

Bienvenue!

Dear colleagues,

It is with great pleasure that we wish to welcome you in Montreal for the 39th annual meeting of the Canadian Association for Physical Anthropology. We hope you will enjoy your visit in Montreal and that you find this meeting interesting and enriching.

The Organizing Committee

Chers collègues,

C'est avec grand plaisir que nous vous accueillons à Montréal pour le 39^e congrès annuel de l'Association canadienne d'anthropologie physique. Nous espérons que votre visite à Montréal sera agréable et que vous trouverez ce congrès intéressant et enrichissant.

Le comité organisateur



Acknowledgements/ Remerciements

Many thanks to a long list of people who advised and helped us in the organization of this CAPA Annual Meeting.

Nos remerciements à une longue liste de gens qui nous ont conseillé et aidé dans l'organisation de cette Réunion Annuelle ACAP.

Thank you also to our student volunteers/Nous remercions aussi nos étudiants bénévoles: Marye-Claude Belzile, Jennifer Bisson-Cyr, Jessica Cantin-Nantel, Sophie Caron, Denny Caron, Pauline Claude, Stéphanie Collins, Émilie Desrosiers, Laurence Dumouchel, Geneviève Falardeau, Judith Forgues-Marceau, Mourad Ghanem, Sabrina Grégoire, Carlos Jacome, Élise Jolicoeur, Alex La Madeleine, Marie Matu, Fanny Morland, Marine Puech, Geneviève Pothier, Émeline Raguin, Jeanne Thalie, Rémi Toupin, Ségolène Vandavelde, Jacinthe Vigeant.

Program at a glance/Programme en bref

Wednesday, October 26/Mercredi 26 Octobre

- 4:00 – 9:00pm Registration: Foyer, 4th floor
6:00 – 10:00pm Welcome Reception (hors d'oeuvres and cash bar)
Sainte-Foy Room, 4th floor

Thursday, October 27/Jedi 27 Octobre

- 8:00 – 9:00am Coffee, tea, juice/Café, thé, jus
8:00am-5:00pm Registration/Enregistrement (Foyer, 4th floor)
8:00 – 8:30am Poster set-up (Chicoutimi)
8:30am-5:00pm **Poster Session A: Forensics and Bone Biology**
Poster Session B: Health-Past and Present
Poster Session C: Primatology
(Chicoutimi) (authors will be at posters during coffee breaks)
8:30am-12:00pm **Session 1: Bioarchaeology and Skeletal Biology-Part I** (Sainte-Foy)
10:00 – 10:30am Coffee Break/Pause Café
12:00am-1:30pm Lunch
1:30 – 2:45pm **Session 2: Bioarchaeology and Skeletal Biology-Part II** (Sainte-Foy)
2:45 – 3:15pm Coffee Break/Pause Café
3:15 – 5:00pm **Session 3: Primatology and Conservation** (Sainte-Foy)
5:00 – 5:15pm Poster take-down

8:00pm-?? PUB NIGHT/SOIRÉE PUB Come celebrate!/Venez célébrer!
50th anniversary/50^e anniversaire
Département d'anthropologie, Université de Montréal.
Free drinks!/Breuvages gratuits! L'Ile Noire Pub - 1639 Rue St-Denis

Friday, October 28/Vendredi 28 Octobre

- 8:00 – 9:00am Coffee, tea, juice/Café, thé, jus
8:00am-5:00pm Registration/Enregistrement Foyer, 4th floor
8:00 – 8:30am Poster set-up (Chicoutimi)
8:30am-5:00pm **Poster Session D: Bioarchaeology and Skeletal Biology & Honours**
(Chicoutimi) (authors will be at posters during coffee breaks)
8:30am-11:30pm **Session 4: Symposium 3D Imaging in Physical Anthropology - New
ways of preserving and analyzing data** (Sainte-Foy)
8:30am-11:30pm **Session 5: Symposium Bioarchaeology in the Andes & South
America** (Rimouski)
9:45 – 10:15am Coffee Break/Pause Café
11:30am-1:00pm Lunch
1:00 – 5:00pm **Session 6: Symposium Multidisciplinary perspectives on primate
evolution** (Sainte-Foy)
1:00 – 2:00pm **Session 7: Anthropology of the living** (Rimouski)
2:00 – 5:00pm **Session 8: La bio-archéologie au Québec** (Rimouski)
2:40 – 3:10pm Coffee Break/Pause Café
5:00 – 5:15pm Poster take-down

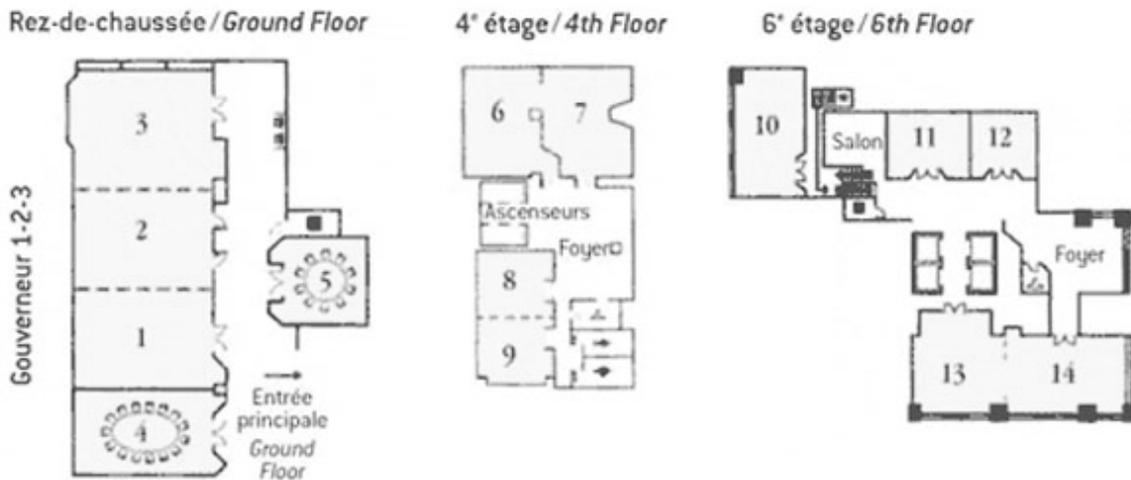
- 5:00 – 6:00pm Business meeting (Rimouski)
 6:30 – 7:30pm Cash Bar (Gouverneur, ground floor/rez-de-chaussée)
 7:30 – 8:30pm Banquet (Gouverneur, ground floor/rez-de-chaussée)
 8:30 – 9:30pm Keynote speaker/Conférencier: Dr. Bernard Chapais,
Title: The evolution of human social structure

Saturday, October 29/Samedi 29 Octobre

- 8:00 – 9:00am Coffee, tea, juice/Café, thé, jus (Foyer, 6th floor)
 8:00 – 11:30am Registration/Enregistrement (Foyer, 6th floor)
 8:30 – 10:30am **Session 9: Paleonutrition** (Sherbrooke, 6th floor)
 10:30 – 11:00am Coffee Break/Pause Café
 11:00am–12:30 **Session 10: Health and Epidemics** (Sherbrooke, 6th floor)
 12:30 – 12:40pm Closing comments and farewells/Conclusions et aurevoirs



Hotel floor plans/Plan des salles de l'Hôtel



1	Gouverneur 1	1,2,3	Gouverneur 1, 2 et 3
2	Gouverneur 2	4	Montréal
3	Gouverneur 3	5	Sept-Îles
1,2	Gouverneur 1 et 2	6	Sainte-Foy
2,3	Gouverneur 2 et 3	7	Québec
6,7	La Capitale	11	Trois-Rivières
8	Rimouski	12	Laval
9	Chicoutimi	13	Sherbrooke 1
8,9	Rimouski-Chicoutimi	14	Sherbrooke 2
10	Longueuil	13,14	Sherbrooke 1 et 2

PUB NIGHT!! PUB NIGHT!! PUB NIGHT!! PUB NIGHT!! PUB NIGHT!! PUB NIGHT!!
SOIRÉE PUB!! SOIRÉE PUB!! SOIRÉE PUB!! SOIRÉE PUB!! SOIRÉE PUB!!

Come celebrate with us!/Venez célébrer avec nous!

The Département d'anthropologie of the Université de Montréal
is turning 50 this year!

Le département d'anthropologie de l'Université de Montréal a 50 ans cette année!

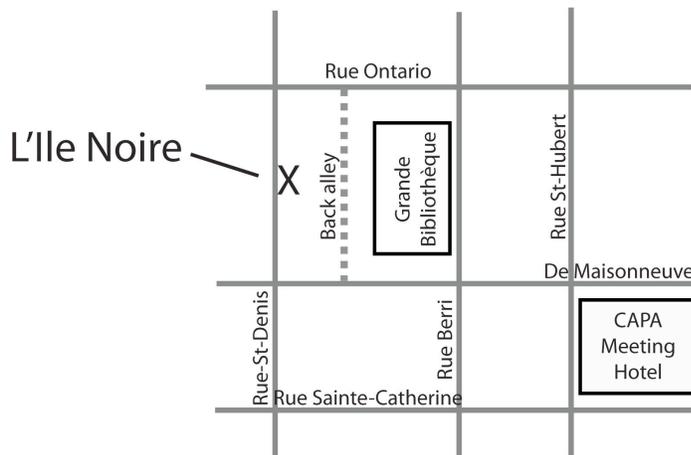
The department is offering a free drink for the first 50 people to arrive.

Le département offre une consommation gratuite aux 50 premiers arrivés.

Don't miss it!/Ne manquez pas cela!

Where/où: L'Île Noire, 1649 Rue St-Denis (between DeMaisonneuve and Ontario Sts.)

When/quand: Thursday night, 8pm/ Jeudi soir, 20h.



In case of bad weather, it is possible to get to the back door of L'Île Noire through the underground city! From the ground floor of the hotel, go to the shopping plaza and follow signs to the subway station, then to the Grande Bibliothèque. One entrance to the Grande Bibliothèque is on the back alley, right in front of the back door to the pub!

KEYNOTE ADDRESS/CONFÉRENCE

Friday, October 28/Vendredi, 28 octobre
Gouverneur Room, Hôtel Gouverneur

The Evolution of Human Social Structure L'Évolution de la Structure Sociale Humaine

Dr. Bernard Chapais
Département d'anthropologie, Université de Montréal

Bernard Chapais is a primatologist and anthropologist working at the Université de Montréal. He did empirical research on primate social behavior for over 25 years before turning his attention to the evolution of human social organization, based on the comparative analysis of the data and concepts of primatology and sociocultural anthropology. This resulted in the book *Primeval Kinship: How Pair-bonding Gave Birth to Human Society* (Harvard U. Press, 2008), which presents a comprehensive model of human social origins. He now works on a new book in which he attempts to demonstrate that the unitary configuration of human society is the product and correlate of a finite set of biological predispositions for social life characterizing all human beings.



The evolution of human social structure

The cultural diversity and complexity of human societies is such that it is extremely difficult to characterize their common structural denominator – the unitary, or deep social configuration of humankind – which is, presumably, the evolutionary blueprint of all human societies. This becomes possible, however, when human societies are compared not only with each other but with other primate societies. I refer to that configuration as the *nested community of multifamily groups* and focus here on two central issues concerning its evolutionary history: how pair-bonding and the multifamily group composition evolved, and how the community of multifamily groups – the multigroup or tribal level of social organization – arose.

SCHEDULE OF PAPERS AND POSTERS/PROGRAMME DES PODIUMS ET POSTERS

WEDNESDAY, OCTOBER 26/MERCREDI 26 OCTOBRE

- 4:00 – 9:00pm Registration/Enregistrement Foyer, 4th floor
7:00 – 10:00pm Welcome Reception/Réception d'accueil (hors d'oeuvres, cash bar)
Sainte-Foy, 4th floor

THURSDAY, OCTOBER 27/JEUDI 27 OCTOBRE

- 8:00 – 9:00am Coffee, tea, juice/Café, thé, jus
8:00am-5:00pm Registration/Enregistrement (Foyer, 4th floor)
8:00 – 8:30am Poster set-up (Chicoutimi)

CHICOUTIMI ROOM-POSTERS

- 8:30am-5:00pm Authors will be at posters during coffee breaks

Poster Session A: Forensics and Bone Biology

1. Investigation of Bone Microarchitecture by Synchrotron X-ray Techniques at the CLS – An Update. **D. Cooper**, Y. Carter, H.M. Britz, T. Wysokinski, G. Belev and D. Chapman
2. Autopsy and Human Dissection During the 19th Century in London: An examination using scanning electron microscopy. **J. Dittmar-Blado**
3. The Face of the Mummy - phenotypic variability among facial reconstructions of Ancient Egyptian Mummies. **V. Lywood** and A.J Nelson
4. A Preliminary Assessment of the Identification of Saw Marks on Burned Bone. **S. Marciniak**
5. Variability in Trauma Related to Judicial Hanging at the Old Don Jail, Toronto, Ontario. **A. Dunlop** and C. Forrest
6. Validation using CT data of Ribeiro's (2000) Method of Measuring the Frontal Sinuses for Forensic Anthropological Applications. **S. Richer**, N. Lynnerup and R.D. Hoppa
7. Spina bifida as a means of identification in forensic contexts. **C. St Dennis**

Poster Session B: Health-Past and Present

8. A Human Systems Integration approach for characterizing the encumbered Soldier. **T. Garlie**
9. Appropriate Methods to Rank Individuals Using Cortisol Levels. **P. Nepomnaschy**, T.C.K. Lee, L. Zeng and C.B. Dean
10. A cross-population analysis of the impact of extrinsic risk on age at introduction of transitional foods. **L. McKerracher**, D. Sellen, P. Nepomnaschy and M. Collard
11. Examining socioeconomic class and age in the epidemic emergence of poliomyelitis in southern Ontario 1900-1937. **H. Battles**
12. The Underreporting of Indigenous Mortality due to Flu in 1918. **K. Bogaert**

13. Identification of food frequency consumption patterns of Metis adults using factor analysis: data from the 2006 Aboriginal Peoples Survey. M.S. **Amarra**
14. Healthy Houses, Healthy Communities: Case Study of a Manitoba First Nations Community. D. **Boutilier**, L. Larcombe, M. Singer, C. Whaley, P. Nickerson, P. Orr
15. The Effects of Natural Background Radiation on Lung, Colon, and Bladder Cancer Incidence and Mortality Rates in Twelve New York State Counties. M. **Fogarty**

Poster Session C: Primatology

16. Why aye-eyes see blue. G. **Moritz**, A.D. Melin, R.A.E. Fosbury, S. Kawamura and N.J. Dominy
17. The juvenile transition: Sex-specific behavioural role-modeling in Coquerel's sifakas. N. **Barrickman** and A. Schreier
18. Non-aggressive gain of alpha status is associated with fecal androgen and cortisol increase in a male white-faced capuchin, *Cebus capucinus*. V. **Schoof**, K.M. Jack and S.D. Carnegie
19. "Stink Flirting" in Ring-tailed Lemurs (*Lemur catta*): Male Olfactory Displays Operate as Costly Signals Impacting Female Choice and Male Mating Success. A. **Walker-Bolton** and C. Ross

SAINTE-FOY ROOM

Session 1: Bioarchaeology and Skeletal Biology-Part I

Chair: Janet Young

- 8:30-8:45 Stress in foragers from Neolithic Siberia. A. **Antonova**
- 8:45-9:00 Non-specific stress indicators and age at death: Using vertebral neural canal size and long bone length to understand childhood stress. E. **Holland**
- 9:00-9:15 Exploring childhood health in early medieval Bergen, Norway, using accentuated striae of Retzius. A. **Dolphin**, K. Lorvik, and A.K. Hufthammer
- 9:15-9:30 The Kids Are Not Alright: A Bioarchaeological Examination of Childhood Health at the Drawsko 1 Cemetery Site. A. **Scott** and T. Betsinger
- 9:30-9:45 Piecing together health status: Using poorly preserved human remains from Chalcolithic Cyprus in palaeopathological analyses. M. **Gamble** and K.O. Lorentz
- 9:45-10:00 Age at Death and Life Expectancy Differences Between Clergy and Laity at Holy Sepulchre Catholic Cemetery, Burlington Ontario. L. **Lockau** and M. Emery
- 10:00-10:30 *Coffee Break and Posters/Pause café et posters (Chicoutimi)*
- 10:30-10:45 *Women on the prehistoric Yorkshire Wolds: Changing quality of life from the Bronze to the Iron Ages. K. **Whitaker**
- 10:45-11:00 Long Bone Bowing Deformities in the Noua Populations of Bronze Age Transylvania. K.L. **Filipek-Ogden** and S. Gloux

*Competing for student prize.

