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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 Pictorial Guide to the Living Primates*, by N. Rowe, Pogonias Press, 1996.

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**

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Cover photograph of a white-handed gibbon (*Hylobates lar*),
taken at the San Diego Zoo by Mark Abbott in 2007

A Case of Fatal *Staphylococcus aureus* Infection in a Long-tailed Macaque (*Macaca fascicularis*): A Sign of Diabetic Involvement?

Roland Plesker[1] and Ellen Prenger-Berninghoff [2]
[1]Paul-Ehrlich-Institut, Langen, Germany; [2]Institut für Hygiene und Infektionskrankheiten der Tiere, Justus-Liebig-Universität, Gießen, Germany

Introduction

It is well known, in humans, that unregulated diabetes mellitus creates an increased risk of infection (Eliopoulos, 1995) and impaired wound healing (Encyclopaedia Britannica, 2009). Furthermore, in diabetic dogs and cats, increased incidence of infections has been described (Hess et al., 2000; Diehl, 1995) due to changes in the immune system (Greco & Harpold, 1994). In addition, impaired healing of fractures was observed in rats with experimentally induced diabetes (Macey et al., 1989).

In diabetic monkeys, immunological changes (Thomson et al., 2008; Zollner et al., 2007) and changes in the vascular repair process (Chambers et al., 1992) have been reported.

Since – to our knowledge – nothing has been reported about a correlation between increased infection rates or impaired wound healing and diabetes mellitus in nonhuman primates, we present in this report a case of a diabetic long-tailed macaque infected with *Staphylococcus aureus*. Originating from a small skin perforation in a fight, first an abscess developed and unexpectedly the infection later invaded the thorax and lungs.

Animal and Methods:

Animal and history: The seventeen-year-old male long-tailed macaque (Monkey A) was housed in a group of five family members in an indoor laboratory primate facility at the Paul-Ehrlich-Institut in Langen, Germany. He had been transferred to the institute 15 years earlier from another experimental animal facility in the Netherlands. Three members of this group were removed, leaving Monkey A alone with his 7-year-old son for three months. They appeared to be friendly with each other, except for one fight (see "Clinical history").

The group lived in two stainless steel cages (each 3 m x 1.25 m x 2.25 m) with connection through a door (.35 m x 1 m). This construction allowed the remaining two monkeys to hide from each other. The cages were equipped with branches, sitting boards at different levels, ropes, toys, and bedding (in accordance with European and German laws).

Clinical history: Monkey A was sterilized in 2004. He was used as a non-infected control monkey in a study of oral infection with bovine spongiform encephalitis.

Half a year before, when all five were still together, sticky urine residues – an indication of diabetes mellitus – had been observed. However, blood glucose testing could not confirm diabetes mellitus in any group member at that time.

Apart from this, Monkey A took part in a fight with his son and, although nothing serious was detected in a clinical examination after the fight, the monkey lost two kilograms of body weight within the next month.

One week before Monkey A had to be euthanized, polydipsia and polyuria became obvious. A blood glucose content of more than 300 mg/ml serum was determined at this time (a normal value is up to 140 mg/ml). However, Monkey A had to be euthanized before he could be trained to take medication for this condition.

One morning, Monkey A was found lying on the ground in an apathetic state; later he managed to climb to the lowest branch. No food or water intake was observed.

Because of poor prognosis, the monkey was narcotized and euthanized with a ketamine/xylazine-overdose (3 ml intravenously, containing 150 mg xylazine [Rompun® Bayer Vital GmbH, Leverkusen, Germany] + 300 mg ketamine [Ketamin 10%®, WDT, Garbsen, Germany]).

Pathology: Necropsy was performed immediately after the death of Monkey A. Photos were taken and a part of his lung was sent for bacteriological investigation. The rest of his organs were fixed in a 4% formaldehyde solution for at least 24 hours. Paraffin-embedding, preparation of 4 µm slides, and hematoxylin-eosin (H&E) staining were performed in accordance with standard procedures.

Bacteriology: After decontamination of the lung sample's surface by heat, a newly performed section was streaked on a blood agar plate (containing 5% defibrinated sheep blood, E. Merck, Darmstadt, Germany) and a Gassner agar (Oxoid, Wesel, Germany). The plates were incubated aerobically at 37°C for 24 and 48 hrs. Furthermore, a Schaedler agar plate with 5% sheep blood (Becton & Dickinson, Heidelberg, Germany) and another blood agar plate containing 1% dextrose (acc. to Zeissler) were inoculated and incubated over 72 hrs anaerobically in a jar using Anaerogen™ (Oxoid). For fungal growth, the sample was streaked on Kimmig-agar (E. Merck) and incubated at 28°C over a 5-day period, and a smear was taken on a slide to obtain a Ziehl-Neelsen (ZN) stain.

R. P., Paul-Ehrlich-Institut, Paul-Ehrlich-Str. 51-59, 63225 Langen, Germany [e-mail: *plero@pei.de*]

Results

Necropsy: At necropsy, marked emaciation and dehydration, as well as general muscle atrophy, were detected.

Figure 1: Biting wound in the skin of a long-tailed macaque that led to a *Staphylococcus aureus* infection.

At the front of the right shoulder, a round skin perforation, 3 mm in diameter, in contact with an underlying abscess cavity, was detected (*Figure 1*). It was covered by fur.

Figure 2: Abscess in front of the right shoulder in a long-tailed macaque infected with *Staphylococcus aureus*.

The underlying abscess was the size of a table-tennis ball. It was surrounded by a thin membrane. The content consisted of beige-grey watery/pasty pus (*Figure 2*).

From the abscess, macroscopically a track of beige-grey discoloured tissue led towards the first rib and into the thoracic cavity, indicating a region of inflammation and infection. In the cranial right part of the thorax purulent pleuritis was seen, both on the ribs and on the surface of the lung. Corresponding to this, in the right lung, chronic purulent pneumonia was obvious in the cranial, middle, and accessory lobe (*Figure 3*). In the rest of the lungs, marked emphysema was visible.

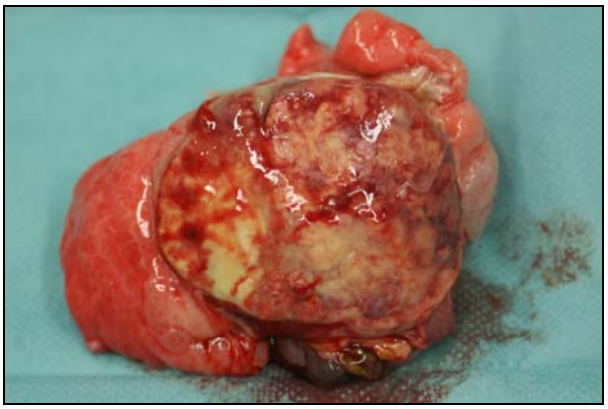

Figure 3: Chronic purulent pneumonia in a long-tailed macaque infected with *Staphylococcus aureus*.

Histopathology: The macroscopic findings of the lungs were confirmed by histopathology. In addition, within the lungs, clusters of basophilic coccoid bacteria (staphylococci) could be detected in the H&E stain (*Figure 4*).

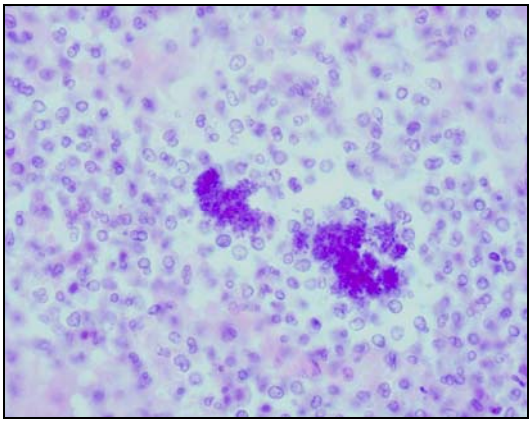

Figure 4: Clusters of basophilic botyoidal coccoid bacteria (staphylococci) in a long-tailed macaque with chronic purulent pneumonia (H&E stain x 1200).

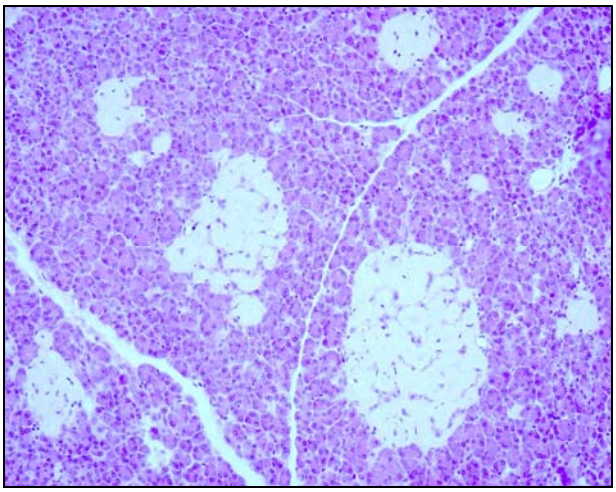

Figure 5: Histology of the pancreas: destruction and enlargement of the islets of Langerhans by deposition of amyloid-like material (H&E stain x 400).

In the spleen, a clear reduction of the number and size of the follicles was visible.

In the pancreas, the islets of Langerhans were destroyed and enlarged by the deposition of amorphic reddish material (*Figure 5*). Very few cells were left within the islets.

Microbiological findings: After 24 hrs of incubation, heavy growth of hemolytic staphylococci was detected on the blood agar plate, which was finally identified as *Staphylococcus aureus*, according to positive results in a rabbit plasmacoagulase test and a Voges-Prokauer reaction. Anaerobic and fungal organisms could not be detected at all and the ZN stain for acid-fast rods proved negative.

Discussion

Staphylococcus aureus is found on the skin and on the mucosa of animals and humans. Therefore, it is not surprising that it is sometimes found in animal illnesses. Pathologically, it is classified as a cause of inflammation and cause of pus (for example in acne or furunculosis). Often, the pathological occurrence of *Staphylococcus aureus* is correlated with a depression of the body's immune system (Rolle and Mayr, 1978, pp. 642-646).

In general, the development of diabetes mellitus in long-tailed macaques is not surprising. However, when pathological pancreatic changes are already detected macroscopically (as in this case), the amount of alteration must have been quite significant; otherwise it would not have been detected. It is very plausible that pancreatic islets which are packed with amyloid-like masses, as is the case in our example, are not capable of a normal level of insulin production any more (see also Plesker et al., 2007). Since very few viable cells are left within the islets, the numbers of insulin-producing cells left are simply too low to guarantee a smooth carbohydrate metabolism.

The therapeutic challenge in this situation is the question: whether it remains possible to regulate and stabilize the blood glucose levels via oral anti-diabetic drugs. This is extremely difficult in monkeys since their blood glucose levels cannot be as carefully monitored and treated as in humans. When the monkey is willing to take the necessary tablet(s), or can be trained to accept the necessary injection, the blood glucose level can be more or less stabilized. Otherwise the monkey must be euthanized in the end due to a) the impossibility of supplying the medication via darts daily and b) highly increased or uncontrolled fluctuations in blood glucose levels, along with the resulting long-term effects (e.g., cataracts or atherosclerosis).

In general, it is not unusual in our colony for biting wounds to occur in monkeys during aggressive behavior within groups. Normally, these wounds are detected and carefully inspected under anesthesia, since we are aware that a tiny hole in the skin can go along with more severe destruction of (or within) the underlying tissues. This is especially seen when the canine teeth of an aggressor puncture the skin. However, until this case, complications after such a skin perforation had been observed only once, when the initial skin wound developed into a spreading, diffuse, purulent inflammation of the tissue in the anogenital region of a female who was in estrus.

This particular case is remarkable for the following reasons:

- First, an infection developed after the skin perforation. This happened, although it is clear that normally *Staph. aureus* needs a second handicap of the body's immune system in order to cause an infection.
- Second, even if the infection progresses, normally a well-demarcated abscess develops in a case like this. In 20 years of monkey pathology, we have never seen the progression of an infection after a well-defined abscess demarcation had taken place. However, the infection in this case proceeded dramatically into the thoracic cavity, although the body was at first able to restrict the infection to a local abscess.

These unusual findings point to the fact that the affected monkey had an impairment of its immune system. This assumption is supported by detection of the severe reduction of follicles and immune cells in the spleen. The question is, what caused the immunosuppression?

There are several principal possibilities:

1. long-lasting stress. This might occur due to inadequate housing conditions (small cages, no hiding possibilities), difficult group composition, or frequent experimental intervention;
2. declining immunological function in old individuals;
3. impaired immunological function in diabetic individuals (as proven in humans);
4. exhaustion of the immune system due to chronic infection; or
5. Severe malnutrition with its influence on protein metabolism.

Since no further data on the functionality of the immune system are available in this case, these possibilities cannot be proven any further. However, it seems unlikely that the last two possibilities played a major role in this case.

At this time, for us, there are contradictionary hints concerning the possible effect of diabetes on immunosuppression and infection susceptibility/resistance in nonhuman primates: On one hand, subjective epidemiological data of our colony give no hint for a higher rate of general infections in diabetic long-tailed macaques (except infections of the urinary tract). In addition – to our knowledge – there are no reports in the literature suggesting this. On

the other hand, we have the impression that this particular case might have been influenced by the diabetes. In addition, an influence on the immune system and the infection rate has been demonstrated in diabetic humans. Changes in the immunological function have been demonstrated in nonhuman primates as well. The question is whether these changes create a higher risk of general infections in diabetic monkeys? We therefore hope that this case can be used as an initial event to encourage detailed investigations of immunological alterations in diabetic monkeys, which might solve these (apparent) contradictions.

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References

Chambers, R. B., Fryczkowski, A. W., Thio, D. B. M., Jonasson, O., & Flower, R. W. (1992). Preliminary observations on hypertensive alteration of retinal and choroidal blood flow and on vascular repair process following laser photocoagulation in the diabetic monkey (abstract). *Investigative Ophthalmology & Visual Science, 33*, 1363.

Diehl, K. J. (1995). Long-term complications of diabetes mellitus, Part II: Gastrointestinal and infectious. *Veterinary Clinics of North America, Small Animal Practice, 25,* 731-751.

Eliopoulos, G. M. (1995). Diabetes and infection. In: K. L. Becker (Ed.), *Principles and Practice of Endocrinology and Metabolism* (pp. 1303-1307). Philadelphia: J. B. Lippincott Company. .

Encyclopaedia Britannica (2009). **"**Therapeutics**",** Encyclopaedia Britannica Online, <www.britannica.com/EBchecked/topic/591185/therapeutics>.

Greco, D. S., & Harpold, L. M. (1994). Immunity and the endocrine system. *Veterinary Clinics of North America, Small Animal Practice, 24*, 765-782.

Hess, R. S., Saunders, H. M., Van Winkle, T. J., & Ward, C. R. (2000). Concurrent disorders in dogs with diabetes mellitus: 221 cases (1993-1998). *Journal of the American Veterinary Medical Association, 217,* 1166-1173.

Macey, L. R., Kana, S. M., Jingushi, S., Terek, R. M., Borretos, J., & Bolander, M. E. (1989). Defects of early fracture-healing in experimental diabetes. *Journal of Bone and Joint Surgery, 71*, 722-733.

Plesker, R., Törner, M., Coulibaly, C., & Boller, K. (2007). Amyloidosis in a rhesus macaque (*Macaca mulatta*). *Verhandlungsbericht des 43 Internationalen Symposiums über die Erkrankungen der Zoo- und Wildtiere*, 82-88.

Rolle, M., & Mayr, A. (1978). *Mediziniche Mikrobiologie, Infektions- und Seuchenlehre*. Stuttgart: Ferdinand Enke Verlag.

Thompson, S. E., McLennan, S. V., Hennessy, A., Bonner, J., Yue, D. K., & Twigg, S. M. (2008). Decreased macrophage number predicts reduced connective tissue growth factor expression in a baboon wound healing model of type 1 diabetes. *Wound Repair & Regeneration*, *16*[4], A65.

Thompson, S. E., McLennan, S. V., Hennessy, A., Bonner, J., Zoellner, H., Yue, D. K., & Twigg, S. M. (2007). Dysregulated inflammation predicts reduced connective tissue growth factor expression in a baboon wound healing model of type 1 diabetes. *Diabetologica , 50* [Suppl.1], S490-S491.

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Meeting Announcements

Fifty years after the development of the model to reduce, refine, and replace animals in research, a conference to discuss the progress that has been made – and the opportunities that lie ahead – will be held as "**Animals, Research, and Alternatives: Measuring Progress 50 Years Later**" on Aug. 26 and 27, 2010, in Washington, D.C. The conference is sponsored by Physicians Committee for Responsible Medicine and the George Washington University Medical Center, along with the Johns Hopkins University Center for Alternatives to Animal Testing, the Institute for In Vitro Sciences, and the Kennedy Institute of Ethics at Georgetown University. The conference is a Continuing Medical Education event. Register at <www.ResearchAlternatives.org>.

The annual **American College of Veterinary Anesthesiologists** (ACVA) meeting will be held in San Antonio, Texas, September 11–15, in conjunction with the **International Veterinary Emergency Critical Care Symposium** (IVECCS) this year. The ACVA annual meeting schedule is online at <www.acva.org/events>. Also see the IVECCS Website: <guest.cvent.com/EVENTS/Info/Summary.aspx?e=ab4e3610-7bb2-4ffc-b482-44d659535ebe> for additional information. Registration is handled by IVECCS.

The 2010 **Midwest Primate Interest Group Meeting** will be held September 24–25, in Chicago, Illinois. For information, see <www.mpig.org>.

The 2010 **Australasian Primate Society Conference** will be held October 16–17 in Katoomba, NSW, Australia. See <www.primates.on.net/apsconf.htm>.

Designing Environments for Aged Primates

C. D. Waitt[1], Moshe Bushmitz[2], and Paul E. Honess[3,4]
[1]Dept of Zoology, University of Oxford; [2]BFC Ltd, Mazor, Tel Aviv, Israel; [3]Dept of Veterinary Services, University of Oxford; [4]School of Veterinary Medicine and Science, University of Nottingham

Introduction

When designing a captive environment, the age of the animals concerned should be a primary consideration, as the requirements of captive primates vary across their lifespans. Primates have long natural lifespans, which are often extended by living in captivity. Many monkey species in captivity (e.g., macaques, capuchins) can have lifespans well over 30 years, while great apes (e.g., chimpanzees, gorillas) can live over 50 years. With old age comes disease and incapacity similar to those experienced by elderly humans, such as osteoporosis, arthritis, cataracts, and endocrinological disorders, as well as degeneration of cognitive abilities (Uno, 1997). Such age-related conditions will affect the way in which aged individuals are able to respond to and utilize their environments.

Reports of osteoarthritis in wild primates are rare (Rothschild & Woods, 1993). However reports about it in wild Old World primates do exist (Japanese macaques: Nakai, 2003; museum specimens of various species: Rothschild & Woods, 1992). Nakai (2003) indicates that the specimens examined in the course of his study contained "old adults"; and, although Rothschild and Woods (1992) note that they were unable to determine age in their samples, there is no reason to assume that museum collections would not include relatively aged animals from wild populations. In Nakai's study the presence of old adults which have a degree of osteoarthritis (6 out of 10 of the oldest of 53 males) suggests that carrying this condition in the wild does not automatically result in premature death. It also suggests that the six-fold lower level of osteoarthritis recorded by Rothschild and Woods (1992) among wild Old World primates (nonprosimian) is unlikely to be a result of the absence of aged animals in wild populations due to death of individuals before they develop age-related arthritis. While the findings of Rothschild and Woods (1992) might be contrary to standard veterinary expectation, the authors suggest the higher incidence of arthritis in captive Old World nonprosimian primates is possibly caused by "impaired cartilage nutrition from a sedentary life style."

Restrictive caging has been reported to impair joint mobility; however this may be ameliorated by improving the quality of the environment (Turnquist, 1985). Many aged primates also become obese, which can result in more serious disorders such as diabetes (Wolfensohn & Honess, 2005). Environments which are not designed to meet the needs of aged animals can lead to further deterioration in health, which will lead to poor welfare. Therefore, it is necessary to plan for an environment that will allow animals to remain active to help stave off such conditions. Additionally, social and thermoregulatory needs may also change with age, and should be taken into consideration.

Many facilities keeping primates, including zoos and research facilities, will have aged individuals in their care. This may be particularly relevant to sanctuaries caring for primates retired from laboratories, as those who are retired are frequently aged animals. In addition there is an increasing demand for aged primate research models, particularly in the areas of progressive neurodegenerative conditions (e.g. Parkinson's disease: Behrstock et al., 2005, and Redmond et al., 2007; Alzheimer's disease: Voytko, 1998) and caloric restriction (Roth et al., 2004; Colman et al., 2009).

There is a need for greater consideration of age as a factor in enclosure design, and our purpose here is to list considerations and requirements for aging primates. Making changes to enclosures to accommodate the needs of aging primates can lead to major improvements in their use of the enclosure and to their behavior (e.g., Zucker et al., 1991), as well as preventing physical deterioration related to increased inactivity.

Environmental Factors to Consider

Accessibility: Age-related conditions, such as arthritis, can hinder animals' ability to move about their enclosures. For example, climbing or jumping onto high perches and swings or leaping between gaps may become impossible. In particular, this is likely to apply to individuals who have been kept in restricted physical environments (e.g., many ex-laboratory and ex-pet primates). Decreased visual capabilities may further reduce the animals' ability to confidently negotiate the environment, but reduced mobility should never be used as a reason to restrict the environment of older animals. Rather, geriatric individuals require environments designed to encourage movement and flexibility in order to delay physical deterioration and to maintain health and well-being. Therefore, it is necessary to consider:

- *Use of fixed structures*. Sturdy climbing materials should be used for geriatric primates. Adults prefer fixed, and avoid flexible, structures and surfaces for locomotion and perching (e.g. squirrel monkeys: Taylor & Owens, 2004; Williams et al., 1988;

Corresponding author: P. H., Dept of Veterinary Services, University of Oxford, Oxford, OX1 3PT, U.K. [telephone: +44-1865-618439; e-mail: *paul.honess@vet.ox.ac.uk*].

macaques: Kopecky & Reinhardt, 1991; chimpanzees: Howell et al., 1997); this is likely to be especially important to older animals who move with difficulty. Therefore ropes, flexible walkways, and the like should be replaced by fixed and stable materials.

