

Abstracts
of
Talks and Posters

The Amboseli Baboon Research Project (ABRP): ontogenetic puzzles led to this

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A year in the life of a society of wild primates or even of an individual provides a snapshot, like the view of a village from a passing train, when the reality is that the subjects and societies change over time with environmental variation, age, and change in membership and families. That is so obvious now. Yet the accomplishments of that first year of observation for each primate species were so hard-won 40 or more years ago, that goals and questions of most research projects, including ours on the baboons of Amboseli, Kenya, were focused initially on that short time frame. However, the findings from each successive year of research brought at least as many questions as answers. Even more importantly, our early emphasis on life-history questions very quickly revealed that answers would require individual-based studies of complete lives, leading us to a focus on long-term, longitudinal methodologies. After 38 years of continuous, longitudinal investigations and 46 years after our initial yearlong ecological study of baboons in Amboseli, ABRP research focuses on four primary lines of investigation, each of which is built on the longitudinal research designs complemented by recent technological advances: life-histories including studies now of aging; paternity and a range of genetic research; physiological mechanisms of life history variability; and behavioral, physiological, and life-history responses to environmental variability.

The complexity of social dynamics of male spider monkeys revealed by long-term field projects in Costa Rica and Mexico

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The social behavior of spider monkeys has been little investigated with most insights deriving from relatively short studies, not usually exceeding the duration of a PhD project and sometimes lacking individual recognition. In 2000 we started two long-term field projects on spider monkeys (*Ateles geoffroyi*). In Santa Rosa National Park, Costa Rica, we have studied one community of individually recognized spider monkeys. In Punta Laguna, Yucatan, Mexico, we joined an ongoing project on two well-habituated and individually recognized communities. Our research teams, including expert local assistants, volunteers, PhD students and postdoctoral fellows, have continuously collected behaviorally, ecologically and genetically relevant data for 7 and 9 years at the Costa Rican and Mexican sites, respectively. Analyses of these data reveal a complexity in the social dynamics of male spider monkeys that was up until now unknown. They provide new compelling evidence for male-male cooperation in intergroup competition by documenting the occurrence of raids remi-

niscent of those of chimpanzees. Within the same community a seeming lack of male-male aggression has been reported, but our recent discovery of male-male intra-group coalitionary lethal aggression undermines this perspective. In addition, our observations indicate that relationships between young and older males are filled with uncertainty, and behavior signaling benign intent and reducing tension, such as embraces, is more often exchanged between males than between any other age-sex combination. Even the generally accepted notion of philopatry of male spider monkeys is challenged by our long-term records. Some of these findings are difficult to reconcile given the reputation of males for having the strongest bonds within spider monkey communities. Our data reveal more complex and flexible dynamics with males highly attracted to each other, while simultaneously somewhat repelled.

The Tai Chimpanzee Project: a forest chimpanzee project and its contribution to our understanding of human evolution

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A predominant theory of human evolution, "The Savanna Model", proposed a shift from a forested habitat to a more open one to be central in explaining the evolution of humans and some of their characteristic behavior patterns, such as tool use, hunting, cooperation, long-lasting family relationships and reproductive strategies. The long-term studies of chimpanzees in the relatively open regions of eastern Tanzania (Gombe Stream National Park and Mahale Mountains National Park) seemed to support this interpretation by providing the first evidences in this species of tool use, hunting, long-lasting family relationships and cooperation. The Tai Chimpanzee Project (TCP) was initiated in 1979 in the rainforest of Côte d'Ivoire to evaluate the role of ecological factors on the evolution of some of the behaviors still so often referred as typically human. Now in its 30th year, the TCP has showed that ecological factors in chimpanzees play an important role in explaining the occurrence of many behavior patterns. In contrast to the "Savanna Model", tool use, hunting, cooperation, altruism, female social position and many other behavior patterns proved to be more frequent or developed in the forest environment among chimpanzees, requiring a reevaluation of the role of ecology in human evolution. High predation pressure by large cats, like leopards, combined with high sexual competition within a rich forest environment proved in chimpanzees to be key factors in promoting the evolution of previously proposed "human-like" social behaviors.

Positive impact of a long-term research project on primate populations in Taï National Park, Côte d'Ivoire

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The Taï Chimpanzee Project in Taï National Park (TNP), Côte d'Ivoire, has been running for 30 years. Three groups of chimpanzees are habituated to human presence and followed on a daily basis in an area covering approximately 60 km². To investigate the positive impact of a research area on primate populations, we walked 75 transects of 1 km in length three times each over a 10 month period, for a total survey effort of 225 km. These transects were distributed systematically over an area of 200 km², comprising the research area and adjacent zones inside TNP. We followed standard line transect methodology for estimating primate abundance, and standing crop nest counts for chimpanzees. Furthermore, all signs of anthropogenic activity along transects were recorded. Although the study of chimpanzees is the main focus within the research area, we were able to demonstrate a significant increase in primate diversity and density compared to the surrounding area. There were also significantly less signs of human disturbance (such as poachers' trails, snares, etc.) inside the research area. The results of this study suggest that even if the principal objective of many field sites is the investigation of primate behavior, their presence is important for primate conservation.

A many-splendored world! Long-term studies on Bonnet Macaques in the Bandipur National Park – Mudumalai Wildlife Sanctuary, Southern India

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The bonnet macaque (*Macaca radiata*), an Old World monkey endemic to peninsular India, usually lives in seasonal tropical deciduous forests and occurs in typically large multi-male multi-female associations. Our ten-year-long continuing study on this species has revealed the appearance of a fairly high proportion of small but reasonably stable uni-male troops within the Bandipur-Mudumalai population in recent years. Demographic analyses indicated that, as compared to multi-male troops, uni-male groups are relatively depleted in subadult and juvenile males, exhibit a unique female-biased birth sex ratio and display extensive female dispersal, all of which may have arisen in response to reproductive monopolization by the solitary resident male. Several ecological factors, including food provisioning, may have led to the evolution of this social organization, unique for a seasonally breeding cercopithecine primate. Provisioning of primate groups also leads to a significant increase in intra-troop competition among individuals for the newly available resources. Individual macaques are, however, able to adopt appropriate social

strategies to maintain peace and reduce aggression under these different ecological regimes. We have also investigated the occurrence of two important epigenetic phenomena, phenotypic plasticity and behavioral inheritance, in these social organizations. Adult females and males appear to exhibit remarkable phenotypic plasticity and individual behavioral variation, both of which may profoundly influence their survival and reproduction in the rapidly changing ecological and social environments they are forced to confront. Our studies have thus examined the role of such phenotypic flexibility in shaping social behavior, the occurrence of individual behavioral traits leading to the establishment of social traditions, and the appearance of gene-culture co-evolution amidst such social traditions in this population. These studies demonstrate the behavioral and social plasticity of a primate species and the value of long-term demographic, ecological and behavioral studies of multiple groups and populations in different ecological environments.

