

### The missing femur at the Mitla Fortress.

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A common belief across prehispanic Mesoamerica was that an individual's power was concentrated in the femur. Several elaborate burial contexts, beginning as early as A.D. 100, contained the remains of elite rulers along with one or more femora. Further, femora have been recorded as missing in other burial contexts in Oaxaca and elsewhere in Mesoamerica, but those burials were poorly preserved. Individual skeletons were not complete, so it was impossible to know when or how the femora were removed or if they were part of a primary burial context. Burial 13 at the Mitla Fortress provides documentation of a clear donor context in which the descendants of an important person carefully reopened his burial cist after death to extract the individual's right femur. This finding provides material support for the process of femur removal that was earlier only hypothesized for Lambityeco.

Such curation of human femora has largely been considered an activity associated exclusively with rulers or those of high status. Yet the residence excavated at the Mitla Fortress was not such a context, and so the removal of femora (at least in the Late Classic period Valley of Oaxaca) may not have been a practice limited to rulers. The individual missing his femur at the Fortress may have been a neighborhood head and/or a lineage founder, who was revered by his descendants. His descendants may have removed his femur in an effort to establish their status in at least the confines of their local community.

### Damage and mortality effects of Cyclone Fanele on sifaka food trees in Kirindy Mitea National Park, Madagascar.

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Cyclones have been suggested to play a major role in the evolutionary history of the flora and fauna of Madagascar. However, very little is known about the effects of cyclones on Malagasy ecosystems. The high wind velocity of cyclones can snap or uproot trees and cause complete defoliation. With the loss of food species, primates may shift their diets to less preferred food items and/or narrow their diets. We assessed the damage to 1184 trees that are known food resources for Verreaux sifaka (*Propi-*

*theus verreauxi verreauxi*) eight months after Cyclone Fanele. Eighty-six percent of food tree species were damaged and 7.4% were dead. Twenty six percent of food trees experienced major branch damage and 26.5% showed major trunk damage. Tree damage was not distributed equally across all species ( $\chi^2 = 45.2332783$ ,  $df = 28$ ,  $p < 0.0025$ ). We evaluated how cyclone Fanele impacted the sifaka food trees using generalized linear mixed modeling with Laplace approximations. A highly significant interaction between tree height ( $p < 0.01$ ), DBH ( $p < 0.001$ ), and damage was found. With each unit increase in tree height and DBH the odds of damage increased. With each unit increase in tree height the odds of dying increased ( $p < 0.001$ ), but this relationship was not significant with larger DBH. Tree height is a stronger predictor of damage and mortality than DBH. Sifaka food resources were significantly reduced, suggesting that these lemurs have had to alter their feeding behavior as a direct consequence of Cyclone Fanele.

### The *Runx2* gene is an important determinant of facial morphology in primates.

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The runt-related transcription factor gene (*Runx2*) encodes a transcription factor that is important for osteoblast development and normal osteogenesis. Previous research has demonstrated that the glutamine to alanine (Q/A) ratio contained within the protein-coding, tandemly-repeated portion of exon 3 of the *Runx2* gene is significantly, positively correlated with facial length within an artificially-selected species (*Canis familiaris*, domestic dog) and among species in a naturally-evolving order (Carnivora). However, the correlation of the Q/A ratio and facial length in primates remains unclear. The present study tests the hypothesis that the Q/A ratio within the *Runx2* gene is correlated with facial length in primates.

Data were collected from a taxonomically-broad sample of primates ( $n = 24$ ). Q/A ratios were collected through DNA sequencing and from published data in national genetic databases. Craniometric data (including facial length and five variables used to correct for size) were collected directly from primate crania ( $n = 24$  species; 306 individuals) in museum collections. Results indicate that the Q/A ratio of the *Runx2* gene is significantly, positively correlated with size-corrected facial length in primates ( $r = 0.62$ ;  $p < 0.01$ ); this correlation remains significant using statistical

methods that control for phylogenetic-relatedness among the species in the sample ( $r = 0.52$ ;  $p < 0.05$ ). These results suggest mutations in protein-coding regions of a developmental-regulatory gene can have important phenotypic effects in primates and demonstrate the utility of using genetic approaches to understanding primate morphology.

This study was funded by a Sigma Xi Grant-In-Aid of Research from the ASU chapter and by ASU undergraduate research funding.

### The role of erect posture in shaping the hominid cranial base.

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The hominid cranial base has been studied extensively over the last 150 years, with most attention focused on the midsagittal plane. Many papers contrast ape morphology with human morphology and conclude that the massive brain expansion characterizing human evolution is the main mechanism that shaped the unique basicranial morphology of *Homo sapiens*. However, relatively few papers did a comprehensive comparative study of the cranial base that included early hominids.

In this work, three groups were studied: humans, chimpanzees, and early hominids. We followed the contour of the midsagittal basicranium, starting from the posterior aspect of the occipital bone, through the foramen magnum, clivus and the sphenoidal plane in the anterior cranial base. Angular measurements were first taken in relation to the Frankfurt horizontal plane. These include the nuchal plane, foramen magnum, clival line and planum sphenoidum. The second measurements, which did not require a reference plane, were angles that are formed between two adjacent segments of the cranial base: nuchal plane-foramen magnum; foramen magnum-clivus; clivus-sphenoid plane.

Our results indicate that early hominids achieve human-like appearance very early in the fossil record. Almost all australopithecines measurements lie closer to humans than chimpanzees. Furthermore, it appears that the entire section of inion-opisthion-basion-clivus behaves as one morphological unit by shifting to a more inferior-anterior position, and thus creating the steeper clival angle which is apparent in hominids. When taking into consideration the small brain volume of australopithecines, our results substantiate the important role that erect posture had on shaping early hominid cranial base.