

between the sexes. Males and females also differ in their patterns of development of the sagittal region following dental maturity. Males vary in timing of development of a sagittal crest, with prominent sagittal crests most frequently observed in the oldest males. Changes to the sagittal region also occur through the course of female development and sagittal crests are observed in the later stages of adult female lifespan. The results are discussed in relation to socio-ecology, life history and biomechanical factors relating to mastication, and their implications considered in terms of their application to sex determination in extinct hominin samples (e.g., *Australopithecus* and *Paranthropus*), where high levels of cranial dimorphism have been inferred.

Lions and tigers and humans, oh my! Including human predation of primates in primate behavioral ecology.

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Predation is often invoked as a strong selection pressure on primate behavior and a key factor influencing primate group size. Previous reviews of primate anti-predator behaviors have included large group sizes, aggressive defense, alarm calling, and crypsis. However, human predation has largely been omitted from models and studies of primate anti-predator strategies. Consequently, little data are currently available on primate behavioral reactions to human predation. Nevertheless, primates are expected to employ anti-predator strategies that are predator-specific, and human predators are different in their use of projectile weapons, cursorial, and ambush hunting styles. Human predators preferably target larger primate species and have larger kill rates than nonhuman predators. Therefore, including human predation as a factor shaping primate behavior has consequences for group size optima and anti-predator behaviors. Given that many primate populations studied today experience some level of human predation, empirical tests of socioecological theory include populations under current or recent human predation pressure. I provide a revised socioecological model including the effects of nonhuman predation pressure on primate behavior. I predict that primates under human predation pressure have smaller group sizes and favor visual and auditory concealment. Studies of Diana monkeys, pig-tailed langurs, and colobus monkeys support these predictions. Rigorous methods for measuring human impact in primate study areas are necessary to determine the levels and types of predation risk that primates experience. Thus, human predation risk can be included in studies of primate behavior, resulting in improved tests of primate behavioral models and overall better model construction.

Sleeping site selection in the Bolivian gray titi monkey, *Callicebus donacophilus*.

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Our study examined sleeping site selection and associated behaviors of four groups, breeding pair plus offspring, of Bolivian gray titi monkeys, *Callicebus donacophilus*, in Parque Yvaga Guazu, Santa Cruz, Bolivia from March to May, 2011. Observers followed and recorded behavior of four habituated, free-ranging groups prior to sleeping and again the following morning. Tree characteristics such as height, DBH, canopy cover, vine density, and canopy connectedness were measured for each identified sleeping tree. Behaviors such as first and last activity, group sleeping order, and other social behaviors were recorded ad lib. The results indicate that groups prefer tall, emergent trees, averaging 18.7 meters that were fairly disconnected from the rest of the surrounding canopy. While sleeping, groups sat in contact with tails twined and offspring between the pair, possibly for protection from predators. Across all groups, feeding was the last activity displayed before sleeping 89% of the time and the first activity in the morning 84% of the time, suggesting the importance of food availability prior to and after sleeping. Groups tend to remain in the same tree for the duration of the night. One group, however, switched trees overnight 78% of the time. Further investigation is needed to determine if other factors such as resource availability, seasonality, and presence or absence of certain predators have an influence on sleeping site selection and sleeping behaviors.

Limbic structures in human evolution: new data and a meta-analysis.

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As a species, humans display elaborate social behaviors and extensive affiliative networks. Because emotion is increasingly recognized as central to social behavior and cognition, we asked whether structures implicated in emotion and motivation, i.e., "limbic" structures, are expanded in the human brain, despite historical assumptions to the contrary.

Our dataset combines new comparative data with data from the literature, addressing all limbic and limbic-associated structures with available volumetric data. These included the amygdala (and 4 amygdaloid nuclei), septum, striatum, thalamus, hippocampal formation, orbitofrontal cortex, and medial frontal cortex. As a contrast, we also assessed a non-limbic structure, the dorsal frontal cortex. We ran allometric regressions through independent contrasts of non-human primate data to assess whether human values were greater than predicted for a primate of our brain size, i.e., exhibited positive residuals. Where sample sizes permitted, we used student's t-tests to test the significance of human residuals.

Only residuals for the amygdala (and its lateral nucleus) and the orbitofrontal cortex were positive. The human residual for the medial frontal cortex was most negative, followed by

the hippocampal formation, the thalamus, striatum, and septum. The mean residual for the dorsal frontal cortex was negative, though it only approached significance. These data suggest that limbic structures participating both in emotional regulation and social affiliation, specifically the amygdala and orbitofrontal cortex, may have expanded in human evolution. Conversely, structures devoted to executive function and memory, like the dorsal frontal cortex and hippocampus, do not unequivocally distinguish human brains from those of other primates.

This study was funded by the National Science Foundation Doctoral Dissertation Improvement Grant (BCS-#0726240), the Wenner Gren Foundation Dissertation Fieldwork Grant, the Chancellor's Interdisciplinary Collaboratory Fellowship, and the Kavli Institute for Brain and Mind.

Ecomorphology in a phylogenetic statistical context: a case study using the bovid femur.

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Antelopes (family Bovidae) are invaluable paleoecological indicators because many species have narrowly constrained habitat preferences. Ecomorphology is a method designed to predict function (e.g., habitat preference) from form (e.g., femoral measurements) without relying on taxonomic identifications. Ecomorphology is "taxonomy-free" in this limited sense, but it is not phylogeny-free. Researchers create predictive models using living species, which are interrelated in a phylogenetic hierarchy. Robust functional inferences can only be made using methods which account for this shared phylogenetic heritage.

This case study applies phylogenetic statistical methods to bovid ecomorphology. The published data set (Kappelman 1991, *Journal of Human Evolution* 20:95-129) consists of seven femoral metrics from 195 individuals belonging to 40 species. Two questions are addressed: (1) Are functional hypotheses regarding trait differences between habitat groups robust to phylogeny? (2) Do habitat classifications change when phylogeny is considered in Discriminant Function Analysis (DFA)?

Six of seven metrics differ significantly among habitat groups in a non-phylogenetic ANOVA framework ($p < .01$). In a phylogenetic framework (PGLS) four of seven metrics retain a significant difference. Proximal femoral characters have more phylogenetically robust functional signals than distal femoral characters. Non-phylogenetic DFA on species means resulted in a classification success of 75%. Phylogenetic DFA resulted in 67.5% classification success. This case study quantitatively demonstrates what has been suggested elsewhere; the anatomical differences between antelopes with different habitat preferences are phylogenetically structured. Thus, phylogeny is a potentially confounding variable that must be considered in ecomorphological studies. Methods for implementing phylogenetic ecomorphology are discussed.