LABORATORY PRIMATE NEWSLETTER

Vol. 47, No. 1 January 2008

Published Quarterly by the Schrier Research Laboratory
Psychology Department, Brown University
Providence, Rhode Island
ISSN 0023-6861

POLICY STATEMENT

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

The *Newsletter* appears quarterly and is intended primarily for persons doing research with nonhuman primates. Back issues may be purchased for $10.00 each. We are no longer printing paper issues, except those we will send to subscribers who have paid in advance. We will not accept future subscriptions, unless subscribers are willing to pay $100/year. (Please make checks payable to the Brown University Psychology Department.) Readers with access to electronic mail may receive a notice when a new issue is put on the Website by sending the message **subscribe LPN-WARN your-own-name** to **listserv@listserv.brown.edu**. (Send the message **subscribe LPN-PDF** to receive PDF files by e-mail; or the message **subscribe LPN-L** to receive the nongraphic contents of each issue.) Current and back issues of the *Newsletter* are available on the World Wide Web at <http://www.brown.edu/primate>. Persons who have absolutely no access to the Web, or to the electronic mailing, may ask to have paper copies sent to them.

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

PREPARATION OF ARTICLES FOR THE *NEWSLETTER.* – Articles, notes, and announcements may be submitted by mail, e-mail, or computer disk, but a printed copy of manuscripts of any length or complexity should *also* be sent by regular mail.. Articles in the References section should be referred to in the text by author(s) and date of publication, e.g., Smith (1960) or (Smith & Jones, 1962). Names of journals should be spelled out completely in the References section. Latin names of primates should be indicated at least once in each note and article. In general, to avoid inconsistencies within the *Newsletter*, the Latin names used will be those in *Mammal Species of The World: A Taxonomic and Geographic Reference*, 2nd Ed. D. E. Wilson & D. M. Reeder (Eds.). Washington, DC: Smithsonian Institution Press, 1993. For an introduction to and review of primate nomenclature see the chapter by Maryeva Terry in A. M. Schrier (Ed.), *Behavioral Primatology: Advances in Research and Theory* (Vol. 1). Hillsdale, NJ: Lawrence Erlbaum Associates, 1977.

All correspondence concerning the *Newsletter* should be addressed to:
Judith E. Schrier, Psychology Department, Box 1853, Brown University
Providence, Rhode Island 02912 [401-863-2511; FAX: 401-863-1300]
e-mail address: **primate@brown.edu**

Current and back issues of the *Newsletter* are available on the World Wide Web at
`http://brown.edu/primate`

ACKNOWLEDGMENTS

The *Newsletter* is supported by Brown University

Cover photograph of a Douc Langur (*Pygathrix nemaeus*),
taken at the San Diego Zoo by Paul G. Wilde, June 1997

Nonhuman Primates Mask Signs of Pain

Roland Plesker[1] and Valentin Mayer[2]
[1]Paul-Ehrlich-Institut, Langen, Germany and [2] Medical doctor, Egelsbach, Germany

Introduction

It is known that wild animals have good reasons to mask signs of pain and illness in nature. First, they might be priority targets for predators if they show signs of pain or illness. Second, social-living individuals might lose their social rank if they do not appear to be perfectly fit.

When kept in captivity, the question of whether animals mask signs of pain is important for monitoring their health. Since there are no generally accepted objective criteria for assessing directly the degree of pain that an animal is experiencing (Morton & Griffith, 1985), indirect criteria must be used. For example, changes from the species-specific "normal" behavior can be used as an indication of pain (Smith et al., 2006; ILAR Committee on Pain and Distress in Laboratory Animals, 1992, p. 41).

It can be difficult to recognize pain in primates since they will often appear to show little reaction to it (Wolfensohn & Honess, 2005, p. 60). Also, experts know that conscious nonhuman primates frequently mask signs of pain (Fortman, et al., 2001, p. 115; ILAR Committee on Pain and Distress in Laboratory Animals, 1992, p.41). However, it is difficult to prove this scientifically, since animals cannot communicate in ways that can be readily understood by people (Hughes & Lang, 1983; Soma, 1987).

In this study, we try to compare primate behavior after detection of wounds or illnesses to imagined human behavior in "comparable situations". Moreover, we try to compare both behaviors to the "objective" severity of wounds or illnesses in an attempt to prove, scientifically, whether primates really mask signs of pain routinely.

Animals and Methods

Animals: The primate colony at the Paul-Ehrlich-Institut in Langen consists of 144 nonhuman primates (62 males, 82 females): 57 African green monkeys (*Chlorocebus aethiops* = 40%), 41 rhesus macaques *(Macaca mulatta* = 28%), 21 pig-tailed macaques *(Macaca nemestrina* = 15%) and 25 cynomolgus monkeys (*Macaca fascicularis* = 17%). They are group-housed in an experimental indoor facility.

There are 38 cages, made of steel; each is 300 cm x 125 cm x 225 cm. The animals are mostly housed in harem groups (1 male and 2-3 females with their offspring). Sometimes a group of this size is restricted to one cage (the only cage in a room); sometimes the group consists of more individuals and they have access to two or three of these cages, attached to each other in one room. Usually, different species of primates are kept in different rooms (but there are two exceptions).

Recording of behavior and wounds: When any signs of injuries/illnesses were detected in the monkey colony (blood in the cage, blood or wounds detected, strange behavior of individuals), experienced animal caretakers or veterinarians observed the particular monkey for at least five minutes to detect and describe its actual behavior accurately. The observed behavioral changes were scored according to the following criteria:

0 = no detectable behavioral changes; 1 = slight behavioral changes such as slow motion of one extremity, behavior otherwise normal; 2 = obvious behavioral changes, such as avoiding use of one arm or leg, slight depression; 3 = severe behavioral changes such as clear apathy or unconsciousness.

Afterwards, the monkeys were anesthetised (general ketamine-xylazine anesthesia) and the wounds or illnesses were described in detail by veterinarians. Photos of the injuries were usually taken. The injuries/illnesses were independently scored according to the following criteria:

1 = only skin affected in a single wound; 2 = muscles involved in a single wound or multiple wounds; 3 = significant loss of tissue or general body condition affected.

Imaginary comparison to humans: For comparison of the monkey behavior to imagined human behavior, an experienced medical doctor was consulted who had no access to the monkey behavior scores. Dr. Mayer was told the sex and age group (e.g., juvenile) of each "patient" and the sizes of the wounds were translated to human dimensions. Photos of the monkey wounds were used to give a better notion of the wounds in the imagined humans. The doctor was also told that the imagined patient could not speak to explain the pain. He was asked how human patients of similar (relative) age and size and of the same sex would behave if they came to him with those wounds or illnesses, and he answered on the basis of his experience with human patients. A five-minute "observation period" of the imaginary human behavior followed, during which the behavioral changes the doctor expected to find in each situation were scored as described above for the monkeys' behaviors.

Results

Monkeys: Fifty-eight cases of injuries/illnesses in nonhuman primates were reported in a six-month period. Of these, 54 cases were included in the study. Three cases

First author's address: Paul-Ehrlich-Institut, Abteilung 4 ZT, P.-Ehrlich-Str. 51-59, 63225 Langen, Germany [e-mail: *plero@pei.de*].

were excluded because a wound was detected on the end of the tail only; in one case the definite reason for illness-related behavioral changes could not be determined. In 29 of these 54 cases rhesus macaques were involved (54%); in 16 cases, African green monkeys (30%); in 5 cases, pig-tailed macaques (9%); and in 4 cases, cynomolgus monkeys (7%).

Of the 54 cases, 42 were wounds as a result of fighting within the group. Females (27 cases) were more often recipients of wounds than males (15). In 16 cases, more than one wound was detected in one individual. Furthermore, in 16 cases, lower-ranking individuals were affected by wounds, in 16 cases, middle-ranking individuals, and in 10 cases, high-ranking individuals. Some individuals were found with wounds more than once (seven rhesus with up to five wounds; two African green monkeys with up to seven).

Imagined comparison to humans: The score for the monkey behavior was clearly lower than the score for the imagined human behavior (0.7 to 2.19 mean scores). In none of the cases did a monkey score higher than the corresponding imaginary human, whereas in 45 cases the monkey scored lower.

Of the 10 wounds scored "3" (significant loss of tissue, or general body condition affected), 3 monkeys and 9 imagined humans behaved in "3" manner (general behavior involved), while 5 monkeys and 1 "human" showed "2" (clear to obvious localized behavioral changes), 1 monkey was a "1" (slight localized behavioral changes), and 1 monkey was a "0" (no detectable behavioral changes).

Of the 24 wounds scored "2" (muscles involved in a single wound or multiple wounds), 6 monkeys showed "2" behavior, 5 showed "1", and the other 13 were "0". The "human" responses were 7 "3s", 14 "2s", and 3 "1s".

All but one (who responded with "1") of the 20 monkeys who had "1" wounds (only skin affected in a single wound), showed "0" behavior, while one "human" was assumed to respond with "3" behavior, 15 with "2", and 4 with "1".

When the wound scores are compared to the monkey behavior scores, it is clear that the behavior scores are strikingly lower than the wound or illness score implies (1.81 to 0.7 mean scores). In 44 of 54 cases the score was lower for the monkeys.

In contrast, when the imagined human behavior is compared to the wounds or illnesses, the differences in the scores are not as pronounced (1.81 to 2.19 mean scores). In 50 % of the cases the imaginary humans behave as our wound or illness score implies (27 of 54 cases). In 23 cases the imagined human behavior score was higher than our wound score implied.

Discussion

When wild animals are kept in captivity, it is extremely important to care as well as possible for their health. The recognition of pain in captive individuals is one important element of health surveillance and the judgment of their well-being. Since pain cannot be directly scored in wild animals like primates, recognizing pain-related behavior is the most important instrument available for knowing when the animals are in pain. Therefore, the knowledge that monkeys indeed suppress pain-related behavior is important for anyone involved in the housing of primates.

The main problem in the evaluation of monkeys' pain behavior is the question of what can be used for reference. A comparison to human behavior seems to be advised for four reasons:

1) Humans normally can explain their pain in words so that it is easier for other humans to understand their feelings.
2) Medical doctors work with pain-related injuries/illnesses every day. They should therefore be better qualified than anyone else to anticipate sensations of pain in non-speaking patients.
3) Human pain behavior nowadays should not be influenced by predators any more.
4) Except in certain gangs of youngsters, the social status within a group should not influence the pain behavior of humans in the same way as in monkeys.

Since one cannot inflict the same wounds on humans to compare their behavior to that of monkeys, one has to imagine human behavior from a given wound, based on experience. This wound must be comparable to what was observed in a monkey before. Therefore, the data for the affected individual as well as the data about the wounds must be translated into a human situation: Age and sex of the patients, and size and severity of wounds must be adapted and considered in order to avoid bias-induced interpretation of imaginary human behavior.

The second problem in the evaluation of monkey pain behavior is the question of the standardization of both behavior and wounds and illnesses in order to avoid bias-induced miscalculation or misinterpretation. To avoid these problems,

1) a score system was set up prior to the calculation, and
2) the physician scoring the "humans" had no knowledge of the corresponding monkey scores.
3) In addition, nearly all cases within the colony were used, no matter how well they fitted into the study, to avoid the possible reproach that only well-fitting cases were used.

Nevertheless, serious potential causes of misinterpretation/miscalculation might include the following:

1) Marginal changes in the behavior of the monkeys might be overlooked, since observation of individuals in a group situation might sometimes be difficult.
2) When the monkeys' behavior was recorded the monkeys were aware that they were observed. This might lead to the masking of behavioral changes as long as the observer was present. (*Both of these points are emphasized by the fact that many monkeys showed no behavioral changes although wounds or illnesses were scored 2 or even 3.*)
3) Medical doctors are normally confronted with patients who can articulate their sensations in words. In this study, however, the verbal expression of pain in words was excluded and human behavior had to be imagined based on photos or descriptions of wounds. Within this process, wide variation is possible and cannot be excluded. It might be the case that the doctor's estimation of the human behavior score is strongly influenced by his own experiences.

We would also like to stress that in this study only one case was available where chronic pain might have occurred; all other cases were acute events.

The following should also be noted: although in the colony only 28% of the monkeys were rhesus macaques, they had 54% of the injuries. This is a reflection of both the relatively aggressive character of this species (de Waal, 1989, Ch. 3) and the time of case collection – in the spring, with its rising hormone levels.

Regarding the results of this study, one question might be whether humans are simply too sensitive to injuries and illnesses in comparison to wild-living monkeys. To answer this question, we determined the wound score (an effort to standardize the severity of wounds and illnesses) in order to compare it to the human reaction. The difference between these two parameters was not very high. Therefore, in the comparison humans:monkeys, humans are not "too sensitive" to wounds and illnesses, but the monkey behavior revealed much less change than the wounds implied. In other words: the monkeys mask signs of pain and illness.

In an experimental indoor primate facility the cage size is limited, whether the monkeys are group-housed or not. This eliminates to a large extent the ability of the primates to avoid contact in tense situations. The possibility of escaping from aggressors is also limited within a cage. This might be the reason for the relatively high numbers of wounds we observed.

The fact that almost 2/3 of the wounds were received by females cannot be explained easily. Perhaps males release their aggression more frequently towards females because they might not have to fear intense fighting responses. It might also be due to stress in the group more often being released to socially low-ranking individuals – which are usually females. This is supported by the fact that some low-ranking females received wounds more than once in this study. Fighting for rank within the group might more often lead to biting between females than males since biting between males (with their larger canines) might lead to more serious injuries.

It is no surprise that high-ranking individuals are less often wounded than middle- or low-ranking group members. High-ranking individuals might solve problems simply by their impressive and dominant appearance.

References

de Waal, F. B. M. (1989). *Peacemaking among primates.* Cambridge, MA: Harvard University Press.

Fortman, J., Hewett, T. A., & Bennett, B. T. (2001). *The laboratory nonhuman primate*. New York: CRC Press.

Hughes, H. C., & Lang, C. M. (1983). Control of pain in dogs and cats. In: R. L. Kitchell & H. H. Erickson (Eds.), *Animal pain: Perception and alleviation*. (pp. 207-216). Bethesda, MD: American Physiological Society.

ILAR Committee on Pain and Distress in Laboratory Animals (1992). *Recognition and alleviation of pain and distress in laboratory animals*. Washington, DC: National Academies Press.

Morton, D. B., & Giffiths, P. H. M. (1985). Guidelines on the recognition of pain, distress and discomfort in experimental animals and an hypothesis for assessment. *Veterinary Record*, *116*, 431-436.

Smith, J. J., Hadzic, V., Li, X., Liu, P., Day, T., Utter, A., Kim, B., Washington, I. M., & Basso, M. A. (2006). Objective measures of health and well-being in laboratory rhesus monkeys (*Macaca mulatta*). *Journal of Medical Primatology, 35*, 388-396.

Soma, L. R. (1987). Assessment of pain in experimental animals. *Laboratory Animal Science, 37*, 71-74.

Wolfensohn, S., & Honess, P. (2005). *Handbook of primate husbandry and welfare*. Oxford: Blackwell.

* * *

A Comparison of Play Behavior in Infant and Juvenile Ring-Tailed Lemurs (*Lemur catta*)

Lucy M. Todd

Introduction

Extensive and varied social and non-social play is found in all primate species ranging from solitary nocturnal prosimians to the great apes. Nevertheless, for most primate species, detailed studies of play are either absent or limited to a single age class (Fagen, 2002). This report examines differences in infant (less than 6 months old) and juvenile (not yet sexually mature) play behavior in a large group of semi-free-ranging ring-tailed lemurs (*Lemur catta*) at the Edinburgh Zoo.

In a classic recent chapter, Fagen (2002) defines play as "improvised performance, with variations, of skilled motor and communicative actions in a context separate from the environment in which behavior including these actions proximately increases reproductive success" (p. 182). Play with peers is one of the first non-mother-directed activities to appear early in life and is a voluntary activity. Since so many animals appear to spend a lot of time and energy at play while young, it is important to consider the possible functions of play.

Play behavior may serve as a mechanism for social development; for establishing the dominance hierarchy; and as an experimental arena for learning communication skills. Although basic postures, gestures, and vocalizations may be predominantly innate, their effectiveness in social interactions is dependent on experience. Social play facilitates social integration. Play may be a means of reiterating stimulus exchange whereby social animals maintain familiarity with one another. Regular playmates may form habitual bonds that persist beyond infancy. Perhaps play between adults is rare because their social relationships are already well established, or because they are reinforced by processes other than play, such as grooming (Smith, 1978).

Little information exists about the process of social development in the more precocial primate species. In contrast to monkeys and apes, prosimians such as *Lemur catta* reach sexual maturity relatively quickly. Consequently, they have less time as infants and juveniles to learn the skills needed to function as adults within their social groups, which are among the largest in prosimians. Although there have been a few studies on early infancy and mother-infant relations in *L. catta* (Gould, 1990, 1997; Jolly, 1966; Klopfer & Boskoff, 1979; Pereira & Izard, 1989), as yet there has been little research as to what extent social and non-social play differ between infants and juveniles. Such comparisons are therefore made in this investigation. This report apparently provides some of the first information on infant and juvenile play in this species.

In addition to this general rationale, several specific predictions are tested. First, studies of many primate species have shown that infants tend to choose playmates of a similar age to themselves: squirrel monkeys, *Saimiri sciureus* (Baldwin, 1969); olive baboons, *Papio anubis* (Owens, 1975); yellow baboons, *Papio cynocephalus* (Cheney, 1978); crab-eating macaques, *Macaca fascicularis* (Fady, 1969); rhesus monkeys, *Macaca mulatta* (Tartabini, 1991); Japanese macaques, *Macaca fuscata* (Imakawa, 1990); and vervet monkeys, *Cercopithecus aethiops* (Fairbanks, 2002; -Govindarajulu et al., 1993). Therefore the first prediction tested was that infants would play more with other infants while juveniles would play more with other juveniles.

