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Understanding the timing and nature of the spread of human diseases provides insights on past human activity as well as greater comprehension of the co-evolution of humans and pathogens. Several evolutionary trajectories based on skeletal morphology and archaeological remains have been suggested for the three subspecies of the human pathogen *T. pallidum*: *T. p.* subsp. *pallidum*, *pertenue* and *endemicum*, the causative agents of human venereal syphilis, yaws and bejel, respectively. Under the original Columbian hypothesis, venereal syphilis originated in the Americas and was brought to Europe by returning explorers, while an alternative Columbian hypothesis suggests that syphilis evolved *in situ* after its introduction to Europe. The Pre-Columbian hypothesis suggests that all treponemal diseases evolved outside the Americas but were diagnosed incorrectly. Finally, a Unitarian hypothesis suggests that the three subspecies are environmentally mediated variants of the same disease.

We performed phylogenetic and AMOVA analyses to determine the evolutionary relationships among the three subspecies of *T. pallidum* using over 10 kb of sequence data from six genes (*tpcC*, *D*, *G*, *I*, *J*, and *K*). The classification of the human treponemes into three distinct subspecies is supported by significant among-subspecies variation at several loci in the AMOVA and generally high bootstrap values for monophyletic subspecies clades. Within *T. p.* subsp. *pallidum*, numerous gene conversion events are detected, which is inconsistent with a very recent origin of this pathogen. Distinct subgroups are observed within this subspecies, which may correspond to geographic or historical separations. Thus, molecular data are incompatible with two of the four evolutionary theories and tend to support a relatively concurrent origin of all three subspecies.

Metacarpal proportions in *Australopithecus africanus*

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Recently, there has been considerable revision to our knowledge of the anatomical, locomotor, and behavioral characteristics of the genus *Australopithecus*, such as the assertion that *A. africanus* possessed more ape-like, forelimb dominated limb proportions than *A. afarensis*. Here, we test whether the intra-hand proportions of *A. africanus* were similarly ape-like, specifically if *A. africanus* had a short and narrow first metacarpal (MC1) relative to the other metacarpals.

MC1 breadth - geometric mean (GM) of articular and midshaft measurements - was compared to the GM of metacarpals 2-4, and

MC1 length was compared to MC3 length. A randomization procedure imposed sampling constraints on the extant sample, producing composite intra-hand ratios for comparison with the incomplete *A. africanus* fossil record (11 attributed metacarpals). Randomized ratios were not significantly different from actual extant ratios, demonstrating the methodological appropriateness of this technique.

A. africanus did not significantly differ from the apes for relative breadth ($p \geq 0.287$) but did significantly differ for relative MC length ($p \leq 0.028$). Conversely, *A. africanus* was significantly different from modern humans in relative breadth ($p = 0.037$), but not so in relative length ($p = 0.809$). *A. africanus* MC1's were thus relatively more ape-like in breadth, while being relatively more human-like in length, consistent with previous work on australopithecine hand proportions. The relatively longer thumb would have enabled opposition of the thumb and fingers, which is critical for precision grips. Nevertheless, the relatively slender, ape-like first metacarpal suggests that *A. africanus* did not place the same mechanical demands on the thumb as later hominins.

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Children of God: subadult weaning, mortality, and isotopic associations with monastic diet in Byzantine Jerusalem

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Previous isotopic studies of skeletal remains at the Byzantine (5th-7th C AD) monastery of St. Stephen's in Jerusalem have examined aspects of adult dietary intake and subadult breastfeeding and weaning patterns. To complement these earlier studies, carbon stable isotope analysis using mass spectrometry was performed on the right femora of infants and juveniles ($n=56$) to determine $\delta^{13}C$ values throughout the breastfeeding and weaning process. Like nitrogen, carbon displayed a trophic level effect, peaking at between six to nine months of age with an enrichment of approximately 1‰. The gradual decline of subadult $\delta^{13}C$ values to adult monk levels after this peak occurred by two to three years of age and suggests that these children consumed a similar, C_3 -based diet to that of the monks and those breastfeeding them.

The biocultural implications of this research are significant in elucidating the presence of children in a monastery. Those breastfeeding the infants shared a diet akin to the monks as inferred from the carbon trophic level effect, indicating that either the mothers of the community or potentially the wet nurses of the monastery ate foods comparable in $\delta^{13}C$ content to the monks. Thus, these children may either have been cared for in a monastic hospital or orphanage by wet nurses, or they

were raised and breastfed by their mothers in the community and were simply buried at the monastery in proximity to holy figures.

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The functional morphology of the bifid cervical spinous process.

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Most textbooks describe the bifid spinous process as a feature of the typical cervical vertebra. Somewhere later they may acknowledge that the cervical spine is not always bifid, and that the two tubercles may be asymmetric. Comparative anatomy reports that the incidence of bifidity is much lower, although not unknown, in non-human primates. A high incidence of bifid cervical spinous processes may be a human characteristic although, because of known racial variation, it may not be a very good one. Yet rarely can one find an attempt to explain the functional basis for this feature. This project explores this question in human anatomy.

The cervical spines of about 50 individuals from the Hamann-Todd collection housed in the Cleveland Museum of Natural History were evaluated using the techniques of geometric morphometrics. That analysis was used to guide observations of human dissections to disclose the relationship of muscular and ligamentous attachments to the shape of the spinous process. Observations from these investigations do not support hypotheses that suggest development (age) or cervical lordosis may be the cause of the bifid spine. Instead, the tubercles appear to develop in response to muscular pull. The incidence of muscular asymmetry in the cervical region corresponds well with the incidence of the asymmetry of the spinous process. It appears that the variation of this bony feature may be the result of variations of cervical muscular anatomy. The question remains, why should there be such wide variations in cervical musculature? The answer to that question will have to be the focus of a future investigation.

Genetic variation and the peopling of northeastern North America.

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This study addresses the origins of both Iroquoian- and Algonquian-speakers of northeastern North America using mitochondrial DNA sequence data from modern and ancient populations. Specifically, it tests hypotheses generated from linguistic and archaeological data. The first is whether modern day Iroquois-speakers descended from a group that