



**AAPA UNDERGRADUATE SYMPOSIUM  
6–8 pm, Wednesday April 13<sup>th</sup>, 2011**

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1. **GIS mapping and reconstruction of the Tipu cemetery.** J. SABINO, M. COHEN.
2. {GIS computer projection for poster 1 above}
3. **New acid preparation technique for fossil samples in breccias.** M. L. BROWN, R. E. KANDATH, K. M. MULDOON, D. A. BURNEY.
4. **Can island dwarfism explain the tiny brain of the Flores “Hobbit”?** L. YAO, R. D. MARTIN.
5. **Accidental discovery leads to purposeful relations: Demographic and pathological analysis of Native sanctioned study.** C. CARROLL-HOWARD, G. D. MADDEN, H. VAN WORMER.
6. **Health and nutrition at the Austin site (22TU549), Tunica County, MS: A comparative analysis of childhood nutrition from village and mound centers in northwest Mississippi.** R. PERASH, J. A. WHITE, K. HERNDON, D. N. COOK.
7. **Women and violence: an analysis of sex differences in cranial trauma at San Pedro de Atacama, Chile.** N. YEE, L. M. KING, B. M. DAVERMAN, C. TORRES-ROUFF.
8. **Comparisons of paleodiet from Chinese skeletal samples: nomadic pastoralist populations from Xinjiang and an agriculturalist population from Henan.** A. BAKER, J. T. ENG.
9. **Can sex differences in muscle strength explain observed differences in child carrying positions?** L. STEARNS, M. MYERS.
10. **§ Self-selected walking speeds: Do females and males carrying children choose differently?** A. MYHRE, M. KPANQUOI, L. STEARNS, K. BOEFF, C. WALL-SCHEFFLER, M. MYERS.
11. **§ Entertaining entrainment: reconsidering the effects of respiratory constraints on the optimal running speed.** M. WILLCOCKSON, C. WALL-SCHEFFLER.

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12. **Skeletal analysis of the Poole-Rose Ossuary: anatomy and pathology of the sacrum.** E. MOFFETT, H. MCKILLOP.
13. **Does practice make perfect? A test of the effect of experience on age-at-death estimation using Transition Analysis.** J. M. GOMEZ, B. F. B. ALGEE-HEWITT.
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16. **§ Responding to chronic stress: longitudinal perspectives on metabolism.** K. KJOSNESS, C. WALL-SCHEFFLER.
17. **Origins of the Tipu Maya based on mitochondrial haplogroup analysis.** J. COONS, M. COHEN, N. ELWESS, S. LATOURELLE.
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19. **A phylogenetic analysis of *Alouatta pigra* inhabiting the Calakmul site of Campeche, Mexico.** L. G. PROCTOR, K. BATAI, K. A. RIZZO, S. R. WILLIAMS.
20. **§ Collagen fiber orientation heterogeneity (CFO-Het): Does this new characteristic reflect habitual load history in the chimpanzee femur and does it corroborate CFO based on image gray levels?** K. E. KEENAN, J. G. SKEDROS.
21. **§ Non-metric trait variability expressed in the deciduous molars of chimpanzees and gorillas.** A. M. HARDIN, S. S. LEGGE.
22. **Patterns of dental variation within middle Eocene primates from southwestern Wyoming: implications for recognizing speciation in the fossil record.** A. A. GALLIGAN, K. M. MULDOON, G. F. GUNNELL.
23. **Community structure and the spread of infectious disease in primate social networks.** R. H. GRIFFIN, C. L. NUNN.

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24. **Hormonal monitoring of reproductive status in wild monogamous female owl monkeys of the Argentinean Chaco.** K. SCHOENROCK, E. FERNANDEZ-DUQUE, K. M. BURKE, P. PHOJANAKONG, C. VALEGGIA.
25. **Using self-directed behaviors to measure social anxiety among blue monkeys (*Cercopithecus mitis*).** V. DU, M. CORDS.
26. **Rock Hyrax (*Procapra capensis*), Red River hogs (*Potamochoerus porcus*), Black and White Colobus monkeys (*Colobus guereza*), and DeBrazza's monkeys (*Cercopithecus neglectus*) in a mixed-taxa zoo exhibit: Effects on the behavior of a breeding group of DeBrazza's monkeys after the birth of an infant.** R. DIAMOND, E. WIERTELAK.
27. **Social information processing in rhesus macaques.** D. R. AMASINO, G. ADAMS, M. PLATT.
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**Social information processing in rhesus macaques.**

DIANNA R. AMASINO<sup>1,2</sup>, GEOFFREY ADAMS<sup>2</sup>, and MICHAEL PLATT<sup>2</sup>.

<sup>1</sup>Department of Anthropology and Neuroscience Studies Major Program, Macalester College, <sup>2</sup>Department of Neurobiology, Duke University.

Primates exhibit rich social complexities, but the neural circuitry underlying social information processing is largely unknown. Investigating neuronal firing in targeted areas of the brain involved in social processing during the presentation of social stimuli will enhance our understanding of the circuitry supporting social complexity and may illuminate some of the evolutionary adaptations leading to complex social behavior. The pilot research presented here tested the viability of a novel experimental paradigm of showing videos of free-ranging rhesus macaques (from the Cayo Santiago research station) to rhesus macaques in the lab to determine their valuation of different types of social information. We accomplished this by letting the macaques choose video options: after every five seconds of a video, the monkeys were given the option of continuing with the video (“next”), watching a randomly selected video from the database of monkey videos (“new”), repeating the five seconds

they had just watched (“repeat”) or watching a blank gray screen (“blank”). As predicted, the rhesus macaques consistently chose the “next” and “new” options over the “repeat” and “blank” options. This result indicates that they valued these novel video stimuli, but not videos of repeated information (repeat) or a lack of information (blank). Their valuation of these stimuli confirms that it will function as a stimulus that provides social information during electrophysiological recordings. Future work using this experimental paradigm will explore the neural circuitry of processing social information using single-unit electrophysiology and will examine whether the behavioral content of the videos affects neural responses.