Figure 1: Closely spaced steps are designed to allow elderly macaques access to the upper level of their enclosure.

- *Positioning of climbing structures*. Rather than providing vertical climbing structures, some older animals may prefer these to be at an angle, creating a ramp or steps to allow for access. *Figure 1* shows steps which were created to allow a group of aged long-tailed macaques (*Macaca fascicularis*) (20 yrs and over) access to a second level of their enclosure, which they use with great frequency. The width of the steps and the spacing between them was carefully designed to provide ease of access.
- *The distance of gaps*. Depending on the physical condition of the animals, it may be necessary to consider making stable bridges between structures.
- *Provision of structures which allow access to higher levels*. Evidence from a variety of species indicates that primates show strong preference for elevated points in their enclosures (tamarins and marmosets: Buchanan-Smith, 1991, Buchanan-Smith et al., 2002; macaques: Clarence et al., 2006, Waitt et al., 2008; chimpanzees: Ross & Lukasb, 2006). Aged animals also exhibit these preferences when they are able to reach higher levels (Taylor & Owens, 2003; Zucker et al., 1991), and they should be given opportunity to do so. Older animals should not be forced to climb up fencing to reach upper parts of caging, as this may be difficult and painful. Branches, steps, or other climbing structures can be placed as ramps to allow access to higher perching.

Furnishings: In addition to accessibility, it is necessary to consider the types and design of furnishings. One should take into account:

- *Width*. Aged individuals will often require wider perches and climbing structures for moving confidently as well as for sitting and sleeping comfortably (*Figure 2*). However one must also keep in mind the shape of the shelving, as New World monkeys will require rounded, rather than flat, perching to prevent pressure sores, as they lack the ischial callosities of Old World monkeys (Abee, 1985).
- *Materials*. Wood is preferable to use as perches for primates, as it has qualities which are more appealing than other materials, such as its thermoneutral properties (Wolfensohn & Honess, 2005). This may be especially important to older animals (see below). Where regulations do not permit the use of wood structures, recycled plastic planking is readily available and is a suitable compromise material (see, e.g., Institute of Laboratory Animal Resources, 1996, p. 23, for United States rules).
- *Providing comfortable sleeping sites*. Extra bedding material for those primates that build nests (e.g., apes,

Figure 2: Wide, stable perches provide comfortable seating for older macaques.

the grey mouse lemur, and some bush baby species) to provide comfort and warmth.

- *Visual barriers*. The quality and quantity of social interactions can change with age, and this can vary with sex and species. For example, older females of various species of macaques engage in fewer social interactions, (Hauser & Tyrrell, 1984; Nakamichi, 1984; Veenema et al., 1997), while males may become more social (Corr, 2000). In captive chimpanzees, levels of social interaction do not change, though females become more submissive (Baker, 2000). As with younger animals, captive environments should provide older individuals with the ability to engage or withdraw from social activity as they desire. The provision of visual barriers will allow animals to visually separate themselves from conspecifics when they choose to do so. Visual barriers can also reduce aggression (Honess & Marin, 2006; Honess et al., submitted). Although levels of aggression decrease with age (e.g., Baker, 2000), aged animals can still engage in highly aggressive behavior with serious consequences (Line et al., 1990). Therefore, the same precautions must be taken to reduce potential aggression in groups containing geriatric animals.

Thermoregulation: Providing animals with the ability to make behavioral adjustments to help them thermoregulate is particularly important for older animals. Like aged humans, aged nonhuman primates may be particularly sensitive to environmental conditions, as they can experience deficits in their autonomic thermoregulatory abilities. This can be due to a variety of age-related conditions, including endocrinological dysfunction (Aujard et al., 2006). The following considerations should be made:

- *Heating*. Preferred ambient temperature can vary with age, with aged animals preferring warmer temperatures (e.g., Aujard et al., 2006). Providing perching near heat lamps and plenty of seating areas in sunny locations is important to prevent animals from feeling cold.
- *Enclosure materials*. Temperature should be considered when selecting these, for example wood, plastic, and fibre have the advantage of being non-thermoconductive, therefore providing more comfort (Wolfensohn & Honess, 2005).
- *Floor coverings*. Though the use of flooring materials such as wood shavings, bark, straw or hay is always recommended, this is especially important for older animals, as they may be especially sensitive to a cold floor.

Conclusions

With increasing interest both in the retirement of primates from laboratories (Kerwin, 2006; Prescott, 2006; Seelig & Truitt, 1999) and in the study of age-related and degenerative models, there is likely to be an increased need to accommodate aged nonhuman primates. In order to prevent physical and psychological deterioration in older animals, it is important to apply the same principles of environmental enrichment and housing as are applied to younger animals. As we have discussed above, the needs of aged individuals can be highly specific and may be markedly different from those of younger animals of the same species. Therefore we have listed some of the key aspects of environmental enrichment and housing that those who are housing older primates should consider in order to preserve the health and well-being of the animals in their care.

References

Abee, C. R. (1985). Medical care and management of the squirrel monkey. In L. A. Rosenblum & C. L. Coe (Eds.), *Handbook of Squirrel Monkey Research* (pp. 99-126). New York: Plenum Press.

Aujard, F., Séguy, M., Terrien, J., Botalla, R., Blanc, S., & Perret, M. (2006). Behavioral thermoregulation in a non human primate: Effects of age and photoperiod on temperature selection. *Experimental Gerontology*, *41*, 784-792.

Baker, K. C. (2000). Advanced age influences chimpanzee behavior in small social groups. *Zoo Biology*, *19*, 111-119.

Behrstock, S., Ebert, A., McHugh, J., Vosberg, S., Moore, J., Schneider, B., Capowski, E., Hei, D., Kordower, J., Aebischer, P., & Svendsen, C. N. (2005). Human neural progenitors deliver glial cell line-derived neurotrophic factor to parkinsonian rodents and aged primates. *Gene Therapy*, *13*, 379-388.

Buchanan-Smith, H. M. (1991). A field study on the red-bellied tamarin, *Saguinus l. labiatus*, in Bolivia. *International Journal of Primatology*, *12*, 259-276.

Buchanan-Smith, H. M., Shand, C., & Morris, K. (2002). Cage use and feeding height preference of captive common marmosets (*Callithrix j. jacchus*) in two-tier cages. *Journal of Applied Animal Welfare Science*, *5*, 139-149.

Clarence, W. M., Scott, J. P., Dorris, M. C., & Paré, M. (2006). Use of enclosures with functional vertical space by captive rhesus monkeys (*Macaca mulatta*) involved in biomedical research. *JAALAS [Contemporary Topics in Laboratory Animal Science], 45*[5], 31-34.

Colman, R. J., Anderson, R. M., Johnson, S. C., Kastman, E. K., Kosmatka, K. J., Beasley, T. M., Allison, D. B., Cruzen, C., Simmons, H. A., Kemnitz, J. W., & Weindruch, R. (2009). Caloric restriction delays disease onset and mortality in rhesus monkeys. *Science, 325*, 201-204.

Corr, J. (2000). How rhesus macaques age: Differences in male and female social behaviors. *American Journal of Primatology*, *51*, 52.

Hauser, M. D., & Tyrell, G. (1984). Old age and its behavioral manifestations: A study on two species of macaque. *Folia Primatologica*, *43*, 24-35.

Honess, P. E., & Marin, C. M. (2006). Enrichment and aggression in primates. *Neuroscience and Biobehavioral Reviews*, *30*, 413-436.

Honess, P. E., Waitt, C. D., Bushmitz, M., & Wolfensohn S. E. (Submitted). Vertical space and social interaction in breeding groups of long-tailed macaques (*Macaca fascicularis*). *Animal Welfare*.

Howell, S. M., Mittra, E., Fritz, J., & Baron, J. (1997). The provision of cage furnishings as environmental enrichment at the Primate Foundation of Arizona. *The Newsletter, 9*, 1-5.

Kerwin, A. M. (2006). Overcoming the barriers to the retirement of Old and New World monkeys from research facilities. *Journal of Applied Animal Welfare Science*, *9,* 337-347, <www.informaworld.com/smpp/title~db=all~content=g783707860>.

Kopecky, J., & Reinhardt, V. (1991). Comparing the effectiveness of PVC swings versus PVC perches as environmental enrichment objects for caged female rhesus macaques. *Laboratory Primate Newsletter*, *30*[1], 5-6, <brown.edu/primate/lpn30-2.html#vik>.

Line, S. W., Morgan, K. N., Roberts, J. A., & Markowitz, H. (1990). Preliminary comments on resocialization of aged rhesus macaques. *Laboratory Primate Newsletter*, *29*[1], 8-12, <brown.edu/primate/lpn29-1.html#line >.

Nakai, M. (2003). Bone and joint disorders in wild Japanese macaques from Nagano Prefecture, Japan. *International Journal of Primatology, 24*, 179-195.

Nakamichi, M. (1984). Behavioral characteristics of old female Japanese monkeys in a free-ranging group. *Primates*, *25*, 192-203.

Prescott, M. J. (2006). Finding new homes for ex-laboratory and surplus zoo primates. *Laboratory Primate Newsletter*, *45*[3], 5-8, <brown.edu/primate/lpn45-3.html#homing>.

Redmond, D. E., Jr., Bjugstad, K. B., Teng, Y. D., Ourednik, V., Ourednik, J., Wakeman, D. R., Parsons, X. H., Gonzalez, R., Blanchard, B. C., Kim, S. U., Gu, Z., Lipton, S. A., Markakis, E. A., Roth, R. H., Elsworth, J. D., Sladek, J. R., Jr., Sidman, R. L., & Snyder, E. Y. (2007). Behavioral improvement in a primate Parkinson's model is associated with multiple homeostatic effects of human neural stem cells. *Proceedings of the National Academy of Sciences, U.S.A., 104*, 12175-12180.

Ross, S. R., & Lukasb, K. E. (2006). Use of space in a non-naturalistic environment by chimpanzees (*Pan troglodytes*) and lowland gorillas (*Gorilla gorilla gorilla*). *Applied Animal Behaviour Science*, *96*, 143-152.

Roth, G. S., Mattison, J. A., Ottinger, M. A., Chachich, M. E., Lane, M. A. & Ingram, D. K. (2004). Aging in rhesus monkeys: Relevance to human health interventions. *Science, 305*, 1423-1426.

Rothschild, B. M., & Woods, R. J. (1992). Osteoarthritis, calcium pyrophosphate deposition disease, and osseous infection in Old-World primates. *American Journal of Physical Anthropology, 87*, 341-347.

Rothschild, B. M., & Woods, R. J. (1993). Arthritis in New World monkeys: Osteoarthritis, calcium pyropyrophosphate deposition disease and spondylo-arthropathy. *International Journal of Primatology*, *14*, 61-78.

Seelig, D., & Truitt, A. (1999). Postresearch retirement of monkeys and other nonhuman primates. *Laboratory Primate Newsletter*, *38*[2], 1-5, <brown.edu/primate/lpn38-2.html#april>.

Taylor, L., & Owens, A. (2004). Enclosure use by aged squirrel monkeys (*Saimiri sciureus*). *American Journal of Primatology*, *62*, 85.

Turnquist, J. E. (1985). Passive joint mobility in patas monkeys *(Erythrocebus patas):* Rehabilitation of caged animals after release into a free-ranging environment. *American Journal of Physical Anthropology*, *67*, 1-5.

Uno, H. (1997). Age-related pathology and biosenescent markers in captive rhesus macaques. *Age, 20,* 1-3.

Veenema, H. C., Spruigt, B. M., Gispen, W. H., & van Hooff, J. A. R. A. M. (1997). Aging, dominance history, and social behavior in Java monkeys (*Macaca fascicularis*). *Neurobiology of Aging*, *18*, 509-515.

Voytko, M. L. (1998). Nonhuman primates as models for aging and Alzheimer's disease. *Laboratory Animal Science, 48*[6], 611-617.

Waitt, C., Honess, P., & Bushmitz, M. (2008). Creating housing to meet the behavioral needs of long-tailed macaques. *Laboratory Primate Newsletter, 47*[4], 1-5, <brown.edu/primate/lpn47-4.html#honess>.

Williams, L. E., Abee, C. R., Barnes, S. R., & Ricker, R. B. (1988). Cage design and configuration for an arboreal species of primate. *Laboratory Animal Science*, *38*, 289-291.

Wolfensohn, S., & Honess, P. (2005). *Handbook of Primate Husbandry and Welfare*. Oxford: Blackwell Scientific.

Zucker, E. L., Deitchman, M., & Watts, E. (1991). Behavioral evaluation of exhibit modifications designed to accommodate an aged Diana monkey. *Zoo Biology*, *10*, 69-74.

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Research and Educational Opportunities

Biosafety and Biocontainment Training Program

The National Biosafety and Biocontainment Training Program (NBBTP), a partnership between the Division of Occupational Health and Safety (DOHS) and the National Institute of Allergy and Infectious Diseases (NIAID) at the National Institutes of Health, is now accepting applications for two-year postdoctoral and post baccalaureate fellowships. This is a rare opportunity for individuals seeking work in high-containment facilities to receive professional training in biosafety and biocontainment at one of the foremost biomedical research centers in the world. Additional information regarding the fellowship, including how to apply, is online at <www.nbbtp.org>; or from Jennifer Elin Cole [e-mail: *jcole@nbbtp.org*], Fellowship Program Director; or by phoning the Frontline Healthcare Workers' Safety Foundation [678-781-5241]. Applications are due July 6, 2010; fellowships begin January 5, 2011, at the NIH Bethesda campus. Applicants must be U.S. citizens, nationals, or permanent residents; applications must be submitted electronically. Any application materials received after July 6, 2010, will not be considered.

Student Environmental Enrichment Course

The Third Student Environmental Enrichment Course (SEEC) will be held at Howletts & Port Lympne Wild Animal Parks, Canterbury, Kent, U.K., July 26–29, 2010. This course is designed specifically for college and university students (past or present) who do not currently work within a zoo setting, but are looking to do so as a career. The aim of the course is to provide valuable experience and an overview of additional useful skills to a would-be keeper's C.V. Please note that you must be at least 18 years old to attend this course. For more information see <www.aspinallfoundation.org/portlympne/keepers-and-rangers/view/241>.

Postgraduate Lab Animal Science Course

"The Faculty of Life Sciences, University of Copenhagen, will arrange a postgraduate course in Laboratory Animal Science September 27 to October 8, 2010, on our Campus in Copenhagen, Denmark. The successful graduate from our course will fulfill FELASA and Council of Europe requirements for applying for a license to perform animal experimentation in Europe, and will be registered in the FELASA database. You must have a bachelor's degree or similar to enter the course.

"All course presentations will be given online before the course, and the time in Copenhagen will be spent in practicums, interactive group work, and discussions. Examination can be in Copenhagen or from your home address by our video-link. The course fee is 18,500 Danish kroner (about € 2500 or US$3170).

"For more information, see <www.phdadm.kvl.dk/cgi-bin/phdkursuskat/offentlig/phdkat-db.pl?mode=viskursus&recnum=80&identifier=2010-03-02*16:14:05>. For information on the faculty, see <www.life.ku.dk/english.aspx>.

"Feel free to contact Professor Axel Kornerup Hansen, Fac. of Life Sciences, Univ. of Copenhagen, Dyrlaegevej 88, DK-1870 Frederiksberg C, Denmark [+45 35332726; Fax +45 35332755; e-mail *akh@life.ku.dk*], for more information."

Animal Welfare and Scientific Research

A symposium, "Animal Welfare and Scientific Research: 1985 to 2010", will be held on October 25–26, 2010, in conjunction with IACUC 101 on October 24, in Bethesda, Maryland. This two-day symposium will celebrate and acknowledge the achievements of two and a half decades of biomedical research conducted under the U.S. Government Principles, the Public Health Service Policy on Humane Care and Use of Laboratory Animals, and the Animal Welfare Act and Regulations.

IACUC 101 is a basic course that provides a one-day didactic and interactive exploration of IACUC fundamentals appropriate for new and seasoned IACUC members, IACUC affiliates, and individuals responsible for their institutions' animal care programs. The course provides a basic yet comprehensive overview of the laws, regulations, and policies that govern the humane care and use of research animals.

The Symposium's Website, <grants.nih.gov/grants/olaw/policy25>, will have program, registration, and accommodation information soon.

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Feeding Behavior of *Saguinus oedipus* in Relation to Food Hardness in a Zoo Setting: Possibilities for Enrichment?

Crystal Ceja[1] and Jess White[2]
[1]College of Arts & Sciences, [2]Dept. of Sociology and Anthropology, Western Illinois University

Introduction

Caring for captive animals is more than simply providing essentials, such as food, water, and shelter. Enrichment is a vital component in the lives of captive animals, providing a means of engagement and a respite from the unstimulating normality of life in captivity. Without any form of enrichment, an animal is likely to begin to show signs of "stereotyped behaviors", unnatural compared to behaviors seen in the wild. Along with activities that provide enrichment based on locomotor skills or manipulation, a great potential lies in the delivery of food items which vary by taste, texture, or hardness.

This paper presents a case study of a pair of callitrichids (*Saguinus oedipus)* housed at the Niabi Zoo (Moline, Illinois) during a period of 14 weeks in 2006 and 2007. In particular, we focus on the potential enrichment possibilities associated with variations of food hardness, following the work of Dumont (1999) and Dumont and O'Neal (2004) with various species of bats. With this project, we aim to highlight the potential of designing enrichment activities that incorporate information from various fields, including ecology, functional morphology, and analysis of the physical characteristics of food items.

Using hard and soft fruits of similar size, shape, and mass, Dumont (1999) and Dumont and O'Neal (2004) compared the effect of fruit hardness on the feeding behavior of New and Old World bats. In these studies, data were collected from five species of New World bats and five species of Old World bats. The goal of each study was to observe how fruit was placed in the mouth during ingestion, how often the head moved during biting, the number of bites taken to remove the edible portion of a piece of fruit, and the number of bite-sequences (mouthfuls) required to process the fruit. Results suggested that feeding behavior among the New World bats not only differed significantly among species, but also within species. Dumont (1999) and Dumont and O'Neal (2004) also found, with several species of Old World fruit bats from Papua New Guinea, that there was variation in feeding behavior among the species. However, they concluded that the behavior of Old World bats does not vary in the same ways as that of New World Bats. These two studies suggest that feeding behavior in bats, in relation to fruit hardness, may play an important role in frugivore ecology.

J. L. White, 404 Morgan Hall, Western Illinois Univ., Macomb, IL 61455 [e-mail: *JL-White@wiu.edu*].

Callitrichids (marmosets and tamarins) are small-bodied New World monkeys with characteristic features of both morphology and behavior. These include a tendency to give birth to twins; claw-like nails on all digits but the hallux; and three-cusped upper molar morphology (Sussman & Kinzey, 1984). Members of the Callitrichidae also lack a third molar on both the upper and lower jaw (Sussman & Kinzey, 1984). The tamarins are divided into two genera: *Saguinus* and *Leontopithecus*. Here, we focus on *Saguinus oedipus* (the cotton-topped tamarin), a member of the more variable tamarin genus. Using the research of Dumont (1999) and Dumont and O'Neal (2004) as a framework for study, we hypothesized that callitrichid feeding behavior and mastication patterns may vary according to food hardness. With a more detailed understanding of feeding behavior in *S. oedipus*, we hope that zoos can develop more effective environmental enrichment for this species, which might decrease anxiety and promote contentment.

Subjects, Materials, and Methods

Our study sample consisted of two adult *S. oedipus* individuals (male and female) housed in the same cage at the Niabi Zoo in Coal Valley, a township near Moline, Illinois. The study subjects were housed in an indoor glass enclosure (12' [H] by 12' [W] by 15' 4" [L]), along with a southern two-toed sloth (*Choloepus didactylus*) and several species of parrot including green-cheeked conures (*Pyrrhura molinae*), nanday conures (*Nandayus nenday*), and sun conures (*Aratinga solstitialis*). In the ventilated enclosure they had access to several levels (trees, rock "cliffs", and the concrete floor) for activities. The regular feeding time (institution-directed) was between noon and 1:00 p.m., at which time four feeding dishes were provided to all occupants of the enclosure. The dishes contained a mix of fruits and chopped greens (whatever was available – produce was donated), as well as mealworms, boiled egg, and monkey pellets (protein biscuits),.

The methodologies presented here generally follow those presesnted by Dumont (1999) and Dumont and O'Neal (2004) in their analyses of masticatory behavior and patterns in Old and New World bats. Three food items were chosen and categorized according to their qualitative "hardness": dehydrated pineapple (hard), dehydrated papaya (hard), and banana (soft). As the goal of this project was to observe whether there are significant differences in how *S. oedipus* process food items according to "hardness", we also recorded the position of

the food item for each "bite" in a "bite-sequence". Here, a "bite" is defined as an attempt by the individual to separate a piece of food from a larger food source. For each bite, two variables are collected: position of the food item over the tooth row and the type of tooth (or teeth) involved in each bite. Position over the tooth row was defined as either "shallow" (incorporating use of the incisors and/or canine teeth) (*Fig.1*: a, b) or "deep" (using the premolars and/or molars) (*Fig. 1*: c, d). The number of teeth involved is defined as either "bilateral" (using the teeth on both sides of the mandible/maxilla) (*Fig. 1*: b, d) or "unilateral" (using the teeth on only one side of the mandible/maxilla) (*Fig. 1*: a, c). Combining these variables produces four patterns of processing: "shallow unilateral" (S/U), "deep unilateral" (D/U), "shallow bilateral" (S/B), or "deep bilateral" (D/B).

