CAPA/ACAP

Banff, 2019

Canadian Association for Physical Anthropology / L'Association Canadienne D'Anthropologie Physique

47th Annual Meeting
47e Congrès Annuel

Program
Programme

UNIVERSITY OF CALGARY

Welcome to Banff, Alberta

Banff National Park was established in 1885 and The Banff Centre in 1933. The former is justly celebrated for its sublime beauty, yet the uninhabited valleys, high passes, and alpine areas of Banff National Park are a recent construction, the presentation of the area as nature's handiwork unspoiled, an illusion. Indeed, these regions were inhabited, plants and animals harvested, minerals mined, and forests utilized by Canada's first peoples for at least 10,000 years before the park was formed (Fedje et al. 1995). Just down the hill from the Banff Centre is the Bow River, long a travel corridor for Indigenous peoples, source of fish and game, and reeds used to make bows. The surrounding valleys, passes, and high alpine areas provided them with additional resources they required. While the mountain upon which the Banff Centre rests is referred to on maps as Tunnel Mountain, many First Nations peoples refer to it as Sacred Buffalo Guardian Mountain or Sleeping Buffalo Mountain.

Consistent with the establishment of many national parks in North America, the formation of Banff National Park led to the exclusion of its Indigenous inhabitants. The last such inhabitants of the park, the Siouan-speaking Stoney Nakoda, were removed between 1890 and 1920 in the interest of sport hunting, tourism, and Indian assimilation (Binemma & Niemi 2006, Passport 2017). Banff is located on the traditional lands of Treaty 7 Territory, comprised of the Stoney Nakoda Nations of Wesley, Chiniki and Bearspaw; three Nations of the Blackfoot Confederacy: the Pikani, Kainai, and Siksika; and the Tsuu T'ina of the Dene people. Treaty 7 territory is also shared with the Métis Nation of Alberta, Region III. We acknowledge the past, present, and future generations of these Nations and commit to thinking about the past and what our relationship to Indigenous Peoples means to us today.

Building bridges with history, it is our great pleasure to welcome you to Banff for the 47th Annual Meeting of the *Canadian Association for Physical Anthropology / L'Association Canadienne D'Anthropologie Physique,* hosted by the University of Calgary. The meeting will be held at the Banff Centre for Arts and Creativity located on the shoulder of Sacred Buffalo Guardian Mountain (*Tunnel Mountain*) in the heart Banff National Park. The town of Banff is a stunning destination with a wide selection of museums, coffee shops, boutiques, restaurants and lively bars. A short stroll away from town will find you in wild country where you're likely to meet elk, deer, or bighorn sheep. Fingers crossed, the bears will be asleep! While we have a full slate of podium and poster presentations, we encourage you to stroll down the hill to Bow Falls or up the nearby Tunnel Mountain Trail. If you can free up a morning or afternoon, take the ~55 minute bus ride to the shores of Lake Louise.

At last count more over 150 of you have registered for this year's conference, including 66 students for Thursday's Student Luncheon, which will cover the topic "Planning for an Academic Career: Pathways to the Tenure Track". We gratefully acknowledge the Department of Anthropology and Archaeology of the University of Calgary for their support of this luncheon.

We are pleased to present a program of nearly 120 presentations, including three symposia, representing the breadth and innovation of Canadian research in biological anthropology. Amongst these is a symposium that honours the scientific, professional, and personal contributions of the distinguished CAPA-ACAP member, Dr. M. Anne Katzenberg. Due to the high number of symposia and podium presentations we are holding concurrent sessions on Friday afternoon.

We hope that your time in Banff is fantastic and that the meetings provide an atmosphere conducive to learning and exchanging ideas.

Warren Wilson

We gratefully acknowledge the following sponsors:

UNIVERSITY OF CALGARY
Office of the Vice-President (Research)

UNIVERSITY OF CALGARY
FACULTY OF ARTS

Department of Anthropology and Archaeology

and contributors:

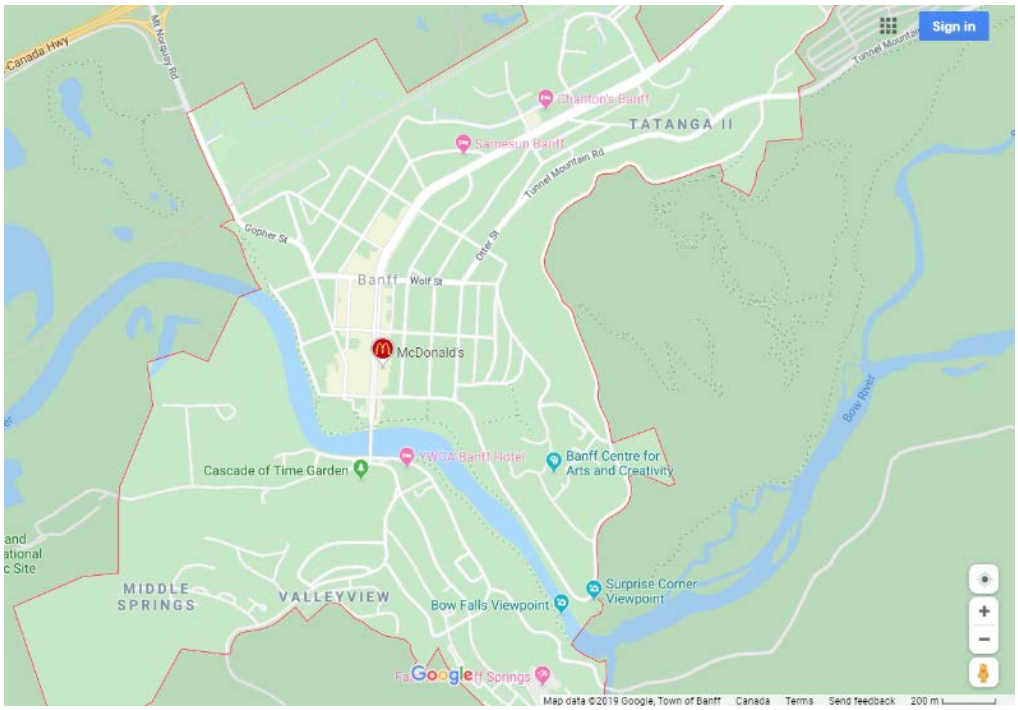
Acknowledgements

I would like to acknowledge our hard-working team, starting with the two coordinators, Kris Russell Markin and Tracy Wyman. Kris and Tracy have invested a tremendous amount of expertise and effort to coordinate this meeting, at times spending weekends in their office to button things down. Without their efforts, we'd be meeting in a clearing in the forest where we'd be rubbing sticks together for warmth. Acting as a sounding board on all aspects of these meetings, vetting abstracts, and designing the scientific program, Dr. M. Anne Katzenberg has earned my undying appreciation. I also greatly appreciate the efforts Dr. Steig Johnson for his vetting of symposia, Dr. Mary Pavelka for her vetting of abstracts, Jeremy Hogan for his help in formatting the scientific program, and Dr. Pascale Sicotte, Vice Dean of the University of Calgary's Faculty of Arts, for agreeing to welcome our delegates to Banff on behalf of the university. Special thanks go to Cheryl Takahashi, CAPA-ACAP's web site designer, who has worked tirelessly to keep the meeting web site up to date and to respond to our unceasing requests to refine the site and manage the data. I am very grateful for the funding provided to CAPA by the University of Calgary's Vice-President of Research, Faculty of Arts, and Department of Anthropology and Archaeology. Julie Boyd of the University of Calgary's Department of Anthropology and Archaeology deserves my thanks for her pivotal role in coordinating this funding in the maze that is university accounting. Thanks go also to CAPA's President, Dr. Ian Colquhoun for his good-natured replies to my many queries, to the three delegates who have graciously agreed to serve as judges of the student competition, and our team of student-volunteers who will keep this plane in the air. Finally, Drs. Andrea Waters-Rist and Andrew Nelson, earn my applause for patiently answering all of my questions about how they organized CAPA-ACAP 2018.

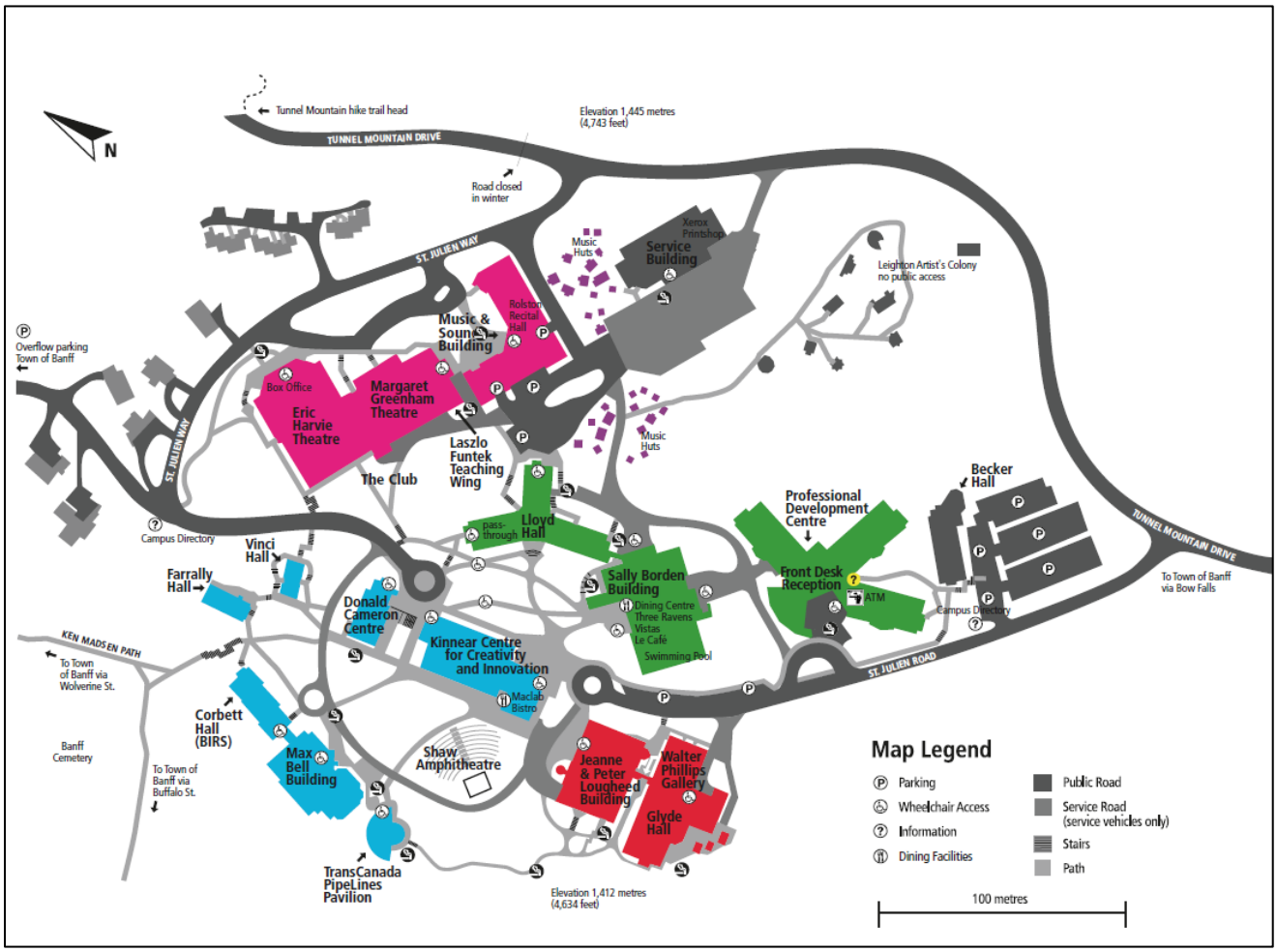
I would also like to acknowledge our venue hosts, the Banff Centre for Arts and Creativity for working through endless details and last-minute changes with us.

We're a cooperative species! Thanks to all!

Location of Banff Centre for Arts and Creativity in Banff, AB

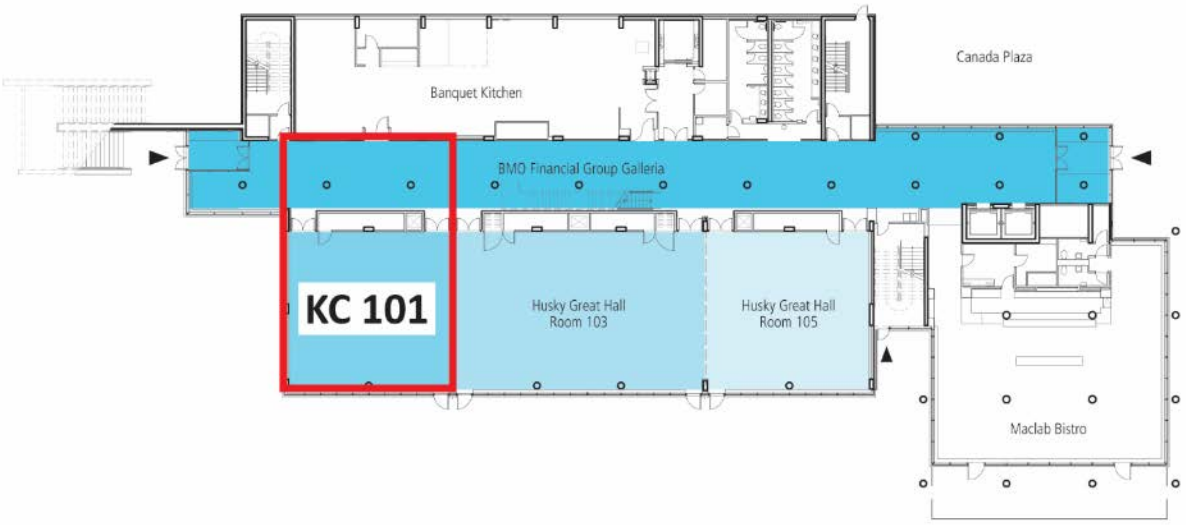


Banff Centre Campus

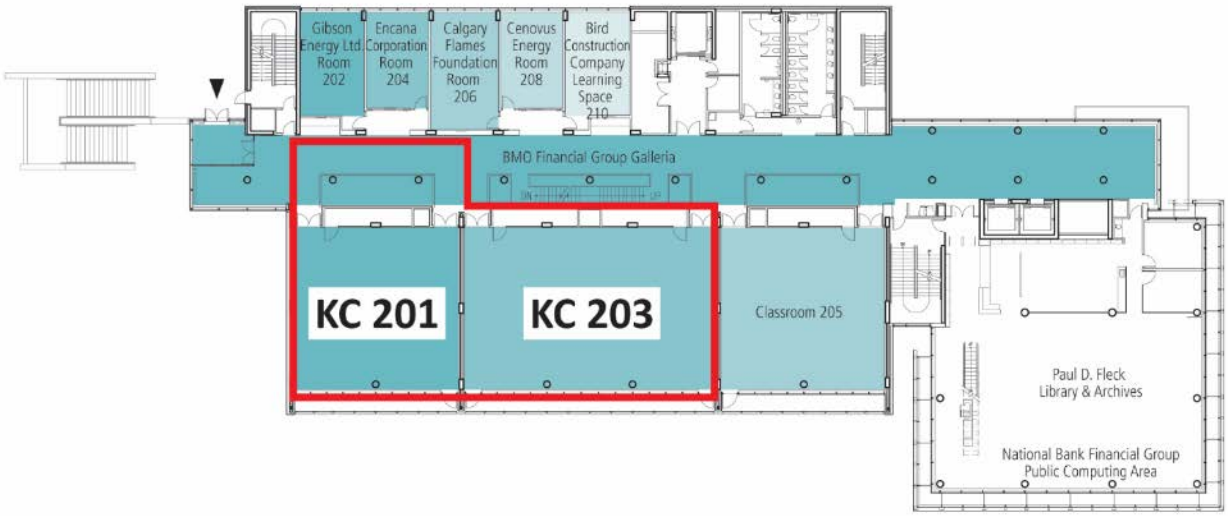


Meeting Rooms

Kinnear Centre: First Floor (KC 101)



Kinnear Centre: Second Floor (KC 201 & 203)



Presentation notes:

Please see the annual meeting web site for presenter guidelines – click here

Podium presenters: Please be present to load your presentation onto the laptop (the machine is a PC) at least 20 minutes before presentations begin in the morning or at the beginning of the coffee/lunch break prior to your talk. A student volunteer will be present to assist and can be identified with a red nametag.

Poster presenters: Please arrive at least 20 minutes before the start of the day's sessions to put up your poster and remember to take it down at the conclusion of the podium sessions. A student volunteer will be present with supplies for hanging posters and to provide assistance as needed. Posters are assigned by number which the volunteers will distribute.

Respect for Diversity and Inclusion (CAPA-ACAP Mission Statement)

Our organization embraces diversity among its membership and values the inclusion of people with diverse perspectives and backgrounds. We commit to providing a welcoming and safe space for scientists and scholars regardless of sex, ethnicity, age, physical appearance, sexual orientation, gender identity, disability, financial situation, religion, national origin, cultural background, pregnancy, parental or marital status, immigration status, academic affiliation, or any other aspect of identity. We seek at all times to mitigate the harms caused by inequities within our academy. We acknowledge the lands on which we gather and our continuing commitment to decolonizing our professional interactions through community-engaged approaches. Bullying, harassment or discriminatory forms of behaviour have no place within our society. All members are to be treated with dignity and respect and are expected to adhere to the CAPA-ACAP Code of Ethics as well as any such codes by which they are bound through institutional or other affiliation.

Mental Health & Sexual Assault Resources in Banff

YWCA Banff
102 Spray Ave,
Banff, AB T1L1A6
http://ywcabanff.ca/programs-services/services/
Phone: Domestic Violence & Sexual Abuse Support (403) 760-3200
Confidential counselling for individuals who have experienced domestic and/or sexual assault. Counselling service includes professional support for those who have experienced domestic violence, and for those questioning whether or not a current relationship is healthy. We also provide consultations for professionals, family members and friends who are seeking tools to help support a peer who may be in an abusive or unsafe relationship. Supportive counselling is available in Banff, Lake Louise and Canmore. This program is for individuals who have experienced emotional, physical or sexual abuse from an intimate partner; individuals questioning whether a current relationship is healthy; individuals who have experienced sexual assault by someone other than an intimate partner; individuals who are supporting a friend or family member who is experiencing violence.

Royal Canadian Mounted Police
Physical Address
335 Lynx Street
Banff, AB T1L 1A1
Phone: 403.763.6600
Emergency: 911

Mental Health Urgent Care
Mineral Springs Hospital
305 Lynx Street
Banff, Alberta T1L 1H7
Phone: 403-762-4451
https://www.albertahealthservices.ca/findhealth/Service.aspx?id=1064160&serviceAtFacilityID=1099657
Urgent Mental Health Walk-In Services (available 7 days/week, 2:00 pm – 9:00 pm)
Offers mental health assessment on a walk-in basis. This service provides psycho-social assessments and support on an outpatient basis. Urgent mental health services are available with no appointment through the Urgnet Care department. Urgent Mental Health conditions may include: depression,

anxiety, thoughts of suicide or harming oneself, overwhelming stress, addictions, and other situations that cause a person to be in crisis.

Banff Community Health Centre
303 Lynx Street
Banff, Alberta T1L 1B3
Phone: 403-762-4451
https://www.albertahealthservices.ca/findhealth/Service.aspx?id=427&serviceAtFacilityID=1052410
Mental Health counselling for individuals, couples and families. Provides programs and services for people experiencing mental health issues. Offers short-term Mental Health Counselling (1 to 10 sessions) that include: assessing, treating and follow up, providing information, and referring people to other mental wellness services.

Bow Valley Victim Services Association
https://www.bowvalleyvictimservices.org/
Bow Valley Victim Services Association
c/o Banff RCMP
335 Lynx Street
Banff, Alberta, T1L 1K3
Phone: 403-760-0197
The Bow Valley Victim Services Association (BVVSA) promotes and advocates the rights and entitlements of victims of crime and trauma through information, referral, support, assistance, community liaison and education.

Calgary Communities Against Sexual Abuse (CCASA)
CCASA/Sexual Assault Crisis – 24 hours
Phone: 1-877-237-5888 (Calgary)
The support and information line is available to anyone who is dealing with or has been affected by any form of sexual violence. This service is extended to friends, family, and support people of the survivor. Staff members operate the line directly from the office from 9am to 5pm Monday through Friday, while calls are dispatched through an answering service to trained employees at a support counselling call centre after hours and on statutory holidays. The services offered on the line include: crisis intervention, emotional support, problem solving, information and referral, access to emergency accompaniment to police or hospital. This is a confidential service is available to anyone who has been affected by sexual violence.

Alberta's One Line for Sexual Violence:
1-866-403-8000

Distress Line – 24 hours
1-888-787-2880

Suicide Crisis Line
1-800-SUICIDE

Addiction 24 hours Help Line
1-866-332-2322

CAPA-ACAP 2018 Schedule at a Glance

Please note that all podium and poster sessions will be held in the Kinnear Centre (KC), Rooms 201 and 203. There is one concurrent session on Friday, October 25th so please check the location

WEDNESDAY, OCTOBER 23 2019

18:00 – 21:00	Registration	Kinnear Centre, 1st flr
	Reception	KC 101

THURSDAY, OCTOBER 24, 2019

07:15 – 17:00	Registration	Kinnear Centre, 2nd flr
08:00	Opening Remarks and Welcome	KC 203
08:00 – 17:00	Poster Session 1	KC 201
08:15 – 10:00	Podium Session 1: Primatology and Human Biology	KC 203
10:00 – 10:15	Break (Poster Session 1 authors at posters for questions)	
10:15 – 11:00	Podium Session 1: Primatology and Human Biology (cont'd)	KC 203
11:00 – 12:00	Podium Session 2: *Symposium: Risky Bodies*	KC 203
12:05 – 13:25	Break	
12:05 – 13:25	Student Luncheon	KC 101
13:30 – 15:15	Podium Session 2: *Symposium: Risky Bodies (cont'd)*	KC 203
15:15 – 15:30	Break (Poster Session 1 authors at posters for questions)	
15:30 – 17:00	Podium Session 3: Primatology	KC 203

FRIDAY, OCTOBER 25, 2019

07:15 – 17:00	Registration	Kinnear Centre, 2nd flr
08:00 – 17:00	Poster Session 2	KC 201
08:00 – 10:00	Podium Session 4: Skeletal Biology and Paleopathology	KC 203
10:00 – 10:15	Break (Poster Session 2 authors at posters for questions)	
10:15 – 12: 00	Podium Session 4: Skeletal Biology and Paleopathology (cont'd)	KC 203
12:05 – 13:25	Break	
13:30 – 15:00	Podium Session 5: *Symposium: One Branch, Many Leaves*	KC 203
13:30 – 15:00	Podium Session 6: Paleoanthropology & Skeletal Biology	KC 201
15:00 – 15:15	Break (Poster Session 2 authors at posters for questions)	
13:30 – 16:45	Podium Session 5: *Symposium: One Branch, Many Leaves (cont'd)*	KC 203
13:30 – 16:45	Podium Session 6: Paleoanthropology & Skeletal Biology	KC 201
16:45 – 18:00	Business Meeting	KC 203
18:15 – 22:00	Banquet	KC 101

SATURDAY, OCTOBER 25, 2019

07:15 – 11:00	Registration	Kinnear Centre, 2nd flr
08:00 – 11:15	Poster Session 2 (cont'd)	KC 201
08:00 – 09:45	Podium Session 7: *Symposium: Embodied Securities*	KC 203
10:00 – 11:15	Podium Session 8: Primatology	KC 203
11:15	Student Awards and Closing comments	KC 203

CAPA-ACAP 2018 Schedule of Papers and Posters

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

Thursday, October 24

The Kinnear Centre, Room 201

8:00am–5:00pm **Poster Session 1. Featuring posters from Skeletal Biology, Bioarchaeology, and Paleopathology. Authors will be present for questions during the coffee breaks.**

1. Sierra E, Albanese J. Intra-observer reproducibility test of 25 features on the pubic symphysis.
2. Calce SE. Variation in aging of human skeletal remains.
3. Gamble JA, Hunter M, Lao Y, Spicer V, Hoppa R, Wilkins J. Sex determination using peptide analysis of amelogenin: Applications to archaeological, deciduous, and fragmentary dental enamel.
4. *Hughes N, Scott AB. Proteins in play: Testing osteocalcin variability between different skeletal sampling sites.
5. *Hyland C, Routledge J, Scott MB, Szpak P. Stable carbon and nitrogen isotope variability as an indicator of distinct individuals.
6. Bishop KG, Garvie-Lok S. To treat or not to pretreat? Assessing how pretreatment impacts carbonate isotope values recorded in dental enamel
7. *Skelton S, Chinique de Armas Y, Hernandez Godoy ST, Gonzalez Herrera UM, Roksandic M. First insights into differential use of maize within Archaic Age Cuba: Variation by age and sex.
8. Dewar G, Schillaci M, Ginter JK. Early maize consumption in Southwestern Ontario: Results from stable isotope analysis of human skeletal remains from the Lucier Cemetery (AD 135-325)
9. Munkittrick J, Varney T, Brown M, Murphy AR, Look C, Grimes V. Exploring childhood origins of probable 18th-19th century Royal Naval sailors at Freeman's Bay, Antigua using stable isotope analyses.
10. *Ross J, Varney T. Investigating origin of individuals from a British Royal Navy Hospital Cemetery, English Harbour, Antigua: A carbon and oxygen isotopic analysis.
11. Arsenault A. An examination of indicators of social status in Ancient Egyptian mummies.
12. *Bourgeois R, Lieverse A, McKenzie H. Reconstructing Moty Novaya-Shamanka, Siberia, Russia: Preliminary analysis.
13. Graves J, Nelson A. Reconstructing the past: Nesmut - A case study.
14. Vanderbyl G, Shaver S, Albanese J. Late Helladic zoological funerary offerings at a Tholos Tomb on Kefalonia, Greece.
15. Bocaege E, Richter T. Early and Late Natufian infant remains from Shubayqa 1, Jordan.
16. *Salahuddin H, Prowse T. An investigation of weaning practices in Iron Age Southern Italy using tooth dentine and bone collagen.
17. Meyers J, Spake L, Gooderham E, Cervantes M, Figura K, Smith D, Duncan M, Cardoso HFV. Early mortality and developmental stress reflected in fluctuating asymmetry of crown dimensions of deciduous dentition.
18. *Avery LC, Brickley MB, Prowse TL. Puberty in the past: Investigating pubertal timing in the Roman Empire
19. *Lavallee V, Brickley MB. Growth and development in a time of famine–St. Étienne Cemetery, Toulouse, France.

Thursday, October 24th (*cont'd*)

8:00am–5:00pm Poster Session 1 (cont'd)

20. Michelman LM. Harris lines as indicators of physiological stress in the Middle Holocene Cis-Baikal.
21. *Smith G, Williams J, Haines H. Differential diagnosis of pathology on postclassic Maya at Ka'kabish, Belize.
22. Hider J, Duggan A, Klunk J, Eaton K, Fornaciari G, Prowse T, Poinar H. The impact of sample choice on pathogen recovery: an ancient DNA case study from medieval Italy.
23. *Cervantes M. Vertebral body osteophyte scoring methods: Representing multiple pathologies.
24. Brickely MB. Picking holes in cranial porotic lesions: Evaluation of lesion formation mechanisms.

