

MIDWEST PRIMATE INTEREST GROUP 2012 MEETING SCHEDULE



Friday September 28th

Registration **5:00-7:00 pm**
(Cole Hall Lobby)

Welcome by Dr. Leila Porter **6:50-7:00**
Department of Anthropology, Northern Illinois University
(Cole 100)

Distinguished Primatologist Award ceremony for **7:00-7:10**
Dr. Robert Martin¹, presented by Dr. Robert Sussman²
¹A. Watson Armour III Curator of Biological Anthropology, Field Museum,
Chicago, Adjunct Professor, Departments of Anthropology at the University
of Chicago, University of Illinois at Chicago, and Northwestern University
² Department of Anthropology, Washington University in St. Louis
(Cole 100)

Dr. Robert Martin's address: **7:10-8:00**
Evolution of Mothering
(Cole 100)

Reception **8:00-9:30**
(paid registrants & volunteers only, please)
(Cole Hall Lobby)

Saturday September 29th

Registration (Cole Hall Lobby) 8:00-10:00 am

Breakfast & Poster Setup (Cole Hall Lobby) 8:00-10:30

Welcome by Dr. Julienne Rutherford (Cole 100) 8:25-8:30

Department of Women, Children, and Family Health Science, University of Illinois at Chicago

Morning Podium Session (Cole 100) 8:30-12:00

1. Behavioral strategies for meeting nutritional demands across seasons and life history stages in the Mexican black howler monkey (*Alouatta pigra*) 8:30-8:45

Katherine R. Amato^{1,2}, Paul A. Garber²

¹Program in Ecology, Evolution and Conservation Biology, University of Illinois, Urbana-Champaign, ²Dept. of Anthropology, University of Illinois, Urbana-Champaign

2. White-faced sakis appear to have good reasons for deviating from straight line travel between feeding trees. 8:45-9:00

Avis Anzelc, Marilyn A. Norconk

Dept. of Anthropology, Kent State University

3. Seasonality, activity patterns, and cortisol in female spider monkeys in a wet forest environment. 9:00-9:15

Michelle A. Rodrigues

Dept. of Anthropology, The Ohio State University

4. Effects of habitat quality, group size, and social rank on testosterone in male red colobus monkeys in Kibale National Park, Uganda 9:15-9:30

Rachel M. Petersen¹, Krista M. Milich²

¹Dept. of Animal Sciences, University of Illinois at Urbana-Champaign

²Dept. of Anthropology, University of Illinois at Urbana-Champaign

5. Living on the edge: patterns of habitat use in *Saguinus midas* 9:30-9:45

Michael Veres

Dept. of Anthropology, Kent State University

6. Outside the fence: forest island management and regional conservation in northern Madagascar 9:45-10:00

Benjamin Z. Freed¹, Lisa L. Gezon²

¹Dept. of Anthropology, Sociology, and Social Work, Eastern Kentucky University, ²Dept. of Anthropology, University of West Georgia

BREAK**10:00-10:30**

7. **The role of transoceanic rafting in the colonization of Madagascar by lemurs and other vertebrates** 10:30-10:45
Karen E. Samonds
Dept. of Biological Sciences, Northern Illinois University
8. **Mandibular helical axis during feeding in non-human primates** 10:45-11:00
Jose Iriarte-Diaz, Callum F. Ross
Dept. of Organismal Biology and Anatomy, University of Chicago
9. **Scaling of distance from center of mass to condylar axis in primate mandibles** 11:00-11:15
Ellen Platts, Treva Walsh, Liam Heins, Laura Porro, Callum Ross
Dept. of Organismal Biology and Anatomy, The University of Chicago
10. **Use of a fecal DNA sequencing technique to determine composition of wild nonhuman primate diets** 11:15-11:30
Elizabeth K. Mallott, Ripan S. Malhi
Dept. of Anthropology, University of Illinois at Urbana-Champaign
11. **Penichus: genetic variability and phylogeny of the mitochondrial (mtDNA) control region of *Callithrix jacchus* and *C. penillata* and their hybrids** 11:30-11:45
Joanna Malukiewicz¹, Vanner Boere⁴, Maria Adélia Borstelmann de Oliveira⁵, Lisieux Fuzessy⁴, Adriana D. Grativol³, Edilberto Martinez⁴, Ita de Oliveira e Silva⁴, Luiz C.M. Pereira⁶, Carlos C. Ruiz-Miranda³, Yuri M. Valença², Anne C. Stone¹
¹Dept. Biology, Arizona State University, ²IBAMA, Recife, PE. ³Universidade Estadual do Norte Fluminense Darcy Ribeiro, Campos dos Goytacazes, RJ, Brazil. ⁴Universidade Federal de Viçosa, Viçosa, MG, Brazil. ⁵Universidade Rural de Pernambuco, Recife, PE, Brazil. ⁶Universidade do Vale São Francisco, Petrolina, PE, Brazil.
12. **Prosimian primates show ratio dependence in spontaneous quantity discriminations** 11:45-12:00
Sarah M. Jones¹, Elizabeth M. Brannon^{2,3}
¹Dept. of Psychology, St. Norbert College
²Center for Cognitive Neuroscience, ³Dept. of Psychology and Neuroscience, Duke University

LUNCH*On your own – please see the map in your folder for nearby restaurants***12:00-1:00****Poster session (Cole Hall Lobby)****1:00-2:30**

See list of poster presentations on page 5

Afternoon Podium Session (Cole 100)

2:30-5:00

13. **Report on A previously undocumented chimpanzee population (*P.t. verus*) discovered in the Tonkolili District of Sierra Leone** 2:30-2:45
Andrew R. Halloran¹, Christina T. Cloutier²
¹ Lynn University, College of Arts & Sciences, ² Dept. of Anthropology, University of Utah
14. **Hair plucking in captive bonobos (*Pan paniscus*)** 2:45-3:00
Colin M. Brand, Linda F. Marchant
Dept. of Anthropology, Miami University
15. **Behavioral effects of providing a choice for outdoor access to captive apes** 3:00-3:15
Laura M. Kurtycz, Katherine E. Wagner, Stephen R. Ross
Lester E. Fisher Center for the Study and Conservation of African Apes, Lincoln Park Zoo
16. **Behavioral changes associated with sexual state in chimpanzees (*Pan troglodytes*) and gorillas (*Gorilla gorilla gorilla*)** 3:15-3:30
Molly C. Fitzpatrick, Katherine E. Wagner, Steve R. Ross
Lester E. Fisher Center for the Study and Conservation of African Apes, Lincoln Park Zoo
17. **Sexual coercion in nonhuman primates – is female-directed aggression an effective mating strategy in the matrilineal primate, long-tailed macaque (*Macaca fascicularis*)?** 3:30-3:45
Lisa Guidi
Dept. of Anthropology, Washington University
18. **Nest box usage in captive owl monkeys (*Aotus spp*)** 3:45-4:00
Leilani Case, Kerrie Lewis Graham
Dept. of Anthropology, Texas State University – San Marcos
19. **Primate socioecology: who are we, where are we, and what are we doing here?** 4:00-4:15
Agustin Fuentes
Dept. of Anthropology, University of Notre Dame

Party (Dr. Leila Porter's home)

(paid registrants & volunteers only, please)

5:00-10:00

POSTERS

- 1. Manual preferences of wild and captive howler monkeys**
Dominique Dallas
Language and Literacy Lab, University of Michigan, DANITA: Association for Conservation of the Tropics
- 2. How do age differences in *Cebus capucinus* compare in terms of object manipulation frequency?**
Faith Stemmler
Dept. of Biology, Park University
- 3. How social status and gender affect agonistic and affiliative behavior in captive Japanese macaques (*Macaca fuscata*)**
Andrea Blackburn
Dept. of Anthropology, Miami University
- 4. Affiliation, agonism, and patterns of association in savanna chimpanzees (*Pan troglodytes verus*) at Fongoli, Senegal—initial post research impressions**
Joshua Marshack
Dept. of Anthropology, Washington University in St. Louis
- 5. Whinnies, grooming, and estradiol in wild female spider monkeys.**
Michelle A. Rodrigues
Dept. of Anthropology, The Ohio State University
- 6. Chimfunshi Sanctuary: discovery of social culture**
Mark D. Bodamer, E.J.C. van Leeuwen, K.A. Cronin, D.B.M. Haun, R. Mundry, I.C. Mulenga
Dept. of Psychology, Gonzaga University
- 7. The effects of varied risk and reward on orangutan decision-making**
Jesse Leinwand^{1,2}, Marietta Dindo^{3,4}, Erin Stromberg², Keith Burt¹, Donna Toufexis¹
¹Dept. of Psychology, University of Vermont, ²Smithsonian National Zoological Park, ³Zoo Atlanta, ⁴Mind, Brain and Evolution Cluster, The George Washington University
- 8. Does the type of leafy green in the morning diet of *Gorilla gorilla gorilla* have an effect on the level of agonism during the day?**
Alison Lovett
Dept. of Sociology, Saint Louis University
- 9. Functionality in tool use in western lowland gorillas**
Matthew LeFauv
Dept. of Animal Behavior, Ecology, and Conservation, Canisius College
- 10. The effects of pregnancy and motherhood on a captive gorilla's behavior**
Chase LaDue
Dept. of Animal Behavior, Ecology, and Conservation, Canisius College
- 11. Western lowland gorilla behavior: development from 0 – 12 months of age**
Macy Madden, Lindsey Perkes-Smith, Kelsey Trumpp
Dept. of Animal Behavior, Ecology and Conservation, Canisius College