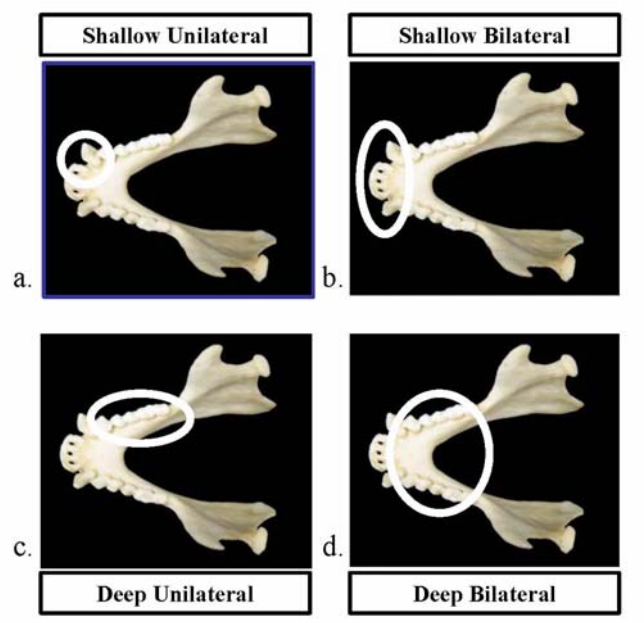

Figure 1: Bite positions.

During the course of this project, the two *S. Oedipus* individuals were provided the food items listed above. These food items were offered once per week for a period of 10-15 minutes before the daily feeding, separately from other dietary items offered by the zoo. During this 10-15 minute period, the two individuals were videotaped; following the feeding period, the video was analyzed by both authors together at a slow speed, allowing them to record how the individual positioned the food item in his/her mouth and how many bites were required to remove one piece of the item from the larger body.

Results and Conclusions

After a total of 12 weeks (4 weeks/food item) of observation, we concluded there were differences in the processing of "hard" versus "soft" food items. When eating harder fruits, such as the dehydrated pineapple or papaya, the tamarins generally favored either a shallow unilateral bite (incorporating use of the incisors and/or canine teeth on only one side of the mandible/maxilla) or a shallow bilateral bite (incorporating use of the incisors and/or canines on both sides of the mandible/maxilla) (*Fig. 2*). When processing soft foods, a generally shallow bilateral bite was preferred. In no case was a deep unilateral or deep bilateral bite (incorporating molars on one or both sides) the predominant pattern (*Fig. 2*).

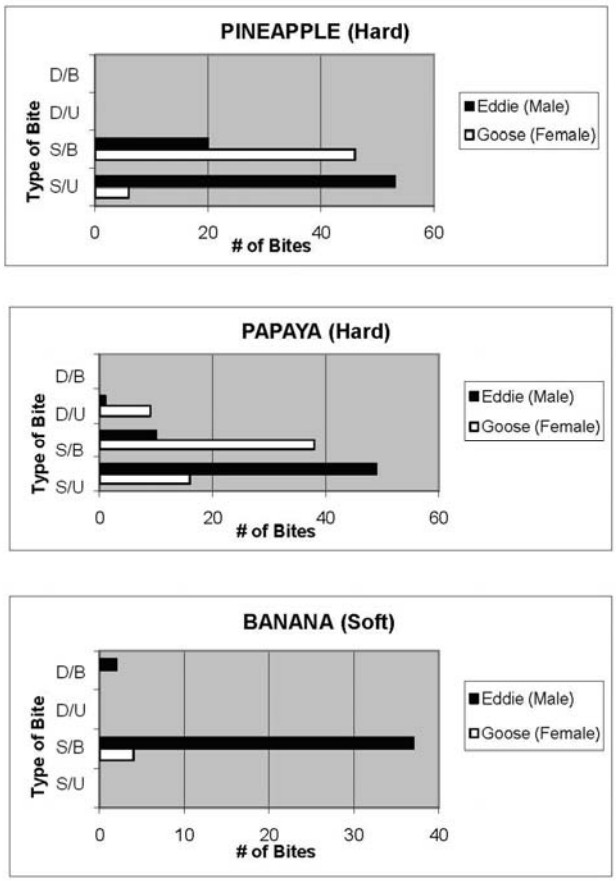

Figure 2: Bite positions for different foods.

While observing the videotape of the tamarins, we noticed they displayed different behaviors when initiating a bite sequence. When eating the harder food items, the female would place the entire piece of fruit into the back of her mouth and soften it by processing it with her molars (in a "mashing" motion). After the fruit had been softened, she removed the larger body of the food from her mouth and was able to pull at the fruit with her incisors, removing small pieces from the fruit. The male also demonstrated a unique trend in initiating a bite sequence. He preferred to use the canines on either side of his mouth to hold onto the fruit and pull (applying tension) with his hands until he was able to break away the smaller piece. We feel our observations of these behavioral manipulations are important because *Saguinus*, compared to other mammals, such as bats, have the capacity for using parts of their bodies in different ways (using

their hands to grasp, for example – an ability not found in bats). In addition, the manipulative abilities of tamarins likely enable access to a relatively wider range of dietary items.

Our small pilot study suggests that the size and hardness of a food item might be used in the design of an enrichment scheme for tamarins (and, potentially, other mammals). With a larger and harder piece of food, the study individuals were forced to invest more effort into the processing of food items.

We suggest that by providing animals with food in a more natural form (i.e., not cut to a standardized size), they would have an opportunity to process the food in a manner that best approaches what would be encountered in wild habitat. By allowing our study individuals to perform these manipulations, we argue that they were able to perform behaviors that they would normally exhibit in the wild, thus possibly reducing stress.

This pilot study provides a fruitful (no pun intended) springboard for enrichment studies, suggesting that variation in food offerings could be utilized in the design of enrichment regimens. Primatologists focusing on behavioral changes associated with enrichment devices, stress reduction in captive animals, and frequency of stereotypic behaviors may find food properties to be worth investigating in future studies.

Acknowledgements

The authors would like to acknowledge the staff at the Niabi Zoo, especially the Head Keeper, Colleen Stalf, for allowing access to the study animals and for the gracious use of their facilities. A preliminary report of this case study was presented as a poster at the 2008 Centennial Honors College Undergraduate Research Day at Western Illinois University.

References

Dumont, E. R. (1999). The effect of food hardness on feeding behaviour in frugivorous bats (Phyllostomidae): An experimental study. *Journal of Zoology, London, 248*, 219-229.

Dumont, E. R., & O'Neal, R. (2004). Food hardness and feeding behavior in Old World fruit bats (Pteropodidae). *Journal of Mammology, 85*, 8-14.

Sussman, R. W., & Kinzey, W. G. (1984). The ecological role of the Callitrichidae: A review. *American Journal of Physical Anthropology, 64,* 419-449.

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Resources Wanted and Available

PubMed Extends Its Biomedical Database to 1947

Citations to more than 60,000 articles indexed in the 1947 Current List of Medical Literature are now available in the National Library of Medicine's (NLM) MEDLINE/PubMed database <www.pubmed.gov>. When the original MEDLINE database made its debut in 1971, it contained citations to journal articles mostly published from approximately 1966 forward. NLM began to expand the retrospective coverage of the database in 1996, when more than 307,000 citations originally published in the 1964 and 1965 Cumulated Index Medicus were made available as OLDMEDLINE. The Library has been moving steadily backward in time ever since.

"Some contemporary medical questions can only be answered by consulting the older literature," observed NLM Director Dr. Donald A. B. Lindberg. "NLM is working to make the journal citations in older printed indexes electronically searchable, and our goal is to go back at least as far as World War II." With the addition of the 1947 citations, the MEDLINE/PubMed subset now contains over 20 million citations produced during 63 years of indexing of the biomedical literature.

For additional information about the data conversion project, go to: <www.nlm.nih.gov/databases/databases_oldmedline.html>.

Comprehensive Guide on Animals and the Law

To keep legal professionals and the public abreast of the most recent updates in animal law, the New York State Bar Association's Committee on Animals and the Law has issued a comprehensive guide that provides up-to-date information on animal laws. It is available free at <www.nysba.org/AnimalLawPamphlet>. *New York State Bar Association, March 8*

PRIMO Database Back Online

Eric Delson announced: "I am pleased to inform you that (finally) the PRIMO (PRImate Morphology Online) database is back online at <primo.nycep.org>. So far, there are caliper data on skulls and teeth, mainly of cercopithecids, with nearly 8,000 individuals in the database (though many of these do not have data available yet). We are working on making 3-D digitizer (Microscribe) data available next. Instructions on the home page will allow you to test it or to request a login and password (which you can change later by clicking on 'manage account' after you log in with the original password). I hope you enjoy using it." – *Announcement on the Physical Anthropology News site,* <physanth.org/news>, *March 10*

Online Collection of Great Ape Skeletons and Records

To help trace the origins of the human species, and potential links to other primates, researchers with the Center for Academic Research and Training in Anthropogeny (CARTA) – a jointly organized research unit of the University of California, San Diego, and the Salk Institute for Biological Studies – began digitizing and examining skeletal specimens and related medical records last summer from more than two dozen chimpanzees.

The chimpanzee specimens and records, which include an extensive collection of skeletons, radiographs, blood serum samples, and observation logs, were donated by the Primate Foundation of Arizona (PFA), which cared for the animals after they were "retired" from zoos or brought to the foundation by owners unable to care for them. All samples were collected in the course of routine medical care, or from chimpanzees who had died of natural causes.

In addition to the digital cataloging of those specimens and records, researchers from the San Diego Supercomputer Center (SDSC), a research unit of UC San Diego, along with other university scientists and faculty, are performing computerized axial tomography (CT) scans of the chimpanzee skeletons in the collection. SDSC researchers successfully performed the first test CT scans of a chimpanzee skull last April, using a mobile 16-slice General Electric CT unit. Digital animations were developed from those first scans.

The resulting scans, using Digital Imaging and Communications in Medicine metadata and software, will allow CARTA members and other users to digitally manipulate the images for detailed analysis and instant digital measurement without ever handling the actual physical specimens. The CARTA databases will become available via the organization's Website <carta.anthropogeny.org>, which is also housed at SDSC.

"This collection is unique because it is such a well-documented subset of chimpanzees," said Margaret Schoeninger, professor and past chair of UC San Diego's Department of Anthropology and co-director of CARTA. "Thanks to the PFA, there are very detailed medical and observational records for this group, along with a superb set of physical specimens. We are excited to add this collection to CARTA's planned online databases, and to make it available to a wide range of anthropogeny researchers for further study and analysis."

The unique collection was given to CARTA by the PFA Board of Directors. PFA Director Jo Fritz stated that the only requirement was that these resources be made available to the widest possible range of scientists interested in better understanding both humans and chimpanzees. "It's always difficult to have an animal die, but to

know that they will live on in science for eons to come makes it a bit easier," said Fritz.

CARTA was established by faculty at UC San Diego and the Salk Institute for Biological Studies as a virtual organization to promote transdisciplinary research into human origins, drawing on methods from a number of traditional disciplines spanning the humanities, as well as the social, biomedical, biological, computational and engineering, and physical and chemical sciences. As the word anthropogeny implies, CARTA's primary goal is to explore and explain the origins of the human phenomenon. – *From a press release by Media Newswire,* <Media-Newswire.com>

My Encyclopaedia of Primates

Eman Fridman, former Chief of the Laboratory of Informational Analysis in Medical Primatology of the Russian primate center at Sukhum, has published the beautifully illustrated *My Encyclopaedia of Primates* [Moscow: Vagrius, 2009. 352 pp. (in Russian)], giving details about the primates of the world and the scientists who have studied them. Contact Dr. Fridman at Shikun Rambam, 13/3 Krisa 2, 38363 Hadera, Israel [e-mail: *emanfridman@013net.net*].

More Guidance for Periods of Noncompliance

"Guidance on Confirming Appropriate Charges to NIH Awards during Periods of Noncompliance for Activities Involving Animals" has been published in the NIH *Guide for Grants and Contracts* on April 15, 2010, NOT-OD-10-081. This Notice provides additional clarification in reference to Notice NOT-OD-07-044 regarding the grantees' responsibilities when animal activities have been conducted which do not meet the terms and conditions of the grant award. See <grants1.nih.gov/grants/guide/notice-files/NOT-OD-10-081.html>. For questions, suggestions or comments, e-mail <*olaw@od.nih.gov*>. – *from* Total E-Clips, *April 19*

New Edition of ILAR *Guide*

The Institute for Laboratory Animal Research (ILAR) has released a newly updated *Guide for the Care and Use of Laboratory Animals*, an internationally accepted primary reference on the humane treatment of animals in research, testing, and teaching. Last updated in 1996, this new edition of the *Guide* integrates recently published data, scientific principles, and expert opinion to recommend practices for responsible laboratory animal use. New features of the *Guide* include expanded coverage of the ethics of laboratory animal use; components of effective animal care and use programs; and new guidelines for the housing, environment, and enrichment of terrestrial and aquatic animals and for veterinary and clinical care. See <www.nap.edu/catalog/5140.html>.

PrimateLit Goes to Wisconsin

As of June 1, 2010, management of the PrimateLit database has moved from the Primate Information Center at the Washington National Primate Research Center to the Jacobsen Library at the Wisconsin NPRC.

Chico Otsuka-Gooding is retiring as the Primate Information Center office manager after almost 40 years of service. The staff of the Wisconsin NPRC would like to thank Chico for her conscientious work identifying and acquiring materials for review, and her meticulous efforts in securing accurate information for the PrimateLit database.

Dr. Jackie Pritchard will continue as the master indexer for PrimateLit. If you were providing the Primate Information Center with materials for indexing in PrimateLit, these should now be sent to: Jacobsen Library, WNPRC, 1220 Capitol Court, Madison, WI 53715 [*primatelit@primate.wisc.edu*].

The PrimateLit database is freely available to all users at <primatelit.library.wisc.edu>.

* * *

Position Available: Director of Veterinary Sciences

A fast-growing and well-funded pre-clinical contract research organization is seeking a Director of Veterinary Sciences to work in Singapore. This person will have a demonstrable track record and leadership capability in the administration, management, and development of veterinary sciences (primate breeding programs and medical imaging in particular) in a contract research environment. S/he will have demonstrable credibility and relationships with decision makers and strategists in pre-clinical and translational development within the client community and will be able to manage client relationships and business development. In addition, the successful candidate will have superb people and communication skills to ensure operational excellence in a world-class service organization.

If you, or someone you know, might be interested in this opportunity, contact Kamini Nair, RSA Singapore, 24 Raffles Place, #20-04 Clifford Centre, Singapore 048621 [+65 6533 5708; e-mail: *Kamini.Nair@ thersagroup.com*].

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News Briefs

Gorillas Could Vanish from Congo by 2025

Gorillas could disappear from much of Africa's Congo River Basin within 15 years without urgent action to protect them, a United Nations and police report says. "Illegal logging, mining, charcoal production, and increased demand for bush meat, of which an increasing proportion is ape meat," are killing off gorillas, the largest of the living primates, the U.N. Environment Program and International Criminal Police Organization, or Interpol, report said. Projections in 2002 that only 10 percent of the original gorilla ranges would remain by 2030 "were too optimistic," given intense illegal habitat destruction and poaching of the ground-dwelling plant-eaters that live in central Africa's forests, the report said.

Outbreaks of the Ebola hemorrhagic fever virus are adding to concerns, it said. "These epidemics have killed thousands of great apes, including gorillas, and by some estimates up to 90 percent of animals infected by the virus will die."

Militias in the Democratic Republic of Congo are behind much of the illegal gorilla trade, worth an estimated several hundred million dollars a year, the report said, adding, "Buyers of poached gorillas are in Asia and beyond."

"This is a tragedy for the great apes and one also for countless other species being impacted by this intensifying and all-too-often illegal trade," U.N. Environment Program Executive Director Achim Steiner said in a statement. "Ultimately, it is also a tragedy for the people living in the communities and countries concerned," he said. – *United Press International, March 25, 2010*

Orangutan Turns 50 at Arizona Zoo

The Phoenix Zoo is used to hosting birthday parties, but this one was a little different. Duchess the orangutan turned 50 on Saturday, March 27, and the zoo treated her to gifts, an ice cake filled with fruit, and a rendition of "Happy Birthday" by hundreds of zoo visitors.

Her keeper, Bob Keesecker, said Duchess didn't seem too stressed about the milestone. "I told her it was her birthday today and she didn't seem to be overly concerned about it," he said. "I made sure her hair looked good before she went out." Keesecker said Duchess has quite a sweet tooth and worked pretty hard to get to the fruit in the ice cake.

Zoo officials say Duchess is the nation's oldest captive Bornean orangutan, and is now 10 years older than the 40-year life expectancy of orangutans in the wild. She was just two years old when the zoo opened in 1962, and is one of only a few remaining original animals. She has given birth seven times and lives with one of her daughters, her daughter's mate, and their daughter.

Saturday's birthday party included the groundbreaking of a new $4-million orangutan exhibit that will provide a more natural environment for Duchess and her family. Zoo officials hope the exhibit will allow them to add more orangutans in the future. – *By Amanda Lee Myers, © 2010 Associated Press*

European Center for Alternatives to Animal Testing

The University of Konstanz, in Germany, and the Johns Hopkins Bloomberg School of Public Health have jointly established the Center for Alternatives to Animal Testing–Europe (CAAT–EU), in an effort to promote better coordination in toxicity testing. The new Center, modeled after the Bloomberg School's Center for Alternatives to Animal Testing (CAAT), will conduct scientific research to find new methods to replace the use of laboratory animals in studies, to reduce the number of animals needed for research, and to refine necessary tests to eliminate the pain and distress of animals in research. CAAT–EU held an inauguration ceremony in Konstanz on March 30.

Marcel Leist, professor at the University of Konstanz, will lead CAAT–EU, along with Thomas Hartung, the Doerenkamp-Zbinden Professor and Chair for Evidence-based Toxicology and Director of CAAT at the Bloomberg School. Hartung also holds an appointment as professor at the University of Konstanz.

"As a transatlantic cooperation center, CAAT–EU will unite its activities in the field of alternatives and toxicology at the University of Konstanz and combine them strategically with the activities of the Bloomberg School's CAAT in the U.S.," said Leist. – *Press release from CAAT, March 30*

Male Gorilla Dies in London Zoo After Short Illness

London Zoo has suffered a "devastating blow" following the death of one of its male gorillas less than six months after he arrived. Despite repeated attempts to resuscitate him, he died. The results of a post-mortem examination on Yeboah are expected to be revealed in a few weeks.

Yeboah, who weighed 20 stone (280 pounds), arrived at the zoo in November from France to live with three female gorillas. The females, Effie, Mjukuu, and Zaire, will be monitored closely by keepers while they adjust to their loss.

It is the second time in less than two years that the zoo has lost a young male gorilla to unexpected illness. In

December, 2008, Bobby – a 25-year-old silverback – was found dead in his nest after a heart attack.

A spokesman said: "Yeboah's death has been a devastating blow to everyone here." – *BBC News, April 2, 2010*

Europe Reviews Primate Rights Rules

A news item by E. Dolgin in *Nature Medicine*, 2010, *16*, 352, <www.nature.com/nm/journal/v16/n4/full/nm0410-352a.html>, reviews recent progress in proposed changes to European laws governing the use of nonhuman primates.

Four Gorillas Die from Extreme Weather Conditions

Kigali, Rwanda — One mother gorilla and three infants are reported to have died because of extreme weather conditions, the Rwanda Development Board (RDB) has announced. The dead mountain gorillas were discovered during routine monitoring by the RDB trackers between May 16 and 17, 2010. Efforts by veterinary doctors to save the babies were futile.

Though the doctors are now conducting a necropsy, it is suspected that the cause of death was the extreme cold in the last few days. The dead gorillas belonged to the Pablo and Ugenda group which is settled in the Karisimbi area. That area is at high altitude, and is currently extremely cold.

"While it is not unusual to witness death of infant gorillas during the first three months, the sudden death of all the four, is not only very shocking, but also is such a great loss to Rwanda and the entire conservation team," said Rica Rwigamba, the RDB Head of Tourism and Conservation, said. "Every gorilla death is a major setback to conservation efforts to remove the mountain gorillas off the critically endangered species list." However, she confirmed that tourism activities have not been affected, since the deaths recorded were in a research group which is reserved for research purposes only and is closely monitored by researchers.

Of approximately 380–400 gorillas living in the Virunga massif ranging between Rwanda, the Democratic Republic of the Congo, and Uganda, Rwanda is home to at least 265, who are regularly monitored. – *Copyright © 2010* The New Times, *reported May 18 by Edmund Kagire*

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Workshop Announcements

Three Rs in Vaccine Research

An international workshop on "Alternative Methods to Reduce, Refine, and Replace the Use of Animals in Vaccine Potency and Safety Testing: State of the Science and Future Directions" will be held September 14–16, 2010, at the William H. Natcher Conference Center, National Institutes of Health, Bethesda, Maryland.

The goals of this workshop are to:

- review the state of the science of the alternative methods that are currently available and/or accepted for use that reduce, refine (less pain and distress), and replace the use of animals in vaccine potency and safety testing, and discuss ways to promote their implementation;
- identify knowledge and data gaps that must be addressed to develop alternative methods that can further reduce, refine, and replace the use of animals in vaccine potency and safety testing; and
- identify and prioritize research, development, and validation efforts needed to address these knowledge and data gaps in order to advance alternative methods for vaccine potency and safety testing, while ensuring continued protection of human and animal health.

For information, registration, etc., see <iccvam.niehs.nih.gov/meetings/BiologicsWksp-2010/BiologicsWksp.htm>. Abstracts should be submitted by July 29.

Association of Primate Veterinarians

The 2010 Association of Primate Veterinarians' Workshop will be held October 6–9 at the Emory Conference Center, Hotel/Emory Inn, Atlanta, Georgia. See <www.primatevets.org>.

Primadaption Workshop

A Primadaption Workshop will be held October 25–28, 2010, sponsored by Primate Products. "Primadaption" is a training and enrichment concept based on the idea that traditional or formal methods of training and enrichment for captive nonhuman primates are not always compatible with the resources that are available at many facilities and, therefore, it is necessary to tweak those methods so that it is possible to achieve the desired results within the set means. The ultimate goal is to create a realistic enrichment and training program that has room to change and grow, but is capable of being easily instituted at the specific facility. This is accomplished primarily through Applied Behaviorism, which integrates environmental enrichment, nonhuman primate training, and behavioral management.

The workshop will be held at Primate Products' Panther Tracks Learning Center in Immokalee, Florida. For more information, see <www.primateproducts.com/cms.php?top=10>.