The Kinnear Centre, Room 203

8:00-8:15 Welcome from the Local Arrangements Committee:
Warren Wilson, Chair, Local Arrangements Committee and Pascale Sicotte, Vice-Dean, Faculty of Arts, University of Calgary

8:15-11:00 Podium Session 1
Contributed papers in Primatology and Human Biology
Chairs: Pascale Sicotte and Tracey Galloway

8:15-8:30 Badescu I, Sicotte P, Sandel AA, Desruelle KJ, Curteanu C, Watts DP, Sellen DW. Premasticated food transfer by wild chimpanzee mothers with their infants: Effects of maternal parity, infant age and sex, and food properties.

8:30-8:45 Li MF, Smeltzer EA, Teichroeb JA. The early monkey gets the matoke: The influence of sex, rank, and arrival time on feeding strategies and food acquisition in *Chlorocebus pygerythrus*.

8:45-9:00 Varsanyi SE, Henzi P, Forrester D, Barrett L. Predictors of infant survival in free ranging vervet monkeys (*Chlorocebus pygerythrus*) from a high latitude, semi-arid environment in South Africa.

9:00-9:15 Pavelka MSM, Brent LJN, Croft DP, Fedigan LM. Post-fertile Lifespan in Female Primates and Cetaceans

9:15-9:30 Lehman SM, Fischer J, Burke RJ, Radespiel U. Living on the edge: First evidence for molecular edge effects in an animal population**.**

9:30-9:45 ***Adams FV, Arseneau-Robar TJ, Bonnell TR, Stead SM, Teichroeb JA. Temporal patterns in a social network of core units in an African colobine multi-level society.

9:45-10:00 Wilbur REMPH, Gartner DR. Utilizing multiple narratives in the evidence base for intergenerational trauma health research.

10:00-10:15 Coffee Break

10:15-10:30 Lotay A. Reproductive loss and migrant belonging in the Punjabi-Canadian diaspora.

10:30-10:45 Hopper C, Dewar G. Unlikely herders in the Namaqualand coastal desert of South Africa: Trade, diversification, and place-making.

10:45-11:00 Ledger ML, Prowse TL, Carroll M, Ward D, Rice CM, Killgrove K, Terrenato N, Mitchell PD. Intestinal parasites, sanitation, and hygiene in Roman period Italy

Thursday, October 24th (*cont'd*)

The Kinnear Centre, Room 203

11:00-3:15 **Podium Session 2**
Symposium: Risky Bodies: Anthropological Intersections of Health and Disease
Chairs: Alyson Holland and Madeleine Mant

Are bodies inherently risky? Or are all bodies the result of their individual context? Who defines a body as risky? Using the body as a locus, we seek to discuss the effects of risk – physical, social, psychological, emotional – on individuals and populations.

For individuals, risk perception is both internal, such as an embodied state, and external, where it becomes an ascribed identity that others project onto the individual. For example, disease states, occupation, age, gender, temporality, and geography all carry differing levels of culturally-defined risk, which invites risk-labelling not only from these internal and external forces, but also from researchers themselves. Risk theory has a long history within anthropological thought and this session draws on key ideas from Ulrich Beck's concept of the "risk society", Foucault's governmentality, and Mary Douglas's assertion that notions of risk are "inevitably phrased through cultural assumptions", to act as a forum for discussions of the "risky" bodies we may study through skeletal samples, medical education, archival records, and contemporary participant observation. In this forum, we use risk as a lens to gain insight into the lived experiences of past and present populations, while also critically asking how notions of risk are generated and applied.

The Risky Bodies symposium presents an opportunity to understand the body in all its various and variable manifestations through the lens of risk. This symposium includes papers by graduate students, early career researchers, and established scholars, creating space for discussions of this important topic between individuals of varied backgrounds and experience.

11:00-11:15 Holland AH. Embodying risk: Contemporary risk discourses and osteoporosis
11:15-11:30 *****Morgan B, Brickley M. Osteoporosis-related hip fractures: Actual versus perceived risk
11:30-11:45 Beresheim A. Reassessing osteoporosis risk in South Africa.
11:45-12:00 Sawchuk S, Grillo K, Janzen A, Kurewa A, Contreras D, Munene J, Edung JE, Ndiema E, Hildebrand E. Building cemeteries to manage risk? Exploring early herder connections across Lake Turkana, Kenya.

12:05-1:25 **Student Luncheon - Husky Great Hall, KC 101**
12:05-1:25 **Break**

1:30-3:15 **Podium Session 2 (*continued)***
Symposium: Risky Bodies: Anthropological Intersections of Health and Disease

1:30-1:45 Prowse TL, Carroll M, Salahuddin H, Evans J, Inskip M. Risky Romans? Investigating lead use and lead exposure in rural Roman Italy (1st–4th c. AD).
1:45-2:00 Mant M, Pitre M, McCarthy C, Hale A. Bodies at risk: Biocultural examination of the St. Lawrence County Poorhouse inmates.
2:00-2:15 Bhattacharjee P, Datta Banik S. Bodies at risk: Sexual dimorphism in allostatic load among adults suffering from undernutrition and metabolic disorders: A study from West Bengal, India
2:15-2:30 Gibb JK, McDade T, Schillaci M. Sexual orientation and physical growth among men in Cebu, Philippines.
2:30-2:45 Moffat T, McKerracher L, Barker M, Oresnik S, Williams D, Mothers to Babies (M2B) Affiliated Research Investigators, Sloboda DM. The concepts of Risk and Resilience in the Developmental Origins of Health and Disease (DOHaD) and the Mothers to Babies (M2B) Project.
2:45-3:00 Schall JL. Transgender and gender diverse individuals' risk for violence: implications for forensic anthropology.
3:00-3:15 Discussion

3:15 -3:30 **Coffee Break**

Thursday, October 24th (*cont'd*)

The Kinnear Centre, Room 203

3:30-5:00 **Podium Session 3**
Contributed papers in Primatology and Skeletal Biology.
Chair: Andrew Nelson

3:30-3:45 Landry F, Teichroeb J. What happens in intergroup encounters when all groups share the same home range? A case study in an Angolan colobus multi-level society

3:45-4:00 Bonnell, TR. The social whirl: how individual interaction is both the shaper of, and is shaped by, social structure.

4:00-4:15 Vilette C, Bonnell TR, Henzi P, Barrett L. Do vervet "sleep-overs" help buffer against social uncertainty?

4:15-4:30 *****Gilhooly LJ, Colquhoun IC. The potential impact of tourism on free-living parasite exposure in a wild group of macaques (*Macaca fascicularis x M. nemestrina*).

4:30-4:45 Scott M, Dust W, Cooper D, Walker E, Lieverse A. The Pathophysiology of OA: Non-articular lesions in a modern surgical sample.

4:45-5:00 Nelson A, Watson LC, Williams J, Gauld S, Motley J, Poeta L, Seston D, Gomez E, Baldeos J, Fuentes S, Pozzi-Escot D. Mummies as microcosms: The non-destructive analysis of mummy bundles from the site of Pachacamac, Peru.

Friday, October 25

The Kinnear Centre, Room 201

8:00am–5:00pm **Poster Session 2. Featuring posters from Skeletal Biology, Human Biology, Primatology, and Paleopathology.** Authors will be present for questions during AM coffee break.

1. Curteanu C, Katzenberg MA, Badescu I. Investigating infant feeding development in wild chimpanzees using stable isotopes in hair keratin.
2. *Chen D, Narváez-Torres P, Tiafinjaka O, Louis Jr. EE, Johnson SE. Lemur paparazzi: investigating arboreal camera traps to assess species richness in southeastern Madagascar.
3. *Funk KR, Nord C, Bonnell T, Roth D, Henzi P, Barrett L. Information use, social learning, and phenotypic constraint in wild vervet monkeys.
4. *Hager H. Comunicative frequencies in *Lemur catta* (ring-tailed lemurs).
5. *Jacobson ZS, Bolt LM, Russell DG, Schreier AL. The impact of edges on mantled howler monkey (*Alouatta palliata*) feeding behaviour in a fragmented Costa Rican rainforest.
6. *Chen LD, Chen D, Holmes SM, Louis Jr. EE, Johnson SE. Impacts of food availability and reproductive events on intraspecific agonism in black-and-white ruffed lemurs (*Varecia variegata*)
7. *Motley J, Nelson A, Watson L, Poeta L, Seston D, Heidari MF, Shirpour M. Improving digitally stitched X-rays and interpretational standards for field paleoradiography.
8. Jones A, Booth S, Henzi P, Barrett L. Structural and caregiver influences on playground motor variability.
9. Katz DC, Aponte JD, Bannister JJ, Hallgrimsson B. Boundaries of human facial diversity from the perspective of syndromic phenotypes.
10. *Halliday J, Albanese J. Multidimensions of poverty: An analysis of the differential effects of racism and poverty on skeletal growth
11. *Figura K, Nichols K, Spake L, Cardoso H. The Brandon Residential School: An exploration of Indigenous children's movement across the Prairie Provinces.
12. Kushlyk K, Vallianatos H. A biocultural understanding of obesity development among the Maltese.
13. Sanchez J, Hoppa RD. Assessing pubertal stage from adolescent skeletons in two early 20th century documented skeletal collections
14. Parker K, Hoppa RD. Changing body proportions in medieval and early modern Denmark.
15. Kurki H, Harrington L, Osipov B, MacKinnon M. How is upper limb asymmetry expressed during ontogeny? A comparison of linear and cross-sectional asymmetry in the humerus.
16. *Simpson R, Varney TL, Swanston T, Coulthard I, Cooper DML. Lead exposure in bones from a modern Saskatchewan population: Preliminary findings

Friday, October 25 (*cont'd*)

The Kinnear Centre, Room 203

8:00am–12:00pm **Podium Session 4.**
Contributed papers in Skeletal Biology and Paleopathology.
Chair: Amy Scott and David Cooper

8:00-8:15 *Robertson HI. Finding true sex differences within the haystack of individual and group coxal bone variation: A lesson in landmark validation.

8:15-8:30 Spake L, Hoppa RD, Cardoso HFV. Lack of biological mortality bias in the timing of dental development in a sample of contemporary children.

8:30-8:45 Wilson, LD, Bonthorne E, Valle de Tarazaga FJ. The Roncesvalles Ossuary: Preliminary Findings and Future Considerations.

8:45-9:00 Murray A, MacKinnon M**.** The application of engineering-based musculoskeletal modelling techniques to understanding the function of anteroposterior limb bone curvature in humans

9:00-9:15 Gooderham E, Nelson J, Meyers J, Holland, E, Harrington L, Cardoso HFV. A comparison of femoral development; does diaphyseal growth and cortical development tell the same story?

9:15-9:30 Scott A, MacInnes S, Pitcher D, Grimes V, Munkittrick J, Garlie M, Moran M, Fonzo M. The Rochefort Point Cemetery: An interdisciplinary approach to understanding mortuary patterns and cemetery composition at the 18th century Fortress of Louisbourg.

9:30-9:45 Yang D, Zhang G, Merrett D. Review of research publications of human osteoarchaeology in China.

9:45-10:00 Willoughby JL, Koropatnick J, Hocking D, Nelson, A. Radiological analysis of experimentally mummified mice for the detection of cancer.

10:00-10:15 **Coffee Break**

10:15-10:30 Shaver S, Albanese J. Reconstructing Mycenaean lives through pathological skeletal conditions: A review of ongoing analysis of remains from tombs at Borzi Hill, Kefalonia.

10:30-10:45 Merrett DC. Vitamin D deficiency in Chalcolithic Iran: Links between maternal and childhood health.

10:45-11:00 Price S, Prowse T, Boldsen J, Kuch M, Duggan A, Eaton K, Klunk J, Poinar H. Pick a tooth, any tooth: Examining regional variation of bacteria in the oral microbiome.

11:00-11:15 *****Garlie M, Scott A, Munkittrick J, Grimes V. Block 3 and Ste. Marie: An isotopic comparison of two cemetery populations from the Fortress of Louisbourg.

11:15-11:30 Pfeiffer S, Williamson RF, Lesage L. Examples of new knowledge about the ancestors, learned from the study of human remains.

11:30-11:45 Marciniak S, Bergey CM, Silva AM, Hałuszko A, Furmanek M, Veselka B, Veleminksy P, Vercellotti G, Wahl J, Zariņa G, Köhler K, Kiss K, Miliauskienė Z, Simalcsik A, Novak M, Jankauskas R, Hajdu T, von Cramon-Taubadel N, Pinhasi R, Perry G. The biological impact of the agricultural transition on human stature: evidence from ancient DNA and skeletal data.

11:45-12:00 Brown EJM, Stock JT. Trabecular bone variation in the mandibular condyle and its association with subsistence in different human populations.

12:00-1:30 **Break**

Friday, October 25 (*cont'd*)

The Kinnear Centre, Room 203

1:30-4:45 **Podium Session 5:**
Symposium**:** One branch, many leaves: A symposium in honour of Anne Katzenberg
Chairs: Sandra Garvie-Lok and Jocelyn Williams

In 1985 Dr. M. Anne Katzenberg joined the faculty at the University of Calgary, Department of Archaeology. She brought with her a new and exciting approach to palaeodietary reconstruction: stable isotope analysis. The research she conducted and supervised over the following decades made important contributions to the method as it grew and matured. This work has helped to cement stable isotope analysis as a cornerstone of bioarchaeological research.

In June 2019, Prof. Katzenberg retired from the University of Calgary. This symposium is intended as an opportunity to reflect on her long and illustrious career and her many contributions to the field of biological anthropology. Over her 34 years of research and teaching at the University of Calgary, Dr. Katzenberg has undertaken both forensic and archaeological research from many temporal and geographical areas with a variety of collaborators in addition to supervising and mentoring postdoctoral, PhD, MA and undergraduate students. She has given generously of herself to the academic community, serving in multiple capacities on the executives of the American Association of Biological Anthropologists, Sigma Xi, the Canadian Association for Physical Anthropology, the Palaeopathology Association and many more. In recognition of her many important contributions, she was elected to the Royal Society of Canada in 2003.

The participants in this symposium are all former, or current, students who will speak about their current work and reflect on the role that Dr. Katzenberg played in their training and success.

1:30-1:45 Introduction and Roman Harrison, Reflections
1:45-2:00 Garvie-Lok S. Humans, animals and landscape in Hellenistic Thessaly: An isotopic approach
2:00-2:15 Varney TL, Brown M, Swanston T,Cooper DML, Coulthard I, Murphy AR. Contributions of archaeological bone chemistry to bioarchaeological investigation of the Royal Naval Hospital Cemetery at English Harbour, Antigua, WI.
2:15-2:30 Cooper D. New Insights into Cortical Bone Remodeling Through 3D and 4D Imaging
2:30-2:45 Williams JS, Sutinen J, Iannone G. Rocks stay stationary, not people: Population movement and long term sociodynamics at the Maya centre of Minanha, Belize.
2:45-3:00 Waters-Rist AL, Nomokonova T, Tishkin AA, Gorbunov VV, Grushin SP, Papin DV, Losey R. Ancient dog diets in the Altai region of Siberia

3:00-3:15 **Break**

3:15-3:30 Offenbecker AM. Isotopic approaches to understanding culture change in the Casas Grandes region of Northwest Mexico
3:30-3:45 Edwards K. For the birds? Avian tissue spacings and their implications in paleodietary reconstruction
3:45-4:00 Peschel E. Vikings, isotopes, and nonmetric traits: The multidisciplinary role of an advisor
4:00-4:15 McConnan Borstad C, Offenbecker A, Taylor S, Katzenberg MA. The contribution of stable hydrogen isotope analysis to understanding human diets at prehistoric Paquimé, Casas Grandes, Mexico
4:15-4:30 Grauer AL. Deep roots, new shoots: Honoring the work of M. A. Katzenberg
4:30-4:45 Discussion

Friday, October 25 (*cont'd*)

The Kinnear Centre, Room 201

1:30-4:15 **Concurrent Session: Podium 6**
Papers in Paleoanthropology and Skeletal Biology
Chairs: Mirjana Roksandic and Todd Garlie

1:30-1:45 Roksandic M, Lindal J, Radovic P, Mihailovic D. New Middle Pleistocene material from Serbia and its implications for human evolution in Europe

1:45-2:00 *****Lindal J, Radović P, Marković Z, Alaburić S, Roksandic, M. The first fossil of a non-human primate from Serbia

2:00-2:15 Viola B, Kolobova K, Chargynov T, Krajcarz MT, Krajcarz M, Fedorowicz S, Shnaider S, Krivoshapkin AI. Excavations at Sel'ungur cave, Kyrgyzstan: an update

2:15-2:30 Schroeder L, Hlazo N, Pickering R, Kibii J, Ackermann RR. New research at the *Paranthropus* bearing site of Gondolin

2:30-2:45 Bundala M, Saanane C, Kinyanjui R, Cote S. A preliminary phytolith analysis of the Middle Pleistocene sites from the Manyara Beds, Northern Tanzania

2:45-3:00 Cameron ME, Stock J. Regional variation in body size and shape properties among Holocene Later Stone Age Southern Africans

3:00-3:15 **Break**

3:15-3:30 Stock JT, Longman D, Murray A, Wells JCK. The use of living athletes to test hypotheses about prehistoric human adaptability: Biomechanics and energetic trade-offs

3:30-3:45 Ginter JK, Ahn SH, Goldchain R, Ali Q, Downey D, Khan S, Ponte M. Digitizing the dead: Using three-dimensional imaging to virtualize, educate and preserve

3:45-4:00 Garlie TN, Choi HJ, Parham JL. U.S. military head size and shape: Visualizing variation for equipment design

4:00-4:15 Rabey KN, Boyd T, Senger JL, Doschak MR, Chan KM, Webber CA. The impact of nerve regeneration on locomotion and musculoskeletal strength

4:45-6:00 **Business Meeting – Kinnear Centre 203**

6:15-10:00 **CAPA / ACAP Banquet – Husky Great Hall, Kinnear Centre 101**

Saturday, October 26

The Kinnear Centre, Room 203

8:00-9:45 **Podium Session 7**
Symposium: Embodied Insecurities
Chair: Tina Moffat

Biological anthropologists increasingly recognize their contributions to exposing health inequities by investigating how resource insecurities, such as food, water, shelter, and healthcare, for example, become embodied in human bodies and populations. These embodiments manifest in conditions such as infectious and chronic diseases, mental health disorders, and malnutrition. In this symposium we will feature the work of researchers who forefront resource insecurities as an important operating variable in their studies with a view to informing social and health policy.

8:00-8:15 *Oresnik S, McKerracher L, Moffat T, Barker M, Williams D, Mothers to Babies (M2B) Affiliated Research Investigators, Sloboda DM. The entanglement of food insecurity and Gestational Diabetes Mellitus: Examining pregnancy health from a syndemics perspective

8:15-8:30 *MacDonald C, Galloway T. An applied nutritional anthropological study of healthy eating perceptions and barriers in an urban First Nations community

8:30-8:45 *****Duignan S, McQueen D, Davis-Hill L, Chow-Fraser P, De Lannoy C, Martin-Hill D, Moffat, T. Testing the waters: A preliminary analysis of water security and holistic health with Six Nations of the Grand River

8:45-9:00 Galloway T, Fafard-St. Germain A-A. "Letting the market decide": how Canada's market-oriented federal policy approach translates into increased food insecurity for northern Indigenous communities

9:00-9:15 Larcombe L, Orr P, Singer M, Coar L, Yassie E, Denechezhe L. Sekuwe (My House): Dene First Nations tackle housing conditions and insecurity in northern Manitoba.

9:15-9:30 Piperata BA, Lee, J, Lee S, Mayta A, Cary A, Oruganti P, Garabed R, Wilson W**.** Characterization of the gut microbiota of Nicaraguan children in a water insecure context

9:30-9:45 Discussion

9:45-11:30 **Podium Session 8**
Contributed papers in Primatology
Chair: Colin Dubreuil

9:45-10:00 *****Blersch RA, Henzi SP, Barrett L, Bonnell TR. Using entropy rate to assess behavioural predictability in a wild primate

10:00-10:15 *****Nord C, Bonnell T, Dostie M (1), Henzi P, Barrett Louise**.** Social tolerance, over knowledge, promotes muzzle contact in vervet monkeys (*Chlorocebus pygerythrus*)

10:15-10:30 Narváez-Torres P (1), Chen D (1), Tiafinjaka O (2), Louis Jr. EE (3), Johnson SE. Canopy cover and exotic species influence the functional diversity of lemur communities in Kianjavato, Madagascar

10:30-10:45 Guthrie NK, Ramananjato V, Raoelinjanakolona NN, Razafindratsima OH, Louis Jr. EE, Johnson SE. Say hello to Jolly's mouse lemur, *Microcebus jollyae*: an introduction to their natural history.

10:45-11:00 Takahashi AT, Barrett L, Pellis S, Henzi P. Mercurial males: Is no strategy the best strategy for males during the mating season?

11:00-11:15 Dubreuil C, Pavelka MS, Notman H. More than just a warning: Do the terrestrial alarm calls of vervet monkeys (*Chlorocebus pygerythrus*) show evidence of sexual selection?

11:15 **Student Awards and Closing Remarks**

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

Temporal patterns in a social network of core units in an African colobine multi-level society

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Examining the variation in animal social networks over time has been influential in demonstrating the evolution of behavioural plasticity in response to environmental changes. The social and ecological environments that individuals experience are ever-changing. Consequently, association patterns and social network structure are expected to vary seasonally, as well as over longer time scales. We examined the temporal variability of inter-group associations at the core-unit level in a multi-level society of Rwenzori Angolan colobus monkeys (*Colobus angolensis ruwenzorii*). This subspecies shows at least three levels of non-random association: core units, clans, and bands. Our study population at Nabugabo, Uganda experiences two rainy and two dry seasons per year. Using 21 months of association data from 12-13 core units (totaling 132-139 individuals), we investigated how changes in rainfall, food availability, and inter-unit dispersals impacted core unit associations, and ultimately social network structure. We found that social network structure varied over the short term (month to month) and long term (year to year). Major changes to network structure occurred; one core unit changed clans from one year to another and an all-male unit formed, leading to a new social unit within the band. Social networks varied seasonally, being more clustered and denser during periods of high fruit availability, when food competition was alleviated. Male dispersals promoted higher than expected dyadic associations in the short-term (1-2 months post-dispersal) between the core units that individuals transferred to and from. Male dispersals were more likely to occur when fruits were abundant, suggesting that the tendency for core units to associate more allowed males to prospect and successfully transfer between core units. These findings show that changes in ecological and social conditions elicit a behavioural response by the colobus that results in a dynamic network of associations over time.

An examination of indicators of social status in Ancient Egyptian mummies

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The primary focus of my research is how the practice of mummification in Ancient Egypt was shaped by social stratification. This is a topic that has seldom been discussed within academic and popular literature. The study of burial practices in Ancient Egypt has traditionally focused on the elites, which has greatly, and inaccurately, impacted the way we have come to understand ancient Egypt. The practice of mummification spread to non-elite and lower status individuals beginning in the New Kingdom. Recently, researchers Andrew Wade and Andrew Nelson (2013) proposed that there is a potential positive correlation between the volume of cranial resin present in ancient Egyptian mummies and their socioeconomic status. This assertion would likely mean that the addition of resin in large quantities was an elaboration of the important excerebration ritual and began as a way for the elites to separate themselves from the commoners. For these reasons, the use of resin has become an important focus of my research and the emphasis of this poster. This poster will illustrate the potential for CT scans to elucidate the relationship between social status and processes of mummification. CT scans are considered the gold standard in mummy studies due to their non-invasive nature, which promotes preservation, while still affording researchers with a wealth of information. I am using the post-processing software Dragonfly, to segment and isolate certain materials, particularly resin, based on density. Through the IMPACT radiological mummy database (Nelson & Wade 2015), I have access to the CT scans of ~80 adult non-

elite Egyptian mummies. This poster highlights Lady Hudson, an Egyptian mummy from the Roman era of ancient Egypt, who has a large amount of resin in her skull. This, along with her intricate wrappings, when compared to other contemporary non-elite mummies, indicates some degree of social differentiation was being expressed in the mummification ritual in post-New Kingdom Egypt. This study will incorporate mummies from other time periods to test whether this pattern can be seen in earlier times.

Puberty in the past: Investigating pubertal timing in the Roman Empire

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Ancient writers tell us that in the Roman Empire, puberty took place between 12 and 20 years of age. However, literary sources can be heavily biased and often represent the attitudes and experiences of higher status individuals living within Rome, rather than the greater population of the Roman Empire. The current study goes beyond these literary sources and examines the skeletal remains directly, investigating if pubertal timing for middle-class adolescents (1st-6th centuries AD) corresponds to ancient literary depictions of puberty. Two samples were selected for analysis representing middle-class individuals from Portus (the main port servicing Rome) and Noviomagnus Lexviorum (a commercial centre in Roman Gaul). In total, 304 adolescent skeletons were macroscopically examined for age-at-death and sex estimates, as well as pubertal stage at death. As expected, females experienced puberty earlier than males (t=2.516, df=34, p=.017, D=0.84), although no significant differences in pubertal timing were noted between the two sites (t=.017, df=34, p=.987). Osteological analysis indicates that puberty extended from 10 to 19 years for females, and from 11 to 18 years for males; ages that roughly correspond to the ancient literary sources. When comparing the length of puberty to clinical data, it is clear that puberty was a longer process in the Roman Empire (Females: 5.5 years, Males: 4.2 years) than modern populations (Females: 2.0, Males: 2.4 years). These data suggest that puberty was a more drawn out process for middle-class Romans compared to modern populations. This is likely due to factors such as poor nutrition, exposure to disease, and social conditions, which are known to delay pubertal development. With this mind, researchers may be able to use pubertal timing as an indicator of overall population health, much like rates of child mortality. Thus, further comparisons of pubertal timing are needed, to help elucidate differences in overall lived conditions between communities and populations. Additionally, with an extended period of biological development, future research should consider if the social changes associated with adolescence were also extended, or if social age changes occurred independently of pubertal development in past populations.

Premasticated food transfer by wild chimpanzee mothers with their infants: Effects of maternal parity, infant age and sex, and food properties

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Premasticated food transfer, when an individual partially breaks down food through chewing and feeds it to another individual, usually mouth-to-mouth, has been described widely across human cultures. This behavior plays an important role in modern humans' strategy of complementary feeding, which involves supplementing maternal milk in infant diets with processed, easily digestible versions of adult foods. Although other primates engage in food sharing, it is unclear the extent to which they engage in premasticated food transfer with infants, and as a result, the extent to which this particular complementary feeding strategy is a uniquely

human trait. We used a wild chimpanzee community at Ngogo, Uganda, to investigate whether premasticated food transfer occurs in one of our closest living relatives. We followed 62 mother-infant pairs. We evaluated the presence or absence and rates of premasticated food transfer relative to maternal parity, infant age and sex, and assessed the food species and part used. We found that chimpanzee mothers regularly shared premasticated food with their infants between 6 months and 4 years old. Multiparous females shared premasticated food with their infants more frequently than first-time mothers. Both easy-to-chew, commonly eaten foods, and tougher, rarely eaten foods were shared via premastication. Premasticated food transfer may be an infant-rearing strategy for chimpanzees to facilitate the transition from a diet of exclusive maternal milk to solid food during early infancy. Given the similarities in premasticated food transfer between chimpanzees and humans, we suggest that the foundation of complementary feeding, a uniquely hominin strategy among primates, might already have been present in a common ancestor shared with chimpanzees seven million years ago, in the form of premasticated, mouth-to-mouth food transfer by mothers with their offspring. Alternatively, this strategy might have evolved more than once in hominids, particularly in species that have a broad diet.