- 11:00-11:15 Lower Limb Activity in the Cis-Baikal: Musculoskeletal Stress Markers Among Middle Holocene Siberian Foragers. A. **Lieverse**, V.I. Bazaliiskii, O.I. Goriunova, and A.W. Weber
- 11:15-11:30 Non-age Related Osteopenia: Implications for Paleopathological Analysis. L. **Watamaniuk**, T. Prowse, R. Ives, R Adams and M. Brickley
- 11:30-11:45 Two-Dimensional Shape Analysis of Lower Thoracic Vertebrae with Schmorl's nodes. K. **Plomp**, U.S. Vidarsdottir and C. Roberts
- 11:45-12:00 Relating Outcome Variables to the Bony Changes in Knee Osteoarthritis. J. **Young**

12:00-1:30pm Lunch

Session 2: Bioarchaeology and Skeletal Biology-Part II

Chair: Helen Kurki

- 1:30-1:45 *A Small-Bodied Later Stone Age Skeleton from Southern Tanzania. E. **Sawchuk**
- 1:45-2:00 The influence of body size and proportionality on human bony pelvic size and shape. H. **Kurki**
- 2:00-2:15 Why use a biological anthropologist when the bones are barely preserved? The recovery of mortuary behaviour from poorly preserved skeletal remains. M. **Liston**
- 2:15-2:30 Classical calibration for histological age-at-death estimation. E. **Raguin**
- 2:30-2:45 *A Test of Age and Sex Determination Methods on Documented Skeletal Collections: Why Subjectivity Should Not Be a Dirty Word. J. **Sharman**
- 2:45-3:15 *Coffee Break and Posters/Pause café et posters (Chicoutimi)*

Session 3: Primatology and Conservation

Chair: Ian Colquhoun

- 3:15-3:30 What if no tourists come? Challenges to ecotourism for a community-managed conservation area in northern Madagascar. I. **Colquhoun**
- 3:30-3:45 Finding a Home: Effects of Human Predation on Chimpanzee Nest Construction in the Lebialem Highlands of Cameroon. C. **Last**
- 3:45-4:00 Breakfast in bed: use of sleeping trees by ursine colobus monkeys (*Colobus vellerosus*) in Ghana. J.A. **Teichroeb**, T.D. Holmes and P. Sicotte
- 4:00-4:15 Population genetics of the black-and-white ruffed lemur (*Varecia variegata*) in continuous and fragmented landscapes. S.M. **Holmes**, A.L. Baden, R.A. Brenneman, S.E. Engberg, E.E. Louis, Jr. and S.E. Johnson
- 4:15-4:30 Social implications of disability for adult female Japanese macaques. S.E. **Turner** and L.M. Fedigan
- 4:30-4:45 Grooming patterns in wild white-handed gibbons (*Hylobates lar*). J. **Vayro** and W. Brockelman
- 4:45-5:00 Males Show Infant Care in *Colobus vellerosus*. I. **Bădescu** and P. Sicotte

*Competing for student prize

5:00-5:15 Poster take-down

8:00pm-?? PUB NIGHT/SOIRÉE PUB, L'Île Noire, 1649 rue St-Denis (map on/carte à la p. 4)

FRIDAY, OCTOBER 28/VENDREDI 28 OCTOBRE

8:00 - 9:00am Coffee, tea, juice/Café, thé, jus

8:00am-5:00pm Registration/Enregistrement (Foyer, 4th floor)

8:00 - 8:30am Poster set-up (Chicoutimi)

CHICOUTIMI ROOM-POSTERS

8:30am-5:00pm Authors will be at posters during coffee breaks

Poster Session D: Bioarchaeology and Skeletal Biology & Honours

1. Bioarchaeology, TT65 Project, Hungarian Mission in Thebes. J. **Cybulski**, R. Stark and T. Bács
2. Percent of achieved adult growth of juveniles at the Campbell Site. A. **Nagel**, L. Cowgill and D. Temple
3. A mid-Holocene human burial from coastal Sri Lanka. S. **Kulatilake**, N. Perera, P. Marr and J. Allan
4. Congenital Malformations of the Spine in a Greek Colonial Population from Apollonia Pontica, Bulgaria. A. **Keenleyside**
5. Identifying disabling conditions in the archaeological record: Possible cases of cerebral palsy, Downs Syndrome, and cleft palate in nineteenth century North America. S. **Phillips**
6. Diet and Disease in Dalheim: An Isotopic Investigation of Skeletons from Medieval Germany. K. **Olsen**, C.D. White, F.J. Longstaffe, F.J. Rühli
7. Stable isotope analysis of faunal remains from the first siege of the Fortress of Louisbourg. J. **Parish**, B. Ellerbrok and V. Grimes
8. A New Method of Dentine Microsampling of Deciduous Teeth for Stable Isotope Analysis. N. **Burt**, S. Garvie-Lok
9. What's in a Tooth: A method for collecting histological, trace element, diagenetic, and isotopic data from single teeth. M. **Teeter** and A.E. Dolphin
10. Effects of Intra- and Inter-Observer Error When Estimating Age at Death Using Various Skeletal Elements. J. **Albanese**, E. Carey, C. Meloche, M. Biddle and S. Craib
11. The Effect of Skeletal Completeness on Cranial Trauma Analyses. K. **Parker**
12. Geometric Morphometric Analysis of Sex Determination from Cranial Landmark Data Using Computed Tomography. A.R. **Klales**, N. Lynnerup and R.D. Hoppa
13. An Investigation of Sexual Dimorphism in the Human Spine. S. **Mazzatto** and B. Glencross
14. Assessing Sexual Dimorphism in Human Eye Orbits Using CT Data. L.J. **Lidstone**, N. Lynnerup and R.D. Hoppa

15. Vertebral Neural Canal Dimensions and Longevity in Two Medieval Danish Populations. J. **Gamble** and R. Hoppa
16. Body Mass Index (BMI) and its effect on adult skeletal age estimation. C. **Merritt**
17. Dental and skeletal indicators of possible tooth-tool use and habitual activities in an individual from Helike, Greece. C. **McConnan Borstad** and S. Garvie-Lok
18. Honouring Canada's leading physical anthropologists: A citation analysis. F. **Toth**

SAINTE-FOY ROOM (morning/matin)

Session 4: Symposium 3D Imaging in Physical Anthropology – New ways of preserving and analyzing data

Organizer and Chair: Meagan S. Gardiner

- 8:30-8:45 The Promise of 3D Laser Scanning. M.S. **Gardiner** and S.C. Kuzminsky
- 8:45-9:00 3-Dimensional Forensic Facial Reconstruction from Fragmentary Craniofacial Remains: The Case of Angelo Poliziano. M. **Billinger**, C. Milani, G. Mahoney, V. Lywood and R. Hoppa
- 9:00-9:15 3D imaging: enhanced record preservation of archaeological dental remains and a potential tool for otherwise complex dental measurements. H. **Gough** and J. Gamble
- 9:15-9:30 The Application of 3D Laser Scanning to Quantitative Age Estimation based on the Pubic Symphysis. A. **Gray** and H.K. Kurki
- 9:30-9:45 Growth of the Humerus Shaft Using 3D Laser Scan Data. A. **Blackburn** and R.D. Hoppa
- 9:45-10:15 *Coffee Break and Posters/Pause café et posters (Chicoutimi)*
- 10:15-10:30 Towards 3D photorealistic visualization for post-field analysis at the Parc Safari cemetery. N. **Gupta**, M. Kalacska and A. Costopoulos
- 10:30-10:45 *Re-evaluating Classical Stereotypes in the Body Cavity Treatment of Ancient Egyptian Mummies. A.D. **Wade**
- 10:45-11:00 Preserving the Dead: 3D Virtual Approaches to Bones Analysis and Conservation. S. **Gloux**
- 11:00-11:15 VIRCOPAL® : collections virtuelles et 3D de paléo-spécimens. Préservation et analyse des données anthropologiques et pathologiques. O. **Dutour**, H. Coqueugnot, B. Dutailly and P. Desbarats
- 11:15-11:30 Discussion

**Competing for student prize*

RIMOUSKI ROOM (morning/matin)

Session 5: Symposium Bioarchaeology in the Andes & South America

Organizer and Chair: Christine Boston

- 8:30-8:45 *Reshaping Life/Death: Exploring the Link Between Artificial Cranial Modification and Morbidity & Mortality in Ancient Northern Chilean Groups. C. **Boston**
- 8:45-9:00 Stable isotope analysis of the human remains from El Castillo in Santa valley, Peru : the question of social stratification through dietary and funerary behaviours. E. **Desrosiers**
- 9:00-9:15 The Contribution of Vertebral Development to Understanding the Moche Giants of Dos Cabezas, Peru. C. **Merbs** and A. Cordy-Collins
- 9:15-9:30 Pre-Columbian Diet and Health in the Quito Basin. C. **Pennycook**, C. White, V. Domínguez, S. Bohorquez, M. Guevara and F. Longstaffe
- 9:30-9:45 Isotopic Effects of Fertilization in the Andes: Implications for Dietary Reconstruction. P. **Szpak**, J.-F. Millaire, F.J. Longstaffe and C.D. White
- 9:45-10:15 *Coffee Break and Posters/Pause café et posters (Chicoutimi)*
- 10:15-10:30 Iconography and Isotopes: Evidence of a Terrestrial-Marine Shift in Late Intermediate Period Diet in Northern Peru. A. **Nelson**, C. White and F. Longstaffe
- 10:30-10:45 Residential mobility at Cahuachi in the Nasca Region, Peru: Oxygen-isotope analysis of archaeological bone and enamel. E.C. **Webb**, C. White and F. Longstaffe
- 10:45-11:00 The Taphonomic Analysis of Human Skeletal Remains from Cerro Amaru, Peru. S. **Spigelski**
- 11:00-11:30 Discussion

11:30-1:00pm *Lunch*

SAINTE-FOY ROOM (afternoon/après-midi)

Session 6: Symposium Multidisciplinary perspectives on primate evolution

Organizers and Co-Chairs: Laura Eastham and Karyne Rabey

- 1:00-1:10 Introduction
- 1:10-1:25 Using Multidisciplinary Techniques to Understand the Adaptive Significance of Primate Colour Vision Variation. A. **Melin**, L.M. Fedigan, D.W. Kline, S. Kawamura
- 1:25-1:40 Early Paleocene Primates from the San Juan Basin: new insights into the first chapters of primate evolution. M. **Silcox** and T.E. Williamson
- 1:40-1:55 Stable Carbon Isotopes in Late Miocene Mammals as Indicators of Forest Canopy Structure. L. **Eastham**, D.R. Begun and L. Kordos
- 1:55-2:10 Primate Social Behaviour and the Evolution of Tail Loss. A. **Mackenzie**

*Competing for student prize

- 2:10-2:25 Sexual Conflict in Primates. R. **Stumpf**, K. Milich, N. Righini, R. Martinez Mota and M. Shattuck
- 2:25-2:40 The evolution of the upper limb after *Australopithecus*: Integrating paleontology and experimental functional morphology. B. **Richmond** and E.M. Williams
- 2:40-3:10 *Coffee Break and Posters/Pause café et posters (Chicoutimi)*
- 3:10-3:25 Muscle architecture and bone morphology of the humerus in orangutans: implications for the study of fossil hominoids. K. **Rabey**, A.E. Mackenzie, S. McCormick and D.R. Begun
- 3:25-3:40 The development of medial and lateral pillars of the femur in hominoids : growth and influence of locomotion. M. **Puech**
- 3:40-3:55 Encephalization, sympatry and seasonality: Primate adaptations at Rudabánya. D. **Begun**
- 3:55-4:10 Aerobic exercise influenced the evolution of hominin brain size and cognitive function. J. **Polk** and D.A. Raichlen
- 4:10-4:25 Dental Morphometric Study of Pitheciine Molars with Comparisons to *Afropithecus turkanensis* and *Morotopithecus bishopi*. L. **Adlam**, K. Rabey and D.R. Begun
- 4:25-4:40 Metric Analysis of the Dentition of a Fossil Orangutan from Vietnam. M.A. **Schillaci**, M.J.C. Reid and D.R. Begun
- 4:40-5:00 Discussion

RIMOUSKI ROOM (afternoon/après-midi)

Session 7: Anthropology of the living

Chair: Tracey Galloway

- 1:00-1:15 What genetics can tell us on the evolution of modern human diseases: Example of Seasonal Affective Disorder (SAD). P. **Claude**
- 1:15-1:30 Interindividual differences genesis: The development of depressive symptoms in childhood. A genetically and environmentally informed prospective study. A. **Paul-Hus** and D. Pérusse
- 1:30-1:45 Is BMI the right tool for the job? Using alternative anthropometric indices to screen for health risk in Canadian Inuit. T. **Galloway**, G.M. Egeland, K. Young
- 1:45-2:00 A test of the hypothesis that high dietary fat intake contributes to elevated ovarian steroid levels. V.J. **Vitzhum**, J. Thornburg, C. Deimel, F. Schaebs and T. Deschner

Session 8: Symposium La bio-archéologie au Québec

Organisation et présidence: Isabelle Ribot

- 2:00-2:10 Introduction
- 2:10-2:25 Study on the coffin hardware and the burial practices of a rural and Catholic community from Beauce in the 19th and 20th centuries: Burials of the Saint-Frédéric cemetery, Québec, Canada. R. **Janson**

- 2:25-2:40 Study of a burial discovered at Parc Montmorency (11G3F7), location of the first cemetery in Quebec City (1608-1688). J. **Vigeant**, G. Piédalue, D. Lebrun, F. Morland, I. Ribot and J.-F. Hélie
- 2:40-3:10 *Coffee Break and Posters/Pause café et posters (Chicoutimi)*
- 3:10-3:25 Criteria for determining dental robustness in Notre Dame's osteological collection, Montreal (first church cemetery, 1691-1796). A.-M. **Grimoud**, S. Lucas, A. Sevin, I. Ribot, F. Morland
- 3:25-3:40 Correlated study of dental caries and tooth wear in the osteological collection from Notre Dame, Montreal (the first church cemetery, 1691-1796). S. **Lucas**, A. Sevin, A.-M. Grimoud, F. Morland and I. Ribot
- 3:40-3:55 Heath and diet: comparison of various bioarchaeological data for a Protestant community from Quebec City (Saint-Matthew, 1771-1860). F. **Morland**, I. Ribot, J.-F. Hélie and W. Moss
- 3:55-4:10 Contribution of two paleonutritional case studies to Quebec bioarchaeology: the cemeteries of Notre-Dame (Montreal, 1691-1796) and Saint-Matthew (Quebec City, 1771-1860). I. **Ribot**, F. Morland, É. Desrosiers, J.-F. Hélie and J. Vigeant
- 4:10-4:25 La pensée bioarchéologique québécoise : confusion récente et perspectives d'avenir. É. **Taschereau**
- 4:25-4:40 Un bilan de la bioarchéologie québécoise. R. **Larocque**
- 4:40-5:00 Discussion
- 5:00-5:15 Poster take-down
- 5:00-6:00 Business meeting/Réunion de l'association (Rimouski)
- 6:30-7:30 Cash Bar (Gouverneur Room, ground floor/rez-de-chaussée)
- 7:30-10:00 Banquet (Gouverneur Room, ground floor/rez-de-chaussée)
- 8:30-9:30 Keynote speaker/Conférencier: Dr. Bernard Chapais,
Title: The evolution of human social structure

SATURDAY, OCTOBER 29/SAMEDI 29 OCTOBRE

- 8:00 – 9:00am Coffee, tea, juice/Café, thé, jus (Foyer, 6th floor)
- 8:00am-12:00pm Registration/Enregistrement (Foyer, 6th floor)

SHERBROOKE ROOM (6th floor)

Session 9: Paleonutrition

Chair: Genevieve Dewar

- 8:30-8:45 Use of Multi-Isotopes Application to Compare Human Scalp Hair to Beard Hair. J. **Mayo**, G. St-Jean and M. Chartrand

- 8:45-9:00 Paleodiet study of a human community from an archaeological site in the west Mexico; “el Tropol”, Colima. C.A. **Jácome** and F. Morland
- 9:00-9:15 Isotopic investigations of ancient Maya diet at Caledonia, Cayo District, Belize. A. **Rand**
- 9:15-9:30 Using Stable Carbon and Nitrogen Isotopes to Investigate Chronological Trends in Ancient Maya Diet at Minanha, Belize: A Preliminary Analysis. S. **Stronge** and J. Williams
- 9:30-9:45 Feasting or farming during the Late Woodland period in southwestern Ontario. G. **Dewar** and J. Ginter
- 9:45-10:00 Going Cold Turkey: Isotopic Evidence for Purposeful Grain Feeding of Wild Turkeys for the Late Woodland Ontario Iroquoian Fall Harvest. Z. **Morris**, C. White, F. Longstaffe, L. Hodgetts and N. Ferris
- 10:00-10:15 Comparing the Reconstructed Child and Adult Diets from a Caribbean Population using Carbon and Nitrogen Stable Isotope Analysis. H.A. **Sparkes**, T.L. Varney, P. Courtaud and T. Romon
- 10:15-10:30 Lead localization in the bone microstructure of historical Antigua bone samples through the use of synchrotron radiation x-ray fluorescence. T. **Swanston**, T. Varney, I. Coulthard, C. Hennig, R. Murphy and D. Cooper
- 10:30-11:00 *Coffee Break/Pause café (6th floor foyer)*