12. The effects of auditory enrichment on gorillas

Lindsey Robbins, Susan Margulis

Dept. of Animal Behavior, Ecology and Conservation, Canisius College

13. Insights from a field course in primate behavior and conservation

Lindsey Perkes-Smith, Susan Margulis, Meredith Brown

Dept. of Animal Behavior, Ecology, and Conservation, Canisius College

14. Pointing in interactions with ASL signing chimpanzees

Christopher Galeucia, Mark D Bodamer

Dept. of Psychology, Gonzaga University

15. Association between cognitive test performance and sexual state of zoo-living chimpanzees (*Pan troglodytes*) and gorillas (*Gorilla gorilla gorilla*)

Katherine E. Wagner, Stephen R. Ross

Lester E. Fisher Center for the Study and Conservation of Apes, Lincoln Park Zoo

16. Developing the brain: a potential role for the placenta in hominin brain evolution

Julienne Rutherford^{1,2}, Elizabeth Abrams², Kate Clancy³, Victoria DeMartelly¹, Sana Said²

¹ Dept. of Women, Children, and Family Health Science, University of Illinois at Chicago, ² Dept. of Anthropology, University of Illinois at Chicago, ³ Dept. of Anthropology, University of Illinois at Urbana-Champaign

17. Cross-species comparisons of the retrosplenial cortex in primates: through time and neuropil space

Mitch Sumner¹, Muhammad Spocter², Patrick R. Hof⁴, Chet C. Sherwood³, Mary Ann Raghanti¹

¹ Dept. of Anthropology, Kent State University, ² Dept. of Anatomy, Des Moines University, ³ Dept. of Anthropology, The George Washington University, ⁴ Dept. of Neuroscience, Mount Sinai School of Medicine

18. Defining the “lean season” and its ecological implications: effects of seasonality on mass intake and nutrient intake in diademed sifaka (*Propithecus diadema*)

Mitchell T. Irwin¹, Jessica M. Rothman², Jean-Luc Raharison³, David Raubenheimer⁴, Colin A. Chapman⁵

¹ Dept. of Anthropology, Northern Illinois University, ² Dept. of Anthropology, Hunter College, City University of New York, ³ Dept. of Animal Biology, University of Antananarivo, Madagascar, ⁴ Institute of Natural Sciences, Massey University, New Zealand, ⁵ Dept. of Anthropology and McGill School of Environment, McGill University; Wildlife Conservation Society

19. Differences in activity budgets and social interactions of female mantled howler monkeys (*Alouatta palliata*) with and without dependent infants

Margaret Buehler

Dept. of Sociology, Saint Louis University

20. Inter-individual spacing patterns in mantled howlers (*Alouatta palliata*)

Brian Schultz

Dept. of Anthropology, Sociology, and Social Work, Eastern Kentucky University

21. Comparison of Callitrichidae taxonomy via phylogenetic and systematic analysis

Katrina Dietz, Marylin Norconk, Walter Hoeh

Dept. of Anthropology, Kent State University

22. Taxonomy of the Bornean slow loris, with new species *Nycticebus* (Primates, Lorisidae)

Rachel A. Munds¹, K. A. I. Nekaris², Susan M. Ford³

¹Dept. of Anthropology, University of Missouri Columbia, Columbia Missouri, ²Dept. of Anthropology and Geography, Oxford Brookes University, Oxford Great Britain, ³Dept. of Anthropology, Southern Illinois University, Carbondale Illinois

23. Developmental trajectories of microscopic architecture of the vervet monkey placenta

Julienne Rutherford^{1,2}, Victoria DeMartelly¹

¹Dept. of Women, Children, and Family Health Science, University of Illinois at Chicago, ² Dept. of Anthropology, University of Illinois at Chicago

24. Electromyography of chimpanzee mastication: investigating muscle recruitment order

Treva Walsh, Ellen Platts, Jose Iriarte-Diaz, Callum Ross

Dept. of Organismal Biology and Anatomy, University of Chicago

25. Foraging preferences and substrate use in the absence of food availability pressures in three lemur (*Lemur catta*, *Eulemur mongoz*, and *Eulemur sanfordi*) species

Ashlee A. Van Schyndel¹, Raymond Vagell²

¹Lemur Conservation Foundation, ²Department of Psychology, CUNY Hunter College

PODIUM PRESENTATIONS

Behavioral strategies for meeting nutritional demands across seasons and life history stages in the Mexican black howler monkey (*Alouatta pigra*)

Katherine R. Amato^{1,2*}, Paul A. Garber²

¹Program in Ecology, Evolution and Conservation Biology, University of Illinois, Urbana-Champaign

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Howler monkeys (*Alouatta* sp.) are generally considered to be energy-minimizers, maintaining small home and day ranges and shifting their diet to include large amounts of young leaves during times of mature fruit scarcity. In this study I examine whether these diet shifts lead to changes in Mexican, black howler monkey (*A. pigra*) foraging strategies. I expected howlers to adopt a nutrient-balancing strategy designed to maintain a minimum protein intake during periods of mature fruit abundance and an energy-maximizing strategy during times of mature fruit scarcity. I also predicted that adult females and juveniles would exhibit higher minimum protein and energy intakes compared to adult males. Diet and activity budget data collected from two groups of howlers (N = 16) over 10 months and across three seasons in Palenque National Park, Mexico demonstrate that howlers included both fruits and leaves in their diet during all months of the year but consumed more than 50% (wet weight) mature fruit in the rainy and dry seasons and more than 50% young leaves and immature fruit during the three month intermediate period. Protein and energy intake was lowest during the dry season and highest during the rainy season for all individuals, and foraging strategies changed. However, females and juveniles consumed more protein than males during the dry and intermediate seasons and more energy during the intermediate season. Additional relationships between diet, behavior, nutritional requirements and life history processes are discussed.

White-faced sakis appear to have good reasons for deviating from straight-line travel between feeding trees.

Avis Anzelc and Marilyn A. Norconk

Dept. of Anthropology, Kent State University

The use of linear travel routes to preferred resources by both terrestrial and arboreal primates suggest that they may conserve energy via “goal directed” travel. White-faced sakis inhabit and defend relatively small home ranges (25 ha) and primarily ingest seeds that are patchily distributed in space, but have a relatively long periods of availability. Thus preferred foods may be spatially and temporally abundant, reducing the incidence of straight-line travel. We studied the travel paths of a well-habituated group of sakis for a 7-week period to assess linearity in travel to feeding trees, frequency of revisits to feeding trees, use of navigation “landmarks,” and effects of home range boundaries on foraging routes. Routes were documented using compass readings; pedometer tracking and post-hoc GPS waypoints for start-stop points. Daily travel routes were replicated using EasyCad v. 7 and compared to hypothetical straight-line routes. Directedness ratios (DR) were computed for all inter-tree combinations (n = 246), where DR of 1.0 (inter-resource straight-line distance/observed distance) is a straight line. We found that sakis are relatively directed in their travel routes (DR = 0.81). More than 80% of angles were ≤ 90 degrees indicating forward progression and rare backtracking. Inter-troop encounters and approaches to territory boundaries reduced DRs and DRs were significantly straighter when reusing trees than for first-time feeding ($z = -2.1, p < 0.05$). We suggest that sakis are often goal-directed travelers, but travel routes are also influenced by territorial monitoring and meanderings possibly related to seeking new food sources.