Reassessing Osteoporosis Risk in South Africa

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Osteoporosis is often thought of as a disease disproportionally affecting elderly white women from European and North American countries. However, skeletal health has been underprioritized and understudied in many other parts of the world, such that this may reflect Western biases in medicine rather than an actual phenomenon. Overshadowed by tuberculosis, heart disease, HIV/AIDS, and malnutrition, osteoporosis is not yet recognized as a major health problem in South Africa. Although the data are sparse, evidence suggests that certain non-white population groups may be at heightened osteoporosis risk. During the apartheid era, the South African Coloured (SAC) population exhibited delayed peak bone mass attainment and substantially reduced bone microstructural properties with age. There is also a history of poor skeletal health in South African Black (SAB) males, as they constituted a high proportion of clinical osteoporosis cases under the apartheid regime. In accordance, early metacarpal radiometry studies demonstrated lower cortical densities in SAB than in South African White (SAW) population groups. Similarly, more recent work using DXA-derived bone mineral density (BMD) has shown comparable or even lower vertebral bone mass in SAB women. Compared to African Americans in the United States, SABs exhibit inferior cross-sectional geometric properties. Therefore, it may not be reasonable to assume greater bone mass in SABs compared to other population groups, as is typically reported for African Americans. The identification of poor skeletal health in various South African groups implicates biosocial rather than genetic causative factors. Patterns of bone loss may be attributed to political and socioeconomic factors that influence disease exposure, access to quality healthcare, the ability to obtain nutritious foods, and issues of substance use. By recognizing the vulnerabilities in men and non-white population groups that stem from structural violence, current public health endeavors can more effectively address osteoporosis and fracture risk in the post-apartheid era.

Bodies at risk: Sexual dimorphism in allostatic load among adults suffering from undernutrition and metabolic disorders: A study from West Bengal, India

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Allostasis is an adaptive mechanism to maintain the stability of the body or homeostasis condition. 'Allostatic load' is used to understand the sustained stress and its effect on health and well being in individuals. This can be explained by the presence of several health problems including nutritional, cardiovascular and metabolic etc. and a cumulative score can be developed. The aim of the present study was to observe sex difference in allostatic load, developed by undernutrition, hypertension, and metabolic disorder among adults. Method was cross-sectional and the study was carried out in 2011-13. Participants were 25 to 65 years old 147 men and 40 women representing three neighbouring tribal communities from Birbhum district in West Bengal, India. Anthropometric measurements of height (cm) and weight (kg) waist circumference were recorded. Blood pressure was measured. Clinical biochemistry tests to estimate levels of haemoglobin, blood glucose, lipid profile (triglycerides and high-density lipoprotein cholesterol or HDL) were done. The derived anthropometric parameter was Body Mass Index (BMI). Abnormalities were identified using cut-off values of the parameters based on standard criteria. Undernutrition was explained using cut-off value of BMI <18.5 kg/m2. Significant sex differences were found between mean values of BMI and waist circumference ($p<0.05$). But there is no significant sex difference found in percent Haemoglobin (Hb%), Glucose, TGA and lipoprotein HDLC ($p<0.05$). Around 2% for both men and women have no allostatic load whereas 79% men and 85% women have more than 2 allostatic loads. This study indicates the population suffers from high level of undernutrition. The low blood pressure, BMI and low Hb% level indicate low consumption of food and nutrition in the population. Women have more allostatic load than men. Around 45%-50% people have low lipoprotein HDLC or good cholesterol level.

To treat or not to pretreat? Assessing how pretreatment impacts carbonate isotope values recorded in dental enamel

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Biological anthropologists often record the stable isotope composition of skeletal carbonate to examine aspects of ancient diet, seasonality, and migration. As part of the analysis process, skeletal samples must be prepared to sufficiently remove exogenous contaminants that confound measured stable carbon and oxygen isotope values. The most common preparation approach for enamel carbonate involves a four hour soak in 0.1 M acetic acid (0.04 mL/mg). Chemical pretreatment is essential for bone samples because of its high organic content and porosity, which increase the risk of contamination; however, recent analyses have challenged the benefits of chemically pretreating enamel because of the opportunity for considerable sample loss (up to 40% in some studies). As a way of preventing excessive sample loss, we have explored alternative pretreatment methods including the use of simple abrasion. Under this method, the outermost layer (<100 µm) of enamel is abraded in order to maintain sample integrity while sufficiently removing contaminants. Our pilot study assesses the variability of recorded stable carbon and oxygen isotope values when enamel has been pretreated using (1) the chemical pretreatment method listed above (according to Balasse et al. 2002) or (2) the abrasion method (according to Chenery et al. 2012). We pretreat enamel microsamples from an archaeological sheep third molar (LM3) under identical laboratory conditions. Ultimately we assess whether abrasion is a suitable pretreatment option for stable isotope analysis of enamel carbonate while measuring

the impact of chemical pretreatment on overall sample loss. Our findings have implications for future studies that wish to minimize sample loss and responsibly test materials.

Using entropy rate to assess behavioural predictability in a wild primate

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Sickness behaviour is an overall reduction in an array of behaviours in response to infection. Several methods have been used to quantify sickness behaviour. However, many require simplification or grouping of behaviours which can result in a loss of detailed behavioural data. Entropy rate is a measure of the complexity of a stochastic process, such as a sequence of behaviours, and quantifies the limiting behaviour of the joint entropy of the random variables as the sequence length increases. Despite its broad application in other fields, research into the behavioural predictability of animals using entropy rate has been limited. Here we consider whether entropy rate can capture behavioural predictability in a wild primate, whether detectable predictability is influenced by individual characteristics and environmental variation, and whether it can be applied to measure sickness behaviour. We converted 10-minute continuous focal samples (N=1469) from 28 wild, adult vervet monkeys (*Chlorocebus pygerythrus*) across three troops into behavioural sequences. We then assessed different time intervals to identify which was most appropriate by calculating entropy rate and sequence length for each. We found that sampling behaviour every 30 seconds resulted in maximum variance across sequences. We simulated sickness behaviour to assess the success and sensitivity of the measure. Using a Bayesian linear mixed effects model, while controlling for sequence length, time of day and troop, we found weak evidence for sex on entropy rate (Estimate=-0.1, l-95% CI=-0.05, u-95% CI=0.04). However, entropy rate increased with increasing food availability (Estimate= 0.79, l-95% CI=0.53, u-95% CI=1.04). We also found that entropy rate can be used to detect sickness behaviour and is evident with a behavioural difference of 20% between sick and healthy individuals. Our results show that while there is low inter-individual variation in entropy rate, environmental variation reliably influences behavioural predictability. This points to the efficacy of using behavioural entropy rate as a method of assessing behavioural predictability in the wild as well as its future application to sickness behaviour detection.

Early and Late Natufian infant remains from Shubayqa 1, Jordan

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The Late Epipalaeolithic Natufian (~14,600–11,500 cal BP) is a key period in prehistory, characterized by increased sedentism and exploitation of plant resources. Past research has focused on how people adapted to this economic intensification in the rich habitat of the “core” Levantine Mediterranean woodland zone. Here, we report on the life history of juveniles from Shubayqa 1, located in the southern Levantine semi-arid to arid "marginal zone”. We assess how growth at this site compares to the Neolithic site of Çatalhöyük.
Dated between the early-late Natufian (~ 14,400–11,600 cal BP), Shubayqa is situated in the eastern Jordan. Eleven complete or partial skeletons were recovered from primary burials, together with disarticulated bones representing at least 12 additional individuals. The Shubayqa 1 assemblage is unusually skewed towards younger individuals with 80% representing the remains of neonates, infants and children. Here, we estimate age at death for 4 infants and one child based on dental development. Corresponding skeletal ages were estimated based on calibration methods appropriate for their age group (< 2 years >). Skeletal and dental methods provide overlapping results for two infants and the child. The dental age of two infants is advanced

over the skeletal age, suggesting they were small for their dental age. However, when compared to the Neolithic dataset, the skeletal growth stages of all four infants are comparable those at Çatalhöyük, which is reflective of a relatively healthy growth environment. The identification of four recurrent furrow-form defects, which can be matched across the child's dentition, indicates several instances of growth disturbances between 3 and 5 years of age. A similar pattern has also been reported for modern transient hunter-gatherers.
The high number of infant burials from Shubayqa 1 is striking. This, together with evidence of recurring growth disturbances, suggests the impact of difficult living conditions on early life. In contrast, skeletal dimensions are comparable to those of a healthy agricultural population, suggesting the need to assess both child mortality, skeletal and dental growth disturbances in order to fully assess the impact of environmental factors on early life history. This research was funded by a British Academy postdoctoral fellowship

The social whirl: how individual interaction is both the shaper of, and is shaped by, social structure

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The anthropoid primates are (in the main) intensely social animals that interact with a variety of partners in a variety of ways across space and time. The patterning of these interactions can be characterized as relationships (sensu Hinde 1976), and have been shown to influence fitness. Yet there is a lack of understanding on how these relationships develop and produce particular social structures at the group level. Here we present our attempt to quantify the development of relationships within a population of vervet monkeys (*Chlorocebus pygerythrus*) using a collective behaviour framework. Under this framework, dyadic interactions are considered to both create group-level structure and, in turn, be influenced by the group-level structures in which they take place. Using dynamic networks, we show that it is possible to identify the mechanisms that determine the development of both overall social network structure and the relationships that underpin them. These results have several implications for understanding the development and maintenance of individual-level variation in social phenotypes, and how this can inform the wider discussion about the evolution of sociality.

Reconstructing Moty Novaya-Shamanka, Siberia, Russia: Preliminary Analysis

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The Early Neolithic Kitoi cemetery site Moty-Novaya Shamanka (Siberia, Russian Federation) was destroyed in the wake of urban development in the 1990s. As part of the Baikal Archaeology Project, this site underwent salvage excavations in 2014 and 2015 that yielded 1246 human bone fragments from three excavations. This paper details the preliminary analyses of these remains and the results of a six week data collection period in May-June 2019. During this time, 192 of these fragments, representing 15.41% of the total fragments (21.65% of identifiable fragments), were able to be reconstructed to form 70 conjoins. We were also able to separate distinct individuals and make other associations based on pair matching and measurements. These data were then compared and contrasted with MNI values of different elements and the original estimation of Russian Anthropologist Dr. Denis Pazhemskii based on expert inference. Preliminary results have revealed information regarding demographics, pathological conditions, and the individual life histories within this population despite the poor preservation of the remains.

Picking holes in cranial porotic lesions: Evaluation of lesion formation mechanisms

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Porotic lesions of the orbital roof and cranial vault, often referred to as cribra orbitalia and/or porotic hyperostosis, are commonly found in archaeological human remains. Debate on the causes and possible links between such lesions has continued for more than 30 years. The aim of the research presented here was to evaluate the basic biological mechanisms that could elicit development of a porous appearance in the cranial bones. A review of the published literature on physiological and morphological aspects of bone and associated soft tissues was undertaken and four basic mechanisms that could lead to the development of porous lesions were identified. Porosity can develop due to: a vascular inflammatory response; marrow hyperplasia; deposition of porous sub-periosteal new bone; impaired mineralisation. The greatest propensity to develop most lesions types occurred in infancy and earlier childhood. For example, previous research by the author demonstrated that the capacity for development of porous lesions linked to marrow hyperplasia is closely linked to marrow type, and formation of lesions due to impaired mineralisation are strongly related to rates of cranial growth. Age-related development of soft tissue structures means lesions associated with vascular inflammatory response and sub-periosteal new bone formation also predominantly occur in younger individuals. However, conditions with the propensity to elicit one or more of the biological responses producing porous lesions (e.g. anemia, scurvy and rickets) were found to frequently co-occur in clinically reported cases. Different diseases can produce broadly similar skeletal lesions and in any disease lesions may vary due to factors such as whether the condition was active or quiescent at the time of death. Combining careful assessment of the morphology of porotic bone in the cranial bones with evaluation of the anatomical distribution of all lesions in the skeleton, and consideration of the mechanisms that could result in each lesion will assist paleopathologists in suggesting a diagnosis.

Trabecular bone variation in the mandibular condyle and its association with subsistence in different human populations

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Mandibular shape and size variation among modern humans has been attributed to changes in mechanical loading related to diet, and more specifically, the transition from hunter-gathering to agriculture. This study tests whether variation in diet associated with biomechanical loading influences trabecular bone in the mandibular condyle among different human populations that have varied subsistence practices, and whether condylar variation correlates with cranial morphology or neutral genetic distance. We compare semi-nomadic pastoralist, agriculturalist, hunter-gatherer and fisher-forager populations from North and South Americas, Africa and Polynesia. Data was collected via the Nikon XTH 225 ST HRCT Scanner at the Cambridge Biotomography centre and analysed via BoneJ, and landmark analysis of skull shape completed in MorphoJ. Analysis consisted of volumetric measurements of trabecular bone in the condyle, including bone volume fraction (BV/TV), connective density (Conn.D) and degree of anisotropy (DA), which all contribute to the mechanical strength of bone. ANOVA results illustrated variation in the degree of anisotropy, connective density and bone volume fraction that correspond with differences in subsistence. Mantel tests illustrated a non-significant correlation between geographical location and the trabecular variables, suggesting that subsistence has a larger impact on trabecular bone growth in the condyle than neutral genetic variation. However, changes in the shape of the skull and masticatory apparatus have strong associations with population differences, indicating that the interaction between genetic constraint and skeletal plasticity in

relation to diet is complex. Bone volume fraction in the Greenlandic Inuit population was low compared to all other populations, signifying that there may be systemic factors influencing condylar trabecular bone among some populations. This study was funded by the Cambridge AHRC Doctoral Training Partnership and the Isaac Newton Trust, and ADaPt Project, ERC grant number 617627 to JTS.

A preliminary phytolith analysis of the Middle Pleistocene sites from the Manyara Beds, Northern Tanzania

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This study is aimed at establishing the past environment of a poorly studied stratigraphic interval in the Middle Pleistocene of Tanzania from 780,000 to 400,000 years ago using phytolith remains from the Manyara Beds. The Manyara Beds near the vicinity of Makuyuni village are known to be rich in Pleistocene fossil vertebrates (including hominins) and archaeological artifacts, and also document the evolution of a major paleolake basin. The Manyara Beds are critical for understanding the ecological landscapes related to the emergence of *Homo heidelbergensis*, and the technological transition from Early to Middle Stone Age tools in Africa. The geology, sedimentology, and stratigraphy of the Manyara deposits are fairly well understood, but little is known about the site's paleoecology. Here we present the results of our pilot field work in summer 2019 in which we conducted surveys to map and collected sediment samples for phytolith analysis. This preliminary field season was done to identify localities with high phytolith concentrations and to distinguish hominin activities (archaeological sites) versus non-hominin occupation area (ancient profiles). Sites with high phytolith recovery will be preferably screened during the next stage of fieldwork. A total of 25 samples collected from both the Upper and Lower Manyara Beds were available for this analysis from: MK 4, MK 17 E, MK 4 B, MK 4C, MK 9, MK 19, and MK 16. Phytoliths were extracted following the methods of Katz et al., (2010). Microscope inspection and counting were done using polarized light microscopy at 40x magnification. The identified morphotypes were described according to the descriptors from the International Code for Phytolith Nomenclature 1.0. Our results show that the Manyara Beds have sufficient phytoliths, and that the majority are in a good condition to be exploited for this study. Also, we were able to detect a significant spatial variation in both Lower and Upper Members. Phytoliths from Lower Members depict a mixed environment while those from Upper Member depict a grassland environment. This difference has important implications for interpreting early hominin activities at the Manyara Beds.

Variation in aging of human skeletal remains

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Much information can be gleaned from the skeleton (sex, stature, diet, disease), but calculating age-at-death is by-far the most difficult, hindered by diverse biological and lifestyle factors that produce tremendous variation in how age traits are presented skeletally. For example osteoarthritis (OA), which is related to age, is not an inevitable consequence of growing old, but arthritic characteristics are routinely used as "reliable" old-age indicators in current methods to estimate age from skeletal joints. This study focuses on individuals that do not fit the typical age-progressive pattern of bone formation by comparing young and old age examples of OA in a documented European cemetery sample of adults. Results of this study show that new skeletal age morphologies are emerging contrary to once-typical rates of bone remodeling: young individuals (<40 years) appear old, and oldest adults (70+ years) appear younger than their chronological age. While traditionally ignored, outlier populations may contain exactly the kind of information we are missing to truly appreciate age-variation in skeletal structures. Results of this study will help bioarchaeologists to better interpret the

usefulness of arthritic characteristics as age indicators, and presents the first step in working towards revising and improving currently established aging methods from human remains.

Regional variation in body size and shape properties among Holocene Later Stone Age Southern Africans

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Southern African Holocene Later Stone Age (LSA) human skeletons from the Mediterranean-type Cape coast are small-bodied in terms of stature, body mass, and body breadth. There is, however, some temporal variability on the Cape coast as reduced body sizes are evident during the mid-Holocene period of 4,000–2,000 BP. This pattern may be linked to higher population stress impacting these foragers due to increased mid-Holocene population densities. Previous research indicates Holocene Cape coast, Southern African central interior, and Namib Desert individuals share the small-bodied phenotype, however, the amount of body size variation among these groups has not been extensively explored. There may be body size variation within this Southern African small-bodied context due to developmental plasticity in response to diverse environmental conditions and subsistence strategies. Herding strategies were incorporated by the late Holocene groups who lived in the semiarid central interior and the hyperarid Namib Desert. Interactions between local ecologies and subsistence strategies may have impacted adult body size phenotypes. Quantifying variation in body sizes and shapes among these southern African groups may clarify the range of variation expected among small-bodied individuals due to ecological and subsistence strategy variation. This paper will examine if body sizes and shapes, including linear dimensions and limb proportions, vary among Cape coast (n=113), central interior (n=63), and Namib Desert (n=17) individuals. The degree of body size and shape variability among these groups will be quantified using univariate and multivariate analyses of osteometric data. Body sizes were smallest among central interior individuals and Cape coast individuals dating from 4,000–2,000 bp, indicating that growth constraints arising from unpredictable resource availability in the central interior and population stresses on the Cape coast may result in similar yet smaller body sizes. Body sizes were comparable among Namib Desert individuals and Cape coast individuals from outside the mid-Holocene period of reduced body size, indicating that beneficial conditions for growth and development may have been maintained in both foraging and herding contexts in diverse ecologies.

Vertebral body osteophyte scoring methods: Representing multiple pathologies

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Scoring osteophytes on vertebral bodies is a common method in bioanthropology for addressing questions associated with aging and activities. The majority of studies imply a progression between increasing scores and the severity of the formations. As a result there is confusion regarding the definitions of pathological processes occurring on the vertebra, wherein enthesophytes and syndesmophytes are misidentified as severe osteophytes. This project demonstrates the inconsistency in these often-used scoring systems and current naming convention, and how together, this creates the implication of a single pathological process. Computed tomography scans acquired from The Cancer Imaging Archive of 200 individuals between 16 and 84 years old were examined and grouped into individuals <39, >40, >50, >60, and >70. The right, anterior and left parts of the superior and inferior margins of the vertebral bodies were scored according McKern and Stewart's 1957 0-4 point scoring system, where 0 indicates no lipping and 4 reflects ankylosis. Frequency of occurrence of each score was calculated for each age group and converted to a percentage determining if higher scores occurred more often than lower scores with advanced age. Morphologies represented by the scoring system are shown in comparison with two pathological processes: ossification of ligamentous tissue as occurring in

Diffuse Idiopathic Skeletal Hyperostosis (DISH) and marginal ossification of fibrocartilaginous joints, typical in osteoarthritis (OA). Results show that all scores increase in with age, for the exception of 0 but higher scores do not overtake lower scores. The score of 1 was present in 44% of data points in the >70 age group, and 4 was present in only 17%. Illustrations of the scoring system in comparison to illustrations of DISH and OA clearly show two differing pathologies. The inconsistent naming convention of syndesmophytes, enthesophytes, and osteophytes and the implication of a single process renders previous data using this scoring method of limited interpretive value. Going forward, acknowledgement and leveraging of the presence of these pathologies within the scoring system can provide data that will more accurately reflect what is being examined.

Lemur paparazzi: investigating arboreal camera traps to assess species richness in southeastern Madagascar

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Camera traps have long been used to monitor wildlife populations and are increasing in popularity. While camera traps have been found to be particularly effective for ground-dwelling species, they have rarely been used to study arboreal species. The aim of this project was to compare the established technique of ground-level camera trapping with arboreal camera trapping for monitoring animal communities with a focus on lemurs. The study took place in Kianjavato, Madagascar over a span of four months during the dry season. Cameras were deployed across five forest fragments in a 700-meter grid formation. There was a total of 30 camera trapping points. Each point consisted of a tree with a ground camera placed approximately 0.5 meters high and an arboreal camera placed 8-12 meters high. Cameras were each left to run for a continuous 30-day trapping period. Photos were then analyzed to calculate species richness via the Menhinick's index. The overall species richness index ranged from 0 to 2.67 (M= 0.77, SD= 0.68) for arboreal cameras and ranged from 0 to 2.48 (M= 0.75, SD= 0.76) for ground cameras. The lemur species richness index ranged from 0 to 1.4 (M= 0.60, SD= 0.53) for arboreal cameras and ranged from 0 to 1 (M= 0.057, SD= 0.22) for ground cameras. Wilcoxen signed rank tests were used to compare richness between the arboreal and ground cameras at each trapping point. There was no significant difference between arboreal and ground camera traps for overall species richness ($V= 128$, $Z= -0.033$, $p>0.1$), which included lemur and non-lemur species (e.g., carnivores, rodents, birds). However, there was a significant difference ($V= 217$, $Z= 3.72$, $p<0.01$) between arboreal and ground camera traps specifically for lemur species richness, with arboreal traps having 10.6x more lemur richness on average. These results show promise for this emerging technique to monitor wildlife in tree canopies, especially arboreal primates. Furthermore, combined arboreal and terrestrial trapping offers a more complete picture of large-bodied vertebrate communities in tropical forests.

Impacts of food availability and reproductive events on intraspecific agonism in black-and-white ruffed lemurs (*Varecia variegata*)

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Agonism within social groups of animals may fluctuate seasonally. Food resources and access to conceptive females also vary by season. Intraspecific agonism could play a role in accessing key resources and mating opportunities. We investigated how reproductive seasonality and food availability affected frequencies of intraspecific agonism in black-and-white ruffed lemurs. Ruffed lemurs exhibit female dominance and fission-fusion dynamics (i.e., fluctuating subgroup size and composition). We employed instantaneous focal (5-minute

intervals) and all-occurrence sampling to collect information on lemur social and feeding behavior in two forest fragments in southeastern Madagascar from March 2014 to December 2017. Phenological surveys were also conducted bi-weekly to estimate fruit and flower availability. Agonism frequencies were calculated for this period by summing all agonistic interactions surrounding a focal individual (i.e., including all individuals within a sub-group, but not necessarily directly involving the focal lemur) within the two-week period surrounding each phenological survey. We used a GLM with Poisson distribution and number of observation hours as an offset. As expected, sub-group size was found to be a strong predictor of agonism and was held constant in order to investigate other potential variables affecting agonism frequencies. Fruit and flower availability were not found to be significant predictors on per capita frequencies of agonism. Agonistic frequencies were strongly associated with mating season but only in years when mating was observed. Agonistic frequencies likewise increased significantly in the birth season in years that births were observed though the pattern was not as strong as that that seen with mating. Overall, this supports the notion that agonism in lemur groups varies seasonally, and may be strongly driven by reproductive behaviors. This highlights the importance of agonism in primate social groups and the need for further investigation of reproductive strategies that may facilitate the complex female-dominated social system manifested by many lemur species. The approach used in this study may also be suitable for studying agonism in species that do not breed annually, as well as species that do not breed at the same time from year to year.

New Insights into Cortical Bone Remodeling Through 3D and 4D Imaging

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Cortical bone has a complex and dynamic internal microarchitecture that has long intrigued biological anthropologists. Decoding the information recorded within the cortex has been pursued for applications in age estimation, assessment of functional adaptation and the diagnosis of disease. Historically the study of bone histomorphology has largely been a two-dimensional pursuit focused around the study of carefully prepared thin sections. The advent of high resolution x-ray micro-computed tomography (micro-CT) late in the last millennium created new opportunities for expanding histomorphology into the third dimension while minimizing or eliminating the need for sample preparation. The arrival of this technology at the University of Calgary in the early 2000's created a unique interdisciplinary opportunity–bringing together Archaeology and Medical Science–to advance our understanding of the aging of the 3D microarchitecture of cortical bone. This presentation details early efforts to utilize micro-CT to characterize age-related changes in the cortical bone of known-age specimens derived from the Melbourne Femur Research Collection. Technological developments over the past two decades and the new opportunities they have created in this field will also be discussed. Finally, recent progress in the development of 4D (3D over time) imaging which is capable of tracking the progression of individual cortical bone remodeling events in animal models (rats and rabbits) at the Canadian Light Source synchrotron will be presented.

Investigating infant feeding development in wild chimpanzees using stable isotopes in hair keratin

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Variation between infants in the speed in which they reach nutritional independence can lead to differences between females in reproductive output. In wild primates, it is difficult to track infant feeding development due to the uncertainty in identifying exploratory mouthing versus ingestion of solid food, and if nipple contacts reflect continued milk transfer. Stable carbon and nitrogen isotopes ($\delta^{13}C$, $\delta^{15}N$) in feces or fallen hair

can be used to physiologically track infant feeding development. While fecal stable isotopes are sensitive to occasional sampling of solid food and show high day-to-day variation, hair stable isotopes show an amalgamation of dietary intake over a few months. We applied $\delta^{13}C$ and $\delta^{15}N$ analyses to keratin of 51 hairs collected non-invasively from 16 mother-infant pairs of wild chimpanzees (Pan troglodytes) at Ngogo, Uganda. We could distinguish infant and maternal hairs from strand diameter, which was ~20 µm lower for infants. Infants ≤1.5 years old showed mean $\delta^{15}N$ and $\delta^{13}C$ values of 1.9‰ and 0.85‰ greater than their mothers, indicating that the overall diet of these infants was mostly milk and little solid food. Infants >1.5 to ≤3 years old showed a mean $\delta^{15}N$ of 1.6‰ greater, and $\delta^{13}C$ of 0.2‰ lower, than their mothers, indicating that while these infants were still relying on maternal milk, a large proportion of their regular diet also included solid plant foods. Infants >3 years old showed mean $\delta^{15}N$ and $\delta^{13}C$ ratios that were 0.6‰ and 0.4‰ greater than their mothers, suggesting that maternal milk constituted a smaller proportion of the diet as infants approached the weaned event, which generally occurs at 4.5 years old. Higher mean $\delta^{13}C$ differences of infants >3 years old reflected a similar trend we found previously using fecal stable isotopes from older chimpanzee infants of similar age. This result is perplexing and may reflect a preference of older infants to select certain food parts while foraging. Overall, we could detect mother-infant trophic level differences and track feeding development using fallen hair. This relatively novel approach in field primatology can provide baseline data needed to better understand the evolution of primate life histories.