Session 10: Health and Epidemics

Chair: Ann Herring

- 11:00-11:15 Assessing Immune Profiles in Ancient Canadian Inuit Groups. M.L. **Campbell**, L. Larcombe, P. Nickerson, R. Hoppa, and P. Orr
- 11:15-11:30 Sex in the City? Examining the Syphilis Outbreak in Toronto (2000-2010). M. **Nafte**
- 11:30-11:45 The 1890 and 1918 Influenza Pandemics in Canada: The Debilitating Effects of Early Life Exposure. S. **Hallman** and A. Gagnon
- 11:45-12:00 Fishing for ancient pathogens: reconstruction of the virulence-associated pPCP1 plasmid of *Y. pestis* from victims of the Black Death. K. **Bos**, V.J. Schuenemann, S.N. DeWitte, J. Krause and H.N. Poinar
- 12:00-12:15 The Russian Influenza Pandemic (1889-90) and the Margins of Memory. A. **Herring** and S. Carraher
- 12:15-12:30 In The Time of Crisis Mortality: Deconstructing the Impact of Yellow Fever and Cholera Epidemics. L. **Sawchuk** and L. Tripp
- 12:30-12:40 *Closing comments and farewells/Conclusions et aurevoirs*

ABSTRACTS/RÉSUMÉS

Alphabetical order by first author/Ordre alphabétique par premier auteur

Dental Morphometric Study of Pitheciine Molars with Comparisons to *Afropithecus turkanensis* and *Morotopithecus bishopi*

[Session 6]

Laura **Adlam**, Karyne **Rabey** and David R. **Begun**
Dept. of Anthropology, University of Toronto

Through the study of the molar cusp morphology of extant pitheciines (*Cacajao*, *Chiropotes* and *Pithecia*) - known sclerocarpic predators - as well as the seed-predating colobine, *P. rubicunda*, this project discusses the differences and similarities between these extant taxa as well as comparing them to *Afropithecus turkanensis* and *Morotopithecus bishopi* (as it has been suggested that both fossil taxa have similar anterior dentition to sclerocarpic foragers). The purpose of this study is to see if these fossil taxa share the same or a different dietary niche and to ascertain if that niche may have been sclerocarpy. If these two fossils do, in fact, share a dietary niche, they may be congeneric rather than separate genera as currently indicated in the literature. This study used occlusal photographs of extant taxa taken with a Canon Rebel Xsi digital camera mounted on a camera platform (with built-in leveling apparatus) and a portable lighting system using an 18-55mm lens. Image capture and measurements of the cusp areas of the pitheciine, colobine and fossil M1 and M2s were achieved using tpsDIG 2.15 software and all data was analyzed with PAST 2.03 statistical software and Microsoft Excel (2007). The results showed that all the pitheciines (*Chiropotes*, *Cacajao* and *Pithecia*) group together to the exclusion of *Prebytis rubicunda* based on occlusal cuspal measurements. The fossils both group with the pitheciines to the exclusion of the phylogenetically closer OWM *P. rubicunda*. *Afropithecus turkanensis* and *Morotopithecus bishopi* are statistically not significantly different from one another but *M. bishopi* is significantly closer to the pitheciines in occlusal measurements than is *A. turkanensis* indicating a possible significant difference between the fossil taxa that may indicate a need for distinction between the taxa at the generic level.

Effects of Intra- and Inter-Observer Error When Estimating Age at Death Using Various Skeletal Elements

[Session D]

John **Albanese**, Emily **Carey**, Chelsea **Meloche**, Meaghan **Biddle** and Sarah **Craib**
Dept. of Sociology, Anthropology and Criminology, University of Windsor

When human skeletal remains are found, forensic anthropologists must address three major questions that can help with positive identification of the deceased. They use various methods to determine sex, and estimate stature and age at death. The focus of this research is to identify the sources of intra- and inter-observer error and quantify their effects on accuracy and reproducibility of various methods for estimating age at death. Intra-observer error is the error that occurs when data are collected by one observer over the course of multiple trials. Inter-observer error is the error that occurs when different examiners assess the same specimens. Various skeletal elements were examined using standard age estimation methods for each

element: cranial suture; os pubis; sacrum; first rib; and the fourth rib (Meindl and Lovejoy 1985, Brooks and Suchey 1990, Rios et al 2008, Kunos et al 1999, and Iscan et al 1984 respectively). Each element was assessed blind three times by four different observers. Although being described as more precise, both rib methods were the most difficult to apply consistently for biological reasons (wide range of skeletal variation) and methodological reasons (poorly defined landmarks on bone and descriptions of characteristics to be examined). In a forensic investigation, incorrect information can be far more damaging to the investigation than imprecise information. We recommend that a small amount of precision should be sacrificed for better accuracy and consistency by selecting methods with lower intra- and inter-observer error.

**Identification of food frequency consumption patterns of Metis adults using factor analysis:
data from the 2006 Aboriginal Peoples Survey**

[Session B]

Maria Sofia Amarra
University of Calgary

Using food frequency data in the Métis Supplement of the 2006 Aboriginal Peoples Survey Public Use Microdata file (APS-PUMF), the study sought to 1) identify existing food frequency consumption patterns of Métis adults using factor analysis; 2) describe how diabetes prevalence and consumption patterns of males and females differ in terms of the following variables: geographic location, educational level, and household income.

Principal component analysis was used to identify existing food frequency consumption patterns of male and female Métis adults. Factor scores were computed for each consumption pattern. Scores of individuals from different geographic locations, educational levels, and household income levels were compared using multivariate analysis of variance.

Predominant eating patterns of Métis adult males and females were: 1) a traditional food pattern characterized by frequent consumption of Indigenous foods; 2) a balanced pattern characterized by frequent consumption of animal protein foods (fish and meat), vegetables and fruits; 3) a fast food pattern characterized by western fast foods (pizza, burger, french fries, softdrinks); 4) a dairy-fruit-cereal pattern characterized by milk, milk products, cereal and fruit; and 5) a hot beverage pattern characterized by coffee or tea and added sugar.

Adults in rural areas where diabetes was more prevalent were more likely to consume the traditional, dairy, and hot beverage patterns. Respondents in urban areas were more likely to consume the balanced and fast food patterns.

Diabetes was more prevalent among those with low educational level and low household income. Low educational level (high school) was associated with frequent consumption of the fast food and hot beverage patterns while high educational level (university) was associated with the balanced pattern.

Low income households often consumed traditional and hot beverage patterns while high income households often consumed balanced and dairy patterns. Among females, higher income was associated with reduced fast food consumption. Demographic characteristics such as geographic location, education, and income are associated with dietary patterns that may affect diabetes risk among Métis adults.

Dietary pattern analysis can be used to understand dietary behaviours that may affect health risks among Métis adults.

Stress in foragers from Neolithic Siberia

[Session 1]

Anastasia **Antonova**
University of Calgary

This paper examines the frequency and developmental chronology of Wilson bands in teeth of foragers from Neolithic Siberia (cal. 8000-5200 BP). These microscopic enamel defects are indicators of non-specific stress (infection, poor nutrition, metabolic disturbance) that occurred during the time of crown formation. Permanent teeth from twelve individuals were examined for the number of bands per tooth, chronology and longevity of band development, and periodicity of stress events. It was found that the majority of WBs were evident in anterior teeth with an average frequency of six defects per tooth. Correlation between the timing of crown formation and the frequency of Wilson bands suggested that stress episodes were periodic and of such severity that affected several teeth developing synchronically. Matching bands across dentition shown that the earliest forming defects would frequently appear in first molars at 5-7 months after birth, while the latest forming defect were recorded from second molars at 4.5 years. The periodicity of defects varied among teeth with molars showing 1-4 months interval, and anterior teeth demonstrating 2-8 months intervals. It is suggested here that because of increasingly rapid growth during the first years of life, the prevalence of Wilson bands in the prehistoric Siberian foragers was recorded between 6 months and three years of age. Therefore the adverse effect of seasonal food deficit and/or acute illness could have resulted in the formation of defects. However precise etiology of Wilson bands was impossible to extrapolate due to limitations of the studied archaeological material. Overall, it is concluded that Wilson bands are an excellent means for documenting and interpreting stress in early childhood.

Males Show Infant Care in *Colobus vellerosus*

[Session 3]

Iulia **Bădescu**^{1,2} and Pascale **Sicotte**²

¹University of Toronto

²Dept. of Anthropology, University of Calgary

Infants are often attractive to non-mothers (natal attraction), who may try to physically interact with them in a manner that resembles maternal care (positive infant handling). In contrast to female primates, reports of positive infant handling among males are rare and biased toward pair-bonded Callitrichids. The lack of positive infant handling by non-monogamous males is probably due to paternity uncertainty, as they are unlikely to gain adaptive benefits through parental investment. We report rates of natal attraction and positive infant handling by males of polygynous *Colobus vellerosus* at Boabeng-Fiema Monkey Sanctuary, Ghana. Behavioral data were collected May to November 2010 via 10-minute focal sampling on 12 infants belonging to 4 groups. *C. vellerosus* infants are born white, darkening over several months. We compared rates (occurrences/hour) in white/grey (WG) vs. black-and-white (BW) infants by adult and subadult males and females. Adult males' natal attraction and infant handling rates were higher than adult females' (mean: 0.016 ± 0.035 & 0.024 ± 0.053 vs. 0.005 ± 0.003 & 0.005 ± 0.005) in BW infants. Adult males in uni-male groups showed higher global mean rates of natal attraction toward infants (both colors) than adult males in multi-male groups ($0.062:0-0.290$ vs. $0.019:0-0.078$). Subadult males' natal attraction rates were higher than adult males and adult females for WG and BW infants (subadult males: 0.140 ± 0.088 & 0.065 ± 0.037 vs. adult males: 0.069 ± 0.101 &

0.016±0.035, adult females: 0.082±0.087 & 0.005±0.003), and they also showed higher infant handling rates in BW infants (subadult males: 0.035±0.034 vs. adult males: 0.024±0.053, adult females: 0.005±0.005). Maternal relatedness may explain the higher infant care reported for subadult males in our study. Adult males in uni-male groups may show more interest in infants due to higher paternity certainty. Our results emphasize the importance of longitudinal data to describe species-typical behaviors.

The juvenile transition: Sex-specific behavioural role-modeling in Coquerel's sifakas

[Session C]

Nancy **Barrickman**¹ and Amy **Schreier**²

¹Dept. of Anthropology, University of Waterloo

²Dept. of Evolutionary Anthropology, Duke University

Few studies have examined the social behavior of juvenile primates despite the importance of the juvenile period as a crucial stage of social development during which individuals transition from infantile to adult behavior. In this study, we examined three social groups of Coquerel's sifakas (*Propithecus coquereli*) housed at the Duke Lemur Center. We tested the hypothesis that juvenile females will preferentially associate with adult females rather than adult males. Conversely, juvenile males will preferentially associate with adult males. Our sample of juveniles included 4 females and 5 males. Association was measured as nearest neighbor and grooming interaction. We conducted instantaneous sampling at 2-minute intervals of all juveniles and adults in the group, during which we recorded activity and nearest neighbor(s). These data were collected between October 2010 and July 2011, for a total of 90 hours of observation. We also tested for age-related differences between the "young" (6-18 months), "middle" (18-30 months), and "old" juveniles (30-56 months). To test for significant differences in association preferences between males and females, we used Wilcoxon Signed Rank test. The results demonstrate that juvenile females associated significantly more with adult females than with adult males, and there were few age-related changes in association preference. In contrast, juvenile males groomed adult males more frequently than adult females, and there was an age-related transition between frequent association with the mother just after weaning to more frequent association with the father as the juveniles aged. These results strongly suggest that juvenile sifakas rely on same-sex role models to facilitate their social development.

Examining socioeconomic class and age in the epidemic emergence of poliomyelitis in southern Ontario 1900-1937

[Session B]

Heather **Battles**

McMaster University

This research project examines polio mortality in Wentworth and York counties of southern Ontario during the period of epidemic emergence in North America. It aims to determine whether these patterns fit the existing polio model and hygiene hypothesis, which hold that improved sanitation and reduced crowding, especially among the middle/upper classes, led to a delayed age of infection and increased risk of paralysis and death.

Data were collected from death registrations and other archival sources. Socioeconomic class was coded for using a 5-point composite score scale which assigned numerical values to individual

polio victims based on father's occupation. Data collection yielded a total of 336 polio deaths for analysis, and 202 of these (60%) could be assigned a status score. Status score 3 (skilled labour) had the most deaths (41%), followed by score 2 (entrepreneurial/clerical) at 29%, score 4 (semi-skilled labour) at 15%, score 5 (unskilled labour) at 10%, and score 1 (professionals) at 5%. These results were compared to the proportion of the population in each status score according to the 1921 Census, in terms of both overall population and children and families in Hamilton and Toronto. As expected, status score 5 had a much lower mortality share compared to its relative population size. Unexpectedly, status score 2 was also slightly below its share, while status score 3 was well above.

Encephalization, sympatry and seasonality: Primate adaptations at Rudabánya

[Session 6]

David **Begun**

Dept. of Anthropology, University of Toronto

The 10 Ma late Miocene locality of Rudabánya (Hungary) is known from an abundant sample of the primitive catarrhine (pliopithecoid) *Anapithecus* and the stem hominine *Rudapithecus*. Excavations at the R. II locality have made it possible to determine that both primates are found in the same levels, and in fact even in the same 1 X 1 excavation units, making it as clear as possible in a paleontological context that they were sympatric. Other cases of sympatry are claimed for fossil catarrhines based on co-occurrence in a locality, but none are demonstrated with the level of precision possible at Rudabánya. In addition, recent work on the paleoecology of R.II indicates that, while it samples a wet forest/subtropical environment, it was relatively seasonal, with cycling in the availability of food resources. Both *Anapithecus* and *Rudapithecus* are reconstructed as frugivores. While smaller than *Rudapithecus*, *Anapithecus* was probably at the lower end of the range of variation of *Rudapithecus*, with some overlap in body mass. The combination of indications from morphology (body mass, diet) and ecology (sympatry and seasonality) suggest the presence of selection pressure for adaptations favoring a reduction in competition, especially in lean months. I propose that this pattern of selection led to the development in both taxa of well-developed dental adaptations for fall-back feeding strategies, and in *Rudapithecus* of an enlarged cranial capacity. While primate community structure is poorly known for most middle and late Miocene localities, pliopithecoids and hominids are known from Europe for at least 2.5 million years before Rudabánya. This ecological context in Europe may have provided the necessary background for the development of the key hominid adaptations of orthograde and encephalization. Long term multidisciplinary research at Rudabánya makes it possible to move beyond functional anatomy and phylogeny towards a more comprehensive reconstruction of the paleobiology and evolution of Miocene hominines.

3-Dimensional Forensic Facial Reconstruction from Fragmentary Craniofacial Remains: The Case of Angelo Poliziano

[Session 4]

Michael **Billinger**¹, Chantal **Milani**², Gregory **Mahoney**³, Victoria **Lywood**⁴ and Robert **Hoppa**⁵

¹Michael Billinger Consulting Services, Ottawa

²Università di Torino, Turin

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⁴John Abbott College, Montreal

⁵University of Manitoba, Winnipeg

Incomplete human remains pose significant challenges to an already difficult task of approximating what the face of a victim might have looked like ante mortem in order to make a positive identification. Prediction of morphology of the mandible is particularly difficult where only fragments have been found, or the mandible is missing altogether. We present here an example of the interface between art and science, using computed tomography (CT) scans and geometric morphometrics to reconstruct a skull from fragmentary craniofacial remains, and then using a haptic device and virtual sculpting to predict the size and shape of a missing mandible in order to complete the skull of 15th century Italian humorist, Angelo Poliziano. A 3D model was then created using rapid prototyping, which formed the basis for a forensic facial reconstruction, which otherwise would not have been possible without such extensive digital manipulation.

Growth of the Humerus Shaft Using 3D Laser Scan Data

[Session 4]

Amanda **Blackburn** and Robert D. **Hoppa**

University of Manitoba

To examine morphological variation of the humerus throughout growth, 3D pointcloud data of the diaphyses of 136 nonadult individuals, and a subsample of 55 adults were collected from 9 archaeological samples. The 3D shape and geometry was acquired using a Polhemus Fastscan handheld laser scanner. Variation in the circumference and cross sectional shape was examined for ontogenetic changes over childhood. The use of 3D laser scan data provides the opportunity to examine a more accurate representation of true circumference and cross sectional shape, which can then be analyzed using geomorphometrics techniques. The age-related changes in humeral diaphyseal size and shape are examined. In particular, midshaft outlines were acquired from the pointcloud data to generate Elliptic Fourier coefficients which are normalized for position and size. A multivariate analysis of variance (MANOVA) of the shape data for age groups 5-8 years and 9-12 years, demonstrated a significant difference in shape in the right (but not left) humeri. Overall growth of the humerus throughout childhood is discussed, and the advantages and limitations of using laser scan data for growth related studies in osteology are reviewed.

The Underreporting of Indigenous Mortality due to Flu in 1918

[Session B]

Kandace **Bogaert**

Dept. of Anthropology, McMaster University

The 1918 influenza pandemic swept around the world in three waves from 1918-1920, killing millions in the wake of the First World War. A major shortcoming to our understanding of this flu is that information on Indigenous mortality is often unavailable. This poster examines the underreporting of Indigenous mortality during this global pandemic through a variety of historical records from the Six Nations community of the Grand River in Southern Ontario. The official death records for the Six Nations reserve, from the province of Ontario registries were collected for two years prior to and through to the two years after the epidemic (1916-1922). These records were then compared to other sources of information on mortality for 1918 – including council minutes, newspaper reports and tombstones located on the Six Nations reserve. For 1918 it was found that mortality was underreported by nearly 50%. The avenues for the underreporting of deaths were complex, and represented at various levels; from the provincial government to the relatives of the deceased, and the doctor being ill with influenza; with all contributing to the obfuscation of Indigenous mortality during the 1918 influenza. This highlights how local circumstances, histories and politics play a role in whose deaths were “counted”. While the absence of information on Indigenous mortality in official records and accounts can be seen as a reflection of social inequality, it is also undoubtedly indicative of opposition to colonial rule. Emphasis is placed on the socially constructed nature of vital registries upon which mortality statistics are based, as well as the need for locally-based studies to counter for underreporting.

