

## **Welcome to Edmonton!**

It is our great pleasure to welcome you to Edmonton for the 45<sup>th</sup> Annual Meeting of the Canadian Association for Physical Anthropology, hosted by the University of Alberta. We come together on Treaty 6 Territory, the traditional lands of First Nations and Métis peoples whose histories, languages, and cultures continue to influence our vibrant community. Since CAPA last met in Edmonton in 2003 at the Varscona Hotel in Old Strathcona, our city has grown significantly. This year we are meeting at Varscona's sister hotel, Matrix, in downtown Edmonton. We hope you will find time, alongside our busy program of conference events, to take in Edmonton's revitalized downtown and our beautiful North Saskatchewan River Valley.

At last count more than 160 of you had registered for this year's conference, including 90 students for Thursday's Professional Development Luncheon. We gratefully acknowledge the financial support of the University of Alberta Dean of Students' Office, Faculty of Arts, and Department of Anthropology that made the luncheon possible; as well as our luncheon speakers, Dr. Andrea Waters-Rist and Dr. Karyne Rabey.

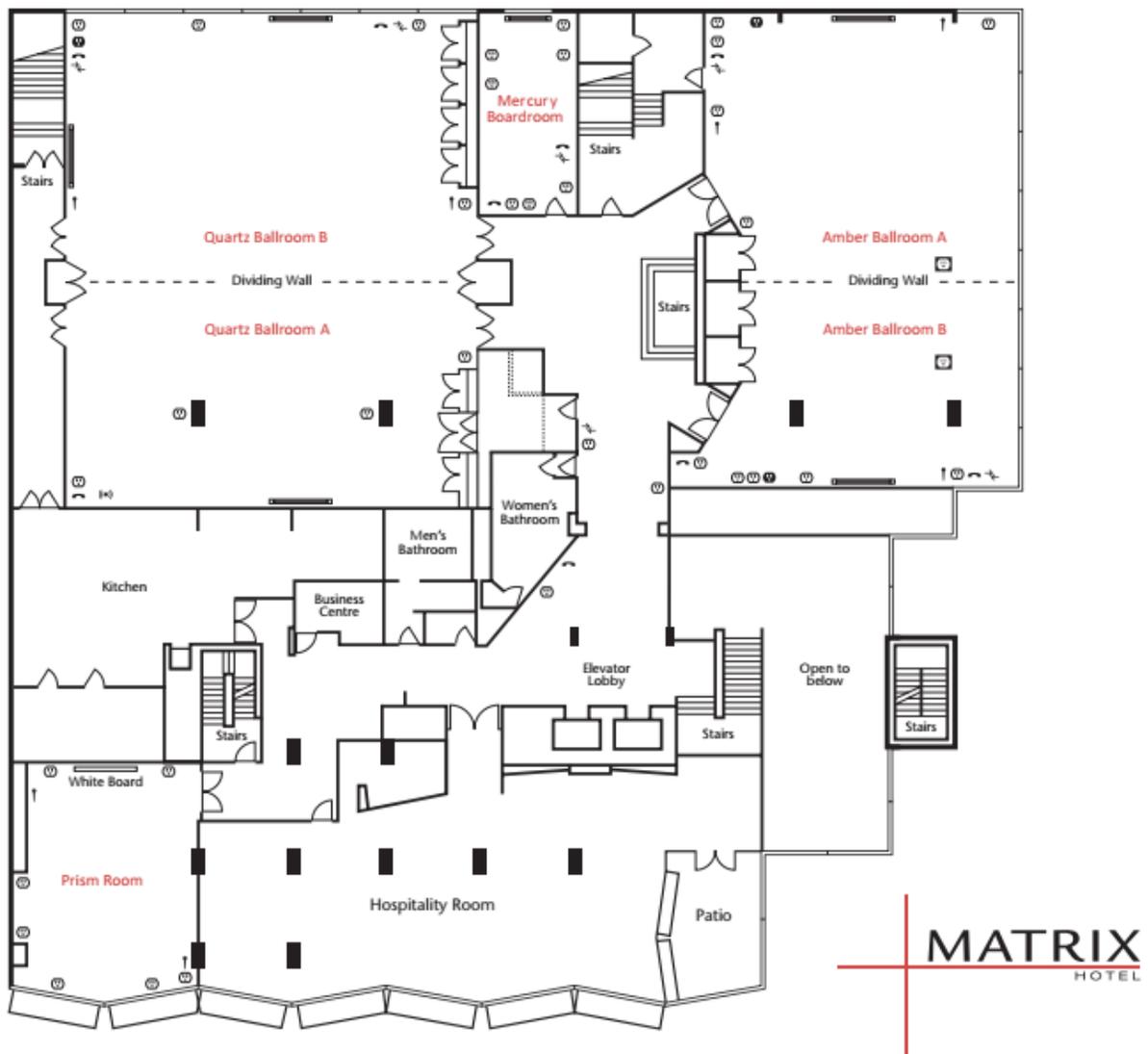
We are pleased to present a Program of 120 papers representing the breadth and dynamism of Canadian research in biological anthropology, including five symposia. The fullness of the Program has necessitated concurrent sessions for podium presentations on Saturday, and therefore we hope your schedule has allowed you to take in all three days of CAPA 2017.

With our best wishes for an enriching meeting,

Lesley Harrington & Sandra Garvie-Lok, Co-Chairs for CAPA 2017  
and Katherine Bishop & Jennifer Nelson, Co-Chairs of the Student Volunteer Committee

## A Special Thanks to our Volunteers

Hosting a conference involves a thousand and one tasks, and we never would have been able to bring it all together without the help of our wonderful University of Alberta student volunteers. Our heartfelt thanks first and foremost to our volunteer coordinators Katherine Bishop and Jennifer Nelson, who planned the volunteer schedule, recruited and briefed volunteers, got most of the donations for the raffle and registration kits, and helped us in so many other ways. Special thanks also to our scientific program planning assistant Benjamin Osipov, our social media specialist Victoria van der Haas, and to Emily Hull and Karl Berendt, our design team who created the conference logo and took care of poster and program design. Finally, a big thank you to all of our other student volunteers in registration, session assistance and other duties: Margaret Aiken, Talisha Chaput, Hanna Friedlander, Kira McLachlin, Chenee Merchant, Jill Morgan, Alexandra Rocca, Helena Ramsaroop, Tonya Simpson, Lynsey Stewart, Elsa van Ankum, and Kayleigh Watson. You are all super – take a bow!



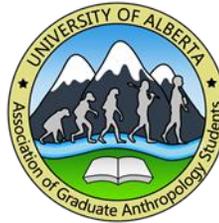
THE CANADIAN ASSOCIATION FOR  
PHYSICAL ANTHROPOLOGY



L'ASSOCIATION CANADIENNE  
D'ANTHROPOLOGIE PHYSIQUE

**We gratefully acknowledges the support of the University of Alberta at many levels:**

Faculty of Arts Support for the Advancement of Scholarship (SAS) Grant Program; Faculty of Arts; Dean of Students; Department of Anthropology; Association of Graduate Anthropology Students; Bookstore.



UNIVERSITY OF ALBERTA  
FACULTY OF ARTS

**We would also like to thank the following sponsors for their generous support:**

Bone Clones Incorporated; Circle CRM Group; City Market Downtown; The Edmonton Welcome Centre; Dr. Nancy Lovell; MacEwan University; The Marc Restaurant; Pearson Canada; Save On Foods; The City of Edmonton Citizen Services Department; TreeTime Services Incorporated; Trowel Blazers; West Edmonton Mall.



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## ***CAPA 2017 Schedule at a Glance***

### **Wednesday, October 25**

- 6:00 pm – 9:00 pm: Registration (second floor foyer)  
6:00 pm – 9:00 pm: Welcome Reception (Prism Room; Cash Bar)

### **Thursday, October 26**

- 8:00 am – 4:00 pm: Registration (second floor foyer)  
8:15 am – 4:00 pm: Poster Session 1 (set-up beginning 8:00am) (Prism Room)  
8:00 am – 8:15 am: Welcome Address (Quartz Ballroom)  
8:15 am – 10:00 am: Podium Session 1 (Quartz Ballroom) *Symposium: Knowledge Translation in Anthropological Health Research: Odysseys from Evidence to Effect*  
10:00 am – 10:15 am: Coffee Break (*Sponsored by Tree Time Services Inc.*)  
10:15 am – 12:00 pm: Podium Session 2 (Quartz Ballroom) *Contributed Papers: Forensic Anthropology* (Quartz Ballroom)  
12:00 pm – 1:30 pm: Student Professional Development Luncheon (Quartz Ballroom) with talks by Dr. Andrea Waters-Rist and Dr. Karyne Rabey  
1:30 pm – 3:00 pm: Podium Session 3 (Quartz Ballroom) *Symposium: Biosocial Perspectives on Growth, Development and Parental Investment*  
3:00 pm – 3:15 pm: Coffee Break (*Sponsored by Pearson Canada*)  
3:15 pm – 5:00 pm: Podium Session 3 continued (Quartz Ballroom)  
6:00 pm – 9:00 pm: CAPA 45 Pub Night @ CRAFT Beer Market

### **Friday, October 27**

- 8:00 am – 4:00 pm: Registration (second floor foyer)  
8:15 am – 4:00 pm: Poster Session 2 (set-up beginning 8:00am) (Prism Room)  
8:00 am – 10:00 am: Podium Session 4 (Quartz Ballroom) *PASC Symposium: Exploring the Limits of the Discipline: Defining PaleoAnthropological Research*  
10:00 am – 10:15 am: Coffee Break  
10:15 am – 12:00 pm: Podium Session 5 (Quartz Ballroom) *Contributed Papers: Methods and Perspectives for Looking at Past Lives*  
12:00 pm – 1:30 pm: Lunch Break  
1:30 pm – 3:00 pm: Podium Session 6 (Quartz Ballroom) *Symposium: Emerging Voices in the Void: Anthropological Investigations of Marginalized Individuals in Past Populations*  
3:00 pm – 3:15 pm: Coffee Break (*Sponsored by MacEwan University*)  
3:15 pm – 4:45 pm: Podium Session 6 continued (Quartz Ballroom)  
5:00 pm – 6:00 pm: CAPA Business Meeting (Prism Room)  
6:00 pm – 6:30 pm: Pre-banquet cocktails (Quartz Ballroom; cash bar)  
6:30 pm – 11:00 pm: CAPA 45 Banquet (Quartz Ballroom; ticketed)

## **Saturday October 28**

- 8:00 am – 12:15 pm: Registration (second floor foyer)
- 8:15 am – 10:00 am: Podium Session 7 (Quartz A) *Symposium: Under the Microscope: Emerging Uses for Histology and Histochemistry in Biological Anthropology*
- 8:15 am – 10:00 am: Podium Session 8 (Quartz B) *Contributed Papers: Primatology (Quartz B)*
- 10:00 am – 10:15 am: Coffee Break
- 10:15 am – 11:15 am: Podium Session 9 (Quartz A) *Contributed Papers: Structural Violence, Repatriation, and Reconciliation*
- 10:15 am – 12:15 pm: Podium Session 10 (Quartz B) *Contributed Papers: Humans on the Landscape*
- 11:15 am – 12:15 pm: Podium Session 11 (Quartz A) *Contributed Papers: Skeletal Signatures of Human Activity*
- 12:30 pm – 1:00 pm: Presentation of Student Awards and Closing Remarks (Quartz A)

### ***Some general notes:***

**Podium presenters:** Please arrive 10 minutes before your session to load your presentation onto the laptop (the machine is a PC). A student volunteer will be present to assist.

**Poster presenters:** Please arrive 10 minutes before your session to pin up your poster, and stop by at the end of the session (4:00 pm) to take it down. A student session chair will be present to assist.

Please note that outside food is not permitted in the Matrix meeting areas. Coffee and water are fine.

## ***Schedule of Papers and Posters***

Titles marked with an asterisk (\*) are entered into the student prize competition.

### **Thursday, October 26**

8:15 am – 4:00 pm: **Poster Session 1** (Prism Room). Authors will be present for questions during the coffee breaks.

- 1 Selig, K.R. and Silcox, M.T. First Analysis of Stem Primate Dental Pathology: Insight into Dietary Shifts and the Frequency of Dental Caries\*
- 2 Hall, A. and Cote, S. Ruminant Dental Wear Supports the Existence of Heterogeneous Environments in the East African Early Miocene
- 3 Butts, C.; Cote, S.; and Kingston, J. Reconstructing the Paleoenvironments of Kalodirr and Moruorot, Kenya Using Stable Carbon Isotopes
- 4 Paquette, J. and Drapeau, M.S.M. Environmental Context and the Diet of Fauna and Hominins in the East African Pliocene\*
- 5 Aiken, M. Maize Consumption Patterning in Eastern North America\*
- 6 Tetreault, A. Human Cranial Base: Encephalization or Bipedalism?\*
- 7 Munkittrick, T.J.A. and Grimes, V. The Use and Abuse of Lead in Bioarchaeological Studies of Tooth Enamel
- 8 Harris, A.; Isaksson, S.; Eriksson, G.; Collins, M.J.; and Lidén, K. A Comparison of Pretreatments for the Removal of Post-Depositional Humic Contaminants from Archaeological Bone Collagen
- 9 Fisk, S.; Marinho, L.; and Cardoso, H.F.V. A New Protocol to Quantify Water, Collagen and Mineral Content in Bone Material
- 10 Swanston, T.; Coulthard, I.; Murphy, R.; Cooper, D.; Grimes, V.; Munkittrick, J.; Jankauskas, R.; and Varney, T. Confirming Bone Diagenesis via High Resolution Synchrotron Imaging of Lead
- 11 Gloux, S.A. Quantifying Enthesal Surface Changes using Geographic Information Systems Technology
- 12 van der Haas, V. Micro-Sampling Dentine to Reconstruct Life Histories of Holocene Hunter-Gatherers in Siberia\*
- 13 Watson, K. Heat-Induced Osteonal Change in Juvenile Bone: A Preliminary Histological Analysis
- 14 Harrington, L.; Osipov, B.; MacKinnon, M.; Cowgill, L.; and Kurki, H. Inside/Outside? The Significance of the Endosteal Contour in Evaluating Cross-Sectional Geometry in the Limb Bones of Children
- 15 Beauchamp, A.M. Evidence of Childhood Hand-Preference in the Humerus\*
- 16 Meyers, J.; Spake, L.; and Cardoso, H.F.V. Sex Differences in the Secular Change of Height and Weight among Affluent Portuguese School Children from 1913 to 2012
- 17 Spake, L.; Meyers, J.; Fisk, S.; Gooderham, E.; Marinho, L.; O'Neill, D.; Nahal, H.; and Cardoso, H.F.V. Early Mortality and Developmental Stress Reflected in Crown Dimensions of the Deciduous and Permanent Dentitions
- 18 Nelson, J.; Harrington, L.; Holland, E.; and Cardoso, H. An Examination of Long Bone Length for Age in Children from a Late 19th Century Cemetery Assemblage from Bologna, Italy\*
- 19 Larter, L.C.; Fox, S.A.; and Sicotte, P. Dynamics of Aggressive Interactions in Multi-Male Groups of *Colobus vellerosus*\*
- 20 Melin, A.D.; Walco, E.R.; Chiou, K.L.; Kawamura, S.; and Fedigan, L.M. Red-Green Colour Vision Increases Fruit Intake Rates of Wild Capuchins (*Cebus capucinus imitator*)

## Thursday, October 26 (continued)

8:15 am - 10:00 am: **Podium Session 1** (Quartz Ballroom) *Symposium: Knowledge Translation in Anthropological Health Research: Odysseys from Evidence to Effect*

The Canadian Institutes of Health Research (CIHR) has long argued that those conducting community-based health research have a responsibility to translate their findings in a manner that resonates with both the community and relevant policy makers. Further, CIHR expresses concern that this critical link between academic research on health and improved health outcomes is often missing. This failure may be due to the fact that knowledge translation is rarely straightforward and must be adapted to local context. Ostensibly, anthropologists and others engaged in participant observation, with their understanding of context that emerges from ethnographic work, are well poised to share their findings in the communities where they work. This symposium is designed to provide researchers focused on health outcomes with an opportunity to discuss their experiences and lessons learned with knowledge translation.

*Chair:* Daniel Sellen

- 8:15 - 8:30 Wilson, W.M. and Hoehn, N. Pitfalls and lessons learned in the translation of human biology research
- 8:30 - 8:45 Abonyi, S. Surface Failures Next 25 km: Navigating Route KTE
- 8:45 - 9:00 Moffat, T.; McKerracher, L; Barker, M.; Rao, S.; and Williams, D. Mothers to Babies (M2B) Research Investigators; and Sloboda, D.M. Is knowledge being translated to the public about the developmental origins of disease risk? The Mothers to Babies (M2B) Hamilton Study
- 9:00 - 9:15 Galloway, T. "Is that what you think of us?": Five things I've learned about sharing research results with people in communities
- 9:15 - 9:30 Ziker, J.P. From Knowledge Translation to Patient-Centered Design Ethnography for Health and Welfare
- 9:30 - 9:45 Montesanti, S.; Hollman, N; Fayant, B; and McGee, T. Indigenous approaches to knowledge translation in addressing health and mental health impacts from the 2016 Alberta Wildfire
- 9:45 - 10:00 Discussion - Daniel Sellen

10:15 am - 12:00 pm: **Podium Session 2** (Quartz Ballroom) *Contributed Papers: Forensic Anthropology* (Quartz Ballroom) *Chair:* Hugo Cardoso

- 10:15 - 10:30 Marinho, L.; Galloway, A.; Robinovitch, S.N.; Sparrey, C.J.; Cardoso, H.F.V. Changes in fracture morphology over the early postmortem interval of buried juvenile pig ribs
- 10:30 - 10:45 Friedlander, H. The Use of Formaldehyde Imbedded Human Remains in Experimental Procedures\*
- 10:45 - 11:00 Fisk, S. and Cardoso, H.F.V. The Differential Effects of Environmental Factors on Immature and Mature Bone Weathering\*
- 11:00 - 11:15 Berendt, K. Palaeoforensic Approaches to Burned Human Remains in Archaeology\*
- 11:15 - 11:30 Klales, A.R. MorphoPASSE: the Morphological Pelvis and Skull Sex Estimation Database
- 11:30 - 11:45 Merritt, C.E. Outliers in age estimation: Who are they?
- 11:45 - 12:00 Cardoso, H.F.V. and Albanese, J. Multi-observer agreement in morphological assessments of Phenice's pubic traits for sex estimation from human skeletal remains

## Thursday, October 26 (continued)

1:30 pm – 5:00 pm: **Podium Session 3** (Quartz Ballroom) *Symposium: Biosocial Perspectives on Growth, Development and Parental Investment*

Patterns of offspring care, feeding and development are important components of early life history models in primates that shape interspecific parameters like postnatal growth rates and weaning age. Human and non-human primate offspring require high investment from caregivers because most species give birth to altricial and slow-developing infants. During pregnancy and lactation, mothers must balance the extra metabolic requirements of fetal development and milk synthesis against their own health and investment in future offspring. While mothers provide primary care in most species, other individuals also play important roles in caregiving. Offspring growth and development continues after weaning, and in some species, juvenile primates keep relying on caregivers for access to resources and information on navigating their social and ecological environments. Infants and juveniles are not passive in their own care and development, and offspring may employ different strategies to maximize the quality and quantity of care that they receive. In addition, plasticity in growth, development and parental investment can act as an important adaptive factor that allows parents and offspring to cope with precarious environments. Recent advances in measuring early life physiology and parental effort complement traditional techniques to better answer ultimate questions. This session aims to bring together biological anthropologists who use diverse methods to explore the biosocial implications of growth, development, and parental investment in human and non-human primates. We aim to assess how parents and offspring mitigate their behavioural and physiological relationships, and to explore the variation in potential strategies employed by parents and immature offspring to maximize fitness outcomes.

*Co-Chairs:* Iulia Badescu & Allyson Gibson-King

- 1:30 - 1:45 Webb, S.E. and Melin, A.D. Meeting energy and nutrient demands in pregnancy and lactation: examining behavioural strategies in wild white-faced capuchins (*Cebus capucinus imitator*)
- 1:45 - 2:00 Fujita, M.; Paredes Ruvalcaba, N.; and Corbitt, M. Human milk antibody as parental investment: An analysis of secretory immunoglobulin A in milk from northern Kenya in relation to maternal nutrition and infant sex
- 2:00 - 2:15 Badescu, I.; Katzenberg, M.A., Watts, D.P.; and Sellen, D.W. Patterning of lactation and infant feeding development in chimpanzees: Lactation effort plateaus while infants attain independent feeding abilities
- 2:15 - 2:30 Atell, M.G.I.; Symchych, N.; and Viola, B. Neanderthal Growth and Development: the growing importance of reference samples on examining the evolution of modern human ontogeny
- 2:30 - 2:45 Decrausaz, S.; Williams, J.E.; Fewtrell, M.S.; Stock, J.T.; and Wells, J.C.K. From little things big things grow - An examination of trends in pelvic growth and body size in growing girls living in London.\*
- 2:45 - 3:00 Villasenor, F.; Rapaport, T.; Altman, R.; and Nepomnaschy, P. Daughters First, Daughters Last: Sex Ratio by Birth Order in a Mayan Community.\*
- 3:00 – 3:15 *Coffee break*
- 3:15 - 3:30 Gibson-King, A.; Crotty, A.; Larter, L.; and Sicotte, P. Group-level characteristics influence infant handling in a wild primate (*Colobus vellerosus*)\*
- 3:30 - 3:45 Stead, S.M. and Teichroeb, J.A. Preliminary Findings: Male-infant interactions in *Colobus angolensis ruwenzorii*\*
- 3:45 - 4:00 Doyle, L.E. Parental investment and the cost of early stress in the Later Stone Age: temporal variation in the relationship between neural canal size and early mortality among adult foragers

### Thursday, October 26 (continued)

- 4:00 - 4:15 Nepomnaschy, P.A.; Salvante, K.G.; Jones, M.; and Kobor, M. Maternal cortisol levels immediately after conception and stress axis programming in girls and boys
- 4:15 - 4:30 Hoehn, N.; DeCaro, J.; Piperata, B.; Schmeer, K.; Rudkoski, A.K.; Brown, G.E.; and Wilson, W. Maternal mental health is not associated with an index of child health in rural Nicaraguan children aged 2-12 years\*
- 4:30 - 4:45 Galloway, T.; Moffat, T.; McKerracher, L.; Sloboda, D.M.; Montessanti, S.; and Rae, K.M. Using a biocultural approach to develop intervention research that shifts trajectories of health for Indigenous children
- 4:45 - 5:00 Discussion - Pascale Sicotte

### Friday, October 27

8:15 am – 4:00 pm: **Poster Session 2** (Prism Room). Authors will be present for questions during the coffee breaks.

- 21 Smith, A.; Eastham, L.; Fukuzawa, S.; Ball, C.; DeVries, M.; and Ranlett, S. The Virtual Mystery Project: Teaching Physical Anthropology with online hybridized problem-based learning
- 22 Albanese, J. Mycenaean Mortuary Practices: New Perspectives Based on the Skeletal Evidence from the Borzi Hill Site, Kefalonia
- 23 Bishop, K.G.; Millions, K.; and Karapanou, S. Preliminary field results of the Archaic burials at Stavros: a collaborative analysis of osteological, ceramic, and mortuary remains in Thessaly\*
- 24 Nelson, A.; Guillén, S.; Bruce, K.; Skufis, J.; Tejada, J.; Conlogue, G.; Garvin, G.; Garcia, B.; and Smith, D. An Osteobiography and Differential Diagnosis of a Young Chachapoya-Inka Child from the Cloud Forest in Leymebamba, Peru
- 25 Bruce, K.L. How does bioarchaeology examine co-occurring diseases? Theoretical implications of collaboration between clinical medicine and the paleopathological record\*
- 26 Judd, M.A. and Kesterke, M.J. Paget's disease of bone from a Byzantine monastic crypt in Jordan: a histological and micro-CT analysis
- 27 Lamer, M.; Merrett, D.C.; Vila, B.; and Contreras, F. A Possible Case of Paget's Disease of the Bone from Sanisera, Spain\*
- 28 McConnan Borstad, C. and Katzenberg, M.A. Revisiting dietary change at Sierra Blanca, New Mexico, AD 900 to post-1400\*
- 29 Waters-Rist, A.L. and Hoogland, M.L.P. Dietary Effects of the 19<sup>th</sup> Century Potato Blight in a Rural Dutch Population
- 30 Gibbon, V.E. and Davies, B. Pilot study using dental matrices to examine population continuity among Iron Age people in southern Africa
- 31 Prowse, T.L.; Brickley, M.; Pacory, J.; and Chapelain de Seréville-Niel, C. A preliminary stable isotope investigation of mobility in the late Roman (4<sup>th</sup> century AD) necropolis of Michelet (France).
- 32 Torres Peña, P. Analysis of the human remains of Las Orquídeas: a new Formative site in the Northern Highlands of Ecuador.\*
- 33 Hinton, J. and Scott, A. New Foundations: A Skeletal Exploration of the First French Inhabitants of the Fortress of Louisbourg, NS\*

## Friday, October 27 (continued)

- 34 Garlie, T.N.; Parham, J.L.; Choi, H.J.; Brantley, J.D.; and Paquette, S.P. The 2012 U.S. Army Anthropometric Survey (ANSUR II): A demographic and body measurement database of military personnel
- 35 Gibb, J.K. The 'Biocultural Choreographies' of Occupational Health and Safety amongst Fur Trappers in Northern Ontario: A Qualitative Investigation
- 36 Kulatilake, S. and Hotz, G. The Sarasins' Collection of Sri Lankan Skeletal Material
- 37 Simpson, R. Ancestry-Specific Variation in the Accuracy of the Rogers Method\*

8:00 am – 10:00 am: **Podium Session 4** (Quartz Ballroom) *PASC Symposium: Exploring the Limits of the Discipline: Defining PaleoAnthropological Research*

The research presented in this session aims to explore the diversity in palaeoanthropological research in Canada and beyond. We invite members of the PalaeoAnthropology Society of Canada, and Canadian Association of Physical Anthropology to present an assorted discussion of palaeoanthropological topics. A special focus is pushing the limits of which types of research are traditionally considered as "palaeoanthropological". Presentations of research that may be considered adjunct or adjacent to the discipline, as well as multidisciplinary and interdisciplinary are included. This symposium will present interdisciplinary topics conducted by physical anthropologists, archaeologists, and geologists through research that has the potential to shed light on hominid behavior and biological evolution. Palaeoanthropology has also recently adopted many methodological approaches, including genetics and three-dimensional reconstructions. These methods have allowed for an expansion of research topics in the fields of past human and non-human life. In bringing together researchers working in a variety of contexts, geographical regions, and methodological approaches, this session will provide CAPA members with an opportunity to examine the diversity of research that is considered "palaeoanthropological" in nature.