Early maize consumption in Southwestern Ontario: Results from stable isotope analysis of human skeletal remains from the Lucier Cemetery (AD 135-325)

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Recent research has changed how we understand the origins and ramifications of agricultural crop use in the Great Lakes region. The traditional view held that, maize, beans and squash arrived together or in quick succession around AD 1000. Introduction of these cultivated resources led to a transition from local hunter-gatherer settlement systems into more sedentary agricultural villages comprising multiple longhouses. This interpretation was primarily driven by the low abundance of macrobotanical remains at sites that pre-dated the advent of longhouse villages. The first data that challenged the coupling of domesticates and sedentary villages was presented by Crawford and Smith (1996, 1997), when they reported two maize cupules directly dated (AMS) to 500 years before the transition to longhouse village life. Recent advances in the study of microbotanical remains including phytoliths and starches residues from sites in Michigan, New York, and Quebec have not only decoupled the arrival of the 'three sisters', they have shifted back in time the origins of the use of maize and squash by a millennium (cf. Hart 2016). Current stable isotope evidence from human remains identify maize in the diet in Ontario (ca. AD 500) and in New York (ca. AD 650) (Harrison and Katzenberg 2003, Hart et al. 2011). We present stable isotope results from an adult female from the Lucier cemetery site in southwestern Ontario that suggest people were consuming maize in abundance ($\delta^{13}C$ = -11.3‰) by the second century AD, supporting the previously reported microbotanical results from Michigan, New York, and Quebec.

More than just a warning: Do the terrestrial alarm calls of vervet monkeys (*Chlorocebus pygerythrus*) show evidence of sexual selection?

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Sex differences in the acoustic structure of vocalizations may arise directly from morphological differences between males and females, or indirectly from sexual selection. Research on the alarm calls of vervet monkeys

(*Chlorocebus pygerythrus*) has largely focused on their putative informational content, often at the expense of objectively describing, quantifying and investigating the functional significance of other possible sources of structural variation in these calls. Here, we quantify sex-differences in the acoustic structure of the vervet monkey's terrestrial alarm calls, and we examine how these differences relate to sex differences in body weight. We recorded alarm calls from wild vervet monkeys over a 7-month period on the Samara Game Reserve, South Africa. We performed a cluster analysis to determine whether our sample of alarms (n=612) segregated into different call types based on variation in key acoustic variables, and we used a random forest model to quantify the degree of sexual dimorphism in our sample. We then used mixed effects models to determine whether call structure in males and females correlated with overall body size (using body weight as a proxy). Our analysis identified two clusters corresponding to the calls of males and females respectively, although some overlap between call types of each sex was evident. The random forest model accurately distinguished between the calls of males and females in 95.00% of cases based on variation in several spectral and temporal features. The mixed effects models demonstrated that a relationship between body weight and the frequency content of the alarms differed for males and females. Specifically, the distribution of acoustic energy in the alarm calls of adult males was concentrated at disproportionately low frequencies relative to their body size compared to energy distribution found in female calls. These results suggest that alarm calls may be under sexual selection to exaggerate caller body size and/or extend the effective range of these signals in males.

Testing the waters: A preliminary analysis of water security and holistic health with Six Nations of the Grand River

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Six Nations of the Grand River (SN) is the largest First Nation reserve in Canada, located in southern Ontario with the major urban centres of Toronto, Hamilton, London, and Brantford within 100-km. Despite a water treatment plant in the community and the close proximity to major cities, many residents do not have access to clean, potable water. As part of the Co-Creation of Indigenous Water Quality Tools project (PI Dawn Martin-Hill), preliminary tap water testing of 72 households was performed in SN. Of these, 29% were contaminated with E. coli. Well water tests for 78 households found that 24, and 10 households water sources tested positive for Mercury (Hg) and Aluminum (Al) concentrations (respectively) above the Canadian regulatory drinking water limits. Significant water quality concerns have emerged in the community: impacts to health and wellness, access and use of water systems, land, culture, and maternal-child health. People's livelihoods and diets depend on fish and other wildlife that live in or around these surface waters. The Haudenosaunee hold ancient spiritual beliefs and practices tied to the water as well (McGregor, King, Forbes 2001). Household water insecurity has profound impacts on holistic wellness for SN Peoples, yet this has not been consistently assessed. A health and water use survey was co-created with SN Health Services as a tool to improve autonomy for health assessments and connect water contamination more effectively with self-reported health outcomes. Follow-up interviews are on-going with participants to learn more about knowledge and experiences around water and health concerns. Within the survey, water security was assessed using the Household Water InSecurity Experience (HWISE) scale. Preliminary results found 58% of 40 respondents experienced household water insecurity during the past month. Connecting household water security prevalence with water test results offers important insight into the sociocultural burdens of water anxiety,

highlighting how these daily experiences impact holistic health outcomes. It is important to centre Indigenous wellness in land, language, community, cultural identity, and empowerment, so this will demonstrate how water security assessments can be culturally appropriate tools, ultimately building autonomy and capacity for SN Peoples.

For the birds? Avian tissue spacings and their implications in paleodietary reconstruction

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Inspired by Anne Katzenberg's insightful work on freshwater fish at Lake Baikal and her drive to test commonly-held assumptions in the scientific literature, this paper examines whether class-specific spacing values of avian species impact the analysis and interpretation of paleodiet. Paleodietary reconstructions using stable isotope analysis rely on tissue spacing values to determine the isotopic values of food items and tissue isotopic ratios from bone preserved in the archaeological record. Accurate tissue spacing values are especially important in research utilizing mixing models because they are sensitive to uncertainty and variability in isotopic values. However, paleodietary reconstructions have relied solely on tissue spacing values established for mammals, regardless of the class of animal being analyzed, and have not considered how the consumption of avian species may impact stable carbon and nitrogen isotope values. This study utilized experimental procedures to determine stable carbon and nitrogen isotope diet-to-tissue and tissue-to-tissue spacing values for the duck species *Anas platyrhynchos*. Avian tissue spacing values were also compared to tissue spacing values typically used in the paleodietary literature to determine the impact of class-specific spacing values on the analysis and interpretation of paleodiet. This research indicates that previous assumptions about tissue spacing values may have caused misrepresentation of the contribution of birds to the diets of past human groups. Class-specific tissue spacing values may therefore help to improve the accuracy of future paleodietary reconstructions using stable isotope analysis, particularly for groups who may have exploited birds as a food resource.

The Brandon Residential School: An exploration of Indigenous children's movement across the Prairie Provinces

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The Brandon Indian Residential School (Brandon IRS) was active from 1895 to 1972. Like many Indian Residential Schools, it drew its student base from a large geographical area. While the Truth and Reconciliation Commission provided a national-level accounting of the experiences of survivors of these schools, relatively little is known about the experiences of individual children attending over 130 residential schools that were in operation between 1831 and 1996 across Canada. In this study, we explore the patterns in the movement of children who were taken from their home communities between 1936 and 1952 in order to attend the Brandon IRS. We draw on publicly available student admission and discharge forms which are available online through Library and Archives Canada. Dates of admission and discharge, home community, and previous educational institution were collected for 620 students. A spatial analysis of the data was conducted using GIS to explore trends in the recruitment of children by school officials over time. Questions of interest included documenting heavily affected communities, differences in recruitment across age and gender and whether and how children were discharged. This study arose as part of a collaborative project between Sioux Valley Dakota Nation who now owns the Brandon IRS and several university partners. The community was interested in knowing more about the children who entered and left the Brandon IRS and encouraged the study of the archives for this purpose. Of particular interest, is to identify instances where

children were not discharged, as the Brandon IRS left a legacy of missing children. The combination of traditional archival research with modern technologies such as GIS provides a powerful tool for tracing how children were moved across the landscape of the Prairie Provinces and beyond. This line of exploration aims to contribute to a growing body of literature documenting injustices committed against indigenous children and their communities, and examining the long-lasting repercussions of the Indian residential schooling system in Canada.

Information use, social learning, and phenotypic constraint in wild vervet monkeys

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Socially-learned information can diffuse throughout groups quite rapidly, and generally requires little effort to be obtained. However, an individual's ability to use the information is likely to be dependent on phenotypic constraints (cognitive, social, behavioural, ecological, and demographic characteristics) which have been proposed to operate in the three successive steps of social information: acquisition, application, and exploitation (Carter, Tico, and Cowlishaw, 2016. In chacma baboons (*Papio ursinus*), Carter et al. (2016) demonstrated that variation in a novel socially-learned behaviour may be explained by phenotypic constraints. We conducted similar experiments with wild vervet monkeys (*Chlorocebus pygerythus*) whose social structure differs from chacma baboons. We tested the sequential process of social information use by using experimental water patches in 3 troops of wild vervet monkeys (approximately 150 individuals) located in the Samara Private Game Reserve, Eastern Cape Province, South Africa. Using a Bayesian multi-level model, we determined whether the phenotypic constraints of age, sex, dominance rank, inter-individual behavioural differences, social network measures, and troop ecology influenced the acquisition, application, and exploitation of the patch. We found that juveniles are more likely to apply information compared to adults in all troops. Additionally, we found differences in acquiring information across troops. We also found that juveniles and individuals who are more connected in the proximity social network were more likely to exploit social information. Our study demonstrates the fundamental consequences of phenotypic constraints on the acquisition, application, and exploitation of social information.

"Letting the market decide": how Canada's market-oriented federal policy approach translates into increased food insecurity for northern Indigenous communities

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In the 1980s, the Canadian government embraced a policy regime oriented towards neoliberal economics, one characterized by offloading of federal services onto provincial and municipal governments through a combination of asset sales and diminishing transfer payments; and deregulation of services previously overseen by federal regulators. This process gained momentum during the period 2006-2015 when the federal government realigned services to reflect a "market-driven" approach, one that has not altered significantly since that time. Current approaches to essential service delivery for northern communities reflect this federal policy orientation, with results that impact food security for thousands of Indigenous Canadians. Remote communities are dependent on-air transportation for delivery of most perishable foods. Deregulation in the airline industry has resulted in reduced competition, higher freight costs, and fewer resupply options for northern communities. Freight costs are also affected by federal offloading of northern airports which shifts the burden for operation and maintenance onto provinces, territories, and in some cases the airlines themselves. Northern retailers receive federal subsidies to offset freight costs in the form of "Nutrition North Canada", a subsidy program implemented in 2011-2012. This market-driven program fails to reduce high

grocery prices for northerners and privileges larger, vertically-integrated retailers, stifling competition and entrepreneurship in small communities. Deregulation has also imposed significant barriers for hunters and fishers wishing to market locally-harvested foods both within and outside of their communities.
A recent time-series analysis compared the prevalence of food insecurity among 3250 Nunavut households 2007-2015, tracking the impact of federal program changes made within this federal policy environment. As a result of the switch from a federal transport subsidy administered centrally through Canada Post to a market-driven retail subsidy implemented in an offloaded, deregulated transport sector, food insecurity rates in Nunavut's ten largest communities rose from from 33-40% to 46-56%. Results support the critique of neoliberal policy approaches that privilege market determination of essential service provision in remote, northern communities.

Sex determination using peptide analysis of amelogenin: Applications to archaeological, deciduous, and fragmentary dental enamel

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A significant limitation of bioarchaeological and forensic research is inaccuracy of sex determination techniques for skeletal remains of pre-pubertal individuals. This means that while age determination is relatively accurate for individuals during growth and development, the limitations in sex determination widens the error ranges of age estimates and has limited the questions that can be asked about cultural and biological sex differences in past populations. From the forensic standpoint, it restricts an examiner's ability to determine a key variable without expensive DNA testing. Dental enamel represents one of the hardest biological substances, and so is resilient to post-mortem degradation processes. It is frequently recovered from archaeological and forensic contexts even when other skeletal remains are too degraded for extensive recovery. One of the main proteins in dental enamel, amelogenin, is isomorphic based on sex, since it is coded by the AMELX_HUMAN and AMELY_HUMAN genes on the X- and Y-chromosomes (respectively). Recent work has demonstrated the effectiveness of proteomics in determining sex based on the amelogenin protein using both modern and archaeological samples. The present research evaluates the use of peptide-based amelogenin analysis for sex determination on modern documented dental samples, including both permanent and deciduous teeth (n = 29), and further tests the method on complete crowns and enamel fragments from archaeological contexts (n = 129). This technique resulted in high recovery from the samples and extreme accuracy in sex determination (100%). Recovery from enamel fragments has significant implications for conservation, as it involves testing on samples which otherwise would provide little information. These results present a significant methodological development with implications for archaeological and forensic human remains, and allow us for the first time to determine accurate (binary) sex for pre-pubertal individuals.

Block 3 and Ste. Marie: An isotopic comparison of two cemetery populations from the Fortress of Louisbourg

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The Fortress of Louisbourg, located in Cape Breton, Canada, had a short, turbulent history, with several groups

occupying the area during the 18th century, including French, New England, and British peoples. Located within the fortress walls, Block 3 was the first cemetery established at the Fortress of Louisbourg and was in use for a 10 years period (1713–1723). While the Block 3 cemetery was eventually relocated, not all individuals were reinterred at the new site (Block 34), as multiple burials were uncovered at Block 3 during the 20th century reconstruction of the fortress. Conversely, the Ste. Marie property, located on Rochefort Point was a mass burial uncovered during excavations in 2006. It is likely that these individuals interred in the Ste. Marie cellar are New Englanders that perished after the first siege in 1745. It is hypothesized that these two groups should have different isotopic chemical signals as they are two separate population groups- Block 3 representing the French population that was forcibly relocated from Placentia, NL and Ste. Marie representing those thought to be New Englanders who were garrisoned at Louisbourg following the 1745 siege. Using stable isotope analyses of carbon ($\delta^{13}C$), nitrogen ($\delta^{15}N$), oxygen ($\delta^{18}O$) and strontium ($^{87}Sr/^{86}Sr$) in human bones and teeth, dietary practices and origins of individuals from Block 3 and Ste. Marie were examined. Preliminary results suggest that the Block 3 burials reflect a diet composed of both terrestrial and marine sources, while the Ste. Marie individuals appear to have a mixed C_3 and C_4 diet. Strontium isotope values suggest that most people from both Block 3 and Ste. Marie have values consistent with a more coastal origin. Oxygen values suggest that the Ste. Marie individuals originate from an area of similar geography to Block 3 but had different dietary carbon sources. These data add further confirmation that the Ste. Marie individuals were likely New Englanders, while those from Block 3 are of French or Newfoundland origin.

U.S. military head size and shape: Visualizing variation for equipment design

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Designing and developing protective head gear for US Military personnel requires a critical awareness of head size and shape variation to optimize fit, form and function. Visualization of size and shape variation requires analyses of head data using a multifaceted approach that includes univariate descriptive statistics (e.g., mean, median, mode, and variance), multivariate approaches, such as Principal Component Analysis, and the analysis of 3D head scan images. Data for this study includes traditional anthropometric head measurements and 3D digital head scan data that were collected during the 2010-2012 US Army Anthropometric Survey (ANSUR II). A theoretical accommodation of a representative sample of US Army personnel, applying the current Advanced Combat Helmet (ACH) sizing system, using traditional anthropometry methodologies is presented. Results summarize the observed variability in head shape and size for males and females and population subgroups relative to helmet size. In addition, head size and shape variability is visualized using available 3D scan imagery relative to each predicted helmet size. The minimum and maximum accommodated head breadths, lengths, and circumferences are selected for each sex and helmet size. Scan representation through phantom view will also be used to further visualize other traditional descriptive statistics to highlight head shape and size differences between the males and females and other population subgroups highlighted in the ANSUR II database.

Humans, animals and landscape in Hellenistic Thessaly: An isotopic approach

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My first research opportunity in Greece came thanks to a chance conversation that Annie Katzenberg had at a conference. In this and many other ways she had a guiding and inspiring influence on my work. My presentation will explore this influence through the lens of research I have carried out with colleagues and students in Thessaly. During the Hellenistic era (323-31 BCE), Thessaly saw the foundation– and sometimes the rapid abandonment– of a number of key cities. Life in these cities depended on trade and subsistence

networks that drew on both local landscapes and distant points in the Greek world. Over the past several years the University of Alberta and the Hellenic Ministry of Culture have explored the domestic economy and landscape of Hellenistic Thessaly, first through the Kastro Kallithea Archaeological Project and currently through the Central Achaia Phthiotis Survey. My students and I have contributed to these efforts through stable isotope studies of human and animal diet and movement in the region. As this evidence is integrated with information provided by household excavation, landscape survey and ancient texts, a finer-grained portrait of everyday life in these communities is emerging.

Sexual orientation and physical growth among men in Cebu, Philippines

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A growing body of research suggests that sexual minority men (SMM) are shorter than heterosexual men due to differences in prenatal androgen exposure. Yet, no studies examining sexual orientation disparities in adult stature have actually used longitudinal data to examine the growth process underlying these differences. Using anthropometric data from the Cebu Longitudinal Health and Nutrition Survey (CLHNS), we assess the physical growth of 608 Filipino males of diverse sexual orientations, in order to understand the pathways influencing sexual orientation disparities in adult stature. SMM were 60 mm shorter than Heterosexual Men (HSM) in this sample and exhibited elevated measures of relative body mass index and perceived stress. SMM and HSM did not exhibit any significant differences in digit ratio, a common putative marker of prenatal androgen exposure. The difference in stature between each group did not exist during infancy, and only emerged when the men were about 11 years of age and correlate with decreased triceps skinfold measures - an indicator of adiposity and available energetic resources. This study is the first to investigate sexual orientation differences in growth among males. Our findings suggest that shorter stature for SMM emerges during late childhood and early adolescence, rather than being present from birth. The lack of significant differences between the two groups is informative as it contradicts the prevailing scientific evidence. Our findings suggest that postnatal conditions such as socioeconomic status, nutrition, and psychosocial stress may have a greater influence on the adult stature for SMM than exposure to prenatal androgens.

The potential impact of tourism on free-living parasite exposure in a wild group of macaques (*Macaca fascicularis x M. nemestrina*)

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Nature-based tourism has been heralded as a conservation tool that can provide employment for local communities while generating revenue for protected areas. Much of the criticism levied against tourism focuses on the increased risk of disease transmission from humans to wildlife, with primates representing a particularly vulnerable group given our shared evolutionary history. In addition to direct transmission, tourism can also affect the prevalence of gastrointestinal parasites in multiple, seemingly contradictory, ways. Anthropogenic activity can affect primates' exposure to pathogens by inflating group density and by altering the local microclimate, which may affect soil-dwelling parasites and insect vectors. Supplemental feeding on provisions may increase primates' risk of contracting human diseases through contamination, or it can provide a buffer against morbidity through improved nutrition and immune function. This study aimed to better understand the potential impact of changes to spatial and feeding behaviour on disease dynamics in a wild group of macaques at the Sepilok Orang-utan Rehabilitation Center (SORC) in Sabah, Malaysia.
We hypothesized that: i) the group's proximity to tourist infrastructure would fluctuate throughout the day

based peak visitor attendance; ii) home range size would correlate with monthly tourist attendance and iii) the consumption of provisioned food would affect macaque activity patterns. We tracked macaque movement using GPS points taken from the centre of the group every fifteen minutes from 0700–1800h. Activity patterns, including feeding behaviour, were recorded at 1-minute intervals during 10-minute focal follows. We examined the spatial overlap between the macaques' home range and tourist infrastructure using kernel utilization distributions (KUD). Macaques appear to use the tourist area more intensely when SORC is closed, though they still encounter tourists regularly throughout the day. It is likely that climatic variable and wild food availability have a greater influence on ranging patterns compared to tourist attendance. The group slept more when they fed on provisioned food. The higher the proportion of overall food intake that was provisioned, the stronger the relationship. These results demonstrate that the group is not avoiding tourists, and their frequent use of provisioned food could have implications for immune function and exposure to environmental pathogens.

Digitizing the dead: Using three-dimensional imaging to virtualize, educate and preserve

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Three-dimensional (3D) imaging is increasingly being utilized by biological anthropologists to achieve a range of research objectives. Openly accessible digital biological anthropology collections and resources are also increasing both in number and variety, yet the range of 3D resources is still limited. Our research aims to contribute to the existing online biological anthropology 3D resources and resolve some of the challenges of 3D imaging human skeletal remains. We will present six years of work centred on devising a methodology for 3D imaging human skeletal remains and creating a digital educational tool that aims to expose a wider audience of learners to the study of human remains. The educational aspirations of this project focused on generating photo-realistic, research-quality 3D representations of human skeletal remains as digital alternatives to hands-on learning in order to increase access to the experiential study of biological anthropology, while at the same time preserving the integrity of delicate teaching materials. Our initial 3D imaging efforts using an entry level NextEngine 3D laser surface scanner did not produce 3D models with the surface quality and image resolution needed to accurately portray the unique features, details and imperfections of archaeologically derived human bone. Subsequently, we enhanced our imaging process by replacing the image information collected by the 3D scanner with extremely high-resolution 2D photographs. To ensure sharp focus across the entire object, multiple photographs were taken of each surface and then rendered into a single image. Texture maps were created from the 2D photographs and then applied to the 3D mesh to produce an accurate, detailed and data-efficient 3D human skeletal model. A custom 3D educational application was developed by the second author to enable users to interact with and explore a complete, articulated virtual human skeleton. This presentation will also raise some ethical issues that should be considered as we make three-dimensional representations of once living persons more publicly accessible in the digital realm.

A comparison of femoral development; does diaphyseal growth and cortical development tell the same story?

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Using a skeletal collection of known age, an analysis of juvenile femoral growth and development as a measure of non-specific stress was conducted. The identified human collection curated at the University of Bologna is a sample of underprivileged individuals originally buried at the near-by Certosa cemetery in the 20th century, before disinterment due to a lack of space. By examining a sample of 57 individuals under the age of 12, this project has the goal of comparing femoral diaphyseal growth deficits to deficits in cortical development of the femoral midshaft. The assumption is that any linear and appositional growth deficits seen in the same individual would be similar and not statistically different. The study of linear growth is commonplace in physical anthropology, however the study of cortical development is less so. Therefore, determining if or how cortical development may differ from linear growth is essential for using these variables to explore juvenile growth and stress. The overview analysis of femoral development was conducted by calculating z-scores for diaphyseal length-for-age and calculating z-scores for three aspects of cortical development-for-age; total area, cortical area, and cortical thickness. Z-scores were calculated using normal and healthy children's reference data of known age from the Denver Growth Study. A mean z-score for each variable was then calculated. In an effort to examine if both types of growth analysis methods produce similar results, the z-score for diaphyseal growth was compared to each cortical development variable. Independent sample t-tests showed that any difference in z-score means between diaphyseal length-for-age and total area, cortical area, or cortical thickness were not significant (p=0.05). These results support the assumption, where that linear and appositional growth follow similar deficit patterns in this stressed sample despite having different biological trajectories.

Deep roots, new shoots: Honoring the work of M. A. Katzenberg

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Dr. M. A. Katzenberg has influenced the field of bioarchaeology immeasurably. Her commitment to rigorous research, along with teaching, mentoring, and leadership has been instrumental in cementing the ties between biological anthropology and archaeology and has led us to a deeper understanding of life and death in the past. This paper celebrates the work and career of Dr. M. A. Katzenberg, highlighting the ways in which her work will impact the field of bioarchaeology for decades to come.

Reconstructing the past: Nesmut - A case study

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Ancient Egypt is popular and salient in modern academia, however there appears to be a remarkable gap in the literature surrounding the topic of childhood. My research broadly attempts to glean an understanding of what childhood was like for those in Ancient Egypt, how society viewed these subadults, and if there were demonstrable age divisions as reflected in the mortuary record. Consider that although a great deal of Ancient Egyptian life has been studied, documented, and reviewed, there is no clear consensus on the age at which girls were said to become women. Some academics suggest that it was the act of marriage that allowed female children to be recognized as adults, whereas others believe the age of first menstruation signified this progression. This presentation will focus on a single juvenile female Ancient Egyptian mummy from the Twenty-second Dynasty, formally known as Nesmut, who is currently housed at the Royal Ontario Museum in Toronto, Ontario. Nesmut was unwrapped in the 1960s, and now is only represented by her skeleton. Nesmut presents an intriguing case study, as her accompanying coffin was inscribed with the title she held during her life: "Lady of the House, Chantress of Amun-Re". This is a role that was generally not thought to be held by juveniles, and yet according to a first-hand osteological analysis of her remains, including the use of long bone lengths, epiphyseal fusion, and dental eruption standards, Nesmut appears to be no greater than 8 years of

age. This research would then suggest that Nesmut was treated as an adult both in life (Lady of the House) and death (mummified and given a decorated coffin) far earlier than other scholars have suggested was possible. This comprehensive poster exposition will present the findings of a personal primary osteobiographical and textual analysis of Nesmut's remains and coffin, in order to attempt to better understand how childhood in Ancient Egypt was reflected in the mortuary program.

Say hello to Jolly's mouse lemur, *Microcebus jollyae*: an introduction to their natural history.

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Madagascar's extremely high levels of human disturbance increase the risk of extinction for animals such as lemurs, especially in species with highly restricted distributions. With limited research on many newly described species, the likelihood of some species going extinct with virtually nothing known about their ecology and behaviour is great. In the mouse lemur genus, *Microcebus*, there are now 24 recognised species, with three described as recently as 2016. For nearly all of these species, their ecology remains unstudied. Our study was the first to investigate aspects of the ecology, reproduction, and population biology of the Endangered Jolly's mouse lemur, *Microcebus jollyae*, throughout the majority of its known distribution in Kianjavato, Madagascar. We set Sherman traps along 78 transects (300m in length) over an area of 47.3km2 from April 2018–July 2019. A total of 96 individuals were captured. Morphometric measurements and biological samples were collected during trapping. We also collected opportunistic observational data of individuals, along or near our transects. The average adult body weight was 7.5% higher than previously recorded in the species, with the largest weight being 93g (mean = 65.9g ± 10g). Based on female oestrus and male testes size, the mating season started in July continuing into September. Infants were first seen at the start of February, weighing 20g, suggesting the birthing season started in January, with signs of lactation in adult females from January-April. We also found that there was home range overlap within and between the sexes. They used heights ranging from <1m to 13m (mean = 4.3m) suggesting they use multiple layers within their habitat including undergrowth and into the canopy. They have an omnivorous diet which we determined from the seeds in their faeces as well as direct observations of them feeding on nectar, fruits, and a small vertebrate (e.g. a frog). Intact seeds from 9 plant species were found in their faecal samples indicating their role as seed dispersers. These results add new information for an Endangered species, including its role in maintaining its rain forest habitats. These are important steps toward understanding its basic requirements and developing conservation strategies.