Parasites in (long-term) primatological research

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During the past decades the interest of behavioral ecologists and conservationists in the effects of parasite infections on hosts has increased. Parasites can impair development, survival and reproduction of their hosts and are thus likely to play an important role in host life history. Still, research on the effects of parasites is a fairly new endeavor in primatology and is often constrained by methodological inaccuracy. A non-invasive method used to monitor gastro-intestinal parasite infections is commonly based on the collection of fecal samples where parasitic stages such as eggs or larvae can be detected when they are shed by their primate host. Although the analysis of fecal samples is among the simplest methods to estimate parasite infection levels, it is labor-intensive and time consuming, thus researchers try to minimize the number of samples. However, parasite egg counts via fecal samples are subject to a high variability due to a range of factors including random day-to-day variation in shedding, the phase of parasitic infection, environmental factors etc.. Hence, the time of sampling and, even more importantly, the number of samples collected per individual can have tremendous effects on the outcome of the analyses. Parasite samples collected weekly from 29 individual wild red-fronted lemurs over two study periods in consecutive years demonstrated the range of variability in parasite infection levels. These observations suggest that the extent of sampling is often insufficient to capture relevant patterns and/or avoid spurious effects. Knowledge about parasite infection can greatly contribute to our understanding of ecological and behavioral patterns found in naturally occurring primate species, but this will require both a more rigorous approach to sampling as well as the integration of parasite analyses in long-term studies.

Group size, group fission and life history in female blue monkeys (*Cercopithecus mitis stuhlmanni*)

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A long-term study of recognized individuals over 30 years provides data on life history parameters in wild blue monkey females in the Kakamega Forest, Kenya, the first such data for any forest guenon. Blue monkeys are obligate forest dwellers: compared to closely related cercopithecines that live in more open habitats, they have a slow life history associated with low immature and adult mortality rates, corroborating theoretical predictions and suggesting a habitat effect. Long-term study is necessary for documenting life histories of slow-breeding animals; another benefit, however, is that it allows one to study rare events. I also present data on five group fissions – which lead to rapid changes in group size – in the study population, considering how they relate to (female) kinship structure in the group and the behavior and reproduction of individual female group members.

The rise and fall of owl monkey dynasties: weather, warfare, or both?

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The Owl Monkey Project represents a relatively novel opportunity to evaluate hypotheses on the evolution and maintenance of social monogamy and infant care. The project takes place in the Chaco region of Argentina, a naturally fragmented landscape characterized by seasonal changes in temperature and dramatic inter-annual fluctuations in rainfall. One of our major research objectives has been to characterize the extent of sexual dimorphism in this monogamous species that shows intense paternal care. Since 1996 we have contacted 40 social groups and ~30 solitaries over 10,000 times to collect demographic information. We have spent over 15,000 contact hours observing habituated individuals in ~15 of those groups (~5000 20-min focals). We are regularly capturing, sampling and collaring individuals, providing unique morphological, genetic, hormonal and olfactory samples (n=141). Numerous and detailed research protocols guarantee that all data are summarized in quantitative monthly reports only a few weeks after they are collected using portable computers. Here I examine whether a relatively infrequent climatic event may have triggered a cascade of behavioral and demographic processes that resulted in a relatively brief period of unusually intense and frequent competition. Long-term data suggest that the El Niño event of 1997-1998 led to an unusually high level of food production, which was followed in 1999 with the highest annual rate of infant production recorded (14 of 17 groups had new infants). A few years later, those infants dispersed and competed for reproductive openings with resident adults, resulting in a high rate of broken canines, missing ear lobes, and fights that sometimes resulted in death. There were dramatic changes in group composition that

resulted in the "fall" of some stable long-term reproducing pairs. Although the new pairs that have risen seem to be at the peak of their infant production, it is difficult to predict what the tenure length of these dynasties will be. Only continuous long-term records will allow us to understand if the observed intense competition was an exception or a species-specific characteristic that is only appreciated within a longer timeframe.

Baboons on the horizon: initiation of a long-term field study on Guinea baboons in the Niokolo-Koba National Park, Senegal

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Baboons (*Papio* spp.) constitute one of the most important models for understanding the evolution of primate social systems. The origin of baboons is thought to be in southern Africa. During the Pleistocene members of the genus dispersed into baboon-free areas of large parts of sub-Saharan Africa. Guinea baboons constitute the western and hamadryas baboons the eastern extreme of the baboon dispersion. In contrast to other baboon species whose social and vocal behavior has been extensively studied, the social system and vocal communication of Guinea baboons is only poorly understood. According to theoretical models regarding the dynamics of baboon dispersal – the so-called frontier hypothesis – it is expected that Guinea baboon males remain in the natal group (male philopatry, as also found in hamadryas baboons), reveal frequent male affiliation and low degrees of male-male competition, as well as low mating and reproductive skew. Correspondingly, male display fights involving loud calls, as found in southern African chacma baboons, should be rare or absent. Vocal signals should mainly be used to coordinate affiliative interactions and group movements in this apparently fluid fission-fusion society. To test these predictions, we will collect genetic and behavioral data, as well as acoustic recordings from wild Guinea baboons ranging near the DPZ field station Simenti in the Niokolo Koba National Park in Senegal. This field site was established by our research group in April 2007. Habituation of a large community of baboons is still under way. Preliminary observations suggest, however, that Guinea baboons differ in terms of their social and vocal behavior considerably from other baboon taxa. The long-term goal of this project is the study of the socio-cognitive underpinnings of life in a complex multi-layered society.

Sexual strategies and field endocrinology in female Assamese macaques (*Macaca assamensis*)

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In multi-male multi-female groups males usually compete to monopolize and mate with as many females as possible, whereas females may employ a mixed strategy to reduce male monopolization potential and to "ideally" balance paternity concentration and confusion. To do so females may make use of different mechanisms such as: prolonged receptive periods, mating during non-fertile stages, synchronization of behavioral and/or physiological events, active polyandrous mating, or attractiveness enhancing signals such as sexual swellings. The study examined potential female mechanisms to balance paternity concentration and confusion in a seasonal species, the Assamese macaque. We determined whether female receptivity is related to fertile phases, and whether females are synchronously receptive and/or fertile. In addition, we investigated female sexual swelling patterns. The study was conducted on a group of Assamese macaques (~ 60 individuals) living at Phu Khieo Wildlife Sanctuary in north-eastern Thailand. Focal animal (> 800 hours) and ad libitum data were collected on all socio-sexual behaviors of 16 females, eight individuals being followed in each of two mating seasons. In addition, 1550 fecal samples were collected for analysis of estrogen and progesterone metabolites in order to assess timing of ovulation and conception. Females were continuously receptive throughout the mating season, i.e. matings occurred during fertile and non-fertile stages of the ovarian cycle, and during pregnancy. Female receptivity was more synchronous (95 % overlap) than expected by chance, and female fertile days overlapped, with up to three females being simultaneously fertile. Females actively initiated copulations and mated with all males including adult and subadult males. Some males and females engaged in sexual consortships of variable length. We could not detect cyclic size changes in sexual swellings suggesting that they are an unreliable cue of female fertile phases. Altogether, our findings indicate that females actively and effectively lower male monopolization potential, and confuse paternity.