Curious George: Monkey as Metaphor

Michael Fink
Rhode Island School of Design

The Jewish Museum in New York has mounted a major show on the origins of *Curious George*. The cheerful and ingenious monkey is the brainchild of Hans Augusto and Margret Rey, who were fleeing Nazi Europe along that crowded road from Paris toward Spain, and inventing the metaphorical and meteoric primate along the way. All this has been reported throughout the year in Manhattan in articles in both the *Wall Street Journal* and the *New York Times*, as well as in our own *Providence Journal*. I told my Big Apple daughter to take her daughters to the special exhibit. She reports that it isn't really intended for the small fry, but rather for grownups with a memory for those desperate times.

"George" started out with a French name and style and metamorphosed into a symbol of the American spirit, soul, and spunk. Even the colors of the illustrations took on a simple, direct, monochromatic tone, without much nuance. He got bratty and buoyant and lost some of his personality en route over the pond and gained other traits: sheer pluck and luck. So, we have the plight of the primates endangered, often abused, hunted and consumed and then we have the stuffed dolls of the nursery. All cleaned up and fun to play with.

And then, for some of us, we have the postwar plight of the Jewish (or Gypsy) refugee, relying on instinct and verve-and-vigor to get by and squeeze a bit of fun out of the voyage. Think of Curious George as a symbol of our generation! I'm Curious George and so are you out there.

I saw a curious film last night. No, it wasn't on *Turner Classic Movies***.** I found it after Rhode Island's April rainstorm flooded my basement, on a DVD. It was Kirk Douglas' rather unusual small flick (directed by Edward Dmytryk) called *The Juggler*. Have you seen it, anyone? It's about a stage and circus entertainer and clown who of course spends the war years in a slave labor and murder camp and loses his family. He winds up in the new Israel but freaks out when he discovers that everybody wants to put him in a hospital or a kibbutz. When all he wants is freedom, space, air! Reviewers at the time, and since, called this little movie pointless, but in the year of Curious George I found it quite fascinating. Douglas's performance made me think of the personality and plight of the primate George. Living on your wits, escaping from troubles and getting into fresh scrapes.

It struck me that among survivor stories there is a shared genre of cleverness, good fortune, and almost folkloric zest mixed with desperation. Still hope to catch the act while it's happening like a version of *King Kong* or *Mighty Joe Young* – the show at the Jewish Museum, I mean, but in any case I'm glad to be reminded of just how deeply the escape of a few of us from those who would wipe us out has affected our culture. And glad to let George open up some doors and let me loose.

Comments to Michael Fink: <*mfink33@aol.com*>.

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Announcements from Publications: Changes at *BMC Biology*

BMC Biology and the *Journal of Biology* are joining forces as a single journal committed to the publication of high-quality commissioned content and research articles of exceptional importance. The combined journal will operate under the name *BMC Biology*, reflecting the strong relationship with the subject-specific *BMC*-series journals, and will be edited by Miranda Robertson, who explains in an inaugural editorial how she sees the fusion combining the strengths of both journals, with continuation of the re-review opt-out experiment initiated by the *Journal of Biology.*

As a new feature to mark the fusion, *BMC Biology* will publish video Question & Answer interviews, also available as text. – *from an e-mailed announcement, April 14, 2010*

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Ancestor Worship in Baboons?

John Price

I am writing a paper on the evolutionary origins of religious belief (it is quite a popular field at the moment) and I can remember a description of what might have been a rudimentary form of ancestor worship in a group of baboons. The group was observed just after the Boer War in the first years of the twentieth century, when most of the Boers were in concentration camps. Even after they were freed they were not allowed rifles, so the baboon troops flourished.

This group, which was observed for several seasons, contained an alpha male who was in the habit of sitting on a conspicuous rock in the middle of their range. No other baboon was allowed on the rock, but they all came and presented to the alpha male as he sat on the rock.

Then the alpha male died. The observers expected the beta male to replace him on the rock, but this did not happen. None of the troop climbed on the rock, but they all continued to come and present to the rock even though it was empty.

It might not be quite ancestor worship, but it appeared to be a form of honoring a group member who had died.

I think this is the only such example to have been described, but my problem is that I cannot remember where I read it. It is the sort of thing Eugene Marais might have described, but I have looked through *The Soul of the Ape* and some of his papers and it is not there. It must have been some time after I became interested in monkeys, which was in the late 1960s.

I wonder if any of you primatologists reading this *Newsletter* might have heard the same story. Please let me know if you have. Thank you!

Contact John Price at Hackmans, Plumpton Lane, Plumpton, BN7 3AJ, East Sussex, U.K. [0044-1273-890362; e-mail: *johnscottprice@hotmail.com*].

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Information Requested or Available

New Veterinary Specialties?

The public comment period is open for two new veterinary specialties currently being considered by the American Veterinary Medical Association (AVMA). The AVMA American Board of Veterinary Specialties (ABVS) is being petitioned to recognize the American College of Animal Welfare. In addition, the American College of Veterinary Microbiologists has petitioned the ABVS to recognize a new parasitology specialty. Public comments help the ABVS make a determination about the need for and impact of any new specialty.

Comments on the proposed American College of Animal Welfare and parasitology specialties must be signed and received no later than Nov. 1, 2010. They should be sent to David Banasiak, AVMA Education and Research Division, 1931 North Meacham Rd, Suite 100, Schaumburg, IL 60173-4360 [e-mail: *DBanasiak@avma.org*].

The AVMA currently recognizes 20 veterinary specialty organizations. The American College of Veterinary Microbiologists petition indicates that the 200 members of the American Association of Veterinary Parasitologists would be a source of potential diplomates if the new parasitology specialty were approved. The American College of Animal Welfare organizing committee estimates that 50 veterinarians will sit for the certification examination within three years of approval of the animal welfare specialty.

For any other information about veterinary medicine, see <www.avma.org>. For a complete list of veterinary specialties, see <www.avma.org/reference/marketstats/vetspec.asp>.

APHIS Animal Care Website Improvements

The Animal Care program of the U.S. Department of Agriculture's Animal and Plant Health Inspection Service (APHIS) has launched a new and improved Website in an effort to provide stakeholders with the best and most easily accessible information. APHIS Deputy Administrator for Animal Care Chester Gipson said, "Our main goal in revising the Website is to provide you and others with the latest news from Animal Care, as well as more information about our leadership on issues of humane care and the treatment of animals."

There has always been a large volume of information on the Website, and there continues to be under the new design. In fact, Animal Care has moved a significant amount of information previously contained in its annual report to the Website. The information can now be updated more easily and provided in a timely manner.

The Website address remains the same: <www.aphis.usda.gov/animal_welfare>, although some items may have moved locations. Please contact Tom Chao [301-734-4980; e-mail: *tom.chao@aphis.usda.gov*] if you have any questions or any trouble locating a resource previously accessed on the Animal Care Website.

Recent Books and Articles

(Addresses are those of first authors unless otherwise indicated)

Books

• *Primatology: Theories, Methods and Research*. E. Potocki & J. Krasiñski (Eds.). Hauppauge, NY: Nova, 2009. [Price: $129]

Contents: Preface; Perspectives in primate bioacoustics, by B. M. Bezerra, A. S. Souto, & G. Jones; The hypothalamic-pituitary-adrenal axis in nonhuman primates: Circadian rhythms of stress-responsiveness and aging, by N. D. Goncharova; Why apes point: Pointing gestures in spontaneous conversation of language-competent *Pan*/*Homo* bonobos, by J. Pedersen, P. Segerdahl, & W. M. Fields; Using sexual dimorphism and development to reconstruct mating systems in ancient primates, by S. Cachel; How latent solution experiments can help to study differences between human culture and primate traditions, by C. Tennie & D. Hedwig; The tendency to make man an exception, by N. Caldararo; Studying social development and cognitive abilities in gibbons (*Hylobates* spp.): Methods and applications, by S. M. Cheyne; Comparing methods for assessing learning and cognition in primates, by M. J. Beran, T. A. Evans, & D. A. Washburn; Patterns of daily movement, activities and diet in woolly monkeys (Genus *Lagothrix*): A Comparison between sites and methodologies, by M. González & P. R. Stevenson; and "How close should we get"– Researchers' role in preventing the anthropozoonotic outbreaks in groups of free ranging chimpanzees and gorillas, by M. Lukasik-Braum.

• *Magnetic Resonance Imaging of the Rhesus Monkey Brain*. J. Frahm, S. Hofer, K.-D. Merboldt, & R. Tammer. Goettingen: Vandenhoeck & Ruprecht, 2009. [Price: $460]

• *Primate Neuroethology*. M. Platt & A. Ghazanfar (Eds.). New York: Oxford University Press, 2010. 688 pp. [Price: $125.00]

Magazines and Newsletters

• *American Journal of Physical Anthropology*, 2010, *141*[1], <www3.interscience.wiley.com/journal/123209155/issue>.

Contents include: Variations in the mechanical properties of *Alouatta palliata* molar enamel, by L. A. Darnell, M. F. Teaford, K. J. T. Livi, & T. P. Weihs; Comparative 3D quantitative analyses of trapeziometacarpal joint surface curvatures among living catarrhines and fossil hominins, by M. W. Marzke, M. W. Tocheri, B. Steinberg, J. D. Femiani, S. P. Reece, R. L. Linscheid, C. M. Orr, & R. F. Marzke; A new species of *Pliopithecus Gervais*, 1849 (Primates: Pliopithecidae) from the Middle Miocene (MN8) of Abocador de Can Mata (els Hostalets de Pierola, Catalonia, Spain), by D. M. Alba, S. Moyà-Solà, A. Malgosa, I. Casanovas-Vilar, J. M. Robles, S. Almécija, J. Galindo, C. Rotgers, & J. V. Bertó Mengual; Joint orientation and function in great ape and human proximal pedal phalanges, by N. L. Griffin & B. G. Richmond; and Ecological correlates of infraorbital foramen area in primates, by M. N. Muchlinski.

• *American Journal of Physical Anthropology*, 2010, *141*[2], <www3.interscience.wiley.com/journal/123233576/issue>.

Contents include: Scramble or contest competition over food in solitarily foraging mouse lemurs (*Microcebus* spp.): New insights from stable isotopes, by M. Dammhahn & P. M. Kappeler; and The interplay between speed, kinetics, and hand postures during primate terrestrial locomotion, by B. A. Patel.

• *American Journal of Physical Anthropology*, 2010, *141*[3], <www3.interscience.wiley.com/journal/123270316/issue>.

Contents include: Optimal foraging on the roof of the world: Himalayan langurs and the classical prey model, by K. Sayers, M. A. Norconk, & N. L. Conklin-Brittain; Finger length ratios (2D:4D) in anthropoids implicate reduced prenatal androgens in social bonding, by E. Nelson & S. Shultz; New hominid fossils from Woranso-Mille (Central Afar, Ethiopia) and taxonomy of early *Australopithecus*, by Y. Haile-Selassie, B. Z. Saylor, A. Deino, M. Alene, & B. M. Latimer; Morphometric variation in the papionin muzzle and the biochronology of the South African Plio-Pleistocene karst cave deposits, by C. C. Gilbert & F. E. Grine; and Plant foods consumed by Pan: Exploring the variation of nutritional ecology across Africa, by G. Hohmann, K. Potts, A. N'Guessan, A. Fowler, R. Mundry, J. U. Ganzhorn, & S. Ortmann.

• *American Journal of Physical Anthropology*, 2010, *141*[4], <www3.interscience.wiley.com/journal/123327340/issue>.

Contents include: Regional, ontogenetic, and sex-related variations in elastic properties of cortical bone in baboon mandibles, by Q. Wang, D. W. Ashley, & P. C. Dechow; Are the gorillas in Bwindi Impenetrable National Park true mountain gorillas? by A. A. Elgart; Trabecular bone structure in the mandibular condyles of gouging and nongouging platyrrhine primates, by T. M. Ryan, M. Colbert, R. A. Ketcham, & C. J. Vinyard; Captive gorillas are right-handed for bimanual feeding, by A. Meguerditchian, S. E. Calcutt, E. V. Lonsdorf, S. R. Ross, & W. D. Hopkins; and Reaction to fire by savanna chimpanzees (*Pan troglodytes verus*) at Fongoli, Senegal: Conceptualization of fire behavior and the case for a chimpanzee model, by J. D. Pruetz & T. C. LaDuke.

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

• *American Journal of Physical Anthropology*, 2010, *142*[1], <www3.interscience.wiley.com/journal/28130/home>.

Contents include: Ecological stress and linear enamel hypoplasia in *Cebus*, by M. B. Chollet & M. F. Teaford; A survey of entodiniomorphid ciliates in chimpanzees and bonobos, by K. Pomajbíková, K. J. Petrelková, I. Profousová, J. Petráová, S. Kiidayová, Z. Varádyová, & D. Modrý; Introgressive hybridization in southern African baboons shapes patterns of mtDNA variation, by C. Keller, C. Roos, L. F. Groeneveld, J. Fischer, K. Zinner, & D. Zinner; Craniodental mechanics and diet in Asian colobines: Morphological evidence of mature seed predation and sclerocarpy, by D. B. Koyabu & H. Endo; Brief communication: Dynamic plantar pressure distribution during locomotion in Japanese macaques (*Macaca fuscata*), by E. Hirasaki, Y. Higurashi, & H. Kumakura; and Contributions of enamel-dentine junction shape and enamel deposition to primate molar crown complexity, by M. M. Skinner, A. Evans, T. Smith, J. Jernvall, P. Tafforeau, K. Kupczik, A. J. Olejniczak, A. Rosas, J. Radovi, J. F. Thackeray, M. Toussaint, & J.-J. Hublin.

• *American Journal of Primatology*, 2010, *72*[4], <www3.interscience.wiley.com/journal/123300977/issue>.

Contents: Seasonal and reproductive variation in body condition in captive female Japanese macaques (*Macaca fuscata*), by C. Garcia, M. Huffman, & K. Shimizu; Socially biased learning among adult cottontop tamarins (*Saguinus oedipus*), by C. Dillis, T. Humle, & C. T. Snowdon; Social dynamics and individual plasticity of infant care behavior in cooperatively breeding cotton-top tamarins, by S. Refetoff Zahed, A. V. Kurian, & C. T. Snowdon; Gastrointestinal parasites of the chimpanzee population introduced onto Rubondo Island National Park, Tanzania, by K. J. Petrelková, H. Hasegawa, C. C. Appleton, M. A. Huffman, C. E. Archer, L. R. Moscovice, M. I. Mapua, J. Singh, & T. Kaur; Diet of the Delacour's langur (*Trachypithecus delacouri*) in Van Long Nature Reserve, Vietnam, by C. Workman; The species–area relationship and confounding variables in a threatened monkey community, by A. R. Marshall, H. I. O. Jørgensbye, F. Rovero, P. J. Platts, P. C. L. White, & J. C. Lovett; The use of Artificial Neural Networks to classify primate vocalizations: A pilot study on black lemurs, by L. Pozzi, M. Gamba, & C. Giacoma; Great apes track hidden objects after changes in the objects' position and in subject's orientation, by A. Albiach-Serrano, J. Call, & J. Barth; and Sex differences in the vocal repertoire of adult red-capped mangabeys (*Cercocebus torquatus*): A multi-level acoustic analysis, by H. Bouchet, A.-S. Pellier, C. Blois-Heulin, & A. Lemasson.

• *Animal Behaviour*, 2009, *78*[1].

Contents include: The alarm call system of female Campbell's monkeys, by K. Ouattara, K. Zuberbühler, E. K. N'goran, J.-E. Gombert, & A. Lemasson; and Cultural inheritance and diversification of diet in variable environments, by D. J. van der Post & P. Hogeweg.

• *Animal Behaviour*, 2009, *78*[2].

Contents include: What do animal signals mean? By D. Rendall, M. J. Owren, & M. J. Ryan; Socially deprived rhesus macaques fail to reconcile: Do they not attempt or not accept reconciliation? By M. M. Kempes, E. Den Heijer, L. Korteweg, A. L. Louwerse, & E. H. M. Sterck; Expectant parents groom adult sons according to previous alloparenting in a biparental cooperatively breeding primate, by A. J. Ginther & C. T. Snowdon; Coalitions in male Barbary macaques, *Macaca sylvanus*: Strength, success and rules of thumb, by A. Bissonnette, H. de Vries, & C. P. van Schaik; and Play behavioural tactics under space reduction: Social challenges in bonobos, *Pan paniscus*, by G. Tacconi & E. Palagi.

• *Animal Behaviour*, 2009, *78* [3].

Contents include: Navigation in human crowds; testing the many-wrongs principle, by J. J. Faria, E. A. Codling, J. R. G. Dyer, F. Trillmich, & J. Krause; and Reproductive benefits of high social status in male macaques (*Macaca*), by J. M. Rodriguez-Llanes, G. Verbeke, & C. Finlayson.

• *Animal Behaviour*, 2009, *78* [4].

Contents include: The development of alarm call behaviour in mammals and birds, by L. I. Hollén & A. N. Radford; Cooperative problem solving in a social carnivore, by C. M. Drea & A. N. Carter; and Postconflict third-party affiliation in *Canis lupus*: Do wolves share similarities with the great apes? By E. Palagi & G. Cordoni.

• *Animal Behaviour*, 2009, *78* [5].

Contents include: Pigs learn what a mirror image represents and use it to obtain information, by D. M. Broom, H. Sena, & K. L. Moynihan; Selective mimetism at departure in collective movements of *Macaca tonkeana*: An experimental and theoretical approach, by C. Sueur, O. Petit, & J. L. Deneubourg; Motor planning for vocal production in common marmosets, by C. T. Miller, S. J. Eliades, & X. Wang; and Movement ecology in a captive environment: The effects of ground substrate on movement paths of captive rhesus macaques, *Macaca mulatta*, by B. A. Beisner & L. A. Isbell.

• *Animal Behaviour*, 2009, *78* [6].

Contents include: All together now: Behavioural synchrony in baboons, by A. J. King & G. Cowlishaw; Vocal, gestural and locomotor responses of wild chimpanzees to familiar and unfamiliar intruders: A playback study, by I. Herbinger, S. Papworth, C. Boesch, & K. Zuberbühler; Birth order affects behaviour in the investment game: Firstborns are less trustful and reciprocate less, by A. Courtiol, M. Raymond, & C. Faurie; Guidelines for the instrumentation of wild birds and mammals, by R. M. Casper; and Can you believe my eyes? The importance of in-

terobserver reliability statistics in observations of animal behaviour, by A. B. Kaufman & R. Rosenthal.

• *Animal Cognition*, 2010, *13*[2], <www.springerlink.com/content/uju133726186>.

Contents include: Signals use by leaders in *Macaca tonkeana* and *Macaca mulatta*: Group-mate recruitment and behaviour monitoring, by C. Sueur & O. Petit; Capuchin monkeys (*Cebus apella*) are sensitive to others' reward: An experimental analysis of food-choice for conspecifics, by A. Takimoto, H. Kuroshima, & K. Fujita; Long-tailed macaques display unexpected waiting abilities in exchange tasks, by M. Pelé, V. Dufour, J. Micheletta, & B. Thierry; Reaching around barriers: The performance of the great apes and 3–5-year-old children, by P. H. J. M. Vlamings, B. Hare, & J. Call; Why do gorillas make sequences of gestures? By E. Genty & R. W. Byrne; and Keeping track of time: Evidence for episodic-like memory in great apes, by G. Martin-Ordas, D. Haun, F. Colmenares, & J. Call.

• *CC Update*, Winter, 2010, *21*[1], <www.communityconservation.org/newsletter.htm>. (Community Conservation, Inc., 50542 One Quiet Lane, Gays Mills, WI 54631 [e-mail: *communityconservation@mwt.net*].)

• *The Enrichment Record*, 2010, *3*, <www.gr8tt.com/enrichrecord.html>.

• *The Gibbon's Voice,* December, 2009, *11*[1], <www.gibboncenter.org>. (Gibbon Conservation Center, P.O. Box 800249, Santa Clarita, CA 91380.)

The Gibbon Center is seeking a new location and has started a fund-raising program.

• *Journal of Medical Primatology*, 2010, *39*[2], <www3.intescience.wiley.com/journal/118493879/home>.

Contents: 25-Hydroxy-vitamin D levels among *Callithrix penicillata* primate species raised in captivity, by D. S. Teixeira, L. C. G. Castro, Y. K. M. Nóbrega, R. C. Almeida, L. Gandolfi, & R. Pratesi; Magnetic activated cell sorting allows isolation of spermatogonia from adult primate testes and reveals distinct GFRa1-positive subpopulations in men, by K. Gassei, J. Ehmcke, R. Dhir, & S. Schlatt; Spontaneous gallbladder pathology in baboons, by J. L. Slingluff, J. T. Williams, L. Blau, A. Blau, E. J. Dick, Jr., & G. B. Hubbard; Analysis of humoral immune responses in rhesus macaques vaccinated with attenuated SIVmac239Δ*nef* and challenged with pathogenic SIVmac251, by D. Freißmuth, A. Hiltgartner, C. Stahl-Hennig, D. Fuchs, K. Tenner-Racz, P. Racz, K.Überla, A. Strasak, M. P. Dierich, H. Stoiber, & B. Falkensammer; Alopecia in rhesus macaques correlates with immunophenotypic alterations in dermal inflammatory infiltrates consistent with hypersensitivity etiology, by J. Kramer, M. Fahey, R. Santos, A. Carville, L. Wachtman, & K. Mansfield; Evaluation of poliovirus antibody titers in orally vaccinated semi-captive chimpanzees in Uganda, by L. Mugisha, G. Pauli, J. Opuda-Asibo, O. O. Joseph, F. H. Leendertz, & S. Diedrich; and Airborne *Mycobacterium avium* infection in a group of red-shanked douc langurs (*Pygathrix nemaeus nemaeus*), by R. Plesker, K. Teschner, O. Behlert, E. Prenger-Berninghoff, & D. Hillemann.

• *Neotropical Primates. A Journal and Newsletter of the IUCN/SSC Primate Specialist Group*, June, 2009, *15*[2], <www.primate-sg.org/PDF/NP15.2.pdf>.