Adults engage in play with infants and juveniles in a number of diverse prosimian species, such as *Propithecus verreauxi* (Grieser, 1992); *P. candidus* (Patel, 2006, in press); *Varecia variegata* (Morland, 1990); *V. rubra* (Vasey, 2007); *Loris l. lydekkerianus* (Nekaris, 2003); *Nycticebus bengalensis* and *N. pygmaeus* (Fitch-Synyder & Ehrlich, 2003); *Tarsius spectrum* (Gursky, 2000); and *Cheirogaleus medius* (Fietz & Dausmann, 2003). In ring-tailed lemurs, Gould (1992) found that adults of both sexes only occasionally played with infants, far less so than young, pre-reproductive group members do. As all adults in the present study were of reproductive age, the second prediction tested was that adults would only occasionally engage in play with infants.

Method

The subjects were a group of ring-tailed lemurs living in captivity at Edinburgh Zoo. The enclosure was comprised of an outdoor grassy field with trees, logs and ropes for the lemurs to climb, and a smaller indoor enclosure (with viewing window) which the lemurs had access to at all times, and in which they were locked at night.

Author's address: 5 Lower Broomieknowe, Lasswade, Midlothian, EH18 1LW, Scotland, U.K. [e-mail: *l.m.todd@hotmail.co.ukv*].

I would like to thank the Royal Zoological Society of Scotland, and specifically Charlotte MacDonald, Research Coordinator at Edinburgh Zoo, for facilitating this research. I would also like to thank Dr. Jolene Galbreath for advice on the statistical analysis of my results. Finally, I'd like to thank Professor Paul Racey and Erik R. Patel for their guidance throughout this project, for their critical reading of earlier drafts, and for the useful comments they made.

This paper is a much abbreviated version of my honors thesis for my BSc degree in Zoology from Aberdeen University, Scotland.

The group comprised 1 adult male, 6 adult females, 5 juveniles and 6 infants. At the start of the study the infants were aged 12-19 weeks old, while the juveniles in the group were all aged around 15 months old. The juveniles were about three times as large as the infants, so there was no possibility of confusing infants and juveniles. The adults all wore collars with colored tags, so were easy to distinguish from the juveniles.

Between July 22 and September 6, 2005, the behavior of a single juvenile or infant was recorded instantaneously every 5 seconds for 10 minutes. Recording took place when the lemurs were at their most active: typically between 10:30 and 12:30, and between 14:00 and 16:00. Unfortunately, the many infants were not marked with dye or outfitted with identity collars. I attempted to identify the infant lemurs individually by natural markings but few reliable natural markings distinguished each infant. As Edinburgh Zoo does not tag the lemurs until they are fully grown, this made it extremely difficult to know which individual was being observed at any one time. However, I was careful to never immediately resample the same individual. Since the lemurs only mate "in season", the infants are all about a year younger than the juveniles, so there is no problem knowing which is in which category.

Recorded Behaviors

Non-social play	*Climb* – moving in the trees, bushes or on the ropes without engaging in feeding or interacting with other individuals
Social play	*Wrestle I* – an individual grapples and rolls about with an infant, while attempting to mock-bite or cuff the infant
	Wrestle J – an individual grapples and rolls about with a juvenile, while attempting to mock-bite or cuff the juvenile
	Chase I – an individual leaps at an infant, and the infant flees
	Chase J - an individual leaps at juvenile, and the juvenile flees
Non-play	*All fours* – terrestrial locomotion, without the individual chasing or being chased
	Rest – sitting still, either alone or in a huddle
	Feed – eating by grasping food with either hands or mouth
	Groom – the focal animal uses its tooth-comb on its own body
	Mutual groom – two individuals groom one another

Results

Forty hours of behavioral data were collected from July to September of 2005.

I. Duration: Mean durations of all recorded behaviors for infants and juveniles are displayed in *Figure 1*.

Ia. Duration of play: Infants spent a significantly greater amount of time climbing than juveniles (Mann-Whitney test: $W = 17408.0$, $n = 240$, $p < 0.0001$). Infants spent a significantly greater amount of time wrestling than juveniles (M-W test: $W = 17017.0$, $n = 240$, $p < 0.0001$). Of the total time infants spent wrestling, they spent 90.8 % of their time engaged with other infants, and only 9.20 % of their time engaged with juveniles (M-W test: $W = 17982.0$, $n = 240$, $p < 0.0001$). Juveniles spent a slightly, but not significantly, greater amount of time engaged in wrestling with other juveniles than with infants (M-W test: $W = 13985.0$, $n = 240$, $p > 0.05$). Infants spent a significantly greater amount of time chasing than juveniles (M-W test: $W = 15635.0$, $n = 240$, $p < 0.05$). Of the total time infants spent chasing, they spent 88.7 % of their time engaged with other infants, and only 11.3 % of their time engaged with juveniles (M-W test: $W = 16888.5$, $n = 240$, $p < 0.0001$). Of the total time juveniles spent chasing, they spent 73.4 % engaged with other juveniles, and only 26.6 % of their time engaged with infants, but the difference was not significant (M-W test: $W = 14078.0$, $n = 240$, $p > 0.05$. See *Figure 1*).

Wrestling accounted for 82.2 % of social play in infants, while chasing accounted for 17.8 % of social play. In juveniles, wrestling and chasing accounted for 69.3 % and 31.7 % of social play, respectively.

Ib. Duration of other behaviors: Juveniles spent a significantly greater amount of time feeding than infants (M-W test: $W = 12622.5$, $n = 240$, $p < 0.001$). Juveniles also spent a significantly greater amount of time resting than infants (M-W test: $W = 11441.0$, $n = 240$, $p < 0.0001$). Juveniles spent a significantly greater amount of time self-grooming than infants (M-W test: $W = 12548.0$, $n = 240$, $p < 0.001$), and mutual grooming (M-W test: $W = 12914.0$, $n = 240$, $p < 0.001$). There was no significant difference in the amount of time infants and juveniles spent on all fours (M-W test: $W = 14266.0$, $n = 240$, $p > 0.05$. See *Figure 1*).

II. Frequency: Mean frequencies of each play behavior for infants and juveniles are displayed in *Figure 2*.

IIa. Frequency of play: The frequency of climbing bouts was significantly higher in infants than in juveniles (M-W test: $W = 17449.5$, $n = 240$, $p < 0.0001$). The frequency of wrestling bouts was significantly higher in infants than in juveniles (M-W test: $W = 16831.0$, $n = 240$, $p < 0.0001$). Infants engaged with other infants in 85.6% of their wrestling bouts, and engaged with juveniles in only 14.4% of wrestling bouts (M-W test: $W = 17840.5$, $n = 240$, $p < 0.0001$). Juveniles engaged in wrestling bouts slightly, but not significantly, more often with other juveniles than with infants (M-W test: $W = 14028.0$, $n = 240$, $p > 0.05$). The frequency of chasing bouts was also significantly higher in infants than in juveniles (M-W test: $W = 15642.0$, $n = 240$, $p < 0.05$). Infants engaged with other

infants in 85.8% of chasing bouts, and engaged with juveniles in only 14.2% of chasing bouts (M-W test: W = 16881.5, n = 240, $p < 0.0001$). Juveniles engaged with other juveniles in 67.7% of chasing bouts, and engaged with infants in only 32.3% of chasing bouts but the difference was not significant (M-W test: W = 14146.5, n = 240, $p > 0.05$. See *Figure 2*).

IIb. Frequency of grooming: Juveniles groomed themselves significantly more frequently than infants groomed themselves (M-W test: W = 12498.5, n = 240, $p < 0.0001$). Juveniles also engaged in mutual grooming significantly more frequently than did infants (M-W test: W =13066.0, n = 240, $p < 0.001$).

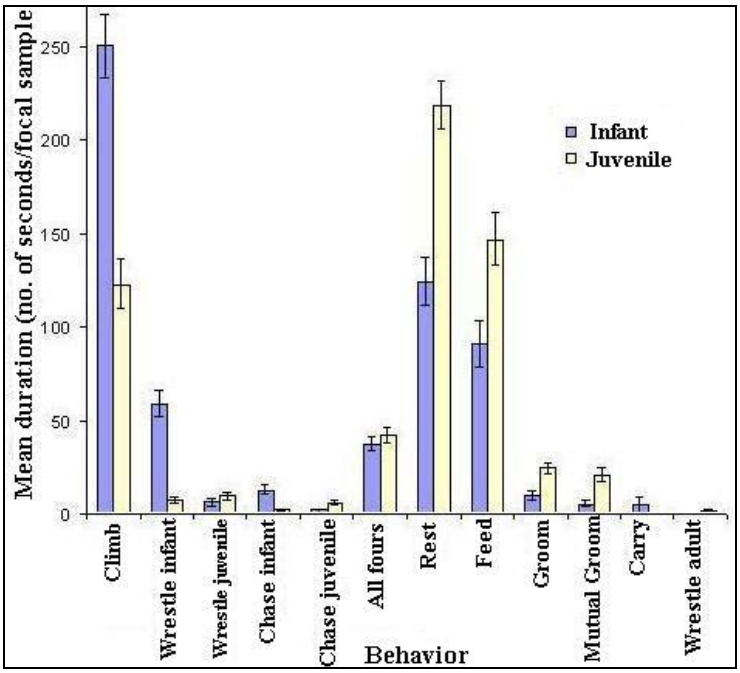

Figure. 1: Mean durations of recorded behaviors per 10-minute focal sample, ± standard errors.

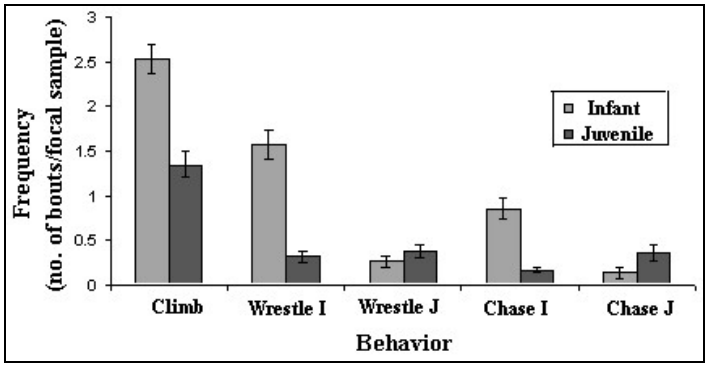

Figure 2: Mean frequencies of play behaviors per 10-minute focal sample, ± standard errors.

Discussion

The data clearly support the prediction that infants would play more with other infants, and juveniles more with other juveniles. This is consistent with studies of other primates, as described earlier. It has been suggested that when animals choose partners of approximately equal weight and strength, play is less likely to break down, because both partners have the chance to direct or dominate the playful interaction, giving animals the maximum opportunity to practice skills of combat (Owens, 1975). Young infants are cautious and attentive when first touching each other, often making approach-withdrawal movements with the hands, and their initial interactions are brief. After several such interactions, the number of withdrawal movements decreases. Eventually, full body contact and gentle wrestling take place. As players become physically stronger and escalate to more intense play, biting can occasionally lead to sharp nips, rough wrestling can lead to hard knocks, and rapid chases can lead to falls. As play begins to include these aversive experiences, the frequency of avoidance, withdrawal, and distance maintenance gradually increases (Baldwin & Baldwin, 1977). This may explain why non-contact play (e.g., chasing) accounted for a greater proportion of play in juvenile lemurs than it did in infants. Older juveniles begin to assert their developing rank in play, monopolizing opportunities to perform in particular roles or to make particular moves. As a result, partners are difficult to attract and play encounters difficult to maintain (Fagen, 2002).

The data also support the second prediction that adult ring-tailed lemurs rarely engage in play with infants or juveniles. Although both mothers and other adults within the group frequently engaged in other forms of infant care such as nursing, grooming and carrying, during 40 hours of observation there was only one incident of an adult playing with a non-adult (specifically, wrestling with a juvenile). As *L. catta* live in groups of 5-30 (average 17) individuals, and are highly seasonal breeders (Mittermeier et al., 2006), infants of this species will usually have access to playmates of the same age. Infant or juvenile play with adults may be less of survival requirement than other forms of allocare.

In addition to showing the distinct preferences of individuals for playmates of the same age, this study demonstrated that infant ring-tailed lemurs participated in play more often and for longer periods than juveniles. This is consistent with data for other primate species: rhesus monkeys, *Macaca mulatta* (Hinde & Spencer-Booth, 1967); Japanese macaques, *Macaca fuscata* (Imakawa, 1990); Hamadryas baboons, *Papio hamadryas* (Leresche, 1976); and howling monkeys, *Alouatta palliata* (Zucker & Clarke, 1992). The age distribution of play provides an essential clue about its true biological effects. Three as-

pects of play are common to most species: play does not occur immediately after birth; when play does appear, its rate of expression rapidly rises to a peak; and thirdly, this peak is brief, compared to the life span of the species. The rate of play falls quickly to zero, or nearly zero in adulthood. This trend holds true for total play, social play, and non-social play (Byers, 1998). A given amount of play at one age may have a greater effect on subsequent survivorship or reproduction than a given amount of play at another age. If all other factors are equal, play should occur most frequently at the age when it is most effective. Knowledge of age-specific play schedules, combined with use of a simple fitness model, may help determine the ultimate causes of a developmental decline in play (Fagen, 2002). Perhaps the tight age distribution of play occurs because play represents a sensitive period during which the performance of certain motor patterns can alter development (Byers, 1998).

The finding that juvenile ring-tailed lemurs spend significantly more time grooming than infants is consistent with studies of rhesus monkeys (Hinde & Spencer-Booth, 1967) and baboons (Young et al., 1982). It has been suggested that the function of mutual grooming is to establish and reinforce social bonds, to initiate social acceptance, and to maintain tolerance between individuals. It occurs most frequently in those species in which dominance relationships play a prominent part in group organization (Doyle, 1974). In large groups of ring-tailed lemurs, females target particular peers for attack and social eviction, and adolescent females are also common targets (Pereira, 2002). Mutual grooming may be an important mechanism by which juvenile females can alleviate tension. The most common response to the initiation of grooming is the adoption by the recipient of postures that invite further grooming. It therefore diverts the groomee to behavior incompatible with agonistic behavior, while simultaneously helping to establish a bond between groomer and groomee. This may explain why juveniles spend more time grooming than infants, as juveniles are more likely to be targets of aggression.

This study did not examine sex differences in duration or frequency of play. However Gould (1990) did not find significant differences in frequency of either social or solitary locomotor play between male and female ring-tailed lemurs. This differs from many studies of anthropoid primate infants in which male infants engage in significantly more wrestling than female infants (Meaney et al., 1983). Gould (1990) suggests that the lack of sex differences in the amount of social play in infant *L. catta* may be attributed to female dominance in this species. Adult females engage in territorial defense, which involves physical battles, and adult males engage in physical fights during the mating season (Jolly, 1966). If play is viewed as an opportunity for young animals to acquire, practice and perfect skills which will be useful in adulthood in both social and agonistic encounters, then both male and female *L. catta* must develop such skills.

Further research may reveal variation in the frequency and duration of different play types between individuals of the same age class. This could provide insight into the development of a dominance hierarchy within the peer group. This study was constrained by a time-scale of six weeks, which is hardly adequate to investigate the developmental behavior of a species that has been known to live for over thirty years in captivity. More robust longitudinal data are required on age changes in lemur behavior, and the conditions under which they occur, in order to understand typical life-history patterns in lemur behavior.

References

Baldwin, J. D. (1969). The ontogeny of social behavior of squirrel monkeys (*Saimiri sciureus*) in a semi-natural environment. *Folia Primatologica*, *14*, 23-50.

Baldwin, J. D., & Baldwin, J. I. (1977). The role of learning phenomena in the ontogeny of exploration and play. In S. Chevalier-Skolnikoff & F. E. Poirier (Eds.), *Primate biosocial development*. New York: Garland.

Byers, J. A. (1998). Biological effects of locomotor play: Getting into shape, or something more specific? In M. Bekoff & J. A. Byers (Eds.), *Animal play*. Cambridge University Press.

Cheney, D. L. (1978). The play partners of immature baboons. *Animal Behaviour*, *26*, 389-408.

Doyle, G. A. (1974). Behavior of prosimians. In A. M. Schrier & F. Stollnitz (Eds.), *Behavior of Nonhuman Primates*: *Modern Research Trends. Vol. 5*. (pp. 155-353). New York: Academic Press.

Fady, J. C. (1969). Les jeux sociaux: Le compagnon de jeux chez les jeunes. Observations chez *Macaca iris*. *Folia Primatologica, 11*, 134-143.

Fagen, R. (2002). Primate juveniles and primate play. In M. E. Pereira & L. A. Fairbanks (Eds.), *Juvenile primates.* University of Chicago Press.

Fairbanks, L. A. (2002). Juvenile vervet monkeys: Establishing relationships and practicing skills for the future. In M. E. Pereira & L. A. Fairbanks (Eds.), *Juvenile primates.* University of Chicago Press.

Fietz, J., & Dausmann, K. H. (2003). Costs and potential benefits of parental care in the nocturnal fat-tailed dwarf lemur *(Cheirogaleus medius). Folia Primatologica*, *74*, 246-258.

Fitch-Synyder, H., & Ehrlich, A. (2003). Mother-infant interactions in slow lorises and pygmy lorises. *Folia Primatologica*, *74*, 259-271.

Gould, L. (1990). The social development of free-ranging infant *Lemur catta* at Berenty Reserve, Madagascar. *International Journal of Primatology*, *11*, 297-318.

Gould, L. (1992). Alloparental care in free-ranging *Lemur catta* at Berenty Reserve, Madagascar. *Folia Primatologica*, *58*, 72-83.

Govindarajulu, P., Hunte, W., Vermeer, L. A., & Horrocks, J. A. (1993). The ontogeny of social play in a feral troop of vervet monkeys (*Cercopithecus aethiops sabaeus*): The function of early play. *International Journal of Primatology*, *14*, 701-719.

Grieser, B. (1992). Infant development and parental care in two species of sifakas. *Primates*, *33*, 305-316.