Fishing for ancient pathogens: reconstruction of the virulence-associated pPCP1 plasmid of *Y. pestis* from victims of the Black Death

[Session 10]

Kirsten **Bos**¹, Verena J. **Schuenemann**², Sharon N. **DeWitte**³, Johannes **Krause**² and Hendrik N. **Poinar**¹

¹McMaster Ancient DNA Centre, McMaster University

²Institute for Archaeological Sciences, University of Tübingen

³Dept. of Anthropology, University of South Carolina

Ancient DNA is an attractive resource for acquiring genetic information about infectious disease in the past, though investigations to date have been limited in scope due to restrictions imposed by DNA preservation and the techniques used for its retrieval. While investigations of medieval plague victims have identified *Yersinia pestis* as the putative aetiologic agent of the pandemic, methodological limitations have prevented large-scale genomic investigations to evaluate changes in the pathogen’s virulence over time, which may partly explain epidemiological differences between ancient and modern forms of plague. To investigate the evolutionary history of *Y. pestis*, we screened over 100 bones and teeth from the well-documented East Smithfield Black Death burial ground from London, UK of 1348 - 1350. Use of a novel DNA enrichment technique permitted capture and subsequent high throughput sequencing of ten full human mitochondrial genomes and a complete virulence-associated plasmid from the ancient organism, thus representing the longest contiguous stretch of reconstructed ancient pathogen DNA to date. Our plasmid shows identity with several modern *Y. pestis* isolates, suggesting tight genetic

conservation in this region over the last 660 years. The demonstrated success of our molecular capture technique suggests that this approach may be an essential tool for isolation of ancient pathogens from the complex metagenomic backgrounds common to ancient samples.

Reshaping Life/Death: Exploring the Link Between Artificial Cranial Modification and Morbidity & Mortality in Ancient Northern Chilean Groups

Competing for student prize [Session 5]

Christine **Boston**

Dept. of Anthropology, University of Western Ontario

Artificial cranial modification (ACM) is a cultural practice in which the cranium is reshaped for the purpose of fulfilling a social need within the group/society. It was practiced for several thousand years world-wide but was particularly prevalent in South America. While basic information concerning this practice is widespread, there is still much that is unknown, particularly regarding if and how ACM affected morbidity and mortality. Two recent studies cite ACM as the cause of the deaths of several infants, but the prevailing attitude that ACM could not have caused death without being abandoned remains.

A study of 507 ancient northern Chilean adult and juvenile individuals was undertaken for the purpose of further exploring these effects in depth. These individuals were surveyed for several different conditions, including lesions associated with and not directly associated with ACM. ACM-related lesions included bone necrosis, premature suture fusion, craniosynostoses, thin bone, grooving, bumps, asymmetry, and indentations. Because several of these lesions can be caused by several different pathological conditions (e.g. scurvy, anemia) cribra orbitalia and dental enamel hypoplasia were also scored for in order to determine if the ACM-related lesions were due to this cultural practice or other pathological condition. The presence and absence of these traits were statistically tested using a row by column Chi-square test and G-test. Additionally, data on the proportions of deceased modified versus unmodified adults and juveniles were examined in order to establish if increased mortality existed in either group.

The results of this study found that modified individuals had increased incidences of specific ACM-related lesions, including bone necrosis, grooves, asymmetry, and indentations, but also demonstrated increased incidences of dental enamel hypoplasia. This evidence supports the hypothesis that ACM increased morbidity. The examination of the adults showed equal proportions of deceased modified and unmodified individuals, which did not support the hypothesis that ACM increased mortality. There was a slight increase in the number of deceased modified juveniles, which does support the hypothesis. This information furthers the current understanding of ACM. Further study should be completed in order to further explore the biological consequences and the cultural motivations of ACM.

Healthy Houses, Healthy Communities: Case Study of a Manitoba First Nations Community

[Session B]

David **Boutilier**¹, Linda **Larcombe**^{1,2}, Matthew **Singer**², Chris **Whaley**², Peter **Nickerson**^{2,3},
Pamela **Orr**^{2,4}

¹Dept. of Anthropology, University of Manitoba

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³Transplant Immunology Laboratory, Manitoba

⁴J.A. Hildes Northern Medical Unit, Dept. of Community Health Sciences, University of
Manitoba

Housing is a crucial social determinant of health in Canadian First Nations communities. The burdens of overcrowding, inadequate structural conditions, and poor access to sanitation are disproportionately prevalent in Manitoba First Nations communities and they have been associated with communicable disease in this province and elsewhere.

This poster presents and discusses results from a community-based housing and health survey conducted in one Northern Manitoba community in September of 2010. Crowding, occupant activity, and environmental and structural conditions are assessed as potential risk factors for moisture generation and mold growth in the home; wet and moldy conditions are contrasted with occupant health reports to better understand exposure risk. In this retrospective case control study, odds ratios are calculated to estimate the risk of poor occupant health outcomes given exposure to certain housing conditions.

While the survey data reveal a distressing illustration of housing conditions in the community, attributing the presence of mold to specific structural factors is difficult due to the ubiquity of suspect conditions that have come to characterize First Nations housing across Canada. Attributing specific health outcomes to those pervasive housing problems is similarly troublesome. However, these data do suggest that recent programs aimed at mitigating the effects of excessive humidity in northern homes may not have been successful, leading to implications for First Nations and all northern housing policy.

A New Method of Dentine Microsampling of Deciduous Teeth for Stable Isotope Analysis

[Session D]

Nicole **Burt**, Sandra **Garvie-Lok**

Dept. of Anthropology, University of Alberta

Carbon and nitrogen stable isotope analysis is used to reconstruct diet. Serial sampling of the dentine can reconstruct an individual's changing diet and the diet of the population. Previous serial studies have used homogenized samples that give broad results. This study presents a new microsampling technique for use with stable isotope analysis that reconstructs diet associated with specific and important juvenile life stages: fetal life, breastfeeding, and weaning.

A sample of 23 modern deciduous teeth was collected in collaboration with the Department of Pediatric Dentistry, University of Alberta. The teeth were longitudinally sectioned. One half of each longitudinally cut tooth was examined histologically to find the level of the neonatal line. The other half is sampled for isotopic analysis. Microsamples of dentine were collected occlusal to the neonatal line, directly apical to the neonatal line, and from the growing edge of the tooth. Collagen was extracted from the samples using standard procedures. The results of the stable isotope analysis have indicated that microsample can be successfully run. The nitrogen results

were accurate for all weights. It does appear that for accurate carbon results the microsamples must have a weight greater than .6mg. This weight can be obtained for the different sampling areas, though multiple punches are for some teeth.

The formation schedule of deciduous dentine suggests that these samples will reflect the diet of the mother during pregnancy, breastfeeding diet, and weaning diet. The results of the isotopic assay on this modern sample can be reasonably explained in terms of modern infant feeding practices and demonstrates the potential value of the technique for research on archaeological remains.

Assessing Immune Profiles in Ancient Canadian Inuit Groups

[Session 10]

Morgan L. **Campbell**¹, Linda **Larcombe**^{1,2,4,5}, Peter **Nickerson**^{2,3}, Robert **Hoppa**¹ and Pamela **Orr**^{2,4,5,6}

¹Dept. of Anthropology, University of Manitoba

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The Inuit and First Nations communities of northern Canada experience a disproportionately high rate of TB prevalence compared to their non-aboriginal counterparts. The TB infection rate in Inuit communities has risen to 185 times the rate of Canadian-born non-aboriginal. To understand this persistent health issue, 152 Inuit skeletons from across the Nunavut territory were assessed. The sample consisted of archaeologically recovered individuals from the late prehistoric period to the late historic period, allowing for the observation of any changes that may have occurred in the population following European contact.

A Palaeopathological inventory to assess health and molecular methods to confirm sex, ancestry and immunogenetic profiles were assessed using amelogenin analysis, mitochondrial sequencing and SNaPshot mini sequencing. The population demonstrated a higher frequency of chronic pathologies compared to acute conditions, with a small portion manifesting characteristic tubercular lesions. The 20 individuals chosen for molecular sampling were largely chosen from the individuals with classic tubercular pathologies and good preservation. Of these, results were obtained for 17 individuals. The mitochondrial sequencing resulted in haplogroups common to Inuit populations of the Canadian Arctic, Hg D3 and A2. Immunogenetic profiles obtained through SNaPshot analysis of SNP's for four key immune system cytokines known to play an important role in an individual's ability to combat tuberculosis. The Inuit immunogenetic profile demonstrates an immune response that would have favoured a Th2 immune response which is an effective defense against parasitic and fungal infections. This is the first example of immunogenetic typing of an archaeologically recovered Inuit population. This research contributes to our understanding of the current high burden of infectious diseases among the Inuit and explores the selective pressures that shaped their immunogenetic profile.

What genetics can tell us on the evolution of modern human diseases: Example of Seasonal Affective Disorder (SAD)

[Session 7]

Pauline **Claude**

Dépt. d'anthropologie, Université de Montréal

SAD is a subtype of depressive disorder that corresponds to a depressed mood in winter with a total remission the next summer. It is characterised by atypical symptoms of depression such as hypersomnia, hyperphagia and weight gain. This disorder affects individual's fitness and account for a non-negligible proportion of the modern global population. The existence of high prevalence of such suboptimal fitness traits has sometimes been ascribed to result from an ancient positive selection on features that do not fit anymore in our fast-evolving modern environment. Since SAD is arguably triggered by seasonal changes in sunlight emission, this exploratory study was suggested to see whether this disorder might have evolved through the process of positive selection by investigating some associated genes. Several theories have tried to explain the evolutionary history of the disease, but direct evidence to test them is still lacking. In light of what is known on the biology and genetics of SAD, two relevant sets of genes were chosen for analysis: one related to the regulation of circadian rhythms and another one to the production of vitamin D. Signals of positive selection were studied using two different tools, the iHS (integrated Haplotype Score) and the XP-EHH (Cross-Population Extended Haplotype Homozygosity). The data was organised by several broad geographic groups in order to compare the emerging patterns with the epidemiological data of the disorder and see whether the differences found in the prevalence of SAD can be explained by evolutionary process. Unfortunately, due to numerous limitations, no conclusive outcome arose from this incomplete set of data. However, this approach is worth consideration in much greater detail with more complete and accurate data, not only to have an overview on the evolution of the disorder but also to have a better understanding of its biology itself in order to target the proximal and actual causes of the disease.

What if no tourists come? Challenges to ecotourism for a community-managed conservation area in northern Madagascar

[Session 3]

Ian **Colquhoun**

Dept. of Anthropology, University of Western Ontario

Although not without its critics, ecotourism (or "sustainable tourism") is often characterized as a means by which communities can: i) generate revenue that can be directed towards the establishment, management, and protection of sensitive or threatened environments; ii) bring economic benefits to residents living near such protected areas, and iii) through these economic benefits, instill support for conservation efforts among the local residents. Additionally, ecotourism that achieves these ends can also serve to educate tourists about the special or unique biological and cultural qualities of the host locale. Seen in this way, ecotourism can even be argued to be akin to sustainable development. But, what if the tourists do not come? This is the problem that confronts the KOFAMA community-managed conservation area in northern Madagascar, a project initiated in 2007 with assistance from the Peace Corps. During May and June 2010, a team of Canadian, American, and French anthropologists, together with Canadian and Malagasy students, worked at KOFAMA to assess the state of this conservation/ecotourism

project three years on from its launch. With impressive limestone karst formations, a diverse array of endemic avifauna, the most southwestern-occurring population of crowned lemurs in Madagascar, and extensive caves in the limestone massif within which numerous human burials have been made over generations, the site certainly has numerous features that should be draws for ecotourists. But, its remote location as well as political instability at the national level since 2009 have worked against KOFAMA. Still, a committed core group of local residents continue the effort to make the project successful. While follow-up work is planned at KOFAMA in May-June 2012, the initial assessment is that KOFAMA provides a case study of the fallacy of a "build it and they will come" approach to ecotourism, sustainable development, and locally-managed conservation efforts.

Investigation of Bone Microarchitecture by Synchrotron X-ray Techniques at the CLS – An Update

[Session A]

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Last year at the “Stones, Bones and Photons” satellite symposium of the 2010 annual CAPA meeting we presented an overview of bone imaging capabilities available at the BioMedical Imaging and Therapy (BMIT) beam line of Canada’s national synchrotron facility, the Canadian Light Source (CLS). Here we focus on micro-CT technologies of this facility and provide an update on developments over the past year and new capabilities scheduled to come online within the next two years. A key research target for our group is the visualization and quantification of osteocyte lacunar density and morphology in both human and animal bone. As we reported last year, this cellular-level imaging has proven challenging. Following initial attempts at 4 micron nominal resolution an alternative optical configuration was implemented to reach down to approximately 2 microns. While this higher resolution provided improved visualization of lacunae, x-ray intensity (flux) limitations using a single energy (monochromatic) beam were encountered. To overcome this we have explored the use of a filtered polychromatic ‘white’ beam. This approach has proven very effective at solving the flux limitation and has two significant implications for future research: 1) scan times can be greatly reduced (e.g. 10 times or more); 2) higher resolutions, on the order of a single micron and potentially smaller, will be feasible with new equipment which is slated for installation in early 2012. Finally, BMIT is also bringing a newer and more powerful (insertion device) branch line alive over the course of the coming year. This branch line will afford new opportunities to image larger and denser objects than are currently possible at the facility. Collectively these advances will enable high quality, high throughput imaging capabilities which are unique within Canada and openly accessible via scientific peer review.

Bioarchaeology, TT65 Project, Hungarian Mission in Thebes

[Session D]

Jerome **Cybulski**¹, Robert **Stark**² and Tamás **Bács**³

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The Tombs of the Nobles in the Theban Necropolis on the west bank of the Nile, opposite Luxor, are informative monuments of the Egyptian upper classes during the Middle/New Kingdom and later periods. Our poster presents a contextual overview of human remains from 5 burial locations associated with one such tomb, TT65, studied on site during the 2010 (14th) field season of the Hungarian Mission in Thebes. Highlighted are Shaft '1' in the forecourt of TT65, which held the known latest burial occupant, and Shafts '3' and '4' on the eastern slope of the forecourt, which held the earliest. Shaft '1' was intended for the original 18th Dynasty owner of TT65 but never used by him and the tomb itself abandoned for reasons unknown. Instead, the remains of a naturally preserved Coptic period "half-mummy" was found in the shaft, possibly disturbed by looters of a nearby grave and hastily discarded. Shaft '4' held a lone occupant, an 18th Dynasty mummy that had obviously been damaged by looters. The estimated mummy length of this probable male was 165 cm, a reasonable proxy indicator of stature during life. Shaft '3' provided a challenging mix of at least 17 individuals, some represented only by one or a few bones, others by limbs wrapped in high quality linen plus loose bones matched during the analysis. The latter may have been the original 18th Dynasty occupants: 3 adult males, a female, a child and an infant as determined from the skeletal remains. Apparent later intrusions, intentional or accidental, included 3 infants, 3 children, a juvenile, 2 adult males and 2 females. Pathology in the overall collection was minimal: porous orbital roofs in youngsters and foci of bone spicules and joint surface erosion in adults that did not resemble the usual scars of degenerative joint disease. We plan to continue analysis in the autumn 2011 field season, adding remains from a sixth burial location.

Stable isotope analysis of the human remains from El Castillo in Santa valley, Peru: the question of social stratification through dietary and funerary behaviours

[Session 5]

Emilie **Desrosiers**

Dépt. d'anthropologie, Université de Montréal

El Castillo site, located in the lower part of the Santa Valley, is considered to be an administrative and ceremonial Moche center of the third (III) phase (300 – 450 AD). It represents a case of cohabitation between the Moche and the local group of the Gallinazo who established earlier a civic-ceremonial center in El Castillo. After the Moche left the area, a third phase of occupation occurred during the Middle Horizon (600-1000 AD) by the Tanguche. Between 2000 and 2005, 31 burials units containing one or more individuals were discovered in the non-residential area of the architectural complex by the "Projet Santa de l'Université de Montréal". Burial patterns were revealed by (bio-)archaeologists showing a wide range of funerary treatments (e.g. elite burials, post-mortem manipulations, burials associated with a construction phase, with or without graves good). The question raised is whether funerary behaviour reflects the social status of individuals buried at El Castillo. Dietary reconstructions

are one way to explore this issue: food systems are key elements in the establishment not only of political economy, but also of social relations between and within complex societies. Therefore, stable carbon and nitrogen isotopes were analysed on rib samples from 25 individuals. Results show that people at El Castillo, despite age and sex differences, had access to a wide range of resources. $\delta^{13}\text{C}_{\text{coll}}$ values suggest a diet including C_4 plants and marine resources. Additional stable carbon isotope analyses on bone apatite indicate that C_4 plants (e.g. maize, amaranths) contributed significantly to an increase in $\delta^{13}\text{C}$ values. $\delta^{15}\text{N}$ values show higher inter-individual variation suggesting differential access to high-protein resources (e.g. individuals from elite burials show higher $\delta^{15}\text{N}$ values, and also higher $\delta^{13}\text{C}$ values, while three individuals associated to a construction phase buried without grave goods present the lower $\delta^{15}\text{N}$ values). $\delta^{15}\text{N}$ values also show differences among the Moche and Gallinazo groups, the latter having a greater heterogeneity within his members. Although almost every burial represents a particular case of funerary and nutritional behaviours, it allows us to observe the phenomenon of social stratification in these complex societies.