*Chair:* Kirsten Bruce

- 8:00 - 8:15 Bradley, M.M.; Hou, L.; Sparrow, L.; Pellatt, E.; Farooq, S.; and Rolian, C.P. Using model organisms to reconstruct locomotor behaviors in fossil primates
- 8:15 - 8:30 Pfeiffer, S.; Cameron, M.E.; and Stock, J. Unique body size and shape phenotypes among Middle and Later Stone Age southern Africans
- 8:30 - 8:45 Schroeder, L.; and Ackermann, R.R. A quantitative genetic approach for investigating skull diversity in *Homo*
- 8:45 - 9:00 Vizely, K. and Calce, S.E. Survival vs. Extinction: An interactive guided story of human evolution\*
- 9:00 - 9:15 Collard, M.; Dembo, M.; and Mooers, A. Is *Paranthropus* a good clade?
- 9:15 - 9:30 Cote, S.; Hall, A.; Butts, C.; and Kingston, J. Applying common Plio-Pleistocene paleoenvironmental proxies in deep(er) time: challenges and opportunities
- 9:30 - 9:45 Willoughby, P.R. Researching the evolution of modern humans in southern Tanzania
- 9:45 - 10:00 Mercader, J.; Abtosoay, M.; Bird, R.; Brown, M.; Bundala, M.; Clarke, S.; Favreau, J.; Gerlach S.C.; Inwood, J.; Itambu, M.; Larter, S.; Larter, F.; Lee, P.; Maley, J.; Mollel, N.; Patalano, R.; Rajdev, V.; Sammynaiken, R.; Soto, M.; Tucker, L.; and Walde, D. Microbotanical Proxies in Palaeoanthropology: The Stone Tools, Diet, and Sociality reference collection at the University of Calgary as an underutilized resource for Canadian Bioanthropologists

## Friday, October 27 (continued)

- 10:15 am – 12:00 pm:       **Podium Session 5** (Quartz Ballroom) *Contributed Papers: Methods and Perspectives for Looking at Past Lives* *Chair: Megan Brickley*
- 10:15 - 10:30   Gibbon, V.E. The University of Cape Town Human Skeletal Collection
- 10:30 - 10:45   Tripp, L. and Sawchuk, L.A. Herd Immunity, Children as Introducers and Gender differences during the 1918/19 Influenza Pandemic in two Island Populations
- 10:45 - 11:00   Gooderham, E.; Matias, A.; Albanese, J.; and Cardoso, H.F.V. A comparative study of child growth and health in Medieval Santarém, Portugal\*
- 11:00 - 11:15   Ledger, M.L.; Stock, F.; Schwaiger, H.; Ladstätter, S.; Knipping, M., Brückner, H.; and Mitchell, P.D. Pathogens in Public and Private Toilets: Intestinal Parasites from Roman Latrines at Ephesus, Turkey\*
- 11:15 - 11:30   Richer, S.M. and Jin, J. A Case Study in Commingling from the Korean War Project Assemblage
- 11:30 - 11:45   Cameron, M. Limb proportionality and dietary composition among Later Stone Age southern Africans
- 11:45 - 12:00   Brickley, M.B.; D’Ortenzio, L.; and Kahlon, B. Let The ‘Tooth’ Be Told: New Insights On Past Vitamin D Deficiency

- 1:30 pm – 4:45 pm:       **Podium Session 6** (Quartz Ballroom) *Symposium: Emerging Voices in the Void: Anthropological Investigations of Marginalized Individuals in Past Populations*

While biological anthropology has the ability to provide information on the lived experiences of past populations, the stories presented are often skewed towards those of higher status because of their greater visibility in both the archaeological and historical records. As a result, the lives of the majority of individuals in past populations are poorly understood, which makes it difficult to draw broad conclusions about past lived experiences. Recently, greater efforts have been made to explore the lives of these previously underrepresented individuals, such as children, the poor, the stigmatized sick, those with invisible diseases, and populations without formal writing. In order to understand the lives of marginalized people, it is necessary to identify these individuals and then place their experiences within the larger narratives of past populations. The need for a holistic understanding of lived experience underscores the importance of interdisciplinary approaches that draw on historical, archaeological and biological data in order to ask more complex questions about the past. In this session, we will draw on works from various streams of anthropological research in order to highlight how the lived experiences of these quieter voices are being identified, at times reconstructed, and contextualized. Contributors will bring together information from archival, archaeological, skeletal, isotopic, and ancient DNA sources from a wide range of geographic locales to build narratives for individuals and explore the breadth of experiences within sub-populations. The topics raised here cut across temporal lines to encompass ancient Rome, through Georgian England and the early European colonization of North America and New Zealand, to twentieth-century Canada. This session brings together established scholars, graduate students, and non-academic professionals from multiple institutions and countries with the goal of fostering discussion and reflection on how anthropological research can continue to work toward a more complete understanding of the complex dimensions of past populations.

*Co-Chairs:* Alyson Holland and Madeleine Mant

- 1:30 - 1:45       Stark, R.J.; Bondioli, L.; and Prowse, T. Illuminating childhood mobility at Imperial Roman Portus (ca. 1<sup>st</sup> to 3<sup>rd</sup> c. CE): A multi-tooth oxygen isotope perspective

- 1:45 - 2:00 Lockau, L. and Brickley, M. More than meets the eye: Looking beyond flagrant rickets in the analysis of vitamin D deficiency at two Roman period sites\*
- 2:00 - 2:15 Marciniak, S. Under-represented pathogens in the archaeological record: integrating ancient DNA techniques within a multi-faceted framework
- 2:15 - 2:30 Mant, M. Pediatric patients and liminal liabilities: hospitalized children in long eighteenth century London, UK
- 2:30 - 2:45 MacKinnon, M. and Mortimer, B. Discovering Bytown's Barrack Hill Cemetery: Archaeology in the Heart of Downtown Ottawa
- 2:45 - 3:00 Scott, A.; Ebert, D.; Fonzo, M.; Hinton, J.; and Georg, R.B. Buttons and Bone: Burial Context and Individuality at the 18<sup>th</sup> Century Fortress of Louisbourg, NS
- 3:00 – 3:15 *Coffee break*
- 3:15 - 3:30 Holland, A. and Irvin, T. Lost but not forgotten: The discovery of an early colonial family cemetery in Ontario
- 3:30 - 3:45 Battles, H.T. Death at the bottom of the world: the forgotten 1916 polio epidemic in New Zealand
- 3:45 - 4:00 Bogaert, K.L. Recovering veterans' voices: accounts of suicide among former members of the Canadian Expeditionary Force, 1918-1936
- 4:00 - 4:15 Lockyer, S. "He is not missing; he is here." – Identities lost in the ravages of war
- 4:15 - 4:30 Ludlow, N.C. and Hackett, F.J.P. Health Inequity and Spatial Divides: Infant Mortality during Hamilton, Ontario's Industrial Transition, 1880-1912
- 4:30 - 4:45 Hackett, F.J.P. and Abonyi, S. Rethinking the roots of Indigenous diabetes: On the historical role of development in creating a modern epidemic

## **Saturday October 28**

8:15 am – 10:00 am: **Podium Session 7** (Quartz A) *Symposium: Under the Microscope: Emerging Uses for Histology and Histochemistry in Biological Anthropology*

Histological analysis as applied to biological anthropology and bioarchaeology has largely been centered around unstained polarized light microscopy. Traditional use of histology has focused on sample identification (human vs. faunal), age estimation, and diagenesis. Recent research has seen paleopathologists employing histological methods to refine differential diagnoses. Increasingly, however, the use of scanning electron microscopy (SEM), laser scanning confocal microscopy (LSCM), synchrotron analyses, and micro-CT, along with enhanced visualization techniques under light microscopy are being employed across the fields of biological anthropology and bioarchaeology as a means of visualizing the microstructure of bone, and its variations and alterations. The research presented in this session aims to introduce the widening scope of technologies, techniques, and applications of 'micro-level' investigation in studies of bone biology and the human past.

Bone responds to stress, pathology, and metabolic variations in a limited number of ways, but with each alteration, those changes begin at the cellular and microstructural level. Understanding the microstructural components better assists in explaining the macroscopic variation. Whether in reaction to environmental or intrinsic factors, an exploration of the underlying physiology and its alterations will offer access to understanding bone biology that gross examinations alone cannot.

In bringing together researchers working with SEM, LSCM, dental histology, bone histomorphology, and pathology this session will provide CAPA members with an opportunity to understand the growing and diverse subfield of histological research. While the use of microscopy has long been held in reserve because of its destructive nature, this session will demonstrate that by improving current methods, and

## Saturday October 28 (continued)

introducing new techniques and technologies, we can increase the amount of information extracted from a wider range of skeletal elements, that gross morphological assessments cannot access. There's a wealth of information to be found in the histological universe under the microscope.

*Co-Chairs:* Ashley Smith & Lelia Watamaniuk

- 8:15 - 8:30 Andronowski, J.M.; Panahifar, A.; Harrison, K.D.; and Cooper, D.M.L. Virtual Histology at the Canadian Light Source
- 8:30 - 8:45 Raguin, E. and Streeter, M.A. Zonal osteons: comparison between BSE/SEM and Polarized Light Microscopy techniques\*
- 8:45 - 9:00 Rabey, K.N.; Hatala, K.G.; and Williams-Hatala, E.M. Understanding the relationship between macroscopic morphology and microstructural design of entheses.
- 9:00 - 9:15 Beresheim, A.C. An investigation of osteocyte lacuna density (OCD) and other intracortical porosities using backscattered scanning electron microscopy (BSE-SEM)\*
- 9:15 - 9:30 Smith, A.C. Use of laser scanning confocal microscopy in osteological examinations\*
- 9:30 - 9:45 Watamaniuk, L. Reconsidering Histochemistry in Bioarchaeology, Osteology, and Forensic Anthropology
- 9:45 - 10:00 Merrett, D.C.; Sawatsky, R.; and Meiklejohn, C. The Differential Diagnosis Conundrum: A Bioarchaeological Perspective

8:15 am – 10:00 am: **Podium Session 8** (Quartz B) *Contributed Papers: Primatology* (Quartz B)  
*Chair:* Michael Schillaci

- 8:15 - 8:30 Irwin, M.T.; Samonds, K.E.; Raharison, J.L.; Glander, K.E.; and Godfrey, L.R. Reduced nutritional intakes in Diademed Sifakas (*Propithecus diadema*) in degraded habitat are reflected in morphometrics and growth – and help identify habitat thresholds
- 8:30 - 8:45 Smeltzer, E.A.; Chapman, C.A.; and Teichroeb, J.A. Contest competition for prime sleep locations within a group of wild vervet monkeys (*Chlorocebus pygerythrus*)
- 8:45 - 9:00 Williamson, R.E.; Rothman, J.M.; Garrett, E.C.; Kawamura, S.; and Melin, A.D. Evaluating the reliability of colour, size, and hardness as nutritional cues in fruits consumed by white-faced capuchins (*Cebus capucinus imitator*) in a dry tropical forest.
- 9:00 - 9:15 Mercado Malabet, F. M. and Colquhoun, I.C. Habitat Choice Patterns in Crowned Lemurs (*Eulemur coronatus*) Reflect Spatially Flexible Responses to Anthropogenic Disturbance and Poor Ecological Quality\*
- 9:15 - 9:30 Moreira, L.A.A.; Watsa, M.; Erkenwick, G.; and Melin, A.D. Evaluating visual cues of parity in two New World monkey species, the emperor tamarin (*Saguinus imperator*) and the saddleback tamarin (*Saguinus fuscicollis*).
- 9:30 - 9:45 Kumpan, L.T.; Smeltzer, E.A.; and Teichroeb, J.A. Taking the lab to the field: A reversal learning experiment with wild vervet monkeys (*Chlorocebus pygerythrus*)
- 9:45 - 10:00 Schillaci, M.A.; Stricker, C.A.; Lintlop, J.; Sumra, M.; and Jones-Engel, L. Preliminary analysis of the relationship between hair cortisol and stable carbon and nitrogen isotope ratios in Barbary macaques (*Macaca sylvanus*) from Gibraltar.

- 10:15 am – 11:15 am:       **Podium Session 9** (Quartz A) *Contributed Papers*: Structural Violence, Repatriation, and Reconciliation *Chair*: Benjamin Osipov
- 10:15 - 10:30   Mayne Correia, P. Repatriation of Human Remains in Alberta: An Individual Journey of Discovery and Understanding
- 10:30 - 10:45   Nichols, K. Addressing Anomalies from the Past: Unmarked Graves and Burial Grounds at the Brandon Indian Residential School
- 10:45 - 11:00   Vanderbyl, G.; Cardoso, H.F.V.; Albanese, J. Exploring Socioeconomic Status and Structural Violence in Identified Human Skeletal Collections: A Study on a Sample from the Lisbon Identified Skeletal Collection\*
- 11:00 - 11:15   Simpson, T. Changing the Conversation: Navigating the Discourse on Gendered and Racialized Violence\*
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- 10:15 am – 12:15 pm:       **Podium Session 10** (Quartz B) *Contributed Papers*: Humans on the Landscape *Chair*: Angela Lieveise
- 10:15 - 10:30   Prowse, T.L.; Smith, T.; and Avery, C. Stable isotope analysis of diet in Iron Age Apulia (7<sup>th</sup> – 4<sup>th</sup> centuries B.C.), Italy: Possible evidence for manuring?
- 10:30 - 10:45   Veilleux, C.C.; Garrett, E.C.; Bankoff, R.; Dominy, N.J.; Perry, G.H.; and Melin, A.D. Farming and the convergent evolution of human chemosensation
- 10:45 - 11:00   Duggan, A.T; Harris, A.; Marciniak, S.; Marshall, I.; Grimes, V.; and Poinar, H. A mitochondrial DNA and stable isotope study of the Beothuk and Maritime Archaic populations from Newfoundland and Labrador
- 11:00 - 11:15   Oxenham, M.F. The Bioarchaeology of Complex Hunter-Gatherers: An illustrative Example from Ancient Southeast Asia
- 11:15 - 11:30   Sawchuk, E.; Goldstein, S.; and Hildebrand, E. Bioarchaeological Salvage Operations at Lothagam Lokam, Turkana, Kenya
- 11:30 - 11:45   Hopper, C.; Dewar, G.; and Orton, J. A herder burial in a shell midden? Identifying nuances in herder cultural and subsistence indicators
- 11:45 - 12:00   Lieveise, A.R.; Ishida, H.; Kubo, D.; and Yoneda, M. Oral and Sinus Infection Among Okhotsk Marine Foragers of Northern Japan
- 12:00 - 12:15   Samson, D.R.; Crittenden, A.N.; Mabulla, I.A.; Mabulla, A.Z.P.; and Nunn, C.L. Night-time sentinel behaviour in Hadza hunter-gatherers
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- 11:15 am – 12:15 pm:       **Podium Session 11** (Quartz A) *Contributed Papers*: Skeletal Signatures of Human Activity *Chair*: Benjamin Osipov
- 11:15 - 11:30   Stevens, E. Bad to the Bone? An in-depth examination of traumatic lesions in Medieval Denmark
- 11:30 - 11:45   Macintosh, A.M.; Pinhasi, R.; and Stock, J.T. Prehistoric women's manual labour exceeded that of athletes through the first 5500 years of farming in Central Europe
- 11:45 - 12:00   Meyers, J. The Relationship between Proximal Epiphyseal Shape of the Femur and Humerus and Activity in Four Hunter Gatherer Populations.\*
- 12:00 - 12:15   Osipov, B. and Harrington, L. The Kids Aren't All Right: The Ontogeny of Handedness\*

## **Abstracts**

Abstracts are arranged alphabetically by first author. Titles marked with an asterisk (\*) are entered into the student prize competition.

### **Surface Failures Next 25km: Navigating Route KTE**

Abonyi, S. (1)

1. Department of Community Health & Epidemiology, University of Saskatchewan, 104 Clinic Place, Saskatoon SK, S7N5E5

In Canada, health research funders are focusing increased attention on the movement of knowledge between researchers and stakeholders to ensure that studies produce findings that may inform programs and policies that improve health outcomes. In this paper I will draw from my experiences with knowledge transfer and exchange (KTE) as an anthropologist working in Canada with Indigenous communities, with teams of interdisciplinary researchers, and with other stakeholders. Successes at the community level are linked with the integration of some of the tools of ethnographic methodology (e.g. participant observation) with the 4Rs of Indigenous health research: respect, relevance, reciprocity, and relationships. Classic challenges of community-based research, such as time, capacity, and resources do still lead to problems with effective KTE. Other significant challenges are not located at the community level, but in KTE to those outside of research communities, in organizations and levels of government in a position to influence more significant and sustainable change. This is an issue that has been raised on many occasions by Indigenous community research partners who explain that while effectively communicated findings at the community level may impact program design, substantive improvements in the health outcomes of Indigenous community members will only come with changes in policies outside the control of communities. Here there are more often failures than successes. This paper will highlight one example of a multi-pronged KT strategy in which we had one small success in this regard.

### **Maize Consumption Patterning in Eastern North America\***

Aiken, M. (1)

1. Department of Anthropology, University of Alberta

Maize has been an essential component of North American economy, society, policy, and diet. It is, however, historically unclear as to when maize became such an integral part of life for settler populations in Eastern North America. This study examines the utilization of maize, geospatially, with respect to race, socioeconomic status, geographic region, and urbanism from the colonial period into the reconstruction era of the, predominantly British, North American colonies that became the present-day United States. This is accomplished through the analysis of published archival stable isotope data integrated with historical literature. Archival data analysis is beneficial as it facilitates the inclusion of a large number of sites and subsequently allows for the examination of larger paleodietary trends than would be possible examining a single or a few sites. The human isotope data encompasses 14 American sites including over 200 individuals and is compared to a contemporaneous British site as well as two faunal studies from the United States. Overall, this study suggests that maize was heavily utilized in Eastern North America throughout early American history, reinforcing its importance socially and economically. There is a clear distinction between the British and Eastern North American sites that connect the social division between the populations to a quantifiable change in diet. Although patterning within Eastern North America has proven more difficult to parse out, the data suggests that maize consumption may be related to how urbanized a region is; maize is less utilized in heavily urbanized areas. Future directions of study would include examining more sites to provide a larger sample size, the analysis of additional faunal material, as well as obtaining supplementary contextual information for each of the sites examined.

## **Mycenaean Mortuary Practices: New Perspectives Based on the Skeletal Evidence from the Borzi Hill Site, Kefalonia.**

Albanese, J (1)

1. Department of Sociology, Anthropology and Criminology University of Windsor 401 Sunset Avenue Windsor, Ontario, N9B 3P4, Canada

Research is on-going involving human and faunal remains from an ossuary and tholos tomb at the Borzi Hill site, Tzannata, Kefalonia, Greece. Data collected during the 2016 and 2017 field season is providing increasing evidence to challenge some of the widely held ideas about Mycenaean Period (Late Helladic III) mortuary practices. The most recent finds include: 1) Animal bones (offerings) have been found throughout the tholos tomb, but not the ossuary. 2) In addition to sheep and goat bones, the bones of several cows and at least one horse have been identified from the tholos tomb. 3) In both tombs, there is a clear pattern of skeletal elements that were recovered: skulls, clavicles, humeri, radii, ulnae, femora, tibiae and fibulae. Other skeletal elements were systematically removed from the tholos tomb after decomposition and purposefully excluded from reburial in the ossuary. 4) The ossuary represents a new tomb type not previously known for this period, and is one of only two known purpose-built tombs with a distinct architecture for reburial of selected skeletal elements after skeletonization had occurred in another location. 5) Although it is now completely oxidized, in both Bronze Age tombs there are multiple examples of small, bright red rust stains left from iron that was likely used for adornment. 6) And last, and possibly most surprising, there are many examples of human bones that manifest chop marks. The pattern of breakage is consistent with damage inflicted when the bone was dry. The proximity of the chop marks, only a few millimetres apart, suggests a concerted effort to break the bones, rather than tool marks left by ancient looters.

## **Virtual Histology at the Canadian Light Source**

Andronowski, J.M. (1); Panahifar, A. (2); Harrison, K.D. (2); and Cooper, D.M.L. (2)

1. Department of Biology, University of Akron, Akron, Ohio, 44325-3908

2. Department of Anatomy and Cell Biology, University of Saskatchewan, Saskatoon, Saskatchewan, Canada, S7M 3L7

Histological analysis of hard tissues holds great potential in many areas of biological anthropology. The inherently destructive nature of histological approaches, however, can be highly limiting. Imaging-based virtual histology has increasingly become a viable non-destructive alternative through the development of high resolution modalities, such as micro-computed tomography (micro-CT). Synchrotron-based micro-CT represents the cutting edge of such imaging, providing a number of advantages derived from intense and highly tunable X-ray beams. The ability to probe histological structures non-invasively has resulted in anthropological applications becoming increasingly common at synchrotrons around the globe and Canada's national synchrotron radiation facility, the Canadian Light Source (CLS), is no exception. The objective of this presentation is to provide an overview of the capabilities of the CLS for the imaging of hard tissues and to highlight key studies that have been conducted in the first 10 years of its operations. Such efforts have ranged from inquiries into human health, human anatomy, forensic anthropology, and paleontology. Investigations employing animal model systems to better understand the physiology of hard tissues will also be highlighted. The CLS offers an invaluable resource for 3D imaging that is accessible to national and international researchers via a peer-review process. This talk will thus conclude with a brief overview of how to initiate new research endeavors with the CLS.

## **Neanderthal Growth and Development: The Growing Importance of Reference Samples on Examining the Evolution of Modern Human Ontogeny**

Atell, M.G.I. (1); Symchych, N. (1); and Viola, B. (1)

1. Department of Anthropology, University of Toronto St. George, 19 Russell Street, Toronto, Ontario, M5S 2S2, Canada

The evolution of human growth has long been subject to scientific study, but the degree of similarity between Neanderthal and modern human developmental patterns remains debated. Previous investigations of Neanderthal growth have primarily used the data from the Denver Growth Study, developed on healthy middle-class children from Denver, Colorado from 1927 through 1967. Studies using this data have generally concluded that Neanderthals grew more rapidly than modern humans. This developmental difference, however, may be more related to other variables, such as climate, ecology, and genetics, rather than interspecies differences. In fact, we see considerable developmental variation in modern humans today. This study will compare Neanderthal growth to that of recent modern humans, utilizing reference populations that vary geographically and chronologically. Our approach will investigate the impact of reference sample choice on growth evaluation in fossil hominins. With more appropriate comparative samples, we hypothesize that Neanderthals grew more similarly to humans than previous analyses suggest. We evaluate the growth tempo of 9 juvenile Neanderthals, by assessing both dental formation and skeletal maturity. Dental and skeletal growth is correlated in modern humans, and using both systems of development in tandem improves the accuracy of age estimation. We estimate the ages using five modern comparative samples: the Denver Growth Study, the Late Woodland Libben assemblage, the North African Kulubnarti sample, an early medieval Central European Mikulčice population, and a combined sample of 4 past Arctic populations. Our results will shed light on the origin of the human growth tempo and the role of Neanderthals in the evolution of modern human ontogeny.

## **Patterning of Lactation and Infant Feeding Development in Chimpanzees: Lactation Effort Plateaus While Infants Attain Independent Feeding Abilities**

Badescu, I. (1,2); Katzenberg, M.A. (3); Watts, D.P. (4); Sellen, D.W. (2)

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Lactation is an energetically costly component of maternal investment in mammals, as females balance the extra metabolic requirements of milk synthesis for current offspring (i.e. lactation effort) against their own health and future reproduction. For most non-human primates, including chimpanzees, it is unknown whether lactation effort decreases, increases, or remains steady as infants attain independent feeding abilities. We assessed the pattern of lactation effort in a cross-sectional sample of wild chimpanzee mothers and infants at Ngogo, Kibale National Park, Uganda. We compared rates and durations of infant nursing and foraging behaviors directly observed at different ages (N = 45 infants) with estimates of the relative reliance of infants on maternal milk versus foraged food from fecal stable carbon and nitrogen isotopes (N = 48 infants, 560 samples from offspring and mothers). Nursing rates and durations were highest for newborns ( $\leq 1$  year), which suggests that lactation effort was greatest soon after birth. Both stable isotope and nursing behavioral data indicated lactation effort were similar across observations from infants age range  $> 1$  to  $\leq 4$  years, which suggests that mothers provided a steady supply of milk while infants increasingly supplemented their growing energy needs with solid foods. Lactation ended and physiological weaning occurred at around 4 years old, which indicates that milk no longer constituted a dietary need for most infants by this age. Taken together, behavioral and physiological data showed that infants continued to nurse at decreasing rates, without milk transfer, which indicates that the mother-infant behavioral relationship terminated later than the nutritional relationship. Findings are consistent with the hypothesis that, like many hominoids including humans,

chimpanzees show a multi-year pattern of lactation during which maternal investment through lactation effort remains fairly constant while offspring build independent feeding abilities. Plateauing lactation effort may allow hominoid infants time to attain the physiology and behavioural skills necessary for independent feeding, while also providing them with a steady immunological and nutritional base on which they could rely consistently through infancy and enabling mothers to maintain a fixed, predictable level of lactation effort.

### **Death at the Bottom of the World: The Forgotten 1916 Polio Epidemic in New Zealand**

Battles, H.T. (1)

1. Anthropology, School of Social Sciences, The University of Auckland, Auckland, New Zealand

The 1916 polio epidemic that hit the northeastern United States between May and November of that year has received considerable attention. The severe epidemic resulted in over 6,000 deaths, 2,243 of them in New York City alone. New Zealand also experienced a major polio epidemic in 1916, with most deaths occurring in January through April – thus preceding the US epidemic by several months. This antipodean epidemic has received scant scholarly attention. In this paper, I draw upon data from death registrations, newspaper accounts, and contemporary studies to examine the mortality patterns of New Zealand's 1916 polio epidemic. Investigation of death registrations for the country's non-Māori population revealed 125 deaths attributed to polio across the country, in contrast to the official reported count of 123 deaths. The sex ratio of deaths was high, at 1.7 (79 males: 46 females) for all ages. Age at death ranged from 6 weeks to 49 years. Perhaps reflecting New Zealand's more isolated position and low population density, and contrary to contemporary patterns in North America and Europe, the majority of deaths (60.8%) occurred beyond the 0-4 age group. I investigate a potential role for WWI mobilisation in increasing opportunities for exposure of older adolescents and young adults to the virus and in creating conditions for intensive exposure (e.g. in crowded training camps) with greater risk of severe infection. Preliminary results are mixed; there is a conspicuous lack of reported polio outbreaks among NZ troops, yet somewhat higher polio mortality in males aged 15-24 compared to both females in same age group and males aged 5-14 years in 1916. I also discuss local social and medical perceptions of the disease and responses to the epidemic, particularly as influenced by the wartime context.

### **Evidence of Childhood Hand-Preference in the Humerus\***

Beauchamp, A.M. (1)

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Evidence of preferred hand use, particularly when hand preference is developed provides valuable information about activity patterns, daily repetitive tasks, as well as societal norms for education or childhood integration into work roles. This study looks at lateralization in the humerus in a sample of 50 individuals aged from neonates to young adults from Medieval and post-Medieval Denmark. Standard measurements such as diaphyseal length, diameter, circumference were tested, as well as cortical thickness. Evidence for hand preference in this sample, becomes most evident in early childhood, with a majority favouring the right over the left upper limb. Most measurements show minimal lateralization, around 1% difference in size, however cortical thickness shows a significant difference between sides with the right humerus on average 3.39 cm<sup>2</sup> larger than the left, a difference of 3.48%. These findings suggest that cortical thickness of the humerus is a promising indicator for the identification of preferred hand use in skeletal remains.

## **Palaeoforensic Approaches to Burned Human Remains in Archaeology\***

Berendt, K (1)

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Methods of fire investigation from forensic anthropology are increasingly being used in archaeology. Concepts such as scene investigation, fire source localisation, testing for accelerants, victim behaviour, and analysis of building structure can be applied to archaeological sites, just as they would be applied in the aftermath of a modern fire. This presentation reviews how these modern methods can be applied to reconstruct the events of past fires from physical, biological, and social perspectives. Thorough analysis of the conditions before, during, and after fires can add a valuable human dimension to archaeological investigation. This theoretical framework will be illustrated through the example of four archaeological human skeletons from Late Bronze-Age Tel Azekah, Israel. These individuals were killed in a sudden conflagration, which preserved their final moments and aspects of their daily lives with startling clarity. Borrowing techniques from forensic fire investigation has revealed details about these individuals' manner of death, enhancing their osteobiographies and contributing to our knowledge of the history of the region.

## **An Investigation of Osteocyte Lacuna Density (OCD) and Other Intracortical Porosities Using Backscattered Scanning Electron Microscopy (BSE-SEM)\***

Beresheim, A.C. (1)

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Backscattered scanning electron microscopy (BSE-SEM) is an underutilized technique in biological anthropology. While it used to be a popular tool for examining diagenesis and bone mineralization density (BMD), for these types of analyses, BSE-SEM has largely been eclipsed by newer molecular and 3-D imaging techniques. However, BSE-SEM still affords certain advantages in the study of bone microstructural variation—most notably greater machine availability, lower costs, and the potential for automation. 3-D imaging techniques tend to be more labor intensive, require extensive data storage, and are limited to small bone volumes. A major advantage of BSE-SEM is that full bone cross-sections can be analyzed at high resolution, improving statistics, and protecting against variation associated with stochastic remodeling and/or the local strain environment. Intracortical porosities such as osteocyte lacunae and Haversian canals, which are difficult to capture using most micro-CT set-ups, can be enumerated and measured with relative ease. In this presentation, I will demonstrate how osteocyte lacuna density (OCD) and other intracortical porosities were quantified in a large sample (nfemale=73, nmale=65, mean age=46.46 years) of mid-thoracic ribs using customized MATLAB scripts. A preliminary analysis of age- and sex-related variation in the study sample will also be discussed.