Contents: Seed predation of *Mabea fistulifera* (Euphorbiaceae) by northern muriquis (*Brachyteles hypoxanthus*), by Í. M. C. Mourthé, K. B. Strier, & J. P. Boubli; Habitat characterization and population density of brown spider monkeys (*Ateles hybridus*) in Magdalena Valley, Colombia, by A. M. Aldana, M. Beltrán, J. Torres-Neira, & P. R. Stevenson; Primatas da RPPN Gargaú, Paraíba, Brasil, by M. de Souza Fialho & G. F. Gonçalves; Distribuição e variação na pelagem de *Callicebus coimbrai* (Primates, Pitheciidae) nos estados de Sergipe e Bahia, Brasil, by M. Cardoso de Sousa, S. Sampaio dos Santos, & M. C. Marques Valente; Occasional field observations of the predation on mice, dove and ants by black-tufted-ear marmosets (*Callithrix penicillata*), by I. de O. Silva, A. B. B. Alvarenga, & V. Boere; Observation of black-capped capuchins (*Cebus apella*) feeding on an owl monkey (*Aotus brumbacki*) in the Colombian llanos, by X. Carretero-Pinzón, T. R. Defler, & S. F. Ferrari; Densidad poblacional y tamaño de grupo de *Saguinus leucopus* en parches de bosque en el Departamento de Caldas, Colombia, by N. R. Duque, W. R. Vinasco, & J. V. Estévez Varón; and Expansão da distribuição geográfica de *Callicebus bernhardi* a oeste do Rio Ji-Paraná, estado de Rondônia, Brasil, by G. R. Monção, V. Selhorst, & J. A. Rodrigues Soares-filho.

• *Neotropical Primates. A Journal and Newsletter of the IUCN/SSC Primate Specialist Group*, June, 2009, *16*[1], <www.primate-sg.org/PDF/NP16.1.pdf>.

Contents: Developmental stages in the howler monkey, subspecies *Alouatta palliata mexicana*: A new classification using age-sex categories, by C. Domingo Balcells & J. J. Veà Baró; Trunk-to-trunk leaping in wild *Callimico goeldii* in northern Bolivia, by P. A. Garber & L. M. Porter; Endoparasitos em Muriquis-Do-Norte, *Brachyteles hypoxanthus*, isolados em pequeno fragmento de Mata Atlântica, by P. Santos Angonesi, B. Almeida-Silva, S. Lucena Mendes, & A. dos Santos Pyrrho; Habitat characterization and population status of the dusky titi (*Callicebus ornatus*) in fragmented forests, Meta, Colombia, by M. Wagner, F. Castro, & P. R. Stevenson; Anthropogenic change and primate predation risk: Crested caracaras (*Caracara plancus*) attempt predation on mantled howler monkeys (*Alouatta palliata*), by T. McKinney; Early behavioral development of a free-ranging howler monkey infant (*Alouatta guariba clamitans*) in southern Brazil, by

L. R. Podgaiski & M. M. de Assis Jardim; Hunting strategy of the margay (*Leo pardus wiedii*) to attract the wild pied tamarin (*Saguinus bicolor*), by F. de Oliveira Calleia, F. Rohe, & M. Gordo; Peruvian red uakari monkeys *(Cacajao calvus ucayalii*) in the Pacaya-Samiria National Reserve — A range extension across a major river barrier, by M. Bowler, J. Noriega Murrieta, M. Recharte, P. Puertas, & R. Bodmer; Comunicación vocal de un grupo de tití gris (*Saguinus leucopus*) en Mariquita, Colombia, by L. H. Rueda & E. Zerda Ordóñez; and Owl monkey vocalizations at the Primate Research Institute, Inuyama, by S. S. Kantha, H. Koda, & J. Suzuki.

Proceedings

• *27th Annual Symposium on Nonhuman Primate Models for AIDS*. New England Primate Research Center and Harvard Medical School, 2009.

• Program of the Seventy-Ninth Annual Meeting of the American Association of Physical Anthropologists. *American Journal of Physical Anthropology*, 2010, *141*[S50], <www3.interscience.wiley.com/journal/123277996/issue>.

Special Journal Issues

• Chimpanzee Research Today. *Science*, 2010, *328*, 32-43, <www.sciencemag.org/content/vol328/issue5974>.

• Disaster Planning and Management, *ILAR Journal*, 2010, *51*[2], <dels-old.nas.edu/ilar_n/ilarjournal/journal.shtml>.

Contents: Introduction: Disaster planning and management: A practicum; Tropical storm and hurricane recovery and preparedness strategies; Disaster preparedness in biocontainment animal research facilities: Developing and implementing an incident response plan (IRP); Management of rodent viral disease outbreaks: One institution's (r)evolution; Crisis planning to manage risks posed by animal rights extremists; Verification of poultry carcass composting research through application during actual avian influenza outbreaks; Wildfire evacuation: Outrunning the witch's curse – One animal center's experience; IACUC considerations: You have a disaster plan but are you really prepared? and Workshop summary: Detection, impact, and control of specific pathogens in animal resource facilities.

• Comparative Functional Morphology in Primates. *International Journal of Primatology*, 2010, *31*[2], <www.springerlink.com/content/104389>

Contents: Comparative functional morphology in primates: An introduction to the special issue, by Y. Hamada, E. Hirasaki, & T. C. Rae; Bipedal versus quadrupedal hind limb and foot kinematics in a captive sample of *Papio anubis*: Setup and preliminary results, by G. Berillon, G. Daver, K. D'Août, G. Nicolas, B. de la Villetanet, F. Multon, G. Digrandi, & G. Dubreuil; Palmar and plantar pressure while walking on a horizontal ladder and single pole in *Macaca fuscata*, by Y. Higurashi, E. Hirasaki, & H. Kumakura; Distal forelimb kinematics in *Erythrocebus patas* and *Papio anubis* during walking and galloping, by B. A. Patel & J. D. Polk; Is the clavicle of apes long? An investigation of clavicular length in relation to body mass and upper thoracic width, by M. Kagaya, N. Ogihara, & M. Nakatsukasa; Cross-sectional morphology of the femoral neck of wild chimpanzees, by A. Matsumura, H. Gunji, Y. Takahashi, T. Nishida, & M. Okada; Estimating the functional axis of the primate foot using the distribution of plantar muscles, by E. Hirasaki & H. Kumakura; A method for quantifying articular surface morphology of metacarpals using quadric surface approximation, by Y. Matsuura, N. Ogihara, & M. Nakatsukasa; Subchondral bone apparent density and locomotor behavior in extant primates and subfossil lemurs *Hadropithecus* and *Pachylemur*, by J. D. Polk, S. A. Williams, J. V. Peterson, C. C. Roseman, & L. R. Godfrey; Functional analysis of the primate shoulder, by H. Preuschoft, B. Hohn, H. Scherf, M. Schmidt, C. Krause, & U. Witzel; and Evolutionary robotic approaches in primate gait analysis, by W. I. Sellers, T. C. Pataky, P. Caravaggi, & R. H. Crompton.

• In the light of evolution IV: The human condition. *Proceedings of the National Academy of Sciences, U.S.A.*, 2010, *107*[Suppl. 2], <www.pnas.org/content/vol107/Supplement_2/?etoc>.

Anatomy and Physiology

• Topographic organization of macaque area LIP. Patel, G. H., Shulman, G. L., Baker, J. T., Akbudak, E., Snyder, A. Z., Snyder, L. H., & Corbetta, M. (Washington Univ., St. Louis, MO 63110 [e-mail: *gauravpatel@gmail.com*]). *Proceedings of the National Academy of Sciences, U.S.A.*, 2010, *107*, 4728-4733, <www.pnas.org/content/107/10/4728.full>.

"Despite several attempts to define retinotopic maps in the macaque lateral intraparietal area (LIP) using histological, electrophysiological, and neuroimaging methods, the degree to which this area is topographically organized remains controversial. We recorded blood oxygenation level-dependent signals with functional MRI from two macaques performing a difficult visual search task on stimuli presented at the fovea or in the periphery of the visual field. The results revealed the presence of a single topographic representation of the contralateral hemifield in the ventral subdivision of the LIP (LIPv) in both hemispheres of both monkeys. Also, a foveal representation was localized in rostral LIPv rather than in dorsal LIP (LIPd) as previous experiments had suggested. Finally, both LIPd and LIPv responded only to contralateral stimuli. In contrast, human studies have reported multiple topographic maps in intraparietal cortex and robust responses to ipsilateral stimuli. These blood oxygenation level-dependent functional MRI results provide clear evidence

for the topographic organization of macaque LIP that complements the results of previous electrophysiology studies, and also reveal some unexpected characteristics of this organization that have eluded these previous studies. The results also delineate organizational differences between LIPv and LIPd, providing support for these two histologically defined areas may subserve different visuospatial functions. Finally, these findings point to potential evolutionary differences in functional organization with human posterior parietal cortex."

• Mapping primary gyrogenesis: High-resolution in utero structural MRI study of fetal brain development in pregnant baboons. Kochunov, P., Castro, C., Davis, D., Dudley, D., Brewer, J., Zhang, Y., Kroenke, C., Purdy, D., Fox, P. T., Simerly, C., & Schatten, G. (Research Imaging Inst., Univ. Texas Health Sci. Ctr., San Antonio, TX 78229 [e-mail: *kochunov@uthscsa.edu*]). *Frontiers in Neurogenesis*, 2010, *4*[20], <www.frontiersin.org/ neuroscience/neurogenesis/paper/10.3389/fnins.2010.00020>.

"The global and regional changes in the fetal cerebral cortex in primates were mapped during primary gyrification (PG; weeks 17-25 of 26 weeks total gestation). Studying pregnant baboons using high-resolution MRI in utero, measurements included cerebral volume, cortical surface area, gyrification index and length and depth of ten primary cortical sulci. Seven normally developing fetuses were imaged in two animals longitudinally and sequentially. We compared these results to those on PG from ferret studies and analyzed them in the context of our recent studies of phylogenetics of cerebral gyrification. We observed that in both primates and nonprimates, the cerebrum undergoes a very rapid transformation into the gyrencephalic state, subsequently accompanied by an accelerated growth in brain volume and cortical surface area. However, PG trends in baboons exhibited some critical differences from those observed in ferrets. For example, in baboons, the growth along the long (length) axis of cortical sulci was unrelated to the growth along the short (depth) axis and far outpaced it. Additionally, the correlation between the rate of growth along the short sulcal axis and heritability of sulcal depth was negative and approached significance (r=-0.60; p<.10), while the same trend for long axis was positive and not significant (r=0.3; p=0.40). These findings, in an animal that shares a highly orchestrated pattern of PG with humans, suggest that ontogenic processes that influence changes in sulcal length and depth are diverse and possibly driven by different factors in primates than in nonprimates."

• Individual differences in scanpaths correspond with serotonin transporter genotype and behavioral phenotype in rhesus monkeys (*Macaca mulatta*). Gibboni, III, R. R., Zimmerman, P. E., & Gothard, K. M. (K. M. G., Dept of Physiol., Univ. of Arizona, 1501 N. Campbell Ave, Rm 4104, Tucson, AZ 85724 [e-mail: *kgothard@email.arizona.edu*]). *Frontiers in Behavioral Neuroscience*, 2009, *3*[50], <www.frontiersin.org/ neuroscience/behavioralneuroscience/paper/10.3389/neuro.08/050.2009>.

"Scanpaths (the succession of fixations and saccades during spontaneous viewing) contain information about the image but also about the viewer. To determine the viewer-dependent factors in the scanpaths of monkeys, we trained three adult males to look for 3 sec at images of conspecific facial expressions with either direct or averted gaze. The subjects showed significant differences on four basic scanpath parameters (number of fixations, fixation duration, saccade length, and total scanpath length) when viewing the same facial expression/gaze direction combinations. Furthermore, we found differences between monkeys in feature preference and in the temporal order in which features were visited on different facial expressions. Overall, the between-subject variability was larger than the within-subject variability, suggesting that scanpaths reflect individual preferences in allocating visual attention to various features in aggressive, neutral, and appeasing facial expressions. Individual scanpath characteristics were brought into register with the genotype for the serotonin transporter regulatory gene (5-HTTLPR) and with behavioral characteristics such as expression of anticipatory anxiety and impulsiveness/hesitation in approaching food in the presence of a potentially dangerous object."

• Space representation for eye movements is more contralateral in monkeys than in humans. Kagan, I., Iyer, A., Lindner, A., & Andersen, R. A. (R. A. A., Div. of Biol., California Inst. of Technology, Pasadena, CA 91125 [e-mail: *andersen@vis.caltech.edu*]). *Proceedings of the National Academy of Sciences, U.S.A.*, 2010, *107*, 7933-7938, <www.pnas.org/content/107/17/7933.full>.

"Contralateral hemispheric representation of sensory inputs (the right visual hemifield in the left hemisphere and vice versa) is a fundamental feature of primate sensorimotor organization, in particular the visuomotor system. However, many higher-order cognitive functions in humans show an asymmetric hemispheric lateralization—e.g., right brain specialization for spatial processing—necessitating a convergence of information from both hemifields. Electrophysiological studies in monkeys and functional imaging in humans have investigated space and action representations at different stages of visuospatial processing, but the transition from contralateral to unified global spatial encoding and the relationship between these encoding schemes and functional lateralization are not fully understood. Moreover, the integration of data across monkeys and humans and elucidation of interspecies homologies is hindered, because divergent findings may reflect actual species differences or arise from discrepancies in techniques and measured signals (electrophysiology vs. imaging). Here, we directly compared spatial cue and memory representations for action planning in monkeys

and humans using event-related functional MRI during a working-memory oculomotor task. In monkeys, cue and memory-delay period activity in the frontal, parietal, and temporal regions was strongly contralateral. In putative human functional homologs, the contralaterality was significantly weaker, and the asymmetry between the hemispheres was stronger. These results suggest an inverse relationship between contralaterality and lateralization and elucidate similarities and differences in human and macaque cortical circuits subserving spatial awareness and oculomotor goal-directed actions."

• Idiosyncratic and systematic aspects of spatial representations in the macaque parietal cortex. Chang, S. W. C., & Snyder, L. H. (Ctr for Cog. Neurosci., Duke Univ. Sch. of Med., Durham, NC 27701 [e-mail: *steve.chang@duke.edu*]). *Proceedings of the National Academy of Sciences, U.S.A.*, 2010, *107*, 7951-7956, <www.pnas.org/content/107/17/7951.full>.

"The sensorimotor transformations for visually guided reaching were originally thought to take place in a series of discrete transitions from one systematic frame of reference to the next with neurons coding location relative to the fixation position (gaze-centered) in occipital and posterior parietal areas, relative to the shoulder in dorsal premotor cortex, and in muscle- or joint-based coordinates in motor output neurons. Recent empirical and theoretical work has suggested that spatial encodings that use a range of idiosyncratic representations may increase computational power and flexibility. We now show that neurons in the parietal reach region use nonuniform and idiosyncratic frames of reference. We also show that these nonsystematic reference frames coexist with a systematic compound gain field that modulates activity proportional to the distance between the eyes and the hand. Thus, systematic and idiosyncratic signals may coexist within individual neurons."

Animal Models

• Visual and motor connectivity and the distribution of calcium-binding proteins in macaque frontal eye field: Implications for saccade target selection. Pouget, P., Stepniewska, I., Crowder, E. A., Leslie, M. W., Emeric, E. E., Nelson, M. J., & Schall, J. D. (J. D. S., Ctr Integ. & Cog. Neurosci., Vanderbilt Vision Research Ctr, Dept of Psych., Vanderbilt Univ., 111 21st Ave. South, 525 Wilson Hall Nashville, TN 37203-0009]. *Frontiers in Neuroanatomy*, 2009, *3*[2], <frontiersin.org/neuroscience/neuroanatomy/paper/10.3389/neuro.05/002.2009/html>.

"The frontal eye field (FEF) contributes to directing visual attention and saccadic eye movement through intrinsic processing, interactions with extrastriate visual cortical areas (e.g. V4), and projections to subcortical structures (e.g. superior colliculus; SC). Several models have been proposed to describe the relationship between the allocation of visual attention and the production of saccades. We obtained anatomical information that might provide useful constraints on these models by evaluating two characteristics of FEF. First, we investigated the laminar distribution of efferent connections from FEF to visual areas V4 + TEO and to SC. Second, we examined the laminar distribution of different populations of GABAergic neurons in FEF. We found that the neurons in FEF that project to V4 + TEO are located predominantly in the supragranular layers, colocalized with the highest density of calbindin- and calretinin-immunoreactive inhibitory interneurons. In contrast, the cell bodies of neurons that project to SC are found only in layer 5 of FEF, colocalized primarily with parvalbumin inhibitory interneurons. None of the neurons in layer 5 that project to V4 + TEO also project to SC. These results provide useful constraints for cognitive models of visual attention and saccade production by indicating that different populations of neurons project to extrastriate visual cortical areas and to SC. This finding also suggests that FEF neurons projecting to visual cortex and superior colliculus are embedded in different patterns of intracortical circuitry."

• Timing of moderate level prenatal alcohol exposure influences gene expression of sensory processing behavior in rhesus monkeys. Schneider, M. L., Moore, C. F., Larson, J. A., Barr, C. S., DeJesus, O. T., & Roberts, A. D. (Dept of Kinesiol., Occup. Therapy Prog., Univ. of Wisconsin, 2175 Med. Sci. Ctr, 1300 Univ. Ave. Madison, WI 53706 [e-mail: *schneider@education.wisc.edu*]). *Frontiers in Integrative. Neuroscience*, 2009, *3*[30], <www.frontiersin.org/neuroscience/integrativeneuroscience/paper/10.3389/neuro.07/030.2009/html>.

"Sensory processing disorder (SPD), characterized by over- or under-responsivity to non-noxious environmental stimuli, is a common but poorly understood disorder. We examined the role of prenatal alcohol exposure, serotonin transporter gene polymorphic region variation (rh5-HTTLPR), and striatal dopamine (DA) function on behavioral measures of sensory responsivity to repeated non-noxious sensory stimuli in macaque monkeys. Results indicated that early gestation alcohol exposure induced behavioral under-responsivity to environmental stimuli in monkeys carrying the short (s) rh5-HTTLPR allele compared to both early-exposed monkeys homozygous for the long (l) allele and monkeys from middle-to-late exposed pregnancies and controls, regardless of genotype. Moreover, prenatal timing of alcohol exposure altered the relationship between sensory scores and DA D2R availability. In early-exposed monkeys, a positive relationship was shown between sensory scores and DA D2R availability, with low or blunted DA function associated with under-responsive sensory function. The opposite pattern was found for the middle-to-late gestation alcohol-exposed group. These findings raise questions about how the tim-

ing of prenatal perturbation and genotype contributes to effects on neural processing and possibly alters neural connections."

• Mosaic HIV-1 vaccines expand the breadth and depth of cellular immune responses in rhesus monkeys. Barouch, D. H., O'Brien, K. L., Simmons, N. L., King, S. L., Abbink, P., Maxfield, L. F., Sun, Y.-H., La Porte, A., Riggs, A. M., Lynch, D. M., Clark, S. L., Backus, K., Perry, J. R., Seaman, M. S., Carville, A., Mansfield, K. G., Szinger, J. J., Fischer, W., Muldoon, M., & Korber, B. (E/CLS – 1047, 330 Brookline Ave, Boston, MA 02215 [e-mail: *dbarouch@bidmc.harvard.edu*]). *Nature Medicine*, 2010, *16*, 319-323, <www.nature.com/nm/journal/v16/n3/full/nm.2089.html>.

"The worldwide diversity of HIV-1 presents an unprecedented challenge for vaccine development. Antigens derived from natural HIV-1 sequences have elicited only a limited breadth of cellular immune responses in nonhuman primate studies and clinical trials to date. Polyvalent 'mosaic' antigens, in contrast, are designed to optimize cellular immunologic coverage of global HIV-1 sequence diversity. Here we show that mosaic HIV-1 Gag, Pol and Env antigens expressed by recombinant, replication-incompetent adenovirus serotype 26 vectors markedly augmented both the breadth and depth without compromising the magnitude of antigen-specific T lymphocyte responses as compared with consensus or natural sequence HIV-1 antigens in rhesus monkeys. Polyvalent mosaic antigens therefore represent a promising strategy to expand cellular immunologic vaccine coverage for genetically diverse pathogens such as HIV-1."

• Publication bias in reports of animal stroke studies leads to major overstatement of efficacy. Sena, E. S., van der Worp, H. B., Bath, P. M. W., Howells, D. W., & Macleod, M. R. (M. R. M., Centre for Clinical Brain Sciences, Univ. of Edinburgh, Edinburgh, U.K. [e-mail: *malcolm.macleod@ed.ac.uk*]). *PLoS Biol*, 2010, *8*(3), <www.plosbiology.org/article/info:doi/10.1371/journal.pbio.1000344 >.

"The consolidation of scientific knowledge proceeds through the interpretation and then distillation of data presented in research reports, first in review articles and then in textbooks and undergraduate courses, until truths become accepted as such both amongst 'experts' and in the public understanding. Where data are collected but remain unpublished, they cannot contribute to this distillation of knowledge. If these unpublished data differ substantially from published work, conclusions may not reflect adequately the underlying biological effects being described. The existence and any impact of such 'publication bias' in the laboratory sciences have not been described. Using the CAMARADES (Collaborative Approach to Meta-analysis and Review of Animal Data in Experimental Studies) database we identified 16 systematic reviews of interventions tested in animal studies of acute ischaemic stroke involving 525 unique publications. Only ten publications (2%) reported no significant effects on infarct volume and only six (1.2%) did not report at least one significant finding. Egger regression and trim-and-fill analysis suggested that publication bias was highly prevalent (present in the literature for 16 and ten interventions, respectively) in animal studies modelling stroke. Trim-and-fill analysis suggested that publication bias might account for around one-third of the efficacy reported in systematic reviews, with reported efficacy falling from 31.3% to 23.8% after adjustment for publication bias. We estimate that a further 214 experiments (in addition to the 1,359 identified through rigorous systematic review; non publication rate 14%) have been conducted but not reported. It is probable that publication bias has an important impact in other animal disease models, and more broadly in the life sciences."