Gursky, S. (2000). Allocare in a nocturnal primate: Data on the spectral tarsier, *Tarsius spectrum*. *Folia Primatologica*, *71*, 39-54.

Hinde, R. A., & Spencer-Booth, Y. (1967). The behavior of socially living rhesus monkeys in their first two and a half years. *Animal Behaviour*, *15*, 269-296.

Imakawa, S. (1990). Playmate relationships of immature free-ranging Japanese monkeys at Katsuyama. *Primates*, *31*, 509-521.

Jolly, A. (1966). *Lemur Behavior*. University of Chicago Press.

Klopfer, P. H., & Boskoff, K. J. (1979). Maternal behaviour in prosimians. In G. A. Doyle & R. D. Martin (Eds.), *The Study of Prosimian Behavior*. New York: Academic Press.

Meaney, M. J., Stewart, J., & Beatty, W. W. (1983). Sex differences in social play – The socialization of sex roles. *Advances in the Study of Behavior*, *15*, 1-58.

Mittermeier, R. A., Konstant, W. R., Hawkins, F., Louis, E. E.. Langrand, O., Ratsimbazafy, J., Rasoloarison, R., Ganzhorn, J. U., Rajaobelina, S., Tattersall, I., & Meyers, D. M. (2006). *Lemurs of Madagascar*. 2nd edition. Tropical Field Guide Series. Washington, DC: Conservation International.

Morland, H. S. (1990). Parental behavior and infant development in ruffed lemurs (*Varecia variegata*) in a northeast Madagascar rainforest. *American Journal of Primatology, 20*, 253-265.

Owens, N. W. (1975). Social play in free-living baboons, *Papio anubis*. *Animal Behaviour*, *23*, 387-408.

Patel, E. R. (2006). Activity budget, ranging, and group size in silky sifakas. *Lemur News*, *11*, 42-45.

Patel, E. R. (in press). Non-maternal infant care in wild silky sifakas (*Propithecus candidus*). *Lemur News*.

Pereira, M. E. (2002). Agonistic interactions, dominance relations and ontogenetic trajectories in ring-tailed lemurs. In M. E. Pereira & L. A. Fairbanks (Eds.), *Juvenile primates.* University of Chicago Press.

Pereira, M. E., & Izard, M. K. (1989). Lactation and care for unrelated infants in forest-living ring-tailed lemurs. *American Journal of Primatology, 13*, 129-144.

Smith, E. O. (1978). *Social play in primates*. New York: Academic Press.

Tartabini, A. (1991). Social play behavior in young rhesus monkeys *Macaca mulatta* at three different ages: From the 3rd to the 6th month of life. *Behavioural Processes*, *24*, 185-192.

Vasey, N. (2007). The breeding system of wild red ruffed lemurs (*Varecia rubra*): A preliminary report. *Primates, 48*, 41-54.

Young, G. H., Coelho, A. M., & Bramblett, C. A. (1982). The development of grooming, sociosexual behavior, play and aggression in captive baboons in their first two years. *Primates*, *23*, 511-519.

Zucker, E. L., & Clarke, M. R. (1992). Developmental and comparative aspects of social play of mantled howling monkeys in Costa Rica. *Behaviour*, *123*, 144-167.

* * *

Information Requested or Available

Update for Gorilla Haven Website

"The Dewars are gradually overhauling their entire Website, at <www.gorilla-haven.org>, which has become HUGE, but for now, this update will let you all know what's going on ... We're trying a new format on this update, so let us know what you think. Thanks!" – Jane Dewar <*jdewar@gorilla-haven.org*>

More Interesting Websites

- Animal Behavior Management Alliance: <www.theabma.org/home.asp>
- Foundation for Biomedical Research's education resources: <www.fbresearch.org/Education>
- Global Biodiversity Information Facility (GBIF): <www.gbif.org>
- A gorilla keeper visits Gorilla Haven: <marilynsbigadventure.blogspot.com>

* * *

Use of a Mirror as a Data Collection Aid

Mary E. Baker
Rhode Island College

One of the problems encountered when studying non-human primates is the disruption of intimate social behaviors as a result of focused visual attention by the researcher. Behaviors such as grooming, some forms of play, body part sucking (e.g., Perry et al. 2003a; 2003b), extended feeding, and infant care require focused attention on the social partner or object. When individuals become aware that they are being watched they may experience a heightened sense of vulnerability. This is particularly problematic in partially or poorly habituated groups and shy individuals: staring is a threat to primates and intense visual orientation by an observer can cause them to stop socializing or move into dense vegetation, or cause aggressive displays directed towards the observer. Such unintended interference by a researcher has negative and frustrating consequences: not only are the research subjects unable to engage in social behaviors, but data on these behaviors is also lost or compromised.

The white-faced capuchin monkeys (*Cebus capucinus*) that I study in Costa Rica engage in oral grooming solicitation and finger sucking. In this behavior the solicitor places a piece of bark, leaf or fruit in her mouth and sits with her lips slightly parted. The interacting subject then attempts to remove the object from the solicitor's mouth. This type of grooming involves nuzzling and mouth-to-mouth contact which sometimes looks like kissing. Groomers may try to pry the solicitor's mouth open to extract the object in the mouth. It always requires the groomer placing her fingers in the groomee's mouth for prolonged periods of time. The solicitor may take hold of the groomer's hand with the object and replace both object and fingers back into her mouth. Often, when the interacting subject removes the object, the solicitor will gently take the object away from the groomer and replace it in her own mouth, thus soliciting the entire sequence again. The monkeys sit, holding hands with the groomer's fingers inserted in the groomee's mouth, for a few seconds to more than 30 minutes, during which both individuals avoid eye contact and stare off into space in a dazed manner, unlike that seen in any other type of behavior.

This interesting and strange behavior is not very common; it could happen several times a month, or only once in several weeks. I wanted to get as much data as possible. However, frequently, when the monkeys became aware that I was closely watching them, they would stop and one or both would move away from me, and they tended not to resume the behavior once they had relocated.

I tried to increase the distance between myself and the monkeys, but this often made it hard to see, and continued to be disruptive for particularly shy individuals. I tried averting my eyes, glancing periodically at the monkeys or turning my body sideways, but none of this seemed to help.

I also tried watching them through my video camera, but found that they were sensitive to the camera presence as well. If the camera was focused at them and my body was oriented behind it, looking into the viewfinder – not visual attention, but body orientation, toward them – they did move away. I tried moving my body sideways, looking into the viewfinder from the side, or watching through the flip screen, but they seemed to understand that I was still watching them.

Additional problems with using a camera in the field are the extra bulk and weight to carry, having access to electricity to recharge the batteries, and, when moving through dense vegetation, uneven terrain, or down the middle of a river, difficulty setting up the camera and/or viewing the monkeys.

It occurred to me that I needed a way to watch the monkeys without their knowledge. In the field I carry a Suunto compass, which has a mirror for estimating slope. I sat on the ground, opened the compass, and, while holding the compass in my lap, angled the mirror towards the monkeys. From the monkeys' perspective I was sitting down, intently focused on the object in my lap. Not only could I watch the monkeys for long periods of time, but I also found I could move very close to them, sometimes to within 2 m, without disrupting their behavior.

I now carry a small compact mirror in my backpack and continue to use it to watch the monkeys. This has allowed me to collect data on complete bouts of sensitive, vulnerable behaviors. The capuchins have never shown any interest in my mirror, perhaps because they have never gotten close enough to see their reflection. Monkeys and prosimians do not demonstrate recognition of their own reflection, so this observational strategy should work well for them. The great apes do, however, demonstrate self-recognition, so using a mirror may not work as well with them (Gallup, 1977).

Author's address: Dept of Anthropology, Rhode Island College, 600 Mt. Pleasant Ave., Providence, RI 02908 [e-mail: *mbaker@ric.edu*].

References

Gallup, G. G., Jr. (1977). Absence of self-recognition in a monkey (*Macaca fascicularis*) following prolonged exposure to a mirror. *Developmental Psychobiology,10,* 281-284.

Perry, S., Baker, M., Fedigan, L., Gros-Louis, J., Jack, K., MacKinnon, K. C., Manson, J. H., Panger, M., Pyle, K., & Rose, L. (2003a). Social conventions in wild white-faced capuchin monkeys: Evidence for traditions in a neotropical primate. *Current Anthropology, 44,* 241-268.

Perry, S., Panger, M., Rose, L. M., Baker, M., Gros-Louis, J., Jack, K., Mackinnon, K. C., Manson, J., Fedigan, L., & Pyle, K. (2003b). Traditions in wild white-faced capuchin monkeys. In D. M. Fragaszy & S. Perry (Eds.), *The Biology of traditions: Models and evidence* (pp. 391-425). New York: Cambridge University Press.

* * *

Meeting Announcements

The Centers for Disease Control will hold the **10th International Symposium on Biosafety**: "Protecting Workers in Clinical Laboratories, Research, Animal Care, and Public Health Communities", February 9-13, 2008, at the Omni Hotel at CNN Center, in Atlanta, Georgia. There will be sessions on Risk Assessment and Management; Worker Protection; Preparedness; Animal Issues; Clinical Issues; Industrial Hygiene/Biosafety Issues; and Facility Design and Equipment. For more information go to <www.eagleson.org/cdc> or call 207-490-1076.

On February 14-15, 2008, the Massachusetts Society for Medical Research (MSMR) and the Southwest Association for Education in Biomedical Research (SwAEBR) will partner to present a novel two-day **IACUC, Institutional Review Board (IRB), and Institutional Biosafety Committee (IBC) conference**. The conference goals are to encourage open dialogue on areas of common ground among these three vital institutional oversight committees. The **Three I's Conference** platform is designed to help research organizations confront tough issues and develop new approaches to enhancing the entire research process through interdisciplinary cooperation and collaboration. The conference serves as a platform for the improvement of communication and understanding via the sharing of viewpoints, ideas and information. See <www.swaebr.org/MSMR_SwAEBR_Conference/2008_MSMR_SWAEBR_Conference.pdf> for complete information.

The conference **Behaviour and Individuality in Primates and other Mammals** will be held at Lusófona University, Lisbon, March 17-18, 2008, as part of the celebrations of the 6th anniversary of BioCEL – the Association of Biology Students at Lusófona University. The conference, organized by BioCEL and by faculty of the Biology Group, is intended for both students and professionals. For more information see <behavior-individuality.blogspot.com>, or e-mail <*behav.individuality@ulusofona.pt*>.

The **Third International Conference on Primate Genomics: "Primate Genomics & Human Diseases"** will be held in Seattle, Washington, April 13-16, 2008. "The goal of this conference is to provide a scientific forum at which investigators in the fields of nonhuman primate research, genomics, proteomics, and bioinformatics can discuss new research findings and technological innovations related to the use of genome-based science in nonhuman primate research." For all details, see <www.seattleprimategenomics.com>.

The **35th Annual American Association of Zoo Keepers National Conference** will be held September 24-28, 2008, in Salt Lake City, Utah. The guiding theme, "Elevating Animal Care", will focus on concepts that highlight professionalism, creativity, and initiative in the realm of conservation, education, and animal husbandry. Animal care professionals from all related fields are encouraged to submit high quality, original topics for consideration. Abstracts are being accepted for papers, posters, and workshops until May 1. For more information, see <www.utahaazk.org>, or contact the Utah Chapter of AAZK [801-584-1784 [e-mail: *utahaazk@hoglezoo.org*].

The **9th International Conference on Environmental Enrichment** will be held May 31 to June 5, 2009, in Torquay, Devon, U.K., hosted by Paignton Zoo Environmental Park. For details on the conference, see <www.reec.info>. For information about sponsorship of the event or having a trade stall, contact Julian Chapman [e-mail: *julian.chapman@paigntonzoo.org.uk*>.

* * *

Educational Opportunities

***Introduction to Animal Behavior* – Online**

Clara Jones, of Fayetteville State University, North Carolina (FSU), will be teaching her course, *Introduction to Animal Behavior* (PSYC 443-D1), online again next semester. This is a 3-credit, upper-level undergraduate course including a field component and a "species profile" assignment. The course is appropriate for college students, preprofessionals, nonprofessionals, and others (e.g., veterinary or zoo technicians). Second semester extends from Wednesday, January 9, to Friday, May 2, 2008. Registration for Spring and Summer semesters began November 12, 2007. Prospective students must register at <www.uncfsu.edu/admissions/index.htm> for a *pro forma* admission to FSU for a $25.00 fee. The last day of regular registration is January 8, 2008, and late registration begins on January 9 with an additional $20.00 fee. Blackboard (see <www.blackboard.com/us/index.Bb>) is the portal for online classes at FSU, and Blackboard does not interface with aol.com. All documents to the university from foreign students must be in English. For additional information, including copies of the course syllabus and schedule, students can contact Dr. Jones [e-mail: *cbjones@uncfsu.edu*].

Primate Medicine and Surgery Training Program

The Division of Primate Medicine at the New England Primate Research Center (NEPRC) of Harvard Medical School has an opening for residents in its two-year primate medicine and surgery training program. The aims of this clinical training program are to provide highly motivated veterinarians with the specialized experience required for successful careers as primate clinicians. This program emphasizes training in colony management, diagnosis and treatment of disease, and implementation of experimental protocols utilizing nonhuman primates (NHPs) as models of human disease. Residents will have a unique opportunity to receive training in biosafety and biocontainment principles. The program will additionally provide opportunities for involvement in clinical research addressing the medical and husbandry needs of NHPs maintained in research settings. To accomplish these goals, the program consists of didactic, case-based, and experience-driven learning. In addition, exposure to a wide range of laboratory animal species will be provided via collaboration with the Medical School. Upon completion of the program it is anticipated that the residents will be eligible for American College of Laboratory Animal Medicine certification.

The NEPRC has extensive experience with clinical training of veterinarians and has an outstanding animal care program. The clinical program is managed by a group of five veterinarians with over 40 years of combined experience in primate veterinary medicine. The NEPRC houses a diverse collection of nonhuman primates representing both New and Old World species. This vivarium includes breeding colonies of rhesus macaques, common marmosets, and cotton-topped tamarins. Clinical work is performed in a newly constructed veterinary clinic with state-of-the-art surgical suites, advanced imaging modalities (ultrasonography, video endoscopy and laparoscopy, EchoMRI, and DEXA), a custom-designed medical records database, and in-house pathology services. The NEPRC also implements a comprehensive NHP psychological well-being plan under the direction of an experienced behaviorist.

The NEPRC has a vigorous research program that encompasses the research objectives directed at biodefense, drug addiction, transplantation biology, behavior, reproductive biology, neurodegenerative diseases, stem cell therapeutics, and aging. While the Center maintains this diverse research portfolio, a continued strength has been its commitment to infectious disease research and emphasis on AIDS-related primate-model-based systems. The success of the infectious disease program has been dependent on specialized biocontainment facilities, including a recently renovated animal biolevel 3 facility that has been utilized for cutting-edge work in mycobacterial, SARS coronavirus, and measles virus research.

The NEPRC is located in rural Southborough, Massachusetts, which is about 25 miles west of Boston and 10 miles east of Worcester. Additional information about the Center can be found at our Website, <www.hms.harvard.edu/neprc>. Applicants must be citizens or permanent residents of the United States. Preference will be given to veterinarians with post-DVM clinical experience. Stipends range from $45,000-65,000, depending on years of experience. Interested applicants are encouraged to submit a letter of intent, curriculum vitae, transcripts, and the names of three references to: Dr. Lynn M. Wachtman, NEPRC, One Pine Hill Dr., P.O. Box 9102, Southborough, MA 01772-9102 [e-mail: *lynn_wachtman@hms.harvard.edu*]. Harvard University is an Affirmative Action and Equal Opportunity Educator and Employer. Individuals from underrepresented minorities are strongly encouraged to apply.

CHCI Summer Program – Ellensburg, Washington

The Chimpanzee & Human Communication Institute (CHCI) is currently taking applications for our 10-week Summer Apprentice Program. Graduates, undergraduates, and postgraduates from various academic backgrounds (e.g. anthropology, biology, psychology, linguistics, philosophy) and all nationalities are encouraged to

apply. The dates of the program are June 15 to August 22, 2008.

The research at CHCI involves a group of chimpanzees who use the signs of American Sign Language (ASL). Washoe, Moja, Tatu, and Dar were part of the cross-fostering research that began in 1966 with Drs. R. A. & B. T. Gardner. Each chimpanzee was raised in an enriched environment in which his or her human family members used only ASL, much like the environment in which a deaf human child grows up. Loulis was adopted by Washoe in 1978 and learned his signs from chimpanzees. Currently, Tatu, Dar, and Loulis reside at CHCI on the campus of Central Washington University in Ellensburg, WA, in a large state-of-the-art facility.

Apprentices are at the institute daily – cleaning enclosures, preparing meals and enrichment, making observations of the chimpanzees, and participating in one or more research projects. The first week is intensive training in laboratory jobs and chimpanzee behaviors. After several weeks each apprentice becomes more autonomous and has responsibilities in research and husbandry. The philosophy of CHCI is that the needs of the chimpanzees come first. Apprentices are trained in humane care and research techniques.

The program fee is $1800 and there is a non-refundable $25 application processing fee. The costs do not include housing and transportation. Inexpensive housing is available on campus. A course in ASL is highly recommended, but not required. For more information on the program and the application, see our Web page, <www.cwu.edu/~cwuchci/apprentice.html>, or contact Dr. Mary Lee Jensvold, CHCI, Central Washington Univ., Ellensburg, WA 98926 [e-mail: *jensvold@cwu.edu*]. The deadline to apply is March 26, 2008.

* * *

Resources Wanted and Available

Debate on Animal Research

A 90-minute video of the September 27, 2007, debate on animal research between University of Wisconsin researcher Dr. Eric Sandgren and animal activist Ray Greek has been posted to Google video: <video.google.com/videoplay?docid=-8464924004908818871&hl=en>.

