Canine Tooth Robusticity mitigates Stress in the Jaw

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Primate tooth crown height is understood to correspond with competitive social regimes. The functional significance of the relative thickness, or robusticity, of canine teeth is assumed to correspond with forces during feeding. In one study, beam theory was used to estimate bending resistance, but tooth fracture data are inconsistent with predictions based on the beam model. This paper hypothesizes that mitigation of the stresses in the jaw, not the tooth, is the principal constraint of the tooth geometry where it meets the alveolar bone at the CEJ. Initial observations using finite element models of CT-scanned canine teeth revealed a pattern whereby the CEJ region experienced higher stresses during vertical and orthogonal loading than mid-crown loci. Using a simplified canine model to further explore the distribution of stress under multiple loading regimes, yield values of three tissues (enamel, dentine, cortical bone) were used as driving constraints to find the optimal geometry for the loads. Constraining the model with cortical bone values in the alveolar tissue resulted in an optimal model that approximated the dimensions and stresses of the CT-scanned primate canine teeth under the same loads. These results are consistent with the hypothesis that structural failure of alveolar bone should precede that of harder tissues in the tooth itself when the canine tooth is in use. In contrast to previous findings, canine robusticity may primarily be an adaptation for the reduction of critical stresses in the jaws during loading on the teeth as opposed to resistance to bending along the crown.

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How selection shapes primate major histocompatibility complex polymorphism

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Major histocompatibility complex (MHC) genes are highly variable in humans, non-human primates and other vertebrates and the MHC plays an important role in immune response to infectious disease. In humans, MHC heterozygosity is as high as 80-90% and this unparalleled finding has prompted many researchers to investigate the high degree of polymorphism in the context of natural selection and other evolutionary forces. Studies in several species support the argument that MHC genes also influence individual odors used in mate choice. Since the MHC is used for cellular discrimination of "self" and "non-self", this genetic system might even be useful for detecting related individuals that share unique combinations of MHC alleles. Although evidence for MHC-based kin recognition or mate attraction in any species is limited, it is possible that odor, color or other phenotypic markers advertise individual MHC genotypes. In this talk, I will review some of the unique and most interesting properties of the MHC and will discuss what we currently know about the relationship between selection and MHC polymorphism in primates.

Integration of the Anthropoid Skull: An Ontogenetic Perspective with Insights into Jaw Fusion

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It is hypothesized that mandibular symphyseal fusion in anthropoids is a complex character because it is functionally integrated with multiple other skull components, constituting an evolutionary stable configuration. Due to canalization of these structures, it is expected that symphyseal fusion, and its integrated components, should be maintained even if no longer functionally necessary. Based on previous analyses differentiating anthropoid and strepsirrhine skull form:function, symphyseal fusion is hypothesized to correlate with increased relative brain size, basicranial flexion, facial kyphosis, higher temporomandibular joint, taller ascending ramus, and vertically-oriented masseter muscles. As growth and development determine how morphological relationships manifest in adults, this study takes an ontogenetic perspective in testing the hypothesized relationships in skull morphology associated with jaw fusion. Skulls from a comparative ontogenetic sample of primates including *Gorilla gorilla* (N=25), *Macaca fascicularis* (N=25), *Cebus apella* (N=25), *Lemur catta* (N=24), and *Propithecus verreauxi* (N=24) were digitized to create 3-D landmark configurations, subsequently aligned using a generalized Procrustes analysis. Two-block partial least squares analyses on the mandible and cranium were implemented for each taxon and for pooled anthropoids and strepsirrhines. Results show similar patterns of skull integration during ontogeny across these primates, but the relationship between cranium and mandible is opposite from what was hypothesized. These results suggest that although previously observed functional relationships exist across taxa in adults, these relationships do not appear to be integrated during ontogeny and do not support previous hypotheses of a uniquely integrated anthropoid skull. Nevertheless, further investigation is needed to document other potential variations in ontogeny.

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Foraging Efficiency and Ecological Risk Aversion in Juvenile Bornean Orangutans

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For species with low mortality and high reproductive costs, like primates, rather than maximize reproduction, natural selection should favor slow growth and slow reproductive rates. Orangutans, because of their slow life history, and the extreme fluctuations in their food supply, are hypothesized to have been selected for slow juvenile development to avoid ecological risk. Juveniles are predicted to be particularly vulnerable during periods of low food availability because of lower foraging success. Thus, we tested the hypothesis that juvenile orangutans are less efficient foragers than adults and that they are less able to both access and digest important fall-back foods. Data were collected on wild orangutans in Gunung Palung National Park, Borneo, Indonesia between 1994-2016. Analyses are drawn from 468 matched follows of mother-offspring pairs in which more than 75% of the diet has been analyzed. We found that juveniles ate fruit when their mother's ate fruit during 98.3% of bouts. However, for other food items, juveniles were much less likely to eat the same food items (insects = 65.2%, leaves 76.5, bark 70.0%, flowers 75.0%, pith 65.8%). As expected, we found that juveniles ate significantly fewer calories than did adults overall, but this difference was particularly pronounced during periods of low food availability ($p < 0.001$). We show that these results were due to constraints on both the processing and digesting of fall-back foods. Thus, the long period of orangutan growth and dependency may reflect a risk-averse growth strategy in this forest characterized by dramatic fluctuations in preferred fruits.

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Manipulation of the dead: exploring delayed burial practices at Neolithic Çatalhöyük

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Funerary customs in the Neolithic Near East encompass a range of practices, including intramural primary and secondary burials, as well as the retention of skeletal elements, especially