rates, and bite weights. Sugar and protein content of 50 and 100 food items, respectively, were measured. Ingestion rates varied more between different food items than between individual langurs (t-tests). Food item category did not predict variation in item-specific ingestion rates (ANOVA). Ripe fruits were high in both protein and sugar in Ramnagar, whereas the average nutrient content of item categories did not vary systematically in Jodh-

pur (ANOVA). General Linear Models revealed that ingestion rate had the same (Ramnagar) or much higher (Jodhpur) predictive power for energy ingestion rate than chemical composition of food items. The results imply that tests of socioecological models or studies of food choice based solely on feeding time analyses might yield spurious results. Hence, definitions or analyses of food quality should be based on nutrient gain rates rather than on chemical composition alone. Supported by Alexander von Humboldt Foundation, DAAD, DFG, and Stony Brook University.

Talk: Behavioural responses to the removal, absence and reintroduction of adult female hamadryas baboons (*Papio hamadryas*) existing in a one-male unit

*Franziska S. Schuerch*¹, *Scott Heffernan*², *Justine K. O'Brien*¹, *Peter Thomson*¹ & *Paul D. McGreevy*¹

¹Faculty of Veterinary Science, University of Sydney & ²Department of Renal Medicine, Royal Prince Alfred Hospital, Sydney, NSW Australia; schuerch@vetsci.usyd.edu.au

Social rank and relationships between non-human primate group members are not static but depend on the social environment. Changes in an individual's social environment are detected by constant monitoring of conspecific group member(s). Individuals that have been temporarily separated from their home group lack knowledge of potential changes in social relationships during their absence. During reintroduction, it would be predicted that non-human primates display behavioural patterns that function to assess their social environment.

Several species and sex differences in behavioural responses to reunion of group members have been identified on non-human primates. However, none have been reported in hamdryas baboons (*Papio hamadryas*). Since female hamadryas baboons maintain primary social bonds with the lead male in one-male units (OMU), it is hypothesised they would (i) react opportunistically to the absence of other females by strengthening their own bond with the lead male and (ii) challenge high-ranking, returning females' social position during reintroduction.

The current study was designed to investigate behavioural responses of members of OMUs to 48h absence and reintroduction of female pairs of different social rank.

Results from this study showed that females (i) did not react opportunistically to the absence of high-ranking females and (ii) following separation and reintroduction, they exhibited an increase in affiliative behaviours, including grooming, contact grunts, regarding conspecifics and submissive behaviours ($P < 0.001$). This suggests that hamadryas baboons exhibit such behaviours to assess their social environment after separation.

Contrary to expectations, returning females appeared to be attractive to other female group members (with which they interacted in affiliative ways during reintroduction). However, high-ranking returnees appeared to be more attractive than low-ranking returnees. These findings suggest that returning females' social positions were not challenged.

Intriguingly, high-ranking returnees failed to demonstrate a preference for interacting (e.g., by allogrooming) with the lead male during reintroduction. This finding

suggests that either hamadryas baboon females' social rank in this study may not be solely based on their relationship with the lead male or that, under certain circumstances, females prefer to interact with other females rather than the male.

Poster: Multicolour flow cytometry for the monitoring of T-cell physiology in long-term SIV infected macaques

Rainer Schulte, Sieghart Sopper, Gerhard Hunsmann & Christiane Stahl-Hennig
Abteilung Virologie und Immunologie, Deutsches Primatenzentrum, Göttingen, D;
rschulte@dpz.gwdg.de

The infection of *rhesus macaques* (RM) with simian immunodeficiency virus (SIV) is the important animal model for AIDS to study pathogenesis and perform vaccine experiments. After infection some macaques become long-term non-progressors (LTNP), which are characterized by low viral load and no clinical progression to AIDS for a long period of time. Even now, the immunological parameters of T-cell physiology in these animals are not well understood. Our aim was to compare T-cell surface marker expression and antigen-specific cellular immune responses of LTNPs with those of infected animals progressing to disease and with those of uninfected controls. To this end we used the multicolour flow cytometry together with intracellular cytokine staining for a phenotypic and functional cellular analysis of T-cells in this nonhuman primate model. Lymphocytes of non-infected and infected, clinically healthy animals were isolated and cellular phenotypes were determined by flow cytometry analysis. For cytokine analysis cells were stimulated with SIV-specific peptides for six hours following intracellular staining of multiple cytokines (TNF, IFN, IL 2). Data were acquired on a BD LSR II flow cytometer. Long-term non-progressor animals show a higher proportion of memory phenotype lymphocytes in comparison to naive animals. In contrast, infected animals with a typical disease course lose this T-cell subset. Upon stimulation with SIV specific peptides LTNPs consistently show increased numbers of CD4+ and CD8+ T-cells expressing the Th1-cytokines IFN and TNF. We show that LTNPs have a high proportion of activated, memory T-cells. They also display CD4- and CD8-mediated immune responses against SIV-peptides. We suggest that both T-cell subpopulations are crucial in viral containment observed in these animals. Thus, potential SIV/ HIV vaccines should prime for strong memory responses against these two T-cell subpopulations.