## **Preliminary Field Results of the Archaic Burials at Stavros: A Collaborative Analysis of Osteological, Ceramic, and Mortuary Remains in Thessaly\***

Bishop, K.G. (1); Millions, K. (2); Karapanou, S. (3)

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2. Department of History and Classics, University of Alberta

3. Director of the Stavros Archaeological Project, Representative of the 15th Ephorate in Larissa

Current knowledge of Archaic (700-480 BCE) burials in Greece stems from cemeteries and individual tombs studied near modern Athens. Most of those remains are cremated and few burials have been thoroughly examined in other regions of Greece. Our collaborative research provides preliminary results of over 30 non-cremated burials studied at the Stavros Cemetery in central Thessaly. In 1997 construction work yielded evidence of human remains near Farsala, Thessaly. Sophia Karapanou directed the recovery efforts with the 15th Ephorate in Larissa and soon established evidence of a well preserved and unlooted Archaic cemetery. In summer 2017 anthropology students from the University of Alberta began full analysis of the Stavros Cemetery skeletal material under the direction of

Katherine Bishop, and burial goods were similarly analyzed by classics student Kristen Millions. Collaborative research of this nature is rarely available but provides a unique opportunity to integrate classical and anthropological archaeology techniques to gain a broader understanding of mortuary patterns and demography during the Archaic period in Greece. Here we discuss age- and sex-based mortuary patterns and evidence for site dating. Using three case studies we also explore some of the Archaic burial patterns for the Thessaly region: Stavros-B19/B19 $\alpha$  represents a potential mother and child burial; Stavros-B10 includes an adult male buried in an anomalous manner with exotic grave goods; and, Stavros-B29 contains an adult female with many cooking vessels. The Stavros Archaeological Project provides an exceptional opportunity. The remains are well-preserved, the site is unlooted, and our collaborative cross-disciplinary approach affords us an exceptional opportunity to understand Archaic burial patterns and demography from a rural Greek context.

### **Recovering Veterans' Voices: Accounts of Suicide Among Former Members of the Canadian Expeditionary Force, 1918–1936**

Bogaert, K.L. (1)

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Throughout the past year, deaths by suicide among returned veterans have featured prominently in Canadian news media. The issues of war trauma and suicide among Canada's returned veterans are not new, although they often re-emerge into the public view when troops are returning home. The First World War was no exception, and the scale of the war effort was simply monumental – the Canadian Expeditionary Force (CEF) enlisted over 600,000 soldiers, of whom, around 400,000 went overseas, and suffered a total of 59,544 fatal casualties, and 172,450 non-fatal casualties. Between 1918 and 1936, 11.9% (n=1855) of all deaths among pensioned First World War veterans were attributed to suicide and accidents. Beyond this statistic, however, little is known about these veterans' post-war experiences. Relying on records of veterans' hospital admissions, service and pension files of the CEF, this paper explores authoritative accounts of First World War veterans' mortality attributed to suicide and accidental causes. Individual veterans' histories were traced, beginning with a sample of 152 veterans admitted as "mental cases" to the Ontario Military Hospital at Cobourg. After record linking hospital records to pension and service files, I examined the narratives constructed around suicide and psychiatric illness within these sources. Military and pension officials invariably ascribed veterans' suicide attempts and deaths to moments of temporary insanity or chronic mental illness, which were in turn attributed to hereditary or personal failing. Veterans' own statements within these files reveal discrepancies between the storylines authored by and about veterans, emphasizing the impact of war and the tension of agency in veteran deaths by suicide.

### **Using Model Organisms to Reconstruct Locomotor Behaviors in Fossil Primates**

Bradley, M.M. (1); Hou, L. (2); Sparrow, L. (3); Pellatt, E. (3); Farooq, S. (4); and Rolian, C.P. (1,3)

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Reconstructing the behaviour of extinct primates is a common objective of palaeoanthropology. Due to the limitations of the primate fossil record, comparisons with the morphology and behavior of model organisms is a helpful means of studying questions that would otherwise be unapproachable. Models with analogous body proportions, and with similar shape, robusticity and microarchitecture of bone can inform our interpretations of how an extinct organism moved. For example, living primates with elongated and gracile limbs include runners (humans) and jumpers (galagos and tarsiers), thus extinct

primates with similar body plans are often interpreted as employing the same types of locomotion. This interpretation rests on the largely untested assumption that hind-limb elongation evolved adaptively due to increased performance in specific ecological contexts. This assumption can be tested using the Longshanks (LS) mouse model. The LS selection experiment has produced mice with tibiae on average 15% longer than those of mass-matched and randomly bred controls. Using the LS, we can directly study the effect of limb length on locomotor performance within a population (the level at which selection operates and speciation occurs), rather than comparing species with highly derived morphology or distantly related taxa. To date, we have conducted several studies with implications for reconstructing fossil locomotor behaviors. We first investigated the effect of longer limbs on gait and cost of transport (COT) during running. COT reduction should result from longer stance durations and reduced stride frequencies. Similarly, during jumping, longer limbs should increase the time over which muscles contract, increasing acceleration and take-off velocity. Theoretical biomechanical models for both running and jumping have not been adequately studied within species, but can be validated empirically by comparing performance variables and morphological correlates in Longshanks and control mice. Our results provide mixed support for these relationships, but also show that the preserved signals in bone require more caution when used to infer locomotor behaviors. These ongoing projects, as well as future studies, aid our ability to interpret fossil remains by providing biological parameters and restrictions, as well as a platform for hypothesis testing.

### **Let The 'Tooth' Be Told: New Insights On Past Vitamin D Deficiency**

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Vitamin D deficiency is now widely recognised as one of the most common health conditions in contemporary societies, and mounting evidence indicates that it has important health consequences. Advances in paleopathology have led to improved recognition of rickets and osteomalacia, but identifying adults who survived a childhood episode of vitamin D deficiency has proved challenging. More accurate recognition of such individuals, and clearer information on age of occurrence, length, severity and number of periods of deficiency would revolutionise our understanding of the condition. Over the last five years we have been working on methods that provide information on all these aspects of deficiency. This paper provides an update on the use of teeth to investigate vitamin D deficiency in past and present communities (preliminary findings were presented at CAPA in 2015). Using known samples incremental interglobular dentine (IIGD) has been shown to be linked to vitamin D deficiency. Location of IIGD indicates timing of deficiency, with length determined by width of defect and severity by characteristics of the IIGD. Studies on archaeological individuals from historic French and Canadian sites demonstrated many individuals with skeletal evidence of rickets experienced multiple episodes of deficiency. Reviews of previously published work found that IGD is preserved in teeth from early time periods with cases of what is almost certainly IIGD described in teeth from the Late Pleistocene site of Skhul, Israel. Reports of IGD were also found in non-human primates from a number of contexts. It is clear IIGD offers a tool with which to fill in many important gaps in understanding past and present aspects of vitamin D deficiency. Work on radiological assessment of shape changes produced by deficiency in the pulp chamber of molar teeth of known individuals indicates x-rays can provide a screening tool to identify those who suffered past deficiency. Importantly this type of work offers the potential to provide stronger research connections between modern health research and paleopathology as a means of better informing interpretations of health in past communities.

## **How Does Bioarchaeology Examine Co-Occurring Diseases? Theoretical Implications of Collaboration Between Clinical Medicine and The Paleopathological Record\***

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This paper provides a theoretical discussion of the examination of “co-occurrence” in bioarchaeology. Co-occurrence, when two or more diseases may be present within an individual through, is explored through the perspectives of clinicians and bioarchaeologists. This is of key importance in the study of bioarchaeology as it is clinically known that co-existing diseases or conditions impact perceptions of health and well-being and create burdens on health care systems. It is of considerable difficulty to establish conclusive evidence of the co-existence of diseases in the past, as disease manifestations may not be identifiable in skeletal remains and skeletal lesions are often altered due to ante-mortem medical treatments, mortuary behaviour, as well as post-mortem taphonomic processes. This paper argues that the bio-cultural approach is essential in the study of diseases in the past, as it allows for an exploration of how social and cultural factors influence biological susceptibility and expression of disease. As assessing health and disease in skeletal remains can be difficult, due to poor preservation and the rate of diseases affecting bone at the time of death, the evidence of two or more diseases has not been prevalent in bioarchaeological examinations. With advancing technology and increased collaboration with medical sciences, I argue that co-occurrence studies have a growing space within bioarchaeology. This paper synthesizes current bioarchaeological evidence of co-existing health conditions, and argues that standardized definitions of co-occurrence conditions are needed in both clinical and bioarchaeological usage, to provide stronger multidisciplinary and comparative approaches.

## **Reconstructing the Paleoenvironments of Kalodirr and Moruorot, Kenya Using Stable Carbon Isotopes**

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The early Miocene (23 to 16 Ma) of East Africa is critical to understanding the diversification and distribution of early catarrhines. The Miocene was a period of global climatic cooling and forest retraction. In the past, East African forest environments were believed to have persisted through the middle Miocene. This was based on paleoenvironmental reconstructions based on paleogeography, community analysis, and index species approaches, as well as a belief that early apes would live in forested environments like modern apes. These forests would have been composed of C<sub>3</sub> plants, such as evergreen trees with interlocking crowns and several stories of vegetation. However, emerging isotopic evidence from the East African early Miocene sites of Napak (20 Ma), Moroto (21 Ma), Rusinga Island (20-17 Ma), and Tinderet (~20 Ma) indicates the presence of open canopy forests, forest mosaics and woodlands. Here, we build on this preliminary research by using stable carbon isotopes to reconstruct the paleoenvironments of the Kalodirr and Moruorot localities in West Turkana, Kenya (17.5 to 16.8 Ma). This is the first carbon isotope data from East Africa for the later part of the early Miocene. Kalodirr and Moruorot preserve a unique primate community that is entirely lacking cercopithecoid primates and including three ape taxa that are restricted to the Turkana basin. This suggests that the environments of Kalodirr and Moruorot were distinct from Western Kenya and Ugandan Miocene sites and we predict may signal a more open canopy forest or woodland environment. We sampled 98 herbivore teeth from eight different mammalian families – Suidae, Anthracotheriidae, Tragulidae, Giraffidae, Rhinocerotidae, Gomphotheriidae, Deinotheriidae, and Titanohyracidae. Enamel samples were collected in powder form using a rotary drill and analyzed using an isotope ratio mass spectrometer with a Kiel carbonate device attachment. Preliminary results from a subset of the samples demonstrate that Kalodirr and Moruorot are generally similar to other early Miocene sites in the region. This suggests a mosaic of largely C<sub>3</sub> vegetation, with no clear

evidence for dense tropical forests. Rather, these environments would have consisted of largely open canopy forests and woodlands.

### **Limb Proportionality and Dietary Composition Among Later Stone Age Southern Africans**

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Southern African Later Stone Age (LSA) body size variability has been associated with changes in population density. Dietary composition, as indicated by carbon ( $\delta^{13}\text{C}$ ) and nitrogen ( $\delta^{15}\text{N}$ ) stable isotopes, does not correlate with body size variability. Intrapopulation variation in LSA limb proportions (i.e. the ratios between proximal and distal limb element lengths) has received less attention. Limb proportionality is often debated in human evolutionary research as it may be affected by climate. However, limb proportions may additionally reflect environmental stressors experienced during growth and development, including nutritional insufficiency. LSA groups from the Mediterranean-type Cape coast and the semiarid central interior consumed different types of foods due to ecological and subsistence strategy variation between these regions. Differential resource availability may have impacted the growth and development of particularly distal limb segments with implications for adult limb proportions. This paper tests if dietary composition, as indicated by  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  stable isotopes, influenced LSA southern African limb proportions among Cape coast (n=73) and central interior (n=38) groups. Maximum humerus, radius, femur, and tibia lengths were used to calculate brachial (radius/humerus) and crural (tibia/femur) indices. Pearson correlation coefficients were used to assess the direction and strength of relationships between these indices and  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  ratios. Central interior crural indices correlated positively with  $\delta^{15}\text{N}$  values, indicating greater tibia lengths relative to femur lengths with the consumption of higher trophic level foods. The consumption of higher trophic level foods in the unpredictable central interior may have positively impacted growth and development in this region.

### **Multi-Observer Agreement in Morphological Assessments of Phenice's Pubic Traits for Sex Estimation from Human Skeletal Remains**

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An assessment of observer error is an important component of assessing the reliability of sex estimation methods. These tests often take the form of an assessment of intra-observer error when one observer collects data two or more times, or inter-observer error typically when 2 to 5 observers collect data. Few assessments have been made of multi-observer error rates with several dozen participants. Tests with a large number of participants are important for two main reasons: 1) they provide a measure of reliability that emphasizes a target individual, rather than a target sample, and 2) they provide a better means to assess the effects of the observer's experience on the reliability of the method. In this study, we report the preliminary results of a multi-observer agreement test that included participants with a wide range of experience from Simon Fraser University and attendees of the 2016 meeting of the Canadian Association for Physical Anthropology. A total of 58 individuals performed a blind assessment of Phenice's pubic traits on 9 different pubic bones, and provide information about experience in human osteology. Percentages of agreement were calculated for each trait and each bone separately, by level of experience (<1 year, 1-10 years, and >10 years). The overall agreement for Phenice's traits in this study was 81.5%. The more experienced group showed the highest agreement, but only modestly better than the 2 other groups. The trait that showed the highest agreement was the shape of ischiopubic ramus (92.0%), with the less experienced group showing the highest agreement. Traits associated with female morphology showed higher agreement (91.6%) than those associated

with male morphology (81.2%). This study suggests that the Phenice traits can be consistently assessed regardless of the level of experience of the examiner, albeit with a smaller agreement than expected.

### **Is *Paranthropus* a Good Clade?**

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The relationships of the three species in the robust australopith genus, *Paranthropus*, remain contentious. One hypothesis avers that *P. aethiopicus*, *P. boisei*, and *P. robustus* share a common ancestor to the exclusion of all other hominin species and therefore form a clade. The main alternative hypothesis contends that *P. boisei* and *P. robustus* are more closely related to *Australopithecus africanus* and *Homo* than either is to *P. aethiopicus*. According to this hypothesis, the similarities between *P. boisei* and *P. robustus* on the one hand and *P. aethiopicus* on the other are homoplasies that reflect the effects of convergent evolution in relation to heavy chewing. While both hypotheses have been supported in previous studies, they have yet to be formally compared. Here we report the results of such a comparison. We conducted a series of dated Bayesian analyses using a large craniodental dataset compiled from the literature. The dataset included scores for 391 characters for 24 hominin species that span the last seven million years. Various phylogenetic hypotheses for the *Paranthropus* species were converted into partially constrained tree models, and we then used Bayes Factors to evaluate the relative likelihood of these models given the craniodental evidence. To begin with, we carried out an analysis in which we used all 391 characters. Next, we repeated the analysis after excluding characters related to heavy chewing. In the third and final analysis, we divided the characters into four developmental-functional groups and then tested between the hypotheses with each developmental-functional group of characters. Overall, the results we obtained provide strong support for the hypothesis that the three *Paranthropus* species form a clade. However, they also show that we need to investigate the phenomenon of homoplasy in more detail.

### **Applying Common Plio-Pleistocene Paleoenvironmental Proxies in Deep(er) time: Challenges and Opportunities**

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A common goal in paleoanthropology is to reconstruct past environments. Fossilized plant remains and geological data (e.g. sedimentary systems, soil chemistry) provide the most direct paleoenvironmental data, but are often not available. In addition, access to paleoanthropological specimens, particularly for destructive analysis, is often not possible. Consequently, paleoanthropologists often turn to methods that rely on the fossil remains of other mammalian taxa found at the site. These include stable isotopic analysis, various measures of tooth wear, ecomorphology, and community composition. These methods are well-established for paleoanthropological sites in the Plio-Pleistocene and hundreds of studies have been published. Applications in deeper geological time are becoming more common, but pose additional challenges. The old adage “the present is the key to the past” becomes more difficult to apply as we move back in time, as many modern analogues begin to fail. With increasing time comes the increasing possibility that the world looked fundamentally different than it does today. Here, we present work using mammalian fossils as paleoenvironmental proxies for early ape environments in the early Miocene of East Africa demonstrating some of these complexities. Were these datasets from the African Plio-Pleistocene, they would be clearly interpretable, but several important factors make this more difficult: (1) early Miocene faunas include many taxa that are phylogenetically distinct from living groups, making it difficult to know which modern taxa to use as analogues; (2) we may be dealing with environments that have no modern analogue, including the presence of a number of

actively erupting carbonatite volcanoes and the possibility of C3 ecosystems unlike any documented on earth today. Our carbon isotope results provide compelling evidence that early Miocene apes lived in more open habitats than today, but the precise nature of these environments is difficult to pin down without additional data. Data from ruminant tooth mesowear and hypsodonty, which we hoped would clarify the matter, provide conflicting results. Grasses may be widespread, but ruminants don't appear to be consuming them. In the future, we hope to incorporate data from additional sources, including postcranial ecomorphology, microwear, and ideally, remains of well-preserved fossil plants.

### **From Little Things Big Things Grow - An Examination of Trends in Pelvic Growth and Body Size in Growing Girls Living in London\***

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The growth pattern of the female pelvis is unclear, making it difficult to quantify possible causes for compromised obstetric capacity. Previous studies demonstrate that pelvic breadth increases more slowly overall than linear growth as girls grow, and that girls reach their mother's height before they reach their mother's pelvic breadth. Parental influence on pelvic growth is equally unclear; though previous work has found that maternal body mass index (BMI) is associated with neonatal adiposity and birthweight, whilst paternal body size is associated with limb lengths. This study examines growth patterns of pelvic breadth as well as the influence of parental body shape and size on pelvic breadth as girls grow into women. Body composition data and pelvic dimensions were collected from dual energy x-ray absorptiometry (DXA) scans from 286 girls and women living in London today between the ages of 4 and 22. Measures of body composition collected include lean mass, fat mass, height and weight. Outcome pelvic dimensions collected from DXA scans were bi-iliac breadth, mediolateral inlet breadth and biacetabular breadth. Growth charts for pelvic measurements were created using the LMS method. Variables were converted to age-adjusted z-scores to enable accurate body composition comparison between adults and growing children. Mediolateral inlet breadth and biacetabular breadth had an increased growth velocity between 9 and 14 years of age and bi-iliac breadth increased steadily from 6 years of age onwards. Multiple linear regression analyses demonstrated that bi-iliac breadth associated significantly with paternal BMI. Maternal BMI did not have any significant associations with pelvic breadth. These results demonstrate that pelvic breadth increases prior to puberty and that there is a paternal influence on non-canal pelvic breadth. This suggests that obstetric capacity is affected by growth prior to puberty and that parental influence on body breadth does not have a directly maternal line of inheritance.

### **Parental Investment and the Cost of Early Stress in the Later Stone Age: Temporal Variation in the Relationship Between Neural Canal Size and Early Mortality Among Adult Foragers**

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Poor conditions in early childhood may stunt growth and impact later survival. Periods of restricted growth may be recorded in osteological markers, such as the diameter of the neural canal (NC). However, it is not clear that the risk associated with early constraint is uniform: contextual variables may introduce variance into the relationship. This analysis tests whether mortality risk associated with a small neural canal, previously identified among Later Stone Age foragers from southern Africa's southwest Cape, varies over time. A temporary increase in the overall frequency of skeletons and a localized cluster of cranial trauma cases between 3000–2000bp, both of which were followed by an increase in average body size, collectively raise the possibility that conditions of growth and survival fluctuated for these foragers. 105 radiocarbon-dated skeletons were sorted into Young Adult (YA, <30

years, N=41) and Mature Adult (MA, 30+ years, N=57) phases based on coxal and dental indicators. Mediolateral NC at T1, T6, L1 and L5, and two body-size variables, femur length (FXL) and head diameter (FXH) were converted to sex-standardized scores using Principal Components Analysis. Linear ordinary-least-squares regression models were fit to the natural logarithms of PCA scores and <sup>14</sup>C dates. The results show that YA values increase significantly over time (B=-0.263, R<sup>2</sup>=0.19, p<0.01), while MA values do not (B = -0.081, R<sup>2</sup>= 0.04, ns). This trend is driven by the smallest YA cases, all clustered before 2000bp. Following 2000bp, YA and MA values are indistinguishable. Similar patterns are not found in FXL and FXH, which mature later in ontogeny. YA deaths are not overrepresented between 3000–2000bp, but the temporal concentration of those with small NCs suggests that early childhood growth mediates mortality risk, but not uniformly over time. Given the importance of caregiver buffering to early growth in particular, these results suggest that parental investment at that stage could significantly affect offspring outcomes, especially before 2000bp. Changes underway after 2000bp, including the introduction of livestock, may have helped decouple adulthood mortality from early growth, perhaps by altering the background stress burden in the Later Stone Age population. FUNDING STATEMENT: This research was financially supported by the Social Sciences and Humanities Research Council of Canada.

### **A Mitochondrial DNA and Stable Isotope Study of the Beothuk and Maritime Archaic Populations from Newfoundland and Labrador**

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The culture and traditions of aboriginal populations are under threat in modern society and we know even less about aboriginal populations of the past. With a combined approach using genetic and isotopic data, we are attempting to answer questions of the settlement of the east coast of North America and the relationship and lifeways between two populations, the Maritime Archaic and Beothuk, who lived in the Canadian province of Newfoundland and Labrador from approximately 7500 – 150 YBP. The Maritime Archaic people were resident in the area from around 7550 - 3500 YBP while the Beothuk, who were the European contact population, appear in the archaeological record only around 2000 YBP and are believed to have gone culturally extinct with the death of Shanawdithit in AD 1829. We have recovered the complete mitochondrial genomes of 74 individuals belonging to these cultures. The data indicate a surprising degree of diversity within these populations but also suggest that there was no maternal continuity between the groups, indeed they may not have even shared a common source population. Additionally, from carbon and nitrogen isotope data in bulk collagen and single amino acids from the remains of 104 Maritime Archaic and 12 Beothuk individuals, we determined their dietary patterns are distinct yet primarily focused on the island's rich marine resources. Significantly, a dietary shift in the terminal Beothuk is evident and likely due to the resource competition they experienced from the expanding migratory and permanent European settlement on the island. This project has broad implications for our knowledge of the peopling of the Americas and their subsistence patterns, especially given the dearth of available data from the northeast, and on a local level allows us to reconstruct the ancestry and foodways of the people who came before. While genetic data cannot recreate cultural information, it can inform us as to the history of these populations and allow us to examine their relatedness with other aboriginal populations, both ancient and extant.

## **The Differential Effects of Environmental Factors on Immature and Mature Bone Weathering\***

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Estimation of postmortem interval is an integral aspect of the forensic identification process. In the case of skeletonized remains, time-since-death is approximated using trends in bone breakdown. Juvenile bone decay, however, has not been sufficiently studied and there is insufficient knowledge about whether it occurs at a faster or slower rate when compared to that of adults. This is also important to further understand the effects of age on preservation of archaeological bone. This study uses a porcine model to explore the role of bone maturity in the overall susceptibility of the skeleton to physical degradation. The radii of immature and mature pigs (*Sus scrofa*) were mechanically defleshed and used as a proxy for human bone of distinct infant and sexually mature age groups. Samples (n=100) from both age groups were left to degrade in a climate-controlled greenhouse, buried 10cm below the soil surface. Every month, for the span of 10 months, four bones from each age group and environment were collected for macroscopic weathering analysis. The results of this study indicate that within the first 10 months postmortem, juvenile and adult bones change and decay at differing rates. The most noticeable changes are in the color, and the breakdown of the metaphyses and cortex. Juvenile bone color becomes noticeably darker in the second month of degradation, and then does not change; adult bone coloration, on the other hand, changes from a common pattern of hemolytic staining, to diffuse soil staining during the fifth month. Breakdown of the metaphyseal plates occurs in the second month of juvenile bone decay, however there is only superficial cracking in the adult samples at this time, with localized loss of the cortex occurring by month six. The diaphyseal cortex of juvenile bone becomes coarse by the ninth month of degradation, while the adult samples experience this change in the fifth month and have lost approximately 5% of the cortex by month nine. These observations indicate that time-since-death estimates based on bone breakdown are age specific and that juvenile bone does not necessarily decay at a faster rate.

## **A New Protocol to Quantify Water, Collagen and Mineral Content in Bone Material**

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Ash weight analysis is a proven, effective method of quantifying bone mineral content. The results are comparable to those obtained from more costly laboratory methods such as dual energy x-ray absorptiometry or thermogravimetric analysis. Previous studies have used ash weight analysis primarily in the quantification of bone mineral content (percent ash weight), however, its potential to give a more complete description of bone composition has not been extensively explored. This paper proposes a revised protocol for the quantification of relative water, collagen, and mineral content of bone material. A porcine model was used with a range of relatively wet to relatively dry bone samples, different bone types and different ages. Bone sections of 1cm<sup>3</sup> were defatted, prior to being exposed to a series of sequential controlled heating. The defatting process was performed by submerging the samples in a chloroform and methanol bath for 24 hours. The heating process was carried out in a muffle furnace over three steps: 24 hours at 65°C, 24 hours at 105°C, and 48 hours at 600°C. Each sample was weighed four times throughout the process and the water, collagen, and mineral contents were expressed as a percentage of total weight. In order to limit sample destruction and lab time, the minimum sample dimensions, and heating times required for optimal results were determined. The present study suggests an updated ash weight analysis protocol as a valuable tool for the quantification of whole bone composition, including its relative water, collagen and mineral content. Compared to other approaches, this method offers the advantages of being cost-effective, involving basic lab instruments that do not require advanced training.

## **The Use of Formaldehyde Imbedded Human Remains in Experimental Procedures\***

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When looking at trauma patterning and various fractures in mass disaster scenarios, it is critical to have a firm understanding of bone biomechanics. Experimental recreations of the fracture types seen in mass disasters can aid in the humanitarian effort to identify and repatriate remains. In such instances where charring or cremation are involved, identifying human remains becomes more difficult. In most burn experiments, animal surrogates are used because they are easily obtained and can be good models for human bone tissue, however; the biomechanical structure between human and animal irregular bones is significant and precludes the use of animal bone for this issue. To aid in the identification of charred or cremated remains, human specimens need to be used instead of animal substitutes. To proceed with research using formalin-saturated bones typical of medical cadavers, it is essential to test how the formalin will affect the analysis. There is no relevant forensic data stating how formaldehyde saturated bone changes when introduced to heat. In this project, sections of bone from medical cadavers are tested to examine the flash point, length of cremation time, and heat fracture patterning. The results obtained from this study will lead to a better understanding of the implications of using medical cadavers to recreate heat traumas instead of defaulting to animal remains. This will greatly aid in allowing for more quantitative and direct studies of heat trauma.

## **Human Milk Antibody as Parental Investment: An Analysis of Secretory Immunoglobulin A in Milk from Northern Kenya in Relation to Maternal Nutrition and Infant Sex**

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Objective: Childhood mortality rates vary by household income and sex of the child, particularly in places where gender inequality and malnutrition are common. One factor that may account for these differences is the level of protection that children receive from mothers' milk. Expanding on our 2015 pilot study, we conducted a secondary analysis of data and breast milk samples from mothers in Arrial agro-pastoral communities where patrilineal descent is followed and polygyny is practiced. The Trivers-Willard hypothesis (TWH) predicts unequal parental investment between daughters and sons in polygynous populations; it predicts son preference among parents in good condition and daughter preference among parents in poor condition. Materials and Methods: Concentrations of secretory immunoglobulin A (sIgA) in milk were determined by ELISA. Maternal arm fat area (cm<sup>2</sup>) was standardized (zAFA). We defined 1SD above mean as high AFA and 1SD below as low AFA. A regression model  $\ln(\text{sIgA}) = \beta_1\text{zAFA} + \beta_2\text{infant sex} + \beta_3\text{zAFA}*\text{sex} + \text{covariates}$  was constructed, where  $\beta_3$  represents the change in sIgA level for sons for 1SD above mean AFA. Results:  $\beta_3$  was positive ( $\beta_3=0.106$ ,  $p<.05$ ,  $n=203$ ), predicting higher sIgA for sons than daughters in high AFA and lower sIgA for sons compared to daughters in low AFA. Of covariates, vitamin A deficiency and protein intake were inversely associated with sIgA. Conclusions: These results provide tentative support for TWH. Maternal thinness may compromise milk sIgA in this population, particularly for (but not limited to) sons. Milk sIgA may also be influenced by other aspects of maternal nutrition.