**Comparisons of paleodiet from Chinese skeletal samples: nomadic pastoralist populations from Xinjiang and an agriculturalist population from Henan.**

ANDREW BAKER and JACQUELINE T. ENG. Department of Anthropology, Western Michigan University.

The paleodiet and stress status of spatially and temporally distinct skeletal populations from China are examined. The goal of this research is to better understand the diet and nutritional adequacy of populations practicing nomadic pastoralism in

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comparison with agriculture by examining the non-specific indicators of stress such as linear enamel hypoplasia, porotic hyperostosis, cribra orbitalia, as well as the paleodietary indicators of carious lesions and tooth wear. Two nomadic pastoral skeletal populations from Xinjiang, China, and one agricultural population from Henan, China are examined. One nomadic population is from the Bronze Age (1,800-1,200 BC) site of Hami (n=86) and the other is from the later site (475 BC-220 AD) of Yanghai (n=85). The agricultural society is from a site in Henan (n=64) and dates from 475-221 BC. Having populations from two different time periods that rely on nomadic pastoralism for subsistence allows for examination of the continuity of diet, and their effects on the skeleton, over-time. Preliminary findings indicate that the diet of the nomadic pastoralist samples may have had adequate levels of protein, as indicated by the relatively low levels of cribra orbitalia and porotic hyperostosis, and possible gendered access to food, as females experience a much higher rate of carious lesions. However, tooth wear is very similar between men and women, suggesting a different etiology than diet.

**New acid preparation technique for fossil samples in breccia.**

MARIELLE L. BROWN<sup>1</sup>, RACHAEL E. KANDATH<sup>1</sup>, KATHLEEN M. MULDOON<sup>1,2</sup>, DAVID A. BURNEY<sup>3</sup>.  
<sup>1</sup>Department of Anthropology, Dartmouth College, <sup>2</sup>Department of Anatomy, Dartmouth Medical School, <sup>3</sup>National Tropical Botanical Garden.

Many fossils found in limestone deposits are encased within a breccia matrix that must be removed in order to study the remains. Traditional methods to remove bones from breccia have included submerging the entire breccia matrix in an acid bath, which softens both the matrix and the bones themselves, increasing the chance that the bones will break or become distorted as they are removed from the matrix. Using a breccia matrix from Anjohibe Cave in northwestern Madagascar, we developed a new method for fossil extraction that limits damage to fossil bones. By mixing weak acetic acid with personal lubricant, we can selectively apply the mixture onto the matrix and not the bones. The personal lubricant functions to solidify the acid mixture enough so that the mixture stays on the area to which it was applied. Once the acid mixture is applied, we let it sit on the breccia for half an hour, and then submerge the breccia in water to wash off the acid. Before we start to extract the bone, we let it completely dry to minimize bone breakage.

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This new extraction technique helps to preserve the integrity of the bones as they are minimally exposed to the acid. The application of this method has allowed us to efficiently remove a diverse micromammalian faunal sample from the Anjohibe Cave breccia. This new method of preparation increases the probability that the fossils encased in breccias, such as subfossil lemurs or South African hominins, can be removed intact for further study.

#### **Project REPA: The timing of menopause in a population with high mortality risks.**

JENNIFER BURCH<sup>1</sup> and VIRGINIA J VITZTHUM<sup>1,2</sup>. <sup>1</sup>Anthropology Department, <sup>2</sup>Kinsey Institute for Research in Sex, Gender, and Reproduction, Indiana University.

That menopause in the human female typically precedes death prompts the hypothesis that some evolutionary advantage must be gained by an individual's premature cessation of reproduction. Several (non-mutually exclusive) evolutionary explanations of menopause have been proposed. Within the framework of life history theory (LHT), an individual's environment and experience are expected to affect the timing and magnitude of her investments in producing offspring. Age at menopause is predicted to be relatively

earlier in populations characterized by high adult mortality risk, especially if maternal survival is a major determinant of newborn survival. Such conditions are common in many non-industrialized populations including the Bolivian *altiplano*, the locale for Project REPA (Reproduction and Ecology in Provincia Aroma), a longitudinal study of reproductive functioning and health in rural Bolivians. We used logit analysis (SPSS v18.0) to estimate the median age at menopause in this population based on women's self-reports of current status in 2010, collected during a private interview conducted in a participant's native language (Aymara). Our preliminary analyses (n=113) find the median age to be 46.1 years (CI: 44.7, 48.0), falling at the lower end of the range of reported ages at menopause in other populations (e.g., India = 44.0 yrs, Nepal = 46.8 yrs, US whites = 51.4 yrs [see Wood, 1994, *Dynamics of Human Reproduction*, Table 9.6]). This observation is consistent with the predictions of LHT. We are also evaluating the potential influence of other factors, including nutritional status and fertility, on the timing of menopause in these rural Bolivian women.

Funded by the Office of the Vice President for Research, Indiana University, Bloomington.

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**Accidental discovery leads to purposeful relations: Demographic and pathological analysis of Native sanctioned study.**

CHRISTOPHER CAROLL-HOWARD, GWYN D. MADDEN and HEATHER VAN WORMER. Department of Anthropology, Grand Valley State University.

Human remains were discovered in Gaines Township, Michigan, in July 2010, when a windstorm uprooted an 80+ year old tree. Following protocol, the Kent County coroner determined that the remains were not modern. Acting on the part of the coroner students and professors from Grand Valley State University excavated the site at the owner's request. The site itself was disturbed by the roots of the tree, as well as the owner's attempt to clean the roots with a hose prior to discovery of the skeletal material. A mixture of historic materials, faunal bone, and commingled human remains were found in the first two levels. Most striking was a 1961 penny laying in the same context as a complete skull. The third level offered a new twist, shovel shaped incisors and a single Native American artifact. After communicating with the Gun Lake Band of the Pottawatomi, permission was granted to finish excavation and evaluate the remains. This research discusses the demographic and health information for the nine individuals

found at the site, ranging in age from fetal to adult. This case is not only important because of the evidence provided through the human remains, but also serves as a good example of how anthropologists and Native Americans can work together in a real world scenario. This poster will be concerning the pathological and demographic analysis of the recovered remains, with special attention paid to cooperation undertaken by both anthropologists and Native Americans.