Feasting or farming during the Late Woodland period in southwestern Ontario

[Session 9]

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During the Late Woodland period, the Western Basin Tradition (WBT) has long been associated with a seasonal transhumance hunter-gatherer economy in southwestern Ontario. This is in opposition to the contemporary Iroquoian economic strategy, which relied on horticulture and in particular the use of maize. However, recent analysis of skeletal remains from a small WBT cemetery in Windsor, Ontario (Great Western Park), dating to the Yonge/Springwells phase, produced evidence that these individuals utilized maize at the same level as their Iroquoian neighbors (Dewar et al 2010). In order to study this unexpected phenomenon further we studied a large sample of individuals from the Lucier (WBT) mortuary complex. Specifically looking at biomechanics and dental pathologies, we compared the Lucier individuals with an Archaic (Hunter-Gatherers) and an Iroquoian (Agriculturalist) population. The preliminary results suggest that the Lucier individuals exhibit the same bone strength as the agriculturalists yet the incidence of dental caries is moderate. We then try to determine how this pattern fits with Strother and Abell's (2002) theory that WBT populations during this time period were in fact consuming maize during ritual feasting rather than relying on maize as a subsistence base.

Autopsy and Human Dissection During the 19th Century in London: An examination using scanning electron microscopy

[Session A]

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This research presents osteological evidence for the varied types of medical instruments used during 19th century autopsy and human dissection from skeletal remains excavated at the Royal London Hospital site, Whitechapel. This excavation, conducted by Museum of London Archaeology (MOLA) in 2006, recovered 265 burials and 89 coffins containing dissected human

body portions. The aims of this research were to reconstruct the processes of human dissection and autopsy as well as identify the surgical instruments used to perform these procedures, develop a method to differentiate types of medically-relevant post-mortem modification including human dissection and autopsy within archaeological assemblages. The objectives were to analyse the tool marks, identify the class of medical instruments used, and to discuss the historic context of human dissection and the formalization of this within medical training. Silicone impressions of the tool marks found on a sample (n=10) of individuals from the Royal London Hospital site were made and analysed using scanning electron microscopy (SEM). Electron micrographs were used to identify tool class in all of the samples analysed, and differences in the tool used within dissection and autopsy were observed. A differentiation method was developed based on previous observations within the literature, and was supported with evidence from the population. The processes of human dissection and autopsy were reconstructed and specific tools identified. The skeletal remains were compared to contemporary sources and a roughly standard method of dissecting cadavers to learn anatomy was confirmed. Similarly, autopsy techniques show remarkable consistency with other reports within the literature.

Exploring childhood health in early medieval Bergen, Norway, using accentuated striae of Retzius

[Session 1]

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During the 12th and 13th centuries Bergen, Norway, quickly developed into a major urbanised trade centre within Scandinavia and became the seat of the Norwegian kingdom. At the heart of Bergen's development were the Bryggen wharf and St. Mary's church – both of which underwent partial excavation from 1955-1968 after a fire destroyed several structures in that area. Osteological analyses of 76 individuals with the most secure contextual information (1170-1198) from the St. Mary's cemetery found that no children less than 6 years of age at the time of death were present in the skeletal sample. Despite the absence of young children's remains it is possible to comment on the health and well-being of Bergen children during this time period through microstructural analyses of teeth. Because teeth develop during early childhood, are sensitive to physiological disturbances during their formation, and permanently capture markers of these disturbances, they can be used as retrospective indicators of the health of this sample of infants and children in Bergen during the early medieval period. An analysis of the frequency and timing of growth arrest markers (accentuated striae of Retzius) was conducted for 24 of the individuals with corresponding osteological and archaeological information. Differences in the presentation of growth arrest will be discussed in light of Bergen's rapid urbanisation during the 12th and 13th centuries and in comparison to results from other Scandinavian sites where similar periods of social change were being experienced at that time.

Variability in Trauma Related to Judicial Hanging at the Old Don Jail, Toronto, Ontario

[Session A]

Alexis **Dunlop** and Crystal **Forrest**
Archaeological Services Inc., Ontario

This poster examines the cranio-cervical injuries observed in the skeletal remains of 15 men that were found during an archaeological assessment of the Old Don Jail in Toronto, Ontario, in 2008. These men were prisoners executed by judicial hanging between 1877 and 1930, and were buried in the East Exercise Yard at the jail. Each individual was subject to an autopsy at the time of death, and 12 of those medical investigations involved craniotomies. In four of those instances some or all of the cervical vertebrae were removed for examination and not reburied with the individual. The rest sustained some type of skeletal trauma (fracture or dislocation) either on the vertebrae, the base of the cranium, or the hyoid bone. There was substantial variability in injuries sustained, and only one individual showed signs of the classic "Hangman's Fracture." While the medicolegal literature of the time stipulated the ideal conditions for judicial hanging, individual hangmen may have employed idiosyncratic techniques. The variability in trauma related to hanging at the Old Don Jail is therefore probably attributable to minor variations in technique over a 53-year period. This research suggests that investigators should exercise caution in interpreting injuries related to judicial hanging due to the inconsistency in the skeletal manifestation of this type of trauma.

VIRCOPAL®: collections virtuelles et 3D de paléo-spécimens. Préservation et analyse des données anthropologiques et pathologiques

[Session 4]

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En anthropologie, paléontologie ou paléopathologie, l'élaboration de modèles 3D de pièces osseuses hautement fidèles à l'original permet leur analyse à des fins de recherche et leur utilisation à des fins de formation tout en préservant les originaux, pièces uniques et souvent fragiles, de toute manipulation. Aussi, il se crée un besoin croissant de constitution de collections virtuelles de "paléo-spécimens" osseux.

Cette communication porte sur la restitution de pièces paléopathologiques à partir de leur acquisition tomodensitométrie (CT scan - microCT scan). Des pièces uniques illustrant diverses pathologies osseuses identifiées sur des squelettes anciens ou des cas cliniques actuels à visées comparatives sont, après numérisation à haute résolution, reconstruites avec le logiciel 3D développé dans notre laboratoire et reproduites en haute fidélité sur une imprimante 3D. Ces modèles sont mis à la disposition de la recherche et de la formation en paléopathologie. Cette chaîne complète de traitement numérique fait l'objet du brevet VIRCOPAL®.

L'objectif scientifique de ce projet est de faciliter de manière durable et non destructive les explorations morphologiques tridimensionnelles des structures externes et internes des pièces paléopathologiques et d'améliorer les performances du diagnostic rétrospectif par les possibilités de multiplier les expertises sans endommager les pièces originales.

Les autres applications de ce projet sont nombreuses notamment dans les domaines de la formation à la spécialité (réalisation de « mallettes diagnostiques ») pour les acteurs de terrain et les chercheurs en laboratoire ainsi que dans le domaine de la valorisation de la recherche (expositions, muséographie).

Stable Carbon Isotopes in Late Miocene Mammals as Indicators of Forest Canopy Structure

[Session 6]

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Changes in forest canopy structure throughout the Neogene have strongly influenced the evolution of hominid cognitive and locomotor adaptations, as well as patterns of dispersal. In Europe, the Late Miocene (10 – 8 Ma) marks the extinction of many of the hominids, which had diversified successfully during the Middle and early Late Miocene. In western and eastern Europe, this occurs in correlation with increasing seasonality and aridity, as well as a shift in vegetation from closed canopy subtropical evergreen to more open canopy deciduous forest and woodland. Floral and faunal data for Late Miocene central Europe indicate the persistence of closed canopy humid forest conditions throughout this period. Reconstructing canopy structure at central European localities is necessary for understanding the evolution and dispersal patterns of hominids. We examine forest canopy structure at the Late Miocene R. II hominid locality at Rudabánya, in northern central Hungary. To evaluate canopy structure at R. II, we examine the stable carbon isotope ($\delta^{13}\text{C}$) values in enamel from ten genera of medium to large-bodied herbivores ($n = 65$). $\delta^{13}\text{C}$ values of the sampled R. II fauna are in accordance with foraging in a range of environments, from densely closed canopy forest to more open woodland. The range of individual $\delta^{13}\text{C}$ values (-17.0‰ to -9.7‰) confirms the presence of predominantly, or exclusively, of C_3 plants. Because the floral assemblage at Rudabánya has been identified as indicating a warm-temperate forest, we can constrain our interpretation of canopy density. After accounting for dietary enrichment (+14.1‰), the average $\delta^{13}\text{C}$ value of plants eaten by the R. II fauna is -26.9‰, a value consistent with that of modern temperate forests. This data supports the possibility of a central European humid forest refugium during the Late Miocene. The results of this study provide insight into the paleoecology of central Europe during a highly dynamic period in hominid evolution.

Long Bone Bowing Deformities in the Noua Populations of Bronze Age Transylvania

[Session 1]

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In recent years, evaluations of pathological conditions present in archaeological skeletal assemblages have considerably advanced. The method of establishing a differential diagnosis in order to narrow a pathogen or a specific condition's skeletal involvement has helped to breed insight into not only the disseminations of the pathologies and conditions themselves, but also cultures as a whole. This study aims at employing this method in order to possibly ascertain a

diagnosis focusing on the bowing deformities in the lower limbs of a sample of the Noua populations in Bronze Age Transylvania. Fifty-three individuals from the Polus Floresti cemetery site of Cluj-Napoca, Romania were available for 3D scans and photographs; of which only twenty-two had lower limbs available or adequate for analysis. The most frequently observed bowing showed an almost even distribution of anteromedial and anterolateral bending in diaphyses of the femora and a slight predilection favouring lateral bending in the diaphyses of tibiae. At present, the differential diagnosis indicates the bowing deformities may have been due to residual rickets; a metabolic condition developed during childhood caused by a lack of vitamin D absorption. If the Noua population indeed suffered from rickets, it stands to reason that the mobility of the group would be impaired, or at the least slightly prohibitive, rather than extensive as previously suggested in the archaeological literature.

**The Effects of Natural Background Radiation on Lung, Colon, and Bladder Cancer
Incidence and Mortality Rates in Twelve New York State Counties**

[Session B]

Melissa Fogarty

St. Lawrence University

Natural background radiation makes up 82% of human radiation exposure and is inescapable as it is constantly emitted by cosmic and terrestrial sources in our environment. Two competing theories have attempted to explain the relationship between radiation levels and cancer risk. Proponents of the linear non-threshold model propose that cancer risk increases in a linear function to radiation exposure. Thus, all forms and exposure levels are harmful to human health and can lead to cancer, creating the foundation of our current knowledge regarding radiation today. Others, however, believe that only high levels of radiation can lead to negative health outcomes and that low levels of radiation can actually lead to multiple health benefits, the most significant being protection against cancer (hormesis theory). The aim of this study was to determine if humans could adapt to natural background radiation, depending upon exposure levels. This study utilized a discriminant function analysis procedure to compare lung, colon, and bladder cancer incidence and mortality rates, from 2004 to 2008, to radon averages in twelve New York state counties. The results of the analysis found that there is no correlation between lung, colon, and bladder cancer mortality and incidence rates and radon averages in the twelve New York state counties tested. Suffolk County had the second lowest radiation average, yet cancer incidence and mortality rates were highest for both sexes in all three types of cancer tested. Cortland County had the highest radon average, yet cancer incidence and mortality rates were the lowest for all three types of cancer in males. These findings strongly support the hormesis theory, thus alluding to a potential human adaptation to natural background radiation.

Is BMI the right tool for the job? Using alternative anthropometric indices to screen for health risk in Canadian Inuit

[Session 7]

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BMI has proven unreliable as a screening tool for cardiovascular and metabolic disease risk in Inuit populations. Greater sitting height ratios among Canadian Inuit complicate interpretation of BMI (Charbonneau-Roberts et al. 2005) and correction factors for sitting height such as those proposed by Norgan et al. (1994) have proven inconsistent (Galloway et al. 2011). Discrepancies in CDC, IOTF and WHO BMI cutoffs available for children provide little support for practitioners needing to identify children at risk of obesity. Numerous studies report inconsistencies between extremely high prevalence of obesity and the burden of metabolic disease borne by Inuit men and women (Chateau-Degat et al 2008; Young 1996, 2003; Young et al. 2007). While researchers suggest that traditional diets may protect the lipid profiles of Inuit Canadians (Dewailly et al. 2001), there is growing evidence for both an increase in cardiovascular disease (Bjerregaard et al. 2003; Egeland et al. 2011; Young et al. 2007) and a decrease in consumption of traditional foods among Inuit undergoing rapid acculturation (Blanchet and Rochette 2008; Sharma et al. 2009). Simple, low-cost health screening methods are a critical component of primary health care in the north and it is essential that these methods accurately predict health risk in Inuit adults and children, for whom the provision of follow-up medical care is costly and logistically challenging.

The present study compares the predictive value of BMI for identifying metabolic risk in Inuit adults with that of a series of metrics: waist circumference (WC)/height (H); WC/H^2 ; WC/H^3 ; WC/SH ; WC/SH^2 ; WC/SH^3 ; and the recently proposed metric H^3/BMI^3 . Subjects are 2168 individuals (837 males and 1331 females) from 36 Inuit communities in the Canadian Arctic who completed anthropometric measures as part of the 2007-8 International Polar Year Inuit Health Survey. We find indices based on WC are strongly associated with lipid profile and insulin levels and more strongly predictive of hypertension than those based on BMI, likely due to fact that, unlike BMI, WC is not strongly correlated with height. Though we did not take hip circumference measurements, we also discuss the issue of using waist-hip-ratio (WHR) and the new body adiposity index (BAI) in this population.

Vertebral Neural Canal Dimensions and Longevity in Two Medieval Danish Populations

[Session D]

Julia **Gamble** and Rob **Hoppa**

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Vertebral neural canal (VNC) dimensions have been used in the past as nonspecific indicators of growth arrest during childhood. Their suggested strength lies in the fact that they are largely unaffected by catch-up growth since they attain their mature size at an early age (Clark et al., 1986). VNC development is, in fact, largely complete by four years of age, a period during which a number of important body systems (the autoimmune system and the central nervous system) are developing. As such, VNC disruption is taken as an indication of systemic disruption which could also have impacted these concurrently developing systems. Past research has suggested a relationship between vertebral neural canal dimensions and low birth weight (Jeffrey

et al., 2003), along with reduced age at death (Clark et al., 1986; Watts, 2010). VNC data was collected from two archaeological samples as part of a larger bioarchaeological study of early life events and mortality in Medieval Danish populations. Preliminary results of this broader research are presented with a focus on VNC dimensions in relation to differential longevity for these two populations.

Piecing together health status: Using poorly preserved human remains from Chalcolithic Cyprus in palaeopathological analyses

[Session 1]

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Preservation of osseous material on Cyprus is typically quite poor, which in the past has prevented problem-oriented research utilising the human skeletal remains. This research seeks to provide evidence of the positive results which can be gained from adapting standard methods to mitigate and account for the issues of preservation. This paper will present a portion of the results of the palaeopathological analysis of the human skeletal remains derived from three Middle Chalcolithic (c. 3000 BC) sites on Cyprus, while including discussion on the issues of preservation and methods incorporated. A skeletal sample from Souskiou-Laona (Operation C) cemetery is compared to the skeletal series' from the settlement sites of Lemba-Lakkous and Kissonerga-Mosphilia. Overall, 17921 skeletal elements were examined, accounting for a minimum of 263 individuals. Of this sample, 26.8% of the skeletal material could not be assessed for pathological lesions due to issues of preservation. This paper will explore the positive results of the palaeopathological analysis, incorporating the results of the preservation analyses.

The Promise of 3D Laser Scanning

[Session 4]

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Repatriation of human remains in both the United States and Canada jeopardizes the preservation and continued study of native North American skeletons. However, three-dimensional (3D) laser scanning technology offers a sophisticated new method of documenting skeletal collections so that if repatriated, the skeletons are not forever lost to the scientific community. Unlike computed tomography (CT) and other radiographic techniques, high definition 3D laser scanners are inexpensive, simple to use, and completely non-destructive to human skeletal material. A major benefit of 3D digital models created from laser scanners is that they can be shared by researchers, reducing travel costs and time spent studying skeletal collections that are housed in institutions around the world. Sharing digital models also allows for increased sample sizes, a common problem researchers face when using prehistoric human skeletal collections. In addition, researchers can use the 3D images to quickly measure, reconstruct, and create cross-sections of skeletal elements. Our aim is to demonstrate the promise of three-dimensional

scanning technology to preserve and document osteological material, expand research ideas in physical anthropology, and increase the potential for scholarly collaboration.