## **“Is That What You Think of Us?”: Five Things I’ve Learned About Sharing Research Results with People in Communities**

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The term “knowledge translation” entered the lexicon of Canadian health research in the late 1990s. Defined by CIHR as a “dynamic and iterative process” (<http://www.cihr-irsc.gc.ca/e/34190.html#k>), it encompasses a wide range of engagement activities, among them the sharing of research-generated knowledge with members of the communities from which participants are drawn. In fifteen years conducting community-based health research, I’ve taken part in dozens of knowledge translation events, including formal presentations, workshops, sharing circles, and informal (even impromptu) gatherings. Often, both research findings and community perceptions are exchanged, along with helpful guidance and suggestions that enhance and improve analysis, interpretation and application of results. This paper offers insights from my experiences and provides specific suggestions to guide scholars in the design and execution of community knowledge translation.

## **Using a Biocultural Approach to Develop Intervention Research that Shifts Trajectories of Health for Indigenous Children**

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Our paper is a critical reading of the scientific paradigms underlying developmental origins (DOHaD) and healthy life trajectories (HeLTI) research programs as they relate to intervention science involving Indigenous people. These paradigms have emerged alongside the development of anthropological lifecourse and life history approaches. Indeed these theoretical streams, with their emphasis on developmental plasticity, accommodation and adaptability, together constitute a powerful explanatory model. We examine this discourse as an organizing ideology for Indigenous health research, highlighting key areas where a biocultural approach, with its emphasis on political economy, gender and a more broadly-defined notion of “environment”, would permit development of a theoretical a framework sufficiently robust to encompass the range of inequities underlying current health disparities for Indigenous people. Our goal is to enhance the design of intervention research based on developmental models.

## **The 2012 U.S. Army Anthropometric Survey (ANSUR II): A Demographic and Body Measurement Database of Military Personnel**

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The US Army Anthropometric Survey (ANSUR II) collected demographic and body measurement data on 8,120 males and 3,841 females at 12 United States Army bases. A total of 4,082 males and 1,986 females are included in a working database that is representative of the current U.S. Army population.

93 directly-measured body dimensions were collected for each subject in this study, to include skeletal heights and breadths, as well as circumferences, measurements of the head, hands and feet, and functional measurements important to clothing/uniform or vehicle/workstation design. An additional 41 measurements critical to design parameters were derived from the direct measurements. Inter-observer error for each measurement was carefully recorded during data collection to monitor performance of measurers, and to provide important context to future analyses. The current database is representative of the US Army by employing a sampling strategy based on age, race/ethnicity, and with males and females treated independently. Detailed demographic data were collected for each subject and are reported with the anthropometric data. The ANSUR II database was designed and executed to replace an earlier anthropometric survey (Gordon et al, 1989) and to serve the US Army's current design and engineering needs. These anthropometric data also critically inform industrial and commercial design of human-centered products, and are a unique resource to a wide variety of researchers concerned with human variation. Technical Reports describing the methods, summary statistics, and measurement techniques are readily available.

### **The 'Biocultural Choreographies' of Occupational Health and Safety amongst Fur Trappers in Northern Ontario: A Qualitative Investigation**

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Background: Little information is available to describe occupational safety and its effects on the health of contemporary fur trappers. Objectives: Making use of qualitative data, the present study investigates the occupational health effects, safety concerns, and risk management strategies employed by fur trappers in Northern Ontario. Methods: Data from semi-structured interviews and participant-observation were collected from 52 fur trappers (50 males, 2 females, age range 23-65), as part of a research project investigating the environmental knowledge, wildlife management strategies, and lived experiences of fur trappers from Northern Ontario in 2015. Results: Common reported effects of trapping on health include back injury from lifting, frost bite, and increased risk of acquiring zoonotic infections such as rabies, giardiasis, and Lyme disease. Age and experience appear to be mitigating factors affecting injury risk. Conclusion: Trappers take great pains to ensure that they are well prepared for the daily task of working on their trapline. More attention should be directed to the ways in which age and experience affect efficiency and energy expenditure in fur trappers.

### **The University of Cape Town Human Skeletal Collection**

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The Division of Clinical Anatomy and Biological Anthropology in the Department of Human Biology at the University of Cape Town (UCT), houses the UCT Human Skeletal Collection, which was started in 1913. In this presentation, the audience will be introduced to the collection followed by a focus on its composition and value for research. The Collection is managed and curated in accordance with the South African National Health Act (2003) regulated by the inspectorate of Anatomy and the South African Heritage Resources Agency (SAHRA) under the graves and burial grounds section 36 of the National Heritage Resources Act No 25 of 1999. The Division and its forensic arm, Forensic Anthropology Cape Town (FACT) is authorised to excavate or hold human remains uncovered during construction, erosion, an investigation or any other activity. The Collection contains 1021 boxes of human remains from various contexts, including; archaeological (45%), cadaveric (36%), forensic (14%), the remaining 5% are from unknown time periods or outside South Africa. The bulk of the archaeological material was derived from controlled archaeological excavations; however, some are from accidental discovery by the public, police or forensic pathology services and donated by private persons. The cadaveric skeletons were sourced from bodies bequeathed by a family member, the

individual themselves or by the State as Paupers to the Department for use in scientific or medical research. The forensic material was sourced through FACT. Unidentified/unclaimed remains sourced from the South African Police Services or Forensic Pathology Services, with permission of the Inspectorate of Anatomy are accessioned into the collection for safe storage and use in teaching and research.

### **Pilot Study Using Dental Matrices to Examine Population Continuity among Iron Age People in Southern Africa**

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Tooth size and shape is strongly correlated with genetics, as such, they can be useful for examining population continuity and dis-continuity in past populations. In this pilot study, dental metrics obtained from Middle Iron Age people in southern Africa were examined for population continuity. Genetically and archaeologically it is supported that Iron Age farmers came into southern Africa around 2000 years ago, migrating from West/Central Africa. Today there is little genetic differentiation among contemporary Bantu-speakers in southern Africa. Based on this, along with similar archaeological evidence, and despite geographic separation (Zambia and South Africa), we expect there to be little to no variation observed in dental metrics from our samples. The sample spans the Middle Iron Age period (800-1300 AD), it consists of adult teeth comprised from 88 individuals; (16 Ingombe Ilede; 9 Isamu Pati; 8 from Mapungubwe; and 55 K2). Each tooth from the maxilla and mandible was measured in its mesiodistal (MD) and buccolingual (BL) diameters following the procedure applied by Jacobson (1982). The data from Mapungubwe and K2 were published and provided for these analyses by Steyn and Henneberg (1997). Metrics were not available on every tooth, due to fragmentation, pathology and tooth loss. The measurements available were compared statistically in SPSS and Excel. Few variations were observed, supporting the theory of population continuity among people from the Iron Age. This is a pilot study and so the small sample size may not represent the broader patterns across the Iron Age, the sample needs to be expanded to verify these results.

### **Group-Level Characteristics Influence Infant Handling in a Wild Primate (*Colobus vellerosus*)\***

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Infant handling behaviors – interactions between infants and non-infants, including touching, holding, carrying, grooming, or play grappling – are observed in an array of nonhuman primate taxa. Both maternal and nonmaternal handling contribute to infant development; yet, research typically addresses these behavioral expressions in isolation. Our study incorporates both using durational data to assess how handling received from each source contributes to a ‘total handling budget.’ We tested which infant-level (age, sex) and group-level (handler-to-infant ratio, stability of adult male membership) factors predict variation in amounts of handling received from each source, and whether handling time differences influence infants’ social network sizes. During June-October 2016 we collected 10-minute continuous focal observation samples (n=1,469) on all infants (n=16) living in 4 groups of ursine colobus monkeys (*Colobus vellerosus*) at Boabeng-Fiema Monkey Sanctuary in central Ghana. During the study, we observed 1,458 bouts of handling (1,169 maternal, 289 non-maternal). We compared handling durations and social network sizes with Generalized Linear Mixed Models (GLMMs) using the `glmer.nb()` and `glmer()` functions, respectively, from the “lmer” package in R (version 3.4.1). On average, maternal handling accounted for 94.21% of all handling received per 2-week interval (range = 0.00 – 100%). Maternal handling decreased as infant age increased and varied significantly based on adult male membership (age: estimate=-0.24, SE=0.08, z=-3.165, p<0.01; stability, global test: df=2, LRT=13.14, p<0.01). Nonmaternal handling had an inverse relationship with infant age and handler-to-infant ratio (age: estimate=-0.52, SE=0.26, z=-1.99, p=0.04; ratio: estimate=-0.57, SE=0.22, z=-2.56,

$p=0.01$ ). Though the amount of maternal handling received did not influence amounts of nonmaternal handling received, infants who received more maternal handling had smaller social networks (estimate=-0.16, SE=0.06,  $z=-2.87$ ,  $p<0.01$ ). Hence, infants who spend more time with their mother do not sacrifice opportunities for socialization, but invest in fewer, more concentrated, relationships. Given that infants in the most stable group type received the least maternal handling, our data suggests that increased stability of adult male membership corresponds to infants with larger social networks and that group-level characteristics play a critical role in shaping an infant's developmental environment.

### **Quantifying Enteseal Surface Changes using Geographic Information Systems Technology**

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Entheses display significant morphological variability which is still being extensively used to reconstruct activity patterns even though many authors call to caution. This morphological variability is characterized by focal changes in robusticity, and variable patterns of bone erosion and bone formation on enteseal surfaces. Most studies of enteseal surface changes are based on qualitative scoring methods which either have high observer error rates and/or fail to capture the complexity of enteseal morphology. Recently, some researchers have tested the application of Geographic Information Systems Technology (GIS) to capture and quantify the 3D topography of enteseal surfaces. This research project is testing the validity of such a method on a subsample of 15 out of 85 individuals from the Human Identified Collection at the University of Coimbra (Portugal). Fibrocartilaginous enteses on the proximal third of the humerus, radius, and femur were first scored visually using the New Coimbra Method. These same regions were then 3D scanned allowing the capture of both fibrous and fibrocartilaginous enteses. Following the method developed by Pany (2009), the 3D models were processed to create both 3D and 2D curves from which 3D and 2D areas and perimeters were measured. Based on Zumwalt (2005, 2006) and Pany (2008, 2009) methods, the 3D models were then imported into GRASS GIS 7.2.1 and converted into digital elevation models from which surface complexity and planarity measures were taken. The preliminary results on 2D and 3D surface areas and perimeters show strong positive correlations with enteseal scores as well as with specific body size proxy for each bone, and age. Surface complexity measures appear to show a negative correlation with Zone 1 scores whereas it does seem to show a somewhat positive correlation with Zone 2 scores; but nothing conclusive was obtained for body size proxy and age. Surface planarity measures also seem to show a positive correlation with enteseal scores, body size proxy and age.

### **A Comparative Study of Child Growth and Health in Medieval Santarém, Portugal\***

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Reduced height and higher frequencies of skeletal indicators of stress are traditionally associated with disadvantaged or stressed populations. This case study examines differences in growth and non-specific stress indicators between two juvenile contemporary populations from Medieval Portugal. The first sample comes from a hospital cemetery and the second sample comes from near-by churchyards. This study uses a total sample size of 30 individuals, of which 10 are from the hospital site. While the total population represents children who did not survive to adulthood, the assumption is that individuals who died at the hospital would have experienced greater stress, as they were likely ill at the time of their

death. Skeletal growth profiles were obtained by plotting humeral and femoral length against age. The non-specific stress indicators examined were enamel defects, cribra orbitalia, and porotic hyperostosis. The hospital and church populations had similar height-for-age. However, when compared with expected height-for-age based on femoral lengths from a healthy population, both groups fell below the expected norm. This indicates that growth was impacted overall but the stressed hospital population did not experience a disproportioned amount of stunting. The frequencies of non-specific stress indicators however, suggest that the children who died at the hospital faced more stress right before or at the time of death, as the frequencies of both cribra orbitalia and porotic hyperostosis were higher, but not enamel hypoplasias. This case study highlights the complex nature of child growth and health in the past and provides further insights into the nature of medieval hospital populations.

### **Rethinking the Roots of Indigenous Diabetes: On the Historical Role of Development in Creating a Modern Epidemic**

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Indigenous communities in Canada face a growing co-epidemic of chronic disease, centred on obesity and diabetes. While we may focus on the emergence of this epidemic during the last decades of the twentieth century, its roots lie somewhat earlier, in comprehensive sociocultural change driven largely by forces external to these communities. In this presentation, I draw on anthropological reports from across Canada, from the decades following the second world war, to better understand the nature and timing of these changes. By turning our focus backwards, we may be better prepared to implement effective interventions that acknowledge the role of past economic development and colonialism in the rise of this epidemic.

### **Ruminant Dental Wear Supports the Existence of Heterogeneous Environments in the East African Early Miocene**

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The appearance and radiation of catarrhine primates is well documented by a rich fossil record at Kenyan and Ugandan Miocene localities. Traditionally the early catarrhines in East Africa were thought to have inhabited dense closed canopy forests. Recent isotopic analysis of mammalian enamel from several fossil taxa suggests that variable habitats were present during the early Miocene. These isotopic results are consistent with signatures from open canopy forests, woodlands and possibly non-forested regions. Stem pecoran and tragulid ruminants are common at these early catarrhine localities and their later relatives, the bovids and cervids, thrive in open habitats. If less forested habitats were available and relatively widespread, it is likely these early artiodactyl ruminants would be one of the first groups to incorporate newly available grasses into their diet. We used two established dietary methods – hypsodonty indices and mesowear scores – to test the hypothesis that ruminant artiodactyls were utilizing non-forested habitats and consuming grasses throughout the early and middle Miocene in East Africa. Two observers collected crown measurement and mesowear scores for over 500 ruminant teeth from 16 species of tragulids and pecorans from 14 early and middle Miocene sites in the fossiliferous regions of Napak, Tinderet, Kisingiri, West Turkana, Maboko, and Fort Ternan. Early Miocene pecorans and tragulids exhibit stable hypsodonty indices. Tragulid hypsodonty indices remain low throughout the middle Miocene. Conversely, hypsodonty indices increase and diversify in pecoran ruminants during the middle Miocene because of the immigration of bovids into the region. Higher hypsodonty indices correlate with teeth that can withstand more wear allowing animals to utilize a more abrasive diet. Pecoran ruminants consistently have higher mesowear scores than

contemporaneous tragulids at all sites throughout the early and middle Miocene. Unexpectedly, pecorans do not exhibit an increase in mesowear scores through time and continue to show browsing signals throughout the middle Miocene. These results suggest some middle Miocene pecorans had the ability to utilize more abrasive diets but continued to exploit a browse focused niche instead. Nonetheless, pecorans become more abundant and taxonomically diverse throughout the middle and late Miocene suggesting their increased dietary flexibility provided some adaptive advantage.

### **Inside/Outside? The Significance of the Endosteal Contour in Evaluating Cross-Sectional Geometry in the Limb Bones of Children**

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Cross-sectional geometry (CSG) of cortical bone in limb diaphyses is a well-established method for examining functional adaptation of the postcranial skeleton. The developmental process of accruing and remodeling cortical bone in children offers an important perspective on understanding activity patterns among past populations. This paper addresses a methodological concern for CSG: whether the amount and distribution of cortical bone about the diaphysis is adequately modeled by the periosteal contour, or whether the addition of the endosteal contour is essential to accurately quantify functional properties. While patterns of long bone strength across adult assemblages have been shown to be well-represented by models of diaphyses based on the periosteal contour alone, this assumption requires examination in the case of immature limb elements. The growing diaphysis undergoes continual remodeling, with developmental windows of sensitivity to endosteal apposition. Furthermore, child health and activity may increase inter-individual variation in the relationship between diaphyseal circumference and robusticity. The question then, is whether it is worthwhile to model internal diaphyseal structure using imaging technology such as radiography or computed tomography toward the objective of quantifying bone strength patterns among children. Femora and humeri from subadult burials (n=194) from diverse non-sedentary Holocene assemblages were modeled for CSG evaluation using techniques that either estimated or excluded the endosteal contour at midshaft. Evaluated against the 'Latex Cast Method' both 'Eccentric Ellipse' and 'Solid Section' models correlate highly for second moments of area, polar second moment, and total area. Closer examination via percent error illustrates that solid sections overestimate properties relative to the latex cast method, while eccentric ellipse models overestimate inconsistently, with high levels of error particularly for the second moment in the anteroposterior plane in both the femur and humerus. The question of whether to model the medullary cavity in CSG analysis of the developing skeleton will be addressed by further examination of how particular age ranges drive the observed variation. The present study illustrates that total area and polar second moment of area, two variables which describe overall bone strength, are well represented by models that rely on the femoral and humeral midshaft periosteal contour alone.

### **A Comparison of Pretreatments for the Removal of Post-Depositional Humic Contaminants from Archaeological Bone Collagen**

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In the post-depositional environment, bone encounters a variety of contaminants that may alter in vivo stable isotope ratios and produce aberrant radiocarbon ages. Humic substances are one particularly problematic source of contamination as these compounds form cross-linkages with bone collagen, and are difficult to remove effectively. Darkly stained bone samples that are targeted for stable isotope analysis and radiocarbon dating are commonly pretreated with a strong base, such as sodium hydroxide

(NaOH) followed by gelatinization and filtration. However, alkaline reagents have been shown to damage the collagen peptide and reduce collagen yields. To assess the effect of alkali pretreatments on the removal of humics and preservation of bone collagen, faunal bone samples with suspected humic contamination were pretreated using one of five methods. Bone samples were divided and subjected to 1) no pretreatment 2) 0.1M NaOH; 3) ultrafiltration; 4) 0.1M NaOH and ultrafiltration; or 5) 0.0001M NaOH and ultrafiltration. All samples were gelatinized, Ezee filtered and lyophilized. The efficacy of the pretreatments was assessed and an initial characterization of the extracted humic substances was achieved using Fourier transform infrared spectroscopy in attenuated total reflection mode (FTIR-ATR). Following the pretreatment procedures, collagen preservation was evaluated using common preservation indicators (%C, %N, C:N), and bulk  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  values. As expected, the pretreatments appeared to have the greatest effect on the C:N ratios and  $\delta^{13}\text{C}$  values with marked differences observed between samples that had received an NaOH pretreatment, and those that had only been ultrafiltered. These results cast doubt on the use of ultrafilters to fully remove humic contamination, and while NaOH pretreatments reduce collagen yields, they may be a necessary step if humic contamination of archaeological collagen is suspected.

### **New Foundations: A Skeletal Exploration of the First French Inhabitants of the Fortress of Louisbourg, NS\***

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Human skeletal remains from colonial archaeological settings are important sources of information. They provide new perspectives on the variation of human adaptation and offer insight into the experience of transitioning to a new environment. This study examines a small subsample of the 18th century founding population of The Fortress of Louisbourg in Cape Breton, NS. Excavated in 1974, during the reconstruction of the site, these individuals represent the period between 1713 and 1720. Twenty-six adult individuals were analyzed macroscopically to assess age, sex, and any pathological conditions. Notwithstanding the poor bone preservation of this collection, results convey a high prevalence of dental caries, antemortem tooth loss, substantial wear, and evidence of enamel hypoplastic lesions. Cribra orbitalia and porotic hyperostosis were also observed and speak to the early life health status of these individuals before their arrival at Louisbourg. Additional pathological changes include possible examples of metabolic disease, ulcerative infections, and increased robusticity at muscle attachment sites primarily in the upper limb. Inferences based on these results corroborate with historical literature that depict a challenging life at Louisbourg. Specifically, the overall poor dental health and high rate of modified muscle markers suggests that the first colonial settlers faced new adaptation demands from exposure to different food resources and increased occupational strain. This analysis provides a unique opportunity to explore the lived experience of those who helped establish Louisbourg as a major French settlement colony in Atlantic Canada.

### **Maternal Mental Health is Not Associated with an Index of Child Health in Rural Nicaraguan Children Aged 2–12 Years\***

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Approximately 1 in 4 individuals worldwide will experience a common mental disorder in their lifetime, and analyses of the collateral effects of poor mental health inform priorities for policy change and intervention planning. Previous research has documented positive associations between maternal mental health (MMH) and child health and development outcomes. However, these studies tend to use

singular outcome measures to represent overall child health. A cumulative index, constructed from multiple markers of intermediary vulnerability to poor health outcomes, may better inform the relationship between MMH and child health by providing a more comprehensive outcome measure. To assess the relationship between MMH and an index of child health in rural Nicaragua, we collected cross-sectional data from 124 maternal-child dyads. We hypothesized that poor MMH would be associated with worse health index scores. MMH was measured with the self-reporting questionnaire 20 (SRQ-20). The index was created using two immunological markers (C-reactive protein and IgE antibodies) and two anthropometric markers (Height-for-age Z and BMI-for-age Z). To construct the index, we assigned decile scores that reflected the tails of risk within each marker's distribution, then summed the decile scores across the four markers. Multiple regression analysis assessed the relationship between variables while controlling for potential confounders including: child sex, breastfeeding duration, household wealth, perceived social support, and maternal education. Statistical analysis was completed in R, version 3.3.0. Child participants were 60% male, with a mean age of 5.95 years. Mean maternal age was 34.86 years, and median SRQ-20 score was 7 (IQR 4-11). Multiple regression analysis found no significant relationship between MMH and the child health index (standardized beta coefficient = -0.039, standard error = 0.119,  $t = -0.402$ ,  $p = 0.689$ ). The overall model predicted only 5% of the variation in the child health index (multiple  $r^2 = 0.051$ , adjusted  $r^2 = -0.0002$ ,  $F = 1.004$ ,  $p = 0.427$ ), and none of the variables were significantly associated with the index. These findings are unexpected, as they contradict previous studies that found positive associations between MMH and child health.

### **Lost But Not Forgotten: The Discovery of an Early Colonial Family Cemetery in Ontario**

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Burial in 19th-century southern Ontario occurred in both designated cemeteries and family plots that often went unregistered. When families moved away the dead were usually left undisturbed, with succeeding landowners often unaware of the burials or, in some cases, choosing to remove gravestones. As modern development spreads out from major metropolitan areas, these historical farmsteads are undergoing archaeological assessment and new developments, leading to the recovery of these early family burial plots. The lack of maintenance of these plots and the high turnover of land ownership makes it difficult to identify the individuals in these graves, resulting in little archaeological evidence. Compounding this problem is the fact that most excavations of 19th-century Ontario homesteads are done as part of CRM, meaning that even when identifiable data is recovered, it is often hidden? in unpublished reports. This presentation discusses ten burials discovered during the construction of a new subdivision north of the Greater Toronto Area. Construction of a sewer line led to the disturbance of ten individuals within coffins and a single tombstone. Excavation of the undisturbed remains, screening, and collection of the disturbed elements took place over a two-month period. This presentation uses this example as a case study of how CRM data can (and should) be used to increase our knowledge of individual lives in 19th-century southern Ontario. Through combining bioarchaeological and archival data from the historical record we can begin to give voice to these individuals, who would otherwise have not been identified.

## **A Herder Burial in a Shell Midden? Identifying Nuances in Herder Cultural and Subsistence Indicators**

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The introduction of pastoralism into southern Africa roughly 2000 years ago is poorly understood due to the paucity of evidence for herders on the landscape. It is generally agreed that the earliest domesticates arrived in the region from East Africa via the west coast of Namibia, following a southerly route through Namaqualand into the Cape. Based on Smith's 1991 criteria, South African pre-colonial herder sites are defined by assemblages containing large ostrich eggshell beads, expedient informal lithics, potsherds, and domestic remains. However, continued research in the region is revealing that the oversimplified nature of this definition ignores the possibility for a dynamic and fluid interaction between pastoralists and hunter-gatherers. Although human remains are rare in Namaqualand, the differences between herder burials (seated cairns) and hunter-gatherer burials (side flexed position), grant a unique opportunity to assess how this fluid interaction impacted material culture. To evaluate this disparity, an in-situ seated burial and associated material culture from the archaeological site AK2006/006 is currently being analyzed. Dated to 650 BP, AK2006/006 is an exceptional shell midden due to its relatively large size (166 m<sup>2</sup>), the presence of an intact burial with grave goods, as well as its sizable archaeological (60 pottery sherds, 86 ostrich egg shell beads, and 9378 stone artifacts) and faunal assemblage dominated by cape fur seal (*Arctocephalus pusillus*). Although faunal analysis is currently underway, the assemblage has yet to produce any domesticate remains. Thus, while the burial provides evidence for a herder site, the associated material culture does not meet Smith's definition. Therefore, we believe that AK2006/006 can be used to examine subtle changes in cultural indicators and provide an updated framework able to identify nuances in herding economies if domesticate remains are not left behind.

## **Reduced Nutritional Intakes in Diademed Sifakas (*Propithecus diadema*) in Degraded Habitat are Reflected in Morphometrics and Growth – and Help Identify Habitat Thresholds**

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Habitat change can have a range of impacts on primates, from extirpation to no change, to improved health. Even when lifestyle shifts are seen (e.g., diet, ranging, social behavior), it is often not clear whether this represents decreased population health, or simply behavioural flexibility; being able to discern between these alternatives is important for conservation efforts. We present body mass and morphometric data from live capture of diademed sifakas (*Propithecus diadema*) over 18 years at Tsinjoarivo, Madagascar (171 captures, 105 individuals). Captures spanned 10 groups, with 81 in largely intact, continuous forest ("CONT") and 90 in degraded fragments ("FRAG") groups. Previous work has shown sharp declines in energy and protein intake with increasing fragmentation/degradation; we predicted that this would cause reduced mass but not length in FRAG adults, and reduced mass and length in FRAG immatures. For adults, few linear measurements varied between CONT and FRAG groups: FRAG trunks were longer, and body length, leg and ulna showed a site-by-sex interaction. Strangely, all differences were largely driven by small CONT males. Mass showed no effect of site, but body condition index, circumference measurements, and testicle width and volume were lower in

FRAG groups. Linear mixed models for immatures aged 1-4 showed no effect of habitat (CONT vs. FRAG) on any measurements; variation at a given age was surprisingly high, perhaps reflecting year-to-year environmental variation. Using “Home Range Quality Index” as a covariate rather than a CONT/FRAG dichotomy revealed a threshold effect. The two FRAG groups in the most degraded habitat showed low adult mass and condition (wasting), and low immature mass and body length (stunting). The poor growth outcomes in the worst habitats follows our predictions, but some FRAG habitats are apparently viable habitat for sifakas, as evidenced by “normal” growth trajectories. The odd results for adults (short CONT males), defy easy explanation. We suggest they are not due to evolutionary change, given the recent nature of habitat loss and fragmentation; possible causes include nutritional shortfalls and locomotor forces during ontogeny. Finally, it is possible our individuals are not independent samples, if animals in nearby groups are closely related.