**Origins of the Tipu Maya based on mitochondrial haplogroup analysis.**

JOSHUA COONS<sup>1</sup>, MARK COHEN<sup>1</sup>, NANCY ELWESS<sup>2</sup> and SANDRA LATOURELLE<sup>2</sup>. <sup>1</sup>Department of Anthropology and <sup>2</sup>Department of Biological Sciences, SUNY Plattsburgh, Plattsburgh, NY.

The haplogroup lineages of ancient Maya from Tipu, Belize have been determined through the isolation of ancient mitochondrial DNA. The analysis uses the teeth of a sample of twenty-two individuals from a total of ca 600 excavated from the 16<sup>th</sup> and 17<sup>th</sup> century visita mission. Isolated ancient mitochondrial DNA samples were amplified utilizing polymerase chain reaction (PCR) technology and digested using restriction enzymes previously established by earlier studies. DNA fragment sizes were determined

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through the use of agarose gel electrophoresis. Based on the resulting DNA fragment sizes, it was possible to determine to which Amerindian haplogroup—A, B, C, D, or X—each individual belonged. Of these twenty-two, three individuals tested positive for haplogroup B, fifteen individuals tested positive for haplogroup C, and four individuals tested positive for haplogroup D. This compares to samples from other ancient Maya sites in Xcaret, Mexico; and Copan, Honduras. The Tipu collection affords the potential for analysis of a much larger sample than previous studies.

**Rock Hyrax (*Procapra capensis*), Red River hogs (*Potamochoerus porcus*), Black and White Colobus monkeys (*Colobus guereza*), and DeBrazza's monkeys (*Cercopithecus neglectus*) in a mixed-taxa zoo exhibit: Effects on the behavior of a breeding group of DeBrazza's monkeys after the birth of an infant.**

RACHEL DIAMOND and ERIC WIERTELAK. Department of Psychology, Macalester College.

Historically, zoos rarely feature mixed taxa exhibits including multiple primate species; the Minnesota Zoo opened such a unique four-species exhibit in May, 2010. Because of potential problems associated with territoriality and aggression, primates in mixed-taxa exhibits are generally

non-breeding. However, the DeBrazza's monkeys at the MN Zoo are a breeding pair with a juvenile offspring. The purpose of this study was to calculate the effects of a mixed taxa exhibit on the behavior of this breeding group, and to compare their behavior before and after the birth of an infant. Pre-birth behavioral observations established activity budgets for the DeBrazza's with the adult male spending 71% of his time resting and 14% of his time in food related activities. The adult female spent 85% of her time resting and only 4% in food related activities, and the juvenile spent 25% of her time resting and 35% of her time in food related activities. Post birth, the adult male spent 68% of his time resting, and 16% of his time with food, the adult female spent 85% of her time carrying the infant, and the juvenile spent 34% of her time resting and 28% of her time with food. Each animal also spent different amounts of time near the other animals; this information will be used to calculate whether the birth of the infant influenced intraspecies or interspecies interactions, which is important because there is concern that this combination of species together in one exhibit might negatively affect the animals.

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**Using self-directed behaviors to measure social anxiety among blue monkeys (*Cercopithecus mitis*).**

VICKY DU and MARINA CORDS.  
Department of Ecology, Evolution, and Environmental Biology, Columbia University.

Self-directed behaviors (SDBs), such as self-grooming, self-scratching, yawning, and body shaking, have been used as indicators of anxiety in non-human primates, but most research in this area has focused on species with steep, linear dominance hierarchies. This study investigated the social correlates of increased rates of SDBs among blue monkeys, a generally egalitarian species with a shallow dominance hierarchy. Subjects were 16 adult females from a habituated blue monkey group inhabiting the Kakamega Forest, Kenya. Five-minute, continuous focal animal follows were conducted from June-August 2010, resulting in 401 total follows. The focal animal's activity, presence of neighbors (<1m), and SDBs were voice-recorded continuously. After controlling for the subject's activity, a multilevel Poisson regression model was made to assess which social variables were most significantly correlated with increased rates of SDBs. The best model included: 1) the number of grooming bouts, or switches, the focal animal engaged in with a neighbor (<1m) and 2) the focal

animal's average rate of received aggression within the group, which was calculated using long-term data on agonistic interactions between adult females. This finding supports the hypotheses of previous research that grooming may be an anxiety-inducing activity among some primate species because it may signal coalitionary allegiances between adult females. This study contributes to the understanding of the social causes of anxiety in a nonhuman primate species with a generally egalitarian, but linear dominance hierarchy.

**Patterns of dental variation within middle Eocene primates from southwestern Wyoming: implications for recognizing speciation in the fossil record.**

AISSLING A. GALLIGAN<sup>1</sup>, KATHLEEN M. MULDOON<sup>1,2</sup>, and GREGG F. GUNNELL<sup>3</sup>. <sup>1</sup>Department of Anthropology, Dartmouth College, <sup>2</sup>Department of Anatomy, Dartmouth Medical School, <sup>3</sup>Museum of Paleontology, University of Michigan.

Because intraspecific variation is the raw material for evolution, documenting patterns of morphological variation within regional faunas may indicate geographic centers of speciation in the primate fossil record. It has been suggested that during the middle Eocene (earliest Bridgerian), the basin

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margin region of South Pass, Wyoming represented a “species pump,” a heterogeneous upland environment well-suited for promoting speciation. In order to test this hypothesis, we compared patterns of dental variation within the primates of South Pass with that of a similar sample from the more homogeneous basin-center environment of the Bridger Basin. We collected upper and lower second molar measurements for a sample of seven omomyid species (73 specimens) and six adapid species (72 specimens). We used the coefficient of variation to determine whether primates from South Pass have greater intraspecific morphological variation than primates from the Bridger Basin center. Our results indicate that there are differences in the levels of intraspecific morphological variation found at South Pass when compared to the Bridger Basin. Several species from South Pass have higher measures of intraspecific variation than those at the Bridger Basin, although levels are still consistent with coefficient of variation values characterizing single-species samples. South Pass has greater levels of variation within adapids and omomyids for most measurements when compared to the Bridger Basin. In addition, measures of intraspecific variation appear to support South Pass as a center of species origination. Further study of morphological variation will elucidate the usefulness

of patterns of geographic variation for understanding primate evolution.