Hair plucking in captive bonobos (*Pan paniscus*)

Colin M. Brand* and Linda F. Marchant
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Ethological studies of non-human primates in wild and captive contexts report the adaptive role of grooming in solitary and social behavior. Indeed, grooming is often characterized as “social glue” in primate social relations. In captivity, grooming behavior is scrutinized to elucidate dominance, kin relations, and social networks. However, many captive primates, including apes, are observed to over-groom which may result in denuding of individuals. This study focused on a discrete pattern of grooming, specifically plucking - a rapid jerking away of the hand or mouth to remove the hair follicle, often accompanied by inspection and consumption. Subjects were 17 bonobos (*Pan paniscus*) housed at the Columbus Zoo. Data were collected using focal behavior sampling, all-occurrence. Results of time-budget analyses show that approximately 21% of self-directed and dyadic-grooming bouts involved hair plucking. The four wild-born individuals were never observed to hair pluck. Age class strongly influenced the percent of grooming bouts that involve plucking - for adolescents the mean percent of grooming bouts involving plucking was 38.5%, whereas in adults it was 20%. Dominance may also play a role in self-directed plucking. The dominant male and female showed the highest percent of self-directed plucking behavior, 54% and 57% respectively. This is the first study to document the significance of plucking in bonobo grooming behavior and contributes to discussions of visitor’s perceptions of ape well being.

Nest box usage in captive owl monkeys (*Aotus spp*)

Leilani Case* and Kerrie Lewis Graham
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Environmental enrichment is frequently utilized in captive settings to enhance and promote species-typical behaviors and for psychological well-being. Our study focuses on owl monkeys (*Aotus spp.*); nocturnal primate species that pose particular challenges in a laboratory setting. In the wild, *Aotus* use tree holes as nest sites, however, little is understood about *Aotus* nest site usage in captivity. Our goal was to identify nest box preferences within and between three different *Aotus* species, housed at Name Facility, Bastrop, TX. We used focal-animal sampling and scan sampling to collect behavioral and location information on three different owl monkey species: *Aotus azarai*, *A. nancyma* and *A. vociferans*. We observed five groups from each species in a variety of family groups that included pregnant/lactating females, infants, siblings and father-daughter pairs, ranging from 2-5 individuals per group. The facility, UT MD Anderson, currently provides 4 different types of nest boxes: [1] a mesh box, [2] a covered box of the same size, [3] a horizontal bucket, and [4] an opaque white box. However, preliminary analyses indicate that the monkeys also use other portions of the cage for resting/sleeping. We discuss nest box preferences, controlling for the effects of group size, sex, age, and condition. We hope that results from this study will be used to optimize future enrichment and housing of captive owl monkeys.

The phyletic position of *Cercocebus torquatus* with notes on origin and radiation of the *Cercocebus-Mandrillus* clade

Catherine Cooke*, W.S. McGraw
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Recognition of mangabey diphyly has spurred a flurry of morphological and behavioral studies. *Cercocebus* mangabeys form a clade with *Mandrillus* to the exclusion of *Lophocebus* mangabeys and baboons. The current geographical distribution of the *Cercocebus-Mandrillus* clade and the presence of a morphocline in certain cranio-facial characteristics led to the proposition that the clade originated in central Africa and subsequently migrated east and west. It is

proposed that *C. torquatus*, the red-capped mangabey, is the most derived species. In contrast, recognition of a fossil mangabey, *Procercocebus antiquus*, from South Africa dated to 2 million years BP that closely resembles *C. torquatus* suggests that *C. torquatus* is the most primitive member of its genus. Relatively little is known about the behavior of *C. torquatus*, particularly the form-function relationship among key skeletal features. This information will help elucidate the position of *C. torquatus* within its clade. Data on the feeding, ranging, and positional behaviors of a population of *C. torquatus* were collected in 2009 in southwestern Gabon. These data speak to whether this species is the basal or most derived member of its genus and suggests a re-evaluation of their biogeographical radiation. Results show that *C. torquatus* is possibly the least terrestrial member of its clade, and its behaviors suggest that this species represents the ancestral *Cercocebus* population and the clade originated in either south or west-central Africa.

Behavioral changes associated with sexual state in chimpanzees (*Pan troglodytes*) and gorillas (*Gorilla gorilla gorilla*)

Molly C. Fitzpatrick*, Katherine E. Wagner, Steve R. Ross

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The influence of sexual state on the behavior of great apes has been well documented at the dyadic level for the purpose of understanding social relationships. Although these cyclical changes in sexual receptivity may be significant on a broader social scale, little research has examined these changes at a group level. We examined behaviors associated with sexual receptivity in mixed-sex, naturally structured captive groups of chimpanzees (N=7) and gorillas (N=7). Behavioral data were collected using focal observations with 30-scan intervals as part of ongoing monitoring. Chimpanzee receptivity was assigned based on visual assessment of swelling size; gorilla receptivity periods were determined by an oral contraception cycle, which included one week per month during which females received a placebo pill. We assigned a receptivity score to each week, based on mode swelling level or contraceptive state (high=full tumescent swelling or no pill; low= less-than-full swelling or pill) and assessed state-related changes in 7 behavioral categories. During high receptivity periods, all chimpanzee subjects showed a higher frequency of abnormal behaviors ($F(1,12)=3.051, p=0.05$), and feed-foraging behaviors ($F(1,12)=3.368, p=0.03$). Gorilla receptivity was associated with a higher frequency of attention behaviors ($F(1,12)=6.80, p=0.012$), and locomotion ($F(1,12)=4.39, p=0.02$) in all group members. These results show significant behavioral variation with sexual state, suggesting that perhaps species-typical patterns of group attention and sociality affect sexual behavior differently.

Keywords: chimpanzee, gorilla, sexual receptivity, behavior

Preference: Podium presentation

Outside the fence: forest island management and regional conservation in northern Madagascar

Benjamin Z. Freed^{1*} and Lisa L. Gezon²

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Madagascar's conservationists have traditionally sought to protect large forest islands 'hotspots' that have greater biodiversity than the surrounding areas. In 2004-2010, we compared the conservation threats and responses on primates and people in the managed forest island of Mt. d'Amber National Park with those in unmanaged, forest fragments surrounding it. In the Park, conservation efforts occurred near touristed areas and accessible agricultural communities; lemur populations were greatest along the forest edge near human populations with conservation-oriented traditions. Deforestation and agricultural encroachment has occurred slowly throughout the forested zone since colonial times. While the Park's conservation efforts have increased since the late 1980s, extensive logging concessions, illegal logging, and farming further fragmented forests outside of and to the west of the Park. Lemur populations there now inhabit smaller, less diverse habitats than within the Park. From our research we conclude: primates and people co-exist peaceably even in the small forest islands outside the fence; these forest islands

experience greater threats from outside disturbance (such as logging) than does the more actively protected park; and local people need ways of collaborating with strong conservation institutions for maximum forest and lemur protection.

Primate socioecology: who are we, where are we, and what are we doing here?

Agustin Fuentes

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Over the last 30 years there is an ongoing discussion (debate?) about the utility, structure and contents of the underlying theoretical structure used by most primatologists: something we like to call socioecological theory. Food (finding it or being it), females, and social organization have been the central themes with competition, friendship, infanticide, cooperation, and many other patterns having their moments in the spotlight. Four years ago Bernard Thierry challenged us to “put up or shut up” and recognize that the results of much (most?) primatological fieldwork do not conform to the expectations of basic socioecological predictions: he suggested we drop the model. This elicited a particularly vitriolic response from some primatologists and a hearty round of approval from others. Now late in 2012 we have the publication of yet another overview (by Clutton-Brock and Janson) concluding that we do need to explore a diversity of explanations for primate social organization, but that holding on to the central themes of socioecological theory might be a good idea as well. Is it time for primatology to grow up and out of outdated models? How do we replace them? This talk will fan the flames of the debate and add a bit of context, a roadmap of sorts, to the future of theory, and practice, in primatology.

Sexual coercion in nonhuman primates – is female-directed aggression an effective mating strategy in the matrilineal primate, long-tailed macaque (*Macaca fascicularis*)?

Lisa Guidi

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In recent years, studies on mating and reproduction in nonhuman primates have focused on the purported conflict of interests existing between males and females due to differential investment in reproduction between the sexes. Females are believed to bear the brunt of reproduction and are accordingly often resistant to mating attempts from undesired males. Sexual coercion theory postulates that female-directed aggression by males functions to harass and intimidate otherwise reluctant females to mate, in some cases, forcing them to do so. It has been suggested that sexual coercion is such a successful reproductive strategy that it represents a third form of sexual selection, alongside male-male competition and mate choice. Although it has been investigated in some primates, chimpanzees in particular, there are many questions in this field of research that remain unanswered. How effective is sexual coercion as a reproductive strategy? Do coercive males have higher fitness than males using other strategies? Do females living in a matrilineal social structure, such as macaques and baboons, experience less coercion than females in a patrilocal social structure? I present a proposed study to examine the efficacy of sexual coercion in long-tailed macaques, a species that meets all of the requirements thought necessary for coercion to be present. In addition to examining the timing, rate and intensity of female-directed aggression, the proposed study will examine whether female coalitionary support is a factor that hinders the use of coercion by males, an investigation providing a novel approach to an unanswered but important question.