APHIS Report Available

The USDA/APHIS/Animal Care annual report for 2006 is now available at the USDA Website: <www.aphis.usda.gov/animal_welfare/downloads/awreports/awreport2006.pdf>. According to the report, the total number of Animal Welfare Act-covered animals in research in 2006 was 1,012,713, an all-time low.

BioMed Central Launches Biology Image Library

BioMed Central has announced the launch of Biology Image Library, an online resource that provides access to over 11,000 biology-related images. This is the latest service from BioMed Central, part of the Science Navigation Group of companies which was also responsible for the creation of <images.MD>, a popular medical image resource.

The Library is a new subscription-based service offering access to an annotated selection of biological images, movies, illustrations and animations. Subscribers may make royalty-free use of images in the collection for research and educational purposes, while commercial usage rights will be available for an additional fee. Subjects covered include developmental biology, histology and pathology, immunology, microbiology and parasitology, molecular and cellular biology, neuroscience, and plant biology.

The Biology Image Library is continuously working to expand its collection of images. Potential contributors should e-mail: <*info@biologyimagelibrary.com*>; or see <www.biologyimagelibrary.com/contribute> for more information.

To view Biology Image Library and register for a free trial, visit <www.biologyimagelibrary.com>.

* * *

Announcements from Publications

Malaria Journal

Malaria Journal is an open-access, online journal, published by Biomed Central, which includes papers on all aspects of malaria. See <www.malariajournal.com> for details.

***Gorilla Gazette* 2008**

Articles are being accepted for consideration in the 2008 issue of the *Gorilla Gazette*, a private newsletter published for all zoos and other institutions housing gorillas. Articles regarding husbandry, research, and/or conservation of gorillas are sought; however, topics involving other primates are also considered.

The *Gorilla Gazette* was conceived by gorilla keepers at the Columbus Zoo in 1987, as a means of sharing information about gorilla husbandry and welfare issues. With the Internet, sharing information is easier and the *Gorilla Gazette* is available online (by subscription). Please contact Jane Dewar [e-mail: *jdewar@gorilla-haven.org*] if you're interested in submitting something for the 2008 issue of the *Gorilla Gazette*. Deadline for this issue is January 10, 2008.

Endangered Species Research

Endangered Species Research (*ESR*), <www.int-res.com/journals/esr>, is currently a free online journal. Volumes 1 (all articles from 2004 and 2005) and 2 (all articles from 2006) are now in print. These have been distributed free of charge, with the compliments of Inter-Research Science Center.

ESR publishes one volume per year. *ESR* contributions are arranged in order of acceptance each year. Hence publication is irregular and individual contributions can appear online fast (i.e. without having to wait for a volume to be completed). Issues will be printed as and when they are full.

The Gibbon Journal

The Gibbon Journal publishes original papers in English or German on all aspects of gibbon natural history. It is distributed electronically [German: <www.gibbonconservation.org>; English: <www.gibbonconservation.org/english>] and published annually by the Gibbon Conservation Alliance.

* * *

Awards Granted

Linda Toth Receives Refinement Award

Linda Toth, of the Southern Illinois University (SIU) School of Medicine, received the 2007 Charles River Laboratories' Excellence in Refinement Award last month at the 6th World Congress on Alternatives and Animal Use in the Life Sciences in Tokyo.

Sponsored by Charles River Laboratories, in cooperation with the Johns Hopkins Center for Alternatives to Animal Testing, the award honors an individual who has made an outstanding contribution to the development, promotion and/or implementation of refinement alternatives. "Refinement," one of the "3Rs of alternatives," refers to methods aimed at minimizing pain and distress for laboratory animals.

Dr. Toth was chosen to receive this award for "a body of research that improves both the understanding and practice of refinement alternatives." Trained in pharmacology and in veterinary medicine, she is a Professor in the Department of Pharmacology and Associate Dean of Research and Faculty Affairs at SIU School of Medicine. "Her exceptional ability to integrate scientific goals and animal care serves to enhance both the quality of research and the quality of life for laboratory animals."

WNPRC Jacobsen Conservation Award to Horwich

Robert Horwich, Director of Community Conservation, a nonprofit primate conservation organization based in Gays Mills, Wisconsin, is the first recipient of the Lawrence Jacobsen Conservation Research Award. This award from the Wisconsin National Primate Research Center supports studies in applied conservation biology that protect nonhuman primate species and their habitats. The award will benefit Dr. Horwich's ongoing work to conserve the golden langur (*Trachypithecus geei*) in India.

The Golden Langur Conservation Project is a holistic project that blends conservation, research, education, economic development and community development. It focuses on the full range of the golden langur in western Assam, India, working with more than 130 villages to create forest protection committees and self-help groups that create economic opportunities for villagers.

Horwich will use the award to step up conservation and evaluation efforts at one focal area, the 17.2 mi.^{2} Kakoijana Reserve Forest. He and project participants, including national forest members and villagers from adjacent communities, plan to measure changes in reforestation, the increase in golden langurs, and changes in economic development within 10 communities surrounding Kakoijana. For more information, contact Cynthia Olmstead, Projects Coordinator [e-mail: *communityconservation@mwt.net*]; or see <www.communityconservation.org>.

The Lawrence Jacobsen WNPRC Conservation Research Award supports studies in applied conservation biology that protect nonhuman primate species in their habitats. Preference is given to those working directly with a nonhuman primate species on the IUCN threatened or endangered list. The annual $5,000 award is available to students and faculty who are affiliated with an academic institution or a nongovernmental agency with a focus on primate conservation. Larry Jacobsen was director of the Primate Center Library from 1973-2003. His many honors have included the Distinguished Service Award from the American Society of Primatologists in 1997 and the Library of the Year Award from the Wisconsin Library Association in 1995. – *November 5, 2007.*

Call for Award Nominations

Leopold and Hornaday Conservation Awards

In 2002, the American Society of Mammalogists (ASM) established two conservation awards to recognize outstanding contributions to the conservation of mammals and their habitats. The Aldo Leopold Award is awarded to a well established individual who has made a lasting scientific contribution to the conservation of mammals and their habitats. Previous awardees are Edward O. Wilson, Russell A. Mittermeier, George B. Schaller, and Rodrigo A. Medellín.

The William T. Hornaday Award is awarded to a current undergraduate or graduate student who has made a significant scientific contribution as a student to the conservation of mammals and their habitats. Previous awardees are Brent Sewall and Isabel Beasley. Nominees should have contributed substantially to:

- the conservation of one or more mammalian species, subspecies, or populations;
- the conservation of mammalian assemblages and communities; or
- advancing the field of conservation biology through focal research on mammals.

Persons contributing to the conservation of land or marine mammals are eligible for consideration. We interpret "contribution" broadly to include:

- scientific research or political activism that has resulted in the preservation of an imperiled species;
- development of protective management recommendations;
- acquisition of new knowledge regarding the conservation status or causes for declines of mammalian species or populations;
- the protection of significant mammalian habitat; or
- promotion of the conservation of mammals through public education.

All persons are invited to submit nominations for these awards. For each award, the nomination packet should include:

- A brief narrative (two pages maximum) that introduces and describes the conservation accomplishments of the nominee;
- As an addendum to this narrative, a list of relevant journal articles, government and NGO reports, newspaper clippings, and other materials that chronicle and corroborate the conservation-related accomplishments of the nominee;
- A current CV or resume;
- Contact information for the nominator and nominee;
- Supporting material:
    - For the Aldo Leopold Award, include letters of recommendation from three individuals familiar with the nominee's contributions to mammalian conservation. One of the letters must be from the nominator.
    - For the William T. Hornaday Award, include letters of recommendation from two individuals familiar with the nominee's conservation activities. One of these letters must be from the student's research advisor.

Electronic submissions of nominations and supporting documents are strongly encouraged. Completed nomination packets should be sent to Richard Thorington, Div. of Mammals, MRC 108, National Museum of Natural History, Smithsonian Institution, Washington, DC 20013-7012 [e-mail: *ThoringtonR@SI.EDU*]. The deadline for receipt of completed nominations is March 14, 2008. The recipients will be announced at the banquet at the ASM annual meeting in June, 2008.

Primatology Film Competition

A Primatology Film Competition will be held to judge the best films/videos made in the area of primatology produced from 1997 up to present. The winning productions will be screened at the Congress of the International Primatological Society (IPS) in Edinburgh, Scotland, August 3-8, 2008.

There will be two categories: (1) professionally made (e.g. commercial or public television company productions with budget above $30,000); (2) nonprofessional, independent productions that cost less than $30,000. There will be preliminary screenings and judging by PhD-level primatologists at one or more locations, and the five best entries in each category will be screened in Edinburgh. Monetary prizes will be awarded to the top entries in the nonprofessional category, and appropriate certificates from the IPS will be awarded the winners in the professional category.

Each film will be ranked from 1 to 10 on the following criteria, by each judge: (1) scientific accuracy/value; (2) aesthetics and film craft; and (3) educational/conservation value. The deadline for receiving entries is January 31, 2008.

Judges will be needed in the New York area. Hopefully, screenings will be scheduled at Columbia and New York University. For further information, see the Congress Website at <www.ips2008.co.uk/FilmCompetition.html> and/or contact Charles Weisbard [e-mail: *cw2359@columbia.edu*].

* * *

News Briefs

Chimp Not a Person, Austrian Court Rules

Animal rights activists, campaigning to get a 26-year-old chimpanzee legally declared a person, vowed to take their challenge to Austria's Supreme Court after a lower court threw out their latest appeal. A provincial judge in the city of Wiener Neustadt dismissed the case earlier this week, ruling that the Vienna-based Association Against Animal Factories had no legal standing to argue on the chimp's behalf.

The association, which worries that the shelter caring for the chimp might close, has been pressing to get "Matthew Hiasl Pan" declared a "person" so a guardian can be appointed to look out for his interests and provide a home for him. Group president Martin Balluch insists that Pan is "a being with interests" and accuses the Austrian judicial system of monkeying around. "It is astounding how all the courts try to evade the question of personhood of a chimp as much as they can," Balluch said.

A hearing date for the Supreme Court appeal was not immediately set. The legal tussle began in February, 2007, when the animal shelter where Pan and another chimp, Rosi, have lived for 25 years filed for bankruptcy protection. Activists want to ensure that the apes don't wind up homeless if the shelter closes. Both were captured as babies in Sierra Leone in 1982 and smuggled in a crate to Austria for use in pharmaceutical experiments. Customs officers intercepted the shipment and turned the chimps over to the shelter. Their upkeep costs about $6,800 a month. Donors have offered to help, but there's a catch: Under Austrian law, only a person can receive personal gifts. Organizers could set up a foundation to collect cash for Pan, whose life expectancy in captivity is about 60 years. But they contend that only personhood will give him the basic rights he needs to ensure he isn't sold to someone outside Austria, where he's now protected by strict animal cruelty laws.

Until this summer, the chimp was known simply as Hiasl. However, in the latest court documents, he was identified with a little more dignity – if not humanity – as Matthew Hiasl Pan.

The Association Against Animal Factories points out that it's not trying to get Pan declared a human, but rather a person, which would give him some kind of legal status. Otherwise, he is legally a thing. And with the genetic makeup of chimpanzees and humans so strikingly similar, it contends, that just can't be. "The question is: Are chimps things without interests, or persons with interests?" Balluch said. "A large section of the public does see chimps as beings with interests. We are looking forward to hearing what the high court has to say on this fundamental question." – *William J. Kole, Associated Press, Sept. 28, 2007*

Washoe, First Signing Chimpanzee

Washoe, believed to be the first animal to learn a human language, died at Central Washington University (CWU) in Ellensburg on October 30. Washoe, who was 42 years old, could use about 250 distinctive American Sign Language (ASL) signs, said Deborah Fouts, director of the university's Chimpanzee and Human Communication Institute, where Washoe lived.

Washoe was born in 1965 in West Africa, where she was captured by the Air Force and brought to the United States, initially for research use in the space program. In 1966, she left that program and began living in Washoe County, Nevada, with Allen and Beatrix Gardner. The Gardners led a project at the University of Nevada, Reno, to teach Washoe ASL. Previous efforts to teach chimpanzees spoken languages had failed, but the Gardners believed there might be a better chance of success using signs. Washoe learned ASL starting that year.

Deborah Fouts and her husband, Roger, became involved in the project in 1967. The Fouts moved Washoe to Oklahoma and added other chimpanzees to their research. In 1980, the Fouts and chimps moved to Ellensburg at CWU's invitation. Washoe was able to teach another chimpanzee, Loulis, sign language without any human intervention, marking the first animal-to-animal transfer of a human language, according to Fouts. – *Nick Perry, for the* Seattle Times, *November 1*

Taiping Four Returned to Cameroon

A five-year international row over the fate of a group of gorillas snatched from the wild by poachers has finally ended. The four western lowland gorillas – a male and three females – were flown in separate wooden crates from Johannesburg to their native Cameroon. It was the final chapter of a long-running battle by wildlife campaigners to prevent the gorillas from spending the rest of their lives in a zoo.

The saga began in 2002 when they arrived at the Taiping Zoo, 150 miles north of Kuala Lumpur in Malaysia, having allegedly come from a captive breeding program in Nigeria. But it was quickly established that the gorillas, then juveniles aged between 14 and 33 months, had been born in the wild, probably in Cameroon, and were almost certainly orphaned and smuggled to Nigeria after their families were slaughtered by bushmeat traders.

A campaign was launched to have the primates, who became known as the Taiping Four, returned to their homeland. In 2004, they were seized by embarrassed Malaysian authorities and sent to the South African National

Zoological Gardens in Pretoria, because they had arrived in the country on a South African Airways flight. It has taken until now to arrange for the gorillas, now aged between six and seven years and each weighing more than 100 kilos, to be sent back to Cameroon.

They arrived safely and were then taken by truck on the three-hour journey to the Limbe Wildlife Sanctuary in the southwest of the country. They will join 11 other gorillas already at the sanctuary where they are likely to spend the rest of their lives. Gorilla numbers have plummeted throughout their range in the past decade by up to 80 percent, largely as a result of human conflict and bushmeat hunting.

Meanwhile the Aspinall Foundation, the wildlife conservation charity, has announced the first-ever birth from a reintroduced western gorilla in the Central African Republic of Gabon. The parents of the baby, born in October, were wild-born orphans Lekedi, 10, and Marco, 12. Marco's group consists of 14 individuals aged between 8 and 12 and have been reintroduced since 2002. Mother and infant are both doing well. – *By Paul Eccleston, November 11, 2007, from* <www.telegraph.co.uk>

Bonobo Reserve Established in Congo

Congo is setting aside more than 11,000 square miles of rain forest to help protect the endangered bonobo, the great ape most closely related to humans, which is found only in this Central African country. U.S. agencies, conservation groups and the Congolese government have come together to set aside 11,803 square miles of tropical rain forest, the U.S.-based Bonobo Conservation Initiative (BCI) said in a statement issued this week. The area amounts to just over 1 percent of vast Congo – but that means a park larger than the state of Massachusetts.

Environment Minister Didace Pembe said the area was denoted a protected reserve last week as part of the administration's goal of setting aside 15 percent of its forest as protected area. The Sankuru announcement increased the amount of protected land in Congo to 10 percent from 8 percent, he said. The Sankuru Nature Reserve aims to protect a section of Africa's largest rain forest from the commercial bushmeat trade and from deforestation by industrial logging operations in the central part of the country known as the Congo Basin.

Sally Jewell Coxe, president of the Washington-based BCI, said the group has been working to establish the reserve since 2005, when it started meeting with leaders in villages that ring the area to persuade them to stop hunting the ape. Though local lore holds that washing a baby with the ashy remains of a bonobo will make the child strong, Coxe said many area villages have committed to ending the practice. – *Eddy Isango, Associated Press, Nov. 20, 2007*

* * *

Grants Available

ACLAM Request for Proposals

The American College of Laboratory Animal Medicine (ACLAM) Foundation Committee members are pleased to announce their solicitation of research proposals in laboratory animal science and medicine. For information, go the ACLAM Foundation Website, <aclam.org/foundation/rfp.html>, or contact Dr. Gregory P. Boivin, Scientific Director, ACLAM Foundation, University of Cincinnati, P.O. Box 670529, Cincinnati, OH 45267-0529 [513-558-9156; e-mail: *boivingp@ucmail.uc.edu*].

Letters of intent are due January 30, 2008; invited full proposals are due Thursday, April 3, 2008. Awards will be announced early in July, 2008.

NIH Pioneer and New Innovator Award Programs

The National Institutes of Health (NIH) is calling for applications for their 2008 NIH Director's Pioneer and New Innovator Awards. Both programs support exceptionally creative scientists who take highly innovative – and often unconventional – approaches to major challenges in biomedical or behavioral research.

Pioneer Awards are open to scientists at any career stage, while New Innovator Awards are reserved for new investigators who have not received an NIH regular research (R01) or similar grant. Pioneer Awards provide $2.5 million in direct costs over five years and New Innovator Awards provide $1.5 million in direct costs over the same period. NIH expects to make five to ten Pioneer Awards and up to 24 New Innovator Awards in September, 2008.

Pioneer Award applications will be accepted from December 16, 2007, to January 16, 2008. Application instructions are at <grants.nih.gov/grants/guide/rfa-files/RFA-RM-08-013.html>. The New Innovator Award application period is March 3-31, 2008. Applications are available at <grants.nih.gov/grants/guide/rfa-files/RFA-RM-08-014.html>.

More information is available at <nihroadmap.nih.gov/pioneer> and <grants.nih.gov/grants/new investigators/innovator award>, or contact Ann Dieffenbach at 301-496-7301 [e-mail: *dieffena@nigms.nih.gov*].

* * *

Positions Available

Veterinarian – Davis, California

The University of California, Davis (UCD), is seeking a highly motivated, enthusiastic veterinarian to join its primate medicine team at the California National Primate Research Center (CNPRC). The CNPRC conducts interdisciplinary research programs on significant human health problems where nonhuman primates are the animal models of choice. In addition to its major efforts in the area of research, the CNPRC is also committed to its missions of teaching and service. The CNPRC veterinary staff provides veterinary services for approximately 5,000 primates of three different species. Responsibilities include all aspects of health care and preventive medicine, provision of veterinary support services to investigators, and management-related tasks under the general direction of senior management. This position will also provide support and training to students, visiting veterinarians, primate medicine residents, rotating Lab Animal Medicine residents, and clinical veterinary technicians in all aspects of primate medicine. Salary and appointment level will be commensurate with experience.