This study was funded by the Claire Garber Goodman Fund to AAG.

#### **Does practice make perfect? A test of the effect of experience on age-at-death estimation using Transition Analysis.**

JAMIE M. GOMEZ and BRIDGET F. B. ALGEE-HEWITT. Department of Biomedical Sciences, Grand Valley State University.

The estimation of age-at-death with some degree of statistical certainty is a key component of any osteological analysis that seeks to extract biological information from an individual or reveal the demographic structure of a skeletal population. Transition Analysis (TA) has emerged as a valuable statistical tool for obtaining robust age estimates that circumvents many of the statistical problems that plague other, traditional, methods. Moreover, the multiple-trait, component scoring approach associated with TA (Boldsen et al. 2002) is known to be a promising alternative to the single indicator methods when dealing with unknown, incomplete, and fragmentary cases. For these reasons, we believe that the TA approach merits more refined testing. This project evaluates the effect of education and experience on the age

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estimates obtained. We are concerned, specifically, with the ease of learning and repeatability when TA is applied by a practitioner who is familiar with age estimation theory but has minimal TA experience. We pose the following questions: (1) how interpretable are the criteria? (2) are some components more difficult to score than others? (3) how repeatable, and, so, reliable are the age estimates produced? (4) do TA scores, and, in turn, age estimates improve with practice? (5) are the patterns of intraobserver error and repeatability consistent between male and female specimens? Data for this study was collected on the Suchey-Brooks pubic symphysis casts: specimens were assigned unbiased identifiers, selected at random and repeatedly "blind"-scored over a two month period. Special attention was paid to the date and conditions of the analysis in order to detect patterned results and tests of intraobserver variation were conducted. Pedagogical and practical-use recommendations are provided.

#### **Community structure and the spread of infectious disease in primate social networks.**

RANDI H. GRIFFIN and CHARLES L. NUNN. Department of Human Evolutionary Biology, Harvard University.

Parasite risk is expected to increase with group size, but empirical studies

have provided mixed support for this prediction. Here, we investigate whether social network structure within groups influences parasite risk. For example, locally interacting sub-groups within a network may slow the spread of socially transmitted infections by containing parasites within sub-groups. Conversely, highly central individuals may facilitate disease spread by acting as super-spreaders. To generate theoretically grounded predictions, we developed an agent-based susceptible-infectious-resistant (SIR) model in MatLab to simulate the spread of infections on artificial social networks. We investigated the effects of network structure on the size of disease outbreaks using two social network analysis metrics: (1) community modularity ( $Q$ ), a measure of network sub-grouping; and (2) the eigenvector centralization index ( $C$ ), a measure of the extent to which a few individuals occupy central locations in the network. The simulations revealed a negative influence of  $Q$  on outbreak size, while the effects of  $C$  depended on other parameters and were thus less predictive of outbreak size. We then tested predictions in a comparative analysis of social network structure and parasite species richness across 19 primate species. Using Bayesian methods to account for phylogeny, we found that  $Q$  had a negative influence on parasite richness as predicted by our

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simulations, while *C* showed no association with parasite richness. We also found that larger groups exhibited higher *Q*, raising the possibility that increased parasite risk associated with group living is offset by a greater degree of sub-grouping in larger groups.

This research was supported by Harvard University, a Summer Undergraduate Research Fellowship (SURF) from the Harvard Initiative in Global Health (HIGH), and the National Science Foundation (BCS-0923791).

**Non-metric trait variability expressed in the deciduous molars of chimpanzees and gorillas.**

ANNA M. HARDIN and SCOTT S. LEGGE. Department of Anthropology, Macalester College.

Non-metric dental traits are a well established tool for anthropologists investigating population affiliation and movement in humans. Nonetheless, similar traits in the great apes have received considerably less attention. The present study provides data on non-metric trait variability in the deciduous molars of great apes from museum context. Twenty-two traits are observed in the upper and lower deciduous molars in specimens of *Pan troglodytes*, *Pan paniscus*, *Gorilla gorilla*, and *Gorilla beringei*. Overall trait

variability is assessed across the species. *Pan troglodytes* demonstrates the greatest number of variable traits (74.1%), whereas *Pan paniscus* has the fewest (51.9%). Five traits were found to be fixed as either always present or always absent across the study group.

This study clearly demonstrates the variability of non-metric traits in the deciduous molars of chimpanzees and gorillas. These traits could potentially be used in the same way that similar traits are in humans, namely group affiliation and population movements through time. Further, this study establishes scoring guidelines and methodology relevant to deciduous dental morphological characteristics found in the great apes, but not necessarily in humans.

This study was funded by a grant from the Paul Anderson Interdisciplinary Summer Research Fund and Macalester College.

**Collagen fiber orientation heterogeneity (CFO-Het): Does this new characteristic reflect habitual load history in the chimpanzee femur and does it corroborate CFO based on image gray levels?**

KENDRA E. KEENAN and JOHN G. SKEDROS. Department of Orthopaedics, University of Utah School of Medicine.