Encumbered Anthropometry: A Human Systems Integration approach for characterizing the encumbered Soldier

[Session B]

Todd Garlie

Ergonomics Team, Anthropology, Natick Soldier Research, Development and Engineering Center (NSRDEC)

Anthropometry generally refers to the physical measurement of the unclothed or minimally clothed human body to obtain nude or near nude body dimensions in order to describe variability in the human form. Understanding this human variation is critical for the purposes of design and development of clothing, equipment and workspaces. However, many times these nude body dimensions are inadequate for designing equipment and workspaces because people rarely operate unclothed in the real world. This is especially true of specialized groups such as civilian first responders and the military who in the course of their duty often wear multilayered protective equipment that results in increased body size and movement restrictions. Therefore it becomes important to characterize the human in a clothed or “encumbered” form so that designers can accommodate these individuals in real world workspaces. Although it is recognized that an individual in multilayered protective gear takes up more space, few studies have documented this in detail. The purpose of this effort is to outline a preliminary Human Systems Integration approach that highlights a current effort to characterize the encumbered Soldier under relevant load and protective clothing conditions for use in digital human figure modeling and simulation. This will provide improved realism and accuracy of Soldier digital models with respect to body size, volume and range of motion.

Preserving the Dead: 3D Virtual Approaches to Bones Analysis and Conservation

[Session 4]

Sabrina Gloux

ArchaeoTek - Canada

Human remains are best understood when they can be revisited over the long term, analyzed by multiple experts, and subjected to new analytical techniques. However, remains recovered from archaeological excavations are subject to numerous conditions and constraints that compromise their preservation, reduce their analytical value, and make it difficult for them to be shared with fellow researchers. While these concerns are broadly understood in Romania for the conservation and preservation of items of aesthetic and artistic value, human remains are considered to be disposable and there is little effort put into their long-term preservation. A recent interest in these collections resulted in samples being taken for genetic testing, isotopic analysis and radiocarbon dating, thus implying destroying this unique and invaluable material. It is thus necessary to preserve essential information about these remains. As part of our research project “Late Bronze Age Populations in Transylvania”, we began creating 3D digital models of individual elements of the collection through 3D laser scanning with the NextEngine scanning and software platform. Non-contact 3D scanning methods are non-destructive and produce highly accurate 3D digital representations that are readily shared, infinitely reproducible and

cheaply and efficiently stored. The virtual model can be precisely oriented in virtual space and measurements can be obtained with essentially infinite precision. In addition, the model may also be “sliced” in any orientation at any point to inspect and measure a cross section, and surface area and volume measurements can be easily made. The strength of the method as an aid to preservation and research lies in the models’ fidelity to the original materials, and advanced capacity for research and comparison. Essential features of the bones are captured in digital format, which can be examined with computer-aided techniques in ways that are not feasible with physical objects.

3D imaging: enhanced record preservation of archaeological dental remains and a potential tool for otherwise complex dental measurements

[Session 4]

Hilary **Gough** and Julia **Gamble**
University of Manitoba

Dental remains have the potential to provide extensive information on age, the timing of stress events, and life history parameters, amongst other things. As such, they represent an invaluable resource for improving our understanding of both modern and palaeo populations. However, much of the most useful information which can be derived from dental remains is that involving the internal microstructures. While we are getting closer to being able to non-destructively access this information, the large-scale application of such techniques is still not possible. Given the utility of internal dental microstructures for investigating such a wide range of questions, archaeological and modern dental specimens continue to be subjected to destructive analysis. It is generally accepted that extensive records must be made prior to undertaking destructive research, and 3D scanning technology provides a useful medium for recording, as an electronic record can be kept and disseminated. In this study, canines from 167 individuals from two medieval Danish samples were scanned using the NextEngine 3D scanner and software. A subsample of these teeth is scheduled for destructive analysis. A series of basic crown measurements were then taken on a subsample of both the original teeth and the 3D scans and cross-compared. Experimentation with further measurements was also undertaken on the virtual teeth to consider the potential of this medium for capturing measurements which are difficult or impossible to obtain from the teeth themselves. The results from these analyses are discussed and suggestions are made with reference to the future utility of such methods and to the challenges and limitations involved.

The Application of 3D Laser Scanning to Quantitative Age Estimation based on the Pubic Symphysis

[Session 4]

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The application of 3D laser scanning to the analysis of human skeletal remains provides the opportunity for new methodological approaches, including for the assessment of age at death. The focus of this new perspective revolves around the question of whether morphological development of skeletal features can be captured with quantitative measurements taken from 3D scanned representations of physical specimens, with the aims of adding an increased level of

accuracy and precision over currently employed age estimations methods that focus on visual, and often subjective, assessments based comparisons with plaster casts and written descriptions. The current research was conducted to determine if specific morphological features of the pubic symphysis could be isolated and quantified on 3D models, and whether these measurements captured the general age related trends of symphyseal development. Using CAD software, each symphyseal face was divided into half and quadrant specific sections in an attempt to better capture the development of symphyseal morphology. A sample of left male pubic symphyses (n = 40) scanned from a well-documented collection of known-age individuals (Coimbra Identified Skeletal Collection) was selected for this study. Seven symphyseal features were identified from the Suchey-Brooks method unisex age phase descriptions. Eight measurements were generated to quantify these features. The data for each feature was subjected to linear regression analyses to test for statistical correspondence to known chronological age at death. Rim completeness, billowing height and area, and depth of symphyseal face depression demonstrated the strongest relationships with chronological age, while curvature of the ventral rampart and the angle of the dorsal aspect, showed significant but weak relationships with known age. Degree of dorsal lipping and dorsal rampart curvature showed no relationship with age. The results of the study suggest that quantitative assessments of morphological changes at the pubic symphysis are possible and therefore can potentially add further insights into age at death estimations based on the pubic symphysis, as measurements taken within CAD software are far more precise than traditional measuring implements. This study illustrates the potential for 3D imaging to improve the methods of osteological analyses applied in the fields of bioarchaeology and forensic anthropology.

**Criteria for determining dental robustness in Notre Dame's osteological collection,
Montreal (first church cemetery, 1691-1796)**

[Session 8]

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Dental morphology is a useful tool for identifying biological affinities, by exploring human variation within and between groups as well as through time and geography. Here as part of a preliminary study, a 17th and 18th century Euro-Quebecois sample is first analysed to establish within-group variation. The aim is to measure and compare dental crown size of Notre-Dame's osteological collection in order to determine the relationship between the robustness of the maxillary and mandibular teeth. Hereafter, further comparisons can be done with various historic European populations, to establish any possible ancestral links.

The sample studied 650 adult permanent teeth from Notre-Dame. Measurements of mesio-distal and bucco-palatal/lingual teeth diameters were taken using a sliding calliper on the canines, 1st and 2nd premolars and 1st and 2nd molars. Robustness was calculated by multiplying the mesio-distal and bucco-lingual/palatal diameters of the tooth crown. Regression analysis was used to study the relationship between maxillary and mandibular robustness.

The results indicate a positive correlation between maxillary and mandibular robustness for the five morphotypes observed within the Notre-Dame dental sample. The t values for the five correlation coefficients are significant (P > 0.001); but robustness was greater for the mandible than the maxillae. Comparison between right and left diameters for the maxillary and mandibular

teeth using chi-square test was not statistically significant, supporting the absence of dental morphological asymmetry.

This study has allowed us to accurately measure the morphological variation within the Notre-Dame sample by identifying five dental morphotypes, whose robustness is significantly correlated between the upper and lower jaws. Comparisons with other populations are necessary so as to explore how robustness has evolved in time and space.

Towards 3D photorealistic visualization for post-field analysis at the Parc Safari cemetery

[Session 4]

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Reconstruction of grave creation often takes secondary position to the detection of graves in investigations of human rights violations. Yet, understanding how and when a mass grave was created is a prerequisite for judicial proceedings. We introduce high-resolution spatial and stratigraphic visualization at the Parc Safari animal cemetery as a tool to interpret a complex co-mingled mass grave. High-resolution records visually document grave characteristics, including depth, composition, relative date of, and spatial relationships between interred remains, and the scale of decomposition. Once skeletal and non-skeletal finds have been exhumed, these records are an invaluable archive for post-field analysis.

To recreate the mass grave, we asked: [1] are interred remains a result of multiple burial events and what is their depositional relationship; [2] are disarticulated remains a result of pre-burial dismemberment or grave disturbance?

High-resolution records indicate one burial event during which all individuals were interred. Pre-burial dismemberment resulted in the disarticulated state of remains. Future work to establish how and when a grave was created will develop and refine 3D photorealistic technologies.

The 1890 and 1918 Influenza Pandemics in Canada: The Debilitating Effects of Early Life Exposure

[Session 10]

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Using registered death records from selected Canadian cities, this research explores whether exposure to influenza early in life during the ‘Russian flu’ pandemic of 1890 influenced risk of mortality during the subsequent ‘Spanish flu’ pandemic of 1918. We hypothesize that exposure during critical periods of development may result in physiological impairments that increase risk of death from later airborne infectious diseases. Contrastingly, according to the “original antigenic sin” model, developing numerous and highly specific antibodies to a given influenza strain early in life may increase the risk of death when infected as an adult by a novel and highly differentiated strain. Preliminary analyses show that, strikingly, mortality in 1918 peaked at age 28 in Toronto, i.e., precisely for the generation born during the previous outbreak. Further, deaths in other Canadian cities revealed peaks in mortality at ages 28 and 30, consistent with our hypothesis that exposure to the influenza pandemic in 1890, in utero or in the first years of life,

elevated risk of death from the pandemic of 1918. This research will provide a comparison with mortality levels in selected American cities as well as age-specific death rates allowing new empirical insights connecting early physiological insults and immunological experiences to later life mortality. Understanding why particular individuals are at greater risk from pandemic influenza may help to establish more effective guidelines to protect the most vulnerable from the threats of future outbreaks.

The Russian Influenza Pandemic (1889-90) and the Margins of Memory

[Session 10]

Ann **Herring** and Sarah **Carraher**

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During the winter of 1889-90 the people of Hamilton found themselves dealing with an influenza pandemic – the Russian Influenza –that in mere months had made its way from Eurasia to the shores of North America. The public was aware of the pandemic’s progress and its effects long before it reached the city because of extensive reporting in newspapers and medical periodicals. Doctors of the period were at a loss to explain what was causing such widespread and variable suffering. This was a time when medical authorities debated whether disease was caused by miasma – noxious odours and poisonous gases – or by invisible bacteria that could only be seen with a microscope; a time in which the public was essentially left to its own devices to treat the illness popularly known as “la grippe”. Despite the fact that the Russian Influenza displayed the hallmarks of pandemic influenza, including elevated mortality rates among individuals in the prime of life, the experience of Russian Influenza in Canada seems to have been lost from public memory, unlike the later Spanish Influenza of 1918. This paper explores the reasons why the Russian Influenza has been relegated to the margins of social history.

Non-specific stress indicators and age at death: Using vertebral neural canal size and long bone length to understand childhood stress

[Session 1]

Emily **Holland**

University of Toronto

Selective mortality can occur for individuals who experienced periods of stress (nutritional or disease) during growth and development. Long bone length is a common non-specific stress indicator used to identify such periods of stress, but its accuracy is questionable due to the confounding factor of catch-up growth. Vertebral growth offers an alternative, as canal growth is essentially complete by the age of four while the body continues to grow until adulthood. Assessing the relative size of the vertebral canals and the vertebral body heights allows for the determination of whether or not a growth disruption occurred early in childhood and if it was followed by a period of catch up growth. In this study 60 individuals of known age at death from the Coimbra Identified Collection were assessed for small vertebral canal size and reduced final adult long bone length (in lieu of stature). Vertebral canal size and final long bone length were assessed with respect to age at death and the presence or absence of linear enamel hypoplasia. Final results are pending. Utilizing multiple non-specific stress indicators has the opportunity to augment not only our ability to identify whether or not a stress occurred during development but also at what period during development it took place.

Population genetics of the black-and-white ruffed lemur (*Varecia variegata*) in continuous and fragmented landscapes

[Session 3]

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Habitat fragmentation is a growing global threat, restricting population size and migration. Small, isolated populations are prone to genetic drift and inbreeding depression. Madagascar has suffered severe habitat fragmentation, which has endangered endemic species, such as the black-and-white ruffed lemur (*V. variegata*). This species has a patchy geographic distribution and is sensitive to habitat disturbance. We tested whether *V. variegata* communities in two continuous forest sites and three recently fragmented sites were genetically differentiated from one another. We investigated whether populations in fragmented forest had lower genetic diversity than those in continuous forest and whether fragment size or isolation had a greater effect on the loss of genetic diversity following habitat fragmentation. We collected blood (n = 22) or fecal (n = 33) samples from lemurs and genotyped the extracted DNA for 16 polymorphic microsatellites. Bayesian cluster analysis and FST assigned individuals to three populations: Ranomafana (two continuous forest sites), Kianjavato (two small fragments separated by less than 100m of non-forest), and Vatovavy (larger, more isolated fragment). Vatovavy was the only population indicating a genetic bottleneck under both the infinite alleles and two-phase mutation models, as well as a significant FIS value (-0.185), showing excess heterozygosity. There was no evidence of decreased genetic diversity in the population spanning the two small fragments. These results indicate that a small geographic separation between fragments may not be sufficient to disrupt gene flow among fragments. In this system it appears that fragment isolation plays a greater role than size in the genetic consequences of habitat fragmentation.

Paleodiet study of a human community from an archaeological site in the west Mexico; “el Tropol”, Colima

[Session 9]

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Dépt. d'anthropologie, Université de Montréal

From October 2008 until February 2009 an archaeological rescue took place in Colima state, Mexico. Relative's (ceramics) and absolute datations (C14) indicate that the site belongs to the Mesoamerican classical period (100 – 900 AD). During the excavations 26 human skeletons were recovered, corresponding to four different occupation periods of the site. The aim of this study is to explore dietary behaviours and their social implications for the ancient Colima inhabitants using paleochemistry. We tried to answer the following questions: 1. What is the importance of maize and maize-fed dogs in the inhabitants diet?; 2. Does it exist biological, demographic, or social differences in relation to diet for the El Tropol community?

Collagen was successfully extracted from twenty-two human bones, six dog bones and two deer bones in which we performed a carbon and nitrogen stable isotope analysis. A carbonized maize cob was also found on the site and thus analyzed. Results corroborate the archaeological data and indicate that the most part of the human diet in El Tropol was composed of C₄ resources (maize

and other tropical plant resources). Carbon and nitrogen isotopic ratios of dog were not significantly different from human ratios, possibly indicating a strong relationship between them. Age differences in human diet were observed only between breastfed infants and the remaining of the group. Finally, a possible relationship between dietary behaviours and social status was hypothesized as the individuals who had offerings in their burials show the lowest isotopic ratios. However, as the samples remains relatively small, these assumptions should be tested for other archaeological sites in Colima.

Study on the coffin hardware and the burial practices of a rural and Catholic community from Beauce in the 19th and 20th centuries: Burials of the Saint-Frédéric cemetery, Québec, Canada

[Session 8]

Rebecca **Janson**

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Within the field of the archaeology of death, this paper aims to present the results of a study undertaken as part of a thesis dealing with a burial assemblage uncovered during the excavation of a portion of the cemetery of Saint-Frédéric de Beauce (ca 1850 - ca 1967). The analysis of the, seldom documented, coffin hardware is done in the context of the burial practices of that rural community. By consulting old catalogues available to morticians and comparisons with data from similar sites in the Northeast, we suggest a chronology of the shape of coffins and metal ornaments related to burial practices. In the context of an industrial production of these objects, we see how the industry of death and the establishment of an extensive distribution network launch the beginning of the standardization of funeral ornamentations. This democratization of the industry of death can also review the correlation between social status and the amount of hardware of a coffin. Finally, a foray into the world of symbolism of death rituals demonstrated that this industry has always complied with the evolution of the perception of the afterlife journey.

Congenital Malformations of the Spine in a Greek Colonial Population from Apollonia Pontica, Bulgaria

[Session D]

Anne **Keenleyside**

Dept. of Anthropology, Trent University

The purpose of this research was to investigate the types, prevalence, and expression of congenital malformations of the spine in an ancient Greek skeletal sample from the site of Apollonia Pontica (5th to 3rd centuries BC), located on the Black Sea coast of Bulgaria. The main objectives were to: 1) calculate the prevalence of these conditions and compare it to that of other archaeological and contemporary populations; 2) compare the skeletal evidence for congenital malformations to textual and iconographic evidence from ancient Greece; 3) assess the impact of such conditions on the health of the affected individuals based on modern clinical data; and 4) consider their social significance using information drawn from the ancient texts and from archaeological evidence for mortuary practices. Six different types of congenital malformations of the vertebral body and/or arch were documented in the sample: atlanto-occipital fusion, lumbosacral transitional vertebrae, sagittal clefting, block vertebrae, cleft neural arch, and

hemivertebrae. Sacralization was the most common condition observed, and all malformations recorded were relatively benign in nature. The ancient literary texts indicate that the Greeks were familiar with a number of spinal abnormalities, including kyphosis and scoliosis, but most of the conditions documented at Apollonia would likely have been unfamiliar to them and would not have been apparent in the affected individuals. The mortuary evidence revealed nothing unusual about the manner of burial of these individuals. Shared congenital anomalies may, however, provide support for the existence of family plots within the necropolis.

