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The appearance of agriculture in the Nile Valley occurs some 2000 years after its development in Europe and the Near East. The major cultigens are the same in these areas. It has been hypothesized by some researchers that agriculture emerges in the Nile Valley concomitant with the arrival of speakers of the Afro-Asiatic language family, both being brought after the differentiation of the Nostratic macrolanguage speech community. In this view agriculture (and Afro-Asiatic) come from Europe, the locale of the Nostratic cradle in this model. A phenetic craniometric analysis of early farmers from the Nile Valley of Upper Egypt was undertaken in order to explore this hypothesis. Badarian crania were studied with European and African series from the Howells' database, using generalized distances and cluster analyses (neighbour joining and UPGMA algorithms). Greater affinity is found with the African series. The results are considered with a variety of linguistic and archaeological evidence, as well as the findings of simulation studies relevant to this study. It is concluded that the earliest Nile Valley farmers in Upper Egypt for which there is record were locals, not European immigrants, and therefore that the development of agriculture in this region was not due to demic diffusion ultimately from Europe. The problems with phenetic affinity studies considered in isolation from other evidence will be discussed, as well as the flaws of thinking in terms of absolute identity, and not relative similarity.

#### **Molar growth in the late Miocene hominoid *Dryopithecus laietanus***

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The developmental milestones that describe the pace of life are collectively known as life history. Since dental development is highly correlated with ontogeny as a whole, the evolution of ape life history can be traced through the fossil record of dental development. We examined molar crown and root formation in *Dryopithecus laietanus*, a fossil ape from the 10 million-year-old site of Can Llobateres in Spain, and considered by some to be within the living great ape and human clade.

Three molars of *D. laietanus* were sectioned to expose the incremental growth lines preserved in the enamel and dentine. Long-period striae (Retzius lines) and short-period cross-striations in enamel, and von Ebner's lines in dentine, were used to calcu-

late crown formation times, enamel secretion rates and root extension rates. Crown formation times were relatively short, about 2.0 years for the first molar and 2.25 years for the second molars. These values are comparable to those of the early Miocene stem hominoid *Proconsul nyanzae*, but shorter than those of extant chimpanzees. Enamel secretion rates consistently increased from inner to outer enamel over all parts of the crown, with the fastest rates, nearly 6  $\mu\text{m}/\text{day}$ , found in the outer cuspal enamel. While the pattern of enamel secretion is very similar to that of the chimpanzee, average secretion rates were uniformly higher in *Dryopithecus*. Despite similar crown formation times, the pattern of enamel secretion differs from that of *P. nyanzae* in several respects. Initial root extension rates were relatively slow, approximately 8-9  $\mu\text{m}/\text{day}$ . A calculated minimum age at first molar emergence, a reliable proxy for overall life history, at 31.5 months is well within the chimpanzee range.

#### **How did they fight over scarce resources? the frequency of fractures in the Julio C. Tello skeletal collection from Nasca, Peru.**

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Archaeological survey and excavation as well as iconographic analyses of the Nasca culture (A.D. 1-700) of arid southern Peru have revealed an ancient society controlled by infrequent rainfall and little arable land. During times of resource scarcity or social stress, interpersonal competition may have been an important aspect of life in this region. This competition may manifest itself bioarchaeologically in a high frequency of fractures suffered in "hostilities", especially cranial fractures.

The Julio C. Tello skeletal collection from Nasca was analyzed for evidence of fractures. Approximately 11% of the 283 individuals from three cemeteries in the Las Trancas valley reveal skeletal fractures. Over 60% of the total fractures are cranial, located mostly on the parietal and the frontal bones. These are mainly depressed healed fractures clearly visible near the face or temple region.

The placement of these cranial fractures, their high frequency, and their non-lethal nature may suggest that the Nasca were competing over scarce resources, but probably in a ritual manner with people who were in their own social group. These competitions may not have been necessarily to the death. For instance, evidence of such non-lethal cranial injury is common among the Chumash hunter-gatherers of southern California, who competed over marine resources and vital

trading routes.

The evidence of cranial fractures in the Tello collection may help shed light on the nature of interpersonal competition in Nasca prehistory.

#### **Age-based anthropometric standards for protective respiratory equipment: a community-based study of at-risk children.**

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Concerns about agricultural-related injuries to children have led to recent adoption of "North American Guidelines for Children's Agricultural Tasks." The guidelines address the age-appropriateness of the agricultural tasks and recommend the use of protective equipment including respirators. However, the appropriateness of commercially available respirators for children was not addressed. Morphologic data gathered from at-risk populations are essential to engineering appropriate protective equipment and for deriving standards to assist parents with selecting respiratory protection for children.

We report on our efforts to assess the appropriateness of respirators for children and to develop age-based anthropometric standards for respirators. The sample consisted of facial measurements on 185 children (101 males, 84 females). The children were between 8 and 16 years of age at the time of measurement (mean = 11.8  $\pm$  2.6 years). Measurements were collected as a nested study within a longitudinal rural health cohort. Measures were selected to evaluate variability in the length and width of the face, lips, nose and head.

Statistical comparison of the children's measurements with comparably collected, published adult data demonstrated that the children were significantly smaller than the adults (t-test,  $p < 0.05$ ) in several critical engineering dimensions. However, we caution against simply seeing a child as a small adult. Growth and development produce changes in proportion as well as size. Standards must consider morphology. This study explores these age-related changes in facial morphology and their critical effects on respirator fit as well as the some of the ethical issues raised by this research.