Long-term studies on wild bonobos at Wamba, Luo Scientific Reserve, D.R. Congo: towards the understanding of the life history of females

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The study of wild bonobos at Wamba was started by Prof. Kano in 1973. Though it was temporarily interrupted by political instability between 1996 and 2002, we have observed bonobos of the same groups for more than 35 years until today. The identity

of most members of the main study group before and after the interruption was confirmed by DNA analyses, and currently we are carrying out various ecological and behavioral studies while following bonobos from dusk to dawn under natural conditions. One of the main topics that I focused on during my 25-year study is the life history of females and their contribution to the peaceful nature of the society of bonobos. We observed how immature females developed their socio-sexual behaviors in their natal group, how they became independent from mother and other members, and how they finally left their natal group. We also observed how females immigrated into a new group, and how they established social status there and had their offspring. When their sons grew up, some females supported them to become alpha males, and had great influence on social relationships within the group as the alpha female and as mother of the alpha male. The prolonged estrus of females reduces the ratio between males and estrous females, which seems to contribute to the lower level of inter-male aggressions. Furthermore, unlike female chimpanzees, the high social status and initiative of females in feeding and ranging allow most of females to attend the mixed-sex party, irrespective of their estrous state. When two different groups encounter, females sometimes go beyond the boundary of the two groups to have affiliative interactions with females or copulate with males of the other group, resulting in co-ranging of the two groups for as long as several days. Thus, the studies of bonobos and comparisons with the male-dominant society of chimpanzees tell us how the changes in sexuality and social status of females may drive the society towards the peaceful coexistence observed among bonobos.

MHC, mate choice and kin discrimination in baboons

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The ability of individuals to assess their relatedness to others may be crucial in the evolution of socio-sexual behavior, since it can be associated with fitness benefits mediated by both nepotism (preferential treatment of kin, including parental care), and inbreeding avoidance. But identifying relatives can prove challenging, especially in mating systems characterized by a high degree of paternity uncertainty. In this context, animals might compare phenotypic similarities between themselves and others in order to assess the probability that they are related ("phenotype matching"). One possible cue is body odor, which is influenced by the Major Histocompatibility Complex (MHC) and may thus act as a genetically-based system of kin recognition. Indeed, MHC similarity favors kin-selected behavior in rodents and discourages mating in a number of species. Since the potential influence of MHC on socio-sexual behavior remains largely unknown in non-human primates, we used data collected over several years in wild chacma baboons (*Papio ursinus*) from Namibia to test whether (1) baboon parents are more dissimilar to one another than randomly-matched partners, and (2) baboon males preferentially befriend the mothers of infants that share close MHC-similarities with themselves. In the first case,

we found no evidence of mate choice for MHC-dissimilarity after examining patterns of parentage across six groups. In the second case, we found that although males preferentially associate with their own offspring, male-infant associations are poorly predicted by MHC similarity. Our results suggest that while baboons do have some ability to recognize kin, they are unlikely to use MHC as a primary cue to identify their relatives.

A 20-year study of a ring-tailed lemur (*Lemur catta*) population at Berenty Reserve, Madagascar

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In a 14.2 ha study area of Berenty Reserve, southern Madagascar, ring-tailed lemur (*Lemur catta*) troops have been studied for 20 years on the basis of individual identification. This long-term field study has been originally started by Professor Naoki Koyama, Kyoto University, in 1989 and is still continued by his students and colleagues. We censused all lemurs and all new born infants in the main study area every year. Population sizes fluctuated between 49 (in 1990) and 116 (in 2006) individuals during the 20-year period with a population increase for the first 17 years and sudden decrease in 2007. In 1989, there were only three troops (Troop B, C, and T) in the main study area, but during the 20-year period, the number of troops increased to eight. Also during this period, several troop fissioned and range take-overs occurred. Troop C was divided into at least four troops and Troop T into three troops. Troop B has completely disappeared from the study area. On the other hand, one troop (Troop YF) immigrated from the outside of the study area. All individuals that have been identified by Professor Koyama in 1989 have died or disappeared from the main study area by 2007. Therefore, we know now the exact age of all females and most males who were born in the area. With these long-term data, we will be able to analyze the longevity and life-time reproductive success of female ring-tailed lemurs at Berenty Reserve.

Fieldwork on Japanese macaques on Koshima Island

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Primatology in Japan started on Koshima Island in the Miyazaki Prefecture. Drs. Kinji Imanishi, Shunzo Kawamura and Junichiro Itani pioneered field research on Japanese macaques inhabiting this island. Japanese macaques on Koshima have been studied ever since their habituation in 1952. This population is most famous for its "sweet-potato washing behavior". A juvenile female, known as Imo, innovated this unusual feeding technique, which then spread to other members of the troop.

The social transmission of this behavior followed her network of relatives and peers of the same age group. Sweet-potato washing was the first "cultural" behavior to be described in detail in primates. It is also one of the few behaviors whose innovation and social propagation has systematically been recorded. More recently, other novel behaviors such as "wheat-place mining" and "fresh fish eating" have also been described and investigated. I report here the history and the present situation of macaque studies on Koshima Island.

The inevitable surprises of long-term studies: fission, revolution, upheaval, and death during one generation in the history of a capuchin group

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We report on the long-term demography of one population of tufted capuchin monkeys (*Cebus [apella] nigritus*) in Iguazu National Park, Argentina. One group, the Macuco group, was monitored or studied intensively from 1991 to the present, with seven additional groups studied and/or censused for 3-4 years since 1991. For demographic analyses based on census information, our sample size is 42 group-years. This population of capuchin monkeys shows a basic pattern of matrilineal residence and male dispersal similar to many Old World monkeys and other reported species of *Cebus*. The life history of this population is characteristically slow, with long delays to first conception (6.5 years), first birth (7 years), male emigration (6.5 years), estimated age for a male to reach dominant status (16 years), high post-adult survival (more than 0.9 per year) and long maximum longevity (estimated at 35 years). We describe patterns of male emigration based on 7 observed cases, tenure durations of males at dominant and subordinate ranks, distinct subordinate male social strategies, one case of an alliance involving a dominant male, and 4 observed cases of male change at the dominant position. We describe three observed group fissions. In all cases, these have followed shortly after a change in the group's dominant male. During the fission process, variable subgroups form around one adult male or one adult female. Final daughter-group compositions tend to divide according to matriline, but some individuals do not follow the rest of their matriline into a new group. In all well-censused cases, the daughter groups increase in size following the split. We describe one instance of group fusion. Although some females remain dominant for many years, there was little evidence of strong matrilineal inheritance of rank. During a period of 14 years, we observed the former alpha female's matriline in the Macuco group dwindle to near extinction, while the matriline of the formerly most subordinate adult female grew large and eventually took over the alpha position. The dynamics of group fission and growth, matrilineal rank change, and long male tenure may combine to explain the relatively relaxed dominance style (despite frequent low-level agonism and threats) that characterize the *Cebus apella* super-species. Neither females nor males appear to have a strong incentive to take large risks to achieve high social rank, although there are immediate and clear benefits of high rank in terms of access to food and/or mating partners.

Berenty: Why does a very tiny reserve matter?