Qualifications: The applicant must possess a valid certificate from a recognized school of veterinary medicine and have demonstrated knowledge of medical primatology as it applies to the diagnosis and treatment of nonhuman primates. An understanding of preventive medicine programs required for laboratory-housed nonhuman primates, including vaccination, parasitology, bacteriology, and virology screening programs is required. The ability to work with large and small nonhuman primates and knowledge of institutional, local, state, national, and international rules and regulations governing the use and care of nonhuman primates (USDA, ILAR Guide, FDA GLP, and California Public Health Law) is necessary. The applicant must also possess knowledge of humane care and housing of animals with understanding of standards and guidelines as established by the American Association for Accreditation of Laboratory Animal Care. Other skills required include: understanding of gross necropsy procedures and basic histopathology of the nonhuman primates; ability to interact with pathologists to identify patterns of disease in colony animals; ability to interact with animal care staff and investigators regarding veterinary care; ability to teach in the classroom situation, seminar format, and on a one-to-one basis; ability to give written and oral presentations at national and international specialty meetings; and good interpersonal, oral, and written communication skills.

For additional information, visit the UC Davis Human Resources Website: <jobs.hr.ucdavis.edu/jm/ViewVacancy?id=9174>. To apply for this position, submit a resume, UCD application, and a list of three references to Skip Watt, California National Primate Research Center, U.C. Davis, 1 Shields Avenue, Davis, CA 95616 [e-mail: *jmwatt@ucdavis.edu*]. Application materials are available at the UCD Human Resources Administration Building, the UCDMC Personnel Office, or at <www.hr.ucdavis.edu/Emp>.

Two Postdoctoral Positions – Davis, California

Two postdoctoral positions are available at the California National Primate Research Center for a NIH-funded study (three years) to develop a set of predictive models of the social and management factors that lead to deleterious aggression and aggression-based morbidity and mortality in group-housed rhesus macaques. These positions will require that successful candidates conduct long hours of observations of four or more groups of up to 150 macaques housed in 1/2-acre enclosures. Experience with identifying and observing the behavior of nonhuman primates in large social groups is required (experience with macaques is preferred). Commitment for the entire three-year study duration is strongly desired. Opportunities for training in social network theory and other mathematical modeling of affiliative, submissive and aggressive behavior will be provided. Opportunities will also be provided for contributing to publications and grant submissions.

For further information, contact Dr. Brenda McCowan [e-mail: *bjmccowan@ucdavis.edu*]. Include a resume or CV along with a brief letter indicating your interest.

* * *

Workshop Announcements: Teaching Research Ethics

Indiana University's fifteenth annual Teaching Research Ethics Workshop will convene at the Indiana Memorial Union on the campus of Indiana University in Bloomington, Indiana, on May 13-16, 2008. Session topics will include an overview of ethical theory, trainee and authorship issues, conflicts of interest, using human subjects in clinical and non-clinical research, and responsible data management. Many sessions will feature techniques for teaching and assessing the responsible conduct of research.

Information and registration are available at <poynter.indiana.edu/tre>.

Recent Books and Articles

(Addresses are those of first authors unless otherwise indicated)

Books

• *The Gestural Communication of Apes and Monkeys*. J. Call & M. Tomasello (Eds). Mahwah, NJ: Lawrence Erlbaum Assoc., 2007. [Price: $80]

• *The Spectral Tarsier*. S. L. Gursky. Upper Saddle River, NJ: Pearson/Prentice Hall, 2007. [Price: $23]

• *Baboon Metaphysics: The Evolution of a Social Mind*. D. L. Cheney & R. M. Seyfarth. Chicago: Univ. of Chicago Press, 2007. [Price: $27.50]

• *Making Lives Easier for Animals in Research Labs: Discussions by the Laboratory Animal Refinement and Enrichment Forum*. Baumans, V., Coke, C., Green, J., Moreau, E., Morton, D., Patterson-Kane, E., Reinhardt, A., Reinhardt, V., & Van Loo, P. (Eds.). (Animal Welfare Institute, P.O. Box 3650, Washington, DC 20027 [e-mail: *viktorannie@yahoo.com*]). Free at <www.awionline.org/pubs/LAREF/LAREF-bk.html>.

Farm and laboratory species, including nonhuman primates, are discussed. Contents include "Basic issues", "Maladaptive behaviors", "Environmental enrichment", "Social housing", "Working with animals", "Safety issues", and "Extraneous variables".

• *Macachiavellian Intelligence: How Rhesus Macaques and Humans Have Conquered the World*. D. Maestripieri. Chicago, Illinois: University of Chicago Press, 2007. [Price: $25]

• *Zoo Animal and Wildlife Immobilization and Anesthesia.* G. West, D. Heard, & N. Caulkett (Eds.). Ames, IA: Blackwell, 2007. [Price: $149.99]

• *Apes of the impenetrable forest: The behavioral ecology of sympatric chimpanzees and gorillas*. C. B. Stanford. Upper Saddle River, NJ: Pearson/Prentice Hall, 2008. [Price: $23]

Audiovisual Material

• *NHP Breeding in China: Status & Prospective*. W. Fang. (Beijing Prima Resources 83 Fuxing Rd, E11-132, Beijing 100039, China [e-mail: *peter@PrimaResources.com*]; <www.primaresources.com/APV2007Presentation.pdf>)

Magazines and Newsletters

• *The Gibbon's Voice,* September, 2007, *9*[1]. (Gibbon Conservation Center, P.O. Box 800249, Santa Clarita, CA 91380)

Contents include: "Going, going, gone?" by P. Österberg; and "Environmental enrichment for captive animals", by J. Ruppell.

• *The Conservation Behaviorist*, 2007, *5*[2], <www.animalbehavior.org/Committees/Conservation/ConservationBehaviorist/theconsbehavvol5no2.pdf>.

• *IPPL News,* December, 2007, *34*[3]. (International Primate Protection League, P.O. Box 766, Summerville, SC 29484 [e-mail: *info@ippl.org*]).

Individual articles are available at <www.ippl.org/news.html>.

• *Lemur News*, June 2007, *12*, <www.dpz.gwdg.de/fileadmin/dpz_home/web/abtlg/lnews/lemurnews_vol-12_hp-gesamt.pdf>.

Contents include: Lemur diversity: A recent efflorescence of species, by A. B. Rylands; Morphometric data for Indri (*Indri indri*) collected from ten forest fragments in eastern Madagascar, by J. R. Zaonarivelo, R. Andriantompohavana, S. E. Engberg, S. G. Kelley, J.-C. Randriamanana, E. E. Louis, Jr., & R. A. Brenneman; Morphological characterization of a population of Sambirano woolly lemur (*Avahi unicolor*) from the Anaborano Forest in northwestern Madagascar, by J. R. Zaonarivelo, R. Andriantompohavana, R. Rakotonomenjanahary, J. Andrianasolo, R. A. Brenneman, & E. E. Louis, Jr.; Rapid survey of white-collared brown lemurs (*Eulemur albocollaris*) in three forest fragments in southeastern Madagascar, by H. Tokiniaina, J. R. Zaonarivelo, F. B. Ralainasolo, R. Andriantompohavana, J. C. Randriamanana, R. A. Brenneman, & E. E. Louis, Jr.; Preliminary lemur survey of Andavakoera Classified Forest and regional forest fragments of Madagascar, by J. R. Zaonarivelo, R. Andriantompohavana, A. Razafindrakoto, J. Andrianasolo, S. Rajaobelina, R. A. Brenneman, S. Wohlhauser, & E. E. Louis, Jr.; Forest fragment and range survey of the Ambararata-Maromokotra Loky River Locale of northeastern Madagascar for golden-crowned sifaka (*Propithecus tattersalli*), by A. Razafindrakoto, R. Andriantompohavana, S. Wohlhauser, S. Rajaobelina, E. E. Louis, Jr., & R. A. Brenneman; Variation de la distribution de deux espèces de microcèbes dans le Parc National Ankarafantsika, by R. Rakotondravony & U. Radespiel; Lemur records at priority sites for plant conservation, by C. Birkinshaw, A. Ravoahangy, & H. E. Andriamaharoa; Lemur survey of the Andranomanitsy Forest, Region of Besalampy, Province of Mahajanga, by J. M. Ralison; Non-maternal infant care in wild silky sifakas (*Propithecus candidus*), by E. R. Patel; Research experience in Vohibasia Forest, southwestern Madagascar, by S. R. Siers; A brief lemur survey

We would like to acknowledge *Primate-Science* as a source for information about new books.

of the Ranomafana Andringitra corridor region in Tolongoina, southeast Madagascar, by A. M. Deppe, M. Randriamiarisoa, K. Schütte, & P. C. Wright; Cytogenetics and taxonomy of the genus *Hapalemur,* by C. Rabarivola, P. Prosper, A. Zaramody, N. Andriaholinirina, & M. Hauwy; Le bloc forestier de Makira charnière de Lémuriens, by D. Rasolofoson, G. Rakotondratsimba, O. Rakotonirainy, T. Rasolofoharivelo, L. Rakotozafy, J. Ratsimbazafy, F. Ratelolahy, V. Andriamaholy, & A. Sarovy; and Disputed taxonomy classification of sportive lemurs (*Lepilemur*) in NW Madagascar, by D. Zinner, C. Roos, J.-L. Fausser, C. Groves, & Y. Rumpler.

• *Madagascar Conservation & Development*, 2006, issue 1, <www.mwc-info.net/en/services/journal.htm>.

• *Folia Primatologica*, 2008, *79*[1].

Contents: Selective logging, habitat quality and home range use by sympatric gorillas and chimpanzees: A case study from an active logging concession in southeast Cameroon, by E. Arnhem, J. Dupain, R. Vercauteren Drubbel, C. Devos, & M. Vercauteren; Distribution of diurnal primate species in Togo and Bénin, by G. Campbell, J. Teichroeb, & J. D. Paterson; and The disregarded west: Diet and behavioural ecology of olive baboons in the Ivory Coast, by B. K. Kunz & K. E. Linsenmair.

• *Primates*, 2007, *48*[4], <www.springerlink.com/content/109670>.

Contents: Do age- and sex-related variations reliably reflect body size in non-human primate vocalizations? A review, by E. Ey, D. Pfefferle, & J. Fischer; Diet and activity budget of *Rhinopithecus roxellana* in the Qinling Mountains, China, by S. Guo, B. Li, & K. Watanabe; Description of joint movements in human and non-human primate locomotion using Fourier analysis, by D. Webb & W. A. Sparrow; Communicative contexts of the LEN facial expression of pigtailed macaques (*Macaca nemestrina*), by B. C. Oettinger, C. M. Crockett, & R. U. Bellanca; Development of the visual preference of chimpanzees (*Pan troglodytes*) for photographs of primates: Effect of social experience, by M. Tanaka; The distributions of howling monkeys (*Alouatta pigra* and *A. palliata*) in southeastern Mexico and Central America, by A. Baumgarten & G. B. Williamson; Evidence of cave use by savanna chimpanzees (*Pan troglodytes verus*) at Fongoli, Senegal: Implications for thermoregulatory behavior, by J. D. Pruetz; Ranging behavior of the François' langur (*Trachypithecus francoisi*) in the Fusui Nature Reserve, China, by Q. Zhou, C. Huang, Y. Li, & X. Cai; and A case of infant swapping by wild northern muriquis (*Brachyteles hypoxanthus*), by W. Pereira Martins, V. de Oliveira Guimarães, & K. B. Strier.

• *Journal of Medical Primatology*, 2007, *36*[6], <www.blackwell-synergy.com/toc/jmp/36/6>.

Contents: Acute neuropathogenicity with experimental infection of equine herpesvirus 9 in common marmosets (*Callithrix jacchus*), by A. Kodama, T. Yanai, K. Yomemaru, H. Sakai, T. Masegi, S. Yamada, H. Fukushi, T. Kuraishi, S. Hattori, & C. Kai; Prevalence of antibody reaction with cercopithecine herpesvirus 1 antigen in *Macaca cyclopis*, *Macaca fascicularis*, and *Papio anubis* in Taiwan, by F. Lee, Y-J. Lin, M-C. Deng, T-Y. Lee, & C-C. Huang; Secondary sexual coloration and CSF 5-HIAA are correlated in vervet monkeys (*Cercopithecus aethiops sabaeus*), by M. S. Gerald & M. T. McGuire; Urinary and fecal immunoglobulin A, cortisol and 11-17 dioxoandrostanes, and serum cortisol in metabolic cage housed female cynomolgus monkeys (*Macaca fascicularis*), by Y. Paramastri, F. Royo, J. Eberova, Ha.-E. Carlsson, D. Sajuthi, A.-L. Fernstrom, J. Pamungkas, & J. Hau; Olive baboon (*Papio anubis anubis*) as a model for intrauterine research, by D. Chai, S. Cuneo, H. Falconer, J. M. Mwenda, & T. D'Hooghe; The timed-pregnant baboon animal model can be used for determining the role of soluble vascular endothelial growth factor receptors 1 and 2 during development, by J. Santolaya-Forgas, S. Edwin, K. Zeiter, A. Pitt, B. Pineles, A. L. Tarca, J. Espinoza, J. P. Kusanovic, O. Erez, R. Wolf, & R. Romero; Pre-clinical evaluation of an sLex-glycosylated complement inhibitory protein in a non-human primate model of reperfused stroke, by A. F. Ducruet, J. Mocco, W. J. Mack, A. L. Coon, H. C. Marsh, D. J. Pinsky, Z. L. Hickman, G. H. Kim, & E. Sander Connolly; Comparison of rectal and infrared thermometry for obtaining body temperature in cynomolgus macaques (*Macaca fascicularis*), by P. Sikoski, M. L. Banks, R. Gould, R. W. Young, J. M. Wallace, & M. A. Nader; Leucoencephalopathy with cerebral calcinosis in a young chimpanzee (*Pan troglodytes*) – a case report, by M. Zoller, A. Grevot, K. Matz-Rensing, P. Hofmann, V. Jurek, W. Schulz-Schaeffer, & F.-J. Kaup; and a Meeting Report – Endometriosis: Clinical monitoring and treatment procedures in rhesus monkeys, by J. A. Mattison, M. A. Ottinger, D. Powell, D. L. Longo, & D. K. Ingram.

Reports

• *The last stand of the orangutan – State of emergency: Illegal logging, fire and palm oil in Indonesia's national parks.* C. Nellemann (Ed.). United Nations Environment Programme Rapid Response Assessment, 2007, <www.unep-wcmc.org/resources/publications/LastStand.htm>.

Special Journal Issues

• Primate Evolution and the Environment. *Folia Primatologica*, 2007, *78*[5-6].

Contents: Preface: Primate evolution and the environment, by C. Soligo; Primate origins: Implications of a Cretaceous ancestry, by R. D. Martin, C. Soligo, & S. Tavaré; Invading Europe: Did climate or geography trigger early Eocene primate dispersals? by C. Soligo; Evolu-

tion and extinction of Afro-Arabian primates near the Eocene-Oligocene boundary, by E. R. Seiffert; Middle Miocene dispersals of apes, by P. Andrews & J. Kelley; Environmental correlates of the cercopithecoid radiations, by S. Elton; Climatic influences on the evolution of early Homo? by S. C. Antón; Primate visual signals in noisy environments, by J. Kingdon; The evolution of extinction risk: Past and present anthropogenic impacts on the primate communities of Madagascar, by L. R. Godfrey & M. T. Irwin; and Biodiversity, phylogeography, biogeography and conservation: Lemurs as an example, by U. Thalmann.

• Abstracts Presented at the Association of Veterinary Anaesthetists Spring Meeting, Paris, France, 7-10 March 2007. *Veterinary Anaesthesia and Analgesia*, 2007, *34*, 1-16, <www.blackwell-synergy.com/doi/abs/10.1111/j.1467-2995.2007.00382.x>.

• Primate behavior studies: Essential to primate welfare. *Journal of Applied Animal Welfare Science*, 2007, *10*[1], <www.psyeta.org/jaaws/v10n1.shtml>.

Contents: Introduction: Celebrating a life by recognizing realities, by V. W. Koch; Welfare of apes in captive environments: Comments on, and by, a specific group of apes, by S. Savage-Rumbaugh, Kanzi Wamba, Panbanisha Wamba, & Nyota Wamba; A tail of two monkeys: Social housing for nonhuman primates in the research laboratory setting, by D. Seelig; Enhancing nonhuman primate care and welfare through the use of positive reinforcement training, by G. Laule & M. Whittaker; Control, choice, and assessments of the value of behavioral management to nonhuman primates in captivity, by S. J. Schapiro & S. P. Lambeth; Enrichment and primate centers: Closing the gap between research and practice, by K. Baker; Life-long well being: Applying animal welfare science to nonhuman primates in sanctuaries, by L. Brent; Toward a science of welfare for animals in the zoo, by T. L. Maple; The role of behavioral research in the conservation of chimpanzees and gorillas, by E. V. Lonsdorf; and three Commentaries: "Applied Behavior" Panel Discussion, by S. J. Schapiro, G. Laule, & D. Seelig; "Primatology" Panel Discussion, by K. Baker, T. L. Maple, V. Wensley Koch, & E. V. Lonsdorf; and Full Panel Discussion, by T. L. Maple, E. V. Lonsdorf, D. Seelig, & S. Savage-Rumbaugh.

Anatomy and Physiology

• Excitatory and suppressive receptive field subunits in awake monkey primary visual cortex (V1). Chen, X., Han, F., Poo, M., & Dan, Y. (Y. D., Group in Vision Science, Univ. of California, Berkeley, CA 94720 [e-mail: *ydan@berkeley.edu*]). *Proceedings of the National Academy of Sciences, U.S.A.*, 2007, *104*, 19120-19125.