Report on a previously undocumented chimpanzee population (*P.t. verus*) discovered in the Tonkolili District of Sierra Leone

Andrew R. Halloran^{1*}, Christina T. Cloutier²

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A previously undocumented group of wild chimpanzees (*P. t. verus*) was discovered living along the Rokel River Meander in Sierra Leone's Tonkolili District. Using standing nest counts and reports from local residents, we estimate group size to be around 40 individuals. During our stay in the area, we observed several instances of chimpanzees being hunted by the local human population. These deaths, in conjunction with reports from the Tacugama Chimpanzee Sanctuary in Freetown, demonstrate that the majority of recent orphans originate from the Tonkolili District. We therefore conclude that this is a heavily imperiled chimpanzee population. Based on the ecology of the area and composition of local villages, we propose a number of conservation strategies that will promote a symbiotic relationship between the chimpanzees and human populations residing in the area.

Mandibular helical axis during feeding in non-human primates

Jose Iriarte-Diaz*, Callum F. Ross

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Mandible movement is often described using the three-dimensional displacement of a single landmark (e.g. a tooth). These trajectories, however, depend on the relative location of the point with respect to the center of rotation of the mandible and their interpretation can be equivocal. To avoid this problem, we describe mandibular movement with the finite helical axis (FHA), which describes the movement of the rigid body as translating along and rotating around an imaginary axis in space. Previous studies have shown that the FHA is located mostly inferior to the temporomandibular joint (TMJ) but that its position and orientation change continually through the gape cycle. Few data are available regarding the position and orientation of the FHA in non-human primates and it remains unclear to what extent the kinematic patterns of the mandible during feeding vary among primate species. Here we present data on the 3D feeding kinematics of *Macaca*, *Papio*, *Cebus* and *Saimiri* obtained using high-speed, high-resolution video recordings. As previously observed, the FHA was located below the TMJ in all species but the axis orientation changed throughout the gape cycle differently among species. Preliminary analyses show that jaw kinematics of *Macaque* and *Papio* are more similar than those of *Cebus* and *Saimiri* suggesting clade-specific differences in kinematics. These differences may reflect differences in TMJ morphology as well as differences in patterns of muscle activation.

Prosimian primates show ratio dependence in spontaneous quantity discriminations

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We directly tested the predictions of the approximate number system (ANS) and the object file system in the spontaneous numerical judgments of prosimian primates. Prior work indicates that when human infants and a few species of nonhuman animals are given a single-trial choice between two sequentially baited buckets they choose the bucket with the greater amount of food but only when the quantities are small. This pattern of results has been interpreted as evidence that a limited capacity object-file system is used to track small numbers of objects and that the ANS is not invoked under these circumstances. Here we tested prosimian primates in food choice comparisons that were chosen to contrast predictions of the ANS and object-file systems. We found that prosimian primates consistently chose the larger of two sets when they differed by a 1:3 ratio regardless of whether both values were small (< 4), both values were large (> 3), or there was one small and one large value. Prosimians were not able to robustly discriminate quantities that differed by a 1:2 ratio for the same three conditions, nor did they show a preference for 2 vs. 3 food items. These results implicate the ANS in the spontaneous numerical discriminations of nonhuman primates.

Behavioral effects of providing a choice for outdoor access to captive apes

Laura M. Kurtycz, Katherine E. Wagner, Stephen R. Ross

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Outside access is often assumed to impact the behavior and welfare of captive great apes, though few studies have explored whether offering a choice to access these outdoor spaces plays a role in this interaction. At Lincoln Park Zoo, chimpanzees and gorillas live in naturalistic enclosures with typically free access between indoor and outdoor enclosures. To examine the influence of having the choice to select between these areas, observers collected focal behavioral data on gorilla (N=9) and chimpanzee (N=6) subjects, including the focal's current location in the exhibit (indoor vs. outdoor). We compared sessions in which apes were locked indoors to those in which they had outdoor access but stayed inside for the entire session, thereby removing the effect of outdoor use and distilling the question to the effect of the choice to use those spaces. When given outdoor access, both species showed an increase in self-directed behavior ($F(1,13)=9.523$, $p=0.009$), and changes in social behavior ($F(1,13)=12.283$, $p=0.004$) and inactivity ($F(1,13)=18.756$, $p=0.001$), though in opposite directions. Chimpanzees increased social behavior ($p=0.003$) and decreased inactivity ($p=0.005$) during periods of outdoor access. Gorillas showed decreased social behavior ($p=0.035$) and increased inactivity ($p=0.002$). These results suggest that the choice of access alone exerts robust effects on ape behavior, including arousal-correlates, sensitive to species-specific traits. Future studies will continue to shed light on the importance of choice for captive animals.

Use of a fecal DNA sequencing technique to determine composition of wild nonhuman primate diets

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Which food resources primates choose to exploit is dependent on a number of changing social and ecological factors, including nutrient balancing, food availability and distribution, patch size and quality, and the presence of conspecifics. In insectivorous primates, such as capuchin monkeys (*Cebus* spp.), previous field studies have been limited by an inability to accurately determine what species of invertebrates are being consumed, decreasing the researchers' abilities to assess the nutrient content of all components of the diet. Fecal DNA sequencing promises to provide a tool to identify invertebrate species present in the diet of wild primates. In this study, I examine whether DNA amplified from capuchin fecal samples can be used to identify insects known to be part of the diet of a group of captive brown capuchins (*Cebus apella*). Fecal samples were collected from pair-housed capuchins (N=6) fed crickets, grasshoppers and wax moth larvae. DNA was extracted from fecal samples, a ~300bp section of the COI mitochondrial gene was amplified with two sets of universal insect primers, and sequenced on a Roche FLX sequencer. These sequences were then compared with known COI sequences in GenBank and the Barcode of Life Database to verify that all three insect sequences were present. This is a promising non-invasive method to gain a more complete picture of wild nonhuman primate diets.

Penichus: genetic variability and phylogeny of the mitochondrial (mtDNA) control region of *Callithrix jacchus* and *C. penillata* and their hybrids

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The evolutionary role of hybridization is being increasingly recognized among primates, including wild Brazilian Atlantic Forest marmosets (*Callithrix* genus); a taxon with low reproductive isolation. This phenomenon exists in natural species contact zones, and areas of artificial sympatry resulting from anthropogenic activities. In cases of artificial sympatry, exotic *C. jacchus* and *C. penicillata* are usually present in the ranges of their congeners. These two species seem better adapted than other marmosets at exploiting the disturbed Atlantic Forest, additionally, most *Callithrix* species are endangered. Thus, hybridization may have important evolutionary consequences for this genus. To better understand those consequences, we present data from the mtDNA control region of pure/ hybridizing *C. jacchus* and *C. penicillata* individuals.

We sampled wild individuals within an artificial hybrid zone in Rio de Janeiro state, a natural hybrid zone in NE Brazil, and pure wild/captive *C. penicillata* and *C. jacchus*. We also utilized Genbank data. A much higher number of hybrids was observed in Rio de Janeiro than at the NE Brazil site. However, lower genetic variability and a smaller number of haplotypes was found in the former when compared to the latter. While *C. jacchus* possessed a higher number of haplotypes than *C. penicillata*, the latter was more variable than the former at the control region. We conclude that introduction and hybridization of marmosets may lessen their biodiversity and induce formation of hybrid swarms in areas of artificial sympatry. Further research is needed to better understand effects of hybridization on marmoset biodiversity and evolution.

Effects of habitat quality, group size, and social rank on testosterone in male red colobus monkeys in Kibale National Park, Uganda

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Both social and ecological stressors can impact hormone concentrations in wild animal populations. This study examined the effects of habitat quality, group size, and social rank on testosterone concentrations in male red colobus monkeys (*Procolobus rufomitratu*s) living in and around Kibale National Park, Uganda. Fecal samples were collected opportunistically from 3 red colobus groups inside the park and 3 groups in unprotected forest fragments outside the park. Additionally, individual identification and social rank were recorded for males in one of the groups. Radioimmunoassays were used to analyze testosterone concentrations of 80 fecal samples from individual males. We tested three main hypotheses: 1) males in the park have higher testosterone concentrations than males in the fragments, 2) males in a large social group (120 individuals) have higher testosterone concentrations than in a small group (60 individuals), and 3) the alpha male has higher testosterone concentrations than subordinate males. Testosterone concentrations were not significantly different between males living in the park and males living in forest fragments ($P=0.764$) or between males living in a large social group and males living in a small social group ($P=0.175$). However, the alpha male of the individually identified group had significantly higher testosterone concentrations ($P=0.015$) than the other males within the group. These results have important implications for wild primate management and the physiological correlates of primate social systems.