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Berenty Reserve proper is about 200 hectares of gallery forest, scrub, and spiny forest by the Mandrare River in southern Madagascar. It connects with about 200 more hectares of forest, all surrounded by fields and river. Such a small area should not matter at all to nature conservation. However, it has been protected for 73 years by the de Heaulme family, who has welcomed scientists since 1963. A wide variety of different research groups and students have gravitated there. Berenty has therefore become a prime site for the study of lemur behavior, and also of ecology as a scale model of the problems of larger reserves. It is a show window for tourists and television. It even turns out to have conservation importance as the largest remaining gallery forest on the Mandrare River. Long-term studies have deciphered many aspects of *Lemur catta* behavior and much about the other lemurs. Still more important is tracking and sometimes attempting to manage the ecological changes brought over decades by introduced and invasive species. Most important of all to Berenty is the development of ecologists' attitudes: we have changed from being a backward looking science, thrilled only by grandeur of evolution of the natural world, to being a forward-looking science which asks how nature and humans may survive in the places we love.

Long-term studies of lemur behavior and ecology at Kirindy forest

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In 1993, the German Primate Center established a permanent study site in Kirindy Forest, one of the largest remaining plots of dry deciduous forests in Western Madagascar. It is characterized by pronounced seasonality and home to 8 sympatric lemur species. We established three study sites in different microhabitats by laying out more than 120 km of trails. More than 1500 individual lemurs have been marked individually and been subjected to regular observations, recaptures or censuses. The main focus of my work has been on lemur social systems. Because lemurs deviate in several behavioral, morphological and demographic traits from some better-studied anthropoids, I am interested in contributing to comparative studies of determinants and mechanisms of primate social systems. Together with my students, we have therefore studied the size, composition and dynamics of groups or local populations of all 8 species to learn more about sex-specific life history tactics. We also characterized lemur mating systems by studying reproductive tactics, their hormonal correlates and genetic consequences. Finally, behavioral studies have focused on questions dealing with communication, cognition and cooperation. I will highlight some examples of these kinds of studies by presenting relevant data with a

long-term component from small, nocturnal, solitary gray mouse lemurs (*Microcebus murinus*) and large, diurnal group-living white sifakas (*Propithecus verreauxi*).

Identifying social learning in long-term field data: enhancing peace in the "culture wars"

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Following the increasing number of high profile, and oft-debated, reports of "culture" in wild primates we wish to emphasize the potential and utility of field studies of cultural transmission. There are currently well established, sophisticated means of documenting social learning in the laboratory, yet such studies offer little ecological validity and are not practicable in social settings, especially where the subjects are large or endangered wild mammals. Without an understanding of social learning (identification of which is a necessary first step) in the context in which its use has evolved, we cannot hope to elucidate the interaction between biological and cultural evolution. Until recently, whether behavioral variation observed in natural contexts is deemed cultural has largely been determined by expert opinion, resulting in heated debates which some have gone so far as to describe as "war". This is because the predominant approaches available to researchers are, as yet, not entirely satisfactory in determining whether social learning is required to produce the observed pattern of behavioral variation. Until we have tools that provide widely acceptable evidence for social learning, in any species, controversy will reign as to the extent of "culture" in animals, and its role in human evolution. Here, we highlight some emerging approaches that are poised - alongside existing observational methods - for application to data produced by long-term field studies of primates. To explain and evaluate the approaches we will draw upon a current validation exercise we are undertaking through application of the methods to data collected from groups of captive chimpanzees in a "naturalistic" social-setting.

A little knowledge is a dangerous thing: dispersal and residence pattern in Phayre's leaf monkeys

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For many nonhuman primates the number of adult males in bisexual groups is related to the number of adult females and their overlap in receptivity. This may also hold for species with male philopatry, in which related males jointly defend

females or resources (or both). More recent data indicate, however, that such cooperation might not necessarily be explained by kin selection alone. Here we describe our changing perspective on the social organization and dispersal in Phayre's leaf monkeys (*Trachypithecus phayrei crepusculus*) emphasizing the importance of long-term data. Since 2000, we have been investigating the behavioral ecology of four habituated groups at Phu Khieo Wildlife Sanctuary, Thailand (279 contact months, i.e., 23.3 group-years). In addition to behavioral, ecological, and demographic data, we collected fecal samples for genetic analyses via microsatellite genotyping (13 or more polymorphic loci). Population-wide we found almost equal numbers of one-male and multi-male groups, but the number of adult males was not correlated with the number of adult females. As in many other colobines, juvenile and adult females routinely dispersed. In contrast, while males occasionally disappeared, many stayed to breed in their natal group and cooperatively defended their group's territory. This seemed to possibly indicate male philopatry and cooperation by related males. Long-term observations now demonstrate that subadult and young-adult males vigorously fight for the top-ranking position resulting in severe injuries and expulsions of competitors turning multi-male groups into one-male groups. However, older, lower ranking males might also be able to stay; hence, groups might remain multi-male. If multiple males left or were expelled from one group they formed all-male bands that were subsequently joined by new females (many with dependent offspring). In general, males seemed to benefit from forming coalitions, because multi-male groups experienced more female immigrations and had larger home ranges compared to one-male groups. Genetic data furthermore indicate that kin selection cannot be the only key to male cooperation, because groups contained related and unrelated males. This relatedness pattern is not due to male immigrations or take-overs, because those were never observed. Instead it relates to the fact that infants were sired by different resident males during a multi-male phase, that females with infants conceived elsewhere joined all-male bands, or the possibility of extra-group paternity. In conclusion, because of the stochasticity of some events (e.g., group formation), it took "forever" to begin to understand the dispersal and residence pattern and its consequences for social organization and relatedness. Supported by the National Science Foundation, the American Society of Primatologists, the Leakey Foundation, National Geographic CRE, the Wenner-Gren Foundation, and Stony Brook University.

A thin red line: shifting distribution boundaries and mixed species associations between rhesus and bonnet macaques in peninsular India

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The rhesus macaque (*Macaca mulatta*) and the bonnet macaque (*Macaca radiata*) are the two most common macaques of India. The rhesus macaque is distributed across eastern Afghanistan, Pakistan, northern India, Nepal, northern parts of Southeast Asia and southern eastern China, whereas the bonnet macaque is ende-

mic to peninsular India. The distribution of both these species was originally believed to be determined by the rivers Godavari and Tapti, and the central Indian arid region. Past surveys have anecdotally revealed that these physical barriers have not been very effective in restricting their distribution as the rhesus macaque has occasionally been reported south of these barriers. During our surveys in central and southern India, we found the distribution of these macaque species to be demarcated by two different boundaries that converge to form an overlapping region. This region is characterized by the presence of mixed species troops and the apparently random distribution of both species, sometimes in close proximity to each other. There has definitely been a range extension of the rhesus macaque but this may have been a natural process, accentuated in some regions by rapidly changing land use patterns. In other areas, direct human introduction of problem troops of the species appears to have facilitated the observed changes in its distribution. Our data thus extend the current distribution of the rhesus macaque much further south than earlier suggested and reveal several new localities with introduced troops of the species in central and southern India, sometimes even within protected areas. These changes in the distribution pattern of the two macaques may have also been influenced by their species-specific temperaments and are likely to have profound effects not only on the distribution and survival of the endemic bonnet macaque but also on human-macaque conflict in many parts of southern India.