"An essential step in understanding visual processing is to characterize the neuronal receptive fields (RFs) at each stage of the visual pathway. However, RF characterization beyond simple cells in the primary visual cortex (V1) remains a major challenge. Recent application of spike-triggered covariance (STC) analysis has greatly facilitated characterization of complex cell RFs in anesthetized animals. Here we apply STC to RF characterization in awake monkey V1. We found up to nine subunits for each cell, including one or two dominant excitatory subunits as described by the standard model, along with additional excitatory and suppressive subunits with weaker contributions. Compared with the dominant subunits, the nondominant excitatory subunits prefer similar orientations and spatial frequencies but have larger spatial envelopes. They contribute to response invariance to small changes in stimulus orientation, position, and spatial frequency. In contrast, the suppressive subunits are tuned to orientations 45°–90° different from the excitatory subunits, which may underlie cross-orientation suppression. Together, the excitatory and suppressive subunits form a compact description of RFs in awake monkey V1, allowing prediction of the responses to arbitrary visual stimuli."

• Ecomorphology of orbit orientation and the adaptive significance of binocular vision in primates and other mammals. Heesy, C. P. (Dept of Anatomy, Arizona College of Osteopathic Medicine, Midwestern Univ., 19555 N. 59th Ave., Glendale, AZ 85308 [e-mail: *cheesy@midwestern.edu*]). *Brain, Behavior and Evolution,* 2008, *71*, 54-67.

Primates are characterized by forward-facing, or convergent, orbits and associated binocular field overlap. Hypotheses explaining the adaptive significance of these traits often relate to ecological factors, such as arboreality, nocturnal visual predation, or saltatory locomotion in a complex nocturnal, arboreal environment. This study reexamines the ecological factors that are associated with high orbit convergence in mammals. Orbit orientation data were collected for 321 extant taxa from sixteen orders of metatherian (marsupial) and eutherian mammals. These taxa were coded for activity pattern, degree of faunivory, and substrate preference. Results demonstrate that nocturnal and cathemeral mammals have significantly more convergent orbits than diurnal taxa, both within and across orders. Faunivorous eutherians (both nocturnal and diurnal) have higher mean orbit convergence than opportunistically foraging or non-faunivorous taxa. However, substrate preference is not associated with higher orbit convergence and, by extension, greater binocular visual field overlap. These results are consistent with the hypothesis that mammalian predators evolved higher orbit convergence, binocular vision, and stereopsis to counter camouflage in prey inhabiting a nocturnal environment. Strepsirrhine primates have a range of orbit convergence values similar to nocturnal or cathemeral predatory nonprimate mammals. These data are entirely consistent with the nocturnal visual predation hypothesis of primate origins.

Animal Models

• A quantitative trait locus for variation in dopamine metabolism mapped in a primate model using reference sequences from related species. Freimer, N. B., Service, S. K., Ophoff, R. A., Jasinska, A. J., McKee, K., Villeneuve, A., Belisle, A., Bailey, J. N., Breidenthal, S. E., Jorgensen, M. J., Mann, J. J., Cantor, R. M., Dewar, K., & Fairbanks, L. A. (Ctr for Neurobehavioral Genetics, David Geffen School of Med., Univ. of California, Los Angeles, CA 90095 [e-mail: *nfreimer@mednet.ucla.edu*]). *Proceedings of the National Academy of Sciences, U.S.A.*, 2007, *104*, 15811-15816.

"Nonhuman primates (NHP) provide crucial research models. Their strong similarities to humans make them particularly valuable for understanding complex behavioral traits and brain structure and function. We report here the genetic mapping of an NHP nervous system biologic trait, the cerebrospinal fluid (CSF) concentration of the dopamine metabolite homovanillic acid (HVA), in an extended inbred vervet monkey (*Chlorocebus aethiops sabaeus*) pedigree. CSF HVA is an index of CNS dopamine activity, which is hypothesized to contribute substantially to behavioral variations in NHP and humans. For quantitative trait locus (QTL) mapping, we carried out a two-stage procedure. We first scanned the genome using a first-generation genetic map of short tandem repeat markers. Subsequently, using >100 SNPs within the most promising region identified by the genome scan, we mapped a QTL for CSF HVA at a genome-wide level of significance (peak logarithm of odds score >4) to a narrow well delineated interval (<10 Mb). The SNP discovery exploited conserved segments between human and rhesus macaque reference genome sequences. Our findings demonstrate the potential of using existing primate reference genome sequences for designing high-resolution genetic analyses applicable across a wide range of NHP species, including the many for which full genome sequences are not yet available. Leveraging genomic information from sequenced to nonsequenced species should enable the utilization of the full range of NHP diversity in behavior and disease susceptibility to determine the genetic basis of specific biological and behavioral traits."

• Stable reduction of CCR5 by RNAi through hematopoietic stem cell transplant in non-human primates. Sung An, D., Donahue, R. E., Kamata, M., Poon, B., Metzger, M., Mao, S.-H., Bonifacino, A., Krouse, A. E., Darlix, J.-L., Baltimore, D., Qin, X.-F., & Chen, I. S. Y. (D. B., Div. of Biol., Cal. Tech., 1200 E. California Blvd, Pasadena, CA 91125 [e-mail: *baltimo@caltech.edu*]). *Proceedings of the National Academy of Sciences, U.S.A.*, 2007, *104*, 13110-13115.

"RNAi is a powerful method for suppressing gene expression that has tremendous potential for therapeutic applications. However, because endogenous RNAi plays a role in normal cellular functions, delivery and expression of siRNAs must be balanced with safety. Here we report successful stable expression in primates of siRNAs directed to chemokine (c-c motif) receptor 5 (CCR5) introduced through CD34+ hematopoietic stem/progenitor cell transplant. After hematopoietic reconstitution, to date 14 months after transplant, we observe stably marked lymphocytes expressing siRNAs and consistent down-regulation of chemokine (c-c motif) receptor 5 expression. The marked cells are less susceptible to simian immunodeficiency virus infection *ex vivo*. These studies provide a successful demonstration that siRNAs can be used together with hematopoietic stem cell transplant to stably modulate gene expression in primates and potentially treat blood diseases such as HIV-1."

• Nonhuman primate event-related potentials indexing covert shifts of attention. Woodman, G. F., Kang, M.-S., Rossi, A. F., & Schall, J. D. (Dept of Psychology, Wilson Hall 111, 21st Ave South,Vanderbilt Univ., Nashville, TN 37203 [e-mail: *geoffrey.f.woodman@vanderbilt.edu*]). *Proceedings of the National Academy of Sciences, U.S.A.*, 2007, *104*, 15111-15116.

"A half-century's worth of research has established the existence of numerous event-related potential components measuring different cognitive operations in humans including the selection of stimuli by covert attention mechanisms. Surprisingly, it is unknown whether nonhuman primates exhibit homologous electrophysiological signatures of selective visual processing while viewing complex scenes. We used an electrophysiological technique with macaque monkeys analogous to procedures for recording scalp event-related potentials from humans and found that monkeys exhibit short-latency visual components sensitive to sensory processing demands and lateralizations related to shifting of covert attention similar to the human N2pc component. These findings begin to bridge the gap between the disparate literatures by using electrophysiological measurements to study the deployment of visual attention in the brains of humans and nonhuman primates."

• Identification and characterization of a Y-like primate retinal ganglion cell type. Petrusca, D., Grivich, M. I., Sher, A., Field, G. D., Gauthier, J. L., Greschner, M., Shlens, J., Chichilnisky, E. J., & Litke, A. M. (A. M. L., Santa Cruz Inst. for Particle Physics, Natural Sciences 2, Univ. of California, 1156 High St, Santa Cruz, CA 95064 [e-mail: *alan.litke@cern.ch*]). *Journal of Neuroscience*, 2007, *27*, 11019-11027.

"The primate retina communicates visual information to the brain via a set of parallel pathways that originate from at least 22 anatomically distinct types of retinal ganglion cells. Knowledge of the physiological properties of these ganglion cell types is of critical importance for understanding the functioning of the primate visual system. Nonetheless, the physiological properties of only a handful of retinal ganglion cell types have been studied in de-

tail. Here we show, using a newly developed multielectrode array system for the large-scale recording of neural activity, the existence of a physiologically distinct population of ganglion cells in the primate retina with distinctive visual response properties. These cells, which we will refer to as upsilon cells, are characterized by large receptive fields, rapid and transient responses to light, and significant nonlinearities in their spatial summation. Based on the measured properties of these cells, we speculate that they correspond to the smooth/large radiate cells recently identified morphologically in the primate retina and may therefore provide visual input to both the lateral geniculate nucleus and the superior colliculus. We further speculate that the upsilon cells may be the primate retina's counterparts of the Y-cells observed in the cat and other mammalian species."

• A comparison of resting-state brain activity in humans and chimpanzees. Rilling, J. K., Barks, S. K., Parr, L. A., Preuss, T. M., Faber, T. L., Pagnoni, G., Bremner, J. D., & Votaw, J. R. (J. K. R., Emory Univ. School of Med., Atlanta, GA 30322 [e-mail: *jrillin@emory.edu*]). *Proceedings of the National Academy of Sciences, U.S.A.*, 2007, *104*, 17146-17151.

"In humans, the wakeful resting condition is characterized by a default mode of brain function involving high levels of activity within a functionally connected network of brain regions. This network has recently been implicated in mental self-projection into the past, the future, or another individual's perspective. Here we use [^{18}F]-fluorodeoxyglucose positron emission tomography imaging to assess resting-state brain activity in our closest living relative, the chimpanzee, as a potential window onto their mental world and compare these results with those of a human sample. We find that, like humans, chimpanzees show high levels of activity within default mode areas, including medial prefrontal and medial parietal cortex. Chimpanzees differ from our human sample in showing higher levels of activity in ventromedial prefrontal cortex and lower levels of activity in left-sided cortical areas involved in language and conceptual processing in humans. Our results raise the possibility that the resting state of chimpanzees involves emotionally laden episodic memory retrieval and some level of mental self-projection, albeit in the absence of language and conceptual processing."

• Diminished adult neurogenesis in the marmoset brain precedes old age. Leuner, B., Kozorovitskiy, Y., Gross, C. G., & Gould, E. (E. G., Dept of Psychology, Princeton Univ., Princeton, NJ 08544 [e-mail: *goulde@princeton.edu*]). *Proceedings of the National Academy of Sciences, U.S.A.*, 2007, *104*, 17169-17173.

With aging there is a decline in the number of newly generated neurons in the dentate gyrus of the hippocampus. In rodents and tree shrews, this age-related decrease in neurogenesis is evident long before the animals become aged. No previous studies have investigated whether primates exhibit a similar decline in hippocampal neurogenesis with aging. To investigate this possibility, young to middle aged adult common marmosets (*Callithrix jacchus*) were injected with BrdU and perfused 3 weeks later. The number of newly generated cells in the subgranular zone/granule cell layer of the dentate gyrus was significantly lower in older animals and decreased linearly with age. A similar age-related decline in new cells was observed in the subventricular zone but not in the hilar region of the dentate gyrus. These data demonstrate that a substantial decrease in neurogenesis occurs before the onset of old age in the adult marmoset brain, suggesting the possibility that similar alterations occur in the human brain.

• Antibodies to CD4-induced sites in HIV gp120 correlate with the control of SHIV challenge in macaques vaccinated with subunit immunogens. DeVico, A., Fouts, T., Lewis, G. K., Gallo, R. C., Godfrey, K., Charurat, M., Harris, I., Galmin, L., & Pal, R. (Inst. of Human Virology, Univ. of Maryland Biotech. Inst., Baltimore, MD 21201 [e-mail: *devico@umbi.umd.edu*]). *Proceedings of the National Academy of Sciences*, *U.S.A.*, 2007, *104*, 17477-17482.

"Epitopes located in and around the coreceptor binding site of HIV-1 envelope glycoprotein (gp120) exhibit enhanced exposure after attachment to the CD4 receptor and comprise some of the most conserved and functionally important residues on the viral envelope. Therefore, antibody responses to these epitopes [designated as CD4-induced (CD4i)] should be highly cross-reactive and potentially useful for HIV vaccine development. To address this question, rhesus macaques were vaccinated with subunit immunogens designed to raise humoral responses against CD4i epitopes and challenged rectally with $SHIV_{162P3}$, which encodes a heterologous envelope versus the immunogen. We found that animals vaccinated with a rhesus full-length single-chain (rhFLSC) complex exhibited significantly accelerated clearance of plasma viremia and an absence of long-term tissue viremia compared with unvaccinated control animals. Such control of infection correlated with stronger responses to CD4i epitopes in the rhFLSC-vaccinated animals, compared with macaques immunized with gp120, cross-linked gp120–CD4 complexes, or soluble CD4 alone. These responses were strongly boosted in the rhFLSC-vaccinated animals by $SHIV_{162P3}$ infection. The control of infection was not associated with anti-CD4 responses, overall anti-gp120-binding titers, or neutralizing activity measured in conventional assays. Vaccine-naive animals also developed anti-CD4i epitope responses after simian/human immunodeficiency virus (SHIV) challenge, which appeared later than the overall anti-gp120 responses and in concert with the decline of viremia to a low set point. Collectively, these data suggest that antibodies to CD4i epitopes

may play a role in controlling SHIV infection and provide insights for HIV vaccine development."

• The origins of cognitive dissonance: Evidence from children and monkeys. Egan, L. C., Santos, L. R., & Bloom, P. (Dept of Psychology, Yale Univ., 2 Hillhouse Ave., New Haven, CT 06520 [e-mail: *louisa.egan@yale.edu*]). *Psychological Science*, 2007, *18,* 978-983.

"In a study exploring the origins of cognitive dissonance, preschoolers and capuchins were given a choice between two equally preferred alternatives (two different stickers and two differently colored M&Ms, respectively). On the basis of previous research with adults, this choice was thought to cause dissonance because it conflicted with subjects' belief that the two options were equally valuable. We therefore expected subjects to change their attitude toward the unchosen alternative, deeming it less valuable. We then presented subjects with a choice between the unchosen option and an option that was originally as attractive as both options in the first choice. Both groups preferred the novel over the unchosen option in this experimental condition, but not in a control condition in which they did not take part in the first decision. These results provide the first evidence of decision rationalization in children and nonhuman primates. They suggest that the mechanisms underlying cognitive-dissonance reduction in human adults may have originated both developmentally and evolutionarily earlier than previously thought."

• Impairment of actions chains in autism and its possible role in intention understanding. Cattaneo, L., Fabbri-Destro, M., Boria, S., Pieraccini, C., Monti, A., Cossu, G., & Rizzolatti, G. (G. R., Dipto di Neuroscienze, Univ. di Parma, Via Volturno 39, 43100 Parma, Italy [e-mail: *giacomo.rizzolatti@unipr.it*]). *Proceedings of the National Academy of Sciences, U.S.A.*, 2007, *104*, 17825-17830.

"Experiments in monkeys demonstrated that many parietal and premotor neurons coding a specific motor act (e.g., grasping) show a markedly different activation when this act is part of actions that have different goals (e.g., grasping for eating vs. grasping for placing). Many of these 'action-constrained' neurons have mirror properties firing selectively to the observation of the initial motor act of the actions to which they belong motorically. By activating a specific action chain from its very outset, this mechanism allows the observers to have an internal copy of the whole action before its execution, thus enabling them to understand directly the agent's intention. Using electromyographic recordings, we show that a similar chained organization exists in typically developing children, whereas it is impaired in children with autism. We propose that, as a consequence of this functional impairment, high-functioning autistic children may understand the intentions of others cognitively but lack the mechanism for understanding them experientially."

• B lymphocyte-directed immunotherapy promotes long-term islet allograft survival in nonhuman primates. Liu, C., Noorchashm, H., Sutter, J. A., Naji, M., Prak, E. L., Boyer, J., Green, T., Rickels, M. R., Tomaszewsk, J. E., Koeberlein, B., Wang, Z., Paessler, M. E., Velidedeoglu, E., Rostami, S. Y., Yu, M., Barker, C. F., & Naji, A. (A. N., Dept of Surgery, Univ. of Penn. Sch. of Med., Philadelphia, PA 19104 [e-mail: *Ali.Naji@uphs.upenn.edu*]). *Nature Medicine*, 2007, *13*, 1295-1298.

"We found that an induction immunotherapy regimen consisting of rabbit anti-thymocyte globulin (Thymoglobulin) and the monoclonal antibody to CD20 rituximab (Rituxan) promoted long-term islet allograft survival in cynomolgus macaques maintained on rapamycin monotherapy. B lymphocyte reconstitution after rituximab-mediated depletion was characterized by a preponderance of immature and transitional cells, whose persistence was associated with long-term islet allograft survival. Development of donor-specific alloantibodies was abrogated only in the setting of continued rapamycin monotherapy."

• Producing primate embryonic stem cells by somatic cell nuclear transfer. Byrne, J. A., Pedersen, D. A., Clepper, L. L., Nelson, M., Sanger, W. G., Gokhale, S., Wolf. D. P., & Mitalipov, S. M. (S. M. M., Oregon Stem Cell Center, Oregon Health & Science University, 505 N.W. 185th Ave, Beaverton, OR 97006 [e-mail: *mitalipo@ohsu.edu*]). *Nature*, 2007, *450*, 497-502.

"Derivation of embryonic stem (ES) cells genetically identical to a patient by somatic cell nuclear transfer (SCNT) holds the potential to cure or alleviate the symptoms of many degenerative diseases while circumventing concerns regarding rejection by the host immune system. However, the concept has only been achieved in the mouse, whereas inefficient reprogramming and poor embryonic development characterizes the results obtained in primates. Here, we used a modified SCNT approach to produce rhesus macaque blastocysts from adult skin fibroblasts, and successfully isolated two ES cell lines from these embryos. DNA analysis confirmed that nuclear DNA was identical to donor somatic cells and that mitochondrial DNA originated from oocytes. Both cell lines exhibited normal ES cell morphology, expressed key stem-cell markers, were transcriptionally similar to control ES cells and differentiated into multiple cell types in vitro and in vivo. Our results represent successful nuclear reprogramming of adult somatic cells into pluripotent ES cells and demonstrate proof-of-concept for therapeutic cloning in primates."