### **Paget’s Disease of Bone from a Byzantine Monastic Crypt in Jordan: A Histological and Micro-CT Analysis**

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Paget’s disease of bone (PDB) results from excessive osteoclastic activity that initiates an osteoblastic response that cannot be constrained by the normal osteoblast-osteoclast coupling during remodeling, producing drastically increased and haphazard bone remodeling. Primary skeletal manifestations include thickened cortical bone and woven-like trabecular bone, large osteoclasts with inclusion bodies, heightened numbers of osteoblasts, a general disorganized appearance of bone, lytic lesions, and vascular inclusions throughout all levels of the bone. PDB is one of the most common metabolic bone diseases in contemporary populations, although it is rarely reported among those of non-European ancestry in Africa and the Middle East. PDB has been present among humans since the Roman Period (1-400AD), with the earliest cases identified by histological analysis in northwestern Europe, corresponding with clinical patterns. Macroscopic evaluations extend PDB to the Neolithic (3500-2000 BC) in more southerly European locations. This study details a case of PDB of an adult male (MNR-EN, Skull 3), with abnormally thickened cranial vault bones (17mm), from the monastic crypt at Mount Nebo, Jordan (~late-4-7th C AD). Micro-CT imaging and histological sections of the bone samples demonstrated an abnormal pattern of bone remodeling, with atypical osteon formation, convoluted and enlarged trabeculae, and an overall pattern of highly vascularized bone. Polarized microscopy shows a mix of woven bone and lamellar bone, the mosaic pattern of atypical bone remodeling indicative of PDB. Coupled with the dense, thickened nature of the vault bones, these data suggest that the individual had PDB. Stapedial footplate fixation (SFF) was observed by endoscope in the right temporal bone. SFF has been associated with conductive hearing loss in a small group of modern PDB cases; whether or not this compromised the individual’s hearing remains unknown. The absence of the postcranial elements limits the assessment of complications resulting from PDB or other disease processes, although many individuals with PDB are asymptomatic. Strontium and oxygen isotope values indicate that the individual was indigenous to the Mount Nebo region. To our knowledge, this represents the earliest paleopathological evidence of PDB in the Middle East supported by micro-analysis. (Wenner-Gren #8029).

### **MorphoPASSE: The Morphological Pelvis and Skull Sex Estimation Database**

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Sex estimation is arguably the most important aspect of the biological profile because many methods for the estimation of the remaining biological profile parameters (ancestry, age, and stature) are sex specific. Bioarchaeologists and forensic practitioners alike tend to prefer morphological methods because of ease of use, lack of equipment, and the timely manner in which data can be collected and

analyzed. Because of these perceived benefits, morphological methods for sex estimation have been updated within the last decade to become more reliable and valid, yet more work remains. Recognizing Sex estimation is arguably the most important aspect of the biological profile because many methods for the estimation of the remaining biological profile parameters (ancestry, age, and stature) are sex specific. Bioarchaeologists and forensic practitioners alike tend to prefer morphological methods because of ease of use, lack of equipment, and the timely manner in which data can be collected and analyzed. Because of these perceived benefits, morphological methods for sex estimation have been updated within the last decade to become more reliable and valid, yet more work remains. Recognizing this need, this research introduces a morphological database for sex estimation: MorphoPASSE. To create the database, morphological skull and pelvic data for eight popularly used traits have been collected from a sample of over 2,000 individuals to examine classification accuracy (validity), observer reliability, temporal change, population differences, and asymmetry for the popular Walker (2008) and Kales et al. (2012) sex estimation methods. Data were collected throughout the U.S. and internationally and included both modern and historic populations. The results of this research have culminated in the creation of the Morphological Pelvis and Skull Sex Estimation Database, which will be available in late 2018. The database is free and allows practitioners to enter skull and pelvic trait scores for their unknown individual. The practitioner will be able to select the most appropriate reference population and temporal period for which to classify their individual using multivariate logistic regression equations. The results will include a sex estimation with associated probabilities for the individual being classified. The database platform is hosted in an R and R Studio package, as well as, via a web based shinyapps.io URL that can be accessed via [www.MorphoPASSE.com](http://www.MorphoPASSE.com). The research is supported by U.S. National Institute of Justice grant #2015-DN-BX-K014.

### **The Sarasins' Collection of Sri Lankan Skeletal Material**

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Early European explorers studied and collected skeletal remains of diverse ethnic groups they encountered in their travels and expeditions. The Sarasins cousins of Switzerland visited Sri Lanka (then Ceylon) on five occasions between 1883-1925. Their first visit was primarily a zoological expedition. In their latter visits the Sarasins' focus was on anthropological research on the indigenous Vedda people and the exploration of prehistoric settlements of the island. Among the data and collections acquired by the Sarasins are about 400 artifacts, 500 photographs and skeletal remains of over 90 individuals affiliated with diverse ethnic groups of Sri Lanka. The ethnic groups represented in the Sarasins' collection include the Vedda, Tamil, Sinhala and Rodi people. Of these groups, the indigenous Vedda people of Sri Lanka have been highlighted for study by the Sarasins, as a society and a life way on the verge of extinction and a larger sample of Vedda artifacts and skeletal material had been collected. This collection constitutes the largest collection of Vedda skeletal remains curated in any single museum collection. The skeletal series is also unique due to the completeness and integrity of specimens, where many individuals are named, aged and sexed by the collectors. We present basic descriptive statistics and observations on the Sri Lankan skeletal material collected by the Sarasins, curated at the Natural History Museum in Basel, Switzerland.

## **Taking the Lab to the Field: A Reversal Learning Experiment with Wild Vervet Monkeys (*Chlorocebus pygerythrus*)**

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The transfer index (TI) task is a reversal learning experiment that was originally proposed by Rumbaugh to track the evolution of cognitive abilities across nonhuman primate species in a standardized way. Animals are first trained to a predetermined accuracy criterion on a two-choice discrimination task, using classical conditioning methods (a rewarding S+ stimulus, and a non-rewarding S- stimulus). Once trained to criterion, the reward contingencies are reversed (S+ becomes non-rewarding, and S- becomes rewarding) in a series of reversal trials. An overall "TI" score is calculated from the number of correct responses in the reversal trials, which is thought to indicate whether an animal is using cognitively simple associative mechanisms or more complex "rule-based" learning mechanisms. Great apes routinely score highly on the task, indicating rule-based learning abilities, whereas other primates score at levels consistent with associative learning abilities. Although the task has helped to elucidate variables correlated with cognitive ability (such as phylogeny and age) the task has never been conducted with wild primates of any species, limiting the ecological validity of these results. We conducted a TI task with 5 wild vervet monkeys (*Chlorocebus pygerythrus*) ranging in age from juvenile to adult at Nabugabo, Uganda. Each monkey completed 10 transfer index problems at each criterion condition (67 and 84%). TI values were calculated based on each set of 10 problems for each monkey, and then compared at the two criterional conditions using Wilcoxon tests. Results showed that like other monkey species, vervets are most likely associative learners. This study demonstrates how typically lab-based experiments can be modified to be effectively conducted in the field.

## **A Possible Case of Paget's Disease of the Bone from Sanisera, Spain\***

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Cases of Paget's disease of the bone have been primarily found in northern European and British populations. However few cases to date have been identified in the Mediterranean portions of the Roman Empire. The remains examined were recovered from the site of Sanisera, an important trade centre on the northern coast of Menorca dating to 123 BC. If this is indeed a case of Paget's disease it could represent contact between populations of Menorca and northern Europe. This poster presents a possible case of Paget's disease of the bone from the late Roman era site of Sanisera Spain.

Fragmentary human skeletal remains of an adult, excavated from necropolis IV adjacent to the basilica are dated to between the 5th and 7th centuries AD. This individual was examined macroscopically for morphology beyond the normal range of variation. The bones of the upper and lower limbs exhibited unusual thickness with disorganized and coral-like bone deposition. Through differential diagnosis, hyperphosphatasia, fibrous dysplasia, leontiasis ossea, and Paget's disease were compared. While Paget's disease and hyperphosphatasia exhibited the most similar patterns of disease to our case study, hyperphosphatasia has been known to only affect juveniles. This leads us to believe that the individual likely represents a case of Paget's disease of the bone. For more conclusive results, in future we hope to conduct radiographic and histological analyses of the skeletal remains.

### **Dynamics of Aggressive Interactions in Multi-Male Groups of *Colobus vellerosus*\***

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**Introduction:** In group-living species, male competition for status is driven by individual aggression. Aggression is not distributed equally among all males; individuals compete more vigorously with certain opponents, due to differences in opponent strength, or the potential benefits of defeating them. I investigate how rank relationships affect male aggression patterns in multi-male groups of *C. vellerosus*. **Methods:** I conducted 10-minute focal observations on adult males (n=15) in 3 multi-male groups of *C. vellerosus*. Male group membership changes resulted in several separate periods of analysis. I calculated individual dominance ranks for each period by averaging Elo-ratings per study day, based on the outcome of displacements (n=292). I calculated aggression rates directed by focal males towards each specific co-resident male per period. Also, for each separate focal that contained focal male aggression, I calculated aggression rate directed by the focal male towards his opponent. I constructed GLMMs to assess how rank distance (higher rank – lower rank), and combined rank (ranks added) of dyads affected aggression rates and the proportion of focals in which dyad members interacted aggressively. **Results:** A male's rank was positively correlated with his overall aggression output per period (p=0.001). Combined rank of dyads was positively correlated with dyadic aggression rate per period (p=0.005), and individual aggression rate directed towards each male over the study period was positively correlated with the combined rank of actor and target (p=0.006). Rank distance did not correlate with aggression rates. Aggression rate per focal was not correlated with rank distance or combined rank of focal and target. The proportion of focals containing aggression between dyad members was positively correlated with their combined rank (p=0.001), though not their rank distance. **Conclusions:** That combined rank of dyad members, rather than rank distance, is driving patterns of aggression in male *C. vellerosus* suggests that aggressive interactions are primarily engaged in by dyads of higher ranking males. Males closer in rank are not uniformly more aggressive at all rank levels. Higher aggression rates are driven by a greater tendency for higher ranking dyads to engage in aggressive interactions, rather than by higher rates of aggression over shorter timeframes.

### **Pathogens in Public and Private Toilets: Intestinal Parasites from Roman Latrines at Ephesus, Turkey\***

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Despite the introduction of latrines and increased sanitation measures, human intestinal parasites are thought to be widespread throughout the Roman Empire. However, we still have little evidence for intestinal parasites in many Roman provinces due to a lack of studies in these regions. To improve our knowledge of the parasite species in Roman period Asia Minor, intestinal parasites were investigated using faecal material from public and private latrines and the harbor canal sediment at the site of Ephesus, Turkey. Sediment samples from the drain of a public latrine (5/6th c.AD), located adjacent to a bath complex, and mineralised material adherent to the sides of a private house latrine (3rd c. AD) were studied for the presence of parasite eggs. Each sample was processed and viewed with digital light microscopy to visualize any preserved parasite eggs indicative of infection of individuals using the latrine. Human roundworm eggs were found in samples from the public latrine, human whipworm eggs were found in the private house latrine, and the harbor canal sediment (2nd c. BC– ca. 5th c. AD)

contained both whipworm and roundworm eggs (at a ratio of 19:1). Roundworm and whipworm are the two most common intestinal parasites found in the Roman Empire, and they are both spread by the contamination of food and drink by human faeces. However, this is the first site where we have been able to directly compare differences between infection in individuals using private latrines and those using public latrines at the same site. Despite the large number of travellers to Ephesus, as the capital of its province, and a major port city in the Roman Empire, we do not see much diversity in parasite species found in these three areas of the city. Interestingly, the range of parasite species was considerably less than has been found in northern Europe at the same time period, and we discuss potential explanations for this.

### **Oral and Sinus Infection Among Okhotsk Marine Foragers of Northern Japan**

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Okhotsk marine foragers occupied northern Hokkaido (Japan) between the fifth and twelfth centuries AD. While contemporary with the Satsumon incipient agriculturalists further south (i.e., on southern Hokkaido and Honshu Islands), the Okhotsk appear to have relied heavily on hunting and fishing, particularly of marine resources. A recent analysis of carbon and nitrogen isotopes from human remains recovered from the Okhotsk site of Moyoro suggests that adult males in this part of northeastern Hokkaido may have consumed more variable diets, including more terrestrial foods, than females (Tsutaya et al., 2014). One possible explanation for this difference focuses on greater accessibility to food resources by males, reflecting cultural or behavioural factors negatively affecting females. This paper presents new data on oral and sinus infection from an adult sample of the Moyoro site in order to examine possible differential frailty among males and females in light of these documented dietary differences. Periodontitis was found to be pervasive or nearly pervasive across the sample population; alveolar defects and antemortem tooth loss increased in prevalence and severity with advancing age, but did not differ considerably between the sexes. Sinusitis, on the other hand, was quite distinct in its distribution, appearing to be more common among young adult individuals—and particularly young adult males—than their more senior counterparts. In the context of several other studies suggesting better nutritional status among Okhotsk peoples (compared to earlier and contemporary Japanese populations) reflecting their overall rich marine diets, this preliminary study suggests that females at Moyoro were not negatively affected by potential sex-based dietary differences. Tsutaya, Naito, Ishida, Yoneda. 2014. Carbon and nitrogen isotope analyses of human and dog diet in the Okhotsk culture: perspectives from the Moyoro site, Japan. *Anthropological Science* 122(2):89–99.

### **More than Meets the Eye: Looking Beyond Flagrant Rickets in the Analysis of Vitamin D Deficiency at two Roman Period Sites\***

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Severe rickets can cause obvious deformity of the long bones; as such, it is a condition that can be visually identified, even into adulthood, in some individuals. In the past, individuals who experienced marked skeletal manifestations of vitamin D deficiency could have been identified by others in their society. These individuals have also been of significant interest to paleopathologists. However, less obvious changes linked to vitamin D deficiency, and particularly to osteomalacia in adulthood, have been much less visible both to individuals in past societies and to paleopathologists. Relatively recently developed criteria for identifying subtle pathological skeletal features associated with vitamin D deficiency in children and especially in adults have enabled paleopathologists to access information on

hitherto underrepresented individuals who experienced this condition. This paper discusses how the identification of a larger proportion of paleopathological cases enhances our understanding of the occurrence and experience of vitamin D deficiency in past populations, allowing us to construct a more nuanced picture of rickets and osteomalacia across the lifecourse. Updated criteria for identifying subtle macroscopic and microscopic evidence for vitamin D deficiency were applied to juvenile and adult skeletal remains from two Roman period sites, Ancaster (3rd to 4th centuries AD) in the UK and Isola Sacra (1st to 3rd centuries AD) in Italy. While the only readily identifiable historical evidence for vitamin D deficiency in the Roman period is represented by descriptions of deformity in the spine and the legs associated with rickets, skeletal evidence from Ancaster and Isola Sacra clearly indicates that Roman individuals experienced a broad range of skeletal changes resulting from deficiency throughout the lifecourse. Identifying potential cases of deficiency that were not observed using previous paleopathological criteria, and would not have been visually evident to other individuals in these Roman period communities, revealed that vitamin D deficiency played a part in individuals' disease experiences in ways that have not previously been recognized.

### **“He is Not Missing; He is Here.” – Identities Lost in the Ravages of War**

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In September 2012, a large-scale archaeological dig in anticipation of the construction of a 20 hectares industrial estate uncovered human skeletal remains and associated First World War artefacts in Thélus, Pas de Calais, France. Only a “CANADA” shoulder title was associated to the remains, no unit or personal identifiers. The location of the discovery, near Vimy, saw many battles during October 1916 to July 1917 while the Canadian Expeditionary Force was in the area. There are 3,426 missing Canadian servicemen commemorated on the Vimy Memorial from that period of time, leaving the range of possibilities too large for conclusive identification. This soldier was buried on 23 August 2017 in Canadian Cemetery No. 2, in Neuville-St. Vaast, France, as “A Canadian Soldier of the Great War. Known Unto God”. This paper discusses the process undertaken by the Canadian Armed Forces's Casualty Identification Program with assistance from the Commonwealth War Graves Commission to attempt to identify the remains discovered in this case and details the challenges and ongoing efforts to identify newly uncovered remains of the more than 27,000 Canadian soldiers with no known grave from 20th-century conflicts. In the First World War, 400,000 Canadians witnessed the ravages of war. Sixty thousand lost their lives, 20,000 of whom are missing with no known grave. So far, most of the cases presented to the Casualty Identification Program have been identifiable; however, the paper will discuss the limits encountered by the Casualty Identification Program as well as its new practices for inconclusive cases in the hopes that identification may be possible in the future. Typically, the discovery, identification and burial of missing soldiers' remains ensure that their individual stories endure the test of time. Sadly in some cases, those stories remain in the void even when the remains of the soldier are no longer missing.

### **Health Inequity and Spatial Divides: Infant Mortality during Hamilton, Ontario's Industrial Transition, 1880-1912**

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This paper empirically investigates multifaceted causes of infant health inequity by exploring historical connections between shifting economic activity, urban development, population change, and mortality. The purpose is to reveal the impact of changing socioeconomics on population structure and urban development, and the association of this impact on spatiotemporal mortality patterns. This research advances knowledge on the complex ecological interplay of population, behaviour, habitat, and subsequent health inequities, revealing a link between health disparities and economic transitions.

Examining Hamilton, Ontario, at two cross-sections (1880–1882 and 1910–1912), using infant samples provides a snapshot of life and death before and during heavy industrial activity. Mixed-methods use data from census and death records, health reports, photographs, and maps to construct a profile of demography, epidemiology, and the urban environment (physical, built, and social). Two major findings are identified: 1) industrialization played a major role in emerging human health ecology risks correlating to the infant mortality patterns; and 2) industrialization tended to increase health inequities amongst the infant population and across the city. The onset of predominately industrial economic activity caused further class divide, uneven urban development, and inequitable health outcomes. Statistical inquiry (multiple logistic regression) of the infant mortality sample revealed a temporal shift with an increased association between diarrhoeal mortality and infant age, and between infectious respiratory mortality and infant age. Results from Historical GIS inquiry indicate residential working-class sections were more unhealthy environments than other areas of the city. Historical documentation and photographs support these results, presenting the likelihood of a social disparity to health outcomes. The interplay between population, environment, and behaviour manifests into a spatiotemporal pattern of stressors related to socioeconomic status, urban development, and health disparity. Industrialization brought new stressors to Hamilton creating unequal opportunities for the rapidly growing working classes. Thus, without careful planning in urban development, concentrations of health risks lead to inequitable population health outcomes, especially those undergoing an economic transition, such as industrialization.

### **Prehistoric Women's Manual Labour Exceeded that of Athletes Through the First 5500 Years of Farming in Central Europe**

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Declining mobility and bone strength through time are often associated with the intensification of agriculture, though trends among women tend to be less pronounced than among men. For example, in Central Europe, prehistoric male agriculturalists (~5300 calBC–850 AD) demonstrate consistent diachronic declines in tibial rigidity and shape, while women in this region are characterized by low tibial rigidity and little temporal change in lower limb bone strength. Due to the potential for sex-specific skeletal responses to mechanical loading and a lack of modern female comparative data, women's activity in prehistory remains difficult to interpret. This study compares humeral and tibial cross-sectional rigidity, shape, and inter-limb loading among prehistoric Central European women agriculturalists and living European women of known behaviour (athletes and controls). Though highly variable, prehistoric female tibial rigidity at all time periods differed little from that of living recreationally-active women on average, and was significantly lower than endurance runners and soccer players. However, humeral rigidity among prehistoric agricultural women significantly exceeded that of all living athlete groups throughout the first ~5500 years of farming. Loading intensity among female agriculturalists was biased heavily towards the upper rather than lower limb: from the Neolithic through Iron Age, inter-limb strength proportions among women were most similar to those of living semi-elite rowers. These results suggest that rigorous manual labour was a more important component of prehistoric women's behaviour than was terrestrial mobility through thousands of years of European agriculture, at levels far exceeding that of modern women.

### **Discovering Bytown's Barrack Hill Cemetery: Archaeology in the Heart of Downtown Ottawa\***

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The Barrack Hill cemetery, located at the base of modern-day Ottawa's Parliament Hill, opened around the year 1828 and remained in use for approximately 20 years. Urban development and city expansion prompted the relocation of this cemetery, although several individuals, likely due to financial constraints on behalf of living relatives, were left behind. Looking forward to present day Ottawa, construction works are currently underway to build a light-rail transit system through the centre of the city (scheduled for completion in 2018). During the process of water main replacements in 2013, human remains were unearthed on Queen Street in the middle of downtown. A forensics investigation, followed by archaeological excavations, has led to the discovery of several in situ and disturbed human remains, remnants of the Barrack Hill cemetery. Over a century of construction has proven extremely invasive on these burials as the Barrack Hill cemetery became the forgotten cemetery of downtown Ottawa. The final resting place of these individuals has become secondary in importance to the urban development of the city, turning these early Ottawa residents into marginalized members of Ottawa's history. A particularly unexpected secondary burial of commingled remains, excavated in 2016, also highlights the seemingly unceremonious treatment that some of these individuals have undergone in the last century. Archaeological exploration of this cemetery has turned attention back to those who were forgotten for many years, and continues to show the importance of diligent archaeological practices in cultural resource management.

### **Pediatric patients and liminal liabilities: hospitalized children in long eighteenth century London, UK**

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The presence of children in English voluntary hospitals during the eighteenth century has only recently come under academic scrutiny. The London Hospital, in its 1762 instructions to those recommending patients for admittance, explains clearly that children under the age of seven are not to be admitted to the hospital except in cases of fracture, amputation, or cutting for the stone. Surviving admission registers were examined; of the 3577 inpatients accounted for, 161 were children (defined here as those age 13 and under). The surviving admission records of the London Hospital were examined to illuminate the hospital stays of pediatric patients; despite the aforementioned rule, children were indeed accepted as inpatients for a range of conditions outside of those outlined, including circulatory disorders, respiratory diseases, neurologic issues, infectious diseases, and skin conditions. The most common category for admittance was trauma; children were brought to hospital with fractures ranging from closed arm fractures to complex compound femoral fractures. Despite the poor reputation of eighteenth-century hospitals, the inpatient records reveal that 80.7% of the pediatric patients were discharged as 'cured'. In most cases young patients stayed in hospital long enough for significant fracture healing to have taken place. This paper explores the conditions surrounding children's admission to hospital, their length of stay, the recorded result of their stay, and which medical issues drove their parents or guardians to seek medical attention for them. This research is the first to examine the London Hospital records, illuminating the morbidity and health risks facing children of the working poor. Further comparative work with bioarchaeological datasets will continue to deepen our understanding of this heretofore marginalized group.

## **Under-Represented Pathogens in the Archaeological Record: Integrating Ancient DNA Techniques Within a Multi-Faceted Framework**

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Microbes interact with humans in complex ways, and the outcome of this interaction ranges from commensal to infectious, depending on individual susceptibility that is further framed within a particular biosocial context. The idiosyncratic nature of ancient pathogen DNA and dynamic mechanisms of pathogenesis means that not all microbes are equally retrievable, which has implications in reconstructing health and disease in the past. I will discuss how the investigation of under-represented pathogens through targeted hybridization capture or parallel pathogen detection strategies can complement our understanding of the lived experience of disease in the past, whether molecular signatures of ‘pathogens’ are detected or not. This complementarity is enhanced by the integration of multiple evidentiary sources (skeletal, historical, and archaeological) to illuminate aspects of disease ecology and human-environment interactions (e.g., land use patterns, such as agriculture or infrastructure activities). I also highlight the potential of harnessing ancient human genomes to explore the scope of human adaptations to novel and changing pathogen landscapes.

## **Changes in Fracture Morphology Over the Early Postmortem Interval of Buried Juvenile Pig Ribs\***

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Forensic anthropologists are often faced with the challenge of determining fracture timing based on bone characteristics when analysing skeletal trauma. Bone fracture characteristics used to differentiate between perimortem and postmortem fractures are discussed in terms of occurring in “fresh” bone versus “dry” bone and yet it is still unclear how long into the postmortem period bone can retain its fresh fracture characteristics, particularly in juveniles. Little experimental data have been generated about rib fracturing, despite the fact that rib fractures represent one of most common occurrences among pediatric deaths. This study uses a juvenile porcine model to examine the relationship between the length of the postmortem interval (PMI) in buried environments and changes in the morphology of rib fractures. Suckling piglets (*Sus scrofa*) aged approximately between two and eight weeks were used. Their ribcages were manually disarticulated and grossly defleshed, and each ribcage was divided into right and left halves. Three half ribcages were buried in a soil filled container (sub-sample = 45 ribs), and a total of 14 soil filled containers were studied over a period of 10 months. The first four sub-samples were collected one week apart, the subsequent two sub-samples 2-weeks apart, and the remaining 8 sub-samples 4-weeks apart, in a total of 14 trials. Individual ribs from each trial were fractured experimentally using a three-point bending test. Selected ribs in each sub-sample were examined for several fracture morphology characteristics, such as the type of fracture, fracture outline, fracture angle, fracture surface, plastic deformation and splintering. Results show a predominance of incomplete transverse (greenstick) fractures for the first two weeks of the PMI. After the second week, a mixture of fracture types and outlines is seen and no discernable changes from more “fresh” to more “dry” gross macroscopic characteristics are observed throughout the early PMI. These results suggest a persistence of fresh bone characteristics in juvenile ribs long into the PMI, consistent with previous studies findings. However, because of ribs normal curvature and thin cortical bone, particularly in very

young juveniles, rib fracturing cannot be directly compared to better known adult long bones biomechanics.

### **Repatriation of Human Remains in Alberta: An Individual Journey of Discovery and Understanding**

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In September 2007, the United Nations Assembly adopted the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP). Article 12:1 establishes “the right to the repatriation of their human remains” and further it is noted in Article 12:2 that “states shall seek to enable the access and/or repatriation of ceremonial objects and human remains in their possession through fair, transparent and effective mechanisms developed in conjunction with Indigenous peoples concerned.” As a technologist and later as a curator and professional consultant, I have been involved in the repatriation of 52 individuals distributed in six unique situations between 1995 and 2017. Depending on my professional position, my involvement in the process varied and I was able to learn something valuable with each situation and some very important lessons have been learned over these 22 years. As we all move towards the repatriation of our human remains collections, it is essential to learn from past experiences in order to participate in a respectful and successful repatriation. To that end, I felt it was time to share with the broader community some of the valuable lessons I have learned from the process as well as from the various individuals within the Indigenous community.

### **Revisiting Dietary Change at Sierra Blanca, New Mexico, AD 900 to Post-1400\***

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The transition to increased sedentism in the prehistoric American Southwest coincided with subsistence changes in many areas. This paper examines human diet from seven archaeological sites located in the Sierra Blanca region of New Mexico that span this particular transition to determine whether similar dietary changes occurred over time. These sites were excavated as part of the Capitan North Project, headed by the late Dr. Jane Kelley. In 1991, she and Dr. Anne Katzenberg published the stable carbon and nitrogen isotope values of human and faunal bone collagen. Most of the original material has been recently re-analyzed and these results, as well as the values of an additional 22 human individuals, are presented here. The Capitan North Project involved multiple lines of research, including faunal analysis. Based upon this, we would expect a shift towards higher stable carbon isotope values as the cultivation (and consumption) of maize increased. An increase in stable nitrogen isotope values would support evidence of changes in hunting and animal consumption practices. For the 67 human individuals, the stable carbon isotope values remain relatively stable from the earlier cultural phases to the later phases, with a range from -10.0‰ to -6.0‰ and a mean of -8.0‰ (PDB). The values are quite high for some individuals and are consistent with C4 resource consumption, both plant- and animal-based. Although C4 resource intake appears relatively stable over time, an increase in maize cultivation for trade rather than consumption cannot be ruled out. The stable nitrogen isotope values range from 6.6‰ to 13.4 ‰, with a mean of 9.9‰ (AIR). The means increase slightly during subsequent cultural phases, which supports the faunal evidence indicating varying reliance on animal meat and a shift towards scheduled spring hunting at the later sites. Overall, these data provide supporting evidence for dietary changes during the periods of increased sedentism in the Sierra Blanca region. Maize cultivation may have increased either for consumption or for trade, and animal consumption patterns do appear to have changed in later phases, indicating more reliance on meat.

## **Red-Green Colour Vision Increases Fruit Intake Rates of Wild Capuchins (*Cebus capucinus imitator*)**

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Despite clear foraging differences in captive experiments, evidence of trichromatic advantage to wild primates has been surprisingly elusive. Here we undertake a comprehensive examination of the fruit feeding efficiency of 72 dichromatic (red-green colourblind) and trichromatic white-faced capuchin monkeys (*Cebus capucinus imitator*) in four social groups over 14 months. We analyse 19,043 feeding events within 1,602 foraging bouts across 27 unique plant species. Controlling for plant species, monkey ID, and social group, we find that ripe fruit index ( $p=0.049$ ) and monkey age class ( $p=0.043$ ) significantly impact fruit intake rates, while sex does not. We also find a significant interaction between colour vision type and fruit colour ( $p=0.006$ ). Trichromats have higher intake rates than dichromats for plant species with yellowish-to-reddish (conspicuous) fruits ( $p<0.001$ ) but not for species with dark or greenish fruits ( $p>0.05$ ). Conspicuous fruits comprise ca. 80% of the annual capuchin fruit diet. This study provides clear evidence of trichromatic advantage in close-range fruit feeding in wild monkeys. Taken together with previous reports of dichromatic advantage for finding cryptic foods, our results illuminate an important aspect of balancing selection maintaining primate opsin polymorphism.

