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the hallux during bipedal propulsion in the Gona individual – that document notable variation in the locomotion adaptations of this early hominin despite occupation of a similar landscape.

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Experimental animal models for domestication: insights into modern human craniofacial evolution

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Dmitri Belyaev's domestication experiments conducted on silver foxes and rats have established that selecting for tame behaviors was the precursor to all genotypic and phenotypic traits associated with domestication. It has also been proposed that humans are a "self-domesticated" species. In fact, gracilization of the modern human face since the Middle Pleistocene is associated with behavioral changes towards increased social tolerance, i.e. "tameness". Our previous study examining the relationship between behavior and craniofacial morphology in Belyaev's rats selected for tameness and defensive aggression showed that not all domesticated phenotypes are necessarily present in experimental animal models for domestication. Here we expand our previous work to include a comparative sample of wild caught rats to further examine the effects of selected behaviors (both tameness and aggression) on the craniofacial skeleton as it relates to domesticated traits. Our objective is to determine whether the aggressive strain is a "true" representation of the "non-domesticated" phenotype. We hypothesize that both the aggressive and tame rats will be different in shape and size from the wild caught sample. We used 3D geometric morphometric methods to quantify and analyze the craniofacial shape of all three groups of rats. Results show group-specific craniofacial size and shape differences. The wild caught sample also exhibits size-related changes associated with sexual dimorphism. This study will help to assess the role of experimental animal models when examining the morphological consequences of domestication and its implications for modern human craniofacial evolution.

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Household exposure to allomaternal care improves early cognitive outcomes in older female infants

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Allomaternal care (AMC: care from someone other than the mother) is known to reduce energetic stress for moms and developing infants. Yet, AMC provides opportunities for infants to learn from various informal teachers, and may enhance cognitive skills. To test this, I collected data from mothers and infants in Tucson, AZ during May 2017-September 2018, including 27 females and 31 males aged 13-15 months, and 28 females and 25 males aged 16-18 months. Cognitive skills were assessed via in-lab administration of the Bayley III Screening Cognitive Subtest (Bayley), while daily diaries and questionnaires were used to obtain AMC data from the mother. Pearson's correlation coefficients were used to determine whether infants who receive more AMC per day, interact with a greater number of caregivers engaged in learning-oriented or play behaviors, or have a larger number of residential caregivers received cognitive benefits. Cognitive benefits were quantified by achievement of higher overall scores on the Bayley, completion of more successful trials of finding a hidden object (Task 18) or obtaining an object from an enclosed space (Task 20), and a higher number of total successful peg placements (Tasks 19 and 21). While several relationships approached significance, there were no uniform predictors of cognitive benefits across age and sex categories ($p > 0.05$). Notably, in older females (aged 16-18 months), an increase in older siblings and total household residents was correlated with higher overall Bayley scores ($p < 0.001$). Further analyses considering residential and nonresidential AMC separately may further clarify these relationships across age and sex categories.

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Impact of the 1854 cholera epidemic at the Erie County Poorhouse, Buffalo, New York

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Buffalo, New York was severely impacted by the 1854 cholera epidemic. Both city residents and inmates of the Erie County Poorhouse (ECPH) including, the Insane Department were affected. This research investigates the incidence of mortality in the city compared to that of the poorhouse to determine if the poorhouse was successful in buffering the inmates from the high mortality associated with that disease.

ECPH Inmate Records for 1854 were examined. Between April and October, 1854, the institution housed 279 inmates: 226 in the poorhouse proper and 53 in the insane department. During this period, 63 poorhouse inmates contracted cholera, 26 males, 33 females and 4 of unknown sex. In the poorhouse, 34 of 43 infected inmates died (79%). In the insane residence, 19 of 20 infected inmates died (95%).

The average age at death was 36 years for insane inmates and 38 for poorhouse inmates. The mean length of stay in the institution was 207 days for insane inmates and 182 days for poorhouse inmates.

The City Health Physician reported 1034 cholera cases in the city. Of these 569 died (55%). The higher mortality at the poorhouse indicates that conditions there did not offer protection from cholera. In fact, poor diet, improper waste disposal and inadequate privies reported by city officials probably were the major factors. Furthermore, the increased length of stay may have compromised insane inmates, leaving them more vulnerable to the disease. Other aspects of life between the insane department and the poorhouse are also explored.

Uncertainties Regarding the Physical Basis of Lamellar Bone Periodicity in Secondary Osteons Suggest that Surrogates Based on Infilling/Periodicity Should be Considered

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Periodicity with which enamel layers form (Retzius periodicity) is a manifestation of a biorhythm that is also expressed in lamellar bone. This idea is being investigated in anthropoids as the Havers-Halberg Oscillation hypothesis (Mahoney et al.). However, defining 'lamellar bone periodicity' (LBP) is difficult because: 1. its physical basis is poorly understood/controversial; 2. LBP can be established by different ultrastructural motifs that might be interpreted as having differences in 'formation period' duration. These motifs include: 1. layered patterns of predominant collagen fiber orientation - the classical Gebhardt-like models; eg, orthogonal plywood design (OrthoP-D) and twisted plywood design (TwistP-D), and 2. Marotti model = alternating dense and loose lamellae (AltD-L-La). In the perspective of a literature review and examinations of computer-assisted and synthetic models, we demonstrate how these motifs can lead to different interpretations of formation periods, hence LBP, in polarized-light images of secondary osteons. Results: the AltD-L-L motif could be interpreted as one or two formation periods. But if the AltD-L-La is actually an artifact of harsh etching (Yamamoto et al.) and LBP is actually created by 180-degree twists of the TwistP-D, then each full twist might be

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considered as three formation periods. Additional confusion arises if some osteons have OthoP-D. However, the infilling rate of two similar-sized osteons is equivalent regardless if OthoP-D or TwistP-D motif. Consequently, when the physical basis for LBP is unclear, then it seems appropriate to use surrogates for Retzius-like periodicity in lamellar bone; for example, averaged osteon infilling rate or the osteon wall thickness normalized to osteon area.

