canals as orthogonal is inaccurate, and that deviations from this normative model could have significant functional consequences. In order to test these predictions, we measured bilateral semicircular canal morphology in 39 mammal species using high-resolution X-ray computed tomography. These CT scans were then used to estimate vestibular sensitivity with Bubbles.mat software. We found that substantial deviations from canal orthogonality, angle symmetry, and coplanarity are the rule rather than the exception for the mammals in our comparative sample. Furthermore, the degree to which the semicircular canals of a given species deviate from orthogonality is negatively correlated with estimated sensitivity to angular accelerations. These findings reveal that much of the received wisdom regarding orthogonal semicircular canal orientation in mammals is not strictly correct, and that interspecific variation in canal orientation has important functional consequences for vestibular sensitivity.

How short is short? A possible case of dwarfism from Egypt's Third Intermediate Period from the Dakhleh Oasis, Egypt

CASEY L. KIRKPATRICK, ELDON MOLTO and CLAIRE VENET-ROGERS. Department of Anthropology, Western University.

This study presents the description and differential diagnosis of a probable pituitary dwarf from a Third Intermediate Period cemetery at Ain Tirghi in the Dakhleh Oasis, Egypt. The skeleton is an adult female estimated to be in the third decade of life. Most medical literature defines a variation of 2 standard deviations below the population mean as an indicator for clinically short stature, with some identifying severe short stature at 3 standard deviations from the population mean. Some bioarchaeologists have chosen not to make this distinction, and prefer to use only the more cautious level of 3 standard deviations to designate shortness. In any case, the individual at Ain Tirghi presents a difference satisfying either criteria when compared with the adult female population mean for measurements of the radii and femora, as well as the summed measurements of the femora and tibiae. Further calculations, however, revealed that her limb proportions fell within the normal range. Normal proportions and a lack of morphological abnormality were also observed during macroanalysis of the skeletal remains. Consequently, conditions leading to disproportionate short stature could be ruled out. A differential diagnosis for an individual with short stature, normal proportions and a lack of osteoporosis indicates this individual represents a probable case of pituitary dwarfism, or hypopituitarism, in the Egyptian archaeological record.

Determining architectural function using human skeletons buried therein

LINZY KIRKPATRICK[1] and DANIELLE KURIN[2]. [1]Anthropology, Wichita State University, [2]Anthropology, University of California, Santa Barbara.

Located 3,886 m above sea-level, Achanchi, built in the 10th-12th century, AD, is one of the largest Chanka sites in the highland region of Andahuaylas, Peru and host to more than 300 stone buildings on over 15 ha. But what was the site used for? Two possibilities exist: 1) as a peaceful, integrative agro-settlement, or 2) as a defensive hill fort. Examining the health of those buried at Achanchi may help address these hypotheses. We evaluated 1107 bones and several hundred fragments including: three articulated skeletons, 14 crania, 87 complete long bones, and 106 vertebrae. We assessed these remains for sex, age, pathology and trauma. Aging the remains yielded a result of: 60% adults (35+ years), 25% young adults (aged 18-35 years), 11% subadults (12-20 years), and 1% children (3-12 years). Fifty percent of the skulls showed trauma, likely the result of a violent encounter. The high prevalence of caries and abscesses, as well as 15 incidences of periostitis and 13 cases of osteoarthritis point to compromised health. Overall, osteological data indicate Achanchi residents experienced violence and deprivation, which in turn suggest that the site's purpose was mostly likely defensive in nature.

Functional correlates of structural asymmetries in the human brain

LINDSEY M. KITCHELL and P. THOMAS SCHOENEMANN. Anthropology, Indiana University.

The human brain is both structurally and functionally asymmetric. However, there have been relatively few studies assessing both structural and functional asymmetries in the same subject population. One behavioral asymmetry of particular interest to human evolution is right-handedness, which is much more pronounced at the population level in humans than in other species. It has been postulated that this may be related to the evolution of tool manufacturing and use, and potentially also to language (which, like control of the right hand, is also lateralized to the left hemisphere). Analyses of fossil hominin endocasts have revealed anatomical asymmetries that are assumed to reflect asymmetries in underlying brain regions. Handedness has been shown to be associated with brain petalias in at least one study, but its association with other structural other areas of the brain have not been extensively investigated. Knowing the extent to which neuroanatomical asymmetries in different regions of the brain are associated with handedness will allow better assessment of handedness in fossil specimens. We report here the results of a study of 72 healthy, female subjects in which degree of handedness was correlated with neuroanatomical asymmetry at each point, assessed via non-rigid deformation (morphing) methods of their MRI scans. Areas of highest association between right-handedness and neuroanatomical asymmetry included: 1) the left motor cortex corresponding to control of the right hand, 2) left occipital pole and adjacent regions, 3) left parietal-occipital-temporal region (Wernicke's area), 4) right middle temporal sulcus, and 5) left orbital frontal.

Fossils, trabeculae and finite element modelling: A holistic approach to reconstructing behaviour in the past

TRACY L. KIVELL[1,2], HUYNH NGUYEN[2], ZEWDI J. TSEGAI[2], THOMAS GROSS[3], DIETER H. PAHR[3], JEAN-JACQUES HUBLIN[2] and MATTHEW M. SKINNER[2,4]. [1]School of Anthropology and Conservation, University of Kent, [2]Department of Human Evolution, Max Planck Institute for Evolutionary Anthropology, [3]Institute of Lightweight Design and Structural Biomechanics, Vienna University of Technology, [4]Department of Anthropology, University College London.

The internal structure of bone – cortical and trabecular bone – remodels throughout life in response to stress and can offer more clear insight into bone function and joint loading during life than analyses of external morphology alone. Furthermore, micro-finite element (FE) modeling of trabecular and cortical structure allows for a more detailed reconstruction of bone function. Here we apply a new method (MedTool) of analyzing internal structure throughout the bone and micro-FE to the third proximal phalanx and the head of the third metacarpal in extant hominoids (*Hylobates, Symphalangus, Pongo, Gorilla, Pan and Homo)* and two *Australopithecus africanus* (StW 382 and StW 394) metacarpals.

The micro-FE analysis of the proximal phalanx loaded in a suspensory posture reveals the functional role of trabecular bone, curvature and the flexor sheath ridge, as well as the effects of variations in these morphological features across hominoids. Trabecular analysis of the metacarpal head reveals that the regions of greatest trabecular density and stiffness (max. E-modulus) within the proximal epiphyses are consistent with the predicted area of peak loading during the most common joint posture across knuckle-walking African apes, suspensory Asian apes and manipulative humans. Both *Au. africanus* specimens show high trabecular density most similar to *Pan*, but peak loading in the palmar-distal region consistent with both suspension and manipulation. The methods used here build upon traditional analyses of volume-of-interest-based trabecular studies or homogenized FE modeling and can provide a more detailed and holistic reconstruction of locomotor and manipulative behaviour in extant and fossil taxa.

Supported by the Max Planck Society.

Making a 'short bone' short: Human pisiform reduction results from the loss of a growth plate

KELSEY M. KJOSNESS[1], JASMINE E. HINES[1], C. OWEN LOVEJOY[2] and PHILIP L. RENO[1]. [1]Department of Anthropology, The Pennsylvania State University, [2]Department of Anthropology, Kent State University.

The wrist is fundamental to reconstructing hominoid phylogeny and behavior but limited understanding of the relative contributions that genetics verses remodeling play in determining skeletal form hinders these analyses. The human pisiform is a small, nodular bone. However, in most other mammals, including apes and likely *Australopithecus afarensis*, pisiforms are