• Determination of virus burst size *in vivo* using a single-cycle SIV in rhesus macaques. Chen, H. Y., Di Mascio, M., Perelson, A. S., Ho, D. D., & Zhang, L. (L. Z., Aaron Diamond AIDS Research Ctrr, Rockefeller Univ., 455 First Ave, New York, NY 10016 [e-mail:

lzhang@adarc.org]). *Proceedings of the National Academy of Sciences, U.S.A.*, 2007, *104*, 19079-19084.

"A single-cycle simian immunodeficiency virus (scSIV) that undergoes only one round of infection and replication was constructed to calculate the total number of virons produced by an SIV-infected cell *in vivo*. Four Mamu-A*01 rhesus macaques were inoculated on two occasions 11 weeks apart with the scSIV by *ex vivo* infection and i.v. reinfusion of autologous cells. After each inoculation, plasma viral loads peaked between 1 and 2.5 days and then declined exponentially in one or two phases to below detection limits within 2 weeks. Although higher levels of SIV-specific cytotoxic T lymphocytes and modest increases in antibody responses were observed for each animal after the second inoculation, decay rates of the infected cells were only minimally affected. Analyzing the viral load data with a mathematical model, the *in vivo* viral burst size averaged 4.0 x 10^4 and 5.5 x 10^4 virions per cell for the first and second inoculations, respectively, with no significant difference between the two inoculations. This estimate, in conjunction with our prior understanding of other quantitative viral and cellular parameters during SIV and HIV infection, provides critical insights into the dynamic process of viral production and its interplay with the infected host *in vivo*."

Animal Welfare

• Appendix A of the European Convention for the Protection of Vertebrate Animals Used for Experimental and Other Scientific Purposes (ETS No. 123). Strasbourg, France: Council of Europe, enacted June 15, 2007, <conventions.coe.int/Treaty/EN/Treaties/PDF/123-Arev.pdf>.

• Peri-anaesthetic and anaesthetic-related mortality risks in great apes (Hominidae) in zoological collections in the UK and Ireland. Masters, N. J., Burns, F. M., & Lewis, J. C. M. (International Zoo Veterinary Group, Keighley Business Ctr, Keighley, West Yorkshire, BD21 1AG, U.K. [e-mail: *n.masters@izvg.co.uk*]). *Veterinary Anaesthesia and Analgesia*, 2007, *34*, 431-442.

To estimate the risk of death and identify the major risk factors for peri-anesthetic mortality in great apes that underwent anesthesia in 16 zoological collections in the U.K. and Ireland between 1 January 1990 and 30 June 2005, all available anesthetic records were collected. Outcome at 7 days post-anesthesia was recorded as alive, dead, or euthanized. The risk of peri-anesthetic mortality was calculated. Multivariable analysis of potential risk factors was performed. A total of 1182 anesthetic records were collected and analysed. Sixteen peri-anesthetic deaths occurred, resulting in a peri-anesthetic mortality risk of 1**.**35%**.** Twenty percent of deaths (3/15) occurred during maintenance and 80% (12/15) occurred post-anesthetic but within 7 days. A subjective assessment suggests at least five anesthetic-related deaths occurred; in other words an anesthetic-related mortality risk of 0.42% (5/1182) or above. In the multivariable analysis, health status and age were significantly associated with peri-anesthetic mortality. Animals assessed as "sick" pre-anesthetic were associated with a 26-fold (95% CI 5.55–122.32) increased risk of death compared with animals with a good health status. Animals aged over 30 years were associated with a 30-fold (95% CI 3.44–261.85) increased risk of death, compared with adults aged between 10 and 30 years. This study has shown that great ape anesthesia appears to carry a high risk of mortality. Sick and aged patients are at an increased risk of death and particular care should be exercised during their anesthesia. Standardization and completeness of anesthetic records across zoological collections would assist greatly in further studies.

Behavior

• Nonhuman primates prefer slow tempos but dislike music overall. McDermott, J., & Hauser, M. D. (Dept of Brain & Cog. Sciences, MIT, Perceptual Sci. Group, NE20-444, 77 Mass. Ave., Cambridge, MA 02139 [e-mail: *jhm@MIT.EDU*]). *Cognition*, 2007, *104*, 654-668.

"Human adults generally find fast tempos more arousing than slow tempos, with tempo frequently manipulated in music to alter tension and emotion. We used a previously published method to test cotton-top tamarins and common marmosets, two New World primates, for their spontaneous responses to stimuli that varied systematically with respect to tempo. Across several experiments, we found that both tamarins and marmosets preferred slow tempos to fast. It is possible that the observed preferences were due to arousal, and that this effect is homologous to the human response to tempo. In other respects, however, these two monkey species showed striking differences compared to humans. Specifically, when presented with a choice between slow tempo musical stimuli, including lullabies, and silence, tamarins and marmosets preferred silence whereas humans, when similarly tested, preferred music. Thus despite the possibility of homologous mechanisms for tempo perception in human and nonhuman primates, there appear to be motivational ties to music that are uniquely human."

• Chimpanzees modify recruitment screams as a function of audience composition. Slocombe, K. E., & Zuberbühler, K. (Dept of Psychology, Univ. of York, York YO10 5DD, U.K. [e-mail: *ks553@york.ac.uk*]). *Proceedings of the National Academy of Sciences, U.S.A.*, 2007, *104*, 17228-17233.

"Wild chimpanzees produce acoustically distinct scream vocalizations depending on their social role during agonistic interactions with other group members. Here, we show that victims during such agonistic interactions alter the acoustic structure of their screams depending on the severity of aggression experienced, providing nearby

listeners with important cues about the nature of the attack. However, we also found that victims of severe attacks produced screams that significantly exaggerated the true level of aggression experienced, but they did so only if there was at least one listener in the audience who matched or surpassed the aggressor in rank. Our results are consistent with the more general hypothesis that chimpanzees possess sophisticated understanding of third-party relationships, so-called triadic awareness, and that this knowledge influences their vocal production."

• Learning by observation in rhesus monkeys. Meunier, M., Monfardini, E., & Boussaoud, D. (Inst de Neurosciences Cognitives de la Méditerranée, UMR6193, CNRS, 31, Chemin Joseph Aiguier, 13402 Marseille Cedex 20, France [e-mail: *meunier@incm.cnrs-mrs.fr*]). *Neurobiology of Learning and Memory*, 2007, *88*, 243-248.

"Habit memory provides us with a vast repertoire of learned rules, including stimulus-reward associations, that ensures fast and adapted decision making in daily life. Because we share this ability with monkeys, lesion and recording studies in rhesus macaques have played a key role in understanding the neural bases of individual trial-and-error habit learning. Humans, however, can learn new rules at a lower cost via observation of conspecifics. The neural properties underlying this more ecological form of habit learning remain unexplored, and it is unclear whether the rhesus macaque can be a useful model in this endeavor. We addressed this issue by testing four monkeys from the same social group in their usual semi-natural habitat using a well-established marker of habit memory, concurrent discrimination learning. Each monkey learned 24 lists of 10 object-reward associations each. For one list out of two, monkeys could observe the testing session of another member of the group prior to being tested with the same list themselves. Learning was faster for these lists than for those learned solely by trial-and-error. Errors to criterion (9/10 correct responses) were reduced by 39%, and faultless performance could be achieved for up to 5 of the 10 pairs. These data demonstrate that rhesus macaques spontaneously observe a conspecific learning new stimulus-reward associations, and substantially benefit from this observation. The data ascertain that the neural underpinnings of socially-mediated forms of habit learning can be explored using the powerful tools of monkey research, including neurophysiological recordings."

• Phylogenetic analyses of behavior support existence of culture among wild chimpanzees. Lycett, S. J., Collard, M., & McGrew, W. C. (Univ. of Liverpool, Hartley Bldg, Brownlow St, Liverpool L69 3BX, U. K. [e-mail: *s.lycett@liverpool.ac.uk*]). *Proceedings of the National Academy of Sciences, U.S.A.*, 2007, *104*, 17588-17592.

"Culture has long been considered to be not only unique to humans, but also responsible for making us qualitatively different from all other forms of life. In recent years, however, researchers studying chimpanzees (*Pan troglodytes*) have challenged this idea. Natural populations of chimpanzees have been found to vary greatly in their behavior. Because many of these inter-population differences cannot be readily explained by ecological factors, it has been argued that they result from social learning and, therefore, can be regarded as cultural variations. Recent studies showing social transmission in captive chimpanzee populations suggest that this hypothesis is plausible. However, the culture hypothesis has been questioned on the grounds that the behavioral variation may be explained at a proximate level by genetic differences between subspecies. Here we use cladistic analyses of the major cross-site behavioral data set to test the hypothesis that the behavioral differences among the best-documented chimpanzee populations are genetically determined. If behavioral diversity is primarily the product of genetic differences between subspecies, then population data should show less phylogenetic structure when data from a single subspecies (*P. t. schweinfurthii*) are compared with data from two subspecies (*P. t. verus* and *P. t. schweinfurthii*) analyzed together. Our findings are inconsistent with the hypothesis that the observed behavioral patterns of wild chimpanzee populations can be explained primarily by genetic differences between subspecies. Instead, our results support the suggestion that the behavioral patterns are the product of social learning and, therefore, can be considered cultural."

• A salience theory of learning and behavior: With perspectives on neurobiology and cognition. Rumbaugh, D. M., King, J. E., Beran, M. J., Washburn, D. A., & Gould, K. L. (Great Ape Trust of Iowa, Des Moines, IA 50320 [e-mail: *drumbaug@aol.com*]). *International Journal of Primatology*, 2007, *28*, 973-996.

"Traditional behaviorists have described behaviors fundamentally as responses to stimuli or, perhaps more liberally, as behaviors under the control of discriminative stimuli or contexts. They have held responses or behaviors to be established, strengthened, sustained, and inhibited or extinguished by contingent events: notably reinforcers, punishers, or the absence of either. In addition, they believed reinforcement acts on the response, the behavior, not on the organism. Here, and in support of Hebb's view, we advance a contrarian view. A key principle of our framework is that species' brains are uniquely designed to perceive and to relate stimulus events that are contiguous, salient, and relevant to adaptation. In accordance with what we here view as the constructive biases of species' brains, stimuli are differentially organized into amalgams that reflect an exchange of salience and response-eliciting properties of component units, which are then integrated to form a basis of knowledge about the organism and its ecological niche. One can then base adaptation on overarching principles and rules, not just on simple associations. Species may create emergent behav-

iors with no history of specific training, and even new capacities, to service adaptation to both familiar and novel challenges."

• Chimpanzees use self-distraction to cope with impulsivity. Evans, T. A., & Beran, M. J. (Language Research Ctr, Georgia State Univ., University Plaza, Atlanta, GA 30302). *Biology Letters*, 2007, *3*, 599-602.

"It is unknown whether animals, like humans, can employ behavioral strategies to cope with impulsivity. To examine this question, we tested whether chimpanzees (*Pan troglodytes*) would use self-distraction as a coping strategy in a situation in which they had to continually inhibit responses to accumulating candies in order to earn a greater amount of those rewards. We tested animals in three conditions in which they were sometimes given a set of toys and were sometimes allowed physical access to the accumulating candies. Chimpanzees allowed the rewards to accumulate longer before responding when they could divert their attention to the toys, and they manipulated the toys more when the candies were physically accessible. Thus, chimpanzees engaged in self-distraction with the toys when such behavior was most beneficial as a coping mechanism."

• Inequity responses of monkeys modified by effort. van Wolkenten, M., Brosnan, S. F., & de Waal, F. B. M. (Dept of Psychology, Georgia State Univ., P.O. Box 5010, Atlanta, GA 30302-5010 [e-mail: *sbrosnan@gsu.edu*]). *Proceedings of the National Academy of Sciences, U.S.A.*, 2007, *47*, 18854-18859.

Without joint benefits, joint actions could never have evolved. Cooperative animals need to monitor closely how large a share they receive relative to their investment toward collective goals. This work documents the sensitivity to reward division in brown, or tufted, capuchin monkeys (*Cebus apella*). In addition to confirming previous results with a larger subject pool, this work rules out several alternative explanations and adds data on effort sensitivity. Thirteen adult monkeys exchanged tokens for rewards, showing negative reactions to receiving a less-favored reward than their partner. Because their negative reaction could not be attributed to the mere visibility of better rewards (greed hypothesis) nor to having received such rewards in the immediate past (frustration hypothesis), it must have been caused by seeing their partner obtain the better reward. Effort had a major effect in that by far the lowest level of performance in the entire study occurred in subjects required to expend a large effort while at the same time seeing their partner receive a better reward. It is unclear whether this effort–effect was based on comparisons with the partner, but it added significantly to the intensity of the inequity response. These effects are as expected if the inequity response evolved in the context of cooperative survival strategies.

• Working memory of numerals in chimpanzees. Inoue, S., & Matsuzawa, T. (T. M., Primate Research Inst., Kyoto Univ., Inuyama, Aichi 484-8506, Japan [e-mail: *matsuzaw@pri.kyoto-u.ac.jp*]). *Current Biology*, 2007, *17*, R1004-R1005.

Chimpanzee memory has been extensively studied. The general assumption is that, as with many other cognitive functions, it is inferior to that of humans; some data, however, suggest that, in some circumstances, chimpanzee memory may indeed be superior to human memory. Here we report that young chimpanzees have an extraordinary working memory capability for numerical recollection – better even than that of human adults tested in the same apparatus following the same procedure.

• Savanna chimpanzees use tools to harvest the underground storage organs of plants. Hernandez-Aguilar, R. A., Moore, J., & Pickering, T. R. (T. R. P., Dept of Anthropology, Univ. of Wisconsin, Madison, WI 53706 [e-mail: *tpickering@wisc.edu*]). *Proceedings of the National Academy of Sciences, U.S.A.,* 2007, *104*, 19210-19213.

"It has been hypothesized that plant underground storage organs (USOs) played key roles in the initial hominin colonization of savanna habitats, the development of the distinctive skull and tooth morphology of the genus *Australopithecus*, and the evolution of the genus *Homo* by serving as "fallback foods" exploited during periods of food shortage. These hypotheses have been tested mostly by morphological, isotopic, and microwear analyses of hominin bones and teeth. Archaeological evidence of USO digging technology is equivocal. Until now relevant data from studies of chimpanzees, useful in behavioral models of early hominins because of their phylogenetic proximity and anatomical similarities, have been lacking. Here we report on the first evidence of chimpanzees using tools to dig for USOs, suggesting that exploitation of such resources was within the cognitive and technological reach of the earliest hominins. Consistent with scenarios of hominin adaptation to savannas, these data come from Ugalla (Tanzania), one of the driest, most open and seasonal chimpanzee habitats. USOs are, however, exploited during the rainy season, well after the period of most likely food shortage, contradicting the specific prediction of fallback food hypotheses. The discovery that savanna chimpanzees use tools to obtain USOs contradicts yet another claim of human uniqueness and provides a model for the study of variables influencing USO use among early hominins."

• Embraces for infant handling in spider monkeys: Evidence for a biological market? Slater, K. Y., Schaffner, C. M., & Aureli, F. (Res. Dept, Operation Wallacea Trust, Hope House, Old Bolingbroke, Lincolnshire PE234EX, U.K.. [e-mail: *kathy.slater@opwall.com*]). *Animal Behaviour,* 2007, *74*, 455-461.

"The presence of young infants influences female primate social behavior, in particular social grooming,

which may be exchanged for infant access within a biological market place. Although social grooming is common among Old World primate species, it is rarely observed in a number of New World primate species, including spider monkeys. We investigated whether affiliative behavior is exchanged for infant handling among wild female spider monkeys, *Ateles geoffroyi yucatanesis*. Occurrences of approaches, grooming and embraces received by 15 adult females were compared when they had infants less than 6 months old ('mothers') and at all other times. The occurrence of grooming was not influenced by the presence of infants. However, females received significantly more approaches and embraces when they were mothers compared to all other times. As mothers, they received significantly more embraces than they gave, indicating that the increase in friendly behavior received was due to increased interest from other females and not simply a general increase in sociality. The exchange of embraces for infant handling was subject to a market effect as the proportion of embraces given to mothers followed by infant handling decreased when fewer infants were present in the group. Although spider monkeys use embraces as the primary means of gaining access to infants, whether embraces provide long-term benefits to the recipient, remains to be determined. Thus, embraces may only serve to signal benign intent and reassure mothers during tense interactions such as infant handling."

• Effects of food preferences on token exchange and behavioural responses to inequality in tufted capuchin monkeys, *Cebus apella.* Fontenot, M. B., Watson, S. L., Roberts, K. A., & Miller, R. W. (Lafayette-New Iberia Research Ctr, 4401 W. Admiral Doyle Dr., New Iberia, LA 70560 [e-mail: *bfontenot@louisiana.edu*]). *Animal Behaviour***,** 2007, *74*, 487-496.

"We examined the extent to which female capuchin monkeys show an 'aversion to inequitable work effort' by providing the monkeys with the opportunity to engage in token exchange tasks to earn either a preferred (grape) or nonpreferred (oat cereal) food item. In experiment 1, monkeys were paired with partners such that both were required to exchange a token (work effort) for either a preferred or nonpreferred food reward. The subject's exchange behavior was then compared to conditions in which the partner received the food reward for no work effort. We found no evidence that differential work effort influenced the percentage of incomplete exchanges. Furthermore, capuchins completed exchanges more rapidly for the preferred food item, regardless of the work effort of the partner. In experiment 2, we evaluated, in the absence of differential work effort, behavioral responses of monkeys to receipt of a preferred or nonpreferred food in conditions where their partner received either the same or different food. These conditions were compared to control conditions where either the same or different food was placed in an adjacent empty cage. Capuchins were less likely to accept nonpreferred food and consumed it more slowly than preferred food. We found no evidence that the presence of a partner influenced acceptance or consumption of the nonpreferred food under inequitable conditions. Overall, we found no indication that capuchins are able to evaluate either the relative work effort of a partner or the inequity of a food reward and are thus unlikely to possess an 'aversion to inequity'."