Talk: Multicolour flow cytometry allows monitoring of immunological parameters

Reiner Schulte, Paris Sidiropoulos, Christiane Stahl-Hennig, Gerhard Hunsmann & Sieghart Sopper
Abteilung Virologie und Immunologie, Deutsches Primatenzentrum, Göttingen, D;
rschulte@dpz.gwdg.de

Fluorescence-activated flow cytometry (FACS) is one of the most powerful technologies used in immunology. By applying a polychromatic approach it is possible to distinguish between multiple cellular phenotypes in one sample of body liquids or tissues. Using the 12-parameter technology by means of the BD LSR II flow cytometer it was our aim to analyse the cellular composition of blood and lymphoid tissues in the rhesus macaque. Whole blood was drawn from rhesus macaques and surface stained for lineage specific markers to characterise cellular subsets. Additional markers were used to display the differentiation state and activation pattern of these subpopulations. After staining, erythrocytes were lysed by a hypoosmotic shock and leucocytes were washed twice and analysed by flow cytometry. For analysis of tissue-derived lymphocytes, lymph nodes were dissected and mechanically disrupted to get cell suspensions. Cells were stained according to protocols used for whole blood and analysed. Lymphocytes were gated according to their forward and side scatter characteristics. At least 30.000 events were acquired and analysed. Here we demonstrate the enormous capacity of polychromatic analysis to discriminate between cell types of different origin. With polychromatic flow cytometry it is possible to dissect the heterogeneity of cell populations that mediate defence against various pathogens. This ability will be crucial for a further understanding of cellular immunity and disease pathogenicity.

Poster: Cathemerality in blue-eyed black lemurs (*Eulemur macaco flavifrons*) on the Sahamalaza peninsula, Northwest Madagascar

Nora Schwitzer^{1, 2}, Werner Kaumanns¹, Horst Zahner² & Christoph Schwitzer¹

¹Arbeitsgruppe Primatologie, Zoologischer Garten Köln & ²Institut für Parasitologie, Justus-Liebig-Universität Gießen, D; studpri@zoo-koeln.de

The blue-eyed black lemur is a critically endangered lemur subspecies living exclusively in the few remaining forest fragments on and just east of the Sahamalaza peninsula (Sofia region, Northwest Madagascar). It inhabits primary and secondary semi-humid forests within a transition zone between the Sambirano region in the north and the western dry deciduous forest region in the south.

Although most of the taxa within the genus *Eulemur*, including the nominate subspecies *E. m. macaco*, have been described as showing activity patterns that involve both day and night activity (see Colquhoun, 1997; Wright, 1999), no systematic study has so far been conducted on activity patterns of wild *E. m. flavifrons*. In captivity blue-eyed black lemurs showed a degree of cathemerality similar to that of other *Eulemur* species (Schwitzer, 2003). In the study at hand, we intended to investigate whether the aforementioned results obtained from captive *E. m. flavifrons* also applied to wild individuals of the taxon.

Four groups of *E. m. flavifrons* living in two different fragments of the Ankarafa forest, situated in the south-western part of the Sahamalaza peninsula, were followed for either 24 h/month or 48 h/month each during four months (October, November and December 2004, March 2005). Activity data were collected separately for males and females via instantaneous group sampling using 2-minute intervals. During night hours it was impossible to distinguish between the sexes.

Preliminary results of our study confirm that *E. m. flavifrons* shows a cathemeral activity pattern in the wild. The degree of nocturnal activity exhibited by the study animals was variable and seemed to be linked to moonlight intensity. Activity peaked during the early morning and late afternoon hours. Similar results were obtained by Colquhoun (1997) for *E. m. macaco*.

The results of the study at hand are discussed with reference to different possible ecological influences that may have favoured the evolution of a cathemeral activity pattern in the blue-eyed black lemur. The study was supported by AEECL, the Conservation International Primate Action Fund and the Margot Marsh Biodiversity Fund.

Talk: Sexual selection and the mandrill

Joanna Setchell^{1, 2}

¹Department of Biological Anthropology, University of Cambridge, UK & ²Centre International de Recherches Médicales, Franceville, Gabon; mandrills@yahoo.co.uk

The mandrill is one of the most sexually dimorphic land mammals, and typifies the exaggerated sex differences that led Darwin to propose his theory of sexual selection. Mandrills are found only in the dense rainforest of central Africa, and have so far proved impossible to habituate in the wild. I will review studies of a semi-free-ranging colony of mandrills at the Centre International de Recherches Médicales, Franceville, Gabon, that have allowed us unique insights into the social organisation and reproductive strategies of this little-known species. I will cover previous work on mandrill social organisation, breeding seasonality, sexual dimorphism, male development and group association, male-male competition and female choice. I will then present recent analyses concerning sexual selection and reproductive careers in both sexes, including mortality, age-specific reproductive success, and variance in reproductive output.