Scaling of distance from center of mass to condylar axis in primate mandibles

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To understand the evolution of primate feeding systems, we are studying the biomechanical determinants of the scaling of chew cycle duration in primates. This project quantified size-related changes in the distance from the mandibular center of mass to the condylar axis in 51 species of primates, 14 prosimians and 37 anthropoids. Center of mass location was calculated from CT scans using Amira. Relative density of the bone was estimated using Hounsfield numbers of the voxels and marrow space was assigned the density of water. The distance from the center of mass to an axis passing

through the backs of the mandibular condyles was calculated. Jaw length was estimated as the distance from the condylar axis to infradentale. The scaling of the distance from the center of mass to the condylar axis relative to jaw length does not differ significantly from isometry in either anthropoids or prosimians. The two groups do not differ significantly from each other in scaling coefficients. Differences in mandible shape between anthropoids and prosimians do not result in differences in scaling of the distance from center of mass to condylar axis. Future work will incorporate more realistic estimates of the location of the axis of rotation.

Seasonality, activity patterns, and cortisol in female spider monkeys in a wet forest environment

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Seasonality plays a crucial role in shaping the ecological context in which individuals live, which in turn shapes their internal processes. The glucocorticoids, or stress hormones, are crucial in allocating the body's resources in accordance with ecological demands, and most animal species experience seasonal variation in glucocorticoid concentrations. Here, I report on the effects of seasonality and activity patterns on cortisol concentrations in wild subadult and adult female spider monkeys, at El Zota Biological Field Station in Costa Rica. Over a 15-month research period, mean individuals rates of time engaged in rest are significantly negatively correlated with mean cortisol concentrations (Spearman's $\rho = -0.737$, $p = 0.010$, $N = 11$). No other activity variable was significantly associated with mean cortisol concentrations. Additionally, over the course of a year, the effects of monthly fruit abundance, mean party size, and activity variables were assessed. Although fruit abundance and party sizes did significantly vary between seasons, cortisol concentrations did not. Furthermore, in a general linear model, none of these variables significantly explain variation in monthly cortisol concentrations, although a non-significant trend was observed between time engaged in rest and cortisol concentrations ($F = 4.703$, $p = 0.082$). These results indicate that in this mildly seasonal environment, variability in fruit abundance and party size has little effect on cortisol concentrations. Rather, time engaged in rest appears to be the most important factor in affecting individual's cortisol concentrations.

The role of transoceanic rafting in the colonization of Madagascar by lemurs and other vertebrates

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Rafting has long been hinted at as the explanation for the origin of Madagascar's lemurs, largely because the island has been isolated for more than 80 million years, well before ancestral lemurs are thought to have evolved. The feasibility of rafting has been debated - some have argued that successful rafting by terrestrial animals is virtually impossible, while others argued that prevailing ocean currents could have aided these journeys. In order to elucidate the mechanisms that shaped the biogeographic history of lemurs and other Malagasy vertebrates, arrival patterns implied by modern taxa were analyzed. For each of 81 clades, arrival date, source, and ancestor type were compared. Changes in arrival rates were explored through time.

For Malagasy vertebrates, the probability of transoceanic dispersal is negatively correlated with distance traveled and influenced by ancestor type and ocean currents. Groups classified as "obligate rafters" show a decrease in successful transoceanic dispersal after the Paleocene, reaching the lowest levels after the mid-Miocene. This is consistent with a paleoceanographic model predicting a change in ocean current direction - before the mid-Miocene they were eastward (from Africa to Madagascar; conducive to rafting from Africa), and afterwards were reversed. This study is the first to directly test the rafting hypothesis for lemurs, and supports the hypothesis that transoceanic transport aided by wind and water helped establish most of Madagascar's present-day vertebrates.

Living on the Edge: Patterns of Habitat Use in *Saguinus midas*

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Genus *Saguinus* is widely noted as “preferring” or “thriving” in edge habitats (Hershkovitz, 1977. Garber, 1980. Porter, 2001.). Data collected over a two month period in a lowland secondary forest in the interior of Suriname supports that hypothesis. These data also demonstrate regular, daily troop movements from the edge in the early morning, towards sites deeper in the interior for the bulk of the day. These regular movements reflect a preference for sleeping sites located in the edge, coupled with a preference for interior forest for feeding. Possible explanations for this behavior include (but are not limited to), an increase in foliage cover as protection from diurnal predators (primarily various raptor species), foliage cover used as relief from excessive temperatures, or an increased density of food resources. Further study at this site would likely provide clearer motivations for daily patterns of habitat use, and an extended period of study would be required to record whether these patterns hold through the change of seasons, or vary due to the seasonal shifts in weather patterns, and the possible seasonality of preferred food resources.

MPIG Abstracts

POSTERS

How social status and gender affect agonistic and affiliative behavior in captive Japanese macaques (*Macaca fuscata*)

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Higher ranking non-human primates are shown to direct agonistic behaviors towards lower ranking individuals to gain access to resources. Lower ranking individuals will direct affiliative behaviors, for instance grooming, towards higher ranking individuals to promote social bonds. I investigated the effect of gender and hierarchal status in *Macaca fuscata* on affiliative and agonistic behavior. I studied eleven adult *Macaca fuscata* at the Cincinnati Zoo. I used instantaneous random focal samples on every minute for ten minutes (n=775) and all-occurrence data. A female dominance hierarchy was constructed using all occurrence data on agonistic behavior. Time spent allogrooming and receiving grooming was compared among females of different ranks. High ranking females received the most grooming (6.7%), high ranking females spent the most time allogrooming (22.5%). High ranking females should receive the most grooming because lower ranking females gain the most fitness benefits by allogrooming high ranking individuals. A comparison between male and female activity budgets revealed that males spent 0% of the time allogrooming, but received grooming 22.3% of the time. Based on the comparison of dyadic interactions, rank does not appear to be an indicator of who interacts with whom. High-ranking individuals interacted repeatedly with low ranking individuals.

Chimfunshi Sanctuary: discovery of social culture

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Chimfunshi Wildlife Orphanage is a 24,000 acre sanctuary in Zambia dedicated to the long term care of over 120 chimpanzees living in virtually wild conditions. It also provides the opportunity to study a diverse array of fauna and flora in this miombo forest. Chimfunshi is eager to identify and develop new behavioral research opportunities for students and faculty; especially research that may compliment the education programs as well as assist with the long term sustainability of this safe haven. Today I will discuss our most recent findings which provide evidence that chimpanzees have social culture. Grooming handclasp (GHC) behaviour was originally advocated as the first evidence of social culture in chimpanzees owing to the finding that some populations engage in the behaviour and others do not. To date, however, it has remained unclear to what extent this social behaviour varies between groups and how validly this evidence can be substantiated. Our results showed that two groups (of four) engaged in GHC behaviour. Critically, GHC style could be systematically linked to the chimpanzee's group identity showed temporal consistency both within- and between-groups. GHC has been part of the behavioural repertoire of the chimpanzees under study for more than 10 years and continued to spread within the group, also across generations. These results provide strong validation of the cultural status of the grooming handclasp behaviour.

Differences in activity budgets and social interactions of female mantled howler monkeys (*Alouatta palliata*) with and without dependent infants

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During June and July of 2012 I conducted a study to better understand the behavioral differences among adult female mantled howler monkeys (*Alouatta palliata*) with dependent infants, and those without. I hypothesized that females with dependent infants would rest and eat more than females without infants, in order to compensate for the increased nutritional demands of lactation and carrying the infant. I also expected that others in the group would want to be near the infant, and thus would approach and follow females with infants more frequently than they would adult females without infants. I collected 41 hours of observational data, in the form of 10-minute continuous focal animal samples. Data were collected in secondary dry tropical forest habitat at the Ometepe Biological Field Station, Nicaragua. My results showed that adult females with infants spent more time resting, and slightly more time eating, than females without infants. Also, adult females with infants spent more time in proximity and in contact with each other, than adult females without infants. Additionally, adult females with infants had almost three times the rate-per-hour of approaches by others, and ten times the rate-per-hour of follows by others. Reasons for these patterns will be discussed and contextualized with other studies. For example, adult females with infants may need to compensate for increased nutritional requirements of raising infants (i.e., rest and eat more), and may have a higher social status (i.e., have higher rates of being approached, followed, as well as rest-in-proximity, and rest-in-contact).