Geometric Morphometric Analysis of Sex Determination from Cranial Landmark Data Using Computed Tomography

[Session D]

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Landmark data were collected on the crania of 106 individuals from a documented age and sex computed tomography (CT) dataset derived from post-mortem scans to investigate determination of sex. Segmentation and rendering of the CT data was done using Materialise MIMICS medical imaging software to create 3D models of the skull for each individual. From the 3D data, thirty cranial landmarks of the skull were designated on each crania. Inter-landmark distances were also calculated from these landmarks. These measurements of the skull predominantly capture size differences and to a significantly lesser extent, shape differences. To further investigate overall shape independent of size in the sample, the x, y, z coordinate data for each landmark was analysed using PAST for geometric morphometric assessment. A Procrustes fit was used to separate size and shape by scaling the raw coordinate data. After all individuals were scaled, a Procrustes mean shape was generated from the least summed squared Procrustes distances from each individual for the entire sample. Discriminant function analysis was undertaken to assess the relative accuracy of sex determination in this sample. The results are discussed relative to other methods of sex determination in the skeleton.

A mid-Holocene human burial from coastal Sri Lanka

[Session D]

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Notable findings on a complete human burial from the archaeological site of Mini-athiliya in the southern coast of Sri Lanka are presented in this poster. Mini-athiliya is primarily a shell-midden site located close to a lagoon in an estuarine environment. It is dated to the mid-Holocene, ca. 4000BP. While archaeological excavations yielded fragmentary human remains from several burials within the shell midden, the focus here is on the complete human burial recovered from this site. The skeleton was removed as block within its matrix from the site and later excavated meticulously. Initially catalogued as HMA Skeleton #6, it was nicknamed “Menik Hāmy”, giving this prehistoric modern human from Sri Lanka, a unique identity. This individual was identified as a male of approximately 45 years. “Menik-Hamy” had been buried in a foetal position with the head placed to the North, and covered with debris including large quantities of

shells within a shallow grave. The burial appeared to have been compressed vertically, crushing and fragmenting many features. While a high degree of attrition to the molar teeth suggested an extremely abrasive diet, cranial and postcranial features indicated a high degree of robusticity. The burial pattern and associated lithic and faunal remains exemplify behavioural and cultural aspects of mobile aquatic foragers of the mid-Holocene in coastal Sri Lanka.

The influence of body size and proportionality on human bony pelvic size and shape

[Session 2]

Helen **Kurki**

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Obstetric selection acts on the female pelvic canal to accommodate the human neonate, and is a factor generating pelvic sexual dimorphism. Some dimensions of the obstetric canal are related to body size indicating that tall or large women have relatively roomier pelvic canals; other dimensions are not related to body size indicating that there is a complex relationship between selection for obstetric sufficiency and for overall body size in humans. The relationship between selective pressures may differ between populations of different body size and proportions. Pelvic canal shape has also been shown to vary among populations, perhaps to accommodate differences in overall body proportionality. The relationships among pelvic canal and body size and shape are examined using nine skeletal samples (total N = 277) from diverse geographical and climatic regions, representing a range of body size and shape characteristics. Pelvic, vertebral and long bone measurements were collected. Principle component analyses demonstrate pelvic and body size and shape differences among the samples; pelvic shape differences are clearer among the females. High latitude samples tend to have larger and broader bodies, and pelvic canals of larger overall size and relatively broader medio-lateral dimensions relative to low latitude samples, which tend to display relatively expanded inlet antero-posterior and posterior canal dimensions. Despite this general patterning in some characteristics, samples also differ in aspects of canal shape with no association to latitude or body size characteristics, suggesting relative independence of canal shape from body size and/or shape.

Un bilan de la bioarchéologie québécoise

[Session 8]

Robert **Larocque**

Bioarchéologue indépendant, Québec

On peut, à la limite, faire remonter les « débuts » de la bioarchéologie québécoise à 150 ans. Mais, jusque dans les années 1970, il n'y eut que des « études » ponctuelles, séparées par de grands vides. En réalité, la bioarchéologie ne pouvait prendre son essor avant que ne se développe l'archéologie au début de cette décennie. Le développement tardif de l'archéologie québécoise est en partie imputable à la période de Grande noirceur qu'a connu le Québec jusqu'au début des années 1960. Puis, il y eut la Révolution tranquille, période d'effervescence sociale et politique, dans la foulée de laquelle se développa l'archéologie en milieu académique. Bien que la table fut mise pour le développement de la bioarchéologie, la discipline ne parvint pas à s'implanter en milieu académique. Les bioarchéologues formés dans les années 1980 ont donc pratiqué en milieu privé, au sein de firmes d'archéologie. Ce confinement aux firmes d'archéologues a néanmoins permis à la discipline de prendre racine au Québec et de développer

une expertise dans la sauvegarde de sépultures menacées de destruction. C'est encore grâce aux firmes qu'aujourd'hui la fouille de sépultures et l'analyse des restes humains font partie de la routine de tout projet mené sur un ancien lieu d'inhumation.

Après une vaine tentative au début des années 2000, la bioarchéologie s'implante définitivement en milieu universitaire au milieu de la décennie. Jouissant de meilleures conditions de recherche, la « nouvelle bioarchéologie » québécoise cherche à se développer en exploitant des collections du Québec et en tablant sur les acquis des trente dernières années. Elle va à coup sûr donner un nouvel élan à la discipline.

Finding a Home: Effects of Human Predation on Chimpanzee Nest Construction in the Lebialem Highlands of Cameroon

[Session 3]

Cadell Last

University of Toronto

In this study, terrestrial and arboreal nest construction among chimpanzee populations was investigated in the Lebialem-Mone Forest Landscape (LMFL) of Cameroon. Data on the material composition, height, distribution, organization, approximate age, altitude and function of chimpanzee nests were collected during two four-week primate field surveys (July-August 2010; July 2011) at two field sites (Bechati and Andu) within the LMFL. Across the 2 years of this study the data were collected and analyzed in order to test what variables affect the construction of terrestrial nest sleeping platforms. Nest data were collected via the recce and line transect method. Nest age was approximated by categorization as either 'fresh', 'recent' or 'old' based on condition upon discovery. Height was measured in meters. Altitude was determined using a GPS handheld unit. All observed sightings of shell casings, snare traps, bush-meat hunters/trappers, in-forest farmland were also compared between sites. Chimpanzees within the LMFL were found to construct both arboreal (type 1) and terrestrial (type 2) nests. However, chimpanzees at Bechati only constructed arboreal night nests, whereas chimpanzees at Andu constructed both arboreal and terrestrial night nests. Data on 124 nests were collected and analyzed in order to test what variables affect the construction of terrestrial night nests. At Bechati 0% of sleeping platforms constructed were terrestrial. In contrast, at Andu 24% of chimpanzee nests constructed were terrestrial sleeping platforms. Human agricultural development and human hunting/trapping are hypothesized to play the largest role in affecting chimpanzee terrestrial nest construction in the LMFL. At Bechati chimpanzees inhabit forest regions around dense, expanding villages and are regularly hunted by local villagers. However, at Andu the chimpanzee populations are not under the same threat. Hunting and agricultural expansion force chimpanzees at Bechati to solely construct sleeping platforms arboreally for safety, whereas chimpanzees at Andu do not have the same predation pressure and can safely construct sleeping platforms terrestrially.

Assessing Sexual Dimorphism in Human Eye Orbits Using CT Data

[Session D]

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Sexual dimorphism reflected in the eye orbits has not always demonstrated consistent or reliable results. This research will help explore the value of the orbits for determination of sex on a documented age and sex CT (computed tomography) dataset derived from post-mortem scans. Utilizing 97 post-mortem CT scans, established morphological and metric techniques for sex determination were assessed from 3D rendered models of the crania. In addition, landmark data were collected on the orbital margin to evaluate the accuracy of sex determination using geometric morphometric techniques. Traditional methods demonstrated poor levels of accuracy for prediction of sex, however, utilizing generalised procrustes analysis and discriminant function analysis on 3D landmark data resulted in 94.95% overall accuracy. The use of landmarks provides information on areas of the orbits that neither morphological evaluation can recognize nor metric analysis can capture. Sexual dimorphism within the orbits is measurable and quantifiable, and should continue to be a part of skeletal evaluations.

Lower Limb Activity in the Cis-Baikal: Musculoskeletal Stress Markers Among Middle Holocene Siberian Foragers

[Session 1]

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Lower limb musculoskeletal stress markers (MSM) are evaluated in order to reconstruct activity and more fully understand cultural and behavioral transition among the middle Holocene (ca. 9000-3000 years BP) foragers of Siberia's Cis-Baikal region. The five cemetery populations examined span a period of dramatic diachronic change characterized by an 800-1000 year hiatus in the region's cultural continuity. Two of the cemetery samples represent the early Neolithic (EN) Kitoi culture, dating from 8000 to 7000/6800 cal. BP; the other three represent the late Neolithic-early Bronze Age (LN-EBA) Isakovo-Serovo-Glaskovo (ISG) cultural complex, dating from 6000/5800 to 4000 cal. BP. Findings suggest heterogeneity in overall lower limb use, but relative homogeneity in general activity patterns. Aggregate data reveal that Kitoi individuals and males engaged in more strenuous lower limb use than did ISG individuals and females, respectively. Furthermore, sexual disparity in MSM scores—being generally higher among males than females for both groups—appears to have increased with advancing age at death, emphasizing the influence of sex-related activities, rather than body size per se, on enthesal morphology. Rank patterning data, on the other hand, disclose remarkable similarities in the types of activities employed by the Kitoi and ISG alike. Hip extensors and abductors, pelvic and trunk stabilizers, and ankle plantarflexors and stabilizers all appear to have been heavily recruited, suggesting that activities such as walking and climbing, particularly while carrying heavy loads and traversing steep and uneven terrain, were frequently and/or intensively undertaken across the region.

Why use a biological anthropologist when the bones are barely preserved? The recovery of mortuary behaviour from poorly preserved skeletal remains

[Session 2]

Maria **Liston**

Anthropology Dept., University of Waterloo

The study of mortuary behavior in Greece is hampered by the persistence of long-held assumptions based on minimal data, coupled with a lack of detail about the actual processes of body preparation and burial. In addition, few archaeological sites offer ideal preservation conditions, and even the best are constrained by the limitations of funding, staff, and time. Yet despite this it is often possible to elicit meaningful interpretations, not only of skeletal material itself, but of mortuary practice and the taphonomic history of the burials. This paper examines the process and results of such reconstruction efforts when applied to prehistoric burial contexts in eastern Crete. The sites provided an opportunity to discern practices associated with secondary processing of bodies and reuse of tombs through the detailed analysis of the distribution patterns and inventory of the skeletal remains. At Kalo Chorio, Crete, salvage excavations of EM house tombs recovered larnikes (bathtub-shaped ceramic coffins) containing secondary deposits of bones. The inventory of human bones found on a floor in the adjacent building revealed that the building was used for the primary burial of bodies which were then removed, presumably for secondary burial in larnikes. At Azoria, Crete, meticulous recording during excavation of a Late Minoan chamber tomb permitted reconstruction of the patterns of bone deposition and the sequence of activities in two major phases of use of the tomb. The reconstruction of the later levels revealed five tightly flexed skeletons arrayed along the south wall of the tomb. The position of the arms and legs suggests that the bodies were tightly wrapped, although no traces of fiber remained, and that all had been lowered into the tomb through the roof. The analyses of poorly preserved skeletal remains at these two sites offer few insights into the biology, lifeways or health of the Minoans, but they do contribute significantly to reconstructing mortuary activities, and to fleshing out our skeletal understanding of ancient behaviours.

Age at Death and Life Expectancy Differences Between Clergy and Laity at Holy Sepulchre Catholic Cemetery, Burlington Ontario

[Session 1]

Laura **Lockau** and Matthew **Emery**

McMaster University

Cemetery studies are an important source of secondary data within anthropological demography, as their results can be combined with primary historical, health and census documentation to add a quantitative aspect to an otherwise strictly qualitative analysis. Our study investigates the differences in age at death and life expectancy between clergy and laity members buried at the Holy Sepulchre Catholic cemetery in Burlington, Ontario. Information on age at death was collected for 565 individuals buried throughout the 20th century; the average year of death was 1949. Life table analysis was used to calculate life expectancy for both male and female clerical and lay samples. Life expectancy was found to be 64.1 years for sisters and 65.7 years for priests. Values for lay males and females were calculated using only individuals aged 18 years or older to facilitate comparison with values for the clergy, all of whom were 18 years of age or older when they were ordained. Life expectancy was therefore calculated to be 77.3 years for lay females and 72.4 years for lay males. These results indicate that both average age at death and

life expectancy values are significantly lower among clergy members, and that this difference is greater for females within the sample. An examination of historical and census documentation revealed many differences in life history and therefore potential causal factors leading to the decrease in life span among the Catholic clergy; these include differences in income, occupation, and exposure to potential health hazards. This study combines statistical analyses with historical information to increase our understanding of the daily lives of clergy members in the twentieth century, a population to which little attention has been paid in the anthropological and demographic literature. The discrepancies in life expectancy highlight the ways in which inequalities of gender and status are expressed in differential patterns of mortality.

Correlated study of dental caries and tooth wear in the osteological collection from Notre Dame, (the first church cemetery, 1691-1796)

[Session 8]

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According to previous historical and palaeopathological studies, historical Euro-Quebecois populations were often affected by dental diseases, probably due to various factors (poor hygiene, dietary habits, low enamel quality). In particular, dental wear (by removing occlusal grooves during food consumption and/or other activities) can be one of the main causes in accelerating the exposure of new fragile dental surfaces to caries. Our objective here is to explore dental health of Montreal inhabitants in the 17th – 18th century, and more specifically to test the possible 'causal' relationship between dental wear and caries.

We studied a sample of 650 adult permanent teeth from Notre-Dame's osteological collection. Carious lesions were recorded on each tooth surface at the coronal, cervical and radicular levels. Dental wear was measured using six levels: 1 - wear absent, 2 - enamel affected, 3 - a small area of dentine revealed, 4 - exposure of the entire dentine, 5 - pulp affected and 6 - entire crown removed. The relationship between caries and dental wear was explored using a chi-square test. Dependant on the level of wear, three main clusters appeared. The first grouped together 79% of teeth characterized by the absence of caries with dental wear 0, 1 and 2; here the number of molars without caries decreased as level of wear increased ($P>0.0001$). The second group included 5.5% of teeth and was characterized by enamel caries with dental wear 0, 1 and 2; here the number of occlusal caries decreased as the level of wear increased ($P>0.05$). The third group consisted of 8% of the total number of teeth and corresponded to proximal caries with dental wear 0, 1, 2 and 3; here the chi-square test was not statistically significant.

These preliminary results indicate that a relationship exists between caries and tooth wear due to various factors. However, observed wear patterns can vary significantly according to types of caries as well as tooth morphotypes. Further analyses are necessary on larger samples, as well as exploring other factors accelerating wear and caries (e.g. continuous eruption).

The Face of the Mummy - phenotypic variability among facial reconstructions of Ancient Egyptian Mummies

[Session A]

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The publication of National Geographic's 2005 reconstruction of the face of King Tutankhamun led to a flurry of controversy in the public and academic worlds regarding the racial attributes given to the reconstruction. This particular controversy can be placed within a larger debate about the population (racial) history of Ancient Egypt which has been often been cast in Eurocentric, Afrocentric and Egyptocentric terms.

The objective of this poster is to examine phenotypic variability in facial reconstructions of Ancient Egyptians. A facial reconstruction has great interpretive power, as makes it easier for both scholars and the general public alike to identify with a person from the past. However, any facial reconstruction is necessarily shaped by scientific techniques, artistic skills and the theoretical paradigms of the forensic artist and consultant biological anthropologists. We seek to deconstruct that set of factors in order to see how they may interact to shape the reconstructions that come to grace museum displays and popular and academic publications.

Primate Social Behaviour and the Evolution of Tail Loss

[Session 6]

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The primate tail is a functionally diverse appendage that serves primarily as an organ of balance among arboreal species. However, in addition to the use of the tail in locomotor and postural behaviour, the tail is frequently incorporated into behavioural displays to signal dominance and submission and thus serves as an important medium for social communication. Despite the usefulness of the tail, reduction in tail length and loss of the tail are widespread phenomena that have evolved independently numerous times across the order Primates, most notably among the hominoids and members of the Cercopithecoidea, such as the macaques. Macaques are characterized by a wide range of tail lengths, and in addition also exhibit a range of dominance styles and degree of tolerance across species. Thus, it is hypothesized here that among macaques relative tail length will be negatively correlated with the level of social tolerance due to a lack of selection on the tail to signal dominance and submission.

In order to test this hypothesis, species means of relative tail length were compared to previously published grades of social tolerance (Grade 1-4) for 15 species of macaque using an analysis of variance. In addition to the overall grade of social tolerance, more specific comparisons were also made between relative tail length and strength of dominance gradient, degree of asymmetry in conflicts, intensity of aggression and conciliatory tendency.

The results of this preliminary study seem to support the relationship between the degree of social tolerance and relative tail length among macaques, such that the most tolerant macaques tend to have shorter tails than the more intolerant species. However, statistical significance is lacking due to a limited sample size, and therefore more data is needed to conclusively test this hypothesis. Research concerning the evolution of tail loss among primates has thus far failed to consider the relationship between social behaviour and tail length, and therefore this study serves

as an important contribution to the understanding of the evolutionary mechanisms associated with primate tail loss and tail length reduction.