Communicative frequencies in *Lemur catta* (ring-tailed lemurs)

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Primates as social animals often utilize several different subtle and explicit signals to communicate with members of the same species. This means the full context of a particular behaviour's occurrence, usage, and how it changes between contexts, species, and especially over time are important factors to consider when studying behaviour through an evolutionary lens. Communicative modes or signals are unlikely to function entirely independent of one another, and lemurs, like other primates including humans, create complex multi-modal signals to communicate with one another. Ring-tailed lemurs (*Lemur catta*) have a diverse range of communicative modes, which makes research on this species valuable to studies of primate behaviour and

evolution. While this species' vocalizations have been studied extensively, other communicative modes include tactile signals, visual cues, and scent-marking to monitor group members, attain mating opportunities, warn group members of threats, defend territory, and maintain their matriarchal social organization. Despite the apparent complexity in how they communicate, the majority of studies on *L. catta*, and on other primate species, have been unimodal: focusing on only one communicative mode and excluding all others. This unimodal approach simplifies the potential complexity of primate communication, which is often a signal composed of two or more modes at once, like a visual cue with a vocalization. Multi-modal research addresses these limitations by recognizing the complex whole of primate social communication. I plan to investigate how the different modes of *L. catta* inter-individual communication are socially coordinated and integrated; what are the various social contexts in which multi-modal communication is used by *L. catta* to interact with one another? Using continuous focal animal sampling, three individual troops of free-ranging *L. catta* at the Duke Lemur Center, located in Durham, North Carolina, were observed for four months this summer, totalling 84 research days. Observation days were divided into morning and afternoon periods of approximately three hours each, and all four communicative modes above were tallied upon occurrence. This poster addresses some of the data collected this summer, focusing on preliminary findings from one of the observed troops totalling four individuals.

Multidimensions of poverty: An analysis of the differential effects of racism and poverty on skeletal growth

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There is evidence that people with a higher income tend to have better overall social, physical, and economic well-being. However, poverty is multidimensional and means more than just a lack of money and income. The differential effects of economic poverty, such as malnutrition and exposure to environmental pollutants, have variable effects on human growth and development depending on the conditions to which individuals and populations are subject. As such, detailed descriptive statistics and multivariate linear regression were used to analyze skeletal and documentary data from the Robert J. Terry Anatomical Collection and the Coimbra Identified Skeletal Collection, with the goal of addressing the impacts of environmental racism on growth and development. Specifically, this study examined local environmental conditions to look at why racism and poverty in the Terry Collection has a very different impact than poverty in the Coimbra Collection.

The impact of sample choice on pathogen recovery: an ancient DNA case study from medieval Italy

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Ancient DNA (aDNA) pathogen research provides a unique line of evidence to study infectious disease in the past. This method can be used to complement historical and paleopathological evidence of disease, by supporting the presence of known or suspected pathogens. aDNA research also allows us to explore questions concerning disease in the past that were previously considered unfeasible due to the ambiguities and limitations of skeletal and historical evidence. While aDNA methods have significantly contributed to our understanding of disease in the past, successful pathogen DNA recovery is impacted by a number of interrelated variables such as pre-laboratory sample conditions, wet laboratory processes, and data analysis. This paper will focus on pre-laboratory sample conditions, specifically how the element or tissue sampled (sample choice) impacts pathogen recovery. Sample choice may impact pathogen recovery because there can

be considerable intra-tissue variation in the DNA remaining in the archaeological samples from one individual. This variation can likely be attributed to two main factors, the amount of DNA present before death (related to the specific disease) and how well that DNA preserves after death (related to tissue type). We examine if the causative agent of brucellosis (*Brucella melitensis*) can be isolated from multiple tissues (i.e. calcified nodules, preserved tissue, and bone) from a *Brucella melitensis* positive individual from 14th century CE Italy to better understand how sample choice impacts aDNA pathogen study outcomes. Our results indicate substantial differences in the amount of *Brucella melitensis* DNA in the tissues sampled. Most of the DNA counts were too low for *Brucella melitensis* identification. Factors influencing aDNA recovery may include DNA present before death and the preservation of pathogen DNA in tissues after death. Understanding the impact of sample choice on results will allow us to better recover pathogen DNA and minimize ineffective destructive sampling of archaeological remains in search of elusive pathogens.

Embodying risk: Contemporary risk discourses and osteoporosis

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Anthropologists frequently draw on epidemiological models to understand how health is experienced at both the individual and population levels in the past and present. Epidemiological models are fundamentally organized around notions of risk, however, risk is a complex concept that has multiple different meanings and potential consequences. Risk is often broken into three main concepts: intrinsic/internal, extrinsic/external and embodied risk. Anthropologists have generally been interested in the process of how certain bodies, populations, activities, and geographies come to be associated with particular types of risk, which has given rise to frameworks for understanding risk. The purpose of this paper is to briefly explore the major theoretical frameworks associated with risk: governmentality, world risk theory, and risk culture and to then apply them to a case study of the recent Ontario osteoporosis screening program to explore how different conceptions of risk produce differing consequences. Ontario's new osteoporosis strategy is designed to increase early diagnosis and treatment of osteoporosis through increased population-level screening and targeted treatment that is organized around risk assessment. Through a critical assessment of this initiative, underlying themes of victim-blaming, embodied risk, medicalization of natural processes, concerns about government surveillance of bodies, and a conspicuous lack of action related to modifying social determinants of health emerge. While risk is a useful way of starting to address basic questions in population health, such as "who is getting sick and why?", there are also consequences inherent in the creation of risk-based categories and recognizing and mitigating the potential harm is an essential step in doing health research.

Unlikely herders in the Namaqualand coastal desert of South Africa: Trade, diversification, and place-making

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The Namaqualand coastal desert is one of the most remote regions of South Africa and is believed to be the gateway for the earliest introduction of herding to the rest of the country around 2100 years ago. Palaeoenvironmental data reveals that for at least five million years, Namaqualand has only ever been semi- or hyper-arid. Therefore, the adoption of herding by hunter-gatherers in this region must have limited their mobility to permanent watercourses. Although research focusing on Namaqualand is becoming more systematic, there remains large spatial and temporal gaps in the archaeological record. This makes it difficult to understand why hunter-gatherers chose to tether themselves to drought intolerant animals in a desert, and how they successfully negotiated and thrived in this marginal landscape for thousands of years.
In this paper we explore preliminary analyses of the material culture recovered from our initial field season at

Spitzkloof D Rockshelter and combine those data with unpublished results from open-air sites in the region to better understand the strategies (trade, economic diversification, place-making, etc.) employed by herders to successfully keep domesticates in this unforgiving landscape. Artifacts such as marine shell, trade beads, a high variety of faunal species, iron implements, and site use/re-use (e.g. burials) can tell us how these herders may have diversified their social relationships, economic activities, and movement to thrive in the desert. Combining data from a variety of archaeological sites in the region will allow us to better understand the sustainability of herding by Holocene foragers living in a challenging environment. Understanding how early herders adapted to these marginal and unpredictable environments provides deep-time perspectives on human adaptation and flexibility that is highly relevant to modern herders in Namaqualand.

Proteins in play: Testing osteocalcin variability between different skeletal sampling sites

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More frequently bioarchaeological research is integrating biochemical analyses to better understand processes that affect the composition of the skeleton and consequently our interpretations of the archaeological past. One such method is quantifying bone protein which has the ability to reflect biological and potentially pathological processes that may otherwise be missed in skeletal analysis. Osteocalcin is a non-collagenous bone protein clinically linked to processes of bone metabolism with its concentration in skeletal tissues affected by known biological factors such as age and sex, but also potentially pathological conditions that impact bone growth and remodelling. Despite the abundance of the osteocalcin protein and its close association with skeletal metabolism, its study in archaeological bone has been limited in terms of sampling technique and quantification method validation. This study assesses the sampling and analytical methods used in recent osteocalcin research to explore the variability in osteocalcin concentrations across paired skeletal elements, particularly the femur. For this comparison, 27 individuals from the Block 3 and Rochefort Point skeletal collections from the 18th century Fortress of Louisbourg were analyzed. 10µg of bone was harvested from the distal third of the posterior aspect of both the left and right femora from each individual. The osteocalcin content of the demineralized bone samples was measured using an ELISA (Enzyme-Linked Immunosorbant Assay) and the total bone protein was quantified using a BCA (bicinchoninic acid) assay. There were no statistically significant differences between the left and right osteocalcin concentrations ($t = 0.44$; $df = 42$; $p = 0.65$); however, one outlier (Block 3, Burial 24) did show a distinct difference likely associated with a pathological condition observed in both femora. This research is significant in that it: 1) validates the method to successfully extract osteocalcin from femoral cortical bone; 2) it demonstrates consistency in osteocalcin concentrations in paired skeletal elements; and 3) establishes the important foundation to further test consistency in osteocalcin concentrations across different skeletal elements.

Stable carbon and nitrogen isotope variability as an indicator of distinct individuals

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Archaeological excavations frequently produce large quantities of highly fragmentary human and faunal bone, which have utility in answering questions of past environments and human and animal life ways. This potential is hindered by the inability to distinguish individual animals, as isotopic studies related to diet and health require the analysis of unique individuals. Stable carbon and nitrogen isotope analysis of bone collagen may be useful in distinguishing individuals within highly fragmented faunal or burial assemblages that cannot be distinguished morphologically. In this study, we quantified three types of isotopic variation: Intra-individual (multiple elements within individuals), inter-individual (multiple individuals of the same species), and intra-bone (multiple samples from the same bone). Mean intra-individual variation was 0.52 ‰ (Euclidean

distance), significantly lower than inter-individual variation (mean of 1.45 ‰) and intra-bone variation (mean of 0.63 ‰). We suggest a distance of 1.50 ‰ in bivariate isotopic space as a metric to distinguish bones from different individuals. Dietary ecology, migratory behaviors, and taxonomy, were important factors influencing the amount of intra-individual isotopic variation. The potential for intra-bone isotopic variation to influence intra-individual variation is discussed in relation to the mechanics of bone growth and isotopic turnover, although its ability to create intra-individual variation appears minor. This quantification of intra-individual isotopic variability should aid researchers in distinguishing individuals from one another.

The impact of edges on mantled howler monkey (*Alouatta palliata*) feeding behaviour in a fragmented Costa Rican rainforest

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Deforestation of tropical habitats is occurring at alarming rates, and understanding the full impact of environmental degradation on primate communities is critically important for species survival. A direct consequence of deforestation, habitat fragmentation increases the amount of forest edge relative to forest interior. Edge habitats undergo drastic shifts in ecological conditions such as wind speed and light penetration, which in turn alter vegetation structure. The resulting changes in food quality and abundance often deleteriously affect primate populations. In this study, we examined the impact of anthropogenic edge on mantled howler monkey (*Alouatta palliata*) feeding ecology at the La Suerte Biological Research Station (LSBRS), a tropical forest fragment in Costa Rica. Specifically, we examined whether feeding tree usage and plant parts consumed varied between interior and 100m anthropogenic edge habitats. We predicted lower feeding tree diameter at breast height (DBH), less fruit consumption, and more leaf consumption in forest edge compared to forest interior. From May-August 2017-2018, we collected behavioural and tree use data on individual monkeys using focal scan sampling, with individuals sampled for 30 minutes and scans taken each 2 minutes. Tree circumference was measured when focal monkeys fed in the same tree consecutively for two samples or more, and DBH was determined from these data. We collected 736 total hours of focal data on howler monkeys at LSBRS, 399 hours in 100m anthropogenic edge zones and 337 hours in interior zones. Our results show that mean feeding tree DBH was significantly higher in forest interior than forest edge (84.5cm vs 61.6cm; Mann-Whitney U test, p=0.003). Contrary to our predictions, howler monkey diet composition at this site did not vary from proportions expected by chance across habitat zones (x2=3.01, p=0.222). Monkeys consumed equal amounts of fruit, leaves, and flowers across forest edge and interior. Our results indicate that mantled howler monkeys at LSBRS selectively feed in large trees in forest interior but do not alter the types of plant parts consumed in response to anthropogenic forest edges. These findings are consistent with previous research showing the resilience of howler monkeys to anthropogenic habitat destruction.

Structural and caregiver influences on playground motor variability

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Children's playgrounds are intentionally constructed to bolster gross motor development, and include structures with specific functions (balancing, brachiating, climbing, spinning, sliding, and swinging). Learning to navigate a playground structure, however, may require a large behavioural repertoire, and variability in performance may be key. For example, adults who showed high variability during a motor task learned the task faster than adults who were less variable (Wu, et al., 2014). Children may also vary their behaviour as a

learning strategy: when given the opportunity to construct their own playscapes, children create variable environments in which to play (Jongeneel, Withagen, and Zaal). To better understand the variety of behaviours children employ on playground structures, we conducted a study on structural and caregiver influences on children's behaviour. We conducted naturalistic observations of three-to-five year-old children, recording the variety of behaviours exhibited on balancing, brachiating, climbing, spinning, sliding, and swinging structures. Simultaneous with child behaviour coding, we recorded the level of caregiver involvement (within reach, at a distance, or actively engaged), and whether caregivers gave instructions on how to engage with the structures. The proposed poster will present preliminary data on the variety and frequency of behaviours observed on each structure and descriptive data on caregiver engagement. The aim here is to determine the extent of variability observed, and whether caregiver influence impedes or enhances this. This information will then be used to inform a future experimental study on the impact of variability in performance on children's motor skill learning.

Boundaries of human facial diversity from the perspective of syndromic phenotypes

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In humans, a remarkably high number of single mutation diseases affect facial development and produce facial dysmorphology. Recent research highlights the potential to leverage associations between syndromes and morphology as a clinical tool for syndrome diagnosis. Less effort has been given to identifying unifying aspects of syndromic effects. However, to the extent such 'rules' exist, they may point toward developmental processes most central to dysmorphism and most susceptible to early intervention. Here, we seek initial insights into this question by looking for ways in which syndromic faces do not vary. We quantify facial shape variation with 65 3D facial shape landmarks in a large sample of children that includes 1579 affected (398 diagnosed syndromes) and 1020 unaffected individuals. The overwhelming pattern across the primary axes (principal components) of shape variation indicate that affected variation differs from unaffected variation primarily in magnitude. That is, the rules of facial shape in affected individuals appear to be the same as in unaffected individuals, except that affected individuals are collectively more variable. We examine the few principal components on which the affected and unaffected distributions differ in location. The primary limitations on development implied from these dimensions relate to cranial breadth.

A biocultural understanding of obesity development among the Maltese

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Population health data have shown the Maltese to have experienced one of the largest increases in obesity prevalence within the European Union. Despite a climate conducive to the production of nutritious foods and the popularity of the Mediterranean Diet in the region, dangerously high body mass indices have been recorded for Maltese men, women, and children since the 1980's. From a review of social and health sciences literature, explanations for this particularly recent development within the small island nation were largely limited to biomedical investigations of genetics, diet, and lifestyle factors. Although these elements directly contribute to health status, consideration for the social context in which obesity arose is equally necessary. Using the analysis of historical and mass media documents, I hypothesize that twentieth century Maltese social history can be integrated with existing health sciences research to provide a more comprehensive understanding of the development of obesity among the Maltese population. Maltese public and institutional discourse on obesity were recorded using a keyword search for articles and advertisements within the Times of Malta digital archives from 1940 to present year. These data were then composited within a timeline

created from Maltese geopolitical, economic, and sociohistorical records, and compared cross-culturally with cases of obesity among other small nations. Findings of the study present cross-cultural and diachronic evidence for the long term effects of colonial influence on the Maltese economic and social environments of the small island nation, resulting in an obesogenic environment with multi-generational effects that persist in 2019. Conclusions from the project propose that the adoption of a biocultural approach is essential to fully understanding the development of obesity among the Maltese. Rising obesity rates are a national public health crisis with costly consequences. By considering the underlying social determinants alongside biomedical research, a biocultural approach to understanding why Maltese obesity developed can provide a more comprehensive way of addressing the concern. In addition to being a risk factor for other noncommunicable diseases, obesity poses a threat to the accessibility of the public health care system in Malta, an issue now shared by much of the developing world.

How is upper limb asymmetry expressed during ontogeny? A comparison of linear and cross-sectional asymmetry in the humerus.

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Humans display asymmetry of the upper limb, predominantly with right-side dominance, and typically associated with asymmetrical mechanical loading. Few studies have examined long bone asymmetry in sub-adults, despite the use of arm asymmetry in linear dimensions and cross-sectional shape in adults as measures of health and activity. During ontogeny the skeleton is most plastic, and adult asymmetries largely reflect activity levels adopted during this period. Cross-section geometry (CSG) in particular is used to assess habitual manipulative behaviors and activity levels, and may be expected to develop greater asymmetry than bone size alone (i.e., linear dimensions). Humerus asymmetry of linear dimensions (bone length, and proximal and distal breadths) and of midshaft maximum bending rigidity (Imax) are examined to assess whether these different aspects of biomechanical asymmetry develop in concert and in similar directions and magnitudes using archaeological hunter-gatherer sub-adult burials (n=57). As humerus length reflects lever arm length, it may be more mechanically canalized and expected to show the lowest asymmetry of all measures. Our analysis finds that Imax asymmetry magnitudes are consistently higher than for linear measures, and only directional asymmetry of articular breadths (proximal and distal) show moderate but significant correlations with that of Imax. Humerus length displays the lowest and least variable directional and absolute asymmetries. Epiphyseal breadth asymmetries are similar to each other, though proximal breadth shows slighty higher and more variable absolute asymmetry than the other linear measures. Distal epiphyseal breadth directional asymmetry and Imax directional and absolute asymmetry develop consistent increases with age. There is high variability in the magnitude and direction of asymmetry of younger individuals (e.g., infants), suggesting that a baseline functional signal that may be important for interpreting biomechanical properties of the humerus.

What happens in intergroup encounters when all groups share the same home range? A case study in an Angolan colobus multi-level society

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Primate groups live within a home range, where they feed, sleep and reproduce. In some species, group members will actively defend their territory against conspecifics, while in others the home range is too large and only part of it will be defensible. Due to these differences in space use, there are different contexts in

which primates may encounter extra-group conspecifics. Intergroup encounters can range from “peaceful” interactions where groups mingle, to ‘’aggressive’’ interactions with physical fights, where the winner of the encounter usually gains access to a certain type of resource. While intergroup encounters are relatively well-studied in primates, our understanding of encounters between groups sharing a home range and showing tolerance to close proximity is still limited. However, a population of Angolan colobus monkeys (*Colobus angolensis ruwenzorii*) presents an excellent opportunity to investigate this situation as they are unique among congeners in forming a multi-level society. We follow a large band of 135 individuals comprising core units that are both uni-male, multi-female (6) and multi-male, multi-female (7). Indeed, this band consists of 13 cohesive units, ranging from 6 to 18 individuals, that have been described to not only be tolerant but also to associate preferentially over time increasing opportunities for encounters. This presentation will explore and describe interunit interactions (N=175) in this population, examining the ID of the units involved, the initiator of the interaction, the behaviour during the encounter, the level of aggression, the winner (if any) and the outcome of the interaction for both units. The results will determine the effect of interunit interactions on the patterns of association between units, broadening our understanding of the unusual patterns of tolerance in this subspecies.

Sekuwe (My House): Dene First Nations tackle housing conditions and insecurity in northern Manitoba.

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The lifestyle and culture of northern remote First Nation communities is distinctly different than life in the south, so why are the homes built for these communities so often designed the same way? How should the unique realities of Indigenous lifestyles and perspectives be reflected in homes designed for First Nations communities? To answer these questions, the University of Manitoba's Northern Health Research group worked with Northlands Denesuline and Sayisi Dene First Nation in northern Manitoba to develop culturally appropriate housing designs for future use in Manitoba’s Dene communities. The project-developed designs for Indigenous-focused homes were informed by community workshops, first-hand experiences with Dene lifestyle, student exchange programs and the exchange of knowledge between architectural students, Dene students and the communities. Here we present some of the designs, concepts and cultural elements that were inspired by using a relational approach to understanding the impact of housing on health. Key themes related to the social determinants of health that were addressed by the designs include education, job opportunities, local and recycled resources, alternative heat sources, sustaining traditional and current activities, and local cultural and environmental assets. The University of Manitoba and Dene students created healthy housing designs and we demonstrated a process through which housing might impact health even before the soil is turned. Future research will continue to model approaches that build relationship, experience, and knowledge to build health equality.

Growth and development in a time of famine–St. Étienne Cemetery, Toulouse, France

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Documentary sources indicate that the city of Toulouse experienced multiple periods of famine during the 10th and 11th centuries, amidst ongoing food insecurity and political instability. To date, bioarchaeological data have not been used to evaluate the indicators of malnutrition in this community. This study aims to assess the growth and development of a medieval sub-adult sample from the St. Étienne Cemetery, Toulouse,

(11th cen. to early 13th cen.), France, to illuminate the medieval childhood experience, both biologically and socially, in the context of food insecurity. Seventy-five individuals were used in this study, in which dental ages were used in conjunction with measurements of the femoral length, distal metaphysis, and femoral head. From these latter measurements, stature and body mass were estimated using least square regression equations based on the Denver Study. Z-scores were calculated using the Denver Study mean and standard deviation for each age cohort. Comparisons to other archaeological populations and modern growth standards produce a skeletal growth profile and relative growth trajectories for identifying patterns of growth stunting. The results show evidence for low body mass and short stature caused by a nutritionally deficient in utero and birth environment with lasting effects into adolescence. Over half of the z-scores (65%) fell below -2 standard deviation indicating growth stunting and the presence of small-for-gestational-age births. Stature and body mass estimates indicate no catch-up growth before the cessation of weaning. By 10 years, an age at which children often began work, both estimates reach the 50th percentile. After this point, body mass increases and height decreases before both fall below the 5th percentile. Children in the workforce would have had increased access to food, which may correspond to the body mass increase in those who died aged 10 years and older. Stature did not increase, however, due to the growth stunting experienced during infancy, as indicated by the z-scores. Food shortage, thus, restricted children by inflicting ecological and economical strains that both dictated their social lives and perpetuated a pattern of stress.

Intestinal parasites, sanitation, and hygiene in Roman period Italy

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From the perspective of urban sanitation and hygiene in the ancient world, Roman Italy has been relatively well studied. However, the same cannot be said of gastrointestinal diseases that rely on sanitation conditions for their transmission amongst people. In particular, there have been very few studies looking for evidence of intestinal parasitic infection in Roman period Italy. This study aims to contribute new evidence for parasites infecting Roman inhabitants of Italy and to analyze this evidence in the context of urban sanitation at the time, which is known through archaeological and historical evidence. Sediment samples from latrines, drains, and the pelvis of skeletons were studied from three Roman period sites in Italy: the complex at Oplontis B, the villa of Vacone, and the rural imperial estate of Vagnari. Microscopic analysis of sediment samples revealed evidence for fecal-oral parasites at all sites, namely roundworm (*Ascaris sp*.) and whipworm (*Trichuris trichiura*). This evidence, in combination with data from Pompeii and Rome, illuminates the dominance of fecal-oral parasites in Roman Italy and the wider Mediterranean region at both urban and rural sites. Although the implementation of sanitation infrastructure, which often diminishes infections in modern populations, was common in the Roman period it does not appear to have stopped infections at that time. We will explore archaeological and historical evidence that sheds light on the use of and attitudes towards sanitation infrastructure and human waste, and how these may be responsible, in part, for the presence of gastrointestinal parasites found in these Roman communities.

Living on the edge: First evidence for molecular edge effects in an animal population

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Forest loss and fragmentation are predominantly anthropogenic processes causing massive biodiversity loss in tropical forests. A direct result of these processes is the creation of forest edges, which represent complex abiotic and biotic interactions between adjacent ecosystems separated by an abrupt transition. Although previous studies have documented patterns of plant and insect responses to edge effects, relatively little is known about how edge effects influence mammal ecology, biology, and genetics. The aims of our study were to assess the current state of theory on mammal responses to edge effects and to report novel results of the application of genetics in this important line of research. Current models focus almost exclusively on how edge effects influence animal biogeography (i.e. distribution, abundance, and species diversity). A critical, missing component in these models is that changes to animal movement patterns may result in population variation at the microhabitat level. We used population genetics tools to determine if molecular edge effects exist in *Microcebus ravelobensis*, a small, nocturnal, arboreal, endangered lemur species, endemic to the dry deciduous forests of northwestern Madagascar. *M. ravelobensis* was sampled in one edge and two interior habitats (500 and 1,400 m from the edge) in a continuous forest bordering abruptly on a savannah. A total of 41 individual mouse lemurs were genotyped with a suite of nuclear microsatellites to determine genetic diversity, genetic differentiation, and movements between the sites. We found that the overall genetic diversity was lower in the edge habitat compared to the two interior sites, and that all subpopulations showed relatively low genetic exchange and significant genetic differentiation, despite the short geographical distances that lie within the possible dispersal distance of single individuals. We interpreted these findings as the first signals of molecular edge effects, and also indicate the potential for local adaptation. Thus, existing models of edge effects should be updated to incorporate the possibility for molecular responses to habitat edges.

The early monkey gets the matoke: The influence of sex, rank, and arrival time on feeding strategies and food acquisition in *Chlorocebus pygerythrus*

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Among social foragers, individuals can actively search and find food resources (the producers) or join already discovered food patches (the scroungers). Compared to scroungers, producers experience greater predation risk because they occupy spatial positions on the leading front edge of the group, but they also benefit from the finder's share, which is the proportion of food eaten before the arrival of others. On the other hand, scroungers face feeding competition (both scramble and contest) when joining a patch already occupied by other individuals. Here, we report on factors influencing feeding strategies and food acquisition among a group of wild vervet monkeys (*C. pygerythrus*) at Lake Nabugabo, Uganda. We collected data using behavioural observations and field experimentation (N = 126) where we set up a feeding patch (1.75m x 1.75m) with dispersed food rewards and recorded participants' ID, feeding strategy, order of arrival, and proportion of food eaten. We calculated the tendency of each individual to produce and scrounge, the finder's share, and the scrounger's share. We found that higher-ranking individuals tended to produce and scrounge more than subordinates. To calculate the effects of different variables on the finder's and scrounger's share, we used linear mixed models and found a significant positive correlation between the duration that a producer feeds alone (i.e., the finder's advantage) and the finder's share. Furthermore, scroungers who arrived at the patch earlier obtained a greater scrounger's share. Overall rank had no effect on the proportion

of food obtained for both producers and scroungers. Taken together, these results suggest that high-ranking individuals opportunistically use both producer and scrounger strategies and all individuals employ an early arrival tactic to obtain a greater share of food. This study corroborates previous studies which have found that even among species with a linear dominance hierarchy and high occurrences of within-group contest competition, dominant individuals do not benefit from feeding advantages at large, dispersed food patches since they cannot monopolize the resource. These results will be used to complement a later study on different types of scrounging strategies and the effects of spatial positions on feeding success.

