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## ABSTRACTS

mass estimates for many of Madagascar's extinct subfossil lemurs using femoral and humeral mid-shaft cortical area. However, this study did not account for the effects of species relatedness within and between clades. Our study revises these widely applied body mass estimates using a new sample of subfossil lemur long bones and phylogenetically informed methods. New and revised estimates of body mass are consistently smaller than previously suggested.

### Pelvic height, lumbar entrapment, and their effects on upper body stability during bipedalism

NATHAN E. THOMPSON<sup>1</sup>, MATTHEW C. O'NEILL<sup>2</sup> and BRIGITTE DEMES<sup>3</sup>

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Compared to modern humans, African apes are characterized by tall iliac blades, narrow sacra, and a short lumbar vertebral column. These characteristics are thought to engender morphological rigidity of the trunk, potentially limiting the ability for upper body stabilization in the sagittal plane during bipedalism. Here we test this hypothesis with 3-D kinematic data on trunk motion during bipedalism in humans (n=10) and chimpanzees (n=2). Marker triads defined trunk segments (pelvis, lumbar region, thorax) and were used to calculate sagittal plane segment motion (tilt) relative to a global coordinate system.

Humans and chimpanzees displayed similar patterns and timings of lumbar and thoracic tilt, while pelvic tilt differed between species. In chimpanzees, all trunk segments tilted either anteriorly or posteriorly together, whereas in humans the thorax and lumbar region tilted posteriorly when the pelvis tilted anteriorly. Humans also displayed smaller ranges of motion (RoM) of all trunk segments compared to chimpanzees (P<0.001), and (unlike chimpanzees) displayed an attenuation of RoM from caudal to cranial.

These results suggest that a relatively unrestrained lumbar vertebral column in humans allows the upper body independence from pelvic motion in the sagittal plane, with the ultimate result being a fairly stable thorax. Chimpanzees are unable to accomplish this, and the lumbar region and thorax essentially follow pelvic motion. To the extent to which tall iliac blades may have characterized the last common ancestor of *Pan* and *Homo*, reduction in iliac height may have allowed early hominins to walk with greater stability of the upper body.

### A characterization of nutritional stress among early Medieval subadult females of the central Dalmatian region of Croatia

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Early Medieval cemetery burials of the central Dalmatian region of Croatia are typical of Medieval Christian burials. Burials are in regular rows and include few grave goods. However, among the burials of the rural church cemetery site Šibenik-Sv. Lovre (9<sup>th</sup>-11<sup>th</sup> centuries A.D.), jewelry items reflective of female costume items (filigreed earrings, simple hooped earrings and rings), accompany many of the burials, including subadult burials. Among the 55 adults, grave goods positively correlated with females (n=22/30; Fisher's p-value=0.0001): no males (n=0/23) at the site had grave goods. Using a biocultural approach, based on grave-good distribution patterns among adults, it is concluded that nine subadult individuals buried with grave goods represent subadult females. These nine subadult females are all estimated to be over the age of 3-4 years at the time of death; suggesting that the social-age of 'femaleness' is applied during early childhood, after weaning. The subadult females were then compared to the indeterminate-sex children, juveniles and adolescents (n=22) for nutritional health differences. Results show that among the non-infant subadult sample, females are not statistically more likely to have suffered from scurvy, cribra orbitalia, porotic pitting nor hyperostosis. The results suggest that subadult health status at the site is not affected by biological sex (or female-sex), and that any socially applied gender differences do not affect subadult nutritional health. The consequences of the results are discussed in relation to life-course and gender theories.

### *Homo naledi's* pedal pathologies

ZACH THROCKMORTON<sup>1,2</sup>, BERNHARD ZIPFEL<sup>2</sup>, PATRICK RANDOLPH-QUINNEY<sup>2,3</sup>, EDWARD ODES<sup>2</sup>, KIMBERLY CONGDON<sup>2,4</sup>, JEREMY DESILVA<sup>2,5</sup>, WILLIAM HARCOURT-SMITH<sup>2,6,7</sup> and LEE BERGER<sup>2</sup>

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Pedal pathologies are present throughout the hominin fossil record; at least ten injured hominin feet, ranging from *Ardipithecus ramidus* to *Homo floresiensis*, have been identified and published. We present here further analyses of the *Homo*

*naledi* pedal specimens recovered from the Rising Star Cave, Gauteng, South Africa that contribute to the history of hominin podiatric problems. Specimens U.W. 101-1013 and 1395 are both lesser proximal pedal phalanges that present evidence of healed traumatic fracture; 1013 has a callosity indicating an incomplete, transverse diaphyseal fracture, while 1395's callosity encircles nearly the entire circumference, and there is diaphyseal displacement, indicating a complete (or nearly complete), oblique fracture. Both injuries are more consistent with stubbing rather than crushing trauma. U.W. 101-1535 and U.W. 101-1534 are associated left medial and intermediate cuneiforms that exhibit modest osteoarthritic lipping along their complementary dorsal facet rims. While difficult to assess, it is unlikely that any of these pathologies would have been permanently disabling. Interestingly, a survey of published literature on great ape skeletal injuries reveals no known cases of chimpanzees (*Pan spp.*) or gorillas (*Gorilla spp.*) fracturing their pedal phalanges or developing midfoot tarsal osteoarthritis. That fossil hominins, including *Homo naledi*, suffered from pedal pathologies more similar to humans than to chimpanzees and gorillas is unsurprising given our lineage's obligate bipedal locomotor behavior.

### Socializing by vocalizing: a test of the vocal grooming hypothesis in the gelada (*Theropithecus gelada*)

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Social time represents a significant constraint on the number of relationships an individual can maintain, and using vocalizations to socialize could help maintain larger social networks than grooming alone. The vocal grooming hypothesis predicts that vocal exchanges allow conspecifics to maintain ties outside of grooming. In humans, the implication is that language represents an efficient social tool that allows us to maintain large, complex groups. Although this hypothesis is difficult to test directly, two predictions follow: (1) that vocal exchanges are more frequent when individuals are not grooming, and (2) that measures of dyadic sociality predict vocal exchange frequency. Here we use 6 years of behavioral data from a population of geladas living in the Simien Mountains National Park, Ethiopia (28 units, 129 females) to characterize when female geladas vocalize and what predicts vocal exchanges. First, we found that vocalizations occurred more than six times as often when