• Global genomic analysis reveals rapid control of a robust innate response in SIV-infected sooty mangabeys. Bosinger, S. E., Li, Q., Gordon, S. N., Klatt, N. R., Duan, L., Xu, L., Francella, N., Sidahmed, A., Smith, A. J., Cramer, E. M., Zeng, M., Masopust, D., Carlis, J. V., Ran, L., Vanderford, T. H., Paiardini, M., Isett, R. B., Baldwin, D. A., Else, J. G., Staprans, S. I., Silvestri, G., Haase, A. T., & Kelvin, D. J. (G. S., Suite 705 Stellar-Chance Labs, 422 Curie Blvd, Philadelphia, PA 19104 [e-mail: *gsilvest@mail.med.upenn.edu*]). *Journal of Clinical Investigation*, 2009, *119*, 3556–3572, <www.jci.org/articles/view/40115/pdf>.

"Natural SIV infection of sooty mangabeys (SMs) is nonprogressive despite chronic virus replication. Strikingly, it is characterized by low levels of immune activation, while pathogenic SIV infection of rhesus macaques (RMs) is associated with chronic immune activation. To elucidate the mechanisms underlying this intriguing phenotype, we used high-density oligonucleotide microarrays to longitudinally assess host gene expression in SIV-infected SMs and RMs. We found that acute SIV infection of SMs was consistently associated with a robust innate immune response, including widespread upregulation of IFN-stimulated genes (ISGs) in blood and lymph nodes. While SMs exhibited a rapid resolution of ISG expression and immune activation, both responses were observed chronically in RMs. Systems biology analysis indicated that expression of the lymphocyte inhibitory receptor LAG3, a marker of T cell exhaustion, correlated with immune activation in SIV-infected RMs but not SMs. Our findings suggest that active immune regulatory mechanisms, rather than intrinsically attenuated innate immune responses, underlie the low levels of immune activation characteristic of SMs chronically infected with SIV."

• A rapidly occurring compensatory decrease in physical activity counteracts diet-induced weight loss in female monkeys. Sullivan, E. L., & Cameron, J. L. (J. L. C., Dept. of Psychiatry, Univ. of Pittsburgh, 3811 O'Hara St., Pittsburgh, PA 15213 [e-mail: *jcameron@pitt.edu*]). *American*

Journal of Physiology – Regulatory, Integrative, and Comparative Physiology, 2010, *298*[4], R1068-R1074, <ajpregu.physiology.org/cgi/content/full/298/4/R1068>.

"To study changes in energy balance occurring during the initial phases of dieting, 18 adult ovariectomized female monkeys were placed on a low-fat diet, and available calories were reduced by 30% compared with baseline consumption for 1 month. Surprisingly, there was not significant weight loss; however, daily activity level (measured by accelerometry) decreased soon after diet initiation and reached statistical significance by the 4th week of dieting (18 ± 5.6% decrease, $P = 0.02$). During a 2nd month of dieting, available calories were reduced by 60% compared with baseline consumption, leading to 6.4 ± 1.7% weight loss and further suppression of activity. Metabolic rate decreased by 68 ± 12 kcal/day, with decreased activity accounting for 41 ± 9 kcal/day, and the metabolic activity of the weight lost accounting for 21 ± 5 kcal/day. A second group of three monkeys was trained to run on a treadmill for 1 h/day, 5 days/wk, at 80% maximal capacity, leading to increased calorie expenditure of 69.6 ± 10.7 kcal/day (equivalent to 49 kcal/day for 7 days). We conclude that a diet-induced decrease in physical activity is the primary mechanism the body uses to defend against diet-induced weight loss, and undertaking a level of exercise that is recommended to counteract weight gain and promote weight loss is able to prevent the compensatory decrease in physical activity-associated energy expenditure that slows diet-induced weight loss."

• Maternal influenza infection during pregnancy impacts postnatal brain development in the rhesus monkey. Short, S. J., Lubach, G. R., Karasin, A. I., Olsen, C. W., Styner, M., Knickmeyer, R. C., Gilmore, J. H., & Coe, C. L. (Univ. of North Carolina, 7023 Neurosciences Hospital, 101 Manning Dr., Campus Box 7160, Chapel Hill, NC 27599-7160 [e-mail: *sjshort@med.unc.edu*]). *Biological Psychiatry*, 2010, *67*, 965-973, <www.ncbi.nlm.nih.gov/pubmed/20079486>.

Maternal infection with influenza and other pathogens during pregnancy has been associated with increased risk for schizophrenia and neurodevelopmental disorders. In rodent studies, maternal inflammatory responses to influenza affect fetal brain development. However, to verify the relevance of these findings to humans, research is needed in a primate species with more advanced prenatal corticogenesis. Twelve pregnant rhesus monkeys were infected with influenza, A/Sydney/5/97 (H3N2), 1 month before term (early third trimester) and compared with 7 control pregnancies. Nasal swabs and blood samples confirmed viral shedding and immune activation. Structural magnetic resonance imaging was conducted at 1 year; behavioral development and cortisol reactivity were also assessed. Maternal infections were mild and self-limiting. At birth, maternally derived influenza-specific immunoglobulin G was present in the neonate, but there was no evidence of direct viral exposure. Birth weight and gestation length were not affected, nor were infant neuromotor, behavioral, and endocrine responses. However, magnetic resonance imaging analyses revealed significant reductions in cortical gray matter in flu-exposed animals. Regional analyses indicated the largest gray matter reductions occurred bilaterally in cingulated and parietal areas; white matter was also reduced significantly in the parietal lobe. Influenza infection during pregnancy affects neural development in the monkey, reducing gray matter throughout most of the cortex and decreasing white matter in parietal cortex. These brain alterations are likely to be permanent, given that they were still present at the monkey-equivalent of older childhood and thus might increase the likelihood of later behavioral pathology.

Behavior

• Campbell's monkeys concatenate vocalizations into context-specific call sequences. Ouattara, K., Lemasson, A., & Zuberbühler, K. (K. Z., Sch. of Psychology, Univ. of St. Andrews, KY16 9JP Saint Andrews, Scotland [e-mail: *kz3@st-and.ac.uk*]). *Proceedings of the National Academy of Sciences, U.S.A.*, 2009, *106*, 22026-22031, <www.pnas.org/content/106/51/22026.full>.

"Primate vocal behavior is often considered irrelevant in modeling human language evolution, mainly because of the caller's limited vocal control and apparent lack of intentional signaling. Here, we present the results of a long-term study on Campbell's monkeys, which has revealed an unrivaled degree of vocal complexity. Adult males produced six different loud call types, which they combined into various sequences in highly context-specific ways. We found stereotyped sequences that were strongly associated with cohesion and travel, falling trees, neighboring groups, nonpredatory animals, unspecific predatory threat, and specific predator classes. Within the responses to predators, we found that crowned eagles triggered four and leopards three different sequences, depending on how the caller learned about their presence. Callers followed a number of principles when concatenating sequences, such as nonrandom transition probabilities of call types, addition of specific calls into an existing sequence to form a different one, or recombination of two sequences to form a third one. We conclude that these primates have overcome some of the constraints of limited vocal control by combinatorial organization. As the different sequences were so tightly linked to specific external events, the Campbell's monkey call system may be the most complex example of 'proto-syntax' in animal communication known to date."

• Evidence of an evolutionary precursor to human language affixation in a non-human primate. Endress, A. D., Cahill, D., Block, S., Watumull, J., & Hauser, M. D. (Dept of Psych., Harvard Univ., Cambridge, MA 02138 [e-mail: *ansgar.endress@m4x.org*]). *Biology Letters*, 2009, *5*, 749-

751, <rsbl.royalsocietypublishing.org/content/5/6/749.full>.

"Human language, and grammatical competence in particular, relies on a set of computational operations that, in its entirety, is not observed in other animals. Such uniqueness leaves open the possibility that components of our linguistic competence are shared with other animals, having evolved for non-linguistic functions. Here, we explore this problem from a comparative perspective, asking whether cotton-top tamarin monkeys (*Saguinus oedipus*) can spontaneously (no training) acquire an affixation rule that shares important properties with our inflectional morphology (e.g. the rule that adds –ed to create the past tense, as in the transformation of walk into walk-ed). Using playback experiments, we show that tamarins discriminate between bisyllabic items that start with a specific 'prefix' syllable and those that end with the same syllable as a 'suffix'. These results suggest that some of the computational mechanisms subserving affixation in a diversity of languages are shared with other animals, relying on basic perceptual or memory primitives that evolved for non-linguistic functions."

• Monkeys recognize the faces of group mates in photographs. Pokorny, J. J., & de Waal, F. B. M. (Living Links, Yerkes NPRC, Emory Univ., Atlanta, GA 30322 [e-mail: *jpokorn@emory.edu*]). *Proceedings of the National Academy of Sciences, U.S.A.*, 2009, *106*, 21539-21543, <www.pnas.org/content/106/51/21539.full>.

Nonhuman primates possess a highly developed capacity for face recognition, which resembles the human capacity both cognitively and neurologically. Face recognition is typically tested by having subjects compare facial images, whereas there has been virtually no attention to how they connect these images to reality. Can nonhuman primates recognize familiar individuals in photographs? Such facial identification was examined in brown or tufted capuchin monkeys (*Cebus apella*), a New World primate, by letting subjects categorize facial images of conspecifics as either belonging to the in-group or out-group. After training on an oddity task with four images on a touch screen, subjects correctly identified one in-group member as odd among three out-group members, and vice versa. They generalized this knowledge to both new images of the same individuals and images of juveniles never presented before, thus suggesting facial identification based on real-life experience with the depicted individuals. This ability was unexplained by potential color cues because the same results were obtained with grayscale images. These tests demonstrate that capuchin monkeys, like humans, recognize whom they see in a picture.

• Affective responses in tamarins elicited by species-specific music. Snowdon, C. T., & Teie, D. (Dept of Psych., Univ. of Wisconsin, Madison, WI 53706 [e-mail: *snowdon@wisc.edu*). *Biology Letters*, 2010, *6*, 30-32, <www.ncbi.nlm.nih.gov/pubmed/19726444 >.

"Theories of music evolution agree that human music has an affective influence on listeners. Tests of non-humans provided little evidence of preferences for human music. However, prosodic features of speech ('motherese') influence affective behavior of non-verbal infants as well as domestic animals, suggesting that features of music can influence the behavior of nonhuman species. We incorporated acoustical characteristics of tamarin affiliation vocalizations and tamarin threat vocalizations into corresponding pieces of music. We compared music composed for tamarins with that composed for humans. Tamarins were generally indifferent to playbacks of human music, but responded with increased arousal to tamarin threat vocalization-based music, and with decreased activity and increased calm behavior to tamarin affective vocalization-based music. Affective components in human music may have evolutionary origins in the structure of calls of non-human animals. In addition, animal signals may have evolved to manage the behavior of listeners by influencing their affective state."

• *Pan* thanatology. Anderson, J. R., Gillies, A., & Lock, L. C. (Dept of Psych., Univ. of Stirling, Stirling FK9 4LA, U.K. [e-mail: *jra1@stir.ac.uk*]). *Current Biology*, 2010, *20*, R349-R351, <www.cell.com/current-biology/pdf/PIIS0960982210001454.pdf>.

"Chimpanzees' immediate responses to the death of a group-member have rarely been described. Exceptions include maternal care towards dead infants, and frenzied excitement and alarm following the sudden, traumatic deaths of older individuals. Some wild chimpanzees die in their night nest, but the immediate effect this has on others is totally unknown. Here, with supporting video material, we describe the peaceful demise of an elderly female in the midst of her group. Group responses include pre-death care of the female, close inspection and testing for signs of life at the moment of death, male aggression towards the corpse, all-night attendance by the deceased's adult daughter, cleaning the corpse, and later avoidance of the place where death occurred. Without death-related symbols or rituals, chimpanzees show several behaviors that recall human responses to the death of a close relative."

• Chimpanzee mothers at Bossou, Guinea carry the mummified remains of their dead infants. Biro, D., Humle, T., Koops, K., Sousa, C., & Hayashi, M. (Dept of Zool., Univ. of Oxford, South Parks Rd, Oxford OX1 3PS, U.K. [e-mail: *dora.biro@zoo.ox.ac.uk*]). *Current Biology*, 2010, *20*, R351-R352, <www.cell.com/current-biology/pdf/PIIS0960982210002186.pdf>.

"The forests surrounding Bossou, Guinea, are home to a small, semi-isolated chimpanzee community studied for over three decades. In 1992, Matsuzawa reported the death of a 2.5-year-old chimpanzee (Jokro) at Bossou from a

respiratory illness. The infant's mother (Jire) carried the corpse, mummified in the weeks following death, for at least 27 days. She exhibited extensive care of the body, grooming it regularly, sharing her day- and night-nests with it, and showing distress whenever they became separated. The carrying of infants' corpses has been reported from a number of primate species, both in captivity and the wild — albeit usually lasting a few days only — suggesting a phylogenetic continuity for a behavior that is poignant testament to the close mother-infant bond which extends across different primate taxa. In this report we recount two further infant deaths at Bossou, observed over a decade after the original episode but with striking similarities."

Conservation

• Tracing the origins of rescued chimpanzees reveals widespread chimpanzee hunting in Cameroon. Ghobrial, L., Lankester, F., Kiyang, J. A., Akih, A. E., de Vries, S., Fotso, R., Gadsby, E. L., Jenkins, Jr., P. D., & Gonder, M. K. (M. K. G., Dept of Biol. Sci., State Univ. of New York, Albany, NY 12222 [e-mail: *gonder@albany.edu*]). *BMC Ecology*, 2010, *10*[2], <www.biomedcentral.com/1472-6785/10/2>.

"While wild chimpanzees are experiencing drastic population declines, their numbers at African rescue and rehabilitation projects are growing rapidly. Chimpanzees follow complex routes to these refuges; and their geographic origins are often unclear. Identifying areas where hunting occurs can help law enforcement authorities focus scarce resources for wildlife protection planning. Efficiently focusing these resources is particularly important in Cameroon because this country is a key transportation waypoint for international wildlife crime syndicates. Furthermore, Cameroon is home to two chimpanzee subspecies, which makes ascertaining the origins of these chimpanzees important for reintroduction planning and for scientific investigations involving these chimpanzees. We estimated geographic origins of 46 chimpanzees from the Limbe Wildlife Centre (LWC) in Cameroon. Using Bayesian approximation methods, we determined their origins using mtDNA sequences and microsatellite (STRP) genotypes compared to a spatial map of georeferenced chimpanzee samples from 10 locations spanning Cameroon and Nigeria. The LWC chimpanzees come from multiple regions of Cameroon or forested areas straddling the Cameroon-Nigeria border. The LWC chimpanzees were partitioned further as originating from one of three biogeographically important zones occurring in Cameroon, but we were unable to refine these origin estimates to more specific areas within these three zones. Our findings suggest that chimpanzee hunting is widespread across Cameroon. Live animal smuggling appears to occur locally within Cameroon, despite the existence of local wildlife cartels that operate internationally. This pattern varies from the illegal wildlife trade patterns observed in other commercially valuable species, such as elephants, where specific populations are targeted for exploitation. A broader sample of rescued chimpanzees compared against a more comprehensive grid of georeferenced samples may reveal 'hotspots' of chimpanzee hunting and live animal transport routes in Cameroon. These results illustrate also that clarifying the origins of refuge chimpanzees is an important tool for designing reintroduction programs. Finally, chimpanzees at refuges are frequently used in scientific investigations, such as studies investigating the history of zoonotic diseases. Our results provide important new information for interpreting these studies within a precise geographical framework."

Disease

• *In vitro* sensitivity of *Plasmodium falciparum* to conventional and novel antimalarial drugs in Papua New Guinea. Wong, R. P. M., Lautu, D., Tavul, L., Hackett, S. L., Siba, P., Karunajeewa, H. A., Ilett, K. F., Mueller, I., & Davis, T. M. E. (T. M. E. D., Sch. of Med. & Pharma., Fremantle Hospital, Univ. of Western Australia, P.O. Box 480, Fremantle, WA 6959, Australia [e-mail: *tdavis@cyllene.uwa.edu.au*]). *Tropical Medicine & International Health*, 2010, *15*, 342-349, <www3.interscience.wiley.com/cgi-bin/fulltext/123237102/HTMLSTART>.

"Recent clinical studies have shown high rates of malaria treatment failure in endemic areas of Papua New Guinea (PNG), necessitating a change of treatment from chloroquine (CQ) or amodiaquine (AQ) plus sulphadoxine-pyrimethamine to the artemisinin combination therapy (ACT) artemether plus lumefantrine (LM). To facilitate the monitoring of antimalarial drug resistance in this setting, we assessed the *in vitro* sensitivity of *Plasmodium falciparum* isolates from Madang Province. A validated colorimetric lactate dehydrogenase assay was used to assess growth inhibition of 64 *P. falciparum* isolates in the presence of nine conventional or novel antimalarial drugs (CQ, AQ, monodesethyl-amodiaquine [DAQ], piperaquine [PQ], naphthoquine [NQ], mefloquine [MQ], LM, dihydroartemisinin and azithromycin [AZ]). The geometric mean (95% confidence interval) concentration required to inhibit parasite growth by 50% (IC50) was 167 (141–197) nM for CQ, and 82% of strains were resistant (threshold 100 nM), consistent with near-fixation of the CQ resistance-associated *pfcrt* allele in PNG. Except for AZ [8.351 (5.418–12.871) nM], the geometric mean IC_{50} for the other drugs was <20 nM. There were strong associations between the IC_{50}s of 4-aminoquinoline (CQ, AQ, DAQ and NQ), bisquinoline (PQ) and aryl aminoalcohol (MQ) compounds suggesting cross-resistance, but LM IC_{50} only correlated with that of MQ. Most PNG isolates are resistant to CQ *in vitro* but not to other ACT partner drugs. The non-isotopic semi-automated high-throughput nature of the *Plasmodium* lactate dehydrogenase assay facilitates the convenient serial assessment of local parasite sensitivity,

so that emerging resistance can be identified with relative confidence at an early stage."

• Anti-tetherin activities in Vpu-expressing primate lentiviruses. Yang, S. J., Lopez, L. A., Hauser, H., Exline, C. M., Haworth, K. G., & Cannon, P. M. (P. M. C., Keck School of Med., Univ. of So. Cal., Los Angeles, CA, 90089 [e-mail: *pcannon@usc.edu*]). *Retrovirology,* 2010, *7*, 13, <www.retrovirology.com/content/7/1/13>.

"The anti-viral activity of the cellular restriction factor, BST-2/tetherin, was first observed as an ability to block the release of Vpu-minus HIV-1 from the surface of infected cells. However, tetherin restriction is also counteracted by primate lentiviruses that do not express a Vpu protein, where anti-tetherin functions are provided by either the Env protein (HIV-2, SIVtan) or the Nef protein (SIVsm/mac and SIVagm). Within the primate lentiviruses, Vpu is also present in the genomes of SIVcpz and certain SIVsyk viruses. We asked whether, in these viruses, anti-tetherin activity was always a property of Vpu, or if it had selectively evolved in HIV-1 to perform this function. We found that despite the close relatedness of HIV-1 and SIVcpz, the chimpanzee viruses use Nef instead of Vpu to counteract tetherin. Furthermore, SIVcpz Nef proteins had activity against chimpanzee but not human tetherin. This specificity mapped to a short sequence that is present in the cytoplasmic tail of primate but not human tetherins, and this also accounts for the specificity of SIVsm/mac Nef for primate but not human tetherins. In contrast, Vpu proteins from four diverse members of the SIVsyk lineage all displayed an anti-tetherin activity that was active against macaque tetherin. Interestingly, Vpu from a SIVgsn isolate was also found to have activity against human tetherin. Primate lentiviruses show a high degree of flexibility in their use of anti-tetherin factors, indicating a strong selective pressure to counteract tetherin restriction. The identification of an activity against human tetherin in SIVgsn Vpu suggests that the presence of Vpu in the ancestral SIVmus/mon/gsn virus believed to have contributed the 3' half of the HIV-1 genome may have played a role in the evolution of viruses that could counteract human tetherin and infect humans."

• Interactome analysis of longitudinal pharyngeal infection of cynomolgus macaques by group A *Streptococcus*. Shea, P. R., Virtaneva, K., Kupko 3rd, J. J., Porcella, S. F., Barry, W. T., Wright, F. A., Kobayashi, S. D., Carmody, A., Ireland, R. M., Sturdevant, D. E., Ricklefs, S. M., Babar, I., Johnson, C. A., Graham, M. R., Gardner, D. J., Bailey, J. R., Parnell, M. J., DeLeo, F. R., & Musser, J. M. (J. M. M., Methodist Hospital Res. Inst., Houston, TX 77030 [e-mail: *jmmusser@tmhs.org*]). *Proceedings of the National Academy of Sciences, U.S.A.*, 2010, *107*, 4693-4698,<www.pnas.org/content/107/10/4693.full>.

"Relatively little is understood about the dynamics of global host–pathogen transcriptome changes that occur during bacterial infection of mucosal surfaces. To test the hypothesis that group A *Streptococcus* (GAS) infection of the oropharynx provokes a distinct host transcriptome response, we performed genome-wide transcriptome analysis using a nonhuman primate model of experimental pharyngitis. We also identified host and pathogen biological processes and individual host and pathogen gene pairs with correlated patterns of expression, suggesting interaction. For this study, 509 host genes and seven biological pathways were differentially expressed throughout the entire 32-day infection cycle. GAS infection produced an initial widespread significant decrease in expression of many host genes, including those involved in cytokine production, vesicle formation, metabolism, and signal transduction. This repression lasted until day 4, at which time a large increase in expression of host genes was observed, including those involved in protein translation, antigen presentation, and GTP-mediated signaling. The interactome analysis identified 73 host and pathogen gene pairs with correlated expression levels. We discovered significant correlations between transcripts of GAS genes involved in hyaluronic capsule production and host endocytic vesicle formation, GAS GTPases and host fibrinolytic genes, and GAS response to interaction with neutrophils. We also identified a strong signal, suggesting interaction between host γδ T cells and genes in the GAS mevalonic acid synthesis pathway responsible for production of isopentenyl-pyrophosphate, a short-chain phospholipid that stimulates these T cells. Taken together, our results are unique in providing a comprehensive understanding of the host–pathogen interactome during mucosal infection by a bacterial pathogen."

• Long-lasting insecticide-treated net usage in eastern Sierra Leone – The success of free distribution. Gerstl, S., Dunkley, S., Mukhtar, A., Maes, P., De Smet, M., Baker, S., & Maikere, J. (Médecins Sans Frontières-United Kingdom, 67–74 Saffron Hill, London EC 1N 8QX, U.K. [e-mail: *sgerstl@aol.com*]). *Tropical Medicine & International Health*, 2010, *15*, 480-488, <www3.interscience.wiley.com/cgi-bin/fulltext/123278383/HTMLSTART>.