Manual preferences of wild and captive howler monkeys

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Over the course of human evolution, handedness has become one of the most prominent signs of brain lateralization. However, recent studies on several nonhuman primates, primarily apes, have documented population-level handedness as well. It is theorized that the cognitive demands placed on a species by their diet has led to task-specific manual preferences. Over time, this would have led to the evolution of brain lateralization and handedness. This study focused on looking for signs of handedness in a population of wild-mantled howler monkeys (*Alouatta palliata*) in the Osa Peninsula of Costa Rica, and two captive groups of black howler monkeys (*Alouatta caraya*) at the National Zoo and Houston Zoo. Howler monkeys were chosen since their diet is composed of mainly leaves, and does not require any of the cognitive demands that are believed to lead to a lateralized brain. In the wild and captive populations of howler monkeys, there were no signs of population-level handedness or task-specific manual preferences. Overall, this study sheds more light into the evolution of handedness and brain lateralization. This adds support to the hypothesis that the cognitive demands from a species' diet over time is an influencing factor into the evolution of brain lateralization and handedness.

Comparison of Callitrichidae taxonomy via phylogenetic and systematic analysis

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Trying to deduce the taxonomic relationship within the primate branch has been going on since scientists have classified systems. Early debates in the taxonomic structure of the primate radiation stemmed from Systematic studies done on morphological and ecological data. In the past twenty years a new form of analysis has taken root, phylogenetic studies,

and has become the corner stone of Current View on taxonomic relatedness. One family that has changed drastically in taxonomy is that of the *Callitrichidae* of South America. This study looks at the Current View of this family's radiation through genetic, morphological, ecological and behavioral characteristics. By using MrBayes analysis tools phylogenetic relatedness was tested among the *Callitrichidae* by looking at the mitochondrial d loop (provided by Genbank) and characteristics taken from All the World Primates database. Using these data three tree comparisons were run; the genetic data alone, the systematic data alone and a total evidence tree ran including the genetic data and systematic data. In the resulting trees discrepancies were found between species relatedness depending on the data that was used to run the tree. The recent division of the genus *Callithrix* into the genera *Callithrix* and *Mico* were well demonstrated in two of the three resulting trees. The tree produced by just the morphological data alone did not show the strong grouping of the *Callithrix* genus into two distinct groups.

Pointing in interactions with ASL signing chimpanzees

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Videotaped interactions between cross fostered chimpanzees and a long time social companion were reviewed. These chimpanzees use American Sign Language (ASL) to communicate with human companions as well as to communicate with each other. A casual review of these tapes showed that it appeared that the chimpanzees often used a pointing gesture when interacting with a human companion. Pointing is used frequently to indicate location and direction of items, but there is debate about whether chimpanzees use pointing as well. There are some studies that report that pointing is part of some chimpanzees' behavior. While others argue that pointing is a uniquely human behavior. Videotape records of conversational interactions were systematically analyzed for instances of pointing behavior. Frequency across chimpanzees was recorded as well as an attempt to determine the utility of this behavior for our sibling species was discussed. Taking the humble ethological perspective of "show me" allows the organism the opportunity to show us even more than we imagined; to make discoveries. In this study it was found that the chimpanzees used a type of pointing that is considered to be uniquely human and also used two other types of points that are not typically classified as a style of human pointing.

Defining the "lean season" and its ecological implications: Effects of seasonality on mass intake and nutrient intake in diademed sifaka (*Propithecus diadema*)

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Many primate field studies identify a "lean season" (when preferred foods are less available), and "fallback foods" (lower-quality, abundant foods consumed when preferred foods are scarce). However, few studies have quantified the implications of lean seasons for mass intakes (how much food is ingested) and nutrient intakes. From July 2006-July 2007, we collected 134 foods of a wild lemur (diademed sifaka *Propithecus diadema*) in two habitats at Tsinjoarivo, Madagascar, analyzed them for macronutrients, and used feeding data to estimate daily macronutrient and energy intakes for four groups (two per habitat).

In the "lean season", sifakas shifted to non-fruit foods (which are mostly higher-protein but lower in other macronutrients and energy); however, intake of all macronutrients and energy decreased. This was not driven primarily by differences in food quality (in terms of macronutrients), but by decreased feeding time and mass ingested; lean season mass intakes were as low as one-quarter those in the rainy season. Sifakas may shift from fruiting season "energy

maximizers” to lean season “time minimizers”. The decreased intakes cannot be explained by day length, fiber intake, or food availability; plant secondary metabolites may limit intakes, but further studies are needed to confirm this. These shifts have implications for understanding seasonality, the evolution of life history strategies, and potentially, ecological differences among different primate clades.

The effects of pregnancy and motherhood on a captive gorilla’s behavior

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Behavioral monitoring in zoos provides a means to quantify how unplanned events may influence an animal’s behavior. We have been collecting such data on a troop of Western lowland gorillas (*Gorilla gorilla gorilla*) at the Buffalo Zoo. Using scan sampling to record the behavior of a focal animal, we conducted 184 observations to track behavior changes in an adult female before, during, and after her pregnancy. By comparing data across these three periods, we predicted that we would observe differences in the mother’s overall activity budget between the three phases. We found that the mother spent significantly more time out of view of the public during her pregnancy, and spent progressively less time with her infant as the infant aged. Additionally, we documented that the mother spent significantly less time in close proximity to a female conspecific during and after her pregnancy. This study demonstrates that pregnancy and motherhood have measurable effects on gorilla behavior.

Functionality in tool use in western lowland gorillas

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Nonhuman primates are known to use objects as tools. Gorillas however seem to be the least proficient tool users. We have previously observed the western lowland gorillas (*Gorilla gorilla gorilla*) at the Buffalo Zoo using buckets, given for enrichment, to collect water (Margulis et. al., 2011). To further explore the cognitive ability of these gorillas, we designed a study that tested whether the gorillas could distinguish between a functional and a non-functional tool. The gorillas (1 adult male and 2 adult females) were given four buckets, two of which had holes drilled in the bottom (the “non-functional” tool). We collected 85 hours of videotaped data to test the null hypothesis that the gorillas could not distinguish between the functional and the non-functional buckets. We documented that there were individual differences in bucket usage depending on the functionality of the bucket, with one gorilla using the functional buckets significantly more often than the non-functional buckets. This study sheds light on the cognitive ability of gorillas and reveals opportunities for further investigation.

The effects of varied risk and reward on orangutan decision-making

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Metacognition, or knowing what you know, is extremely useful for decision-making. Recent studies have shown that several species of non-human primates are consciously aware of their knowledge states during memory-based experiments, and are thus able to avoid making costly decisions. Here, we examined whether or not the difficulty of a task and the size of the available reward affected decision-making in six orangutans. Subjects were first shown the

quantity of a variable food reward, which was subsequently and covertly placed in one of several opaque containers. Subjects could guess the correct reward location or instead choose an always present "escape" option consisting of a lesser reward. We found that subjects were willing to take risks by guessing the location of the larger reward only when the chances of guessing incorrectly were small, and were more likely to take those risks as the size of the potential preferred reward increased, resulting in a significant interaction between the size of the reward and difficulty of the task ($F(2,3) = 9.664, p < .05$). Our results suggest that orangutans possess the ability to make varied decisions based on potential risk and reward, a feat requiring them to monitor their own knowledge states, and thus implying the presence of certain metacognitive abilities.

Does the type of leafy green in the morning diet of *Gorilla gorilla gorilla* have an effect on the level of agonism during the day?

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The purpose is to examine the possible correlation between the type of leafy green in the diet of the Western Lowland Gorillas (*Gorilla gorilla gorilla*) at the Saint Louis Zoo and the level of agonistic behavior (specifically aggression) exhibited in the bachelor group. The gorillas receive specific amounts of: vegetables, fruit, and leafy greens twice daily. The gorillas at the St. Louis Zoo are an all-male bachelor group. In July of 2011, Nadaya (10) and Bahari (6) arrived from Brookfield Zoo in Chicago and were integrated into the already existing group of three [Juma (24), Jontu (14), and Joe (13)]. During the difficult time of introduction, the two largest fights happened on days that they were given Bok Choy in their morning diet. The gorillas at the zoo like neither Bok Choy nor Napa cabbage and therefore will not eat it. The hypothesis is that there exists a positive correlation between type of green given in morning diet and the level of agonistic behavior throughout the day. Focal samples of 5 minutes each were used to observe the males. Originally research posited that the cause of agonism, by way of leafy green, was a hunger issue. However research showed no significant correlation.

Western lowland gorilla behavior: development from 0 – 12 months of age

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Few gorillas are born in zoos each year; therefore it is important to look at each one's behavior in order to determine what is normal. Having a baseline of normal behavior allows abnormal patterns of behavior and development to be detected. We studied the behavioral development of an infant gorilla at the Buffalo Zoo for the first 12 months of her life. Sixty-two observations were collected throughout the year using focal animal sampling and an established ethogram from October 2010 to October 2011. We analyzed her changes in activity budget and independence from her mother throughout those 12 months. As expected, we found that the infant increased independent behaviors such as foraging, terrestrial locomotion, and object play while exhibiting a decreased time in contact with her mother. The infant's behavior appears to follow normal patterns. These results contribute to the growing basis of normal patterns of behavioral development in zoo-born gorillas.