Long-term social networks in olive baboons

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Social network analysis has become the new catch-phrase for primatologists interested in primate sociality. Although many of the concepts behind this are actually old, the computational tools are new and offer exciting opportunities to gain further insight into primate social complexity. It has been suggested previously that social complexity may be related to i) a high level of fragmentation and ii) a strong differentiation of social networks based on different behaviors. In addition, the function of social relationships is far from understood – do primates only interchange "goods" in a biological market or do their social bonds reflect real preferences? In this study we use our long-term database on baboon social behavior (Gashaka Gumti National Park, Nigeria) to investigate baboon social networks. We compare social network based on a variety of different social behaviors to analyze the level of network overlap and fragmentation. We also assess to what degree preferences are maintained over long periods of time and compare these long-term networks to those based on shorter time windows, emphasizing the importance of long-term data. Results will also be discussed in the light of the social brain hypothesis and our understanding of social complexity in primate societies.

The Ambatovy Lemur Population Viability Assessment: preliminary results of the lemur spatial monitoring program

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The Ambatovy Project includes an open pit mine located in Madagascar's east coast rain forest, an area recognized for its high regional biodiversity exemplified by the presence of 13 confirmed and a potential 16 lemur species present. Due to the mine's location, a stringent Biodiversity Management Plan has been formulated. The lemur viability assessment program, based on the objectives outlined in the Lemur Management Plan, aims to confirm that the mine's activities do not lead to a long-term reduction in the pre-construction viability levels of priority lemur species' populations present in the mine area forests. The primary work to be conducted through the spatial monitoring program is to assess the ability of lemur species' to move away from clearing impact areas and to monitor radio-collared lemurs and their movements in the refuge forests. Between March 2007 and July 2009, 166 individuals representing 11 lemur species were equipped with radio-collars. Preliminary results based on spatial monitoring of radio-collared individuals within the mine's forests, indicate that most species have the ability to move away from impact areas into adjacent refuge forest areas unaided, however, few individuals have moved far away from the impact areas. These results suggest that displaced lemurs are adapting to their new habitats and are not seeking to migrate further away from these impact areas, which, in effect, can be considered as their territorial limit. Further work is needed to begin to assess the carrying capacity of the adjacent refuge forests and the cascade effect of displaced lemurs on recipient lemur populations located in the refuge forests.

The long-term field study of chimpanzees in Bossou-Nimba since 1976

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This presentation aims to summarize the past, current, and future of the chimpanzee project in Bossou-Nimba, Guinea, West Africa. Yukimaru Sugiyama started the long-term study of wild chimpanzees at Bossou in 1976. The 33-year project has illuminated the unique cultural tradition of the community. For example, Bossou chimpanzees are well known to use a pair of mobile stones to crack open oil-palm nuts. The highlight is the field experiments of tool use in the outdoor laboratory since 1988. It examined the lithic technology and the other kinds of tool use at the same time and place. We also continued the long-term study of the neighboring communities in Nimba Mountains, about 5 km to the east of Bossou, since 1993. In addition to the reports on the long-term data on demography and life-history, I will introduce the conservation project called "Green corridor". It is a reforestation and environmental education program of planting trees in the savanna separating Bossou

from Nimba, the World Natural Heritage site that is also facing the iron-mining threat.

Long-term field studies of chimpanzees at Mahale Mountains National Park, Tanzania

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In this presentation, I will summarize the history of the long-term chimpanzee research in the Mahale Mountains National Park, Tanzania. Since Dr. Toshisada Nishida started the long-term study of wild chimpanzees at Mahale in 1965, research has been continued for 44 years and more than 70 researchers from various countries have participated. I will also briefly introduce the current infrastructure of the Mahale research camp, which may be humble compared to camps at other research sites. The long-term research enabled us to produce several important outcomes. For example, accumulation of everyday behaviors of chimpanzees at Mahale enabled us to publish a detailed ethogram, which has facilitated finer comparisons of behaviors among chimpanzees across research sites in recent years. Collective data on demography of the Mahale chimpanzees provides fundamental knowledge to understand the species, at the same time it is an important source for conservation management. Finally, I will emphasize the importance of long-term research for understanding behavioral and social development of chimpanzees. Because chimpanzees grow very slowly and each individual developmental process is unique, we need decades to obtain the data on life history of each individual.

Assessing long-term patterns in a population and habitat context: temporal and inter-individual variation in sex ratios of free ranging yellow baboons (*Papio cynocephalus*) in Mikumi National Park, Tanzania

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The Viramba troops of Yellow Baboons, studied since 1974, are part of a contiguous population within a vast area. Over 100,000 km² are within protected areas without major anthropogenic alteration. The population within Mikumi National Park, includes Viramba, and has varied demographically over 3.5 decades due to population trends (stable, expanding, declining) and correlated troop fissions and fusions. There have been seven demographically distinct Viramba troops varying in size from 6 to 128 individuals and existing in time from 5 months to 15 years. Thus the classic model of males as the mortality prone, reproductively expensive dispersing sex competing for females and of females as the resident sex competing for resources within matrilineal stable dominance hierarchies can be tested under a full

range of troop sizes, troop numbers, competitive, demographic, resource and seasonal conditions. Here three aspects of sex ratio are considered: sex ratio of the breeding population; recruitment to adulthood by sex; and secondary sex ratio at birth. Predictions generated by the Trivers-Willard, Local Resource Competition and Silk's adaptation of the Local Resource Competition hypotheses were tested with 30 years of data, including 405 births by 108 females, and 110 mature males. Multivariate measures tested for variation in sex ratio in relation to levels of competition and individual condition and competitive ability. Sex ratio at birth was not significantly different from 50:50 and there was little difference in recruitment to adulthood by sex. A female bias in breeding adults resulted from delayed maturation in males. GLM analysis showed that short-term variations in sex ratios were not associated with measures of competitive, demographic or ecological context. These results suggest that in non isolate, extensive populations, sex ratios vary due to an evolved male strategy of delayed reproduction and are not affected by female strategies or differential mortality by sex.

The balance of investment in offspring care and production among male baboons

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Non-monogamous males that care for their offspring face potential trade-offs in the balance of investment between care and offspring production behavior because of time constraints and conflicting social opportunities. In the present study, we tested the hypothesis that the number of a male's immature offspring, the number of cycling females in the group and a male's dominance rank predicted the balance of investment between offspring production and care among wild adult male baboons in Amboseli, Kenya. Controlling for other factors, the number of 1) a male's immature offspring and, 2) cycling females in the group predicted investment in paternal care relative to offspring production. Males with more immature offspring invested more in care relative to offspring production than those with few. Males invested more in offspring production relative to care as the number of cycling females in the group increased. We also found a positive correlation between dominance rank and investment in offspring production; such that as males decline in rank, so does their investment in offspring production. Together, results of the present study support the proposition that opportunities for paternal care and offspring production influence the balance of investment between behaviors associated with care and those associated with production.