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Gray levels (GLs) in circularly polarized light (CPL) images reflect predominant CFO: darker GLs represent longitudinal orientation, brighter GLs represent oblique-to-transverse orientation. CFO-Het (variability of CFO) is a new characteristic that might correlate more strongly with habitual load history than CFO or secondary osteon morphotype score (osteonMTS) (Skedros et al., 2009 BONE). CFO-Het = the full-width at half-maximum (FWHM) of an image GL profile (larger FWHM = greater CFO-Het). Eight skeletally mature chimpanzee femora (50% shaft; proximal shaft =70% and 80%) were embedded in methacrylate, ultramilled, and imaged in CPL. FWHM was measured from GL profiles of the CPL images where we measured CFO and osteonMTS in our previous studies. CFO-Het data were analyzed for section location and quadrant (anterior, posterior, medial, lateral) differences. We hypothesized CFO-Het to be greatest in regions with predominant shear (torsion and/or neutral axis regions). Results showed that CFO-Het correlated with CFO ( $r \sim 0.88$ ) and osteonMTS ( $r \sim 0.63$ ). Unexpectedly, CFO-Het is highest in the medial 'compression' cortex ( $p < 0.05$ ) of the proximal shaft (habitual bending) but, as expected, was not significantly different quadrant-wise in the 50% shaft (comparatively more diffuse torsion/shear). However, the

50% shaft had unexpectedly lower CFO-Het than the proximal shaft ( $p < 0.05$ ). CFO-Het generally corroborates CFO-based load history data, but does so unexpectedly and less consistently than the CFO and osteonMTS data that we previously reported for these bones. But CFO-Het could reveal toughening mechanisms not shown by CFO data in bones where osteonMTS data cannot be obtained (e.g. none/few secondary osteons).

#### **Responding to chronic stress: longitudinal perspectives on metabolism.**

KELSEY KJOSNESS and CARA WALL-SCHEFFLER. Department of Biology, Seattle Pacific University.

It has recently been suggested that a "stress response" may increase survivorship of individuals, particularly when individuals are undergoing dramatic shifts in resources. A stress response may increase survival by activating two separate physiological pathways that continuously replenish energy stores: activation of the sympathetic-adrenal system (SAS) when mobilization of energy is required for physical responses, and activation of the hypothalamic-pituitary-adrenal (HPA) axis to decrease energy requirements in times of psychosocial stress when energy balance is positive and physical demand decreased. While some studies

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attribute laboratory-induced, acute mental stressors that activate SAS with increased metabolic cost, no studies have evaluated the influence of chronic, HPA-inducing stressors (when energy balance is positive) on energy expenditure. The present study tests our hypothesis that resting metabolic rate (RMR) decreases with prolonged exposure to psychological stress. RMR, blood pressure, saliva samples, a 10-item Perceived Stress Scale questionnaire, and a questionnaire of adherence to protocol and weekly academic work were collected on 17 female students for the duration of a 10-week academic term. Saliva samples were assayed for salivary cortisol (indicative of HPA activity). A significant increase in RMR was observed with increased salivary cortisol concentration ( $p=0.028$ ), indicating that HPA activation may lead to an increase in metabolic cost instead of the hypothesized decrease. We suspect that the observed increase in cost could be resulting from increased maintenance requirements caused by physiological responses to chronic stress, including higher blood pressure, heart rate and wear on organ systems.

This study was funded by the Murdock Charitable Trust, reference number 2006194;JVA:11/16/2006.

### Mitochondrial analysis of the Mijikenda.

ELIZABETH LEENHEER, SLOAN WILLIAMS, and KEN BATAI. Department of Anthropology, University of Illinois at Chicago

The Mijikenda, a Bantu speaking ethnic group from southeastern Kenyan coast, consisting of nine tribes, collectively claim recent origin from Singwaya, an area around northeastern Kenya or Somalia. However, some believe that European colonial rule led the formally ethnically distinct Mijikenda tribes to unite and claim ancestral relationship under the Singwaya origin myth. This project examines the mitochondrial DNA (mtDNA) variation of the Mijikenda to evaluate the Singwaya myth. In order to test the Singwaya origin myth, we analyzed mtDNA hypervariable region I (HVRI) sequence of 92 individuals from four of nine tribes (Jibana, Kambe, Kauma, and Ribe) and then we compared it to mtDNA variation of the other five Mijikenda tribes, Bantus and East African populations. Supporting the recent origin of the Mijikenda tribes in northeastern Kenya, two Mijikenda tribes were plotted closely with Afro-Asiatic populations from Ethiopia and Somalia. The genetic relationship of Mijikenda tribes to other Bantu and East African populations were examined with a multidimensional scaling (MDS) plot constructed using

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population pairwise genetic distance. The recent origin, however, suggests genetic homogeneity among the Mijikenda tribes, but Exact Test and AMOVA show that they are genetically differentiated from each other, and they are scattered widely on the MDS plot. The observed genetic differentiation could be explained by the ethnic distinction existed among the Mijikenda tribes or genetic drift due to small population size. In fact, the Mijikenda tribes were genetically not as diverse as many Bantu and non-Bantu East African populations.

#### **Skeletal analysis of the Poole-Rose Ossuary: anatomy and pathology of the sacrum.**

ELIZABETH MOFFETT and  
HEATHER MCKILLOP, Department of  
Anthropology, Louisiana State  
University.

The Poole-Rose Ossuary represents a Late Woodland burial site in southern Ontario, Canada. The site dates to A.D. 1550 ± 50 years and consists of commingled skeletal remains. This study examines several aspects of the sacra in the Ossuary. Analysis of the sacra in the Poole-Rose Ossuary was conducted to garner information about the demography, health, reproductive biology, and cultural behavior of this population. Data collected from the Poole-Rose Ossuary sacra include minimum number of individuals

(MNI), measurements of several elements of the sacrum, prevalence of lumbar facets in the population, frequency of osteophytic growth along the margins of the first sacral vertebra (S1), incidence of variable numbers of sacral vertebrae, and presence of cultural modifications such as defleshing marks. The MNI for the sacrum is 172, including 155 adults and 17 subadults. The mean straight length and maximum breadth of the sacrum are 110.1 mm and 117.8 mm respectively; these measurements are in the upper range of variation compared with other populations. Osteophytes are present along the edge of S1 in 17.6% of adults. Cutmarks are present on some of the sacra, suggesting defleshing of some individuals before burial. The prevalence of lumbar-sacral facets is 5.5%, and 21.4% of individuals have extra vertebrae fused to the sacrum; these anatomical variations have obstetrical implications. This study of the Poole-Rose Ossuary sacra contributes to data previously collected by researchers regarding the health and demography of Prehistoric Native Americans and provides insights into the reproductive biology and cultural behavior of the population.