The first fossil of a non-human primate from Serbia

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Despite the long history of paleontological research of Neogene mammals in Serbia, no primate fossils have been identified in the country so far. Here we report the identification of two fossil primate teeth from Ridjake, a rich paleontological site in Western Serbia: an upper third molar with heavy occlusal wear and taphonomic weathering, and a well-preserved lower third molar with only minor damage to the cusps and root apices. We assessed the taxonomy of the specimens based on non-metric traits and bivariate comparisons of linear measurements, which show characteristics typical of papionins combined with a relatively large size. Combined with the early Villafranchian (MN16) age of the site, we attribute both teeth to cf. *Paradolichopithecus* spp. This represents the first non-human primate found in Serbia, and the only primate known from Serbia prior to the Middle Pleistocene. Along with recent hominin finds, the Ridjake specimens add to the growing primate fossil record of Serbia and highlight the need for continued research in this country.

Reproductive loss and migrant belonging in the Punjabi-Canadian diaspora

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Pregnancy loss is a taboo subject in contemporary society. Despite the fact that an estimated 15-20% of pregnancies result in miscarriage, it is rarely talked about openly (Robinson 2011). More troubling still, there is a large gap in the anthropological literature on experiences of pregnancy loss in the Canadian context. A survey of physicians in Ontario found that misinformation, cultural background, and language were significant barriers to accessing health services following pregnancy loss (Engel and Rempel 2016). Studies of Euro-Americans' experiences of reproduction, and to a lesser degree of cultural communities outside North America, have linked pregnancy loss to static cultural ideas about family, marriage, death, and personhood (see Cecil 1996; Erviti et al. 2004; Layne 2003; Savage 1996; Simmons et al. 2006). While these studies compellingly depict deep personal experiences, they fail to account for nuanced and dynamic relations between reproduction and global sociopolitical forces. Most notable is the lack of scholarly engagement with immigrant and diasporic populations grappling with undesired pregnancy outcomes. Diasporic communities make up seven percent of the world's population (UN 2017), occupying hybrid cultural spaces between the homeland and their new homes (Safran et al. 2013). The Punjabi-Canadian diaspora in British Columbia is one of the largest in Canada and the world. It offers a unique opportunity to explore the impact of mass migration and diasporic lifeways on the health and reproductive lives of Punjabi-Canadians who must negotiate belonging within the Indian community, and within wider Canadian society, in their practices around reproduction. This talk will explore the healthcare experiences of Punjabi migrant families as not only embedded in their own unique health worldviews, but also influenced by the policies and politics of the wider

state systems. Focusing on results from my fieldwork, I will examine how families are constructed in this the Punjabi diaspora in light of these changing dynamics and how health-related perceptions and reproductive experiences can define migrant belonging and identity.

An applied nutritional anthropological study of healthy eating perceptions and barriers in an urban First Nations community

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The nutritional status of Indigenous people in Canada has been a frequent avenue of research due to its relationship to community health. Studies report that the diets of Indigenous people often do not meet nutritional guidelines, a problem exacerbated by increasingly diminished access to nutrient-rich traditional foods. Nutrition interventions have documented only marginal success, which may be due in part to a disconnect between programming and community-defined notions of what constitutes culturally appropriate "healthy eating". Colonization has led to food system destruction through land appropriation, urbanization, and attempted assimilation. Many Indigenous communities are working to regain their food sovereignty by engaging in applied research. Nutritional anthropology offers a unique framework for these studies as barriers can be contextualized within their unique historical, political, social and ecological antecedents. Community nutritional status is thus the embodied outcome of the lived experience of colonialism and marginalization. The present study was conducted in partnership with an urban BC First Nations community to address concerns expressed by community leaders about the presence of barriers preventing access to a culturally relevant healthy diet. Adult caregivers (n=20) were interviewed using a collaboratively developed instrument. Heavy use of food assistance programs was reported, with most caregivers reporting weekly participation. Caregivers reported minimal participation in traditional food sharing networks, which may contribute to food insecurity. Healthy eating was most frequently described in terms of fruit and vegetable consumption, reflecting the influence of dominant, non-Indigenous perspectives. Fish and salmon were identified as culturally relevant by approximately three quarters of participants, but the number of foods identified was generally limited and lacked species diversity. This suggests that the culturally significance of fish/salmon has been maintained to a greater extent than plant foods. Barriers to healthy eating were reported by 80% of participants with the top three identified as cost, access to unhealthy options, and time limitations. Barriers to accessing traditional foods were reported by 70% of participants, with the top three being transportation/access, knowledge, and cost. Cost was a persistent barrier in our study which highlights the importance of underrepresented urban Indigenous perspectives.

Bodies at risk: Biocultural examination of the St. Lawrence County Poorhouse inmates

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This presentation is part of the Death in St. Lawrence County Project, drawing upon the adult intake records from the St. Lawrence County Poorhouse (Canton, NY) from 1875 to 1920. Intake certificates from 1718 adults (1049 males, 669 females) from over 20 countries of origin have been digitized and made available for study. Records from the poorhouse allow for diachronic reconstruction of individuals' reasons for admission, reflecting 45 years of marginalizing pressures upon a vulnerable population. Males were significantly more likely ($p<0.01$) to enter the poorhouse due to ill health, intemperance, and traumatic incidents than women. Females were significantly more likely ($p<0.01$) to seek admittance due to abandonment by their husbands or

pregnancy. Investigations of marital status, temperance, capability of labour, and previous occupations reveal a diverse group of individuals making use of the poorhouse for stays of one day to multiple years. Chronic issues such as low socioeconomic status and food insecurity have been identified in contemporary biomedical research as having embodied health effects, increasing the risk of individuals developing conditions such as cardiovascular disease and mental illness. Interestingly, salvage excavation in 2017 of skeletons from the associated poorhouse cemetery found evidence of care in burial, including containers, coffin hardware, and burial shrouds. These sources of evidence allow for a biocultural examination of health across the life course of these institutionalized individuals, some of whom made use of the poorhouse multiple times.

The biological impact of the agricultural transition on human stature: evidence from ancient DNA and skeletal data

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Human stature is a sensitive proxy for health status in the past, reflecting the combined influences of genetics and the environment. In particular, the bioarchaeological record of the foraging-to-farming transition presents a scenario of health decline among farming communities, manifesting as reduced stature and an increased prevalence of dental and skeletal indicators of non-specific stress compared to earlier foraging communities. Here, we leverage modern genome-wide association studies with ancient human genomes to investigate how environmental factors impacted achieved (skeletal) stature. On a per-individual basis, we compared achieved height (estimated from skeletal measurements) to “genetic height” (a prediction based on genomic analyses of height-associated variants), for 68 individuals from prehistoric Europe (33,000-2,500 BP). A regression-based approach was used to estimate height from long bone measurements (standard error 1.86-2.73%) and genetic height scores were calculated using the summary statistics from a modern genome-wide association study. We find that genetic height scores were positively correlated with skeletal height (r^2=0.072, P=0.015), leading us to then compare whether individuals were environmentally “taller” or “shorter” than expected. We find that males were shorter given their genetic height scores during the shift to farming (Neolithic P=0.039, Copper Age P=0.058) compared to the Upper Paleolithic, Mesolithic and Bronze Age (P > 0.170 for these periods), while females exhibited a less “extreme” trend in height (P > 0.247 across all periods), potentially indicating a buffering of stress. We also compared whether non-specific indicators of skeletal stress impacted height, and show that linear enamel hypoplasia was associated with reduced skeletal stature (~7-10cm), suggesting a potential accentuation of physiological stress, notable for the Neolithic and Copper Age

individuals. By comparing skeletal and genetic height metrics alongside skeletal stress indicators, it is possible to gain insight into how gene-environment interactions may impact growth trajectories during periods of economic, social and environmental change.

The contribution of stable hydrogen isotope analysis to understanding human diets at prehistoric Paquimé, Casas Grandes, Mexico

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Paquimé was an important prehistoric centre linking the American Southwest and Mesoamerica. Previous archaeological and stable isotope analyses indicate that diets were based upon C_4/CAM cultivars and wild foods but the importance of meat remains unclear. Identifying patterns of protein consumption allows us to consider how the dietary aspects of social differentiation may have been expressed at Paquimé and general adaptations to semi-arid climates. Stable hydrogen isotope analysis of bone collagen can identify relative amounts of meat in the diet. It offers information on trophic level that is largely independent from stable nitrogen isotope values, which may be elevated in semi-arid climates or supressed by bean consumption. The process of analyzing collagen and calculating the dietary stable hydrogen isotope values has recently become simpler thanks to the development of collagen standards by the USGS Reston laboratory. Using the isotopic data from 71 individuals from Paquimé and the nearby Convento site, we estimated the meteoric water values and then the relative meat consumption for each individual. Interestingly, although some individuals were consuming more animal protein than others, the data do not strongly correlate with sex, age, non-local origin, or elite burial status. Young Adult individuals are the exception to this, as they appear to have consumed relatively more meat than adolescent or older individuals. While no one individual shows evidence of an exclusively vegetarian diet, plants do appear to have provided crucial sources of protein, which is consistent with the other archaeological evidence from these sites. This study shows the benefit of adding stable hydrogen isotope analysis of bone collagen to dietary reconstructions, especially when there are questions about plant and animal protein use that are not resolved by stable nitrogen isotope analysis alone. By incorporating additional sources of dietary information, we can better understand past individual and group dietary adaptations in semi-arid and arid environments.

Vitamin D deficiency in Chalcolithic Iran: Links between maternal and childhood health.

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Infant health and survival have long been recognized as measures of stress exposure as well as overall population health. As such there are myriad factors at play, not only in the circumstances of the child's life after birth, but also in the legacy passed on to the child while still in utero. This paper examines the health of 25 infants under age 3 years from the Chalcolithic site of Seh Gabi, Iran, dated to 6,000 BP, to estimate population health. During the Chalcolithic, population increase resulted in settlement of marginal zones such as the Seh Gabi local. This placed Seh Gabi intensive agriculturalists at increased risk of episodes of stress exposure in times of periodic drought, crop failure, and resource depletion. Analysis uses skeletal macromorphology, enamel cross-striation age at death estimates, and dentin micromorphology to identify pathological conditions suffered by infants. Deciduous molars were embedded, and sectioned, then examined by bright field and polarized light microscopy. The neonatal line was identified, age at death calculated, and location of interglobular dentin calculated relative to the neonatal line allows for timing of the Vitamin D deficiency to be identified, whether in utero or after birth, that is, whether or not the mother was Vitamin D compromised as well as the child. The intricate and complex relationships between health of mother and

infant displayed through microscopic examination of deciduous molars are discussed. Results are then examined in the broader context of overall population health.

Early mortality and developmental stress reflected in fluctuating asymmetry of crown dimensions of deciduous dentition

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The Developmental Origins of Health and Disease hypothesis proposes that early-life stress increases negative health outcomes later in life, caused by energetic trade-offs that favour short-term survival and brain development, and negatively impact growth, health and life expectancy. Guagliardo (1982) found some evidence for increased levels of fluctuating asymmetry (FA) in the crown dimensions of juveniles as opposed to those of adults. However, the association between FA in crown dimensions and early mortality has not been investigated in the deciduous dentition, which more closely reflects pre and peri natal periods. We examined the association between FA in deciduous crown dimensions and age at death to test the hypothesis that early life stress, as measured by asymmetry in deciduous crown size, has a negative impact on life expectancy in children. The buccolingual and mesiodistal dimensions of left and right maxillary and mandibular deciduous teeth were measured for 61 individuals of known sex (26 females and 35 males) and age (post-birth to11 years at death) from the Luis Lopes Collection. Absolute difference between left and right teeth was used to calculate FA. Linear and logistic regression analyses were used to test the relationship between fluctuating asymmetry and age at death in the sample. Increased FA of the deciduous tooth crowns was generally associated with reduced age at death. The strength of the relationship was generally small and was only statistically significant for the mesiodistal dimension of the upper canine and the buccolingual dimension of the lower central and lateral incisors. As only a few associations between FA in crown dimensions and age at death were significant, FA does not consistently indicate early mortality. The sample is limited to individuals who did not survive childhood and thus may exhibit a higher degree of fluctuating asymmetry than deciduous teeth of comparatively healthier individuals who survived into adulthood. Inclusion of adult individuals, who represent survivors relative to juvenile individuals, may yield stronger associations between FA and age at death, but this type of analyses is difficult to address due to the shedding of the deciduous teeth.

Harris lines as indicators of physiological stress in the Middle Holocene Cis-Baikal

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The Middle Holocene (~9000–3000 years BP) of the Cis-Baikal region of Siberia (Russian Federation) was marked by a period of climatic shift coinciding with extensive cultural change by hunter-gatherer populations. During this period, the Middle Neolithic (7000–5600 cal. BP) is distinct in that no evidence exists of formal cemetery use. As a result, populations residing on either end of this cultural shift, that being those in the Early Neolithic (EN) period and Late Neolithic – Early Bronze Age (LN – EBA), respectively, are largely recognized as culturally, socially, and biologically distinct despite geographical relatedness. Previous research suggests individuals residing in the EN appear to have suffered more frequent or severe stress events than those in the later LN – EBA populations, likely as a result of lower resource availability during the EN.
For the purpose of this study, two mortuary populations dating to the EN (7500 – 7000 cal. BP) and one dating to the LN – EBA (5600 – 3700 cal. BP) were examined for the presence of Harris lines (HL). Believed to represent physiological stress events during growth and development, HL appear as dense, radiopaque transverse lines on human long bones. The premise of this study suggested EN and LN – EBA populations

should display differing levels of HL as a result of their discrepancies in physiological stress experiences. If EN individuals experienced greater and more frequent stress events, they should arguably display a higher prevalence of HL than those in the LN – EBA. Preliminary results indeed suggest disparities in HL prevalence between populations on either end of the MN; however, early findings indicate a higher prevalence of HL in the LN – EBA and not the EN as was expected. As such, future research will continue to examine this discrepancy and, in consideration of past research, suggest possible explanations. This project provides an important bridge between past research and new understandings of behaviour and adaptation through the reconstruction of stress events in the Middle Holocene Cis-Baikal.

The concepts of Risk and Resilience in the Developmental Origins of Health and Disease (DOHaD) and the Mothers to Babies (M2B) Project

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Human bodies are subject to risks that are inequitably distributed through populations. Pregnant bodies, however, experience unique risks that can affect both mother and infant. During early life, moreover, the pregnant woman sends signals about their environment that influence their offspring's risk for non-communicable diseases (NCD) later in life, as predicted by the Development Origins of Health and Disease (DOHaD) hypothesis. These risks are also inequitably distributed, as they are influenced by access to, among other resources, nutritious food, income, education, and healthcare. While the translation of DOHaD to medical professionals and the public has been framed largely negatively in terms of risks associated with stressors to the unborn child, e.g. poor nutrition, there are also opportunities to frame DOHaD research and policy in terms of resilience. We conceptualize resilience as going beyond individual attributes to encompass social systems that support capacity to overcome challenges and to experience healthy pregnancies. Methods: The M2B researchers conducted ten focus groups and one stakeholder engagement meeting with pregnant/postpartum women of lower Socio-Economic Position (SEP) and representatives of the city's health and social care providers. Thematic network analyses uncovered factors shaping pregnancy diet that we developed into conceptual maps for priority identification and intervention development. Findings: Salient themes were resources, relationships, and the embodied experience of pregnancy. Participants articulated how socioeconomic, political, and social-cultural forces constrain access to resources for many pregnant women that negatively affect the quality of their diets. Intervention development ideas focused on decreasing health inequities by cultivating individual and community resilience to improve early life nutritional environments. These included: better-integrated services, greater income supports, and strengthened peer and service-provider support. Conclusion: Identifying risks associated with pregnancy that affect maternal-child health outcomes and later lifecourse trajectories help to identify underlying drivers of NCDs. They are not, however, the best way to educate about DOHaD, nor do they move us towards achieving health equity. The use of the concept of resilience alongside risk allows us to develop interventions that can empower vulnerable people to achieve healthy pregnancies.

Osteoporosis-related hip fractures: Actual versus perceived risk

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The term “osteoporosis” has been in use since the 18th century, but the exact relationship between bone loss and fracture in the femoral neck, a common occurrence, was not fully understood until the development of radiographs and operative fracture treatments in the late 19th century. This paper explores changing perceptions amongst medical practitioners of osteoporosis, fractures, and risk throughout this transition. We explore how changes in understanding affected patient care and treatment outcomes, and how perceptions of who was at risk compared to actual known risk factors for osteoporosis-related hip fractures. Medical publications and doctor’s comments on hip fracture cases from two contexts (1700-1850 London, UK and 1850-1950 Missouri, USA) were analyzed, and the terms used to describe bone health were recorded. This range of early contexts encompasses the transition from non-operative to surgical hip fracture treatments, and provides an ideal setting in which to analyze how improvements in medical understanding can affect perceptions of risk. After the association of hip fractures with bone loss, words used to describe bone health became more specific and the term “osteoporosis” began to appear in published clinical literature. The importance of age and sex on osteoporosis risk are also emphasized during the later context, although literature that established the link between menopause and osteoporosis was not published until the end of the time period. Risk discourse began to shift from a focus on morality and blame (poor bone health was attributed to poverty, drinking, etc.) to a broader acknowledgment of the biological factors that affected risk of fracture (such as age and sex). Changes in perceptions of risk and improved knowledge of the factors affecting bone health led a greater focus on hip fracture prevention, and to the eventual incorporation of osteoporosis treatment as a standard part of fracture care.

Improving digitally stitched X-rays and interpretational standards for field paleoradiography

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This presentation describes interdisciplinary efforts to reduce human error and produce higher quality composite x-ray images for archaeological analysis. Conventional radiography is the most cost effective and common non-destructive methodology in the analysis of mummified human remains. The use of digital x-ray technology also allows for the rapid collection of larger sample sizes. In the examination of these radiographic images, bioarchaeologists are not only interested in biological structures, but also body positioning, taphonomy, and the spatial relationships of interred artifacts. Additionally, certain paleopathological conditions of interest (e.g., Pott’s disease or scoliosis) require a full representation of the body. Unfortunately, the flat panel of an x-ray system has a limited field of view, necessitating the digital stitching of two or more x-rays of large objects to produce a single high-resolution mosaic image. The analytical challenges of post-processing 888 x-rays of 54 Andean funerary bundles that were examined during the summer of 2019 are described. While many methods of image stitching exist via photo editing programs and panoramic software, the adverse conditions of field radiography and the complexity of funerary remains can introduce novel variables that create errors that are detrimental to interpretation. This presentation explores algorithmic solutions intended for computer vision, the limitations of existing editing software, and future directions for researchers as digital data recording and interpretational standards continue to develop in paleoimaging.

Exploring childhood origins of probable 18th-19th century Royal Naval sailors at Freeman's Bay, Antigua using stable isotope analyses

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Between 2007 and 2016, both salvage and planned excavations took place at Freeman's Bay, Antigua to recover the remains of 18 individuals who were haphazardly buried in the 18th and 19th centuries. Those that could be osteologically assessed were determined to be adolescent to young adult males. Given the historical and archaeological context, these were likely individuals associated with the Royal Navy who were hastily buried on the beach. One of the study's objectives was to establish the likelihood that these individuals represented members of the Royal Navy, who should be distinguishable from non-naval individuals based on previously established dietary differences. Additionally, variability in weather, geography, and underlying geology mean that the geographic origins of these individuals can also be distinguished. Since our goal was to assess where they likely lived during early life, tooth enamel is an ideal tissue for analysis. This is because as teeth form, they incorporate chemical elements from the diet and physical environment of an individual. The $\delta^{13}C$ values vary based on the source of carbon and represent dietary patterns, $\delta^{18}O$ values vary based on weather patterns and geography, and strontium ratios record variation in the underlying soil and geology. Together, these isotope systems can aid in differentiating potential places of geographic origins in regions within the British Atlantic World. To better understand the lives of these individuals, we explore their childhood origins using stable isotope analyses for isotopic values of $\delta^{13}C$, $\delta^{18}O$, and $^{87}Sr/^{86}Sr$ ratios. Enamel carbonate and strontium were preferentially sampled from second premolars, which form between two and nine years of age. This poster we will present the preliminary results compared to previously published data at other Royal Naval and British sites. These data allow us to explore the variable childhood origins of Royal Navy sailors within the British Atlantic World. Establishing the likelihood that these individuals represented members of the Royal Navy was the key objective of this study, and should be distinguishable from possible non-naval individuals based on previous differences of diets.

The application of engineering-based musculoskeletal modelling techniques to understanding the function of anteroposterior limb bone curvature in humans

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Greater limb bone curvature is characteristic of more active human populations in the past, yet it is not immediately clear why, as increasing the curvature of a bone increases strain in the tissue. One suggestion is that curvature makes strain more predictable when loading is highly variable. Here, we apply engineering-based musculoskeletal (MSk) modelling to simulate the comparative effects of femoral and tibial anteroposterior curvature variation on the muscle and joint forces within a subject's lower limb when walking on flat versus uneven, steep terrain. This talk outlines our pilot work building two custom models using the MSk modelling software OpenSim, from matched pairs of archaeological femora and tibiae from two individuals of similar estimated body size: one pair consists of a curved femur and relatively straight tibia, the other a curved tibia and relatively straight femur. These custom models will be run through simulations of both normal walking and stair-climbing (a proxy for mobility in steep terrain), with the resulting forces and torques exerted in the ankles, knees, and hips and in all of the key muscles in the lower limb quantified across the full walking cycle. By comparing the datasets between the two models at select stages of the cycle, we can

explore what the effect of limb bone anterior curvature is when walking in different terrain, and ultimately better understand the biomechanics of curvature in the archaeological record.

Canopy cover and exotic species influence the functional diversity of lemur communities in Kianjavato, Madagascar

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Madagascar has lost a substantial portion of its forests due to human disturbance. Lemurs, the endemic primates of Madagascar, are arboreal primates that perform key roles in their ecosystems. Currently, there are over 100 lemur species and their decrease in diversity due to habitat disturbance will impact the way that ecosystems function. This study aims to understand how factors such as canopy cover and human disturbance affect the functional diversity (total ecological variation within a community) of lemur communities. We hypothesize that 1) a higher percentage of canopy cover increases the functional diversity of lemur communities, while 2) human disturbance decreases it. We collected data from May-August 2019 in five forest fragments in southeast Madagascar. To determine which lemur species were present at each forest fragment, we used 30 arboreal camera traps placed at an average height of 10m, and 30 ground cameras (height=0.5m) to document the diversity and abundance of exotic species (e.g., rats and dogs). The cameras were positioned within a grid with a density of one camera per 0.5km^2 and operated for 30 days. We estimated canopy cover at each camera trapping station using a densitometer. To quantify functional diversity based on diet, body size, and activity pattern, we used Petchey and Gaston's FD. Taking into account only the best models selected by their ΔAICc values, lemur FD was influenced by 1) percentage of canopy cover (ΔAICc= 0), and 2) the combination of percentage of canopy cover and abundance of individuals of exotic species (ΔAICc= 1.68). We did not find the number of exotic species to be a significant variable in any of the models. Our results support the hypothesis that forest fragments with a higher percentage of canopy cover are maintaining more ecologically diverse lemur communities. However, functional diversity is decreasing in forest fragments with a higher abundance of individuals of exotic species. Camera traps are a great tool to monitor changes in lemur diversity. Other measures of human disturbance should be combined with the use of camera traps to better understand how these types of disturbances impact lemur diversity.

Mummies as microcosms: The non-destructive analysis of mummy bundles from the site of Pachacamac, Peru

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Our bioarchaeological project, "Mummies as Microcosms", aims to reconstruct changes in the funerary preparation and state of health of individuals buried at sites in the Rimac Valley on the Central Coast of Peru, during the Late Intermediate Period (1340AD-1440AD) and the Late Horizon, Inca Period (1440AD-1532AD). Taking a Bioarchaeology of Imperialism approach, we seek to understand the effects of the Inca Imperial occupation on the local population, by means of the study of the people themselves. The individuals who died during this time period were prepared as bundles and the body was placed in a tightly flexed position and then wrapped with an abundance of textiles, often containing artifacts, creating the bundle. We detect and analyze

the contents of the bundle using non-destructive radiographic techniques including digital radiography and computed tomography. In the work described here, we have teamed up with the staff of the Museo de Sitio at the archaeological site of Pachacamac. Pachacamac was a major oracle and pilgrimage centre on the Central Coast from ca. 200 AD to colonial times. In this presentation we illustrate our paleoimaging process and present some initial results based on a sample of individuals from a 2015 excavation at Pachacamac. This excavation took place because a cemetery containing skeletons and mummies from the Late Intermediate Period, Ychsma occupation of the site, was encountered during the initial stages of construction of a new National Archaeological Museum (Spanish acronym MUNA). This cemetery contained approximately 100 funerary contexts including 72 mummy bundles. Initial results indicate a range of ages and sexes, many artifacts including those related to status (e.g. metal objects, spondylus shells) and occupation (e.g. weaving artifacts, a club), and various indications of preburial manipulation of the corpse (e.g. removal of the head). Analysis is ongoing.

Social tolerance, over knowledge, promotes muzzle contact in vervet monkeys (*Chlorocebus pygerythrus*)

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Muzzle contact, where one animal brings its muzzle into close proximity of another, has often been hypothesized as a rather straight-forward means of socially-mediated food investigation. Using 2,707 observations of muzzle contact occurring across three troops of wild vervet monkey (*Chlorocebus pygerythrus*), we tested this social learning hypothesis by constructing three multi-level models. Our first model allowed us to characterize the social structuring of muzzle contact by analyzing the phenotypes of muzzle contact initiators and receivers. Similar to previous research, juveniles initiated muzzle contact at higher rates than adults, particularly towards adult females and animals with lower dominance rankings. The highest interaction rates occurred between kin compared to rates between non-kin. However, on the whole, muzzle contacts occurred at low rates. Our next two models determined whether muzzle contact is used as a means to socially learn, specifically by animals to seek foraging information. Our second model determined whether initiators specifically target foragers, and our third tested whether initiators were more likely to forage after muzzle contacting a forager. We found that initiators do not overwhelmingly target foragers, meaning animals do not appear to be directly seeking information about food during muzzle contact. However, animals who contacted foragers were more likely to change their behavior and forage themselves, in comparison to those who contacted non-foragers, indicating that foragers provide information about food. These findings indicate that both kin and low-ranking animals serve as discriminative stimuli for approach, and that foraging animals serve as discriminative stimuli for food availability. We interpret these findings to conclude that tolerance, over knowledge, is the most likely antecedent to muzzle contact, and that animals engage in this behavior as a low-cost means of maintaining a baseline rate of information about their environment.

Isotopic approaches to understanding culture change in the Casas Grandes region of Northwest Mexico

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In 2013 Anne Katzenberg was awarded a SSHRC Insight Grant to conduct bioarchaeological research in the Casas Grandes region of northwest Chihuahua, Mexico. She and the late Jane Kelley (Co-Investigator), along with several graduate students, tackled long-standing debates about the Casas Grandes culture through the use of isotopic and osteological methods. In so doing, this project has led to important insights about diet, migration, violence, health, and chronology during a key transitionary period in the region. This paper presents the results of one facet of the project; migration and its impacts on culture change at Casas Grandes.