Talk: Female-directed aggression in wild spider monkeys: Male display and female mate choice

Kathy Y. Slater¹, Colleen M. Schaffner¹ & Filippo Aureli²

¹Department of Psychology, University College Chester & ²School of Biological and Earth Sciences, Liverpool John Moores University, UK; k.slater@chester.ac.uk

Although aggression in spider monkeys occurs relatively infrequently, male spider monkeys are reported to direct the majority of their aggression towards adult females. It has been hypothesised that these attacks are a form of male coercion but recent analyses found that female reproductive state did not influence the frequency of male attacks, with no increase in attacks to coincide with the peri-ovulatory period of the ovarian cycle. Our data from two wild groups of spider monkeys (*Ateles geoffroyi yucatanensis*) from the Otoch Ma'ax Yetel Kooh reserve in Yucatan, Mexico indicated that the majority of female-directed aggression by males was character-

rised by a unique form of non-contact chasing, which led to the hypothesis that male attacks were a form of male sexual display. In order to test this hypothesis, the rates of attacks were compared across different female reproductive states. A peak in attacks was found when females were cycling, i.e., after weaning of the current infant until approximately 7 months before the birth of the next infant (at which point the female had become pregnant). Further analyses indicated that these attacks were associated with male place-sniffing behaviour (sniffing the location where a female was sitting) although place-sniffing did not cease once females had become pregnant. Female-directed male aggression may therefore be a form of sexual display, triggered by olfactory cues that indicate female receptivity. These displays may provide females with information regarding the strength and power of each male: information that will enable them to choose their mating partners.

Talk: Infection of rhesus monkeys with SIV as animal model for HIV-induced neuropsychiatric disorders

Sieghart Sopper¹, Tanja Bischoff¹, Christiane Stahl-Hennig¹ & Eleni Koutsilieri²

¹Abteilung Virologie und Immunologie, Deutsches Primatenzentrum, Göttingen &

²Klinische Neurochemie, Universität Würzburg, D; sopper@dpz.gwdg.de

HIV-infects the brain and results in neuropsychiatric deficits in a significant proportion of patients. The pathogenetic mechanisms leading to these disorders are still not well understood. We used the infection of rhesus monkeys with simian immunodeficiency virus (SIV) as animal models to fill the gaps in our knowledge.

Macaques were infected with different strains of SIV, and the time course of virological, immunological and neurochemical parameters were studied in cerebrospinal fluid. After necropsy at defined time points, brain tissue was assessed by histopathology and neurotransmitter systems were analyzed in anatomically defined brain areas. In addition, microglia was isolated for *ex vivo* studies. In order to develop targeted neuropharmacological therapies some animals were treated with dopaminergic drugs.

In this animal model, the viral load within the brain correlates with the development of neurological signs and depends on both, viral and host factors. In addition, SIV-infection leads to activation of microglia and neurochemical abnormalities such as decreased postsynaptic levels of dopamine early in the course of the disease, when only few infected cells can be found in the brain. These effects are more pronounced in animals with high intrathecal viral replication. Activation of microglia is associated with the production of potentially neurotoxic substances, such as TNF or glutamate and neurotransmitter disturbances. Treatment of SIV-infected monkeys with dopaminergic drugs restored dopamine deficits. However, histopathological analysis revealed vacuolization of the grey matter and increased viral and TNF RNA-expression. The adverse effects of dopaminergic treatment seem to be the result of a potentiation of oxidative stress found in SIV-infected monkeys through increased extracellular levels of dopamine.

Our results suggest that low-level activation of microglia may be responsible for the observed alterations in neurotransmitter systems during the early asymptom-

atic stage of SIV-infection. In this phase the brain seems to be exquisitely sensitive to oxidative stress.

Talk: Social learning strategy in *Macaca nemestrina*: a two-actions test

*Caterina Spiezio*¹, *Fabio Sempreboni*^{2,3}, *Donata Grassi*⁴ & *Emanuela PratoPrevide*⁵

¹Cognitive Neuroscience Sector, ISASS-SISSA, Trieste, ²Department of Biology, University of Padua, ³Department of Animal Biology, University of Turin, ⁴Parco Natura Viva - Garda Zoological Park, Bussolengo (VR) & ⁵Institute of Psychology, Faculty of Medicine, University of Milan, I; spiezio@sissa.it

The existence of an imitative learning ability (i.e. learning to do an act by seeing it done) can be evaluated only by distinguishing between different social learning mechanisms, and the so called two-action procedure has proved highly effective in this respect. In this research, the Two-Action Test paradigm was employed to investigate which social learning mechanism was involved in the acquisition of a new behaviour by pig-tailed macaques (*Macaca nemestrina nemestrina*). Ten subjects hosted at Parco Natura Viva, Bussolengo, I, were assigned to two different experimental groups and their ability to solve a problem after observation of a human model was assessed. The subjects were presented with the same object (a winged-box) that could be opened in two simple but different ways to reach a reward: by pushing down the lid on the one side of the box or by lifting it up on the other side. Each group was shown only one of the two possible solutions. All the subjects touched and manipulated the same part of the equipment touched by the demonstrator when opening the box to retrieve the reward. However, they used an individual strategy to solve the task. These findings show that macaques learned something through observation, i.e. which part of the box should be manipulated to open it, but did not imitate the behaviour witnessed (pushing/ lifting). The process underlying the acquisition of the new behaviours via observation, therefore, seems to be stimulus/local enhancement plus individual learning. All the subjects tried to open the box by lifting the lid up and none of them pushed it down. As during a previous study, the macaques were shaped to open a box by lifting up the lid from the front side, thus, a priming effect could have interfered with the acquisition of the new response.