#### **Quantification of anisotropy in trabecular bone fabrics.**

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Studies of trabecular bone fabrics using high-resolution X-ray CT (HRXCT) offer unique opportunities for anthropological research. Microtrabecular structure of extant primates can be linked to locomotor behaviors, in turn providing a tool for interpretation of fossil material in which trabeculae are preserved. The degree of anisotropy (DA) is one of the most commonly used descriptors for trabecular structure, with low values indicating relatively isotropic bone reflecting a diverse loading regime, while high values denote anisotropic bone as would be expected with unidirectional or stereotypical loading.

Because DA has been calculated in a number of ways, comparison of DA values across different studies utilizing different data and methodologies is problematic. In this study we examine the variation of DA values generated by the built-in randomness of DA algorithms, the choice of thresholding method, and intra-specific variation using trabecular data from the femoral head of several specimens of *P. potto*. We find that all of these factors can significantly alter DA results, though intra-specific variation is the largest factor. We therefore suggest that unless methods are precisely replicated, comparisons of DA values among studies should only be done via relative relationships rather than absolute values. It is also highly advantageous to analyze species using multiple rather than single individuals.

Furthermore, because DA is only a single scalar value, it can lead to unwanted convergence: different trabecular fabrics can yield indistinguishable results. We thus explore graphical and mathematical means to utilize additional data, particularly orientation, to help meaningfully differentiate among trabecular fabrics.

#### **Expansion of ALFRED, the ALlele FREquency Database.**

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We are converting ALFRED (<http://alfred.med.yale.edu/alfred/>) into a curated publicly accessible database expanding the contents to include published allele frequency data on defined population samples and unpublished data from other researchers who are willing to submit them. To encourage user input to the design and enhanced functionality of the database we have placed links on each page of the Web interface to the administrator's email address.

This email address also serves to accumulate suggestions from the community about what criteria should be used to evaluate data for entry into the database since allele frequency data based on very small or ill-defined samples have limited anthropologic utility. Data that do not meet the quality standards agreed to by the community should not be entered into the database or should have a clear "warning" associated with the entry. As of September, 2001, ALFRED contains over 3500 allele frequency tables (one polymorphism in one population); this number should increase rapidly in the next few months. Currently ALFRED has tools for accessing the raw allele frequency data and the data can be displayed graphically either as frequencies or as heterozygosities and numerically in different tabular representations. To the degree possible ALFRED will either contain or have links to specific protocols used to type the polymorphisms as well as links to other relevant databases. (Ongoing support of ALFRED is provided by NSF grant BCS-0096588.).

#### **Defining relationships between Native American Groups: a biodistance study of the North Carolina coastal plain.**

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Population relationships on the North Carolina coastal plain have previously been reconstructed based on language, material culture, typology of ossuary sites, and robusticity of human skeletal remains, creating a tripartite division of Native Americans into Algonkian, Iroquoian, and Siouan linguistic/cultural groups. However, many prehistoric populations in North Carolina exhibit conflicting or ambiguous material culture and ossuary evidence, preventing classification and regional grouping. In this study, biodistance measures are used to clarify Late Woodland population relationships.

Biological distance of skeletal remains is examined by way of nonmetric cranial traits, as suboptimal preservation of ossuary material made metric assessments impractical. Eleven ossuaries, totaling over 200 individuals, are examined from three different regions of the coastal plain for the presence or absence of 25 nonmetric variants. These data answer the questions of whether prior cultural classifications hold true, whether residence and marriage patterns can be determined based on biodistance and sex data, and whether populations with mixed or ambiguous characteristics can be classified based on biological distance data.

Because investigation of most ossuary sites in North Carolina has been limited to robusticity of skeletal elements and non-con-

temporaneous ethnohistoric accounts of language variation, further research into the biological variation of these Native Americans is a necessary correlate to previous culture studies.

#### **Climate, body size allometry and the effect on craniofacial measurements.**

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There has been considerable interest in the role of climate on body size in the recent literature and the implications for understanding our fossil ancestors. This research seeks to extend this climatic research and examine the degree to which measures of the face and head are integrated with those of the body. The degree of allometry using linear regression was determined for a series of cranial and facial widths and pelvic breadth. A similar analysis was conducted for cranial and facial lengths and femoral length.

Three hundred skeletons were measured from arctic to subarctic, cold temperate, tropical and subtropical climates. The author collected the database over the past six years at The Cleveland Museum of Natural History, The National Museum of Natural History, The Musée de l'Homme, Paris, The Institute of Human Biology, Vienna and the Canadian Museum of Civilization, Hull.

Bi-iliac breadth was not as large as anticipated for the arctic and subarctic peoples examined and some of the tropical people had larger pelvic breadths than anticipated. Stature plays a significant role in the available surface area and the best climatic patterns were observed between ratios of stature to pelvic width. Males exhibited femoral and pelvic patterning in accordance to the rules of Bergmann and Allen to a greater degree than their female counterparts. Lastly, both cranial breadths and cranial lengths did have negative allometric relations with both measures of body width and body length as anticipated. The implications of these finds will be discussed.

#### **Parameterized reference models for morphological comparison of fossil and modern skulls.**

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In the field of anthropology, the discrimination of taxa and the quantitative description of ontogenetic or evolutionary change requires the analysis of morphological patterns. Geometric Morphometrics uses landmarks and furthermore semi-landmarks to extract information from unsampled regions