Interregional interaction has factored prominently in debates about the origin and cultural trajectory of Paquimé, the epicentre of the Casas Grandes culture, since the site was first excavated six decades ago. In this study, we examined the structure and scale of migration at Paquimé to better understand who migrated to the site, their possible motivations for doing so, and the impacts that their arrival had on this prehistoric community. Radiogenic strontium and stable oxygen isotope results indicate that the majority of (~68%) of non-local individuals moved to Paquimé from within the Casas Grandes region, while ~32% migrated from neighboring regions. The immigrants consisted of men, women, and children, which suggests that migration likely occurred within social- or kin-based units. The multi-tissue sampling strategy employed in this study revealed that immigrants from outside the Casas Grandes region moved multiple times during life. There was also compelling evidence for captive taking. This study highlights the utility of isotopic approaches in shedding new light on previously enigmatic and seemingly unresolvable questions about our prehistoric past.

The entanglement of food insecurity and Gestational Diabetes Mellitus: Examining pregnancy health from a syndemics perspective

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Food insecurity, or lack of access to affordable, healthy, and culturally appropriate food, has been linked with a greater risk for non-communicable diseases such as type 2 diabetes. Food insecurity during pregnancy adds another layer of health issues to these risks. Pregnancy is an embodied experience that brings numerous physiological and psychological complexities, as well as relational changes due to social connotations of pregnancy and motherhood. These complexities can lead to various complications including Gestational Diabetes Mellitus (GDM). We hypothesize that food-insecure-pregnant women are more likely to develop GDM. The main questions we aim to answer are: Is there a positive association between household food insecurity during pregnancy and pregnancy complications? What are the challenges of eating healthy food during pregnancy, particularly with pregnancy complications? Methods: The Mothers to Babies investigative team conducted a survey of 404 pregnant people and held focus groups with pregnant/postpartum women of lower socio-economic position, as well as front-line health and social-care workers in Hamilton, Ontario. Findings: From the survey, we found that 21% of pregnant people were food insecure and 21% had pregnancy complications. GDM accounted for 32% of all complications. Furthermore, 44% of those who were food insecure experienced pregnancy complications. Overall, food-insecure-pregnant people were 1.2 times more likely to experience complications as determined through logistic odds analysis. In focus groups, women with GDM commented about difficulties managing their diet and diabetes while on a limited budget. Survey results revealed that pregnancy diet was impacted by factors beyond affordability. A total of 65% of respondents agreed that lack of time to prepare food affected their diet, 66% stated that diet was impacted by their mood, and 69% said that diet was influenced by pregnancy nausea and vomiting. Conclusion: Food insecurity during pregnancy impacted diet and risk of pregnancy complications for participants. It is crucial to understand the experience of food insecurity and pregnancy complications because maternal health during pregnancy has lasting impacts on maternal and offspring health and wellbeing. Future research includes investigating associations between household food insecurity during pregnancy, GDM, and feelings of stress, anxiety, or depression at Hamilton and national levels.

Changing body proportions in medieval and early modern Denmark

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The aim of this poster is to assess body proportion changes in medieval and early modern Denmark. Using two cemetery samples, the rural cemetery of Tirup (1150-1350 CE) and the urban Black Friars cemetery (1240-1607 CE), stature, body mass, and robusticity were assessed. The cemetery collections span the medieval (1050-1536 CE) and early modern periods (1536-1660 CE) in Denmark. The medieval period was a time of significant socioeconomic, environmental, and residential transition. Christianity replaced old Viking Pagan religions, urbanization increased, the climatic downturn of the Little Ice Age affected crop yields and food security, and infectious disease, specifically the Black Death epidemic, decimated the European population. As such, medieval Denmark provides an excellent sample for biocultural research. Stature was estimated using a modified hybrid model including the anatomical stature estimation method, European specific mathematical regression formulae, and skeletal length measured in grave. Body mass and Body Mass Index (BMI) were estimated from femoral head diameter. Robusticity was estimated using cross-sectional geometric properties (CA, Imax, Imin, J, Zmax, Zmin, Zp) of the right femoral shaft. The results illustrate a decrease in stature between the rural and urban sample (not significant) and the medieval and early modern period (significant) in both males and females. A significant increase in body mass was noted between the rural and urban samples for both males and females, however when the body mass estimates were converted into BMI only female differences remained significant. While no difference was seen between the body mass estimates between time periods, when converted into BMIs a significant increase was noted. A general trend towards increased robusticity was perceived between the rural and urban samples for both males and females. Between time periods, males seem to maintain robusticity while female robusticity increased significantly. Results are discussed in the context of changing socio-economic conditions which worsened with increasing urbanization in late medieval and early modern Denmark.

Post-fertile Lifespan in Female Primates and Cetaceans

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Popular and scientific interest in menopause in humans has led to increased interest in the extent of post-fertile life in other animals, particularly in long lived social species such as other primates and cetaceans. Information on maximum life span achieved, and age at last birth are available from long-term observations of known individuals from 11 primate species in the wild. Comparable information from wild cetaceans are more difficult to obtain, however there are relevant fisheries data, as well as a small number of long-term individual-based studies. Using post-reproductive representation (PrR) as a population measure of post-fertile lifespan that allows comparisons across populations and species, this review confirms that among primates, only humans have a maximum lifespan significantly longer than 50 years, and only human female life history includes a significant post fertile stage of life. However, available data on the baleen fin and Bowhead whales show that reproduction past the age of 50 does occur in some mammals and there is evidence for lengthy post-fertile lifespan in two species of toothed whales. So, although a prolonged post-fertile stage of life is very rare in mammals, it does occur in some exceptionally long-lived taxa, such as humans and two species of toothed whales. Thus menopause evolved independently at least three times in mammals, the reasons for its evolution may differ in different lineages. Direct selection is proposed for the two whale species, but in humans it may be a by product of the extended lifespan of *Homo sapiens*.

Vikings, isotopes, and nonmetric traits: The multidisciplinary role of an advisor

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Dr. Anne Katzenberg has led dozens of students successfully to master's and Ph.D. degrees. The success of her former and current students is a testament to her abilities as an advisor. The purpose of this presentation is to demonstrate the qualities that have made Anne Katzenberg an invaluable advisor, through examples taken from my own experiences as her Ph.D. student. As an accomplished academic and leader in stable carbon and nitrogen analysis, she is a highly sought-after advisor. Her broad and far-reaching knowledge of biological anthropology allows her to be an adept advisor for students with interests that do not fall directly under her research program, such as my work on the Viking Age, and strontium isotope and biological distance analyses. She is able to provide feedback to her students regardless of their research agenda to ensure that their projects are of high caliber. A stamp of approval by Anne Katzenberg is well known to carry much weight, not only within the University of Calgary community, but across the discipline of biological anthropology.

Examples of new knowledge about the ancestors, learned from the study of human remains

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Following the reburial of Huron-Wendat ancestors' skeletons in 2013, we have used the retained tooth samples to pursue questions about those ancestors' lives. Carbon, nitrogen and strontium isotope studies now provide detailed information about people's diet and mobility from the 13th through 17th centuries, during which the ancestors exploited a broad swath of southcentral Ontario. As we have had the privilege to do the research, we now must interpret complex, extensive datasets in ways that convey meaningful information to the descendants and to the broader public. The body of work includes examples of corrections of some past misperceptions and corroboration for some scenarios deduced from archaeological evidence. There are illustrations of ecological and social complexity, gender-based dietary patterns, and confirmation that the disruptions caused by disease and warfare led to food insecurity for some. This research program provides an example of the value of the retention and curation of tissue samples, and of post-repatriation collaboration between researchers and descendants.

Characterization of the gut microbiota of Nicaraguan children in a water insecure context

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The gut microbiota varies across human populations. The first years of life are a critical period in its development. While delivery mode and feeding strategy contribute to this variation, other environmental factors, relevant to the majority of the world's children, who live in less-developed countries, remain underexplored. One factor is enteric pathogen exposure. In this pilot study, we explore the relationship between household water security and the gut microbiota of children. From n=39 Nicaraguan households, we collected drinking water samples, as well as fecal samples from n=53 children aged one month to 5.99 years. We tested water samples for total coliforms (CFU/mL) and the presence of common enteric pathogens. Bacterial community structure and diversity were characterized by 16S rRNA sequencing. Households were classified as having a 'low' (<29 CFU/mL) or 'high' (≥ 29 CFU/mL) coliform level in their drinking water. We

used PERMANOVAs and Mann-Whitney U-tests to identify differences in the composition and diversity of the gut microbiota of children living in these two home types. Insecure access led households to store water and 85% tested positive for coliforms. High concentrations of Salmonella and Campylobacter were found in drinking water and children's fecal samples. Controlling for age, the gut microbiota of children living in homes with high coliform drinking water were compositionally different and significantly less diverse than those living in homes with low coliform water. This study provides evidence of an important route by which water insecurity can undermine human well-being.

Pick a tooth, any tooth: Examining regional variation of bacteria in the oral microbiome

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Dental calculus is an important reservoir for bacterial DNA that provides insight into the oral microbiome in archaeological samples. The oral microbiome plays host to a wide range of bacteria and is an integral part in the maintenance of health in an individual. An imbalance of the bacteria present in this community may result in a diseased state. Early genetic analysis of dental calculus was exploratory in nature, examining the genetic diversity of calculus, and has shifted to examining specific pathogens, diseases, and diet. What is not yet clear is the amount of variation in the bacterial community found in dental calculus from different regions of the mouth, and how intra-individual variation compares to variability in bacterial communities between individuals. To examine intra-individual variation, DNA was extracted from dental calculus found on multiple teeth in different regions of the mouth from eight individuals. To explore inter-individual variability, dental calculus from the right mandibular second premolar of eight additional individuals was also analysed. Shotgun sequencing was performed for metagenomic analysis of the samples. The resulting DNA profiles were compared and analyzed using principal coordinate analysis (PCoA). The PCoA shows the samples from the same individual tend to cluster together. Some individuals show a larger spread between samples from within the same mouth, and are partitioned to one side of the plot. This spread appears to be due to a larger abundance of commensal bacteria typically found in the mouth and throat. Cases where one tooth sample deviates strongly from others from the same individual tends to be due to some slight differences in bacterial communities. Overall, samples from the same individual cluster more tightly together than the samples that came from the same tooth, but different individuals. These results suggest that dental calculus aDNA samples from several teeth within an individual are more alike in composition than dental calculus from the same tooth in different individuals. While there is some variability in the bacterial composition of calculus in different regions of the mouth, future studies need not constrain sampling to only one tooth type.

Risky Romans? Investigating lead use and lead exposure in rural Roman Italy (1st–4th c. AD)

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The widespread use of lead in Roman Italy is well attested through multiple lines of evidence, including descriptions of its use in ancient written sources, the presence of lead artifacts and slag on archaeological sites, and high levels of lead accumulating in ice cores and lake sediments dating to the Greek and Roman periods (ca. 500 BCE–300 CE). The apparent ubiquity of lead in the Roman period contributed to the now-debunked claim that the fall of the Roman Empire was due to its widespread use in aqueducts, water pipes, household items, medicine, and cooking. Even though it was widely used as a cheap and malleable metal, its

toxic effects were known to ancient Romans and was recognized by medical writers as a poison. Excavations at the site of Vagnari in southern Italy have uncovered a vicus (village) and necropolis associated with a large Imperial estate (1st–4th centuries AD). Evidence of metal working, lead scrap, and lead objects from the vicus at Vagnari suggest that lead was an abundant resource on this estate. This raises questions about where this lead came from and the possible health consequences of its widespread use on the people working and living at Vagnari, particularly for children who are at greater risk for negative health consequences associated with exposure to lead. Pb isotope analysis of the lead manufacturing debris and artefacts recovered in the vicus indicate that some of the ores were extracted from mines in Sardinia and/or western Italy. LA-MC-ICP-MS analysis was also performed on 20 deciduous and permanent molars from the Vagnari skeletal sample. Preliminary results reveal that approximately 20% of the sample had highly elevated lead levels (up to 37.7 ppm), including women and children, suggesting that individuals were exposed to high levels of lead during tooth development. This interdisciplinary study examines the relationship between lead production, lead exposure, and possible health risks for members of this rural Roman community.

The impact of nerve regeneration on locomotion and musculoskeletal strength

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Common fibular nerve injuries impact the tibialis anterior muscle resulting in a functional loss of dorsiflexion. This functional impairment, also called foot drop, is characterized by an asymmetric unstable gait pattern leading to muscle atrophy and long-term bone loss. If the rate of nerve regeneration can be accelerated, it may result in significantly improved functional outcomes. Here, we tested conditioning electrical stimulation (CES) to see if it would improve nerve regeneration. If so, an individual could reach normal locomotor patterns by shifting their weight on the injured limb and increasing muscle contractions. Since muscle and gravitational forces are prime triggers for bone adaptation, CES could potentially increase reloading of bone, making recovery easier. Twenty-four adult male rats had a distal nerve transfer (DNT), where a functional branch of the tibial nerve was rerouted to the injured nerve. Half of the animals (n = 12) received one hour of CES to the donor nerve one week prior to the DNT surgery. Locomotor data were collected at recovery weeks 6 to 10 using a force plate runway to calculate ground reaction forces (GRFs) and high-speed cameras to calculate speed and kinematic data. At sacrifice, the tibialis anterior muscles were weighted and the tibiae were then micro-CT scanned (SkyScan 1176). Animals treated with CES had significantly improved motor reinnervation (CES 7.8 ± 0.8 mm; no-ES 3.1 ± 0.49 mm nerve growth) and functional recovery, as evidenced by an overall increase in velocity (CES 62.3 ± 3.9 cm/s; no-ES 58.2 ± 4.1 cm/s), an increase in vertical peak GRFs and contact time as well as a recovery of dorsiflexion of the injured limb. CES animals had greater muscle weight. All animals had an increase in bone mineral density (BMD) in the contralateral tibia associated with the extra weight bearing during recovery. Finally, the CES animals showed an increase in BMD of the injured tibia showing a reduction in long-term bone loss often associated with foot drop. Seeing that bone recovered as quickly as the muscle that attach to it could help us better understand the relationship between the two systems.

Finding true sex differences within the haystack of individual and group coxal bone variation: A lesson in landmark validation

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Objectives: To determine the location, number, and individual effectiveness of common landmarks used in sex-based shape analysis of whole adult coxal bones and propose a method of sex estimation based on measurements between those landmarks. Methods: Three-dimensional models (NextEngine desktop laser scanner) of left and right os coxae from 396 individuals (William Bass Skeletal Collection, Forensic Anthropology Center, University of Tennessee, Knoxville, TN) were subjected to shape analysis using 32 landmarks (Landmark 3.6, Institute for Data Analysis and Visualization). Each landmark was individually removed and subjected to a new Principal Component Analysis (PCA) to identify the effect omitting a landmark has on PC1/PC2 ordination. Landmarks that poorly discriminated sex-based shape were considered redundant for sex estimation. Associated linear measurements between remaining landmarks were assessed for reliability using discriminant function analysis. Repeatability of the final discriminant function equation was assessed on an independent test population (n = 120) from the W. Bass Skeletal Collection. Results: This study identified 17 landmarks that most accurately represent sex-based shape of right and left coxal bones, these are: the anterior superior iliac spine; posterior superior iliac spine; posterior inferior iliac spine; iliac crest; apex of the auricular surface; greater sciatic notch; ischial spine; superior, inferior and distal points on ischial tuberosity; superior, inferior and midpoint on the symphyseal face; arcuate eminence; ischiopubic ramus; posterosuperior and anterosuperior points on the acetabular rim. From 8 measurements associated with these landmarks, 5 were most reliable for estimating sex in a discriminant function equation: Maximum Coxal Height (XCH), Maximum Iliac Breadth (XIB), Maximum Pubis Length (XPL), Ischial Length (ISL), and Minimum Apical Border to Symphysion (WAS). The equation, XCH (0.082) – XIB (0.030) – XPL (0.167) + ISL (0.233) – WAS (0.073) – 9.464, accurately predicted sex 99.7% of the time, and 99.2% of the time in the test population. Conclusions: Sex estimation methods can be improved when measurements are averaged between left and right sides to account for individual human variation or fluctuating asymmetry, based on a population that varies in body size, and based on landmarks that have been evaluated for accurate representation of sex-based shape.

New Middle Pleistocene material from Serbia and its implications for human evolution in Europe

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Recent discoveries in the Balkans have put a strong emphasis on this region of Europe as essential for our Recent discoveries in the Balkans have put a strong emphasis on this region of Europe as essential for our understanding of Pleistocene human migrations and interactions. With its plesiomorphic morphology, the early Middle Pleistocene hemi-mandible BH-1 from Mala Balanica suggested the possibility of two lineages in the area. Neanderthals were certainly present in the territory by 100 ka in a nearby Pešturina cave. The site of Velika Balanica (which together with Mala forms the Balanica Cave Complex) yielded a Middle Paleolithic lithic industry with a strong Charentian character. In 2017, four hominin fossils specimens were recovered from the geological layer 3 at Velika Balanica. The material, belonging to at least two individuals, consists of a permanent upper third molar (BH-2), a deciduous upper fourth premolar (BH-3), a maxillary fragment with the permanent first molar (BH-4), and a permanent upper central incisor (BH-5). The results of our preliminary analysis suggest morphological affinity with the members of the Neanderthal lineage. Since the layer 3 has been recently dated ~270 ka, Velika Balanica hominins could thus represent the earliest Neanderthals in the

Balkans. With the possibility of an early modern *Homo sapiens* presence in the Balkans older than ~210 ka, and with the admixture between modern humans and Neanderthals pushed back to more than ~270 ka, Velika Balanica materials could also prove to be crucial for our understanding of the complex later Middle Plesitocene hominin interactions.

Investigating origin of individuals from a British Royal Navy Hospital Cemetery, English Harbour, Antigua: A carbon and oxygen isotopic analysis

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Stable isotope analysis allows questions previously seemingly unanswerable regarding past human populations to be addressed. This poster summarizes an attempt to utilize stable carbon (C) and oxygen (O) isotope analysis of dental enamel to determine whether 19 adult individuals interred at the Royal Naval Hospital cemetery in Antigua (c. 1800) were born on the island or migrated there later in life. This cemetery was found to contain the remains of individuals of both white and black ancestry, suggesting limited segregation in death. This fact was surprising considering the strict social stratification of the colonial Caribbean. The natal origin of these individuals is an important query as some may have been enslaved and forced to migrate to Antigua from Africa or elsewhere in the British colonies during their early childhood where they served the British Navy. Reconstructing the life history, emphasizing not only the presence but also the contribution of oppressed populations in Antiguan history is crucial as their stories are lacking in the historical record, beyond the brutality of plantation slavery. Stable isotope signals established during development are retained in dental tissues since unlike bone, teeth do not undergo remodeling thereby preserving indicators of childhood lifestyle. Since O isotope ratios in meteoric water vary geographically due to environmental factors, and historic populations of Antigua primarily consumed collected rainfall, the O isotopic signature might have been useful for determining natal locality. However, the O isotope values of the Caribbean are similar to those of both West Africa and the British Isles. When the O isotope data is considered together with C isotope ratios, which are indicative of diet, four burials are indicated as outliers. Previous osteological analysis of craniofacial features assessed three of these individuals to be of black/African ancestry (Burials 4,13 and 25), and one of white/European ancestry (Burial 2). The findings for Burial 13 are consistent with previous findings suggesting possible non-Antiguan natal origins through comparison of bone and dental $\delta^{13}C$ values. The future outlook for this study is to include strontium isotope analysis to refine the determination of possible natal origins.

An investigation of weaning practices in Iron Age Southern Italy using tooth dentine and bone collagen

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This poster will present the analysis of early childhood feeding practices in three Iron Age (7^{th}–4th century BCE) Italian samples from southern Italy, using a combination of incremental dentine and bulk bone collagen sampling methods. Stable nitrogen and carbon isotope analysis of human tooth dentine, rib, and femoral collagen from 12 subadults, and tooth dentine from 9 adults, was undertaken to investigate early life feeding histories of individuals from the sites of Parco San Stefano, Botromagno, and Padreterno. The dentine serial sections were used to determine the onset and completion of weaning for each individual, as well as distinguish trends in early feeding practices in these Iron Age samples. Results indicate that the average onset of weaning occurred at 8 ± 3.4 months and weaning was completed by 4 years of age at the latest; however, the patterns of breastfeeding and weaning were variable both within and between samples. There is also isotopic variation in early childhood diet between survivors (i.e., those who lived into late childhood/adulthood) and non-survivors (i.e., those who died prior to 4 years of age). Non-survivors were

weaned more rapidly than survivors–possibly contributing to their earlier death–and some non-survivors demonstrated elevated $\delta^{15}N$ tooth dentine values that may have been the result of physiological stress. Differences between rib and femoral isotope values for subadults were also discerned, with femoral $\delta^{15}N$ and $\delta^{13}C$ values being higher. This may be related to a faster bone turnover rate in ribs allowing for a more recent reflection of diet consumed closer to the time of death. Additionally, the combined use of dentine and bone collagen data for the subadult individuals was able to discern periods of physiological stress and accelerated growth. The combined analysis of incremental dentine samples and bone collagen demonstrates the value of a mixed-sampling approach to understand the relationship between stable isotope values and dietary change, the influence of physiological growth and stress on stable isotope profiles, and variability in early childhood feeding practices in the Italian Iron Age.

Assessing pubertal stage from adolescent skeletons in two early 20th century documented skeletal collections

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The adolescent skeleton has been of increased interest for bioarchaeologists in the last decade, which is largely due to the social, cultural, and biological importance of this stage of human life. The identification of pubertal stages has been of particular interest since the biological changes associated with puberty marked an adolescent's transition into adulthood in past societies. The aim of this study was to explore the ages at which adolescents began and completed the pubertal growth spurt in a skeletal sample with documented age-at-death in the United States during the late 19th to early 20th century. A combined sample of 96 subadult skeletons (8-20 years) from the Hamann-Todd and Terry collections was assessed for four skeletal indicators of pubertal stage following Shapland and Lewis (2013). Overall, females reached each pubertal stage earlier than males by 1 to 2 years, with the exception of the pubertal growth onset, which occurred at comparable ages (10 years for females and 9.6 years for males). The earlier onset of puberty seen in males, however, may be the result of a lower sample size. Menarche in females occurred at an average age of 15 years, a delay of approximately 3 years compared to modern standards. The patterns of pubertal growth in this study are comparable to those found in a study on a temporally similar documented European skeletal collection as well as studies on skeletal assemblages of archaeological contexts. The results of this study have shown that pubertal stage analysis is an effective tool to understand the nuances of adolescent growth that may ultimately prove to be crucial to further explore the age transitions of other biological parameters of the human skeleton.

Building cemeteries to manage risk? Exploring early herder connections across Lake Turkana, Kenya.

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Ancient peoples built elaborate monumental sites around Lake Turkana, Kenya ~5000 years ago amidst profound environmental, economic, and social change. As global climate change shrank the lake by ~50%, domestic cattle, goats, and sheep were introduced from Sudan or the Horn of Africa. This process involved contact between local and non-local groups, fueling economic and technological transformations and innovations. During this period, people built megalithic sites with large rocky platforms/mounds and standing

stone pillars. Recent excavations by the Later Prehistory of West Turkana (LPWT) team have demonstrated that these “pillar sites” are cemeteries, one containing an estimated >580 individuals, and that the people buried were engaged in herding. These findings raise many questions about early herder social structures, and the role(s) cemeteries played in the spread of pastoralism into eastern Africa. One hypothesis is that burying the dead within pillar sites may have helped herders manage risk by regularly assembling dispersed mobile groups, strengthening social networks, and facilitating resource and information sharing. This idea has been difficult to test, in part because only one pillar site, Lothagam North, has been extensively excavated. Whether all pillar sites were built for the same purposes, and by related peoples, remains unclear. Building on our previous work at Lothagam North, in July 2019 the LPWT team excavated at the Jarigole pillar site, which was built around the same time >100 km away on the opposite side of Lake Turkana. Excavations revealed strong architectural similarities between the two sites, but raised other questions about site use and biological/cultural relationships across the lake. Bioarchaeological comparisons of Jarigole and Lothagam North provide a starting point for determining how pillar sites may have helped people manage risk on a basin-wide scale, and the success of such strategies as reflected in the bodies of the interred.

Transgender and gender diverse individuals' risk for violence: implications for forensic anthropology

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Social initiatives to improve attitudes toward marginalized people and those at risk, such as the trans community, must not end when a person dies. Undergoing gender-confirmation surgery should not lessen the chance that someone will be positively identified. This issue is becoming increasingly more relevant and common as the number of trans individuals undergoing surgical modifications, such as facial feminization surgery, continues to grow. Unfortunately, the number of trans individuals subjected to violence has also increased. There were at least 2,115 reported killings of trans- and gender diverse people in 65 countries worldwide between 2008 and 2016. In 2017, the Human Rights Campaign (HRC), an LGBTQ-oriented advocacy organization in the United States, recorded at least 29 instances of transgender people fatally shot or killed by other violent means, a record for the organization. In 2018, the HRC specified at least 26 deaths of transgender people in the United States from fatal violence. In 2019, HRC has estimated 18 transgender killings year-to-date. These homicides included assailants who were acquaintances, partners, and strangers, with some based on anti-transgender bias. The assessment of sex and gender of trans individuals is a virtually unexplored issue in forensic anthropology that must be addressed in order to facilitate legal identification in a manner that is respectful of the personal identity of the deceased.

New research at the *Paranthropus* bearing site of Gondolin

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The Gondolin palaeocave, situated in the northeastern portion of the Cradle of Humankind UNESCO World Heritage Site in South Africa, is a rich fossiliferous site that, since excavations began in 1979, has yielded a substantial amount of fossil fauna, including a large molar belonging to the genus *Paranthropus* discovered in ex situ mining dump deposits. Geologically, the in situ deposits have been roughly dated to between 1.95 and 1.78 Ma using faunal correlation and palaeomagnetic methods. However, given the advances made in absolutely dating hominin sites in the Cradle using U-Pb dating, there is great potential to provide a fine-scale chronology of the site, as Gondolin stands out as one of only two major hominin bearing sites in South Africa

not currently dated with U-Pb. Previous field seasons and surveys have also identified numerous unexplored fossiliferous areas that could prove fruitful for further fossil discovery and research. Although Gondolin is recognized as an important location in the Cradle of Humankind, work at the site has been minimal compared to other hominin-bearing localities. With this in mind, we completed a site survey in July 2019 to explore new deposits and determine the research potential for further excavations. During this survey we identified extensive flowstone material, meaning we are confident of finding suitable deposits for dating. We have also mapped 3 areas of decalcified fossiliferous deposit that we hope to excavate next year. The objective of our new project is to recover more hominin fossils, to provide a more detailed picture of the context of the site, specifically the previous hominin finds, and ultimately add to the rich history of hominin occupation in South Africa.