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**Self-selected walking speeds: Do females and males carrying children choose differently?**

ANNA MYHRE<sup>1</sup>, MELVINA KPANQUOI<sup>1</sup>, LAURA STEARNS<sup>1</sup>, KELSEY BOEFF<sup>1</sup>, CARA WALLSCHEFFLER<sup>2</sup>, and MARCELLA MYERS<sup>1</sup>, <sup>1</sup>Department of Biology, St. Catherine University, <sup>2</sup>Department of Biology, Seattle Pacific University.

Determining the metabolic cost and movement consequences of child-carrying is critical to our understanding of human evolution. Current hypotheses of behavioral interactions within early human populations suggest that female and/or male relatives might have helped mothers of small children carry their offspring for periods of time, effectively transferring to these mothers more energy for breast-feeding or future reproduction. To determine how child-carrying affects the free walking speed choices of adults as a function of sex and task, we calculated the walking speed of 6 females and 6 males as they walked around the perimeter of a gym while performing 12 tasks in a randomized order. Tasks consisted of all combinations of 3 loading conditions – carrying a 10kg toddler-proportioned manikin on the shoulders or hip, or a comparable mass around the waist – and 4 walking speed directives

(“slowest”, “walk-all-day”, “brisk”, and “fastest” walks). We found that speed category ( $p < .0001$ ), sex ( $p = 0.08$ ), and the interaction of sex and speed ( $p < .0001$ ) affected free-walking speed, but not loading condition (General Linear Model). For all loading conditions, females walked significantly faster than males (or marginally so) at all but the fastest speed category, with the sex difference decreasing with speed (14, 11, and 7 % difference from slowest to brisk walk). At the two fastest speed categories, free-walking speed was slower for hip than for shoulder carrying. Although the carrying task was a larger burden for the females due to their smaller body mass, females consistently chose faster walking speeds than males.

This study was funded by 3M Faculty/Student Collaborative Grant #212607 (Center of Excellence for Women, Science, and Technology), the Office of Collaborative Undergraduate Research, and the Endowed Professor in the Sciences at St. Catherine University, St. Paul, Minnesota.

**Health and nutrition at the Austin site (22TU549), Tunica County, MS: A comparative analysis of childhood nutrition from village and mound centers in northwest Mississippi.**

RACHEL PERASH, JULIA A. WHITE, KELSEY HERNDON and DANIELLE N COOK. Department of Sociology,

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Anthropology, and Social Work,  
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This paper will analyze the health patterns associated with the Mississippianization of a village site in the southeastern U.S. The Austin Site (22TU549) located in Tunica County, Mississippi dates to approximately AD 1200, spanning the Woodland-Mississippian transition. Archaeologically, such villages traditionally have been overlooked by researchers in favor of more “impressive” mound centers. This analysis of smaller polities will contribute to the understanding of Mississippian culture. Past research has shown that mound centers typically have larger population densities and an increased reliance on agriculture, which may contribute to poor nutrition among inhabitants. In contrast, it could be argued that poor health would not have been as prevalent at the Austin village site based on a smaller population and the possibility of a more balanced diet through continued hunting and gathering instead of a dependence on agriculture. One way this can be revealed is through skeletal markers indicative of childhood health. This hypothesis is tested by examining 61 individuals for porotic hyperostosis (PH), linear enamel hypoplasias (LEH), and stature. Results showed that 53% (n=20) of the total population had PH,

73.9% (n=17) of adults had LEH, and stature estimates indicated an average of 164.4 cm for adult males. Comparing Austin to other village sites and mound centers reveals that rates of PH and LEH are higher whereas adult stature is smaller. It can be concluded that Austin individuals suffered from poor nutrition during developmental years and that there was no expected difference found between village and mound sites regarding childhood nutrition.

**A phylogenetic analysis of *Alouatta pigra* inhabiting the Calakmul site of Campeche, Mexico**

LINDSEY G. PROCTOR, KEN BATAI, KATHLEEN A. RIZZO and SLOAN R. WILLIAMS. Department of Anthropology, University of Illinois at Chicago.

Howler monkey, *Alouatta*, phylogeny is not well understood and researchers have recognized anywhere from six to ten species of *Alouatta*, and up to nineteen subspecies. We analyzed the mitochondrial cytochrome *b* gene sequence of four Yucatan Black Howler individuals (*A. pigra*) and compared them to published sequences from nine of the ten recognized howler species to better understand howler phylogenetic relationships. DNA was extracted from fecal samples collected from two troops of howler monkeys living at the

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Calakmul site in the Campeche state of southeastern Mexico. We sequenced the first 800 bases of the mitochondrial cytochrome *b* gene. A neighbor-joining tree was constructed to compare the Calakmul sequences with published *Alouatta* sequences, including *A. pigra* samples from two collection sites in Tabasco and Chiapas, Mexico. The Calakmul samples were identical to each other, but did not match the Tabasco and Chiapas samples. We identified four substitutions among the Calakmul howlers. Two substitutions were synonymous, but the other two changes were non-synonymous mutations that resulted new amino acids. In all, three different sequences were found among the ten *A. pigra* samples collected from the three locations. Although the Calakmul sequences differed from published *A. pigra* sequences, they clustered with them on the neighbor-joining tree and support the identification of *A. pigra* as a separate species. The genetic relationship among the individuals in the two Calakmul howler troops is currently unknown, but these identical sequences suggest the possibility of close maternal relationships that will be further explored in future studies.

This research was funded by a UIC Chancellor's Undergraduate Research Award to Proctor.

### **GIS mapping and reconstruction of the Tipu cemetery.**

JUSTIN SABINO and MARK COHEN.  
Department of Anthropology, State University of New York, Plattsburgh.

GIS (Geographic Information System) techniques were used to map a Colonial period Mayan cemetery at Tipu, Belize. GIS is a computer-based tool that provides the capability to do mapping and geographical analysis of Earth's features. Using GIS techniques, an interactive 3-D schematic map was created from scanned individual burial map drawings of the cemetery. The database that resulted from this project contains demographic data for age, sex, and pathology. Additionally, data was obtained for artifacts, burial type, mtDNA haplotype group, depth of burials, and spatial coordinates. Using GIS mapping, the cemetery was analyzed for the distribution of these traits and some combinations of them, and displayed as maps. Researchers are also able to use these techniques for instant analysis of any desired combination of the above traits.