The Lomas Barbudal Monkey Project: two decades of research on *Cebus capucinus*

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The Lomas Barbudal Monkey Project was established in 1990 by Susan Perry and has since logged ~60,000 hours of contact with 11 study groups. Currently, a core staff of 5 long-term employees supervises a crew of 6-9 interns. The long-term staff participates in data collection, and jointly manages the project logistics, conservation work, educational outreach, data base organization, and training and data quality checks for temporary project members (visiting researchers and interns). Interns stay a full year and are most often people who have just finished university. The interns are responsible for the core data collection (censusing, group scans, focal follows, fecal sample collection), so that there is no interruption in the documentation of social dynamics over time. The interns also assist graduate students, post-doctoral fellows and faculty in their research. The long-term nature of the Lomas Barbudal project has enabled research regarding social learning and life history strategies that would not have been possible in a shorter study. For example, some of the most intriguing types of social interactions at Lomas (e.g. eyeball-poking) are innovations that have spread through social networks and remained in a group's behavioral repertoire for about 10 years before vanishing. The longitudinal depth has also permitted us to document that capuchins (especially females) tend to adopt the foraging techniques used most by their mothers, and also the technique they had the most frequent exposure to during the first 5 years of life. Documentation of life history strategies is currently the primary research goal at Lomas. We now know that alpha male tenures can endure up to 17 years. These unusually long tenures result in the potential for father-daughter mating, yet genetic analyses have revealed that fathers and daughters avoid inbreeding. Alpha males maintain a strong reproductive monopoly until their daughters mature, and then their daughters breed with the alpha male's subordinate allies. Peaceful phases during long tenures are a sharp contrast with chaotic group takeovers, when groups of males invade and kill the infants.

Matrix use in fragmented landscapes: the case of the black howler monkey *Alouatta pigra*

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A majority of studies on primates in fragmented landscapes has focused on the "fragment scale", concluding that some of the characteristics of the fragment affect primate abundance. However, few have included the matrix surrounding the fragments as part of the area of activity, whether as a corridor or sites that provides food. We evaluated matrix use by observing the behavior of 7 troops and by doing a com-

plete census of a 5,000 ha fragmented area in Balancán, Tabasco, Mexico (2007-2008). The results revealed that the matrix was used by 217 howler monkeys belonging to 44 troops and 11 solitary males. Scattered trees, eucalyptus plantations and permanent orchards were the most used. Behavior was observed over a total of 814 h during the rainy season and 660 h during the dry season. Howler monkeys spent 53 % of their time in some part of the matrix (783.41 h). Mangoes (*Mangifera indica*) were eaten for a period of 2.49 h in permanent orchards and the newly sprouted leaves of scattered *Ormosia macrocalix* trees were eaten for 23.58 h. Four troops of howlers spent 34 % of their time (935 h) in the eucalyptus plantations. The distance covered on the ground by howlers was 18-160 m in pastures and 27.1 - 95.6 m along barbed wire fences. This reflects the behavioral flexibility of howlers with respect to exploiting matrix resources. As such, it is essential to include the matrix as part of the landscape when making long-term conservation plans.

Recent Developments in the Study of Wild Gibbons

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Gibbons and siamangs were long considered the standard examples of primate monogamy, which is seen as a simple, static state entailing a tight pair bond and an exclusive mating relationship. Mating exclusivity was believed to be a co-evolved corollary of pair-living in primates. Our long-term research on the supposedly monogamous white-handed gibbons at Khao Yai calls this concept into question. We regularly see groups composed of two adult males and one female, and most adults in our population have more than one mating partner. The reason for adult group size variation may lie with differential access to food resources: females living on poorer quality home ranges may compensate by increasing their range size, and on a larger home range a female's primary male may benefit from accepting another male to help with territorial and/or mate defense. Further, our notion of gibbons' mild promiscuity, which has also been seen in other populations, receives support from observations of female sexual swellings. In agreement with the graded-signal hypothesis, which associates conspicuous swellings with promiscuous mating, we show that changes in sexual swellings influence male mating behavior and correspond to hormonal changes during females' ovarian cycles. The now emerging concept of socio-sexual flexibility of hylobatids is not unique to our research but is reflected in studies across multiple sites and species. These findings shed new light on gibbons' liaison with the larger apes, where the "flexibility trait" has already been identified as an important adaptation related to the evolution of larger brains, advanced cognitive skills, and extended life histories.

Are habituated groups representative of the broader population?: Mountain gorillas as a case study

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Gorillas live in a diverse array of environments across Africa, yet most of our knowledge about them comes from the Virunga Volcanoes, an extreme of gorilla habitat. The Karisoke Research Center, managed by the Dian Fossey Gorilla Fund International, is one of the longest running primate field sites in the world. The demographic database, spanning from 1967 to the present, has enabled us to test several predictions of the socio-ecological model as well as estimate life history parameters and population dynamics. Challenges faced to maintain this study site have included the nearly two decades of political instability in the region. While the benefits of having such a long term database are indisputable, there are limitations due to the common problem of having only a few groups habituated for a long-lived species. For example, group size may greatly exceed the average for the population, but provide information on the flexibility and extremes that may occur. Routine censuses of the entire Virunga population have been conducted approximately every 5 years since 1971, which in conjunction with data from the groups habituated for both research and tourism make it possible to use different methods of estimating population growth. However, differing results leads to the conclusion that the habituated groups may not be representative of the entire population, thereby emphasizing that temporal and spatial variation in ecological and anthropogenic factors needs to be considered when analyzing demographic data. Lastly, the results from Karisoke and the Virunga Volcanoes will be put in a broader context by making comparisons with mountain gorillas from the nearby Bwindi Impenetrable National Park, Uganda.

The acquisition of gestural communication in non-human great apes

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Despite the increasing body of research in gestural communication of non-human primates, little is known about how great apes acquire their gestures and which mechanisms underlie the early development of non-vocal communication. The present longitudinal and observational study aimed to investigate the emergence of gestural communication in different captive non-human great ape species. The objectives of the study were: 1) to provide a systematic documentation of apes' initial gestural repertoires, 2) to examine these repertoires in respect to the similarities and differences that exist between and within species and 3) to add to our knowledge of mechanisms that potentially underlie gesture acquisition (i.e. the relationship between genetic determination, ontogenetic ritualization, and social learning).

Twenty-five great ape infants (6 bonobos, 8 chimpanzees, 3 gorillas, and 8 orangutans) were observed from birth up to twenty months and their interactions with other group members were videotaped. The results indicated variability across species in terms of gesture type and frequency. Unlike the African great apes, orangutans did not use auditory gestures and showed a tendency for a delayed onset of gestural communication. In terms of underlying mechanisms, results indicate that infants did not imitate their mothers' gestural repertoire, as they shared as many gestures with other infants' mothers as they did with their own (these analyses were restricted to genus *Pan*). In addition, the proportion of shared gestures among infants was significantly higher than those shared between infants and mothers. The findings will be discussed in respect to how innate determinants and social organizational factors might influence the gestural and cognitive development of young great apes.

Adaptive value of sociality in male Assamese macaques

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In multi-male groups male reproductive success may not rely on physical fighting abilities alone but also on politics which is well described for philopatric male chimpanzees. The formation of agonistic coalitions against other males, however, is also widespread among dispersing baboon and macaque males. Whether these males exchange sociality for agonistic support or form reciprocal bonds that enable partners to engage in stable political alliances remains poorly understood. We present data on wild Assamese macaques (*Macaca assamensis*) from their natural habitat in Phu Khieo Wildlife Sanctuary, Thailand. Males were rather social and associated with other males as often as with females. Males regularly groomed other males but showed low or no asymmetry in these exchanges. A small fraction of males formed friendships with special partners (10-15 % of dyads) characterized by above average association and grooming rates from both partners' perspectives as well as formation of coalitions against other males. These friends also reconciled their aggressive conflicts more often than non-friends. The strength of a male's social bonds assayed by the sociality index, however, was poorly related to his current dominance rank. Instead, a males' sociality predicted his future dominance success. After a fatal take-over of the alpha position from within the group two friends of three years acquired top ranks. Hence, the adaptive value of Assamese macaque male social bonds may lie in the maintenance and acquisition of high dominance status achieved through political alliances.