Poster: Can young chimpanzees learn a new behaviour by observing their human caregiver?

*Caterina Spiezio*¹, *Donata Grassi*², *Andrea Sgaravatti*³, *Michael A. Hufmann*⁴ & *Emanuela PratoPrevide*⁵

¹Cognitive Neuroscience Sector, ISASS-SISSA, Trieste, ²Parco Natura Viva - Garda Zoological Park, Bussolengo (VR), ³Department of Psychology, University of Trieste, I, ⁴Primate Research Institute, Kyoto University, J & ⁵Institute of Psychology, Faculty of Medicine, University of Milan, I; spiezio@sissa.it

The relationship between the interaction of two individuals and the transmission of knowledge and skills from one to another is called "master-apprenticeship"; through repetitive observation of the master (i.e., mother), the apprentice (i.e., infant) acquires a skill that was not part of his behavioural repertoire before. Over a period of 5 years, infant chimpanzees develop and, under natural conditions, they use their mother as a model for acquiring new behaviours and habits. In captivity, hand-reared chimpanzees form a strong bond with their human caregiver who represents a substitute of their natural mother. We investigated whether hand-reared young chimpanzees would learn a new behaviour, namely the leaf swallowing behaviour, by observing their "human mother" performing it. Four hand-reared young chimps housed at Parco Natura Viva, I, were allowed to observe for ten times their caregiver swallowing the leaves of a plant species similar to one chimpanzees naturally use in the wild. At the beginning of the study, all the subjects played with the plant without paying attention to it or interacting with its leaves. However, during the experimental sessions, all the subjects showed the leaf swallowing behaviour at least twice. When they witnessed the leaf swallowing behaviour from their keeper, they started to interact with the leaves and to display this behaviour. These results suggest that hand-reared young chimpanzees can learn new behaviours by observing their human surrogate mother. Furthermore, this study moves a step forward towards the comprehension of how the leaf swallowing behaviour is acquired in the wild, suggesting that it is acquired socially.

Poster: Decrease of bipedal behaviour with increasing age in captive Western lowland gorillas (*Gorilla g. gorilla*)

Anna B. Stein, Christine Biemann, Nancy Clauß, Vanessa Zacher & Carsten Niemitz
Institut für Humanbiologie und Anthropologie, Freie Universität Berlin, D;
humanbio@zedat.fu-berlin.de

Gorillas are regarded as quadrupedal primates with bipedal positional and locomotor pattern playing a minor role. We aimed at testing this assumption with special regard to bipedal patterns during ontogenetic development.

Three juvenile and subadult (aged 3, 4 and 8 years) and five adult gorillas (aged 12-47 years) were observed in the Zoological Garden Berlin. We recorded bipedal and quadrupedal behaviour, sitting, lying, climbing and other behaviour. We differentiated between general bipedality (support by the hind limbs, e.g. squatting) and upright bipedal behaviour.

In the 3 year old juvenile, bipedal behaviour was most frequent (33.1 % of all time points), while, in the 4 year old gorilla, it took up 25.3 % of time, ranging second behind quadrupedality, which consumed 36.5 %. However, upright bipedality contributed only 2.1 %, whereas, in the younger juvenile, the corresponding value was 5,6% ($p < 0.000$). The 8 year old subadult showed bipedal behaviour in 9 % of all time points but only 1.9 % of upright bipedal behaviour, the most frequent category being quadrupedal patterns.

Between the ages of 3 and 8 years, we found a decrease in upright bipedal patterns ($p < 0.000$). In the five adult gorillas, bipedal behaviours contributed 3.9 % in-

doors and 10.2 % in the outdoor enclosure. However, upright bipedal behaviour consumed only 0.5 % indoors, and 1.5 % outdoors. The decrease in upright behaviour from juvenile to adult gorillas indoors was most significant ($p < 0.000$). The decrease of bipedal behaviour observed during ontogeny in our few individuals will be compared with findings by other authors.

Talk: Female choice in long-tailed macaques: an experimental study of mating preferences in relation to the female cycle

Elisabeth H.M. Sterck¹, Eleni Nikitopoulos¹, Michael Heistermann², J. Han de Vries¹ & Jan A.R.A.M. van Hooff¹

¹Behavioural Biology, Utrecht University, NL & ²Abteilung Reproduktionsbiologie, Deutsches Primatenzentrum, Göttingen, D; e.h.m.sterck@bio.uu.nl

Female primates in many multi-male multi-female groups mate promiscuously, but some males obtain more matings than others. Such a pattern may be due to female preferences for particular males or to male monopolisation of the female. To tease apart these possibilities, we conducted an experimental study where females control access to males. In addition, female and male behaviour may differ depending on the possibility to fertilise a female. During their fertile period, females are expected to exert preferences, whereas they are expected to be promiscuous during the non-fertile period. We investigated this in captive long-tailed macaques (*Macaca fascicularis*) at the Utrecht University. Six socially housed females were trained to enter a chamber, where for an eight month period, they could choose daily between pair-wise combinations of four males. We collected faecal samples to determine female hormone levels. Five out of the six females chose to mate with all males and were highly promiscuous. Their level of promiscuity did not differ between the fertile and the non-fertile period. Our results indicate that females, given the opportunity, mate promiscuously and distribute their matings rather evenly over the males. This suggests that the observed mating-biases in group-living long-tailed macaques are probably the result of an interaction between female and male sexual strategies.