Affiliation, agonism, and patterns of association in savanna chimpanzees (*Pan troglodytes verus*) at Fongoli, Senegal—initial post research impressions

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Between April 1, 2011 and May 20, 2012, I conducted all-day focal follows of the eight adult male members of the Fongoli chimpanzee community, collecting over 1200 hours of data. I documented conspicuous active social behaviors such as grooming, displays and attacks, as well as more passive social behaviors, such as staying in close proximity. Analyses will examine agonism, affiliation, and patterns of association in relation to socio-ecological context, including proximity, presence of various types of food and water resources, age, sex, rank, and kinship. I hope to add to our understanding of the role agonism plays in the daily lives of social animals and to test claims about the importance and adaptiveness of intense aggression in hominoids.

While the context of agonism overall has yet to be statistically analyzed, it may be noted that the most severe bouts of aggression were related to changes in hierarchy. During my dissertation research, the nearly three-year-occupying alpha male was attacked and supplanted and two sub-adult males, after healing from socially sustained injuries, worked their way into the adult dominance hierarchy. Mild aggression sometimes occurred during feeding, mating, and fusion events, but episodes resulting in injured individuals temporarily avoiding other group members for days or weeks to nurse visible and movement-hampering injuries appeared to have more to do with the vicissitudes of a transient social structure than anything else. Also, attacks towards sub-adults may be analogous to rites of passage in human socialization.

Taxonomy of the Bornean slow loris, with new species *Nycticebus* (Primates, Lorisidae)

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More species of nocturnal primates are now recognized than in the past, because many are cryptic species. Subtle morphological disparities, such as pelage pattern and color variation, vocal cues, and genetics have aided in elucidating the number of diagnosable species in a genus. The slow lorises (genus *Nycticebus*) once included only two species, but recent taxonomic studies resulted in the description of three additional species; further incompletely explored variability characterizes each of the currently described species. The Bornean loris in particular is characterized by pelage and body size variation. In this study, we explored facemask variation in the Bornean loris (*N. menagensis*). Differing facemask patterns, particularly influenced by the amount of white on the face, significantly clustered together by geographic regions, separated by notable geographic boundaries. Our results support the recognition of four species of Bornean lorises: *N. menagensis*, *N. sp nov1*, *N. sp nov2*, and *N. sp nov3*. Genetic studies are required to support these findings and to refine further our understanding of the marked variability within the Bornean loris populations.

Insights from a field course in primate behavior and conservation

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At Canisius College, the Animal Behavior, Ecology, and Conservation Dept. prides itself on educating students by taking them out of the classroom and learning through hands-on experience. ABEC 404 –Wildlife Ecology and Conservation in South Africa – lives up to this statement. The course is a designated “capstone” course for the college, which aims to give students an opportunity to reflect on issues of global awareness, diversity, justice and ethics. Students travel to South Africa to conduct primatological field work at the Lajuma Research Centre in the Soutpansberg Mountains. While Lajuma is rich in biodiversity, the course emphasizes Sykes’ monkeys. Students familiarize themselves with field methods including locating and following habituated primates, use of GPS to track movements, creating an ethogram, and use of camera traps. During the second week, students travel to Kruger National Park to observe wildlife and learn about the conservation challenges associated with the park. During the final week, students return to Lajuma, develop research projects centered on Sykes’ monkeys, and collect data that are used for the projects. Students are also able to

gain insight into the lives of South Africans by working directly with local students and others from around the world. The course provides students with an opportunity to experience the life of a field primatologist and aids students in their career and life decisions.

The effects of auditory enrichment on gorillas

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Several studies have demonstrated that auditory enrichment can be used to reduce stereotypic behaviors in captive animals. The purpose of this study was to determine the relative effectiveness of three different types of auditory enrichment—naturalistic sounds (the African Rainforest CD), classical music (Chopin), and rock music (songs by the artist Muse)—in reducing stereotypic behavior displayed by Western lowland gorillas (*Gorilla gorilla gorilla*). Four gorillas (one adult male, two adult females, and one infant) were observed at the Buffalo Zoo for a total of 24 hours per music trial. A control observation period, during which no sounds were presented, was also included. Each music trial consisted of a total of 3 weeks with a 2 week control period in between each music type. The results reveal a decrease in stereotypic behaviors from the control period to naturalistic sounds. The naturalistic sounds also affected patterns of several other behaviors including locomotion. These results suggest that auditory enrichment, which is not commonly used in zoos, can be easily utilized by keepers to help decrease stereotypic behavior.

Whinnies, grooming, and estradiol in wild female spider monkeys

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Identifying hormonal correlates of social behavior in primates can help us understand variation in specific social behaviors across individuals. Here, I report preliminary results of a study of behavior and endocrinology in wild adult and subadult female spider monkeys from El Zota Biological Field Station, Costa Rica, over a 15-month period. Estradiol concentrations were assayed from fecal samples collected from recognized females using Enzyme-immunoassay (EIA) techniques. Over the entire research period, mean individual rates of whinny vocalizations were significantly correlated with mean estradiol concentrations (Spearman's $\rho=0.818$, two-tailed $p=0.002$, $N=11$). Furthermore, both whinny rates (Spearman's $\rho=-0.755$, two-tailed $p=0.007$, $N=11$) and estradiol concentrations (Spearman's $\rho=-0.764$, two-tailed $p=0.006$, $N=11$) were significantly negatively correlated with mean grooming rates. These findings cannot be accounted for by differences in age, reproductive state, or parity. Previous studies have indicated a sex difference in whinny production rates, with females producing more whinnies than males. The results of this study suggest that endogenous hormonal factors may affect whinny production, and these factors may underlie the pronounced sex differences observed for this vocalization. The negative relationship between whinnies and grooming indicate that whinnies may serve as a form of "vocal grooming" that plays a role in maintaining social bonds in a less time-exhaustive manner.

Developmental trajectories of microscopic architecture of the vervet monkey placenta

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Nonhuman primate models of placental and fetal development are rare but have specific relevance to human growth and development. Most data comes from term samples, but less is known about trajectories of placental and fetal growth across gestation. A series of 50 vervet monkey (*Chlorocebus sabaues*) placentas from the St. Kitts Biomedical

Research Foundation was characterized in terms of microscopic morphology and shifts in efficiency across the latter half of a species-typical 167-day gestation. Architecture was analyzed via stereology. Both fetal mass and placental mass increased significantly with gestational age (Pearson's correlations: $R=0.85$, $P<0.00001$; $R=0.64$, $P<0.00001$, respectively) but the size of the placenta relative to fetal mass decreased significantly between period 1 (d. 83-130) and period 2 (d. 131-159) (T-test: $T=-3.60$, $P<0.00001$). Placental mass accrual slowed at day 130 while fetal mass continued to increase. Though relative placental size decreased between period 1 and period 2, the surface area of the placental villi – the site of nutrient transport from mother to fetus – increased significantly, both in terms of volume (T-test: $T=-4.49$, $P<0.00001$) and surface area (T-test: $T=-5.33$, $P<0.00001$). The surface area expanded significantly more than the underlying volume, suggestive of increases in topographical complexity. These changes suggest there is an important shift in the metabolic capacity of the placenta, via an expansion of the microscopic surface area of the villi to support the energetic burden of late gestation brain and somatic growth. Future work in this sample will incorporate analyses of GLUT1 expression to characterize aspects of the transport of glucose, the primary substrate for brain growth. A better understanding of how the placenta drives and constrains fetal and brain growth in anthropoid primates is thus directly relevant to developmental models of human brain evolution.

Developing the brain: a potential role for the placenta in hominin brain evolution

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Of all primates, humans produce the largest-bodied and –brained neonates, relative to maternal size. This suggests that the intrauterine supply of nutrients available to the developing fetus by the placenta has increased or been made more efficiently available in hominins compared to other primates. The monkeys, apes, and humans all have hemochorial placentas: within that framework, do they differ from one another in ways that could explain differences in fetal brain growth? 1) We compared descriptions and consequences of placental invasion and vascular remodeling across primate taxa. 2) To calculate placental efficiencies at term we performed literature searches to extract data regarding placental, neonatal body, and brain weights in as many primate taxa as we could find. 3) We compared the magnitude in increases in efficiency across late gestation between humans and vervet monkeys. 4) We compared increases in villous surface area relative to fetal growth across late gestation between human and vervet monkeys. Several lines of evidence suggest that human and ape placentation is more invasive than monkey placentation. Apes and humans, the largest-brained primates, have the most efficient placentas, both in terms of supporting overall fetal growth and brain growth specifically. While placental efficiency increases across gestation for both the vervet and the human, the magnitude is significantly greater in humans (65% vs. 48%). It takes 8 times as much surface area to build one gram of human fetus as it does vervet fetus (4.0 mm^2 vs. 0.5 mm^2 , $p<0.0001$). Metabolic investment in the human fetal brain is high. These preliminary findings suggest that the more expensive the fetal brain, the more the hemochorial placenta exploits existing mechanisms (i.e. invasiveness, efficiency, surface area) to enhance energetic investment.