The value of long-term studies of semi-free-ranging primates

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Studies of primates living in naturalistic enclosures or on islands can provide easily accessible field sites and invaluable information about research questions, and even species, that are otherwise difficult or impossible to study. They can also facilitate multidisciplinary and interdisciplinary studies. A search for 'semi-free-ranging AND primate' in Web of Knowledge produced 90 hits, including 25 species, living on five continents. Enclosure/island sizes vary greatly (e.g. 0.2 to 15.2 ha) and most species are housed outside their natural habitat range. Research questions include social behavior, cognition, growth and development, reproduction and reproductive success, physiology, biomechanics, vocalizations, anatomy, chronobiology and genetics. We review the advantages and disadvantages of such semi-free-ranging studies, then concentrate on the mandrill colony housed at the Centre International de Recherches Médicales de Franceville, Gabon (CIRMF) as an example of what can be learned from semi-free-ranging animals when wild animals are extremely difficult to study, and impossible to habituate. CIRMF provides the unique possibility of long-term study of known individual mandrills, in combination with regular captures for collection of morphological data, blood, and other biological samples. Studies of the colony have yielded valuable data concerning life history, social strategies, mating and reproductive strategies, the effect of inbreeding, and virology. We present highlights of these studies, concentrating on those that were only possible through the analysis of long-term data.

Beza Mahafaly: a field site in southwestern Madagascar

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The Beza Mahafaly Reserve in southwestern Madagascar was founded in 1978 and inaugurated as a Réserve Spéciale in 1986. It was established as a collaborative research, education, conservation, and development project among University of Madagascar (now University of Antananarivo), Washington University, and Yale University with the agreement of the local people. Since 1995, the Department of Water and Forests of the School of Agronomic Sciences (Ecole Supérieure des Sciences Agronomiques, ESSA/Forêts), University of Antananarivo has been offi-

cially the principal operator and administrator of the Beza Mahafaly Project, and infrastructures to facilitate research and training have been developed. The reserve consists of two noncontiguous parcels separated by 10 km, a gallery forest dominated by *Tamarindus indica* covering an area of 80 hectares and a xerophytic, desert-like spiny forest approximately 520 ha in size dominated by species adapted for the long dry season. Currently, in close collaboration with local communities, an extension of the reserve of up to 4,600 ha to join the two parcels, is in progress. Six species of lemurs are found in or near the reserve and, along with a diversity of habitats, the region has a very diverse and highly endemic flora and fauna. The ring-tailed lemur and white sifaka have been the subject of long-term research at Beza Mahafaly. The stability of the reserve and the long-term nature of the project have enabled us to conduct research on: the population demography and life histories of ring-tailed lemurs and sifaka; the effects of drought on the ring-tailed lemur population; behavioral, hormonal, and social correlates of reproduction in both diurnal species; the genetic population structure of the sifaka population; long-term patterns of health and disease among ring-tailed lemurs; dental health, tooth loss, tooth wear, and temporal changes in tooth size among ring-tailed lemurs; and socioeconomic characteristics of the local human population. Highlights of this research will be presented, as well as a description of the data collection and management techniques employed in conducting these ongoing long-term projects.

Does the time it takes to learn vital skills determine age at first reproduction in orangutans?

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Long-term studies are especially useful to examine life history questions. A long-standing idea in anthropology is that a developmental period is required to provide children enough time to learn the numerous vital skills needed to be a successful human adult. This need for skill learning is a widely regarded explanation for the slow development of large-brained organisms in general. Longitudinal developmental studies of long-lived primate species are needed to test the major direct prediction of this hypothesis: vital skills reach adult levels only around or even slightly after reaching sexual maturity but not before. In a mixed longitudinal and cross-sectional study of immature Bornean orangutans (*Pongo pygmaeus wurmbii*) at Tuanan field station in Central Kalimantan, Borneo, we found that immatures had acquired the same diet by weaning time at around age 6, and had reached adult-level feeding rates and probably full ranging skills by around age 10, whereas age at first reproduction and full body size were reached only several years later. We therefore reject the Skill Learning Hypothesis for orangutans. The findings of developmental studies on other species are ambiguous, but comparative work supports the orangutan conclusion. In brief, energy supply rather than real time determines the time at which animals reach maturity, as shown by the effects of allomaternal care and basal metabolic rate on maturation time. These findings have consequences for anthropological hypotheses about the duration of human development.

Behavioral ecology of Kibale chimpanzees

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Long-term research projects on chimpanzees at the sites of Kanyawara and Ngogo, in Kibale National Park, Uganda, provide valuable opportunities for investigating chimpanzee behavioral ecology and life history strategies from within- and across population perspectives. Long-term perspectives are particularly valuable for chimpanzees, given their slow life histories and ecological flexibility. Ngogo and Kanyawara clearly illustrate the importance of comparative research on multiple communities in the same population: the two sites are only about 10 km apart, but chimpanzee population density at Ngogo is over three times as high as that at Kanyawara, and the community there, with over 150 members, is more than three times as large as the Kanyawara community. Fruit is the major dietary component at both sites, but most of the Ngogo diet comes from tree species that are rare or absent at Kanyawara, and temporal variation in fruit abundance is lower at Ngogo. Chimpanzees at Kanyawara rely most heavily on pith and stems of terrestrial herbs when ripe fruit is scarce, whereas Ngogo chimpanzees rely more on leaves and especially rely on figs from *Ficus mucoso*, the most important item in their diet in terms of feeding time, when non-fig fruits are scarce; *F. mucoso* is common at Ngogo but essentially absent at Kanyawara. Such differences in tree species composition and variation in food abundance presumably help to explain why effects of feeding competition on female social strategies are evident at Kanyawara, but apparently absent at Ngogo. We present a preliminary analysis of female life histories at the two sites, aimed at addressing whether inter-birth intervals are shorter, infant survivorship is higher, and/or female survivorship is higher at Ngogo, as might be expected given higher food availability there. Data from both sites confirm the general characterization of eastern chimpanzee society as "male bonded", although Ngogo females show both spatial and social sub-structuring and Ngogo males have also evidenced sub-structuring in habitat use and social association. Male dyads at both sites maintain long-term social relationships, and Ngogo data show that males there establish strong, linear dominance hierarchies (despite the large number of males in the community), in part because most coalitions are conservative (i.e. all coalition partners outrank their targets). Ngogo data confirm theoretical expectations that maternal relatedness influences male social relationships, but evidence for effects of paternal relatedness are equivocal at best and may be difficult to distinguish from age similarity effects, which are important there and may be generally important for chimpanzee males. Data on paternity success at Ngogo are consistent with the hypothesis that reproductive skew among chimpanzee males varies inversely with the number of males per community. Finally, we discuss comparative data on hunting by chimpanzees at the two sites, with an emphasis on the negative impact that chimpanzee predation has had on red colobus monkeys at Ngogo, and present evidence that "male politics", and not just harassment, influences meat transfers.