Poster: Machos or Don Juans? The reproductive tactics of male bonobos (*Pan paniscus*) in captivity

Jeroen M.G. Stevens^{1,2} & Hilde Vervaecke^{1,2}

¹Department of Biology, Group Ethology, Wilrijk & ²Centre for Research and Conservation, Antwerp, B; jeronobo@skynet.be

Bonobos have for a long time been considered as a promiscuous species with little male-male competition over access to females. Recent evidence suggests however that competition is more important than previously stated. Moreover, female mate choice may also influence male mating success since females can occupy high-ranking positions in the dominance hierarchy. Males may therefore have to invest in affiliation with females as sexual coercion, (forced copulations, infanticide) may be more difficult.

We investigated to what extent male mating success is influenced by contest competition (Macho tactic) and/or intersexual affiliation (Don Juan tactic). We studied three multi-male groups in captivity (Apenheul, NL; Twycross Zoo, UK; Plancendael Wild Animal Park, Belgium) for a total of nearly 1500 hours. 9 mature males (older than 7 years) and 11 females were the focus of the study. Observations consisted of a combination of all occurrence sampling and focal animal sampling of the males.

Our results show that competition among males is more prominent in captive bonobos than previously stated. Aggression increased in the presence of females with a maximal swelling in two study groups. Males harassed copulations relatively frequently. Only in one group did a dominant male obtain the highest number of copulation bouts. Female mate choice predicted male mating success in two groups. When females showed a preference for the alpha male, lower ranking males were found to increase their grooming efforts, which is in accordance with predictions of biological market theories. In conclusion, we find that male bonobos can behave both as Machos and as Don Juans. Contest competition over access to females is likely to be exaggerated by captive conditions (few male competitors, few females to monopolise, relatively simple environments) but is hindered by female mate choice. Females need not prefer dominant males.

Poster: Olfactory predator recognition in predator-naïve grey mouse lemurs (*Microcebus murinus*)

Dina Sündermann, Marina Scheumann & Elke Zimmermann
Institut für Zoologie, Tierärztliche Hochschule Hannover, D;
elke.zimmermann@tiho-hannover.de

Olfactory signals of predators, such as feces or urine, are known to elicit fear responses in mammals (e.g. avoidance; e.g. Pillay et al., 2002). To date, however, there is no respective information on olfactory predator perception in primates.

We have tested whether the odor of feces of different predator categories (raptors, carnivores) and of non-predatory controls (parrots, lemurs) induces fear responses in captive born, predator-naïve mouse lemurs. In the olfactory predator experiment, a mouse lemur was exposed to a particular odor fixed at a preferred location where the animal was trained to get a reward. The behavior of the mouse lemur towards the respective stimulus category was videotaped and quantified. First results showed that mouse lemurs interrupted getting the reward significantly earlier when exposed to odors of carnivores when compared to those of raptors and non-predatory controls. These findings are in favor of a genetic predisposition of olfactory carnivore recognition, which might be based on the perception of sulphurous metabolites from meat digestion. Supported by the DFG.

Talk: Differential orienting asymmetries in response to acoustic stimuli in primates?

Christoph Teufel & Julia Fischer

Forschergruppe Kognitive Ethologie, Deutsches Primatenzentrum, Göttingen, D;
cteufel@dpz.gwdg.de

An important question concerning the evolution of primate communication is how the primate brain is specifically shaped to process certain features of conspecific vocalisations. Working under field conditions, Marc Hauser and colleagues showed that Rhesus monkeys (*Macaca mulatta*) exhibit a right head-turning bias in response to playbacks of conspecific vocalisations when the stimuli are presented from 180° behind the animal, whereas in response to heterospecific or some manipulated conspecific calls, the animals show a left orienting bias. Given the contralateral connection of the auditory circuitry in the mammalian brain, this finding was related to a hemispheric lateralisation of the processing of natural conspecific vocalisations in Rhesus monkeys. Since the observed head-turning asymmetry provides a powerful paradigm to investigate the communicatively relevant parameters of non-human primate vocalisations, we replicated the experiments using a slight modification of the setup. We tested Barbary macaques (*Macaca sylvanus*) living in the enclosure 'La Forêt des Singes' in Rocamadour, and chimpanzees (*Pan troglodytes*) living at the Wolfgang-Köhler Research Centre at the Zoological Garden Leipzig. Barbary macaques failed to show any head-turning preferences in the conspecific condition as well as in the heterospecific condition, whereas, the results for the chimpanzees remain equivocal due to the small sample size. In order to base the orienting paradigm on a more solid foundation, we are currently preparing similar experiments with human subjects. The results are discussed in light of findings on lateralised processing of acoustic stimuli in non-human and human mammals and birds.