## **Microbotanical Proxies in Palaeoanthropology: The Stone Tools, Diet, and Sociality Reference Collection at the University of Calgary as an Underutilized Resource for Canadian Bioanthropologists**

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For over twenty years, our research group has collected botanical samples from phytochoria in Central, West, Southern, and East African nations; including Angola, Botswana, Burundi, Cameroon, D.R. Congo, Equatorial Guinea, Ivory Coast, Kenya, South Africa, Swaziland, Tanzania, Uganda, and Zimbabwe and more. Our collection represents about 100 families and more than 500 species, and includes various plant tissues (bark, leaf, grain, bean, fruit, nut, rhizome, root, seed, and tuber). Modern referentials play a key role in establishing baselines that galvanize multidisciplinary work. For example, we use this resource to explore new fields in palaeoanthropology comprising primate archaeology, hominin ecology (ethnobotany), phytolith studies, starch analysis, analytical and organic chemistry (FTMS, PyGCMS, Stable Isotopes), and the application of cutting-edge instrumentation (SEM, TEM, Spectroscopy) to archaeological problems. A growing dataset demonstrates that stable isotope variations exist between and amongst tissues of the same plant, such as fruits, seeds, and leaves. With our extensive collection, we are able to contribute to this dataset by measuring bulk isotopes (carbon and nitrogen) in order to analyze variations amongst different plant parts, but also from plants growing in diverse ecoregions. In addition, by using referential material from roots, nuts, and legumes,

we can characterize the isotope values of modern species, and use preliminary results to explore dietary variability in relation to human evolution. The University of Calgary's extensive collection is an invaluable resource to ethnobotanists seeking to delimit the Linnean taxonomic designation of their botanical collections. Furthermore, by working with the communities who live amongst and utilize the samples we collect, we can understand human ecological situations that such communities navigate and preserve for future generations the multifaceted and sophisticated categorizations, preparations, and uses of botanical specimens. This presentation will illustrate the types of research topics that palaeoanthropologists explore through the use of microbotanical proxies; and encourage members of the Canadian Association for Physical Anthropology to collaborate on research that utilizes the University of Calgary's plant reference collection; a rich database open to everyone.

### **Habitat Choice Patterns in Crowned Lemurs (*Eulemur coronatus*) Reflect Spatially Flexible Responses to Anthropogenic Disturbance and Poor Ecological Quality\***

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Anthropogenic-driven loss of forest habitats across Madagascar has resulted in the degradation and fragmentation of much of the island's original extent of forest habitats. As anthropogenic pressure and forest loss continue, it has become increasingly necessary to properly assess whether forest habitats that exhibit poor ecological conditions and immense human influence possess the necessary characteristics to effectively sustain endangered lemur populations. If properly managed, there is much potential for these types of forest habitats to contribute to the expansion of conservation efforts in Madagascar by serving as the backdrop for small-scale, community-based projects. However, this ultimately depends on whether or not these habitats are of sufficient quality for effective conservation. To this end, we address this uncertainty by exploring how the habitat choice patterns of a small population of crowned lemurs (*Eulemur coronatus*) occupying a degraded forest fragment, located within the protected area of Oranjia Conservation Park in northern Madagascar, are realized by the influence of ecological and anthropogenic factors. Specifically, we present quantitative assessments of the availability of key ecological and environmental resources, as well as the variation of the intensity of anthropogenic influence that characterise this site. To examine this, we developed an ecological niche model (ENM) in MaxEnt, using presence-only data gathered during the summer-season of 2016 and high-resolution background variables detailing anthropogenic and ecological aspects of the site, to determine: i) how the local *E. coronatus* population is distributed within the site based on these factors; and, ii) how well this site can sustain the crowned lemur population. Our results show that *E. coronatus* displays a spatially flexible response to high levels of disturbance; this indicates that their occurrence across the site is a product of their need to maximize foraging opportunities while also avoiding environmental and anthropogenic stressors. Furthermore, this research shows that degraded forest fragments can play an important role in the conservation of wild lemur populations, as long as management of these forest habitats proceeds with ample consideration of the socio-ecological realities that shape anthropogenic pressures and ecological forces.

### **Outliers in Age Estimation: Who Are They?**

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When skeletal remains are found, estimating age at death is an important part of the biological profile. Age estimates can include or exclude individuals in forensic cases, and age estimates are relied upon to create demographic profiles of past populations. A survey of practicing biological and forensic anthropologists found that 62.2% simply used the age range presented by the method when providing a

final age range for an individual using one method (Garvin & Passalacqua, 2012). For the Suchey-Brooks pubic symphysis method, these ranges can be almost 60 years (for example, the age range for females scored as a phase 5 is 25 to 83 years). In the distributions of the Suchey-Brooks phases, there are often only one or two individuals at the ends of the age ranges, yet they strongly influence the final estimates. Who are these outliers? And why do they look different from other individuals of a similar age? This study analyzes a sample of 420 CT scans of cadavers from the Victorian Institute of Forensic Medicine. Individuals were assessed using the Suchey-Brooks scoring system. Once they were placed into a phase, each individual was scored for “correctness”: that is, did they fit into the age range provided by the method? And, if so, where did they fit on the distribution of ages for the phase? Data on occupation, medical history, cause of death, and body size were available for each individual, and this presentation will explore who these outliers were, and strategies we can use to mitigate their impact on our age estimates.

### **The Differential Diagnosis Conundrum: A Bioarchaeological Perspective**

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This case study highlights the difficulties inherent in the analysis of human skeletal remains that exhibit morphology beyond the range of normal. It uses microscopic and histological analyses to further delineate a potential diagnosis and to extend inferences of more traditional lines of evidence. The remains of an older woman recovered during rescue excavation of burials associated with an early Mennonite community in southeastern Manitoba were examined macro-and microscopically. Analysis revealed multiple inflammatory lesions throughout the skeleton. Initial investigations in the mid 1990s suggested venereal syphilis to be the closest diagnosis that “made sense” within a strict palaeopathological framework of the time. However this result was discordant with the knowledge of the cultural context. Following a bioarchaeological theoretical framework, this study combines microscopic analyses of tibial and fibular lesions, early 20th century clinical treatises, extensive knowledge of lifeways of early 20th century Manitoba Mennonites, and more recent macroscopic diagnostic criteria to lead to a new and different potential diagnosis. This paper highlights the complexities of diagnosis of diseases identified solely from skeletal remains. Furthermore it emphasizes bioarchaeology as a synthetic, holistic discipline that incorporates bone histology, macroscopic and radiographic observations, cultural context, and historical and clinical documentation.

### **The Relationship Between Proximal Epiphyseal Shape of the Femur and Humerus and Activity in Four Hunter Gatherer Populations\***

Meyers, J. (1)

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Long bone epiphyseal shape is thought to be highly regulated by genetic factors related to joint function, and thus limited in its plastic response in individuals. Certain aspects of bone morphology have demonstrated a plastic response to habitual mechanical loading. Diaphyseal cross-sectional shape, reflecting distribution of bone tissue, has been shown to be related to habitual loading regimes. Epiphyses are central components to joints, and therefore areas of biomechanical importance and major muscle attachment. This research investigated evidence for plastic response in epiphyses to habitual activity. A 3D Geometric Morphometrics approach was used to examine shape variation in the proximal epiphysis of the humerus (n = 91) and femur (n = 84) among four hunter-gatherer populations; Andaman Islanders, Indian Knoll, Point Hope Alaskans, and the Sadlermiut. Historical, archaeological, and ethnographic information has created robust activity profiles for each of these groups. Landmark configurations reflective of major points of muscle attachment were laid at 12 points on the proximal portion of each bone. These configurations were subject to Principal Component

Analyses, to determine shape variation within and among the samples. Diaphyseal polar second moments of area (J), reflecting torsional loading of the limbs, were used as an indicator of habitual loading. A bivariate regression analysis was conducted to examine the relationships between the shape Principal Components and J values in order to determine whether activity levels are related to aspects of epiphyseal shape. In the humerus, relationships were detected between J and PC 4, 7, and 15. In the femur, relationships were found between J and PC 1, 9, 12 and 23. The shapes represented in these PCs were associated with areas of biological significance, particularly areas of muscle attachments and those where high levels of force occur. This analysis demonstrates that epiphyseal shape, though still influenced by genetics and biomechanical constraints, is more plastic than previously understood.

### **Sex Differences in the Secular Change of Height and Weight among Affluent Portuguese School Children from 1913 to 2012**

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Secular changes in physical growth of children have been largely examined with cohorts consisting mostly of boys from the 20th century. Few studies have examined secular change among girls, and even less so have compared change between boys and girls. This is important because sex-specific growth trajectories and differential cultural treatment of the sexes affect the way by which girls and boys respond to changes in the ontogenetic environment. This study examined secular change in height (cm), weight (kg) and Body Mass Index (kg/m<sup>2</sup>) in affluent Portuguese school children from the three periods of time: early, 1913-1916, middle, 1929-1943, and late 20th Century, 1992-2012.

Anthropometric data was taken by school staff and nurses from the Colégio Militar (boys) and the Instituto de Odivelas (girls), from 10 to 17 years of age. Height, weight and BMI were plotted against age for the three periods to assess sex-specific changes and sex differences in the secular trend. Results indicate a similar pattern of secular change across boys and girls; wherein children measured in the Late 20th Century demonstrated a dramatic increase in height, weight and BMI, with the greatest increase occurring between the middle and late periods. Height and weight increases the most in boys between the ages of 13 and 15, while in girls the most dramatic differences between height and weight are observable between ages 10 to 12. In general, boys are slightly taller and weigh slightly more than girls during all periods, but changes in BMI across ages are noticeable. Generally, girls have similar BMI to boys until they go through puberty and their weight to height ratio, and thus BMI, increases. The general increase in height and weight has been attributed to changes to the socioeconomic environment in Portugal after the 1960's. It seems a similar trend to that of boys is observable in girls, which is surprising given the Portuguese historic level of gender inequality.

### **Is Knowledge Being Translated to the Public About the Developmental Origins of Disease Risk? The Mothers to Babies (M2B) Hamilton Study**

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Background: Non-communicable diseases (NCDs), including type 2 diabetes and cardiovascular disease, constitute leading causes of illness and death in Canada. Maternal nutrition during pregnancy influences a child's risks of developing NCDs later in life. The paradigm for investigating the early life origins of NCD risk, Developmental Origins of Health and Disease (DOHaD), has recently gained traction among health researchers and funders, but it is unclear whether DOHaD messaging is being translated to the Canadian public. Methods: To begin to address this, we evaluated the current state of

DOHaD knowledge (DOHADK) relative to General pregnancy health Knowledge (GK) in a socio-demographically diverse sample of pregnant women from Hamilton, ON. Respondents (N=77) completed a 169-item questionnaire designed to assess DOHADK, GK, and demographic characteristics. We generated 20-point scales to measure DOHADK and GK from responses (0-6=low medium=7-13 and high (14-20) knowledge of current evidence), and compared scale means and coefficients of variation (COVs). We also developed multivariate linear mixed effects models in which we regressed each scale on socio-demographic characteristics known to influence health (age, socioeconomic status, immigrant status, parity), adjusted for geographic clustering. Results: GK scores were higher (mean=14.3) and less variable (COV=0.08) than DOHADK scores (mean=7.6, COV=0.37;  $p=0.000$ ). GK scores were not associated with participants' socio-demographic characteristics. DOHADK scores, in contrast, were positively associated with socioeconomic status and parity. Conclusions: These findings suggest that lower socioeconomic status, multiparous women demonstrate less DOHADK. Policy and interventions aimed at increasing the translation of DOHADK to decrease NCD risk factors in the next generation of Canadians are needed and should prioritize families from these at-risk groups. Future challenges include developing the best practices in communicating the knowledge translation of DOHaD.

### **Indigenous Approaches to Knowledge Translation in Addressing Health and Mental Health Impacts from the 2016 Alberta Wildfire**

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Mainstream Knowledge Translation (KT) practices are incompatible with (or exclude) Indigenous health research principles. A key Indigenous research principle in Canada is that researchers must meaningfully engage with Indigenous people to ensure Indigenous knowledge is shared in a respectful way and is shared with context provided (of Indigenous knowledge, how it was shared, and with what intent). In community-based research, the use of a community advisory committee (CAC) can facilitate shared leadership, decision-making, and ownership over research. This paper will describe a qualitative case study that draws on multiple sources of data (interviews, meeting minutes, discussions, observations, and document review) to describe and discuss CAC members' experience working collaboratively across a community-based project to examine the health and mental health impacts to Indigenous peoples from the 2016 wildfire in Fort McMurray.

### **Evaluating Visual Cues of Parity in Two New World Monkey Species, the Emperor Tamarin (*Saguinus imperator*) and the Saddleback Tamarin (*Saguinus fuscicollis*)**

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The role that social and sexual selection plays in the evolution of colour vision and colour signals in Old World monkeys is well studied, but in the New World, this is a relatively new area of inquiry. This is unfortunate, as New World monkeys have an intriguing colour vision polymorphism; due to X-linked opsin gene variation, individuals can be either dichromats (red-green colour blindness exhibited in all males and some females) or trichromats (colour normal relative to humans, exhibited in heterozygous females). Interestingly, in some species, such as tamarins and marmosets, behavioural and hormonal suppression of reproduction in subordinate females occurs leading to intrasexual reproductive competition. By integrating study of colour signals and species-specific vision models, we

investigate the potential importance of colour in signaling parity status in two wild populations of New World monkeys species, the emperor tamarins (*Saguinus imperator*) and the saddleback tamarins (*Saguinus fuscicollis*). We conducted research at Los Amigos Biological Station, a field site at the Peruvian Amazon during the dry season. Fifteen tamarin females (six emperor tamarins; nine saddleback tamarins) were trapped following a well established field protocol. Spectral reflectances were collected using a spectrometer from two bare skin areas, the vulva and inner thigh. We modeled how the two skin areas are perceptually contrasting to the colour vision phenotypes present in our study species. We found that parous females show a higher colour contrast between genitalia and thigh compared to non-parous females. According to our models, this colour contrast can be perceived by conspecifics and be used as a reliable way of assessing the reproductive status of females. These results corroborate with previous studies conducted in Old World monkeys, and with recent research in a marmoset species that revealed subtle yet perceptible changes in genital colouration during pregnancy. This study is the first to investigate the potential importance of color in signaling parity in a New World monkeys species. Understanding the strategies used by these species to communicate their reproductive status can lead us to better understand their social dynamics and we can use these concepts further in primate's conservation.

### ***The Diagnostic Applications of Micro-CT to Palaeopathology: A Quantitative Study of Porotic Hyperostosis [abstract withdrawn]***

Morgan, J.

*The purpose of this study was to assess the value of micro-CT to palaeopathology for the non-destructive histological analysis of orbital porotic hyperostosis (cribra orbitalia), common lesions observed in many archaeological skeletal collections. The primary objective of this study was to quantitatively evaluate orbital porotic hyperostosis at the histological level to better understand disease pathogenesis and improve the differential diagnosis of these lesions. Sixty-six individuals obtained from four skeletal collections were assessed using micro-CT and methods of digital image analysis. The results of this assessment demonstrated that porotic lesions of the orbit are the result of a primarily resorptive process with increased osteoclastic activity leading to generalized bone loss. The volume of trabecular bone was significantly reduced and trabecular shape, thickness, and number were significantly affected in medium-severe active lesions ( $p < 0.05$ ). A similar pattern in mean value directionality was observed during early lesion development and healing, but significant changes to trabecular microarchitecture in these stages were not demonstrated. When these data were compared against radiographic and histologic data from clinical studies, and the specific palaeoecological context of the study sample was considered, a diagnosis of an anaemic condition was supported over other pathological conditions that may result in the development of orbital porotic hyperostosis. Based on the results of this study, it is clear that micro-CT is an excellent alternative to destructive histological techniques, is of high value for research in palaeopathology, and can improve our understandings of the pathogenesis of disease in bone.*

### **The Use and Abuse of Lead in Bioarchaeological Studies of Tooth Enamel**

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Lead trace element and isotope analyses have been used in bioarchaeological studies since the 1960s. Despite this length of time, there remain areas for improvement in data production and interpretation that could result in the development of more robust conclusions. Lead is a non-essential heavy metal present in low amounts within the natural environment, but anthropogenic practices can result in human exposure to higher, potentially toxic levels. The presence of lead within skeletal tissues have prompted bioarchaeologists to investigate themes such as health, mobility, and cultural affinity in past populations. While previous research has primarily used bone tissues as an analyte, more recently

researchers sample tooth enamel, which is more likely to retain a biogenic record of in vivo lead exposure and can be less affected by diagenetic contamination. Since teeth form during childhood and lead exposure reflects individuals' interactions with their physical and cultural environments, this tissue presents an intriguing means to examine experiences of the children themselves. Yet, there are significant theoretical and methodological factors that need to be considered while developing a research project. This study reviews the last 17 years of bioarchaeological research using lead trace element and stable isotope analyses, paying particular attention to sample choice, diagenetic checks, and environmental and cultural lead sources considered during interpretation. Neglecting these methodological and theoretical factors can produce problematic data and/or the misinterpretation of environmental and cultural factors that resulted in lead exposure of past populations. While there are concerns in the application of lead isotope and trace element analysis of archaeological human skeletal remains, as long as the limitations are acknowledged and extrapolation is done with caution, it is possible to obtain robust data with meaningful conclusions.

### **Bad to the Bone? An In-Depth Examination of Traumatic Lesions in Medieval Denmark**

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Traumatic lesions in skeletal remains can provide direct evidence of past behaviors and lifestyles. Specifically, they create a direct link from the person's own relationship with their physical and cultural environment, making trauma an ideal way to gather a more holistic and biocultural understanding of past populations. The main objective of this research was to examine age-related differences in traumatic lesions between urban and rural Medieval Danish populations. Most importantly, the age distribution of adults are represented by more precise and accurate estimates using transition analysis (Boldsen et al., 2012). Age-related differences between the two residence patterns are further informative of the change in activities and lifestyles between urban and rural adult individuals. This study compared 345 adult individuals from two rural (Nordby and Tirup) and two urban (Ole Worms Gade and Horsens Klosterkirk) populations from the 11th-19th centuries Denmark. Observed traumatic lesions ranged from fractures and sharp force traumas to joint dislocations. It was hypothesized that more trauma would be present in male individuals and the urban populations; further patterns of trauma in individuals would help in deducing specific activities. The trauma frequencies were calculated in several ways including bone, segment and individual counts, individual mean trauma counts, and mean multiple injury counts. These counts consider levels of preservation in making more accurate assessment of trauma lesions. The results of this study supported one of these hypotheses, observing a higher proportion of males with trauma in all four populations. The number of individuals who showed evidence of trauma did not differ significantly between the samples. Vertebral and femoral fractures were the most frequently represented traumatic lesions. Finally, more concise age groupings from the transition analysis showed evidence of individuals over 60 years of age with traumatic lesions.

## **An Osteobiography and Differential Diagnosis of a Young Chachapoya-Inka Child from the Cloud Forest in Leymebamba, Peru**

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In 1997, farmers near Leymebamba of Peru discovered a Chachapoya funerary site that included six complete chullpa burial structures, and the foundation of another. The chullpas contained over 200 mummy bundles, an estimated 1000 disarticulated and comingled skeletons, funerary offerings, and other artifacts. Unfortunately, looters slashed open many mummy bundles with machetes looking for valuables. Bioarchaeologist Sonia Guillén and archaeologist Adriana von Hagen led the collection/rescue of mummies and artifacts from the site and established Museo Leymebamba/Centro Mallqui, where the collection is housed. This paper discusses the macroscopic and radiographic examination of one subadult mummy from this collection, CMA 0026. Through a collaborative effort, we conducted an osteobiography and differential diagnosis on the basis of x-rays and gross observations. Dental development and diaphyseal length of the humerus suggest a developmental age of 3-4 years, and a soft tissue structure in the midline is suggestive of male genitalia. X-rays and macroscopic observation demonstrated the presence of a necklace with two shell beads under a cloth scarf and indications of insect activity during decomposition. Three distinct machete slashes revealed internal organs in the right side of the thoracic cavity and in the abdomen, demonstrating that the individual was not eviscerated (the common practice at this site). Macroscopic observation of area around the jugular notch and neck noted edematous soft tissue and a sub-cutaneous swollen mass that appeared to have ruptured. The lateral x-ray suggests the presence of pectus carinatum and Harris Lines. Differential diagnosis considered chronic asthma, pulmonary infection, and acute infection of the lymph nodes or tonsils. It is unclear whether the pectus carinatum was related to the pathological condition or whether it was the result of the mummification procedure which involved placing the individual in a tightly flexed position with ropes and wrappings holding the knees against the thorax. The consensus explanation for the edema and ruptured mass is that this was likely caused by a localized acute infection that may have led to the child's death. While we cannot identify the specific infection, tuberculosis presence in adults at the site is extremely high, so primary TB is a likely candidate.

## **An Examination of Long Bone Length for Age in Children from a Late 19<sup>th</sup> Century Cemetery Assemblage from Bologna, Italy\***

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Assessments of long bone length for age are frequently used to evaluate growth stunting, a physiological response to stress during childhood. From this and other stress indicators, insights can be gained into the socioeconomic status and general health of an individual, reflecting overall quality of life in the community. The current study presents the preliminary results of research into skeletal and dental markers of growth quality in children from the Certosa collection curated by the University of Bologna. This documented collection is comprised of individuals of known sex and age, who were

born and died in the late 19th to early 20th century, and who are known to have belonged to poorer socioeconomic classes. Seventy children (n=30 males, n=40 females) between the ages of 0.25-11 years at death were studied for markers of skeletal and dental development. The aim of the present analysis is to evaluate statural growth of impoverished Bolognese children from a narrow death cohort in relation to modern healthy individuals. Measurements of diaphyseal length of the humerus, ulna, femur and tibia were compared to corresponding data from the Denver, Colorado growth study (Maresh 1955, 1970). Results indicate that children from the Italian population followed a similar growth pattern to those from the Denver sample, however they appear to be shorter for age in comparison. Review of z-scores for each element found all diaphyses to be stunted in comparison to the Denver standard, however the distal segment of the upper limb and the proximal segment of the lower limb produced markedly lower values, potentially indicating a greater level of susceptibility to stress factors. Upon analysis of male and female cohorts, no significant difference is found in growth delay observed. Additional research will examine variation in long bone length for age as a function of early stress events, other indicators of stress at the time of death, and socioeconomic status of the individuals. This will provide a better understanding of how different aspects of social organization impact multiple markers of skeletal and dental growth quality, in concert.

### **Maternal Cortisol Levels Immediately After Conception and Stress Axis Programming in Girls and Boys**

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Maternal stress during gestation may affect in utero programming of the stress or hypothalamic-pituitary-adrenal axis (HPAA) with consequences for child development and subsequent disease susceptibility. As crucial epigenetic processes take place during this period, the first eight gestational weeks (early post-conceptional period, EPCP) may represent a critical window of vulnerability. To test this hypothesis we evaluated the relationship between mothers' EPCP cortisol levels, a biomarker of maternal HPAA activity, and their children's pre-pubertal cortisol levels. We quantified cortisol in first-morning urine specimens collected every other day from 22 mothers during the EPCP and daily from their pre-pubertal children for three weeks at age 11 as they started a new school term, a "natural" challenge. We also measured the children's salivary cortisol response to an experimental stressor. Maternal cortisol levels during specific EPCP weeks were associated with children's "basal" cortisol levels prior to the start of school and cortisol responses and habituation to the start of school and the experimental stressor. Some of these associations were modulated by the children's sex. This is the first study to evaluate the relationship between maternal EPCP cortisol and children's stress physiology. Our results suggest that EPCP stress may affect HPAA ontogeny and post-natal functioning.

### **Addressing Anomalies from the Past: Unmarked Graves and Burial Grounds at the Brandon Indian Residential School**

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This paper focuses on deaths and burials of children who attended the Brandon Indian Residential School (IRS), in Manitoba. The history and location of the Brandon IRS burial grounds has slowly eroded from the community's collective memory. Previous research investigated potential unmarked graves at the school site by using mixed methods including; archival research, qualitative interviews, Ground-Penetrating Radar (GPR), Electromagnetic Ground Conductivity (EM38), control burns, and aerial photography. Locally affected First Nation communities have identified repatriation as the next step moving forward. To complete this project requires collaboration with medico-legal agencies to

formally excavate unmarked graves on the school property. Any recovered skeletal remains will be utilized to construct a biological profile and DNA analysis will be explored to positively identify human remains. This investigation aligns closely with the recommendations of the Truth and Reconciliation Commission of Canada (TRC) that call upon governments to work with First Nations to commemorate unmarked cemeteries and respond to families requesting burial in their home communities. This research aims to advance the study of unmarked graves, serve as a model for those interested in addressing similar issues in their own community, and put meaning into some of the calls to action contained in the TRC's final report.

### **The Kids Aren't All Right: The Ontogeny of Handedness\***

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Unlike other primate species, all human populations show strong right-hand preference, and this makes the right upper limb skeletal elements more robust. However, little is known about how this patterning arises during growth in different skeletal elements. We explore how the frequency of right hand dominant individuals changes throughout development and when differences between sides become statistically significant. Individuals were divided into three cohorts: Cohort 1: 0.0-5.9 years old (yo); Cohort 2: 6.0-11.9 yo, and Cohort 3: 12.0-19.5 yo. Total cross-sectional area was compared for paired clavicle midshaft, humerus midshaft, distal humerus (35% of length from distal end), and ulna midshaft cross-sections. Differences in the frequency and magnitude of right and left dominance were assessed using plots of directional asymmetry against age and chi-square tests. Evaluation of statistical differences in total area between paired elements were conducted using the Wilcoxon signed-rank test. Differences in side-dominance emerge at different ages in different cross-section locations. Significant right-side dominance emerges at the humerus midshaft after age six, and at the distal humerus after age twelve. At the ulna, 62 percent of individuals older than 12.0 demonstrate greater right side robusticity and differences between sides are nearly significant ( $p < 0.1$ ). The clavicle midshaft does not demonstrate significant hand dominance by the end of adolescence. Results suggest the humerus shows the greatest sensitivity to asymmetric loading during development, particularly at midshaft. Greater right side robusticity of the ulnae and clavicles must arise in late adolescence or young adulthood, perhaps due to an increase in workloads. These findings have important implications for reconstructing behavior in juveniles and assessing handedness in evolutionary studies of the genus *Homo*.

### **The Bioarchaeology of Complex Hunter-Gatherers: An Illustrative Example from Ancient Southeast Asia**

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This paper explores the evidence for the emergence of complex behaviour among ostensibly sedentary hunter-gatherer communities in the past, using Southeast Asia as an illustrative example. The issue of the definition of complexity in a bioarchaeological sense, in the context of evidence for major archaeologically visible changes in human behaviour over time, is explored. Following an overview of the population history of the region, a range of possible reasons for the rise and success of complex hunter-gatherers are contrasted with the emergence of the first farming communities (starting c. 10,000 years ago), and concomitant massive demographic changes, in the same area. Throughout the discussion of the emergence of complex behaviours key catalysing factors, such as potential environmental (e.g. climate volatility and the effects of documented temperature rises of 2 to 4°C between 8-3,000 years ago) and anthropogenic (e.g. land clearance, wild plant and animal management), are examined. Finally, it is asked if any salutary lessons can be drawn from such ancient communities that adapted to and lived with the effects of climate change thousands of years ago.