Long-term studies of the Gombe chimpanzees

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The study of chimpanzees at Gombe National Park, now in its 50th year, has yielded many discoveries that would have been impossible without long-term data. The basic data collection procedure has remained constant since the early 1970s, with a team of Tanzanian field assistants conducting all-day focal follows of individual chimpanzees in the Kasekela (1973-present) and Mitumba (1994-present) communities. Field assistants record map location and party composition at 15-minute intervals, a continuous record of the focal subject's feeding behavior, and *ad libitum* narrative notes on behavior, including mating, dominance interactions, tool use, hunting, boundary patrols, and intergroup interactions. Field assistants also monitor the unhabituated Kalande community (1999-present). The long-term record has yielded large enough samples of many behaviors to reveal clear patterns, while also providing an accumulated record of less common occurrences, such as births, deaths, and unusual events such as "assassinations" and "kidnappings". The introduction of new techniques has yielded findings on pathogens, genetics, hormones, tool use, hunting, meat sharing, ranging patterns, demography, and population- and landscape-level changes. Two topics for which long-term data have proved especially informative are intergroup aggression and disease ecology. Gombe was the first site to provide detailed observations of intergroup violence, and intergroup aggression continues to play a major role in range use and mortality at Gombe. Studies of territorial behavior support the view that males defend a feeding territory for themselves, their mates and offspring. Analysis of 18 years of data found that several indirect measures indicated increased food availability in years with larger home range size. Chimpanzees foraged in larger parties, males encountered receptive females more often, and females reproduced more quickly. A thirty-three year series of body mass measurements found that, controlling for age, sex, and reproductive status, individuals were heavier when the home range size was larger. More recently, we have extracted data from over 30 years of territorial behavior, including fourteen years in which neighboring habituated communities have been observed. These data support the view that access to high quality feeding areas depends closely on numerical asymmetries. Since the early 1990s, the large Kasekela community has dramatically expanded its range at the expense of the smaller Mitumba and Kalande communities. The percent time that the smaller Mitumba community spends in the contested area between Mitumba and Kasekela depends closely on the total number of males in the smaller Mitumba community. Gombe is currently the site of a comprehensive health monitoring effort, and also happens to be the only chimpanzee study site at which some of the chimpanzees are naturally infected with the SIVcpz, the immediate precursor to the AIDS virus, HIV-1. Detailed demographic data, combined with molecular genetics and pathology, have revealed that this virus, initially thought harmless to chimpanzees, increases mortality risk of infected chimpanzees by 10 to 16 times, and causes AIDS-like damage to immune system tissues. We are currently working to model the likely impact of this increased mortality on the population as a whole.

Lemur Research at Centre ValBio, Ranomafana National Park, Madagascar

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Duke University, and then Stony Brook University, have managed a research station in what is now Ranomafana National Park (RNP) since 1987. In 2003 the Centre ValBio research station, adjacent to the park, was inaugurated in order to provide facilities for the increasing number of long-term researchers. The behavioral ecology of ten of the 12 species within RNP has been studied over 22 years. This includes *Propithecus edwardsi*, *Eulemur fulvus rufus*, *Eulemur rubriventer*, *Varecia variegata*, *Avahi laniger*, *Hapalemur griseus*, *Hapalemur aureus* and *Prolemur simus*. Briefer studies have been completed on *Cheirogaleus major* and *Lepilemur microdon*. Ongoing long-term studies have focused on aspects of sexual selection, including reproductive strategies, as well as predation by raptors and the mammalian carnivore, the fossa (*Cryptoprocta ferox*). The distribution and coexistence of sympatric bamboo lemurs are being studied in several areas of RNP. Recently completed and ongoing projects on phylo-geographic questions have focused on the genera *Eulemur*, *Lepilemur* and *Propithecus*. More anatomical subjects include dental morphology/physiology and morphometrics. Current priorities in lemur research at Centre ValBio include communication, cognition, seed dispersal by lemurs, effects of climate change on lemurs, demography, dispersal, female dominance, parasites and senescence in lemurs in the wild.

Gorilla social ecology: socially stable with different feeding strategies

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Gorillas are distributed from lowland tropical forests to montane forests at higher altitudes. They exhibit various diets according to food availability, in particular to fruit availability. Western lowland gorillas have a frugivorous diet like sympatric chimpanzees, while mountain gorillas have a folivorous diet. Socio-ecological theory predicts that such dietary differences may lead to different activity rhythm, ranging, and social relationships between them. However, annual and monthly range sizes of gorillas are consistent irrespective of their habitats or diets. It is in marked contrast to those of chimpanzees, fluctuating with fruit availability. How do gorillas and chimpanzees respond to the same environmental changes? In order to answer this question, we have conducted a long-term study on the social ecology of sympatric gorillas and chimpanzees in the Kahuzi-Biega National Park, Democratic Republic of Congo. A group of Grauer's gorillas and a group of eastern chimpanzees have been habituated and monitored since 1994. The phenology of their preferred fruits has been monitored twice per month, and their dietary com-

position has been estimated by daily fecal samples. Their daily travel routes have been recorded by GPS and plotted on the vegetation map. More than two groups of gorillas have also been habituated and monitored since 1970s for tourism. We found distinct differences in their foraging patterns, which may support their sympatry in the montane forest with less availability of fruit. Several drastic changes in their environment occurred during these 10 years: 1) bamboo flowering in 1994, 2) large-scale poaching in 1998, and 3) group fission by joining a solitary male. Bamboo shoots, the most favorite food of gorillas, were not available from 1994 until 1997. At least three neighboring groups disappeared from the study group's range during the period of civil war when half of the gorilla population was killed by poaching. After the death of a leading silverback, a solitary male joined the study group, which subsequently split into two sub-groups. After the collapse of habituated groups by poaching, many females moved between groups and infanticide occurred in a group habituated for tourism. These observations suggest that gorillas have higher social and ecological flexibilities than previously thought.

The Siberut Conservation Programme: combining field research and conservation

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The Siberut Conservation Programme (SCP) is a joint initiative of the German Primate Center (DPZ) and Bogor Agricultural University (IPB) in Indonesia. Located on the island of Siberut in the Mentawai archipelago, which forms part of the Sundaland hotspot of Biodiversity, it provides the only basis in this region for field researchers working on diverse aspects of tropical biology and utilization of natural resources. Established in 2002, SCP represents a multidisciplinary program in which field research complements community-based conservation. SCP's three main components - biological research, community-based conservation, and capacity building - are designed to contribute to a novel management paradigm for Northern Siberut based on both ecosystem protection and human needs. In more detail its three main objectives are i) to create a biological database relevant for future conservation strategies ii) to develop a sustainable community based program for nature conservation in Northern Siberut and iii) to built capacities and raise public awareness on a wider range. The initial and current research projects are focused on the five primate species endemic to the Mentawai archipelago (*Hylobates klossii*, *Presbytis potenziani*, *Simias concolor*, *Macaca siberu* and *Macaca pagensis*), whereas the community-based conservation initiatives, amongst others, include community education, improvement of public health and hygiene as well as eco-tourism. In this talk we will give an overview of the research program and the local conservation initiatives as well as a prospect of the future development of SCP.