Talk: To see or not to see - How attention shapes visual perception and visual information processing

Stefan Treue

Abteilung Kognitive Neurowissenschaften, Deutsches Primatenzentrum, Göttingen, D; treue@gwdg.de

Vision is the dominant sense in humans and many other primates. Its highly evolved sensors, the eyes, provide the central nervous system with an enormous amount of information. We use attention, a sophisticated selection and filtering system, to concentrate the cortex' limited processing resources onto the most relevant incoming information. Attended aspects of the environment are processed faster, more accurately, with higher spatial resolution and enhanced sensitivity.

Using the processing of visual motion information as a model system, I will demonstrate how electrophysiological recordings from cortical neurons of macaque monkeys trained to perform attention tasks in combination with human psychophysics, functional brain imaging and computational neuroscience can help to elucidate how

the attention system modulates the processing of information in the visual cortex. These data show the neural correlates of various types of attention (spatial, feature-based, object-based) and demonstrate that sensory cortex is by no means a passive feed-forward, purely sensory system designed to provide an accurate and complete representation of the visual environment. Rather, from the earliest stages of processing, in cortex neuronal activity is the result of an interaction of sensory signals with cognitive factors. As a result, the visual system actively creates a representation of the environment that is shaped by the current behavioural state of the organism, focuses on the most relevant aspects of the sensory input, sacrifices accuracy for efficiency and emphasizes particular aspects.

Poster: Identification of distinct mitochondrial DNA (mtDNA) haplotypes in a baboon (*Papio*) population by use of a PCR-RFLP method

Christine Tuailon

Department of Biology, Nassau Community College, NY, USA; kasavac@ncc.edu

The mitochondrial DNA (mtDNA) Brown region, also known as the "896" region, is a fairly conserved coding region of the mitochondrial genome. It has been shown to be an appropriate mtDNA marker for baboon genetics studies, as this region contains several base pair substitutions and can be used to identify polymorphism within a baboon population as well as between populations. Some studies have used sequencing to determine genetic polymorphism. In this genetic study of a *Papio hamadryas* population in Awash National Park, Ethiopia, the Brown region of the mtDNA was first amplified using the Polymerase Chain Reaction (PCR). The mtDNA amplification was followed by restriction endonucleases (RE) digestion. Each RE digestion was done separately. The choice of appropriate RE was done by screening *Papio hamadryas* mtDNA sequences published in GenBank. Visualization of the digested fragments was done on polyacrylamide microgel stained with ethidium bromide. The baboon population studied showed two distinct RFLP patterns, which were easily distinguished from each other. Two of the four enzymes used in this study (Mse I and Hinf I) created two different RFLP patterns, but both detected a base pair substitution at the same location. The PCR-RFLP method used in this study, with the additional utilization of published sequences in GenBank to compare the RFLP predicted with the RFLP observed, was shown to be a valid method to screen with relative rapidity the mtDNA haplotypes present in the study population. When large samples of mtDNA have to be analyzed, a PCR-RFLP method might be an appropriate method to use, as it has been shown to be reliable, and it consumes less time, equipment and money than sequencing methods.

Talk: Cognitive and life-history evolution in primates

Carel van Schaik & Karin Isler

Anthropologisches Institut & Museum, Universität Zürich, CH; vschaik@aim.unizh.ch

Primates are brainy mammals, great apes are brainy primates and humans are brainy great apes. The life histories of primates are slow for mammals, those of great apes are slow for primates and that of humans is the slowest of all. In this paper, we revisit the old question of whether there is correlated evolution between cognition and life history. The answer is positive for both primates (and mammals generally) and for birds, both with and without techniques to correct for phylogenetic non-independence. The best way to interpret this result is that increased brain size is one of several pathways toward slower-paced life history due to its effect on adult mortality, despite several clearly demonstrable developmental costs. Comparisons of the strength of the relationship among lineages point to ecological conditions in which this pathway is more likely. There is no evidence for a direct role of reduced gut size, as required by the expensive tissue hypothesis. We explore in particular the role of seasonal shortages in energy uptake. We discuss the relevance of this correlation for understanding human evolution.

Talk: Who's calling? A study on the food-calls of the common marmoset (*Callithrix jacchus*)

Amanda Tedesco¹, Flavia Chiaretti² & Augusto Vitale²

¹Dipartimento di Biologia dell'Animale e dell'Uomo, Università "La Sapienza" & ²Reparto di Neuroscienze Comportamentali, Dipartimento di Biologia Cellulare e Neuroscienze, Istituto Superiore di Sanità, Roma, I; keeko_willi@yahoo.it

The aim of this study is to investigate the possible communicatory function of the food-calls in the common marmoset (*Callithrix jacchus*). The responses of single individuals were studied in five different conditions: food-calls from family-mates; food-calls from individuals belonging to the same colony, but from a different family; food-calls coming from individuals from a different colony; marmoset contact calls; silence. The monkeys turned their head toward the source of all of the sounds. However, they significantly moved more often towards, and spent significantly more time in the cage the sounds were coming from, when hearing a call from the same family and the same colony, compared with a call from a different colony. They explored significantly more near the speakers after hearing a call from the same family and same colony, compared with a sound from a different colony. This latter condition was similar to the control silence. Finally, exploration tended to persist at high levels through three replications after a call from the same family, whereas tended to decrease with time with all of the other sounds. These results strongly suggest the communicatory function of the food-calls in this species. Furthermore, the stronger responses obtained by familiar food-calls also suggest a kin-related benefit.