## **Environmental Context and the Diet of Fauna and Hominins in the East African Pliocene\***

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The environment is a key aspect of human evolution and is often linked to adaptations and speciation events in our lineage. For example, bipedalism in *Australopithecus* has been associated with the exploitation of more open environments. However, the discovery of *Ardipithecus ramidus*, a bipedal hominin in the Awash Valley dated at 4.4 Ma, has been interpreted as occupying closed settings by its discoverers (White et al. 2009). On the other hand, analyses of stable isotopes in paleosol carbonates identify *Ardipithecus ramidus*' environment as being very open (Cerling et al. 2011). Thus, the environmental context in which this early bipedal hominin lived is unclear. The purpose of this study is to better document the environmental context of the *Ardipithecus-Australopithecus* transition in relation to the hominin's diet. We used mammalian enamel stable isotopes to estimate the proportion of woody plants (closed environments) and tropical grasses (open and arid environments) consumed by the fauna during that period. Mammals that have a generalist diet, eating the two types of plants depending on ambient resources, can be used to assess relative availability of these different types of plants in the past. Our sample consists of ~1600 stable isotopic values of mammals and hominins of the Awash Valley compiled from publications. Based on results of paleosol carbonates' stable isotopic data (Cerling et al. 2011), we predicted a period of great aridity at 4.4 Ma in the Awash Valley. However, our preliminary results show a mixed environment in this region that remained relatively stable between 4.6 and 3.2 Ma. Hominins, on the other hand, show a different trend, with a clear shift between ~4.0 and ~3.7 Ma. This seems to indicate that hominins had a diet distinct from mixed feeders prior to 3.9 Ma, but that they shifted towards a more generalist diet despite an absence of environmental change.

## **Unique Body Size and Shape Phenotypes Among Middle and Later Stone Age Southern Africans**

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Holocene Southern African Later Stone Age (LSA) skeletons and their contemporary descendants, the KhoeSan peoples of southern Africa, have small adult body sizes and gracile builds. Genetic analyses indicate that contemporary KhoeSan groups diverged from non-Khoesan groups approximately 110–160 kya, during the Middle Stone Age (MSA). The most diverse group of MSA postcranial fragments comes from the Klasies River Mouth Main Site (KRM) on the southern Cape coast. The KRM materials include a lumbar vertebra, left clavicle, left proximal radius, right proximal ulna, and left first metatarsal. We compare the external linear dimensions, shape characteristics, and cross-sectional geometric properties (CSGP) of KRM postcrania to those of LSA southern Africans to see if distinctive small body sizes and shapes are evident in the MSA. Discriminant function analyses (DFAs) and analyses of variance (ANOVAs) are used to compare each of the KRM elements to adult LSA southern Africans (n=108) and other Holocene groups (n=149) encompassing a range of body sizes. The DFAs group the KRM elements with LSA southern Africans when predicting group membership ( $\alpha < 0.01$ ), except for the ulna that shows archaic shape features. The similarities between KRM and LSA southern African materials are driven by size. KRM clavicle and metatarsal CSGP have greater torsional and compressive strength properties than analogous elements from LSA southern Africans. These results demonstrate that small southern African adult body sizes may have great temporal depth. They provide further evidence for biological continuities between MSA and LSA southern Africans, consistent with genomic studies.

## **A Preliminary Stable Isotope Investigation of Mobility in the Late Roman (4<sup>th</sup> Century AD) Necropolis of Michelet (France)**

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This poster presents stable oxygen isotope ( $\delta^{18}\text{O}$ ) results of 26 individuals from the Michelet necropolis (4th century AD) associated with the city of Noviomagus Lexoviorum (modern Lisieux, France). Archaeological and historical evidence indicates social upheaval, changing burial customs, and the establishment of new cemeteries in the region during the 3rd and 4th centuries AD, so we investigated whether there was isotopic evidence for the presence of non-locals in this sample. Thirteen adult females and thirteen adult males were analyzed, with no statistically significant difference in  $\delta^{18}\text{O}$  values based on sex ( $p < 0.05$ ). When the sample was assessed for outliers, only one adult male (MIC 649, 50+ years) had a  $\delta^{18}\text{O}$  value that fell outside the expected local range (defined by 2SD and 1.5IQR). This individual's converted drinking water  $\delta^{18}\text{O}_{\text{Dw}}$  value (-12.8‰)(vSMOW) suggests possible geographic origins in the Alpine region of northern Italy, parts of northern Europe, or Scotland. Archaeological evidence from the Michelet necropolis indicates that MIC 649 was buried in a nailed wooden coffin with no grave goods, a standard burial treatment similar to other individuals in the sample identified as 'locals' based on their oxygen isotope values. Further, this individual displays skeletal evidence of healed rickets, caused by Vitamin D deficiency during growth and development. Cases of active and healed vitamin D deficiency were found to be relatively common in the Michelet necropolis with clear evidence identified in 3.8% (23/603) of individuals studied; two of the isotopically 'local' individuals also had evidence of deficiency (one case of healed rickets and one of osteomalacia). To date, no investigations of vitamin D deficiency have been undertaken in the regions where MIC 649 may have spent his childhood so it is impossible to know how common rickets may have been in the community in which he grew up, but evidence from the SSHRC-funded project on vitamin D deficiency in the western Roman Empire demonstrated levels of rickets were clearly linked to latitude.

## **Stable Isotope Analysis of Diet in Iron Age Apulia (7<sup>th</sup> – 4<sup>th</sup> centuries B.C.), Italy: Possible Evidence for Manuring?**

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This paper presents preliminary  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  data from 31 bone collagen samples from three Iron Age sites (Botromagno, Parco San Stefano, and Padreterno), located within a 1 km radius of the modern city of Gravina in Puglia, Italy. These sites were extensively excavated in the 1960s and 1970s, but the skeletal remains were never analyzed. Analysis of childhood (i.e., post-weaning) and adult diet reveals significant differences in  $\delta^{15}\text{N}$  values between the samples ( $p < 0.05$ ), but no differences in the closely clustered  $\delta^{13}\text{C}$  values. The samples from Botromagno have a lower average  $\delta^{15}\text{N}$  value (9.6‰) than those from nearby Padreterno (10.6‰) and Parco San Stefano (10.4‰). All the Iron Age  $\delta^{15}\text{N}$  values appear somewhat elevated, particularly given the dearth of archaeological evidence for the regular consumption of fish or seafood at these sites. To further contextualize these data, 18 faunal samples (e.g., cow, sheep, goat, dog, chicken, and deer) recovered mainly from Iron Age contexts on Botromagno (6th – 4th centuries B.C.) were analyzed. As expected, the human  $\delta^{15}\text{N}$  values are higher than most of the animal species, and dog values cluster most closely with the human data, suggesting that they are consuming a diet comparable to that of the humans. Some of these animals show higher than expected  $\delta^{15}\text{N}$  values for terrestrial herbivores, which raises the possibility that these animals were grazing on manured fields around the Iron Age sites. The data suggest that agricultural practices in these Iron Age communities were characterized by intensive land use and manuring. In comparison, preliminary faunal data ( $n=8$ ) from the nearby Roman (1st – 4th centuries AD) site of Vagnari do not

display elevated  $\delta^{15}\text{N}$  values in comparable species. These results suggest a possible shift in land use patterns, and diet, from the Iron Age through the Roman period in this region.

### **Understanding the Relationship Between Macroscopic Morphology and Microstructural Design of Enteses**

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Behavioural and health patterns in past populations are often inferred from the morphology of bones. Many studies use the size and shape of muscle attachment sites (enteses) to infer habitual activities. The principle is simple: a greater amount of muscular contractions associated with a particular task should lead to a stronger muscle, which in turn will result in the hypertrophy of the attachment of that muscle. The co-development of bone and muscle and how factors, such as age and activity, affect their growth and morphology has important implications not only for evolutionary interpretations, but for musculoskeletal health research as well. Unfortunately, we do not understand the dynamic interactions between the anatomy and physiology of hard- and soft-tissues, nor, consequently, do we understand the resulting effects on bone remodelling and entesis formation. The goal of our research is to observe the relationship between muscles and their enteses using different models (mice,  $n = 30$ ; and human cadavers,  $n = 23$ ), to see what can confidently be inferred from their morphology. Activities of the mice (control, wheel running, and cage climbing) were monitored and ages of all samples were recorded. Muscle architectural data (e.g., mass, fibre length, PCSA) and histological data (e.g., fibre type) have been measured. Surface measurements of enteses (e.g., size and shape) along with microstructural data under the enteses (e.g., trabecular and cortical density) were also collected. Some microanatomy of the bone was collected through micro-CT scans, while the remainder of the histological data for both soft- and hard-tissues were collected using immunohistochemistry. Behaviour and age were determined to have clear correlations with muscle data (e.g., muscle atrophy, changes in fibre type distribution with different activity and increased age). Some trends were found with respect to cortical bone (e.g., greater cortical area with increased muscle force) but not trabecular bone. Both models failed to show clear relationships between muscle function and the morphologies of enteses. This research continues to demonstrate that despite the functional plasticity of muscle tissue, enteses are less predictable and their surface appearance should not be used to make behavioural inferences from past populations.

### **Zonal Osteons: Comparison Between BSE/SEM and Polarized Light Microscopy Techniques\***

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The zonal osteon (ZO) is a distinct morphotype of secondary osteon that is characterized by a hypermineralized ring within the concentric lamellae resulting from a change in density. It has been hypothesized that ZOs are formed during remodeling in response to some physiological stress. Matrix formation is interrupted during the resulting in zones of different mineralization. Studies have also utilized the age-associated accumulation of ZO to estimate age at death. Numerous researches have reported results of zonal osteon from Polarized Light Microscopy (PLM). However, PLM allows observing the birefringence of the bone upon the orientation of its collagen fibers. Thus, it does not reflect hyper mineralization assessment. More recently Backscattered electron imaging in a scanning

electron microscope (BSE/SEM) has been used to provide direct information on mineralization status of bone and therefore is a more accurate means of identifying ZOs. This study compares PLM and BSE/SEM to determine if PLM is an accurate method for identifying ZO. The sample consists of 30 femurs from Euro-Canadian settlers interred in St. Matthews cemetery (1771-1860), Quebec City, Quebec. ZOs were counted in the same four anatomical quadrants (anterior, medial, posterior, and lateral) independently, using PLM and SEM-BSE. Chi-squared test shows that there was no significant difference between the two methods ( $p=0.466$ ). Cohen's kappa also shows a substantial agreement between the two methods ( $K=0.66$ ). PLM proves to be an accurate (sensitivity 79%, specificity 99.4%) and reliable method (PVV: 86.71%; NPV: 99.45%). Consequently, both methods are interchangeable and PLM is as reliable as the SEM.

### **A Case Study in Commingling from the Korean War Project Assemblage**

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Commingling in the Korean War Project (KWP) assemblage is extensive and presents an added challenge to the DPAA's mission to provide the fullest possible accounting of U.S. service members. The inherent difficulties of working with commingled remains are compounded as the number of individuals and the degree of fragmentation increase; analysis is further complicated when elements are disarticulated (Adams and Byrd 2008). The pattern of commingling seen in the KWP differs from other forms (e.g. mass graves, mass disasters) because skeletal elements from a single individual may have been recovered more decade apart and from different purported locations, resulting in different elements of the same individual being identified sometimes years apart. This presentation describes the project and, through a case study, illustrates the methods used to resolve the commingling. The Korean War (1950-1953) resulted in 103,284 wounded and 36,574 killed; as of July 2017 there are approximately 7,800 unaccounted for U.S. servicemen (<http://www.dpaa.mil/Our-Missing/Past-Conflicts/>). The KWP assemblage consists of 208 boxes unilaterally turned over by the North Korean government between 1990 and 1994, and 124 accessions from joint recovery operations (JROs) conducted between 1996 and 2005. The case study presented here illustrates the variety of methods used by KWP analysts and the two-step process employed. Initially, mitochondrial DNA analysis performed by the Armed Forces DNA Identification Laboratory (AFDIL) is used to group remains and match to reference samples provided by family members of missing service members. Since multiple individuals can share the same mitochondrial DNA profile, anthropological methods (osteometric sorting, pair matching articulation and taphonomy) are applied to associate sampled and unsampled elements. To associate a name to the remains, nuclear DNA testing (Y-STR and Autosomal-STR), biological profile, dental analysis, chest radiograph comparisons, and historical data on loss location are used where appropriate. The commingling seen in the Korean War Project directly affects and complicates the DPAA's mission to identify and return U.S. service members to their families. The case study presented here illustrates the unique form of commingling in the KWP assemblage and demonstrates the success of combining DNA analysis with anthropological and historical methods to make identifications.

### **Night-Time Sentinel Behaviour in Hadza Hunter-Gatherers**

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Sleep represents a time of extreme vulnerability to predation, hostile conspecifics and environmental dangers, yet it is essential for survival. The sentinel hypothesis proposes that group-living animals reduce the risks of sleeping by sharing the task of vigilance during sleep, with some individuals sleeping while others are awake. To investigate sentinel-like behaviour in sleeping humans, we investigated activity patterns at night among Hadza hunter-gatherers of Tanzania. Using actigraphy, we discovered that all subjects were simultaneously scored as asleep for only 18 min in total over 20 days of observation, with a median of eight individuals awake throughout the nighttime period; thus, one or more individuals was awake (or in light stages of sleep) during 99.8% of sampled epochs between when the first person went to sleep and the last person awoke. We show that this asynchrony in activity levels is produced by chronotype variation, and that chronotype covaries with age. Thus, asynchronous periods of wakefulness provide an opportunity for vigilance when sleeping in groups. We propose that throughout human evolution, sleeping groups composed of mixed age classes provided a form of vigilance. Chronotype variation and human sleep architecture (including nocturnal awakenings) in modern populations may therefore represent a legacy of natural selection acting in the past to reduce the dangers of sleep.

### **Bioarchaeological Salvage Operations at Lothagam Lokam, Turkana, Kenya**

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Lothagam Lokam (formerly the Lothagam Harpoon Site) is known for having one of the largest archaeological samples of Later Stone Age human remains from eastern Africa. During the early-to-mid Holocene, Lake Turkana's transgression transformed the site into a prominent peninsula with diverse aquatic habitats. Excavations led by Robbins (1965-67) and Lynch (1975) yielded large lithic assemblages, pottery, and fauna. Researchers also excavated 21 burial features containing at least 23 individuals from two different mortuary areas. Numerous barbed bone points (harpoons) linked Lothagam Lokam's occupants to "Aqualithic" fisher-forager populations living throughout the Sahara and eastern Africa during the early Holocene African Humid Period (AHP). However, the site's long, stratified sequence suggested people may have lived at Lothagam until the end of the AHP ~5300 BP, when the onset of arid conditions caused the lake to dramatically recede. We returned to Lothagam Lokam in 2017 to explore connections between site use and local environmental changes that occurred during/after the AHP. Large geological profiles and excavations yielded radiometric dating samples and new paleoenvironmental data. Discovery of human remains eroding out of the deposits added an urgent second research priority: bioarchaeological salvage. Although we recovered seven of the most at-risk burials, there are over 30 locations where remains are exposed. This significantly expands perspectives on mortuary activity at Lothagam Lokam, and has great potential to advance our knowledge of human populations living during this period. We report on the preliminary results of this season as well as ongoing threats to this vulnerable site.

## **Preliminary Analysis of the Relationship Between Hair Cortisol and Stable Carbon and Nitrogen Isotope Ratios in Barbary Macaques (*Macaca sylvanus*) from Gibraltar**

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Although stress has been recognized as a potential contributor to variation in stable carbon and nitrogen isotope ratios, very few studies have reported on the relationship between stress as measured by cortisol concentrations and  $\delta^{15}\text{N}$  and  $\delta^{13}\text{C}$  in non-human primates. The purpose of our study was to examine the relationship between hair cortisol, measuring the average cumulative daily stress under typical social and environmental conditions, and stable carbon and nitrogen isotope ratios in Barbary macaques (*Macaca sylvanus*) (n=65) from seven locations in Gibraltar. Statistical analysis of measured  $\delta^{15}\text{N}$ ,  $\delta^{13}\text{C}$ , and cortisol levels included standard parametric and nonparametric tests (correlation, least-squares regression, t-tests, Mann-Whitney U and Kruskal-Wallis tests), as well as multiple regression. The results of these analyses indicated that cortisol levels are not significantly correlated with, or a significant contributor to,  $\delta^{15}\text{N}$  and  $\delta^{13}\text{C}$  values. We found significant differences across age categories in  $\delta^{15}\text{N}$  and  $\delta^{13}\text{C}$  values, but not in cortisol levels. There were not significant differences between males and females in stable carbon and nitrogen isotope values or cortisol levels. These findings suggest that the cumulative daily stress associated with typical social and environmental conditions does not influence substantially  $\delta^{15}\text{N}$  and  $\delta^{13}\text{C}$  values measured in macaque hair, at least not for this population.

## **A Quantitative Genetic Approach for Investigating Skull Diversity in *Homo***

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New fossil discoveries have highlighted the remarkable variation and diversity within our genus, *Homo*, fuelling the debate surrounding our evolution. Previous interpretations of this diversity have focused on scenarios of adaptation, rarely considering the contributions of non-adaptive processes such as gene flow and genetic drift. Understanding the action of these underlying processes on our lineage is an essential step in identifying probable evolutionary scenarios, and provides further evidence informing possible relationships between species. Here, we use statistical tests developed from quantitative genetic theory to test whether genetic drift (as opposed to selection) could be responsible for the cranial and mandibular variation observed in *Homo*. Analyses were performed on 3-D scan data collected from early and later *Homo* specimens from eastern and southern Africa, Dmanisi, Georgia, as well as Java, Indonesia. Results show that for the majority of cases, the cranial and mandibular phenotypic diversity seen between these geographical and spatially separated *Homo* groups is consistent with genetic drift. Rejections of drift, signifying possible selective forces, are associated with: 1) the Dmanisi hominins (the earliest migration of *Homo* out of Africa); 2) maxillary and mandibular diversity among groups, possibly connected to dietary differences; and 3) the divergence of *Homo rudolfensis* from other *Homo* groups. These results indicate that genetic drift played a much larger role in driving our evolution than previously thought, suggesting that a significant amount of the variation and novelty we see in *Homo* could be due to random chance, likely acting in small populations.

## **Buttons and Bone: Burial Context and Individuality at the 18th Century Fortress of Louisbourg, NS**

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Bioarchaeological research is built on a foundation of context and how social and historical considerations can aid us in better understanding the individual and society. Arguably burial patterning and excavation techniques play an equally important role in establishing context by identifying variations in burial traditions between individuals and over time. Established in 1713, the Fortress of Louisbourg was home to many unique groups over its 45 year history, from the early fishermen participating in the cod trade, to the French and New England soldiers who fought during the sieges; Louisbourg was a mosaic of individuals, with their individual stories. This case study highlights one individual buried at Rochefort Point. Dating to the mid-18th century, this 30-34 year old adult male was located in the general cemetery population with no obvious skeletal changes that could speak to who this individual may have been. However, the inclusion of three unique buttons underneath the body hints at an unexpected position this individual may have held at the Fortress. Corroborated by historic records and isotopic analysis, this research focuses on the significance of multiple methods of analysis when conducting bioarchaeological research so that we may better assess and interpret the lived experience at an individual and population level.

## **First Analysis of Stem Primate Dental Pathology: Insight into Dietary Shifts and the Frequency of Dental Caries\***

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The plesiadapiform family Microsyopidae represents one of the longest-lived groups of primates known, having survived for over 20 million years, from the late Paleocene until the late Eocene. A sample of nearly 1000 stratigraphically controlled specimens of the microsyopid species *Microsyops latidens* is known from the early Eocene of Wyoming's Big Horn Basin, allowing for characterization of patterns of variation in morphological and pathological traits through time. *Microsyops latidens* as a species is characterized by a relatively high frequency of dental caries when compared to modern primates, with over eight percent of individuals showing signs of caries. In order to trace morphological correlates of diet through time, dental topographic analysis was used to quantify curvature, complexity, and relief of the second lower molars. Our results suggest that this species underwent two periods of increased adaptation to the processing of fruits. During these periods, this species is characterized by notably higher frequencies of caries, suggesting that the increased consumption of sugar-rich food had direct consequences on the dental health of these animals. Overall, this study gives some of the first insight into the health of plesiadapiforms and demonstrates the applicability of dental topographics to the contextualization of dental pathologies. As one of the first studies to look at incidences of caries in a fossil primate species, it provides a starting point for considering patterns of change in dental pathology through evolutionary time.

## **Ancestry-Specific Variation in the Accuracy of the Rogers Method\***

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Rogers' (1999, 2009) visual method is a technique for estimating skeletal sex based on four traits of the distal humerus, and is valuable in cases of commingled or fragmented remains when use of more

dominant cranial and pelvic methods is not possible. However, Rogers' initial accuracy of 92% has not been replicated by subsequent tests of the method, and the role of biological ancestry in the accuracy of this method has not been sufficiently addressed. I conducted a blind test of the method on a sample of black and white individuals from the Hamann-Todd Collection. This test resulted in an overall accuracy of 67%, ranging from 54–73% between the two groups. These results demonstrate that accurate estimation of sex using the method is two times more likely for a white individual than for a black individual. Future researchers applying this method in bioarchaeological and forensic contexts should use this method in conjunction with others, where possible.

### **Changing the Conversation: Navigating the Discourse on Gendered and Racialized Violence\***

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Indigenous women are significantly more likely to be victimized in comparison to other demographics, as they represent a disproportionately higher population of those missing and murdered in Canada. Since the Royal Canadian Mounted Police released a report detailing the victimization of Indigenous women in 2014, many groups and organizations have proposed ways to address what has become known as the 'Missing and Murdered Indigenous Women (MMIW) crisis.' This research uses a literature review to analyze trends in the proposed solutions of social and political groups to determine how out-groups understand the source of gendered and racialized violence. The findings are compared with approaches taken by Indigenous activist organizations and female Indigenous scholars. Results suggest that out-groups tend to attribute violence towards Indigenous women to dangerous social factors and focus strategies to address this violence on amending harmful social conditions. In contrast, members of the Indigenous community largely recognize the violence as a result of the imposition of colonialist ideologies, and are actively trying to mobilize Indigenous feminism to counter the victimization. The research considers how the mobilization of Indigenous feminism is changing the dialogue surrounding the MMIW crisis and how an integration of Western academic research methodology and Indigenous epistemology can produce a unique research framework that can help to inform the ongoing discussion. By establishing an effort to bridge the understandings and approaches to the MMIW crisis of Euro-Canadians and Indigenous peoples, this research pursues the broader concept of reconciliation.

### **Contest Competition for Prime Sleep Locations Within a Group of Wild Vervet Monkeys (*Chlorocebus pygerythrus*)**

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Group-living provides many benefits to primates, but one of the main costs is intragroup competition for resources such as food, mates, and resting sites. Contest competition occurs when there are not enough resources for all individuals to exploit simultaneously, and the costs will not be distributed evenly among group members. Subordinates often suffer greater effects from contest competition because dominant individuals have priority-of-access and monopolize resources. Many studies focus on intragroup competition for mates and food resources, but relatively few explore competition for sleeping locations. In this study, we examined variation in the quality of and competition for sleep locations within a group of wild vervet monkeys (*Chlorocebus pygerythrus*) at Lake Nabugabo, Uganda. We followed the group at dusk for 36 days between July and August 2017. Individual identities or age-sex class of individuals were recorded whenever possible, as well as the sleeping site within the home range, all visible sleeping trees, co-sleeping individuals, and location of each individual on branches. All trees within continuous canopy of the sleep sites were mapped, and we recorded the tree species, height, crown diameter, and diameter at breast height. Vervets appeared to

compete for priority sleep locations by displacing subordinates. Additionally, we found that in the two (of three) smallest sleeping sites, the group would fission and the most subordinate individuals would sleep separately from the rest of the group. While all three sleep sites were in areas with some human disturbance, these ‘fissioning sleep sites’ contained fewer trees overall and trees were shorter with smaller crown diameters. It is likely in the sleep sites with fewer large trees, there were not enough preferred sleep locations for all of the individuals in the group, resulting in subordinates fissioning to look for a more suitable place to sleep. These low-ranked individuals were likely at greater risk of predation at fissioning sleep sites because they did not receive the group benefits of detection and dilution. These findings have significant implications for the effects of deforestation on optimal group size and the impacts of intragroup contest competition on low-ranking monkeys.

### **Use of Laser Scanning Confocal Microscopy in Osteological Examinations**

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Much of the histological work that has been conducted in biological anthropology and archaeology to date has been limited to the use of polarized light microscopy. More recently, however, there has been a shift to using newer technologies such as scanning electron microscopy (SEM), and new methodologies such as specialized staining of samples for histopathological analyses. This presentation focuses on the use of an underutilized microscopic tool in osteological studies: laser scanning confocal microscopy (LSCM). Formally developed in the early 1980's, LSCM combines the principles of SEM and polarized light, using lasers to excite photons of specific wavelengths in a given sample. It is these fluorescent photons that are ultimately used to develop an image. By stacking overlapping images along the z-axis, a full 3-dimensional (z-stack) image can be produced. Further, with later technologies such as remote controlled motorized stages, multiple z-stack high-resolution images can be taken along both the x- and y-axes, affording a large image over the whole of the tissue. While predominately focusing on the distinguishing early postmortem (<24hrs) from late postmortem (≈5yrs) damage, this presentation will demonstrate the differences and usefulness of two forms of LSCM including a Carl Zeiss LSM 510 Meta and the Carl Zeiss LSM 800. This presentation will focus on selected stains and techniques, and the use of LSCM in both sample identification, post-mortem interval, and even the detection of cells and proteins. Further, this presentation will demonstrate both the quantitative and qualitative properties of LSCM, as well as ways to target specific wavelengths in a manner to isolate target material. Following this presentation, attendees will better understand that laser scanning confocal microscopy can be a useful tool in bone histological study, and through fluorescent imaging a means of better understanding bone biology.

### **The Virtual Mystery Project: Teaching Physical Anthropology with Online Hybridized Problem-Based Learning\***

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Problem-based learning (PBL) is an active learning strategy where students work in small collaborative groups to investigate open-ended case scenarios. PBL develops critical thinking through problem-solving by giving students an opportunity to apply theoretical learning to practical situations (Loyens, Jones, Mikkers & vanGog, 2015). The challenge of implementing PBL in large courses is that it requires additional resources to facilitate the ongoing dialogue of a small group experience (Fukuzawa, Boyd & Cahn, 2017). The virtual mystery overcomes this challenge by using the self-release functionality of the institutional management engine. It is a cost-effective way to implement the principles of PBL to engage students in large courses with a small group active learning experience. The virtual mystery is currently being implemented in a large first-year undergraduate course (n=800) in Introduction to Biological Anthropology and Archaeology at the University of Toronto Mississauga.

Practical anthropological case scenarios from the subfields of biological anthropology and archaeology are presented as monthly mysteries. Each mystery is self-released by the institutional learning management's discussion board to groups of five students through a series of weekly clues and images. Students use course resources to investigate each clue and post weekly comments to progress the investigation of the mystery. A PBL report is produced by each group at the end of the project. The report assimilates all the clues and incorporates peer reviewed journal articles to support a final solution. This poster will demonstrate the virtual mystery as an effective teaching method that uses technology to increase student engagement in the sub-fields of biological anthropology and archaeology. Student evaluations have been positive. Students commented that it "made them understand what an anthropologist does" and "feel like an anthropologist" (Fukuzawa & Boyd, 2016).

### **Early Mortality and Developmental Stress Reflected in Crown Dimensions of the Deciduous and Permanent Dentitions**

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The Developmental Origins of Health and Disease (DOHaD) hypothesis proposes that early-life stress increases negative health outcomes later in life, including all-cause mortality. This is because stress during the pre and post-natal periods can cause energetic trade-offs which favour short term survival and brain development, but which can negatively impact skeletal growth and health. The association between reduced crown dimensions and early mortality has previously been investigated in bioarchaeological samples, but has not been consistently supported. We test the association between crown dimensions and age at death to test the hypothesis that early life stress, as measured by reduced crown size, has a negative impact on life expectancy. The buccolingual and mediobuccal dimensions of deciduous and permanent crowns were measured for 160 juveniles (72 females and 88 males) aged between birth and 21 years at death. These individuals are documented and housed in the Luis Lopes Collection, at the National Museum of Natural History, Lisbon, Portugal. Linear and logistic regression analyses were used to test the relationship between tooth size and age at death in the sample. Smaller crown measurements of either the deciduous or permanent dentition were generally associated with age at death in the sample, but the strength of the relationship was always small and rarely reached statistical significance. Results do not seem to support or reject either of the two competing hypothesis about human physiological responses to early stress - life history trade-offs and predictive adaptive response. However, the sample is limited to individuals aged 21 years at death and under, and thus is composed mainly of individuals who did not survive childhood. Inclusion of adult individuals, who represent survivors relative to juvenile individuals, may yield stronger associations between dental measurements and age at death. On the other hand, final attained tooth size may be more resistant to environmental pressures than other aspects of dental development. Further analyses are necessary to adequately address these questions.