The database can be updated and prepared to accept data from fluorine dating analysis and dental enamel hypoplasia analysis that is currently being conducted. Moreover, using the hyperlink function in ArcMap, any hardcopy lab reports and field data can be scanned into the program as

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demonstrated with the burial drawings. This allows researchers to have a comprehensive database of all burials in one easily accessible and transferrable format, facilitating further analysis of the Tipu cemetery.

**Hormonal monitoring of reproductive status in wild monogamous female owl monkeys of the Argentinean Chaco.**

KELSI SCHOENROCK<sup>1</sup>, EDUARDO FERNANDEZ-DUQUE<sup>2</sup>, KEVIN M. BURKE<sup>1,2</sup>, PAM PHOJANAKONG<sup>1</sup>, and CLAUDIA VALEGGIA<sup>1,2</sup>.  
<sup>1</sup>Reproductive Ecology Laboratory, University of Pennsylvania,  
<sup>2</sup>Department of Anthropology, University of Pennsylvania.

Owl monkeys (*Aotus* spp.) are one of few primate species that show strict social monogamy. It has been proposed that monogamy may arise if females exhibit synchronous reproductive cycles, limiting the number of females that a male can fertilize. To evaluate this hypothesis, it is crucial to monitor the ovarian cycles of several females in nearby territories. The aim of this study was to evaluate the feasibility of collecting fecal samples in the field on a regular basis and then analyze them for reproductive hormone metabolites. To our knowledge, this is the first report of hormonal profiles of free-ranging female owl monkeys. We collected 107 fecal samples from five adult owl

monkey females (*Aotus azarai*) in northern Argentina during three mating seasons between 2007 and 2009. The samples were processed and stored in SPE columns in the field. Samples were analyzed for estrogen and progesterone metabolites using enzyme-immunoassays. The resulting hormonal profiles were indicative of ovarian cyclicity. Preliminary estimates of cycle length were within the range published for captive owl monkey species (13-19 days). We identified two conceptions, one confirmed by the birth of an infant during the following birth season. The pattern of excretion of reproductive hormone metabolites was similar to the one observed in other neotropical primates. The successful use of fecal samples collected from small arboreal primates in the field is encouraging and promises to be an excellent tool for testing hypotheses about life history traits, reproductive behavior and the evolution of monogamy in owl monkeys.

**Can sex differences in muscle strength explain observed differences in child carrying positions?**

LAURA STEARNS and MARCELLA MYERS. Department of Biology, St. Catherine University.

Despite the frequency and necessity of child-carrying by adults, very little research has focused on the energetic costs and behavioral patterns

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associated with this activity. This study explores differences in physical capacity between females and males as a possible explanation for the observation that men are more commonly seen carrying children on their shoulders, while women tend to carry toddler-sized children on their hips. To address this issue, I measured the one-repetition maximum (1RM) of four large muscle groups in 5 female and 4 male participants (age 18-45 y). The 1RM procedure determines the largest mass a person can lift one time with correct form. Because the participants carried a toddler-sized manikin (10 kg) either on their shoulders or their hips, I chose four muscle groups related to these tasks: arm curl, bent-over row, leg press, and shoulder press. Males had higher 1RMs for all of the muscle groups than females ( $p$  values between 0.006 and 0.06). For the females, the toddler mass was 91%, 54%, 46%, and 11% of their 1RM for arm curls, bent-over row, shoulder press, and leg press, respectively, while for the males 50%, 31%, 16%, and 4%. The greater strength of their shoulder muscle group gives men, in general, a greater ability to lift children onto their shoulders. As demonstrated by the results hip-carrying for women might be a more manageable alternative, since a toddler would be near the limit of their single-arm curl strength. These results have implications regarding our

predictions about child-carrying interactions in populations of contemporary humans as well as in groups of the earliest known humans.

#### **A comparison of activity budgets in two captive white-handed gibbon groups.**

SARA WARREN and ELIZABETH STRASSER. Department of Anthropology, California State University, Sacramento.

We study whether the complexity of zoo habitats affect the lives of captive gibbons by comparing activity budgets of pairs of white-handed gibbons housed at two northern Californian zoos: the Oakland and Sacramento Zoos. The Oakland habitat is twice as large as and more complex than that at Sacramento. Consequently, we expected the Oakland gibbons to travel more and rest less than the Sacramento gibbons.

Instantaneous scan sampling was used to determine the activity budgets. Data were collected for 15 hours at each zoo in spring, 2010. Observations were recorded at 30s intervals, resulting in ~3400 observations per site. Comparisons were made within each zoo. Comparisons between zoos were of two types: by sex and by combined samples.

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For the within-zoo comparisons, at both sites the females fed substantially more and traveled much less than did their male counterparts. Between-zoo comparisons found the Sacramento individuals fed twice as much as their Oakland counterparts while both males rested the same amount. At both zoos, females traveled the same amount, but the Sacramento female rested more than the Oakland female. The comparison of combined activity budgets demonstrated that the Sacramento gibbons engaged in more feeding, resting and autogrooming and less traveling and interacting socially than did those in Oakland.

Perhaps the Sacramento gibbons autogroomed more than the Oakland gibbons as a function of their lower frequency of social interaction. As expected, the Oakland gibbons travel more than the Sacramento gibbons, probably because they have twice the space in which to do so.

This study was funded by the Ronald E. McNair Postbaccalaureate Achievement Program.

#### **Birth control does not significantly alter women's preferences for variants of men's voices.**

JASON WHITAKER<sup>1</sup>, RYAN SETTEN<sup>2</sup>,  
and ULV ANKERSTJERNE<sup>3</sup>.

<sup>1</sup>Department of Psychology,

<sup>2</sup>Department of Biology, University of

California, San Diego, <sup>3</sup>Saxo Institute, University of Copenhagen.