"Médecins Sans Frontières (MSF) runs a malaria control project in Bo and Pujehun districts (population 158,000) that includes the mass distribution, routine delivery and demonstration of correct use of free, long-lasting insecticide-treated nets (LLINs). In 2006/2007, around 65,000 LLINs were distributed. The aim of this follow-up study was to measure LLIN usage and ownership in the project area. Heads of 900 randomly selected households in 30 clusters were interviewed, using a standardized questionnaire, about household use of LLINs. The condition of any LLIN was physically assessed. Of the 900 households, 83.4% owned at least one LLIN. Of the 16.6% without an LLIN, 91.9% had not participated in the MSF mass distribution. In 94.1% of the households reporting LLINs, the nets were observed hanging correctly over the beds. Of the

1135 hanging LLINs, 75.2% had no holes or 10 or fewer finger-size holes. The most common source of LLINs was MSF (75.2%). Of the 4997 household members, 67.2% reported sleeping under an LLIN the night before the study, including 76.8% of children under 5 years and 73.0% of pregnant women. Our results show that MSF achieved good usage with freely distributed LLINs. It is one of the few areas where results almost achieve the new targets set in 2005 by Roll Back Malaria to have at least 80% of pregnant women and children under 5 years using LLINs by 2010."

Evolution, Genetics, and Taxonomy

• Differences in human and chimpanzee gene expression patterns define an evolving network of transcription factors in brain. Nowick, K., Gernat, T., Almaas, E., & Stubbs, L. (L. S., Inst. for Genomic Biol., Univ. of Illinois, 1206 W. Gregory Dr., Urbana, IL 61801 [e-mail: *ljstubbs@illinois.edu*]). *Proceedings of the National Academy of Sciences, U.S.A.*, 2009, *106*, 22358-22363, <www.pnas.org/content/106/52/22358.full>.

"Humans differ from other primates by marked differences in cognitive abilities and a significantly larger brain. These differences correlate with metabolic changes, as evidenced by the relative up-regulation of energy-related genes and metabolites in human brain. While the mechanisms underlying these evolutionary changes have not been elucidated, altered activities of key transcription factors (TFs) could play a pivotal role. To assess this possibility, we analyzed microarray data from five tissues from humans and chimpanzees. We identified 90 TF genes with significantly different expression levels in human and chimpanzee brain among which the rapidly evolving KRAB-zinc finger genes are markedly over-represented. The differentially expressed TFs cluster within a robust regulatory network consisting of two distinct but interlinked modules, one strongly associated with energy metabolism functions, the other with transcription, vesicular transport, and protein inactivation by ubiquitin. Our results suggest that concerted changes in a relatively small number of interacting TFs may coordinate major gene expression differences in human and chimpanzee brain."

• Dynamic functional evolution of an odorant receptor for sex-steroid-derived odors in primates. Zhuang, H., Chien, M.-S., & Matsunami, H. (Duke Univ. Med. Ctr, Durham, NC 27710 [e-mail: *hiroaki.matsunami@duke.edu*]). *Proceedings of the National Academy of Sciences, U.S.A.*, 2009, *106*, 21247-21251, <www.pnas.org/content/106/50/21247.full>.

"Odorant receptors are among the fastest evolving genes in animals. However, little is known about the functional changes of individual odorant receptors during evolution. We have recently demonstrated a link between the in vitro function of a human odorant receptor, OR7D4, and in vivo olfactory perception of 2 steroidal ligands — androstenone and androstadienone — chemicals that are shown to affect physiological responses in humans. In this study, we analyzed the in vitro function of OR7D4 in primate evolution. Orthologs of OR7D4 were cloned from different primate species. Ancestral reconstruction allowed us to reconstitute additional putative OR7D4 orthologs in hypothetical ancestral species. Functional analysis of these orthologs showed an extremely diverse range of OR7D4 responses to the ligands in various primate species. Functional analysis of the nonsynonymous changes in the Old World monkey and great ape lineages revealed a number of sites causing increases or decreases in sensitivity. We found that the majority of the functionally important residues in OR7D4 were not predicted by the maximum likelihood analysis detecting positive Darwinian selection."

• The biogeography of introgression in the critically endangered African monkey *Rungwecebus kipunji*. Roberts, T. E., Davenport, T. R. B., Hildebrandt, K. B. P., Jones, T., Stanley, W. T., Sargis, E. J., & Olson, L. E. (National Evolutionary Synthesis Center, Durham, NC 27705 [e-mail: *trina.roberts@nescent.org*]). *Current Biology*, 2010, *6*, 233-237, <rsbl.royalsocietypublishing.org/content/6/2/233.full>.

"In the four years since its original description, the taxonomy of the kipunji (*Rungwecebus kipunji*), a geographically restricted and critically endangered African monkey, has been the subject of much debate, and recent research suggesting that the first voucher specimen of *Rungwecebus* has baboon mitochondrial DNA has intensified the controversy. We show that *Rungwecebus* from a second region of Tanzania has a distinct mitochondrial haplotype that is basal to a clade containing all *Papio* species and the original *Rungwecebus* voucher, supporting the placement of *Rungwecebus* as the sister taxon of *Papio* and its status as a separate genus. We suggest that the *Rungwecebus* population in the Southern Highlands has experienced geographically localized mitochondrial DNA introgression from *Papio*, while the Ndundulu population retains the true *Rungwecebus* mitochondrial genome."

• New perspectives on anthropoid origins. Williams, B. A., Kay, R. F., & Kirk, E. C. (Dept of Evolutionary Anthropology, Duke Univ., Durham, NC 27708-0383 [e-mail: *blythe.williams@duke.edu*]). *Proceedings of the National Academy of Sciences, U.S.A.*, 2010, *107*, 4797-4804, <www.pnas.org/content/107/11/4797.full>.

"Adaptive shifts associated with human origins are brought to light as we examine the human fossil record and study our own genome and that of our closest ape relatives. However, the more ancient roots of many human characteristics are revealed through the study of a broader array of living anthropoids and the increasingly dense fossil record of the earliest anthropoid radiations. Genomic data and fossils of early primates in Asia and Africa clarify relationships among the major clades of primates. Progress in

comparative anatomy, genomics, and molecular biology point to key changes in sensory ecology and brain organization that ultimately set the stage for the emergence of the human lineage."

• Hominins on Flores, Indonesia, by one million years ago. Brumm, A., Jensen, G. M., van den Bergh, G. D., Morwood, M. J., Kurniawan, I., Aziz, F., & Storey, M. (Centre for Archaeological Sci., School of Earth & Environ. Sciences, Univ. of Wollongong, Wollongong, New South Wales 2522, Australia [e-mail: *abrumm@uow.edu.au*]). *Nature*, 2010, *464*, 748-752, <www.nature.com/nature/journal/v464/n7289/full/nature08844.html>.

"Previous excavations at Mata Menge and Boa Lesa in the Soa Basin of Flores, Indonesia, recovered stone artefacts in association with fossilized remains of the large-bodied *Stegodon florensis florensis*. Zircon fission-track ages from these sites indicated that hominins had colonized the island by 0.88 ± 0.07 million years (Myr) ago. Here we describe the contents, context and age of Wolo Sege, a recently discovered archaeological site in the Soa Basin that has *in situ* stone artefacts and that lies stratigraphically below Mata Menge and immediately above the basement breccias of the basin. We show using $^{40}Ar/^{39}Ar$ dating that an ignimbrite overlying the artefact layers at Wolo Sege was erupted 1.02 ± 0.02 Myr ago, providing a new minimum age for hominins on Flores. This predates the disappearance from the Soa Basin of 'pygmy' *Stegodon sondaari* and *Geochelone* spp. (giant tortoise), as evident at the nearby site of Tangi Talo, which has been dated to 0.90 ± 0.07 Myr ago. It now seems that this extirpation or possible extinction event and the associated faunal turnover were the result of natural processes rather than the arrival of hominins. It also appears that the volcanic and fluviolacustrine deposits infilling the Soa Basin may not be old enough to register the initial arrival of hominins on the island."

• The complete mitochondrial DNA genome of an unknown hominin from southern Siberia. Krause, J., Fu, O., Good, J. M., Viola, B., Shunkov, M. V., Derevianko, A. P., & Pääbo, S. (Max Planck Inst. for Evolutionary Anthropology, Deutscher Platz 6, D-04103 Leipzig, Germany [e-mail: *krause@eva.mpg.de*]). *Nature*, 2010, *464*, 894-897, <www.nature.com/nature/journal/v464/n7290/full/nature08976.html>.

"With the exception of Neanderthals, from which DNA sequences of numerous individuals have now been determined, the number and genetic relationships of other hominin lineages are largely unknown. Here we report a complete mitochondrial (mt) DNA sequence retrieved from a bone excavated in 2008 in Denisova Cave in the Altai Mountains in southern Siberia. It represents a hitherto unknown type of hominin mtDNA that shares a common ancestor with anatomically modern human and Neanderthal mtDNAs about 1.0 million years ago. This indicates that it derives from a hominin migration out of Africa distinct from that of the ancestors of Neanderthals and of modern humans. The stratigraphy of the cave where the bone was found suggests that the Denisova hominin lived close in time and space with Neanderthals as well as with modern humans."

• Evolution and biogeography of primates: A new model based on molecular phylogenetics, vicariance and plate tectonics. Heads, M. (Buffalo Museum of Science, 1020 Humboldt Pkwy, Buffalo, NY 14211-1293 [e-mail: *michael.heads@yahoo.com*]). *Zoologica Scripta*, 2010, *39*, 107-127, <www3.interscience.wiley.com/journal/122680933/abstract>.

The ages of the oldest fossils suggest an origin for primates in the Paleocene (≈56 Ma). Fossil-calibrated molecular clock dates give Cretaceous dates (≈80–116 Ma). Both these estimates are minimum dates although they are often 'transmogrified' and treated as maximum or absolute dates. Oldest fossils can underestimate ages by tens of millions of years and instead of calibrating the time-course of evolution with a scanty fossil record, the geographical boundaries of the main molecular clades of primates are calibrated here with radiometrically dated tectonic events. This indicates that primates originated when a globally widespread ancestor (early Archonta) differentiated into a northern group (Plesiadapiformes, extinct), a southern group (Primates), and two south-east Asian groups (Dermoptera and Scandentia). The division occurred with the breakup of Pangea in the Early Jurassic and the opening of the central Atlantic (≈185 Ma). Within primates, the strepsirrhines and haplorhines diverged with volcanism and buckling on the Lebombo Monocline, a volcanic rifted margin in southeast Africa (Early Jurassic, ≈180 Ma). Within strepsirrhines, lorises and galagos (Africa and Asia) and lemurs (Madagascar) diverged with the formation of the Mozambique Channel (Middle Jurassic, ≈160 Ma). Within haplorhines, Old World monkeys and New World monkeys diverged with the opening of the Atlantic (Early Cretaceous, ≈130 Ma). The main aspects of primate distribution are interpreted as the result of plate tectonics, phylogeny and vicariance, with some subsequent range expansion leading to secondary overlap. Long-distance, transoceanic dispersal events are not necessary. The primate ancestral complex was already widespread globally when sea-floor spreading, strike-slip rifting and orogeny fractured and deformed distributions through the Jurassic and Cretaceous, leading to the origin of the modern clades. The model suggests that the topology of the phylogenetic tree reflects a sequence of differentiation in a widespread ancestor rather than a series of dispersal events.

• *Australopithecus sediba*: A new species of *Homo*-like Australopith from South Africa. Berger, L. R., de Ruiter, D. J., Churchill, S. E., Schmid, P., Carlson, K. J., Dirks, P. H. G. M., & Kibii, J. M. (Univ. of the Witwatersrand, Pri-

vate Bag 3, Wits 2050, South Africa [e-mail: *profleeberger@yahoo.com*]). *Science*, 2010, *328*, 195-204, <www.sciencemag.org/cgi/content/full/328/5975/195>.

"Despite a rich African Plio-Pleistocene hominin fossil record, the ancestry of *Homo* and its relation to earlier australopithecines remain unresolved. Here we report on two partial skeletons with an age of 1.95 to 1.78 million years. The fossils were encased in cave deposits at the Malapa site in South Africa. The skeletons were found close together and are directly associated with craniodental remains. Together they represent a new species of *Australopithecus* that is probably descended from *Australopithecus africanus*. Combined craniodental and postcranial evidence demonstrates that this new species shares more derived features with early *Homo* than any other australopith species and thus might help reveal the ancestor of that genus."

• Geological setting and age of *Australopithecus sediba* from southern Africa. Dirks, P. H. G. M., Kibii, J. M., Kuhn, B. F., Steininger, C., Churchill, S. E., Kramers, J. D., Pickering, R., Farber, D. L., Mériaux, A.-S., Herries, A. I. R., King, G. C. P., & Berger, L. R. (James Cook Univ., Townsville, QLD 4811, Australia [e-mail: *paul.dirks@jcu.edu.au*]). *Science*, 2010, *328*, 205-208, <www.sciencemag.org/cgi/content/full/328/5975/205>.

"We describe the geological, geochronological, geomorphological, and faunal context of the Malapa site and the fossils of *Australopithecus sediba*. The hominins occur with a macrofauna assemblage that existed in Africa between 2.36 and 1.50 million years ago (Ma). The fossils are encased in water-laid, clastic sediments that were deposited along the lower parts of what is now a deeply eroded cave system, immediately above a flowstone layer with a U-Pb date of 2.026 ± 0.021 Ma. The flowstone has a reversed paleomagnetic signature and the overlying hominin-bearing sediments are of normal polarity, indicating deposition during the 1.95- to 1.78-Ma Olduvai Subchron. The two hominin specimens were buried together in a single debris flow that lithified soon after deposition in a phreatic environment inaccessible to scavengers."

• Early hominin diet included diverse terrestrial and aquatic animals 1.95 Ma in East Turkana, Kenya. Braun, D. R., Harris, J. W. K., Levin, N. E., McCoy, J. T., Herries, A. I. R., Bamford, M. K., Bishop, L. C., Richmond, B. G., & Kibunjia, M. (Archaeology Dept, Univ. of Cape Town, Rondebosch 7701, South Africa [e-mail: *david.braun@uct.ac.za*]). *Proceedings of the National Academy of Sciences, U.S.A.*, 2010, *107*, 10002-10007, <www.pnas.org/content/107/22/10002.full>.

"The manufacture of stone tools and their use to access animal tissues by Pliocene hominins marks the origin of a key adaptation in human evolutionary history. Here we report an in situ archaeological assemblage from the Koobi Fora Formation in northern Kenya that provides a unique combination of faunal remains, some with direct evidence of butchery, and Oldowan artifacts, which are well dated to 1.95 Ma. This site provides the oldest *in situ* evidence that hominins, predating *Homo erectus*, enjoyed access to carcasses of terrestrial and aquatic animals that they butchered in a well-watered habitat. It also provides the earliest definitive evidence of the incorporation into the hominin diet of various aquatic animals including turtles, crocodiles, and fish, which are rich sources of specific nutrients needed in human brain growth. The evidence here shows that these critical brain-growth compounds were part of the diets of hominins before the appearance of *Homo ergaster/erectus* and could have played an important role in the evolution of larger brains in the early history of our lineage."

• Chimpanzee and human Y chromosomes are remarkably divergent in structure and gene content. Hughes, J. F., Skaletsky, H., Pyntikova, T., Graves, T. A., van Daalen, S. K. M., Minx, P. J., Fulton, R. S., McGrath, S. D., Locke, D. P., Friedman, C., Trask, B. J., Mardis, E. R., Warren, W. C., Repping, S., Rozen, S., Wilson, R. K., & Page, D. C. (D. C. P., Dept of Biology, Massachusetts Institute of Technology, 9 Cambridge Ctr, Cambridge, MA 02142 [e-mail: *dcpage@wi.mit.edu*]). *Nature*, 2010, *476*, 536-539, <www.nature.com/nature/journal/v463/n7280/full/nature08700.html>.

"The human Y chromosome began to evolve from an autosome hundreds of millions of years ago, acquiring a sex-determining function and undergoing a series of inversions that suppressed crossing over with the X chromosome. Little is known about the recent evolution of the Y chromosome because only the human Y chromosome has been fully sequenced. Prevailing theories hold that Y chromosomes evolve by gene loss, the pace of which slows over time, eventually leading to a paucity of genes, and stasis. These theories have been buttressed by partial sequence data from newly emergent plant and animal Y chromosomes, but they have not been tested in older, highly evolved Y chromosomes such as that of humans. Here we finished sequencing of the male-specific region of the Y chromosome (MSY) in our closest living relative, the chimpanzee, achieving levels of accuracy and completion previously reached for the human MSY. By comparing the MSYs of the two species we show that they differ radically in sequence structure and gene content, indicating rapid evolution during the past 6 million years. The chimpanzee MSY contains twice as many massive palindromes as the human MSY, yet it has lost large fractions of the MSY protein-coding genes and gene families present in the last common ancestor. We suggest that the extraordinary divergence of the chimpanzee and human MSYs was driven by four synergistic factors: the prominent role of the MSY in sperm production, 'genetic hitchhiking' effects in the absence of meiotic crossing over, frequent ectopic recom-

bination within the MSY, and species differences in mating behavior. Although genetic decay may be the principal dynamic in the evolution of newly emergent Y chromosomes, wholesale renovation is the paramount theme in the continuing evolution of chimpanzee, human and perhaps other older MSYs."

Instruments and Techniques

• Vertebrate DNA in fecal samples from bonobos and gorillas: Evidence for meat consumption or artefact? Hofreiter, M., Kreuz, E., Eriksson, J., Schubert, G., & Hohmann, G. (Dept of Biology, Univ. of York, York, U.K. [e-mail: *msh503@york.ac.uk*]). *PLoS ONE,* 2010, 5[2], e9419, <www.plosone.org/article/info:doi/10.1371/journal.pone.0009419>.

"Deciphering the behavioral repertoire of great apes is a challenge for several reasons. First, due to their elusive behavior in dense forest environments, great ape populations are often difficult to observe. Second, members of the genus *Pan* are known to display a great variety in their behavioral repertoire; thus, observations from one population are not necessarily representative for other populations. For example, bonobos (*Pan paniscus*) are generally believed to consume almost no vertebrate prey. However, recent observations show that at least some bonobo populations may consume vertebrate prey more commonly than previously believed. We investigated the extent of their meat consumption using PCR amplification of vertebrate mitochondrial DNA (mtDNA) segments from DNA extracted from bonobo feces. As a control we also attempted PCR amplifications from gorilla feces, a species assumed to be strictly herbivorous. We found evidence for consumption of a variety of mammalian species in about 16% of the samples investigated. Moreover, 40% of the positive DNA amplifications originated from arboreal monkeys. However, we also found duiker and monkey mtDNA in the gorilla feces, albeit in somewhat lower percentages. Notably, the DNA sequences isolated from the two ape species fit best to the species living in the respective regions. This result suggests that the sequences are of regional origin and do not represent laboratory contaminants. Our results allow at least three possible and mutually not exclusive conclusions. First, all results may represent contamination of the feces by vertebrate DNA from the local environment. Thus, studies investigating a species' diet from feces DNA may be unreliable due to the low copy number of DNA originating from diet items. Second, there is some inherent difference between the bonobo and gorilla feces, with only the later ones being contaminated. Third, similar to bonobos, for which the consumption of monkeys has only recently been documented, the gorilla population investigated (for which very little observational data are as yet available) may occasionally consume small vertebrates. Although the last explanation is speculative, it should not be discarded a priori given that observational studies continue to unravel new behaviors in great ape species."

• Long-term asynchronous decoding of arm motion using electrocorticographic signals in monkey. Chao, Z. C., Nagasaka, Y., & Fujii, N. (N. F., Lab. for Adaptive Intelligence, RIKEN Brain Sci. Inst., 2-1 Hirosawa, Wakoshi, Saitama, 351-0198, Japan [e-mail: *na@brain.riken.jp*]). *Frontiers in Neuroengineering*, 2010, *3*[3], <www.frontiersin.org/neuroengineering/paper/10.3389/fneng.2010.00003>.

"Brain–machine interfaces (BMIs) employ the electrical activity generated by cortical neurons directly for controlling external devices and have been conceived as a means for restoring human cognitive or sensory-motor functions. The dominant approach in BMI research has been to decode motor variables based on single-unit activity (SUA). Unfortunately, this approach suffers from poor long-term stability and daily recalibration is normally required to maintain reliable performance. A possible alternative is BMIs based on electrocorticograms (ECoGs), which measure population activity and can provide more durable and stable recording. However, the level of long-term stability that ECoG-based decoding can offer remains unclear. Here we propose a novel ECoG-based decoding paradigm and show that we have successfully decoded hand positions and arm joint angles during an asynchronous food-reaching task in monkeys when explicit cues prompting the onset of movement were not required. Performance using our ECoG-based decoder was comparable to existing SUA-based systems while evincing far superior stability and durability. In addition, the same decoder could be used for months without any drift in accuracy or recalibration. These results were achieved by incorporating the spatio-spectro-temporal integration of activity across multiple cortical areas to compensate for the lower fidelity of ECoG signals. These results show the feasibility of high-performance, chronic and versatile ECoG-based neuroprosthetic devices for real-life applications. This new method provides a stable platform for investigating cortical correlates for understanding motor control, sensory perception, and high-level cognitive processes."

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2010 Directory of Graduate Programs in Primatology and Primate Research

ARIZONA

• Arizona State University, School of Human Evolution and Social Change

PROGRAM DESCRIPTION: PhD in Anthropology (with MA awarded in the process). Within physical anthropology, specializations in primatology are available. Areas of concentration include primate social behavior and ecology, primate positional behavior and functional and evolutionary morphology, primate dental development and life history, and primate evolution. Interdisciplinary training is available in musculoskeletal and neural adaptations in form and function. Facilities include extensive fossil casts and skeletal collections, a variety of specimens for dissection, 3D-imaging and analysis capabilities, and excellent computing capabilities. Faculty interests include relationships between social organization and ecology, infant socialization, parental behavior, primate community ecology, and comparative primate functional and evolutionary morphology. Financial aid may be available to graduate students on a competitive basis. Aid is in the form of teaching or research assistantships and graduate fellowships.