Inter-individual spacing patterns in mantled howlers (*Alouatta palliata*)

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Mantled howling monkeys (*Alouatta palliata*) form dominance hierarchies and readily subgroup within multi-male/multi-female groups (Chapman, 1990; Sanchez-Villagra et al., 1997). What is less understood is the extent to which age-sex class affects group spacing patterns. In baboon groups (*Papio cynocephalus ursinus*), for example, adult males disperse themselves much further apart than do other group members, especially lactating females, perhaps as a result of male reproductive strategies (Cowlshaw, 1999). Throughout July, 2012, I examined age-sex class spacing

patterns in three groups of mantled howling monkeys in Ometepe, Nicaragua. The hypotheses were: 1) females with dependent infants spend more time close (within one meter) to other group members than do other adult females; and 2) adult males spent the least amount of time close to other adults. I collected forty hours of fifteen-minute individual scan samples on groups composed of two to nine individuals. Data supported both hypotheses. Whereas females with dependent infants were close to other group members in 65.9% of all samples (n=554) other adult females spent only 31.1% of samples (n=843) close to other howlers. Adult males spent the least amount of time, 9.4% of samples (n=1005) close to other howlers. As I observed little male-male competition for females, I suggest that these spacing patterns reflect heightened vulnerability and energy needs of howler mothers, and decreased vulnerability of adult males.

Foraging preferences and substrate use in the absence of food availability pressures in three lemur (*Lemur catta*, *Eulemur mongoz*, and *Eulemur sanfordi*) species

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Foraging behaviors are complex and are contingent upon the environment in which the organism lives. In situations where the ecological pressure of food availability is removed, individuals have the option of foraging based on preference. At the Myakka City Lemur Reserve in Myakka City, Florida, lemurs are semi-captive, free ranging, and provisioned. However, between the multiple lemur species in the free-ranging forests, there is an expected diversity in foraging preferences in terms of food choice and substrate use. For this study, three species of lemurs were studied: ring-tailed lemurs (*Lemur catta*), mongoose lemurs (*Eulemur mongoz*), and Sanford's brown lemurs (*Eulemur sanfordi*). A focal animal scan sampling and all occurrences sampling was completed over the course of two months that measured activity budget, food item choice, and substrate use. Results indicate there is a relationship between the niches inhabited by the lemurs in terms of substrate use and food item choice.

How do age differences in *Cebus capucinus* compare in terms of object manipulation frequency?

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Of the two families of nonhuman primates observed to exercise object manipulation, capuchin monkeys (*Cebus*, spp.) are the only New World primates recognized to utilize purposeful object-substrate manipulation in both the wild and in captivity. Object manipulation encompasses any self-advantageous behavior made by an individual, in which an object is utilized to alter another detached object or substrate. In response to recent studies involving fur-rubbing behavior to repel insects and other object-use in capuchins, I conducted this study aimed to 1) examine, record, and compare the object manipulation types and frequencies performed by both adult and juvenile white-faced capuchins at La Suerte Costa Rica and 2) identify the different species utilized in object-use, paying special attention to plant genera used in fur-rubbing. I collected data on two subgroups of *C. capucinus* from June to July, 2012. Object-use (pound, fulcrum, rub, hand pound, branch-shake, fur-rub, rub and brush, and ethnomedicinal consumption) was recorded with group scans using all occurrences sampling. Variation in results between juveniles and adults in fur-rubbing (24.3% for adults and 44% for juveniles) and branch-shake (22.9% for adults 19% for juveniles) behaviors may be due to the larger quantity of juveniles in the group compared to the quantity of adults, adults exercising object manipulation to influence and assist juvenile behavior in order to mimic and learn these acts, and provide group protection.

Cross-species comparisons of the retrosplenial cortex in primates: through time and neuropil space

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Chronesthesia, or mental time travel (MTT), is the ability to be conscious of both past experiences and possible future scenarios. Behavioral studies have demonstrated that some non-human animals are capable of episodic-like memory, yet there exists no convincing evidence of true MTT. The retrosplenial cortex (Brodmann's areas 29 and 30) plays a critical role in episodic memory, which is vital for MTT. Because MTT appears to be a uniquely human capacity, this region is of major interest for evolutionary studies. However, comparative neuroanatomical data for these regions are scarce. The goal of the present analysis was to compare neuropil space among capuchins, macaques, chimpanzees, and humans to determine if humans differ from the other species. The amount of neuropil space provides a proxy measure of connectivity because a large component of the neuropil is comprised of dendrites, synapses, and axons. Digital images were analyzed using ImageJ software to obtain a neuropil fraction. We discovered significantly higher neuropil fractions in humans relative to the other species examined. These results demonstrate a unique neuroanatomical reorganization of the human retrosplenial cortex, possibly supporting the hypothesis that complex mental time travel is an ability that is unique to humans.

Foraging preferences and substrate use in the absence of food availability pressures in three lemur (*Lemur catta*, *Eulemur mongoz*, and *Eulemur sanfordi*) species

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Foraging behaviors are complex and are contingent upon the environment in which the organism lives. In situations where the ecological pressure of food availability is removed, individuals have the option of foraging based on preference. At the Myakka City Lemur Reserve in Myakka City, Florida, lemurs are semi-captive, free ranging, and provisioned. However, between the multiple lemur species in the free-ranging forests, there is an expected diversity in foraging preferences in terms of food choice and substrate use. For this study, three species of lemurs were studied: ring-tailed lemurs (*Lemur catta*), mongoose lemurs (*Eulemur mongoz*), and Sanford's brown lemurs (*Eulemur sanfordi*). A focal animal scan sampling and all occurrences sampling was completed over the course of two months that measured activity budget, food item choice, and substrate use. Results indicate there is a relationship between the niches inhabited by the lemurs in terms of substrate use and food item choice.

Association between cognitive test performance and sexual state of zoo-living chimpanzees (*Pan troglodytes*) and gorillas (*Gorilla gorilla gorilla*)

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In primates, changes in sexual state carry behavioral and physiological implications that may also influence cognition. This interaction may be particularly important when interpreting performance results of small sample cognitive testing, but has been infrequently examined in a naturalistic social context. Zoo-living chimpanzee (N=4) and gorilla (N=4) subjects were tested on a computerized sequencing task. We analyzed task performance for each subject in relation to the sexual state of female groupmates, as determined by sexual tumescence (chimpanzees) and cyclical contraception schedules (gorillas). Chimpanzees exhibited a decrease in performance when the social group contained two or more maximally tumescent females ($F(1,6)=2.97$, $p=0.006$). Repeated measures analyses suggested no relationship between female performance and the female subject's own swelling size ($F(1,4)=0.31$, $p=0.61$). Gorillas exhibited no such performance sensitivity ($F(1,6)=0.45$, $p=0.27$). Chimpanzees' robust sensitivity to this factor may stem in part from a species-typical impulsivity and competitive mating ecology that especially taxes attentional and cognitive load during

periods of high receptivity compared to the hierarchical, female-driven mating strategy of the gorilla. Together, these preliminary results demonstrate the need to interpret the results of cognitive tests of great apes in the context of species-specific sensitivities to sexual state and sociosexual activity.

Electromyography of chimpanzee mastication: investigating muscle recruitment order.

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In recent decades, much has been revealed about the order of recruitment of primate jaw muscles during mastication. This study investigated patterns of muscle recruitment of both the balancing- and working-side muscles during mastication in *Pan troglodytes*. Video data of left- and right-side chewing of a variety of foods was taken from four individuals, and the corresponding electromyographic data of the firing of the superficial and deep masseter and the anterior and posterior temporalis muscles were collected. Results were compared to jaw-muscle recruitment order in Old World monkeys. EMG data were processed using a root-mean-square analysis with a time constant of 84 milliseconds. For each power stroke, for each muscle, we calculated the relative timing of peak activity and of 25%, 50%, 75% activity before and after the peak. This analysis indicates that, for both the superficial and the deep masseter muscles, peak firing of the balancing-side muscle precedes that of the working side. For the anterior temporalis, peak firing of the balancing side precedes that of the working side. The working- and balancing-side posterior temporalis muscles show no consistent firing pattern. These patterns are consistent with those of Old World monkeys for the superficial masseter, but differ for the deep masseter and posterior temporalis. Comparison with muscle recruitment order in humans is needed.