Research shows that women's preferences for masculine voices (low pitch) vary as a function of the menstrual cycle, becoming positively augmented around ovulation. The proximate cause catalyzing this effect is attributed to fluctuating estrogen levels. Thus, the introduction of hormonally based birth control has been shown to have a dampening effect in experiments researching women's preference of dimorphic secondary sexual characteristics. However, this dampening effect has not yet been explored in respect to women's preferences for masculine voice types. This experiment sought, first, to investigate the effect of birth control on subjects off and on birth control; and, second, to replicate past findings: Women's preference for masculine voice types increases during ovulation.

Six voice stimuli were created from voice recordings of two men speaking monophthong vowels. Each recording's pitch was increased or decreased 3%. Subjects rated the attractiveness of each stimulus using a five point Likert type scale. Results showed that women ( $n = 145$ ; 85 off and 60 on birth control, average age =  $23.1 \pm 4.57$ ) preferred the naturally lower pitched voice; though, this preference could not be attributed

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to pitch, solely. Fourth order polynomial regression analysis revealed preference for deep voice pitch was not influenced by ovulation, though significant fluctuation in preference occurred over the cycle. Lastly, there were no significant differences in preference scores between the on and off birth control samples. The authors discuss multiple methodological and statistical methods in respect to these novel findings.

#### **Entertaining entrainment: reconsidering the effects of respiratory constraints on the optimal running speed.**

MICHAEL WILLCOCKSON and CARA WALL-SCHEFFLER.  
Department of Biology, Seattle Pacific University.

In Carrier's (1984) initial paper on the importance of running as a hunting strategy among *Homo*, he put forth the observation that 'running humans should display greater plasticity in the critical functions of respiration...than running quadrupeds.' He used this observation to partly explain the invariance in the Cost of Transport (CoT) of human running, and the ability of *Homo sp.* to run down prey at the prey's least optimal speed. Since it has recently been shown that the CoT of human running is not speed invariant, this leads to the obvious question of whether people actually

have the plasticity in critical aspects of breathing function, such as a link between the breathing cycle and the locomotor cycle ('entrainment'). Here we measured the energetic cost of human running (N=9) at five different speeds and calculated individual CoT curves for each participant. Simultaneously, entrainment was determined by the degree to which a post-stimulus histogram (breaths per 0.05sec bin following a footfall) differed from a uniform plot. We then compared the degree of entrainment to each participant's optimal running speed and found that while eight of our subjects clearly entrained at some speeds, entrainment was not a function of CoT ( $p=0.897$ ). Since entrainment was also not correlated with speed ( $p=0.304$ ), it appears that bipedalism removed the respiratory constraints associated with quadrupedalism as originally predicted by Carrier. Unlike quadrupeds, for whom respiratory constraints remain implicated for leading to a minimum CoT, constraints which lead to an minimum CoT for people must involve other variables.

#### **Can island dwarfism explain the tiny brain of the Flores "Hobbit"?**

LU YAO<sup>1</sup> and ROBERT D. MARTIN<sup>2</sup>.  
<sup>1</sup>Weinberg College of Arts and Sciences, Northwestern University,  
<sup>2</sup>The Field Museum, Chicago.

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The putative new Late Pleistocene hominid species *Homo floresiensis*, reported in 2004, differs from other *Homo* species in South-East Asia (*H. erectus*, *H. sapiens*) in having very short stature and by far the smallest endocranial volume ever found in the genus. The initial explanation proposed was island dwarfism, an empirical generalization according to which large mammals become smaller on islands to reduce resource needs. Since the Flores hominid was discovered, several apparent cases of brain size reduction have been published, but the island rule had not previously been applied to brain size. To determine whether island dwarfism applies to brain size as well as body size, volumetric and linear measurements were collected on skulls of pigs (n=66), deer (n=69), and gibbons (n= 87) indigenous to the South-East Asian islands and mainland regions. Data were collected at The Field Museum (Chicago), the American Museum of Natural History (New York City) and the Smithsonian Museum of Natural History (Washington). Scaling analysis of endocranial volume relative to body size reveals that there is no difference between island-living mammals and their mainland relatives. The island samples of pigs, deer and gibbons did not display dwarfing in brain size. Indeed, contrary to expectation, island dwarfing was not even observed in body size for pigs and gibbons of the region. Thus, these

results suggest that island dwarfism cannot be invoked as a general principle to explain the tiny brain size of *H. floresiensis*.

#### **Women and violence: an analysis of sex differences in cranial trauma at San Pedro de Atacama, Chile.**

NATALIE YEE<sup>1</sup>, LAURA M. KING<sup>1</sup>, BLAIR M. DAVERMAN<sup>2</sup>, and CHRISTINA TORRES-ROUFF<sup>1,3</sup>.

<sup>1</sup>Department of Anthropology, Colorado College, <sup>2</sup>Department of Anthropology, Purdue University, <sup>3</sup>Instituto de Investigaciones Arqueológicas y Museo, Universidad Católica del Norte.

Around AD 1000, the prehistoric peoples of San Pedro de Atacama in northern Chile experienced a severe drought and the collapse of a powerful neighboring group. This resulted in societal stress and increased incidence of cranial trauma. Departing from previous studies, research presented here analyzes sex differences in traumatic injury during this volatile time. This paper explores the possibility that females have a more prominent role in violence than previously thought. Generally, females are not considered active participants in warfare and interpersonal violence. Trauma found on women's crania is often interpreted as a result of fleeing a violent confrontation. In contrast, fractures of the anterior cranium are

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associated with face-to-face confrontations, frequently between males. We analyze a sample of 322 individuals from three cemeteries to examine male and female roles in violent encounters. Solcor 3 and Solcor Plaza are cemeteries dating to the Middle Horizon (AD 500-1000) while Tchecar Túmulo Sur dates to the Late Intermediate Period (AD 1000-1450). Trauma frequencies between males and females are not significantly different except at Solcor Plaza. Both sexes display high rates of anterior trauma at 85.7% (12/14) for females, and 92% (23/25) for males. These include numerous nasal bone fractures consistent with violent confrontations. This evidence suggests greater female participation in conflict and illustrates the crucial role women played in navigating times of societal stress and cultural change.

This study was funded by generous grants from the NSF (BCS-0721229) and Colorado College.

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