FACULTY AND THEIR SPECIALTIES: Leanne T. Nash (social behavior and ecology of primates, socialization, nocturnal prosimians, experimental analysis of behavior); Kaye E. Reed (primate community ecology, primate paleoecology, primate evolution, paleoanthropology); Mark A. Spencer (comparative primate functional and evolutionary morphology, biomechanics, cranial evolution, morphometrics, paleoanthropology); and Gary T. Schwartz (primate and human evolution, comparative primate dental development, life history).

FOR FURTHER INFORMATION: Drs. Leanne T. Nash [480-965-4812; e-mail: *leanne.nash@asu.edu*], Mark A. Spencer [480-727-8763; e-mail *mspencer.iho@asu.edu*], Kaye Reed [480-727-6580; e-mail: *kaye.reed@asu.edu*], or Gary Schwartz [480 967-8684; e-mail *garys.iho@asu.edu*], School of Human Evolution and Social Change (formerly Dept of Anthropology), Box 872402, Arizona State University, Tempe, AZ 85287-2402 [480-965-6213; fax: 480-965-7671]; and see <shesc.asu.edu>.

CALIFORNIA

• University of California, Davis, Anthropology Department

FACULTY AND THEIR SPECIALTIES: Alexander H. Harcourt (primate behavioral ecology, biogeography, conservation); Lynne A. Isbell (primate behavioral ecology, primate origins and evolution); Andrew J. Marshall (community ecology, tropical forest ecology, primate conservation); and David G. Smith (primate genetics).

FOR FURTHER INFORMATION: Dept of Anthropology, One Shields Ave, University of California, Davis, CA 95616-8522; or see <anthropology.ucdavis.edu>.

• University of California, Davis, Psychology Department

PROGRAM DESCRIPTION: Psychobiology is an area of specialization within the Psychology graduate program.

FACULTY AND THEIR SPECIALTIES: Karen L. Bales (neuroendocrinology of primate social bonding); John P. Capitanio (primate social behavior and development, personality/temperament, psychoneuroimmunology); Richard G. Coss (developmental psychobiology, evolution, experimental aesthetics, antipredator behavior); Leah A. Krubitzer (evolutionary neurobiology); William A. Mason (primate social behavior); Sally P. Mendoza (behavioral endocrinology; physiological basis of primate social relationships, stress, and reproduction); Jeffrey C. Schank (social behavior, individual-based modeling, biorobotics, development); and Brian C. Trainor (behavioral endocrinology; genes and behavior).

FOR FURTHER INFORMATION: Graduate Admissions, Department of Psychology, University of California, One Shields Ave, Davis, CA 95616.

GEORGIA

• University of Georgia, Athens, Psychology Department

PROGRAM NAME: Neuroscience and Behavior with a specialty area in primatology.

FACULTY AND THEIR SPECIALTIES: Irwin S. Bernstein (primatology, social organization, aggression, sex, dominance) and Dorothy Fragaszy (primate behavior, cognition, development, motor skills, social behavior). We also enjoy full cooperation with other departments and universities within the University of Georgia system, as well as collaboration with the Yerkes RPRC of Emory University and the Atlanta Zoo.

FOR FURTHER INFORMATION: Neuroscience and Behavior Program, Dept of Psychology, Univ. of Georgia, Athens, GA 30602-3013 [706-542-2174; fax: 706-542-3275]; and see <psychology.uga.edu/graduate/programs/neuroscience>.

NEW YORK

• American Museum of Natural History, Richard Gilder Graduate School

See under: The New York Consortium in Evolutionary Primatology (NYCEP)

• City University of New York, Anthropology PhD Program

See under: NYCEP

• Columbia University, Department of Ecology, Evolution & Environmental Biology

See under: NYCEP

• New York Consortium in Evolutionary Primatology

PROGRAM DESCRIPTION: NYCEP is a graduate training program funded by the National Science Foundation's Integrative Graduate Education and Research Traineeship (IGERT) initiative. It consists of four degree-granting institutions – City University of New York (CUNY), the American Museum of Natural History (AMNH), Columbia University (CU), and New York University (NYU) – in collaboration with the Wildlife Conservation Society (WCS). Our focus is on nonhuman as well as human primates from the perspectives of comparative morphology, paleontology and systematics, molecular and population genetics, behavior and ecology, and conservation biology. Students in the program take courses in all of these areas at the three universities and AMNH, attend seminars that draw upon the staff of all five cooperating institutions, and have the opportunity to engage in original research in laboratories, museums, and in the field. Detailed information is available at <www.nycep.org>. NYCEP provides funds for research and travel support and coordinates course programs and seminars.

NYCEP is basically an umbrella organization which coordinates course programs and and provides funds for student research and travel support. The graduate programs of the four collaborating institutions offer graduate fellowships supported by the IGERT award (up to $30,000 per year for up to four years), as well as full financial aid programs with regular fellowships and special opportunities for minority students. IGERT funds can only be awarded to U.S. citizens and nationals, but highly qualified applicants regardless of nationality may be supported in some institutions. Members of groups underrepresented in science are especially encouraged to apply. Appropriate undergraduate majors for NYCEP applicants include biological anthropology and other life (or earth) sciences. Students apply to one or more cooperating universities and send a one-page tracking form to NYCEP; this is available from the Website or from Dr. Delson (see below). Annual application deadline is early January.

FACULTY AND THEIR SPECIALTIES: CORE FACULTY are those with whom students will take most courses and who will be likely dissertation supervisors: Susan Antón, NYU (paleoanthropology, comparative morphology, forensic anthropology); Shara Bailey, NYU (paleoanthropology, dental anthropology); Doug Boyer, CUNY (primate evolutionary and functional morphology, paleontology, paleoanthropology, systematics and evolution); Marina Cords, CU (primate behavior, especially African cercopithecids); Eric Delson, CUNY (paleoanthropology, catarrhine systematics and evolution, biochronology, morphometrics); Tony DiFiore, NYU (primate behavior and ecology, population and molecular genetic applications); Todd R. Disotell, NYU (molecular systematics and evolution, catarrhine primates); John Flynn, AMNH (Neotropical paleontology, including primates; carnivoran evolution); Chris Gilbert, CUNY (paleoanthropology, primate [especially cercopithecid] comparative morphology, paleontology and evolution); William Harcourt-Smith, CUNY (paleoanthropology, evolution of bipedalism, primate locomotion, morphometrics); Terry Harrison, NYU (catarrhine systematics, comparative morphology, and primate paleontology); Ralph L. Holloway, CU (paleoneurology, human evolution); Jeffrey T. Laitman, CUNY (paleoanthropology, evolution of speech); Don J. Melnick, CU (population genetics and molecular evolution of higher primates); Kate Pechenkina, CUNY (paleopathology, bioarcheology, paleodietary reconstruction); Tom Plummer, CUNY (paleoanthropology, hominid paleontology and paleoecology/behavior, Paleolithic archeology); Herman Pontzer, CUNY (locomotor biomechanics and energetics, foraging ecology, hominid evolution); Ryan Raaum, CUNY (population genetics, human molecular variation, phylogeography); Alfred Rosenberger, CUNY (evolution of New World monkeys, comparative and functional morphology of dentitions); Jessica Rothman, CUNY (African primate ecology and behavior, nutrition, evolutionary ecology); Vincent Stefan, CUNY (forensic anthropology, human osteology, craniometry); Michael Steiper, CUNY (molecular anthropology, human and other primate genetic adaptations, population genetics, malaria); Sara Stinson, CUNY (population biology of living humans); Larissa Swedell, CUNY (primate, especially cercopithecid, social behavior; population genetics).

RESOURCE FACULTY, some from other institutions, are available for consultation, and may supervise internships and participate on dissertation committees: Gail Ashley, Rutgers (Quaternary geology, stratigraphy, geochronology); Marie-Pierre Aubry, Rutgers (Cenozoic chronostratigraphy, micropaleontology); Bill Berggren, Rutgers (Cenozoic chronostratigraphy, micropaleontology); Walter Bock, CU (vertebrate functional and evolutionary morphology, biomechanics, systematics, evolutionary theory); Tim Bromage, NYU Dental School (paleoanthropology and developmental morphology); Nick Conard, Tübingen (European Middle and Upper Paleolithic archeology and art); Peter deMenocal, CU (geochemistry; African

climate and human evolution); Rob De Salle, AMNH (molecular systematics); Craig Feibel, Rutgers (African Plio-Pleistocene geochronology, stratigraphy, climate); Patrick J. Gannon, Hofstra and Mount Sinai/NYU (primate brain evolution and relationship to communication; neurochemistry); Katerina Harvati, Tübingen and CUNY (paleoanthropology, later human evolution and variation, geometric morphometrics); Sidney Hemming, CU (geochronology); Mike Hickerson, CUNY (ecological modeling, phylogeography); Patrick Hof, Mount Sinai/NYU (neurobiology); Jean-Jacques Hublin, Max-Planck Inst, Leipzig (paleoanthropology); Clifford J. Jolly, NYU (genetics, systematics, and comparative morphology of primates); Ross D. MacPhee, AMNH (development and systematics of primates and other mammals); Colleen McCann, WCS (conservation biology, behavior and ecology of cercopithecids, hormonal mediation of behavior); Shannon McPherron, Max-Planck Inst, Leipzig (European and North African Middle and Upper Paleolithic archeology, site formation); Jin Meng, AMNH (mammalian paleontology and evolution, China); Jason Munshi-South, CUNY (ecology and conservation genetics of primates and other mammals of SE Asia); Xijun Ni, AMNH and CUNY (paleontology and evolution of early primates and other mammals, China); Michael Novacek, AMNH (systematics of mammals and early primates); Joy Reidenberg, Mount Sinai/NYU (comparative and developmental anatomy of the mammalian skull and upper respiratory tract); John G. Robinson, WCS (conservation biology, Neotropical primates); Robert Rockwell, CUNY (population genetics, population ecology and dynamics, conservation biology); F. James Rohlf, CUNY and SUNY/Stony Brook (mathematical biology, biostatistics, geometric morphometrics); Eric Sanderson, WCS (GIS approaches in conservation science); Mitchell Schaffler, CCNY/CUNY (functional and comparative morphology); Eleanor J. Sterling, AMNH (primate social behavior, ecology, and conservation, especially in Madagascar); Katherine St. John, CUNY (computational biology, phylogeny reconstruction and comparison, algorithms); Carl Swisher, Rutgers (geochronology and stratigraphy of primate-bearing deposits); Ian Tattersall, AMNH (systematics and evolution of lemuriform primates and hominids); Herb Terrace, CU (comparative psychology); Christian Tryon, NYU (African Lower and Middle Paleolithic archeology, geochronology, geoarcheology); John A. Van Couvering, Micropaleontology Project (geochronology and stratigraphy of the Old World Cenozoic); Linda Vigilant, Max-Planck Inst, Leipzig (primate molecular and conservation genetics); John Wahlert, CUNY (mammalian, especially rodent, paleontology, morphology and evolution); Ward Wheeler, AMNH (molecular systematics); Randall White, NYU (European Middle and Upper Paleolithic archeology, ornamentation).

FOR FURTHER INFORMATION: Dr. Eric Delson, Dept of Vertebrate Paleontology, American Museum of Natural History, New York, NY 10024 [212-769-5992; fax: 212-769-5842; e-mail: *eric.delson@lehman.cuny.edu*]; or see <www.nycep.org>.

- New York University, Anthropology Department
  See under: NYCEP

NORTH CAROLINA

- Duke University, Evolutionary Anthropology (formally Biological Anthropology and Anatomy)

PROGRAM DESCRIPTION: Undergraduate and PhD programs in Evolutionary Anthropology including: Primate Behavior and Ecology, Primate Paleontology; Cognitive Evolution; and Functional Morphology.

FACULTY AND THEIR SPECIALTIES: Steven Churchill (functional morphology, hominin paleontology); Leslie Digby (primate behavior, reproductive competition; lemurs); Christine Drea (social behavior, social learning, reproductive endocrinology); Ken Glander (ecology and social organization); Brian Hare (cognitive evolution, human and non-human apes); Richard F. Kay (primate phylogeny, paleontological field research); Anne Pusey (behavioral ecology, parent-offspring interaction, sex differences in development, dispersal patterns, mating systems); Daniel Schmitt (evolution of primate locomotor mechanics); Christine Wall (evolutionary and functional morphology of primate skull); and Blythe Williams (primate paleontology; functional morphology).

FOR FURTHER INFORMATION: Dept. of Evolutionary Anthropology, Director of Graduate Studies, 08 Biological Sciences Bldg, Box 90383, Duke University, Durham, NC 27708; [DGS Assistant: Lisa Squires: 919-684-4124; e-mail: *mlsquire@duke.edu*].

PENNSYLVANIA

- Bucknell University, Program in Animal Behavior

PROGRAM DESCRIPTION: The Bucknell University Animal Behavior Program offers Master's degrees (MS) in animal behavior. The program does not offer a formal degree in primatology, but primate behavior is an area of specialization offered within the program. Bucknell maintains four colonies of socially living primates for use in observational studies and noninvasive experiments of behavior and cognition. The Master's program is designed as an apprenticeship for one or two students to work closely with a sponsoring faculty member.

FACULTY: Dr. Peter G. Judge (specializes in conflict resolution behavior, social cognition, cognitive abilities).

FOR FURTHER INFORMATION: Graduate Studies, Bucknell University, Lewisburg, PA 17837; 570-577-3655. Also see: <www.bucknell.edu/x1783.xml> or <www.bucknell.edu/AnimalBehavior.xml>.

- University of Pennsylvania, Departments of Anthropology, Biology, and Psychology

PROGRAM DESCRIPTION: Students may enroll for a PhD with a specialization in primatology in one of the three sponsoring departments; graduate programs will conform in structure and content to the requirements of each department. A group of core interdisciplinary courses is also offered for primatology students, in addition to courses that pertain to their specialties (e.g., cognition, ecology, behavior). Other resources include faculty in ecology and conservation within the Department of Biology; faculty in psycholinguistics, cognitive science, animal behavior, and the evolution of human behavior in the Department of Psychology and at the Institute for Research in Cognitive Science; faculty in human biology, primatology, and endocrinology in the Department of Anthropology; and faculty in neuroscience and neuroethology in the Medical School. Dorothy Cheney and Robert Seyfarth accept only graduate students who plan to do field research, and in past years have supervised students working on elephants in Sri Lanka, hyenas in Kenya, rhesus monkeys on Cayo Santiago, and gelada baboons in Ethiopia. Eduardo Fernandez-Duque is particularly interested in students who will consider working on neotropical monogamous species in Ecuador or Argentina. Claudia Valeggia's research interests include primate reproductive ecology (primarily human), reproductive endocrinology, maternal and child health, and health of indigenous populations in Latin America. Tad Schurr is interested in molecular anthropology, modern human evolution, primate biological variation, biomedical genetics, and ancient DNA research.

FACULTY AND THEIR SPECIALTIES: Dorothy L. Cheney (Biology: behavior, communication, cognition); Robert M. Seyfarth (Psychology: behavior, communication, cognition); Eduardo Fernandez-Duque (Anthropology: behavior, ecology, conservation); Claudia Valeggia (Anthropology: energetics, endocrinology, reproduction); and Tad Schurr (Anthropology: genetics).

FOR FURTHER INFORMATION: Contact Dr. Cheney [e-mail: *cheney@sas.upenn.edu*] or Dr. Seyfarth [e-mail: *seyfarth@psych.upenn.edu*] or Dr. Fernandez-Duque [e-mail: *eduardof@sas.upenn.edu*], University of Pennsylvania, Philadelphia, PA 19104.

TEXAS

- University of Texas at Austin, Anthropology Department

PROGRAM DESCRIPTION: MA and PhD degrees are offered in Anthropology, with specialization in physical anthropology, including primate anatomy, ecology, evolution, behavior, paleoanthropology, and molecular anthropology.

FACULTY AND THEIR SPECIALTIES: Deborah Bolnick (physical anthropology, molecular anthropology, ancient DNA); Mariah Hopkins (primate conservation, geographic information system (GIS) modeling systems, research in Panama); John Kappelman (physical anthropology, paleobiology, primate evolution, functional morphology, stratigraphy; Africa and Asia); Chris Kirk (physical anthropology, primate evolution, functional anatomy and evolution of sensory systems); Rebecca Lewis (evolution of primate social behavior, power dynamics and power structures, intersexual conflict, social relationships, biological markets, feeding ecology, lemurs); Denné Reed (human evolution, micromammal paleoecology, taphonomy, GIS, remote sensing); and Liza Shapiro (physical anthropology, primate evolution, functional morphology, locomotion).

FOR FURTHER INFORMATION: Graduate Admissions Advisor, Dept. of Anthropology, Univ. of Texas, 1 University Station, C3200, Austin, TX 78712; or see: <www.utexas.edu/cola/depts/anthropology/programs-and-subdisciplines/Physical-Anthropology.php>.

WASHINGTON

- University of Washington, Department of Psychology

PROGRAM DESCRIPTION: The Animal Behavior Program at the University of Washington is dedicated to providing the best possible graduate training including research techniques, theory, and investigative work with animals both in the laboratory and in natural habitats, preserves, and progressive zoos. The program leads to the PhD in Psychology, with special training in animal behavior (including primate social behavior and conservation). It is administered by the core faculty in animal behavior, who are listed below. One of the great assets of this Animal Behavior Program is the interest and competence of faculty in departments other than Psychology. Cordial and cooperative relationships exist with behavior-oriented colleagues in Biology, Anthropology, wildlife science (College of Fisheries and School of Forest Resources), the Center for Conservation Biology, the Neurobiology Program, the Washington National Primate Research Center, and the Center for Human Development and Disabilities. Excellent rapport and research affiliations also exist with the Woodland Park Zoological Gardens, Point Defiance Zoo, the Seattle Aquarium, Northwest Trek, Friday Harbor Laboratory

(biology and marine research laboratories), and other colleagues in the greater Puget Sound area.

FACULTY AND THEIR SPECIALTIES: Michael D. Beecher, (animal communication, avian sociobiology and ecology); David P. Barash (sociobiology, behavioral ecology, animal behavior and evolution); Eliot A. Brenowitz (avian behavior, neuroethology, neuroendocrinology, animal communication); Sean O'Donnell (social behavior, especially of insects; evolution of eusociality, particularly division of labor and task allocation; behavioral genetics; and physiology); and Joseph Sisneros (neuroethology; comparative neural bases, anatomy, physiology, function, and modeling of audition). Also available to facilitate student projects are James Ha (social behavior and cognition, behavioral genetics; applied animal behavior; primates, corvids, cetaceans), Randall Kyes (international macaque field site; conservation biology), and Renee Ha (behavior and ecology of corvids; conservation biology), almost all of whom are graduate faculty.

FOR FURTHER INFORMATION: Michael D. Beecher, PhD, Dept. of Psychology, Box 351525, University of Washington, Seattle, WA 98l95-1525 [e-mail: *beecher@u.washington.edu*].

WISCONSIN

• Wisconsin National Primate Research Center (WNPRC), University of Wisconsin–Madison, Graduate School, supported by a base operating grant from the National Institutes of Health–National Center for Research Resources

PROGRAM DESCRIPTION: The research program at the WNPRC has opportunities for graduate studies in several areas, especially reproductive and developmental biology, including placental biology and stem cell research, immunogenetics, virology and AIDS vaccine development, veterinary medicine, aging and metabolic disease, psychology and psychobiology, and neurobiology, including Parkinson's disease research.

Students may conduct research at the WNPRC by enrolling in an appropriate academic department at the University of Wisconsin–Madison and choosing a faculty advisor with WNPRC affiliation. Current faculty have appointments in various departments in the Medical School, College of Letters and Science, School of Veterinary Medicine, and College of Agriculture and Life Sciences, as well as such interdisciplinary programs as the Endocrinology–Reproductive Physiology Program, Interdepartmental Graduate Program in Nutritional Sciences, the Biology of Aging and Age-Related Diseases Training Program, Stem Cell and Regenerative Medicine Center Education and Training Programs, and the Neuroscience Training Program. For information about these departments and programs, potential students should write to The Graduate School, Bascom Hall, UW–Madison, Madison, WI 53706; or visit <www.wisc.edu>.

FACULTY AND STAFF: The WNPRC supports the work of 125 UW–Madison scientists (27 with base grant support), 112 scientists at other institutions, and 175 staff members.

FOR FURTHER INFORMATION: Donna Paulnock, Interim Director, WNPRC, 1220 Capitol Ct, Madison, WI 53715-1299. Director's Office and general information: [608-263-3500; fax: 608-265-2067]; or see: <www.primate.wisc.edu >.

ALBERTA, CANADA

• University of Calgary, Department of Anthropology

PROGRAM DESCRIPTION: Master's and Doctoral programs are available in primate studies, principally field-based and with a behavioral ecology approach. Both programs require course work, a formal research proposal defense, field research, preparation and defense of a thesis, and candidacy and second-language exams at the doctoral level. The Department has research relationships with various primate centers in the U.S.A.; the Monkey River, Belize, site at which an annual field school is conducted; the Boabeng Fiema Monkey Sanctuary in Ghana at which an annual field school is conducted; Santa Rosa National Park in Costa Rica; and various field sites in Madagascar.

FACULTY AND THEIR SPECIALTIES: Linda Fedigan (life histories, behavioral ecology, and conservation of neotropical primates; field site in Costa Rica); Steig Johnson (behavioral ecology, biogeography, speciation, and conservation biology of lemurs, especially brown lemurs; field sites in Madagascar); Mary Pavelka (social organization, social relationships, aging, and reproduction; field sites for spider and howler monkeys in Belize); and Pascale Sicotte (behavior, social relationships, behavioral ecology, colobines, apes).

FOR FURTHER INFORMATION: Dept. of Anthropology, Univ. of Calgary, Calgary, Alberta T2N 1N4, Canada [e-mail: *Fedigan@ucalgary.ca*, *steig.johnson@ucalgary.ca, Pavelka@ucalgary.ca*, or *sicotte@ucalgary.ca*] or see: <www.anth.ucalgary.ca/anth>.

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