Poster: Food quality and quantity affect the emission of food-calls in common marmoset (*Callithrix jacchus*)

Augusto Vitale¹ Amanda Tedesco² & Flavia Chiarotti¹

¹Reperto di Neuroscienze Comportamentali, Dipartimento di Biologia Cellulare e Neuroscienze, Istituto Superiore di Sanità & ²Dipartimento di Biologia dell'Animale e dell'Uomo, Università "La Sapienza", Roma, I; vitale@iss.it

The aim of this work was to investigate the possible role of food quality and quantity on the emission of food-calls by the common marmoset (*Callithrix jacchus*). Subjects were housed at the Istituto Superiore di Sanità, in Rome. The vocal emission of 13 isolated individuals were studied in three different conditions: i) in the presence of 50 g of a preferred food (hard-boiled eggs); ii) in the presence of 50 g of a less preferred food (banana); iii) in the presence of four to five small pieces of the preferred food (hard-boiled eggs). The different individuals were exposed to each one of the three conditions for 6 m. An observer recorded, using one/zero sampling during 4s intervals, when the animal was eating and when it was emitting food-calls. The results show that the marmosets emitted a significantly greater number of food-calls in the presence of the preferred food when compared with the less preferred one. Furthermore, the number of food-calls emitted was significantly higher in the presence of the largest quantity of the preferred food, compared with the smaller one, although the monkeys ate the same quantity of the preferred food in the two conditions. The results strongly suggest that the food-calls produced by common marmosets are influenced by the quality and the quantity of the food.

Poster: Coordination of group movements in wild redfronted lemurs (*Eulemur fulvus rufus*)

Katrin Wagner¹, Claudia Fichtel¹ & Peter M. Kappeler^{1,2}

¹Abteilung Verhaltensökologie und Soziobiologie, Deutsches Primatenzentrum, Göttingen & ²Institut für Zoologie und Anthropologie, Universität Göttingen, D; k-wagner01@t-online.de

An important aspect for group living species is the maintenance of group cohesion for which individuals need to coordinate their different interests. We studied behavioural aspects and mechanisms of coordinated group movements in wild redfronted lemurs in Kirindy forest, western Madagascar. In particular, we investigated the initiation and course of group movements as well as vocalisations used to initiate group movements in 4 social groups. Results indicate that both sexes initiated group movement, but females did so more often, whereas special females in each group initiated movements most often. Movements initiated by females enlisted more individuals and were often movements over mediate distances. We also found that a single group movement could be initiated and terminated by different individuals. These movements were longer than group movements initiated and terminated by the same individual. Vocalisations, so-called meows, were used before and during group progression, but no specific intention-movements were used to initiate group move-

ments. Thus, redfronted lemurs converge with group-living anthropoid primates in several fundamental aspects of group coordination and cohesion.

Talk: Post-conflict interactions in captive gorillas

Iris Weiche

Abteilung Tierökologie, Universität Tübingen, D; iris.weiche@uni-tuebingen.de

Conflict management has been intensively studied in non-human primates. Philopatric and hierarchical species developed social mechanisms to restore relationships and reduce stress after conflicts. For individual-egalitarian species with group transfers after maturity, as is the case in female gorillas, no resource access benefit is obvious from forming intra-sexual bonds. Therefore, reconciliation or coalitionary behaviour is only expected in relatives. For mountain gorillas this was proven true (Watts 1997), however, for lowland gorillas with different habitats and more frugivory, other strategies might have evolved. Additionally, in captive groups with long-term co-residency, stronger bonds could be established than under free-ranging conditions.

Long-term behavioural data (1,895 hours) on adults of four captive gorilla groups were analysed concentrating on post-conflict interactions. Five response categories were recognized: aggression, affiliation, avoidance, ignorance and control interventions. Groups differed in response category proportions (n=2,256 responses) after female conflicts, two groups showing most frequently affiliations, in one group aggression was prominent and in another group post-conflict affiliation and agonism were not statistically different. Solicitation was the most chosen affiliative response after conflicts between males and females. A positive response reconciliation was most frequent after female contests, followed by solicitation and support by bystanders. Affiliative responses were linked to quality of dyadic relationships: in "good" female relationships, solicitation was most frequent. The amount of friendly interactions between former opponents generally increased after dominance, renewed or reprimand aggression and seemed to be related to a higher intensity of aggression and corresponding behaviours.

Study results point to the presence of conflict resolution strategies in gorillas. This was expected between females and males, as male service and protection against infanticide is vital for female reproductive success. However, females also exhibit intra-sexual relationship restoration and coalitionary support with non-relatives. This may decrease further aggression and serve proximate stress-reduction and, ultimately, benefit individual fitness.