The Rochefort Point Cemetery: An interdisciplinary approach to understanding mortuary patterns and cemetery composition at the 18th century Fortress of Louisbourg

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At the 18th century Fortress of Louisbourg, the Rochefort Point cemetery was the community's longest-used burial ground. Established by the French after 1738 and used throughout the remainder of their occupation, burials also took place in this cemetery during periods of New England and British occupation (1745-49 and 1758+). Using burial data (i.e., burial depth and coffin use), stable isotope analysis (i.e., carbon, nitrogen, oxygen, and strontium), and historic records, this study aims to better understand the composition of the Rochefort Point cemetery and the affiliation of the individuals within. To date, 100 individuals have been excavated from Rochefort Point with all burial data collected at the time of excavation. Tooth samples collected from the second molar and bone samples collected from the ribs and long bones were taken from 35 of these individuals for isotope analysis. The mortuary data suggest a complex and variable interment pattern on Rochefort Point, with burial depth variation up to 75 cm between individuals and coffin use only seen in half of all interments. Historically, New Englanders at Louisbourg buried their dead in deep graves in contrast to the documented shallow burial practices of the French, and while coffin use was popular for both the French and English during the 18th century, decorated coffins excavated at Louisbourg have been tied to the New Englander period of occupation. Despite the observed mortuary variability that can be historically linked with French and/or English traditions, the isotopic results allude to a predominantly New Englander cemetery composition, with fairly homogenous dietary and mobility signals between individuals buried on Rochefort Point. As such, there is a need to consider other factors beyond cultural affiliation (i.e., manner of death, season of death, previous site use) which may have contributed to the observed mortuary variation in this large and complex 18th century cemetery.

The Pathophysiology of OA: Non-articular lesions in a modern surgical sample

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Osteoarthritis (OA) is a set of overlapping conditions involving the loss of articular cartilage and changes to the underlying subchondral bone; ultimately, the structure and function of an affected synovial joint can be compromised. Pain is a hallmark of the condition, but the source of pain is poorly understood. OA is an ancient

disease, with evidence of its presence in human populations dating to more than 7000 years ago. Paleopathological criteria for OA diagnosis include eburnation, marginal and surface osteophyte presence, porosity, and alteration in joint contour. This research combined the knowledge and techniques of clinical medicine and bioarchaeology to observe and analyse OA lesions on dry bone to identify potential pain sources. Tibial plateaus removed from 62 patients undergoing total knee replacement surgery due to OA were reduced to dry bone and observed and scored using the Buikstra and Ubelaker (1994) standards. While results indicated that articular surface OA lesions were present in all study specimens, some of the more intriguing results involved lesions not included on bioarchaeological measures of OA. These lesions, consistently observed in the non-articular portions of the plateau, included proliferative bone in the intercondylar region, and areas of dense appearing trabecular bone and lytic defects, both on the inferior (cut) side of the plateaus. It is suggested that the inferior lytic defects may be physical evidence of bone marrow lesions (BML), a clinical OA symptom visible only via MRI. Previous research has linked BML to pain, as well as inflammation and ligament pathology. The latter conditions have also been linked to both intercondylar enthesophytes and third intercondylar tubercle of Parsons (TITP) presence, as observed in the intercondylar regions of these samples. These results suggest numerous avenues for future research in both bioarchaeology and clinical medicine.

Reconstructing Mycenaean lives through pathological skeletal conditions: A review of ongoing analysis of remains from tombs at Borzi Hill, Kefalonia

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Research is on-going involving human remains from an ossuary and tholos tomb at the Borzi Hill site, Tzannata, Kefalonia, Greece. The site is one of the most archaeologically significant known areas from the Mycenaean (Late Helladic III) Period on the island of Kefalonia. These tombs were excavated from 1992 to 1994, and the systematic analysis of the human skeletal remains began in 2015. The tombs were used for several hundred years beginning around 3300 years ago, and contain the partial remains of over 100 people. Over the last five years, careful examination of the human remains has revealed much previously-unknown information about the context of the site and the individuals buried there. In this paper we present a brief survey of the various pathological conditions that have been identified thus far including perimortem trauma, healed fractures, carious lesions, enamel hypoplasias and other defects, arthritic changes, active and healed infections, et cetera. One of the challenges with the analysis of these tombs is separating perimortem trauma from postmortem ritual process of the remains. This systematic approach to the identification and assessment of the prevalence of pathological conditions is essential for the most complete reconstruction of the lives, deaths and mortuary practices of those included in the tombs.

Intra-observer reproducibility test of 25 features on the pubic symphysis

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Perhaps the greatest challenge to those investigating the identity of human skeletal material is accurate age estimation. Factors that contribute to shape individual morphologies are numerous and variability also increases with chronological age. Maybe due to these issues, traditional research has focused on testing for accuracy over precision of age estimation methodologies. For the purpose of this study, aim was focused on reproducibility. Therefore, we defined a new data collection protocol that integrates many sources of skeletal variability, in the form of 25 landmarks on the pubic symphysis correlated with age. Reproducibility was assessed in a blind analysis of hip bones from 30 individuals equally distributed by sex over a wider range of ages. Specimens were selected from the Terry Collection (Smithsonian Institution) using a sampling strategy to

include a wide range of variation. Our results show that presence or absence of the defined landmarks can be assessed with >90% precision using the new protocol. Other landmarks that required more complex definition were given a numerical score inside of an interval of variation. In these cases, >90% of the times the given score is the same or appears within the neighbouring stage. These intra-observer reproducibility results show potential for further age estimation and the definition of a new methodology that is universally applicable.

Lead exposure in bones from a modern Saskatchewan population: Preliminary findings

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Trace element analysis of lead (Pb) in archaeological bone can provide valuable insights into past human industry, socioeconomic dynamics, morbidity, and mortality. Use of synchrotron X-ray Fluorescence Imaging (XFI) can provide precise spatial data for elements, which can be particularly informative when used in conjunction with conventional trace element analytical techniques (e.g., mass spectrometry). Previous research has assessed lead exposure in a British Royal Navy Hospital cemetery (1793–1822) in Antigua, West Indies, and among crewmembers of the Franklin expedition (1845–1848); however, further research on other populations is needed to contextualize these data. The aim of this current research is, in part, to characterize lead exposure in a population of modern humans. Preliminary steps have involved collecting femoral samples from a collection of cadavers through collaboration with the University of Saskatchewan's Body Bequeathal Program and sacrificing a portion of each sample for mass spectrometric analysis to determine bulk levels of biogenic lead. Results from the mass spectrometry ranged from 1.2–7.1 μg/g of lead, which is comparatively lower to past studies of lead levels in historical populations that reported lead levels on the scale of 100s of μg/g, but is consistent with levels observed in other modern populations not occupationally exposed to lead. Future steps will analyze the nature of lead exposure using synchrotron XFI to identify the spatial distribution of lead in relation to bone microstructure.

First insights into differential use of maize within Archaic Age Cuba: Variation by age and sex

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Recent research has demonstrated the consumption of maize by Archaic Age groups in the Caribbean, suggesting that this plant contributed to a broad and varied diet. However, questions about this plant's significance remain. Stable isotopes and starch granules were analyzed for two Archaic sites, Canímar Abajo (CA) and Playa del Mango (PM), Cuba. This data was used to examine differences in dietary variation by age and sex. Isotopic analyses of PM and CA skeletal material indicate that C_4 plants were consumed irrespective of the individual's sex (Student's T-test, $p > 0.05$). Furthermore, maize starches were recovered from males and females at both sites. This result confirms that maize likely contributed to the C_4 component of the diet. Significant variation by age was observed within CA: among juveniles only those older than 5 years consumed C_4 plants (ANOVA, $\alpha=0.05$). Our findings indicate that plant use at CA and PM was complex, with evidence that maize did not form part of the early infant diet and that it was consumed only by non-adults older than 5 years of age and adults irrespective of sex.

Differential diagnosis of pathology on postclassic Maya at Ka'kabish, Belize

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Located in northern Belize, the ancient Maya site of Ka'kabish had a long occupational history spanning from the Middle Formative period (800-600 BC) into the Postclassic period (900-1500 AD). Excavations at Ka'kabish revealed eight plazas and courtyards, the largest plaza being Group D. To the south of Group D were several chultuns, or subterranean chambers, which functioned as burials for the occupants of Ka'kabish; all chultuns contained multiple internments. For my master's thesis, I was tasked with examining the material from the chultuns, identify MNI and investigating diet and health using both stable isotope and osteological analysis. As is typical of skeletal material in the Maya area, preservation of the human remains from the chultuns was poor and commingled in nature. Based on the osteological examination, an MNI of 27 individuals were identified with 17 adults, 5 subadults and 5 neonate/perinates. The poor preservation and fragmentary nature of the assemblage made the identification of sex and pathology difficult and impossible for most of the skeletal material. In one chultun, however, the preservation was very good and it was possible to observe pathology on numerous skeletal elements corresponding to at least two adult individuals. Lesions consistent with osteoarthritis, infection, metabolic disease and congenital defects are present. The pathology are quite variable and do not clearly correspond to a systemic disease or a single etiology. The purpose of this poster is to illustrate the lesions, present differential diagnoses, and discuss possible impacts of these diseases.

Lack of biological mortality bias in the timing of dental development in a sample of contemporary children

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Biological mortality bias is the idea that individuals who die prematurely are biologically different from those who survive. If mortality bias is present and its magnitude is large, then examinations of skeletal samples do not necessarily inform bioarchaeologists about the health of the living populations from which they are drawn. In this study, we investigate whether individuals who die in childhood exhibit delayed dental development in comparison to their surviving peers. Full body CT scans of 209 children aged birth through 12 years at death collected from the New Mexico Office of the Medical Investigator (USA, n = 99) and the Victorian Institute of Forensic Medicine (Australia, n = 110) were analysed. Dental developmental stages for the permanent teeth were scored for each child based on the Moorrees Fanning and Hunt (1963) stages and converted into Demirjian (1973) stages as per McVeigh (1999). Transition analysis revealed no difference in development between the New Mexico and Victorian children and the collections were lumped together into a single sample. Children were then separated into two groups: natural deaths (n = 75), who represented non-survivors of early/premature mortality, and accidental deaths (n = 134), who represent survivors as their deaths are independent of biological status. Mean age of attainment for each Demirjian stage was calculated for the survivors and non-survivors using transition analysis. Manner of death showed no significant impact on the age at which children attained each stage. This suggests that children who succumb to stressors are not significantly developmentally delayed compared to their surviving peers. However, dental development is known to be more resistant to environmental influence than skeletal development. Further investigation of developmental status using skeletal indicators is needed to complement this study's findings.

The use of living athletes to test hypotheses about prehistoric human adaptability: Biomechanics and energetic trade-offs

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Our interpretations of prehistoric human biology and behaviour are constrained by our understanding of skeletal physiology that underlies observable variation in skeletal tissue. Gaining a better understanding of how skeletal tissue varies among living humans, and the roles of this variation in mediating mechanical stress, energetic expenditure, and endocrine function, will improve our interpretations in bioarchaeological and palaeoanthropological research. We report here on the results of several studies of living human athletes with the aims of understanding the relationship between mechanical loading from habitual activity and the mechanical properties of bone tissue. We demonstrate that distance running has a significant influence on the mechanical properties of lower limb bones among both men and women. In addition, inter-limb indices of mechanical properties illustrate that the relative strength of the upper limb reflects habitual loading of the limbs in sports such as rowing or swimming. These results have implications for how we interpret skeletal variation, sexual dimorphism, and habitual activity in the past. Recently, we have extended the use of athletes as models for understanding adaptability to the study of the energetics of locomotion and energetic trade-offs in human physiology. Using ultra-endurance athletes, we investigate variable energy allocation under conditions of chronic energy deficit. Our results demonstrate trade-offs between individual phenotype and energetic efficiency, as well as shifts in energy allocation to different physiological functions. These results highlight the internal physiological processes that underpin adaptive human adaptive responses today. The results have implications for how we interpret skeletal variation and human adaptive response in the past.

Mercurial males: Is no strategy the best strategy for males during the mating season?

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The demands of social life are thought to have shaped the size and structure of the brain in a particular way in which monkeys, apes and humans think about the world. Most work in this area has tended to focus on the ultimate advantages of social cognition (i.e., those that are fitness enhancing), rather than identifying how animals negotiate on a daily basis. To begin remedying this, I investigated the proximate mechanisms that male vervet monkeys (*Chlorocebus pygerythrus*) use to regulate and control their signalling behaviours during the mating season. Interactions between males from two habituated troops in the Samara Game Reserve, South Africa were video recorded during the mating season (April–June 2009). These data were then notated and analysed using Eshkol-Wachman movement notation. I tested whether the distance at which threat behaviours occurred functioned as a mechanism to keep signals “honest”, as predicted by Szamado (2008). I found that proximity did influence the frequency of threat displays as a whole, but could not explain the variation in threat displays. Threat displays seem to occur in an unpredictable fashion rather than following a ritualized pattern. As males transfer in to and out of troops during the mating season and competition is high, it is possible that males’ uncertainty about other males’ behaviour keeps unpredictability high. In addition, male interactions may be inherently protean, and contingent on moment by moment changes in males’ emotional state, which may reflect the current information they can pick up from its opponent and then use to their advantage.

Late Helladic zoological funerary offerings at a Tholos Tomb on Kefalonia, Greece

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Research is on-going involving faunal remains included as sacrifices and/or offerings in a tholos tomb at the Borzi Hill site, Tzannata, Kefalonia, Greece. As the largest true tholos, it is one of the most prominent tombs and examples of monumental architecture from the Mycenaean (Late Helladic III) Period on the Ionian Islands. The tomb was excavated from 1992 to 1994, and the systematic analysis of the faunal remains began in 2017. The tomb was used beginning around 3300 years ago and deceased were included until after 2900 years ago, about 200 years after this type of tomb was no longer used anywhere else in Greece. In this paper we present a brief survey of the species identified thus far. Some of the finds are consistent with other tombs from this period and include dogs, sheep, goats and pigs. The remains of much rarer and ritually significant cows have also been identified. Other inclusions in the tomb, such as a horse, are exceptionally rare. There are only two documented cases of horse sacrifices from the Late Helladic III in all of Greece. Some of the faunal remains show evidence of butchering and cooking, and were likely part of a funerary feast or ritual meal with offerings for the deceased being included in the tomb. In other cases, such as the dogs and the horse, there is evidence of a sacrifice rather than ritual consumption. The pattern of processing of the horse is more consistent with practices in Crete during the Late Minoan than with the Late Helladic in the rest of Greece. This systematic identification of species and skeletal elements included in this tomb are the foundation for better understanding the mortuary rituals for this period.

Contributions of archaeological bone chemistry to bioarchaeological investigation of the Royal Naval Hospital Cemetery at English Harbour, Antigua, WI.

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The overall goal of over two decades of research has focused on reconstructing the lived experiences of individuals that were interred in the cemetery associated with the Royal British Naval Hospital at English Harbour, Antigua, WI (c. 1800). Sporadic salvage excavations have resulted in the disinterment of over 47 individuals. It was recognized early in excavations that the interred not only included sailors of European origin but also individuals of African ancestry who may have been enslaved or free blacks serving the Navy at the nearby dockyard. Stable isotope and trace element analyses of bone and teeth have been applied in attempts to establish the identity of individuals with respect to ancestry and social status. Initially, study focused on the premise that different groups within a stratified society might maintain different diets that would then be reflected in the stable carbon and nitrogen isotopic values of skeletal tissues. Historical knowledge of dietary habits was used to guide hypotheses and interpretation of isotopic data. Results suggested that two main groups could be separated on the basis of their stable isotope values that corresponded to ancestral affiliation as determined by analysis of facio-cranial features. These results also corresponded with other differential osseous evidence such as occupational stress markers. Subsequent study of the trace toxic element of lead facilitated the path to combining isotopic and trace elemental data to refine efforts to determining the identify the interred. Primary documents have also recently been obtained that are further informing this on-going work. These efforts will contribute to illuminating the active role of people of African ancestry in Naval and Antiguan History beyond the common association with plantation slavery.

Predictors of infant survival in free ranging vervet monkeys (*Chlorocebus pygerythrus*) from a high latitude, semi-arid environment in South Africa

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Vervet monkeys (*Chlorocebus pygerythrus*) are seasonal breeders that produce cohorts of infants who experience similar ecological conditions but different social conditions, insofar as the latter reflect their mothers' varying maternal attributes. Previous studies have provided evidence that characteristics associated with mothers' maternal rank, the presence of siblings, the sex of the infant, and the mother's standing within the troop's social network can predict an infant's likelihood of survival in both wild and captive populations. We examined the relationship between maternal attributes and infant survival in three free-ranging troops in the Eastern Cape Province of South Africa. We recorded all births (n=110) across four birth seasons (October to December) and assessed survival probabilities using a Cox proportional-hazards regression. The analysis was confined to weaning age (7 months in this population) as this is when infant survival is tied most closely to its mother's intervention. Most maternal attributes did not predict survival to weaning age. The exception was the presence of siblings, specifically a sibling born the year prior, which had a negative impact on the current infant's survival (Hazard Ratio: 3.35, p=0.002). The year of birth, however, was a strong predictor of survival, (Hazard Ratio: 41.5, p=0.00001). We argue that this may be due to the harsh ecological conditions at our study site. Against expectation, therefore, our results do not support the idea that various maternal factors play a role in survival to weaning age and suggest that environmental stressors overwhelm maternal characteristics in our study population.

Do vervet "sleep-overs" help buffer against social uncertainty?

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Various factors can create social uncertainty. For example, changes in health and reproductive status, death, emigration, immigration, rank reversal–even something as simple as the presence of particular bystanders–can all increase unpredictability in the outcomes of social interactions. Such uncertainty makes the social environment difficult for individuals to navigate, as it reduces the degree of control that they can exert over their daily lives. One way that animals can cope with social uncertainty is to build and maintain strong, resilient social relationships. Sleeping clusters, or huddles, in which individuals spend time in body contact during sleep, are characteristic of most primate species. Sleeping huddles provide one means by which animals can build and consolidate social relationships through time and therefore represent an important social behaviour. Using results generated from observed sleep huddles in wild vervet monkeys (*Chlorocebus pygerythrus*), we investigate whether animals mediate their spatial proximity throughout the day in order to maintain huddle partners formed at night. By calculating social similarities, at the individual and group level, using a dynamic network approach, we seek to understand whether some individuals are more able to maintain stable social connections, and so reduce uncertainty in their social interactions. This approach allows us to explore how temporal dynamics influence how relationships form and change through time. This, in turn, has implications for the evolution of primate sociality.

Excavations at Sel'ungur cave, Kyrgyzstan: an update

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Sel'ungur in the Fergana Valley of Kyrgyzstan is a crucial site for our understanding of the Palaeolithic of Central Asia, as the only site where lithic, faunal and hominin remains were found stratified, in a likely pre-OIS 5e context. Excavations in the 1980s revealed an at least 8 m thick sequence of Late and probably Middle Pleistocene deposits with a rich faunal and archaeological record. The cultural layers were interpreted as Acheulean by the excavators (Islamov et al., 1988). The hominin remains described by Islamov and colleagues included six teeth and a child humerus. Since 2014, we have been conducting an international research project aimed at the re-examination of the old collections and the re-excavation of this important site, with a special focus on dating and site formation processes. Our results show that the site is likely significantly younger than assumed before, and that the most important part of the industry is an early Middle Palaeolithic, but in certain parts of the cave Upper Palaeolithic deposits are also present. In this short update from the field I will discuss the results of the new excavations, and their implications for our understanding of the Central Asian Middle Palaeolithic.

Ancient dog diets in the Altai region of Siberia

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This presentation brings together two avenues of foundational stable isotope research by Dr. M. Anne Katzenberg. She was one of the first to explore archaeological dog isotope values and demonstrate similarity between dog and human diets; a phenomenon that has now been investigated in numerous sites across the world. Dr. Katzenberg also conducted extensive stable isotope research in Siberia, creating opportunities for her graduate students that have since continued as fruitful research collaborations. This research explores the diets of dogs, wolves, and other animals from the Altai region of Southern Siberia. This mountainous forest and steppe region witnessed major transformations in the Bronze Age, with the appearance of domesticated sheep, goat, cattle, horse, and millet, at various times. We begin with the Early Bronze Age (EBA) settlement of Berezovaia Luka where subsistence practices of the Elunin culture involved a mix of hunting, fishing, and pastoralism. Except for one wolf with unexpectedly low stable carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$) values, the dogs and wolves (n=7) group together with the highest $\delta^{13}C$ (-18.6±0.78‰) and $\delta^{15}N$ (9.3±0.35‰) means of all eleven species analyzed. Based on published stable isotope data for other Bronze Age Altai sites, dog diets were somewhat similar to human diets, but not similar enough to be used as a proxy. The dog data suggest they obtained their food using a mix of human provisioning, scavenging, and hunting, which likely varied seasonally. Dog diets may have included some fish, especially if they ate parts not often used by humans like bones, or their high $\delta^{13}C$ could indicate minor consumption of herbivores that ate small amounts of millet. Next, dog and other faunal isotope data from the Early Medieval Kurgan cemetery, Inia I, of the Srostinsk culture exhibit a different pattern. Dog isotope values vary widely in $\delta^{13}C$ (-24.6 to -18.5‰) and somewhat in $\delta^{15}N$ (9.1-10.7‰) suggesting much more variation in dogs' diets in this agricultural community, which

sometimes differed a lot from that of the people. Dogs' food environments have changed throughout their evolution and in the Altai region this occurred in correspondence with major socioeconomic events.

Utilizing multiple narratives in the evidence base for intergenerational trauma health research

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Empirical evidence regarding the pathways through which historical trauma impacts contemporary health in Indigenous communities is difficult to identify. While researchers have struggled to scientifically demonstrate causation between historical events and contemporary health experiences, the connection between the two is intuitive for many Native communities, families, and individuals. Denying this relationship for lack of conclusive settler-colonial research not only discounts the experiences of those suffering, but could threaten the already tenuous relationship between many Native communities and health researchers. Health research regularly emphasizes the importance of the 'evidence base'. The presence of a strong evidence base enables the formation of health policy and the funding of interventions. There are times, however, when there is no, limited, or conflicting evidence to draw upon. This work juxtaposes two different narratives stemming from a single historical trauma event in order to demonstrate how narrative shapes knowledge production. The first presents an Indigenous family's oral history, while the second is the settler-colonial historical account of the same event. Narratives were analyzed for common and divergent themes, in order to understand the ways in which reliance on one narrative over the other may impact the way in which a historical trauma event and its responses are perceived and acted upon in the present day. I argue that the inclusion of alternative sources of data, particularly family oral histories, in the evidence base for intergenerational health research strengthens the field while providing avenues for effective interventions that may erode existing health disparities. By continuing to value some forms of knowledge over others, health research risks perpetuating colonialist systems of oppression and contributes to the very health disparities which we seek to ameliorate.

Rocks stay stationary, not people: Population movement and long term sociodynamics at the Maya centre of Minanha, Belize.

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In this study, we used strontium isotope analysis to investigate population movement at Minanha, a small Classic period kingdom located in the North Vaca Plateau. Using principles of the new mobilities paradigm we explored the role of human movement in Minanha's development and history by comparing the temporal and spatial 87Sr/86Sr distribution in individuals both at Minanha and regionally. The analysis included human skeletal material from throughout the site epicenter and periphery and spanning most periods of Minanha's occupation (Late Middle Preclassic (600-400 BC) until the Late Postclassic (AD 900-1200)). This span of time covers the community's formation, fluorescence and decline in addition to encompassing periods of local and regional socio-economic, environmental and political change. A sample of archaeological faunal material (n = 3) was used to establish the 87Sr/86Sr baseline for the site. In a sample size of twenty, 60% of the population have strontium isotope ratios outside the faunal baseline. These individuals were identified in virtually all time periods including the Late to Terminal Classic; supporting the archaeological evidence that suggests lineages/individuals from outside Minanha played a role in the kingdom's emergence and florescence during the 8th Century. Individuals with $^{87}Sr/^{86}Sr$ outside the faunal baseline were identified in multi-entry ancestral tombs, caches and sacrifices; some of these individuals that dated to the transitional Early to Middle Classic period were re-interred in Terminal Classic architecture. Together these data suggest a deliberate tactic on the part of the non-local polity elites to physically locate themselves, and their ancestors, within the ritual

practices of the Minanha population in order to establish and normalize their power. The strontium isotope data demonstrate the important role that migration may have played in shaping Minanha as an important and contested frontier zone within the Southern Maya Lowlands.

Radiological analysis of experimentally mummified mice for the detection of cancer

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Paleopathological studies of cancer have largely focused on the preservation of neoplastic disease in skeletal remains, as skeletal remains are more abundant in the archaeological record. However, this limits the diagnosis of cancer and neoplastic disease to those that affect the skeleton, and excludes the higher number of cancers that manifest in soft tissues. Mummified human remains have the potential to preserve soft tissue tumors in addition to skeletal evidence of neoplastic disease. Analysis of mummified remains will present a broader and more detailed picture of neoplastic disease in the past. Radiological analysis of mummified human remains presents a non-invasive method of identifying potential cancer and neoplastic disease. For desiccated tissues, CT analysis represents the most detailed and appropriate method. Unfortunately, the effects of natural and anthropogenic mummification on soft tissue tumours are unknown and could affect the visibility of tumours in mummies examined through CT analysis. An experimental archaeology project was undertaken to test the effects of natural and anthropogenic mummification on tumour tissues and their appearance through CT imaging analysis. Mice from a cancer research center that contained human melanoma tumors were mummified in various conditions replicating anthropogenic mummification in the ancient Egyptian style, and natural desiccation using a controlled heat source. Prior to mummification, the mice were documented using a microCT scanner, and were scanned again after mummification and also three years post-mummification. Tumour volume and density were recorded and changes in the different tissues were observed over time, demonstrating that soft tissue tumours are visible in mummified material.
This research demonstrates the value of experimental archaeology for paleopathological research, as well as for our understanding of the presentation of cancer in mummified remains.

The Roncesvalles Ossuary: Preliminary findings and future considerations

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Excavations at the Roncesvalles Ossuary, located in Navarre, Spain, represent a unique opportunity to investigate the veracity of legends and prior documentation related to this historic monument and current burial place. Repeat flooding of the ossuary led to a decades-long hiatus in archaeological interventions. New excavations began in July of 2019. The ossuary, according to popular legends the burial place of Charlemagne's rearguard killed at the Battle of Roncesvalles in 778 and later a burial place for pilgrims that died on the Way of St. James near Roncesvalles, is still used as a final resting place for local people. Interventions along the south wall of the ossuary resulted in the extraction of multiple contexts of commingled human remains, three individuals in anatomical position, and various material finds including musket balls, military buttons, and rosary beads. Individuals in primary burials were covered in calcium oxide. One of these individuals was found to have ballistic trauma to the cranium. Based on expected completeness of skeletal elements and the size of the assemblage, the minimum number of individuals (MNI) was calculated using methodology outlined by Buikstra and Ubelaker (1994) for adult individuals. Subadult remains have not yet been inventoried for this site. MNI from commingled remains was calculated to be 178 (right calcaneus). Preliminary findings raise questions about historic patterns of usage of the ossuary for primary vs. secondary burial and about potential adaptations to current MNI methodologies to maximize efficiency.

Review of research publications of human osteoarchaeology in China

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China has great potential to make a unique contribution to human osteoarchaeology, however, such potential is only recently being gradually realized. In this paper, we reviewed over 300 journal papers and book chapters published in Chinese and in China since the 1960s to characterize the informativeness and comparability of human osteological data and analyses. Our results show that many publications still lack in-depth comparative analyses but many others have started to demonstrate significant usefulness and meaningful contributions to archaeological studies. We believe that the current status quo more likely reflects the nature of on-going developmental and maturing processes of the discipline in China.