N/A

It's getting better all the time: A look at the contributions of G. Richard Scott to dental anthropology

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Dental anthropology has experienced significant changes over the last half century, including the development of the widely used Turner-Scott dental morphological trait scoring method (formerly the Arizona State University Dental Anthropology System). G. Richard Scott has played a key role in the advancement of dental anthropological research. Specifically, he has made improvements to scoring dental crown and root morphology with special attention given to shoveling, Carabelli's trait, and two-rooted lower canines. Scott is currently a Foundation Professor of Anthropology at the University of Nevada, Reno, but he also achieved full professor status at the University of Alaska, Fairbanks.

Throughout his 40-year research career, Scott has authored three books, edited two books, and authored over 70 articles and book chapters. Specifically, his contributions to dental anthropology through *The Anthropology of Modern Human Teeth* and the Turner-Scott method represent fundamental sources of information required to perform research on dental morphological traits. Additionally, Scott collaborates internationally and has co-authored publications with researchers from nine countries, including England, Portugal, Spain, Denmark, Croatia, Australia, Brazil, Colombia, and Chile. He was the first president of the Alaska Anthropological Association, and he currently serves as co-editor of the *Dental Anthropology* journal and associate editor for the *American Journal of Physical Anthropology*. Scott also helped to develop the biological anthropology graduate program at the University of Nevada, Reno. His dedication to his graduate students, colleagues, and research endeavors will continue to advance dental morphological research and make a significant impact to the scientific community in decades to come.

Archaic encounters: Retracing interactions between Neandertals and Denisovans

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Denisovans and Neandertals separated from each other at least 390,000 years ago. Skeletal remains of individuals from both groups have been discovered at Denisova Cave (Russia). To date, nuclear DNA has been retrieved from five of these individuals – four Denisovans and one Neandertal. Traces of Neandertal DNA in the genome of one of the Denisovans demonstrated that Neandertals and Denisovans admixed at least once in the past.

"*Denisova 11*" is an additional individual from Denisova Cave, represented by a single bone fragment identified using collagen fingerprinting, whose genome has now been sequenced. This individual had both Neandertal and Denisovan ancestry, in nearly equal extents. To explore this signal of mixed ancestry, comparisons between the distribution of Neandertal-like and Denisovan-like genetic variants across her genome, and theoretical expectations under different genealogical scenarios, were carried out. These indicated that she was the daughter of a Neandertal mother and a Denisovan father, and that her Denisovan father had at least one distant Neandertal ancestor.

The genome of *Denisova 11* provides direct evidence for multiple admixture events between Neandertals and Denisovans, occurring ~300,000 years after the separation of the two groups. Added to previous evidence for admixture between Denisovans and early modern humans, and between Neandertals and early modern humans, this suggests that individuals from different Late Pleistocene hominin groups mixed often when they encountered one another.

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Comparative biomechanics of the Hominidae mandible

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Intra- and interspecific variation in the shape of the hominid mandible has been documented, but the mechanical consequences of these variations remain unclear. Specific shape metrics including symphyseal depth and inclination, corpus thickness, the height and orientation of the rami and the divergence of the posterior dental row have all been hypothesized to be functionally related to feeding. According to previous work, these features should either serve to reduce bone strains or increase biting efficiency or both. However, whether these features function together to produce species-specific patterns of deformation or strain patterns has not yet been evaluated. This study uses finite element analysis (FEA) to examine the biomechanical implications of mandibular shape variation within and across species of extant great apes.

Geometric morphometric methods were used to analyze shape variation in the mandibles of four extant hominid species (26 *Pan troglodytes*, 18 *Pongo pygmaeus*, 22 *Gorilla gorilla*, 37 *Homo sapiens*) based on 504 Procrustes coordinates. Shape-space principal coordinates analysis (PCA) was used to identify the mean female and male specimens for each species and eight total finite element models (FEMs) were constructed from the CT scans of the selected specimens. The FEMs were assigned the material properties of bone, loaded with equivalent muscle forces and constrained to simulate maximal bites at multiple locations across the tooth row.

Preliminary results indicate variation in strain magnitude but some broad similarities in strain regime and deformation patterns across taxa.

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The Use of Laser Scanning Confocal Microscopy in Detecting Bone Microstructure Using Basic Fuchsin and Toluidine Blue Stains

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The use of laser scanning confocal microscopy to develop a three-dimensional imaging of bone is still relatively novel in the field of human osteology. The purpose of this project is to demonstrate the usefulness of using basic fuchsin stain and toluidine blue to develop a three-dimensional image of bone microstructure using a laser-scanning confocal microscope. This project used 3 human femora, three human ribs, and three pig ilia damaged fragments to examine the microstructure using basic fuchsin and toluidine blue stains. Testing was done using a Carl Zeiss LSM800 at the 10x, 20x, and 64x magnification, with an emission wavelength setting of 543nm and 653nm; the emissions wavelength best used to view the two stains. Using the elements described, the results of this project found that it is possible to develop three-dimensional imaging of lamellar