Talk: Multiple cycles and sexual swellings as evolved traits that counter male infanticide in wild chacma baboons

Tony Weingrill^{1, 2}

¹Anthropologisches Institut & Museum, Universität Zürich, CH & ²Behavioural Ecology Research Group, University of Natal, Afrika; tonyw@aim.unizh.ch

It has been suggested that the exaggerated sexual swellings found in many Old World primates have evolved to counter the risk of infanticide by males. With the aid of the swelling, females manipulate paternity probabilities of males and mate with the dominant male during periods where ovulation is most likely whereas they mate polyandrously during periods with lower probability of conception. A further possible physiological adaptation against the risk of infanticide is multiple cycles prior to conception. To find out if multiple cycles also aid in biasing and confusing paternity, this study examines mating behaviour and the size of sexual swellings in the multiple cycles of wild female chacma baboons. On average, females passed through 5.2 cycles before conceiving. They rarely had more than one consort partner during the fertile cycle whereas more males mate-guarded females on non-conceptive cycles. Females were also consorted on fewer days on non-conceptive cycles. They mated more often and with more different males when they were not mate-guarded and, therefore, had more mating partners on non-conceptive cycles than on conceptive cycles. Mean swelling size measured during the periovulatory period increased from cycle-to-cycle towards conception and was correlated with mating effort, indicating that males may use size differences between cycles to determine their mating effort. This suggests that not only the swelling during a cycle but also the relatively large number of non-conceptive cycles can be regarded as graded signals that both advertise and confuse paternity in order to reduce the risk of infanticide by males.

Talk: Ontogenetic development of bipedal behaviours in apes and human children

Vanessa Zacher, Anna Stein, Christine Biemann, Marion Pforr, Nancy Clauß & Carsten Niemitz

Institut für Humanbiologie und Anthropologie, Freie Universität Berlin, D,
zacher@zedat.fu-berlin.de

A comparison of the ontogeny of bipedal behaviour in apes and human children contributes further to the understanding of the upright gait in human evolution.

We combined the findings of several studies of quantitative analyses of bipedalism in children (*Homo sapiens*), western lowland gorillas (*Gorilla g. gorilla*) and chimpanzees (*Pan troglodytes*). For this purpose, 152 children between 4 and 48 months, eight gorillas between 3 and 47 years and five adult chimpanzees were observed. We defined behaviour as bipedal if the hind limbs supported all or most of the body weight.

The development of bipedal behaviour in children up to the age of 48 months showed that already at the age of 13 months, shortly after learning how to walk (12.2 months average), bipedal behaviour developed with 50.4 % as the most frequent behaviour in children. The maximum is reached half a year later: 72.6 %. From this time onwards, bipedal behaviour decreases but never reaches a value below 50 %.

One three-year-old gorilla showed 33.1 % bipedal behaviour, it being the most frequent behaviour at this age. For the four-year-old gorilla, bipedal behaviour was only the second most frequent behaviour (25.3 %). The eight-year-old gorilla showed only 9.0 %. From this age on, bipedality constitutes the fourth most frequent beha-

viour. This decrease proceeded with age as the adult gorillas showed only 6.1 % bipedal behaviour.

With regards to adult chimpanzees, bipedal behaviour amounts to 2.7 %. Overall, it is the fourth most frequent behaviour in chimpanzees.

There is an opposite ontogenetic development of bipedalism for human children and juvenile gorillas. In the behavioural ontogeny of gorillas and chimpanzees, the time budget used for bipedalism showed a low whereas constant value, but in human infants, it is of outstanding significance at varying values. Our results elucidate a number of comparative quantitative aspects of the ontogeny of bipedalism for the three primate species concerned.

Talk: On the molecular phylogeny of Mentawai macaques: taxonomic and biogeographic implications

Thomas Ziegler¹, Christophe Abegg¹, J. Keith Hodges¹, Lutz Walter² & Christian Roos²

¹Abteilung Reproduktionsbiologie & ²Forschergruppe Primatengenetik, Deutsches Primatenzentrum, Göttingen, D; tziegl@dpz.gwdg.de

To elucidate the evolutionary history and radiation of the "silenus-group" of the SE-Asian macaques, data on the molecular phylogeny of several macaque species, collected from extant primate populations living in key areas are needed. In this talk, we provide a comprehensive phylogenetic reconstruction of the "silenus-group" members of the genus *Macaca* with an emphasis on new genetic data from macaque species endemic to the Mentawai islands off Sumatra's West coast. Based on faecal samples collected from macaques from all four major Mentawai islands (Siberut, Sipora, N- and S Pagai), the Greater Sunda islands and the SE-Asian mainland, we sequenced a 567 bp fragment of the mitochondrial cytochrome b gene. The dataset was completed by homologous sequences from closely related macaque species available from GenBank.

The results show that i) macaques from Siberut island significantly differ not only from mainland *M. nemestrina* but also from the macaques found on the southern Mentawai islands of Sipora, North- and South Pagai, ii) these "southern Mentawai macaques" (*Macaca pagensis*) form a sister-clade to all other members of the pigtailed macaques and iii) *M. leonina* and *M. silenus* form a sister clade.

These new data support a classification of the mentioned forms into five separate taxa on a full species level: *Macaca nemestrina*, found on Sumatra and Malaysia, *M. siberu*, endemic to the northern Mentawai island of Siberut, *M. pagensis*, endemic to the southern Mentawai islands Sipora, North- and South Pagai, *M. leonina* found on SE Asian mainland and *M. silenus* from SW India.

These results have biogeographic implications and require an alternative theory explaining the evolutionary history of this group of macaques.