### **Illuminating Childhood Mobility at Imperial Roman Portus (ca. 1st to 3rd c. CE): A Multi-Tooth Oxygen Isotope Perspective**

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With the expansion of territory, mobility became a staple of the Roman empire. Yet, not all segments of society are equally considered in textual and epigraphic accounts. Women and children are particularly underrepresented in current discussions of Roman mobility, with most research focussing on mobility among employment age males. The use of isotopes as an additional method to textual

reconstructions provides a further avenue of investigating mobility, allowing for assessments of movement for any given individual with sufficiently preserved skeletal elements. This presentation focuses on childhood mobility among twenty individuals who resided at Imperial Roman (ca. 1st to 3rd CE) Portus and were interred in the necropolis of Isola Sacra. Portus, located at the mouth of the Tiber on the Tyrrhenian coast, was the main port of entry for individuals transiting to and from Rome, and as such is a location of significant expected mobility. A serial oxygen ( $^{18}\text{O}$ ) isotope analysis of the adult 1st, 2nd, and 3rd molars of these 20 individuals was undertaken to investigate possible childhood mobility events away from the local  $^{18}\text{O}$  range of Portus. Childhood mobility events among these individuals are evident in several forms, with potential instances of unidirectional, circular, and long distance mobility apparent. Several individuals exhibit  $^{18}\text{O}$  signatures suggestive of an origin away from Portus, while others appear to have resided at Portus, moved as children, and ultimately returned to Portus before completion of third molar development (~17.5 years). This  $^{18}\text{O}$  study illuminates not only that children were mobile at Imperial Roman Portus, but that variable types of mobility were undertaken by these children. The findings of this study contest traditional textual understandings of Roman mobility evincing inferences and understandings about Imperial Roman childhood mobility that can help to expand future investigations of human movements across the landscape during the Imperial Roman era.

### **Preliminary Findings: Male-Infant Interactions in *Colobus angolensis ruwenzorii*\***

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Male care, which includes all behaviours directed toward an infant that are positive and resemble maternal care, is rare or absent in most mammalian species. This is due to the mother's role in gestation and lactation as well the uncertainty that males face when identifying their offspring. If a male is unrelated to an infant, investing time and energy into infant care can reduce the male's fitness. Therefore, these behaviours should be selected against if paternity is uncertain. Nonetheless, extensive male care has been reported in some primates with high paternity uncertainty, challenging these previous notions. To further our understanding of male care, we sought to explore male-infant interactions in an African colobine, a group where, until recently, male-infant interactions were thought to range from simply tolerant to infanticidal. Here, we provide data on adult male natal attraction (i.e. touching, grooming, playing) and infant handling (i.e. holding and carrying) for 10 Angolan colobus (*Colobus angolensis ruwenzorii*) infants during 67 focal hours collected from May to August 2017 at Lake Nabugabo, Uganda. We found that adult males had much higher rates of natal attraction and infant handling than expected for a black-and-white colobus species. Compared to closely related *C. vellerosus* at Boabeng-Fiema (BFMS) in Ghana, male handling occurred 41 times more often (Male handling rates, Nabugabo: 1.380, n=10 infants, range: 0.370-2.757; BFMS: 0.033, n=12 infants, range: 0-0.312, Bădescu, MA Thesis, 2011). These large differences in rates of male-infant interactions may be due to differing social organizations, as *C. vellerosus* form relatively small, cohesive groups while the *C. a. ruwenzorii* at Nabugabo are likely living in a multi-level society. These results raise questions regarding the function of male care and how it can vary in different socio-ecological environments, even among closely related species.

### **Confirming Bone Diagenesis via High Resolution Synchrotron Imaging of Lead**

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The ingestion and inhalation of the toxic element lead (Pb) has impacted the health of individuals for millennia. To fully understand the scope and extent of the impact of Pb through time, we have previously identified the biogenic uptake of Pb in skeletal samples associated with different geographical and burial contexts dating to the 19th century, including the Antigua Royal Naval Hospital cemetery and the Tiškevičius (Tyszkiewicz) family chapel in Kretinga, western Lithuania. Through non-destructive high resolution synchrotron X-ray fluorescence imaging (SR-XFI), the uptake of Pb during life can be differentiated from Pb associated with bone as a result of diagenesis. The Pb spatial maps of two of our recently scanned samples clearly showed Pb along the periosteal surface of the bone and not associated with the typical bone microarchitecture related to normal remodelling. This evidence supports the knowledge that Pb will bind with bone post-mortem. Additionally, our results further demonstrate that conclusions on toxic element exposure in past populations that are based only on bulk bone Pb concentrations via inductively coupled plasma mass spectrometry (ICP-MS) can be tenuous, and additional evidence via SR-XFI may be required to provide a comprehensive and accurate indication of Pb exposure.

### **Human Cranial Base: Encephalization or Bipedalism?\***

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The cranial base (CB) is a set of bones in the skull that divides the face and the skull from one another. In humans, the CB is extremely flexed (where flexion indicates that the face has  $< 180^\circ$  of space). Research has been done connecting the flexion of the CB angle with the rapid increases in brain size (encephalization) evident during human evolution. The cranial packing theory proposes that increases in brain size led to the need for more space on top of the CB, and caused the flexion present in the CB by putting pressure on it. However, there are numerous examples from the human lineage, including; *Homo erectus*, *H. ergaster*, and *Australopithecus boisei* individuals that do not fit with this theory as they have more flexion in the CB than predicted from their brain size. As such, in this poster presentation I outline discrepancies in the cranial packing theory and I propose another factor which could also influence CB flexion. During the course of human evolution, another trend which occurred, besides encephalization, and CB flexion was the shift towards increasingly upright posture, which eventually resulted in bipedal (two-legged) locomotion. When looking at skulls from the fossil record, upright posture and bipedalism can be identified when the foramen magnum (FM) – the large hole through which nerves and blood vessels of the spinal column run – is found below the skull rather than at the back. The FM is directly connected to the CB as the landmark Basion marks both the front (anterior) edge of the FM and the back (posterior) edge of the CB. As such any changes to FM position will affect the CB angle. Thus, I propose that the CB angle is influenced by changes in posture, which would be observable through the position of the foramen magnum under the skull, and that shifts in this position would be correlated to changes in flexion of the CB angle.

## **Analysis of the Human Remains of Las Orquídeas: A New Formative Site in the Northern Highlands of Ecuador\***

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In 2013, public works carried out for constructing sports fields in the barrio Las Orquídeas, revealed a considerable amount of cultural materials. This find required the intervention of archaeologists, who not only discovered an intact stratigraphic sequence dating 800 – 400 cal BC, but also one of the largest bodies of evidence for craft production in the northern highlands of Ecuador. Three seasons later, some of the features excavated include a hearth, a fire pit, and trash pit. In addition, excavation recovered a total of six burials. Four of them were primary and one a secondary burial; the type of burial of the sixth individual is unknown as it was exposed after looting activity took place at the site. This paper presents the age, sex, and stature estimations of five of these individuals, as well as evidence of dental and bone pathology. Additionally, estimations based on the skull of a seventh individual are presented. This skull was discovered by local residents at the time they were building the foundations of their own house. However, in this case, everything related to this find has been considered isolated due to the lack of a funerary context and more remains. These analyses were conducted throughout the second and third seasons of excavation in 2014 and 2015. The lack of research and publications over the last fifteen years in the field of biological anthropology in Ecuador makes this study one of the first efforts to demonstrate the importance of this type of studies, emphasizing the great amount of evidence they can provide. Moreover, future research involving these human remains is already in progress, this time including collagen carbon and nitrogen stable isotope analysis for reconstructing their diet and comparing the values with other archaeological sites of the northern highlands from the Early and Late Formative Period in Ecuador.

## **Herd Immunity, Children as Introducers and Gender differences during the 1918/19 Influenza Pandemic in Two Island Populations**

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Understanding epidemics in human populations continues to be a central research theme in the time of new and re-emerging novel pathogens, globalization, forced migration, and climate change. Grounded in epidemiological methodology, the bio-medical anthropological approach for the study of epidemics embraces a holistic biosocial and ecological perspective. This study examines the sources of variability in shaping the morbidity and mortality experience of the island populations of Malta and Gozo during the 1918/19 influenza pandemic. The larger sister island of Malta serves as a benchmark to assess inter-island differences in the signature features of the pandemic. Common risk factors that persisted across the two islands included: poverty; female gendered roles and children aged ten to fourteen as introducers of sickness to the household; and mass gatherings as effective means of disease transmission. The epidemic pattern for the two islands showed considerable diversity that manifested in terms of Gozo's lack of a herald wave and significant difference in influenza rates. Gozo experienced a significantly higher morbidity rates ( $x^2=382.27$ ;  $p<0.001$ ) and mortality rates ( $Z$  score= 4.97;  $p<0.0001$ ) than Malta during the fall wave (September to November 1918), but higher morbidity rates ( $x^2= 321.72$ ;  $p<0.001$ ) and mortality rates ( $Z$  score= 4.84;  $p<0.0001$ ) in the winter wave were observed in Malta. Limited exposure history as a consequence of isolation, scale effects and rurality contributed to a lack of herd immunity to influenza in Gozo. Rarely found disease notification information located for Gozo was used to uncover intra-population variation in the influenza experience. While current studies show the importance of children as introducers of sickness to the household, this is the first

study that demonstrates the presence of this phenomenon during the 1918/19 influenza pandemic. Because of their role as primary caregivers, females were infected at disproportionately higher rates.

### **Exploring Socioeconomic Status and Structural Violence in Identified Human Skeletal Collections: A Study on a Sample from the Lisbon Identified Skeletal Collection\***

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As the most accessible source of raw data documenting human skeletal variation, well-documented skeletal reference collections are integral to a large portion of research in biological anthropology. Most widely used collections have been sourced from either anatomical specimens used for teaching, or from cemeteries that do not have a perpetual care mandate. It is known that various forms structural violence was present in multiple stages of the collection process of cadaver collections that targeted the poor and marginalized in society. Individuals in cadaver and cemetery collections have been sourced from unclaimed individuals. Bodies in cadaver collections were sourced almost immediately after death, while in cemetery collections the collection process relies on bodies that were previously buried and abandoned after a significant length of time in a cemetery. Statistical analyses explore the relationship between socioeconomic status and abandonment in a sample of individuals in the Lisbon Identified Skeletal Collection. Results demonstrate that there is no relationship between the socioeconomic status of an individual and the length of time they remain in a cemetery prior to abandonment. Additional research into burial practices in Lisbon has shown that the structural violence in the United States that facilitated the accumulation of collections by targeting the bodies of the poor and marginalized is actually represented in the Lisbon Collection as the exclusion of the poor and marginalized from the collection as they were not given individualized burials for any significant length of time. These findings will allow researchers to view cemetery based collections as products of an entirely different process than cadaver based collections and may facilitate the investigation of research questions on appropriate collections.

### **Micro-Sampling Dentine to Reconstruct Life Histories of Holocene Hunter-Gatherers in Siberia\***

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This paper presents a contemporary method for investigating the dietary history of past peoples by micro-sampling dentine of permanent molars from middle Holocene (~8300–3500 cal BP) hunter-gatherers in the Cis-Baikal region, Siberia. Previous geochemical tests on bone demonstrated that during the Early Bronze Age a number of individuals migrated from the North of the Cis-Baikal, the Upper Lena area, toward the coast of Lake Baikal, the Little Sea micro-region. Some hunter-gatherers appear to have retained diets typical of their homeland while in other cases they were abandoned for new local diets. The dentine has been sampled into 1 mm strips and each is analyzed for carbon and nitrogen stable isotope ratios. Each dentine strip represents roughly nine months of developmental life while bone samples typically average over the course of ~10–20 years. Micro-sampling of dentine allows for a more complete and informative record of human behavior in the Baikal region and a greatly improved temporal resolution of the chemical signatures obtained from human teeth.

## **Farming and the Convergent Evolution of Human Chemosensation**

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Human transitions to agriculture, which began around 10,000 years ago, occurred independently in geographic regions around the world and involved diverse plant and animal domesticates. Yet, these transitions all represent a profound shift in how humans acquire and process foods. Previous genomic and morphological studies suggest that the adoption of a farming subsistence strategy is associated with major changes in human environments and biology, particularly in traits related to diet. However, little work has explored the effects of agricultural transitions on human sensory systems, including the senses often involved in evaluating food quality and toxicity (the “chemosenses”: taste, olfaction). Thus, in this study, we investigated the influence of subsistence strategy on the evolution of human chemosensory genes. Specifically, we used targeted capture and sequencing to analyze 895 genes (encoding taste receptors and olfactory receptors) and 71 neutral intergenic regions in 165 individuals from two distinct geographic regions: Uganda and the Philippines. In each region, we sampled two hunter-gatherer populations and a neighboring farming population, thus allowing us to investigate convergent evolution across two independent transitions to agriculture. We employed three allele frequency-based tests (population branch statistics, Bayescan, and bayenv2) to identify chemosensory variants that may reflect adaptations to farming. We found several genes shared across multiple tests that represent candidate targets of convergent evolution associated with the transition to agriculture. These include 3 taste receptor genes (encoding the sweet receptor TAS1R2 and the bitter receptors TAS2R1 and TAS2R4) and at least 14 olfactory receptor genes. Together, these data suggest that the adoption of a farming-based subsistence strategy is associated with similar changes in chemosensation across continents.

## **Daughters First, Daughters Last: Sex Ratio by Birth Order in a Mayan Community\***

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A large number of studies have analyzed evolutionary and ecological contexts that could lead mothers to give birth preferentially to offspring of one sex over the other. In this paper we test the daughter first hypothesis. In many traditional societies, daughters provide allomaternal care to younger siblings. Thus, we hypothesize that having daughters first could have a positive impact on mothers' reproductive fitness. If so, we predict that selective pressures will have resulted in observable increases in birth sex ratios across women's reproductive lifespans. To test this hypothesis, we developed two distinct a-priori predictions. i.) The probability of a girl being born within the first two births should be higher than 50%. ii.) The probability of a girl being born should be higher within the first two births than for all later births. We tested these predictions using data collected between 2000 and 2013 from two natural fertility, traditional Mayan communities from the highlands of Guatemala. As predicted, the maximum likelihood estimate of female birth probability was 0.593 within first two births ( $p=0.0034$ ), while the maximum likelihood estimate of female birth probability outside of the first two births was 0.494 (a difference of 0.099,  $p=0.0099$ ). After visualization of the data, we also decided to test a post-hoc hypothesis that: iii) The relationship between female birth probability and birth order was non-monotonic. To test this hypothesis we fit a quadratic model to the data. The quadratic term in our model was estimated to be  $-0.02947$  ( $p = 0.0300$ ), indicating that female birth probabilities began high,

decreased sharply by the third child, and then plateaued or even rose for late-born children. To our knowledge, ours is the first study to evaluate birth sex ratios by birth order. Our study adds to previous efforts to understand both birth sex ratios and maternal investment strategies. Importantly, we contribute to the emerging understanding that female reproductive strategies are dynamic and should be studied longitudinally, across the entirety of women's reproductive life-spans.

### **Survival vs. Extinction: An Interactive Guided Story of Human Evolution\***

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Games have been a part of society and culture since ancient times, and there is evidence to suggest that the use of games in teaching may support higher-order cognitive development and strengthen motivation in skills-based learning. Teaching human evolution by natural selection through cooperative games provides a platform for informal learning of otherwise complex scientific concepts. Survival versus Extinction is a live-action-role-play game that approaches human evolution as an interactive guided story, taking students through a theoretical version of early human development starting with a hypothetical population and a last common ancestor. A moderator alternates between rounds of selective pressures that affect morphological change, and ultimately causes speciation or, population extinction. The game structure employs a step-wise approach to learning as the outcome varies each time the game is played. This sequence-based approach also allows for careful and reflective reasoning, important skills that lead to synergetic associations. The story itself can be adapted and expanded to specific levels of comprehension. Moderators can adjust the length of the guided story for time or material constraints. We present this game as a model for integrative and informal learning in biological anthropology, with the goal of improving science literacy and education.

### **Reconsidering Histochemistry in Bioarchaeology, Osteology, and Forensic Anthropology**

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Histological analysis in bioarchaeology has largely been centred around plain and polarized light microscopy. Unstained slide preparations with undecalcified specimens are the norm for most research in bioarchaeology, and forensic anthropology. However, the incorporation of special stains into histological protocols provides researchers opportunities to extract more information from skeletal samples, an important consideration when justifying the use of destructive techniques. Our colleagues in Pathology and Laboratory Medicine routinely employ histochemical techniques in histological analyses. "Special stains" are used regularly to aid in differential diagnosis, and micro anatomical investigation. Subsections of bone microstructure, cell type, tissue type, and associated chemical and biochemical contexts can be distinctively examined by employing specialized agents to highlight elements of interest. A suite of stains is available to examine mineralized bone (Hematoxylin, Toluidine Blue, Basic Fuchsin), differentially highlight soft versus hard tissue (Goldner's Trichrome, Villaneuva Trichrome), and to identify compounds that have become incorporated into bone in pathological processes (Prussian Blue for iron toxicity, Acid Solochrome Azurine for aluminum toxicity, etc.). This presentation will discuss four areas where the inclusion of a staining protocol to the histological examination of skeletal material can enhance research and analysis. First, using special stains permits the direct comparison of skeletal to clinical histological samples with known medical history and diagnosis. In this type of comparison, visualizing soft tissue changes adjacent to hard tissue provides a fuller understanding of biological and pathological processes. Second, improved visualization of microstructures via staining permits decreased ambiguity of identification, and therefore increased ease and precision of histomorphometric analysis. Third, diagenetic change can be characterized and understood more fully, even within and between micro-environments. Finally, in forensic contexts, the use of histochemical techniques aids in the identification of soft tissue, even in

highly decomposed samples, acting as a 'pre-test' before embarking on other, more expensive techniques (e.g. DNA analysis). Following this presentation, attendees will be able to assess the benefit of histochemistry in osteoecological research.

### **Dietary Effects of the 19th Century Potato Blight in a Rural Dutch Population**

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The 1845 potato blight devastated populations from mainland Europe as well as Ireland. In the Netherlands, rye and wheat crop failures in 1846 and 1847 caused a three-year period of food scarcity that caused the death of up to one-third of the population. However, there were regional differences in mortality, with the impact of this subsistence crisis on rural populations less well known. The majority of the nearly 500 human skeletons excavated from the rural site of Middenbeemster, The Netherlands, span AD 1829-1866, with archival identification for over 150 individuals specifying year of birth and death. Stable carbon and nitrogen data from bone collagen exist for 270 individuals, including all those identified archivally, allowing us to assess if diet changed during the subsistence crisis, relative to earlier and later periods. Adult and adolescent stable isotope data are derived from ribs, which reflect average diet for around five to ten years; while those data from under thirteen-year-olds are derived from a long bone metaphysis which reflect diet in the last year or so of a growing individual's life. There are no statistically significant differences in stable isotope data of the under thirteen-year-olds who died during the subsistence crisis relative to age-matched individuals from earlier and later periods. There are also no statistically significant isotopic differences between adults who lived through the subsistence crisis within the last ten years of their life, to those who died before, or 10 years after the crisis. As a group, however, the nonadults and adults whose bone collagen in part reflect the 1845-1847 period show greater isotopic variability. In addition, long bone length and enamel hypoplasia occurrence do differ significantly between those who did and did not experience the subsistence crisis while growing. Overall, these results suggest this rural Dutch population was able to endure the subsistence crisis with limited dietary change. The Beemster region's self-reliant focus on cattle-farming and minimal class differences likely served to shield the majority of citizens from pronounced dietary changes, even while much of the country was experiencing considerable food scarcity.

### **Heat-Induced Osteonal Change in Juvenile Bone: A Preliminary Histological Analysis**

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Burnt bone is frequently encountered in forensic death investigations; however, it is still relatively under studied. Current research of cremation processes in adult remains is inadequate for successfully recovering and analysing juvenile remains; and therefore, it fails to adhere to the required legal standards expected in forensic cases. Gross morphological differential burning patterns of juveniles are primarily explained using anecdotal evidence and the cause for dissimilarity has not been investigated. When considering forensically cremated remains, it is important to understand how the pre-burning differences in anatomy will affect those processes. Due to age-related bone remodelling, osteonal size and orientation can be used in histomorphometric analyses to determine age at death, indicating that there is a clear and observable difference in adult and juvenile bone micromorphology. Decomposition of adult bone tissues, in response to heat, has been investigated by examining the dimensional change to the osteonal complex. Given that there are documented differences between adults and juveniles, applying existing histomorphometric methods using osteonal size of pre- and post-heat-induced change, would be inappropriate in juvenile individuals. The following study investigates the dimensional change experienced by osteonal complexes during heat treatment of juvenile remains. This experiment utilized the remains of *Ovis sp.* (domestic sheep) as a recognized analogue for human remains. Samples

of unburned bone were dissected and the remaining full cadaver was burned in an outdoor woodpile. Fire debris was sifted and the remaining cortical bone was sectioned for histological analysis. Osteonal complexes were measured and the overall change in their morphology was documented. This poster will demonstrate the observed histomorphometric properties of burnt juvenile bone; and, demonstrate how the change of osteonal dimensions in these samples compare to published records of adult bone morphology. This research will take an important step into the understanding of the cremation of juvenile remains and add to the literature base needed for forensic evidence in court.

### **Meeting Energy and Nutrient Demands in Pregnancy and Lactation: Examining Behavioural Strategies in Wild White-Faced Capuchins (*Cebus capucinus imitator*)**

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Meeting the energy demands of pregnancy and lactation has been an influential force in mammalian evolution. Primates employ multiple strategies to address increased energy costs of these stages, including decreasing intensity or duration of physical activity and/or increasing energy intake. Primates can increase their energy intake during times of peak demand by: 1) increasing time spent foraging; 2) increasing food intake rate; or 3) selecting for higher energy foods. In addition to increases in energy demands, primates also face increases in protein demand during gestation and lactation. From April–September 2016, we investigated activity budgets in a population of wild white-faced capuchins (n = 31 study individuals) at Sector Santa Rosa in Guanacaste, Costa Rica. Using generalized linear mixed models, we found that: 1) compared to pregnant capuchins, lactating individuals spent significantly more time in low energy, restful states and 2) consumed insects at a higher rate. In comparison, 3) there were no significant differences between pregnant and cycling capuchins. These data suggest that 1) lactation is more energetically expensive than gestation in this species, and that white-faced capuchin mothers adjust behaviour to potentially mitigate energy costs; 2) lactating females increase intake rates of insects, possibly as a strategy to increase protein intake without drastically adjusting foraging activity budget; and 3) pregnant females do not rely on behavioural strategies to address energy and protein costs. Future investigation of physiological responses to energy and other nutrient demands throughout the reproductive cycle are needed to better understand reproductive evolution and the diverse strategies employed by mammals to mitigate reproductive demands.

### **Evaluating the Reliability of Colour, Size, and Hardness as Nutritional Cues in Fruits Consumed by White-Faced Capuchins (*Cebus capucinus imitator*) in a Dry Tropical Forest**

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Animals use their senses to detect and evaluate potential food. Primates—mammals especially reliant on vision—may use this sense to assess fruit size, colour, and shape prior to selection and ingestion. However, there is little data on how well visual cues actually correlate with fruit nutrition. In addition to using vision, primates possess sensitive grasping hands with which they routinely handle fruits during assessment. At the very least, they often use their hands to transport foods to the mouth prior to ingestion. Both provide opportunities for assessing haptic cues, which are poorly studied in primate sensory ecology. We present data from a 5-month study of the foraging behaviour of white-faced

capuchins (*Cebus capucinus imitator*), along with haptic (e.g. elastic modulus, toughness), visual (e.g. chroma, luminance, size, shape), and nutritional data for different species of fruits of varying ripeness. Detailed behavioural data were collected from individual capuchin monkeys during bouts of fruit foraging. Samples of species of fruits consumed by the capuchins were collected in the field and their individual visual and physical properties were measured. Fruit size was measured using digital calipers; luminance and chroma were measured using an Ocean Optics Jaz spectrometer; finally, physical properties, such as elastic modulus (MPa) and toughness (Jm<sup>-2</sup>), were measured using a Lucas Scientific FLS-1 portable mechanical tester. After these tests were performed in the field, fruit samples were dried and sent to a U.S. collaborator for nutritional analysis. We find: 1) that haptic changes in fruits are significantly related to nutritional ripening (n=7, p=0.0042); and 2) for some fruits, mechanical cues are a better indicator of ripeness than visual cues. Specifically, some fruits undergo colour changes prior to fruit softening and before the fruit is nutritionally ripe. These results suggest that, for some plant species, colour may serve as a long-distance signal to attract frugivores to trees, but foragers must rely on other senses (e.g. touch and olfaction) for close-range assessment of individual fruits. This study contributes to our knowledge about the foraging cues available to primates and other frugivores, and how multiple sensory modalities can inform food assessment and selection.

### **Researching the Evolution of Modern Humans in Southern Tanzania**

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Our own species, *Homo sapiens*, evolved in Africa sometime around 200,000 years ago. This was towards the end of the Acheulean and the start of the Middle Stone Age (MSA). Descendants of these MSA people subsequently dispersed out of the continent starting around 50,000 years ago, interbred with indigenous people in Eurasia, and ultimately settled the globe. But what was happening in sub-Saharan Africa at the time? In many regions, glacial periods saw increasing dry and cold conditions and local extinction of plants, animals, and possibly hominins as well. But the Southern Highlands of Iringa, Tanzania may have been more or less continuously occupied over the past 200,000+ years. There is extensive evidence of human occupation starting in the Acheulean and extending through the MSA and Later Stone Age (LSA) into later and modern times. Two sites have already yielded human skeletal remains, including MSA teeth and a LSA skeleton. This presentation reviews the various lines of evidence being used to examine the Pleistocene and early Holocene history of the Iringa highlands.

### **Pitfalls and Lessons Learned in the Translation of Human Biology Research**

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Gaps between evidence and decision-making occur at all levels of health care, including those of patients, health care professionals and policy-makers, resulting in inefficiencies and a reduction in both quantity and quality of life. Effective sharing of our findings with all stakeholders could clearly help to close these gaps. However, putting the results of our research on human health into practice is challenging. In this presentation we describe our experiences with knowledge translation in Guyana, Tanzania, and Nicaragua. Each site presented its own suite of obstacles and, hopefully, lessons that should inform our efforts to more effectively put our findings into action.

## **From Knowledge Translation to Patient-Centered Design Ethnography for Health and Welfare**

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This paper describes two experiences with knowledge translation centered on communicating community-based health research to agencies and policy makers. The first occurred during a recent research chair, funded by the Palix Foundation and Fulbright Canada. During this chair at University of Lethbridge, Palix organized a series of nine meetings and talks across Alberta, in which I presented on my project. The project looked specifically at drug and alcohol use and reproductive timing using a host of independent variables representing prenatal factors, social and environmental stress, social moderators, and parental mortality indicators in a new analysis of the Canadian National Longitudinal Survey of Children and Youth. I presented the research questions and theory behind them and very early results to a wide range of audiences, ranging from social workers to university students. In this process I discovered that middle childhood is an under-represented life history stage for social services. Most social services focus on parenting, early childhood, and adolescence. These findings may eventually help to develop new programs that can help alleviate problems in adolescence. The second experience involves our new program in Design Ethnography at Boise State University. We have been contracted by a regional health district to conduct ethnographic research in a series of communities in order to help develop insights into the inner workings of these communities with the goal of helping transform health care delivery to remote communities in Idaho. This project works from the opposite direction than the first. We are deploying student research assistants to communities to find out what is going on well and what are possible areas for improvement. This contextual approach will provide insights into what weaknesses can be addressed, what successes can be leveraged, and by considering what is palpable for the community. Bringing these two approaches together opens possibilities for integration of insights into new programs and services that will meet the needs and align with the social conventions of distinct communities.