Conservation

• Forest fragmentation, the decline of an endangered primate, and changes in host–parasite interactions relative to an unfragmented forest. Gillespie, T. R., & Chapman, C. A. (Div. of Epidemiol., Dept of Pathobiol., College of Vet. Med., Univ. of Illinois, 2001 S. Lincoln Ave, Urbana, IL 61802 [e-mail: *trg@uiuc.edu*]). *American Journal of Primatology*, 2007, *69*, 1-13.

"Forest fragmentation may alter host–parasite interactions in ways that contribute to host population declines. We tested this prediction by examining parasite infections and the abundance of infective helminths in 20 forest fragments and in unfragmented forest in Kibale National Park, Uganda. Over 4 years, the endangered red colobus (*Procolobus rufomitratus*) declined by 20% in fragments, whereas the black-and-white colobus (*Colobus guereza*) in fragments and populations of both colobines in unfragmented forest remained relatively stable. Seven nematodes (*Strongyloides fulleborni, Strongyloides stercoralis, Oesophagostomum* sp., an unidentified strongyle, *Trichuris* sp., *Ascaris* sp., and *Colobenterobius* sp.), one cestode (*Bertiella* sp.), and three protozoans (*Entamoeba coli, Entamoeba histolytica/dispar*, and *Giardia* sp.) were detected. Infection prevalence and the magnitude of multiple infections were greater for red colobus in fragmented than in unfragmented forest, but these parameters did not differ between forests for black-and-white colobus. Infective-stage colobus parasites occurred at higher densities in fragmented compared with unfragmented forest, demonstrating greater infection risk for fragmented populations. There was little evidence that the nature of the infection was related to the size of the fragment, the density of the host, or the nature of the infection in the other colobine, despite the fact that many of the parasites are considered generalists. This study suggests that forest fragmentation can alter host–parasite dynamics and demonstrates that such changes can correspond with changes in host population size in forest fragments."

• Primate tourism, range restriction, and infant risk among *Macaca thibetana* at Mt. Huangshan, China. Berman, C. M., Li, J., Ogawa, H., Ionica, C., & Yin, H. (Dept of Anthropology, State Univ, of New York, Buffalo, NY 14261 [e-mail: *cberman@buffalo.edu*]). *International Journal of Primatology*, 2007, *28*, 1123-1141.

"Primate tourism is a growing trend in habitat countries, but few assessments of its impact on primate groups

are available. We compare infant mortality in a group of Tibetan macaques 6 yr before the government translocated the group and subsequently used them for tourism (1986-91), 12 yr during management for tourism (1992-2002, 2004), and 1 yr when management was temporarily suspended (2003). We also compare aggression rates among adults before and during management, and test several hypotheses about specific factors (numbers of tourists, degree of range restriction, demographic changes, changes in α-males) that may have harmed infants. Infant mortality was significantly higher during management than before, but it was similar before management vs. during its suspension. After management began, serious attacks on infants occurred shortly before they died, and many infant corpses had bite wounds. Typically, infants sustained wounds after aggression broke out among adults in the provisioning area used for tourist viewing. Adult aggression rates in the provisioning area correlated positively with infant mortality over time. Range restriction accounted for 54.5% of the variation in infant mortality, and was more closely associated with both mortality and aggression than any other specific factor examined. We hypothesize that range restriction led to increased infant mortality by raising aggression levels in the provisioning area. We conclude that infant mortality is useful as an indicator of the impact of tourism on primate groups, and that range restriction is an inappropriate tourism management practice."

Disease

• Effects of simian immunodeficiency virus on the circadian rhythms of body temperature and gross locomotor activity. Huitron-Resendiz, S., Marcondes, M. C. G., Flynn, C. T., Lanigan, C. M. S., & Fox, H. S. (H. S. F., Dept of Molecular & Integrative Neurosciences, SP30-2030, Scripps Research Inst., 10550 N. Torrey Pines Rd, La Jolla, CA 92037 [e-mail: *hsfox@scripps.edu*]). *Proceedings of the National Academy of Sciences, U.S.A.*, 2007, *104*, 15138-15143.

"In monkeys infected with simian immunodeficiency virus (SIV), changes in body temperature and locomotor activity occur after the acute retroviral syndrome stage of the disease. However, alterations to the circadian rhythm of these factors in SIV-infected monkeys have not been reported. To determine whether the circadian rhythm of body temperature and locomotor activity are disrupted during SIV infection, we analyzed the temperature and activity patterns of SIV-infected monkeys through different stages of the disease, progressing to SIV encephalitis by using the cosinor model for circadian oscillation. We found that SIV infection resulted in significant impairments of the amplitude and mean of the circadian rhythm of body temperature and activity and in the acrophase of the circadian rhythm for temperature. These alterations were not related to changes observed in the acute febrile response induced after viral inoculation. In animals killed once marked circadian anomalies were evident, microglia infiltration and macrophage accumulation in the hypothalamus were observed. Together, these results clearly demonstrate that SIV infection compromises aspects of circadian regulation in monkeys, with important implications for physiological functions, including cognition, in HIV-infected individuals."

• Isolates of Zaire ebolavirus from wild apes reveal genetic lineage and recombinants. Wittmann, T. J., Biek, R., Hassanin, A., Rouquet, P., Reed, P., Yaba, P., Pourrut, X., Real, L. A., Gonzalez, J.-P., & Leroy, E. M. (E. M. L., Inst de Recherche pour le Développement, UR178, Mahidol Univ. at Salaya, Phutthamonthon 4, Nakhonpathom 73170, Thailand [e-mail: *eric.leroy@ird.fr*]). *Proceedings of the National Academy of Sciences, U.S.A.*, 2007, *104*, 17123-17127.

"Over the last 30 years, Zaire ebolavirus (ZEBOV), a virus highly pathogenic for humans and wild apes, has emerged repeatedly in Central Africa. Thus far, only a few virus isolates have been characterized genetically, all belonging to a single genetic lineage and originating exclusively from infected human patients. Here, we describe the first ZEBOV sequences isolated from great ape carcasses in the Gabon/Congo region that belong to a previously unrecognized genetic lineage. According to our estimates, this lineage, which we also encountered in the two most recent human outbreaks in the Republic of the Congo in 2003 and 2005, diverged from the previously known viruses around the time of the first documented human outbreak in 1976. These results suggest that virus spillover from the reservoir has occurred more than once, as predicted by the multiple emergence hypothesis. However, the young age of both ZEBOV lineages and the spatial and temporal sequence of outbreaks remain at odds with the idea that the virus simply emerged from a long-established and widespread reservoir population. Based on data from two ZEBOV genes, we also demonstrate, within the family *Filoviridae*, recombination between the two lineages. According to our estimates, this event took place between 1996 and 2001 and gave rise to a group of recombinant viruses that were responsible for a series of outbreaks in 2001–2003. The potential for recombination adds an additional level of complexity to unraveling and potentially controlling the emergence of ZEBOV in humans and wildlife species."

• Protection against simian/human immunodeficiency virus (SHIV) 89.6P in macaques after coimmunization with SHIV antigen and IL-15 plasmid. Boyer, J. D., Robinson, T. M., Kutzler, M. A., Vansant, G., Hokey, D. A., Kumar, S., Parkinson, R., Wu, L., Sidhu, M. K., Pavlakis, G. N., Felber, B. K., Brown, C., Silvera, P., Lewis, M. G., Monforte, J., Waldmann, T. A., Eldridge, J., & Weiner, D. B. (D. B. W., Dept of Pathology & Lab. Med., Univ. of Penn. School of Med., 422 Curie Blvd, Philadelphia, PA 19104 [e-mail: *dbweiner@mail.med.upenn.edu*]). *Pro-*

ceedings of the National Academy of Sciences, U.S.A., 2007, *104*, 18648-18653.

"The cell-mediated immune profile induced by a recombinant DNA vaccine was assessed in the simian/HIV (SHIV) and macaque model. The vaccine strategy included coimmunization of a DNA-based vaccine alone or in combination with an optimized plasmid encoding macaque IL-15 (pmacIL-15). We observed strong induction of vaccine-specific IFN-γ-producing $CD8^+$ and $CD4^+$ effector T cells in the vaccination groups. Animals were subsequently challenged with 89.6p. The vaccine groups were protected from ongoing infection, and the IL-15 covaccinated group showed a more rapidly controlled infection than the group treated with DNA vaccine alone. Lymphocytes isolated from the group covaccinated with pmacIL-15 had higher cellular proliferative responses than lymphocytes isolated from the macaques that received SHIV DNA alone. Vaccine antigen activation of lymphocytes was also studied for a series of immunological molecules. Although mRNA for IFN-γ was upregulated after antigen stimulation, the inflammatory molecules IL-8 and MMP-9 were down-regulated. These observed immune profiles are potentially reflective of the ability of the different groups to control SHIV replication. This study demonstrates that an optimized IL-15 immune adjuvant delivered with a DNA vaccine can impact the cellular immune profile in nonhuman primates and lead to enhanced suppression of viral replication."

Evolution, Genetics, and Taxonomy

• Postcranial evidence from early *Homo* from Dmanisi, Georgia. Lordkipanidze, D., Jashashvili, T., Vekua, A., Ponce de León, M. S., Zollikofer, C. P. E., Rightmire, G. P., Pontzer, H., Ferring, R., Oms, O., Tappen, M., Bukhsianidze, M., Agusti, J., Kahlke, R., Kiladze, G., Martinez-Navarro, B., Mouskhelishvili, A., Nioradze, M., & Rook, L. (Georgian National Museum, 0105 Tbilisi, Georgia [e-mail: *dlordkipanidze@museum.ge*]). *Nature*, 2007, *449*, 305-310, <www.nature.com/nature/journal/v449/n7160/full/nature06134.html>.

"The Plio-Pleistocene site of Dmanisi, Georgia, has yielded a rich fossil and archeological record documenting an early presence of the genus *Homo* outside Africa. Although the craniomandibular morphology of early *Homo* is well known as a result of finds from Dmanisi and African localities, data about its postcranial morphology are still relatively scarce. Here we describe newly excavated post-cranial material from Dmanisi comprising a partial skeleton of an adolescent individual, associated with skull D2700/D2735, and the remains from three adult individuals. This material shows that the postcranial anatomy of the Dmanisi hominins has a surprising mosaic of primitive and derived features. The primitive features include a small body size, a low encephalization quotient and absence of humeral torsion; the derived features include modern-human-like body proportions and lower limb morphology indicative of the capability for long-distance travel. Thus, the earliest known hominins to have lived outside of Africa in the temperate zones of Eurasia did not yet display the full set of derived skeletal features."

• Preexisting-bias hypothesis. Fernandez, A. A., & Morris, M. R. (Dept of Biol. Sciences, Ohio Univ., Athens, OH 45701 [e-mail: *af180603@ohio.edu*]). *American Naturalist*, 2007, *170*[1], 10-20, <www.journals.uchicago.edu/AN/journal/issues/v170n1/41851/brief/41851.abstract.html>.

"The evolution of trichromatic color vision in primates may improve foraging performance as well as intraspecific communication; however, the context in which color vision initially evolved is unknown. We statistically examined the hypothesis that trichromatic color vision in primates represents a preexisting bias for the evolution of red coloration (pelage and/or skin) through sexual selection. Our analyses show that trichromatic color vision evolved before red pelage and red skin, as well as before gregarious mating systems that would promote sexual selection for visual traits and other forms of intraspecific communication via red traits. We also determined that both red pelage and red skin were more likely to evolve in the presence of color vision and mating systems that promote sexual selection. These results provide statistical support for the hypothesis that trichromatic color vision in primates evolved in a context other than intraspecific communication with red traits, most likely foraging performance, but, once evolved, represented a preexisting bias that promoted the evolution of red traits through sexual selection."

• The derived FOXP2 variant of modern humans was shared with Neandertals. Krause, J., Lalueza-Fox, C., Orlando, L., Enard, W., Green, R. E., Burbano, H. A., Hublin, J.-J., Hänni, C., Fortea, J., de la Rasilla, M., Bertranpetit, J., Rosas, A., & Pääbo, S. (Max Planck Inst. for Evolutionary Anthropology, Deutscher Platz 6, 04103 Leipzig, Germany [e-mail: *krause@eva.mpg.de*]). *Current Biology*, 2007, *17*, 1908-1912.

"Although many animals communicate vocally, no extant creature rivals modern humans in language ability. Therefore, knowing when and under what evolutionary pressures our capacity for language evolved is of great interest. Here, we find that our closest extinct relatives, the Neandertals, share with modern humans two evolutionary changes in *FOXP2*, a gene that has been implicated in the development of speech and language. We furthermore find that in Neandertals, these changes lie on the common modern human haplotype, which previously was shown to have been subject to a selective sweep. These results suggest that these genetic changes and the selective sweep pre-date the common ancestor (which existed about 300,000-400,000 years ago) of modern human and Neandertal populations. This is in contrast to more recent

age estimates of the selective sweep based on extant human diversity data. Thus, these results illustrate the usefulness of retrieving direct genetic information from ancient remains for understanding recent human evolution."

• Molecular and genomic data identify the closest living relative of primates. Janečka, J. E., Miller, W., Pringle, T. H., Wiens, F., Zitzmann, A., Helgen, K. M., Springer, M. S., & Murphy, W. J. (W. J. M., (Dept of Veterinary Integrative Biosciences, College of Vet. Med. & Biomed. Sciences, Vet. Med. Admin. Bldg, Rm 107, Texas A&M Univ., College Station, TX 77843-4458 [e-mail: *wmurphy@cvm.tamu.edu*]). *Science*, 2007, *318*, 792-794.

"A full understanding of primate morphological and genomic evolution requires the identification of their closest living relative. In order to resolve the ancestral relationships among primates and their closest relatives, we searched multispecies genome alignments for phylogenetically informative rare genomic changes within the superordinal group Euarchonta, which includes the orders Primates, Dermoptera (colugos), and Scandentia (treeshrews). We also constructed phylogenetic trees from 14 kilobases of nuclear genes for representatives from most major primate lineages, both extant colugos, and multiple treeshrews, including the pentail treeshrew, *Ptilocercus lowii*, the only living member of the family Ptilocercidae. A relaxed molecular clock analysis including *Ptilocercus* suggests that treeshrews arose approximately 63 million years ago. Our data show that colugos are the closest living relatives of primates and indicate that their divergence occurred in the Cretaceous."

• A new Late Miocene great ape from Kenya and its implications for the origins of African great apes and humans. Kunimatsu, Y., Nakatsukasa, M., Sawada, Y., Sakai, T., Hyodo, M., Hyodo, H., Itaya, T., Nakaya, H., Saegusa, H., Mazurier, A., Saneyoshi, M., Tsujikawa, H., Yamamoto, A., & Mbua, E. (Primate Res. Inst., Kyoto Univ., Aichi 484-8506, Japan [e-mail: *kunimats@pri.kyoto-u.ac.jp*]). *Proceedings of the National Academy of Sciences, U.S.A.*, 2007, *104*, 19220-19225.

"Extant African great apes and humans are thought to have diverged from each other in the Late Miocene. However, few hominoid fossils are known from Africa during this period. Here we describe a new genus of great ape (*Nakalipithecus nakayamai* gen. et sp. nov.) recently discovered from the early Late Miocene of Nakali, Kenya. The new genus resembles *Ouranopithecus macedoniensis* in size and some features but retains less specialized characters, such as less inflated cusps and better-developed cingula on cheek teeth, and it was recovered from a slightly older age (9.9–9.8 Ma). Although the affinity of *Ouranopithecus* to the extant African apes and humans has often been inferred, the former is known only from southeastern Europe. The discovery of *N. nakayamai* in East Africa, therefore, provides new evidence on the origins of African great apes and humans. *N. nakayamai* could be close to the last common ancestor of the extant African apes and humans. In addition, the associated primate fauna from Nakali shows that hominoids and other non-cercopithecoid catarrhines retained higher diversity into the early Late Miocene in East Africa than previously recognized."

Field Studies

• Cathemeral activity patterns of the blue-eyed black lemur *Eulemur macaco flavifrons* in intact and degraded forest fragments. Schwitzer, N., Kaumanns, W., Seitz, P. C., & Schwitzer, C. (Bristol Zoo Gardens, Clifton, Bristol BS8 3HA, U.K. [e-mail: *cschwitzer@bristolzoo.org.uk*]). *Endangered Species Research*, 2007, *3,* 239-247, <www.int-res.com/abstracts/esr/v3/n2/p239-247>.

This study describes the activity pattern of the blue-eyed black lemur *Eulemur macaco flavifrons* for the first time and investigates the parameters, such as season or habitat, that may influence the distribution of activity over the 24 h cycle. Four groups of *E. m. flavifrons* in 2 forest fragments with different degrees of degradation were followed for 24 h each month over a 7-month period between July 2004 and July 2005. Blue-eyed black lemurs exhibited a bimodal activity pattern which peaked during the morning and evening twilight. The groups consistently showed activity bouts both during the day and at night, a behavior that corresponds to Tattersall's (1987) definition of cathemerality. The proportion of illuminated lunar disc and the nocturnal illumination index were positively associated with the amount of nocturnal activity. Total activity, both diurnal and nocturnal, was significantly higher in the secondary than in the primary forest. In view of our results, the cathemeral behavior of *E. m. flavifrons* may best be explained as flexible responses to a framework of varying environmental factors, each of which may enhance or inhibit activity within the lemurs' range of adaptability. This temporal behavioral plasticity may be an adaptation to an erratic and severe climate with frequent droughts and cyclones and unpredictable resource availability.

Miscellany

• Beast Practices. Carter, T. *ABA Journal*, November 2007, <www.abajournal.com/magazine/beast_practices>.

A news story on the "current landscape of animal law."

* * *

CONTENTS