A Preliminary Assessment of the Identification of Saw Marks on Burned Bone

[Session A]

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McMaster University

This study assesses the degree of modification to the saw mark characteristics of dismembered skeletal remains when exposed to a controlled outdoor fire of limited duration. The sample consists of 36 adult pig hind limbs which were dismembered fleshed. Six handsaws and six power saws were used, with three limbs dismembered and burned for each of the saw types. Results indicate that fire exposure affects the visibility and identifiability of saw mark striae. With the handsaws, the bow saw, hacksaw, and keyhole saw were consistently recognizable. In the power saw group, the saw marks of the jigsaw, reciprocating saw, and chainsaw remained identifiable. Although the bone ends exhibited thermal alterations, the false starts were well preserved with minimal damage. Given the parameters of this study, it is possible to identify the class of saw based on the diagnostic characteristics present on the cremated bones.

Use of Multi-Isotopes Application to Compare Human Scalp Hair to Beard Hair

[Session 9]

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The adage “you are what you eat” is very much true. All the food and beverages a person consumes is used to fuel our bodies and create new tissues, including hair. Since hair grows at approximately 1 cm per month, hair is an ideal medium to study a person’s dietary habits and travel, as it provides a chronological “map” of a person’s activities. Food is our main source of carbon and nitrogen, and different foods have different isotope values. As such, the carbon and nitrogen isotope values in a person’s hair provides clues about their dietary habits. Also, the isotope value of water varies by geographical location. As people tend to consume water from their local water supply, the isotope value of the local water is incorporated into a person’s hair. As a result, the hydrogen and oxygen isotope values of hair can provide clues as to where a person is from, or where a person has travelled.

Beard and scalp hair were analysed for $\delta^{13}\text{C}$, $\delta^{15}\text{N}$ and $\delta^2\text{H}$ for 3 participants. This research directly compares beard and scalp hair of two participants who did not travel or change their dietary habits for the study period. The local Participant 1 showed consistent $\delta^{15}\text{N}$, $\delta^{13}\text{C}$ and $\delta^2\text{H}$ values between beard and scalp; however, the isotope values for Participant 2 were different. The difference in $\delta^{15}\text{N}$, $\delta^{13}\text{C}$ and $\delta^2\text{H}$ signal in beard compared to scalp hair for Participant 2 may be linked to different appearance in color of the samples. As for the difference in $\delta^{15}\text{N}$ and $\delta^{13}\text{C}$ values between Participant 1 and Participant 2, it may be due to different metabolism or different diet.

The second part compares the beard and scalp hair from a third participant that frequently travelled back and forth between Ottawa and the Middle East. This paper demonstrates that beard hair can be used to track travel. It is also noted that the $\delta^2\text{H}$ values, showing that a change the carbon component of his diet can also be reflected in his beard hair.

An Investigation of Sexual Dimorphism in the Human Spine

[Session D]

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The sexual identification of human skeletal material is a necessary component of any forensic or archaeological investigation. Morphological based techniques used in sexing human skeletal remains depend on the identification of sexually dimorphic elements and traits some of which have been studied intensively by osteologists for over a century. A great deal of attention has been given to the os coxae and cranium as well as a variety of other elements however, relatively little work has been done on the human spine. Most of what we do know of vertebral sexual dimorphism comes indirectly from clinical radiology investigations concerned with ageing, osteophyte development and osteoarthritis, and that tend to focus on a few select features, individual vertebra, or a single area of the spine. Given these limiting aspects a more comprehensive study of sexual dimorphism in the human spine is needed. Using the Grant Collection, currently housed at the University of Toronto, we have examined skeletal elements (Female =26, Male = 27) from each spinal segment (C7, T6, T11, T12, L1, L4, L5), incorporating a wide variety of measurements. Using dry bone, measurements included in this analysis are sagittal and coronal breadths of both the superior and inferior endplates of the vertebral body as well as body height. From these measurements a series of indices were also developed. Preliminary results indicate statistically significant differences in size between males and females for all body dimensions with the exception of body height in L4 and L5. We discuss the influence of ageing and body size on the observed differences between female and male vertebral body dimensions.

Dental and skeletal indicators of possible tooth-tool use and habitual activities in an individual from Helike, Greece

[Session D]

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University of Alberta

During examination of human remains from a late Byzantine-era cemetery from the site of Helike, Greece, an unusual tooth wear pattern was found in one adult male. Strongly oblique wear, heaviest on the lingual aspect, is evident in the upper and lower first molars. These teeth also show semi-circular notches along their buccal edges. The rest of the dentition shows less severe wear with no unusual characteristics, similar to the wear patterns seen in other individuals from the site. The distinctive wear pattern of the first molars is strongly suggestive of the use of the mouth in some sort of habitual non-dietary activity during the individual's life. Pronounced and occasionally asymmetrical muscle and ligament markings on the skull and elements of the upper limbs suggest that this individual engaged in repetitive physical activities involving preferential use of one side of the body over the other. These activities may – or may not – have been linked to the non-dietary use of the teeth.

Given the the proximity of Helike to the sea, activities such as fishing, net-making or cord-making may have contributed to this individual's unique morphological and dental findings. The anthropological literature about unintentional dental modification has focused primarily on excessive wear to the anterior teeth or on interproximal grooving as consequences of ongoing

tooth-tool use. However, net- or cord-making activities can also affect wear on the posterior teeth. Our findings contribute to knowledge about daily life in Byzantine-era Greece and illustrate the challenge of interpreting tooth-tool use and habitual activities in the absence of specific ethnographic or historical information.

A cross-population analysis of the impact of extrinsic risk on age at introduction of transitional foods

[Session B]

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Complementary feeding is a phylogenetically unique characteristic of human weaning with important effects on survival and reproduction. However, anthropologists do not fully understand the evolutionary ecology of the large variation in age at introduction of “transitional foods” to breastfed babies observed within and among human populations.

Recently, it has been suggested that human mothers have evolved to adjust the timing of events in the weaning process in response to the level of extrinsic risks to infant survival. This extrinsic risk hypothesis predicts an inverse quadratic relationship between ages at which key events in the weaning process occur (e.g. age at introduction of transitional foods) and level of risk, such that mothers invest heavily in offspring quality in low or moderate risk environments but instead invest in offspring quantity in high risk environments.

We tested the extrinsic risk hypothesis using cross-sectional, ethnohistoric data from 38 nonindustrial, natural fertility farming and herding populations. We regressed age at introduction of transitional foods on indicators of two forms of extrinsic risk, pathogen risk and subsistence risk. We found that age at introduction of transitional foods is quadratically correlated with subsistence risk but not in the expected direction. Introduction of transitional foods is linearly negatively correlated with pathogen risk. Thus, our results are inconsistent with the predictions of the extrinsic risk hypothesis, at least as currently formulated. Our findings suggest that age at introduction of transitional foods is sensitive to extrinsic ecological risks. But, given that the relationships did not follow the predictions of the risk hypothesis, the strategy that underlies the association in question remains unclear.

Using Multidisciplinary Techniques to Understand the Adaptive Significance of Primate Colour Vision Variation

[Session 6]

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The adaptive significance of primate colour vision is an active area of investigation that lends itself to multidisciplinary approaches. The question of how primates use colour vision has piqued the interests of biological anthropologists, psychologists, geneticists, physicists and neurobiologists, whose research contributions provide a multidimensional understanding. Trichromacy among placental mammals is limited to primates, and results from variation in the middle-to-long wavelength sensitive (M-L) opsin. Although trichromacy is believed to confer foraging advantages via detection of colourful foods, tests of this are mostly theoretical. Intraspecific variation is common among New World monkeys and humans, due to M-L opsin polymorphism, yet the functional consequences and selective pressures remain poorly understood.

We investigated colour vision polymorphism in white-faced capuchins (*Cebus capucinus*) by conducting 1) genetic analyses looking for signatures of selection operating on the M-L opsin genes; 2) psychophysical studies in which humans, serving as monkey “surrogates,” searched for capuchin food items in colour-processed images, altered to simulate dichromatic and trichromatic capuchin phenotypes; 3) behavioural observations of wild monkeys in Costa Rica.

M-L opsin polymorphism is maintained by balancing selection (versus neutral drift). Psychophysical study: human participants experiencing trichromatic phenotypes were faster and more accurate at locating colourful fruit targets. Behavioural observations: trichromatic capuchins were more accurate during fruit foraging behaviours but did not eat more fruit per minute.

These results suggest heterozygote advantage favoring trichromats maintains capuchin colour vision variation. Differences in foraging success between dichromatic and trichromatic capuchins in the wild were smaller than expected, indicating that dichromatic monkeys are able to compensate- perhaps by relying on other senses, such as smell. These findings contribute to a better understanding of the consequences of and selective pressures operating on primate colour vision.

The Contribution of Vertebral Development to Understanding the Moche Giants of Dos Cabezas, Peru

[Session 5]

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Five Moche tombs were excavated between 1997 and 2000 at the site of Dos Cabezas on the north coast of Perú. The Moche civilization flourished from AD 100 to 800, and these tombs date to approximately AD 300. The five primary individuals in the tombs, all males, were remarkably tall, measuring well above the norm for the group. They are thus referred to as giants.

One feature shared by three of the individuals was a pattern of skeletal imprinting that indicated long periods spent in a particular pose, kneeling on one knee, holding objects in their hands. This is the ritual warrior pose of the Moche, the objects held being a club and shield. Since there is no evidence that they were actual warriors, it is assumed that these individuals served a religious role, perhaps a cult of the warrior, their unusual stature enhancing their appearance in a warrior-like tableau.

These individuals present an unusual pattern of growth that makes age-at-death difficult to determine. Excluding individual 4, a late adolescent by all criteria, they appear young (early 20s) in terms of epiphyseal closure and pubic symphysis appearance, but old (middle to late adulthood) in terms of degenerative changes such as osteoarthritis and osteoporosis. One aspect of the unusual growth pattern that produced these aging contradictions can be seen in the vertebrae, specifically the region C7-L4. Here the vertebral bodies developed to their normal anteroposterior diameter, with development and fusion of the ring epiphysis, but then continued to develop anteriorly, ultimately leaving the ring far from the anterior edge of the vertebral body. Vertebral height, however, appears normal, indicating that the unusual stature observed is a product of the long bone development, with no vertebral contribution.

Based on a model that these individuals represented a royal lineage, the search to explain this unusual growth pattern focused on inherited conditions. However, the results were not convincing, and the lack of other shared inherited traits made the entire lineage model questionable. This study searched instead for a physical cause for the unusual growth seen in the giants of Dos Cabezas.

Body Mass Index (BMI) and its effect on adult skeletal age estimation

[Session D]

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In all biological sciences, body size, in particular body mass index (BMI), is a crucial variable researchers control for when analyzing biological traits of subjects, yet in the assessment of adult human skeletal age the influence of body size has received little attention. The most reliable and frequently used methods are based on changes to pelvic morphology, an area subject to loads that vary with body weight; however, the influence of body height and weight on skeletal aging remains undetermined. This study assessed age from weight-bearing and non-weight-bearing surfaces from a skeletal collection of individuals with known heights and weights at death.

Eight age estimation methods were applied to over 500 skeletons from the Hamann-Todd Collection at the Cleveland Museum of Natural History. Individuals ranged in size from 1.295m to 1.927m and 24kg to 99.79kg. The pubic symphysis, auricular surface, sacrum, and acetabulum represented the weight-bearing joints; the first and fourth ribs represented the non-weight-bearing joints.

Individuals with Underweight BMI's tended to be under-aged more often than those with Normal and Overweight/Obese BMI's for all age estimation methods. Individuals with Overweight/Obese BMI's tended to be over-aged more often than those with Normal and Underweight BMI's with all methods except Lovejoy et al.'s auricular surface method and İscan et al.'s fourth rib method.

The comparison of individuals with differing BMI's to age estimation suggests that there are age-related patterns among Underweight, Normal, and Overweight/ Obese individuals. Among the sites tested, the Kunos et al. first rib method and Buckberry and Chamberlain auricular surface method consistently ranked as the oldest ages within individuals and the Suchey-Brooks pubic symphysis method and the DiGangi first rib method consistently ranked as the youngest ages.

Why aye-eyes see blue

[Session C]

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The capacity for colour vision varies among nocturnal primates. Some species are truly colourblind, having lost the functionality of their short-wavelength-sensitive-1 (SWS1) opsin pigment gene. In other species, such as the aye-aye (*Daubentonia madagascariensis*), the SWS1 gene remains intact. Recent findings suggest that this gene has been maintained by natural selection and that the pigment has a peak sensitivity (λ_{max}) of 406 nm, which is ca. 20 nm closer to the ultraviolet region of the spectrum than in most primates. The adaptive significance behind the preservation and unusual λ_{max} of this SWS1 opsin pigment is unknown and perplexing given that aye-eyes are active at night and all mammals are presumed to be colourblind in the dark. Here we comment on this puzzle and discuss recent findings concerning the colour vision intensity thresholds of terrestrial vertebrates with comparable optics to aye-eyes. Although aye-eyes are nocturnal, we show that activities often begin under dim twilight, which is enriched in short-wavelength (bluish) light, and that twilight and full moonlight are probably sufficient to support cone-mediated colour vision. We speculate that the SWS1 opsin pigment of aye-eyes is a crepuscular adaptation and we report on the blueness of relevant visual targets, such as scent marks and the brilliant blue arils of *Ravenala madagascariensis*.

Heath and diet: comparison of various bioarchaeological data for a Protestant community from Quebec City (Saint-Matthew, 1771-1860)

[Session 8]

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During the 18th and 19th centuries, although Quebec City residents were mostly Catholics (French Canadians and Irish), a minority of them (20 to 25%) belonged to the Protestant community. Protestants were socio-economically the most well off social class due to the professions they chose (trade, army, medicine, law, etc.). However, living conditions in a pre-industrial dense urban milieu such as Quebec City were harsh for all inhabitants. Historians reported poor sanitary conditions, epidemics and repeated periods of starvation that increased mortality and morbidity. Saint-Matthew's Protestant burial ground, mainly excavated in 1999 and 2003, provided a large well-preserved skeletal collection that is unique for Quebec.

The present study on 82 skeletons focused on the relationship between health and nutrition through both stable isotope and palaeopathological analyses. The issue addressed is: Was diet significantly different between the most and the least pathological individuals, assuming the fact that, within a group, people can have variable access to food and that consequently their health can be affected differently on a long term?

Palaeopathological conditions related to various causes were observed: i) caries, ii) *antemortem* tooth loss, iii) *cribra orbitalia*, iv) porotic hyperostosis, v) periostitis, vi) endocranial lesions, vii) scurvy, viii) rickets and ix) enamel hypoplasia. Moreover, the overall health status was evaluated for the most well preserved skeletons (N=30) to identify individuals with the highest prevalence and severity of lesions. All observations were cross-referenced against carbon and nitrogen isotopic ratios from bone collagen.

Statistical tests showed significant differences between the severity degrees of *cribra orbitalia* and $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$: the most severely affected individuals tended to correspond to those who had the lowest isotopic ratios. This result could support the hypothesis that low consumption of animal protein on a long term (as reflected in low $\delta^{15}\text{N}$ values) can lead to poorer health, nutritional deficiencies, a lowered immune system and/or parasitic diseases. No significant correlations were found between other palaeopathological data and the isotopic values. Further carbon isotope analyses from apatite could help to explain dietary behaviour such as the identification of various food resources consumed (plant versus animal) that directly increase isotopic ratios.

Going Cold Turkey: Isotopic Evidence for Purposeful Grain Feeding of Wild Turkeys for the Late Woodland Ontario Iroquoian Fall Harvest

[Session 9]

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We compare stable isotopic evidence for purposeful feeding of wild turkey (*Meleagris gallopavo*) by two Late Woodland (1000-1600AD) groups; agricultural Ontario Iroquoians and semi-mobile, horticultural Western Basin peoples. According to modern ecological literature, wild turkeys are unable to eat maize from stalks, but will consume it opportunistically from ground scatter. Because maize was the plant staple for both groups, and has a carbon isotopic composition distinctive from most other plants in the region, its consumption by turkeys provides a proxy for human diet and subsistence behavior. The consumption of maize by wild turkeys was measured using the stable carbon and nitrogen isotopic compositions of bone-collagen from 10 Late Woodland Ontario Iroquoian and 4 Western Basin archaeological sites as well as one pre-agricultural, Early Woodland site. Our results suggest that during the Late Woodland period, maize consumption increased among wild turkeys from Ontario Iroquoian sites. This finding reflects increased human consumption. When combined with archaeological evidence of turkey burials and seasonal killing, the results also suggest purposeful feeding of wild turkeys. In contrast, no increase in maize consumption was noted for wild turkeys recovered from contemporary Western Basin sites despite the recent record of heavy maize consumption determined for Western Basin human skeletons. We explore possible cultural differences in human-animal interactions to explain these behavioural differences in subsistence.

Sex in the City? Examining the Syphilis Outbreak in Toronto (2000-2010)

[Session 10]

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As a re-emerging infectious disease in the Western world, syphilis is once again the center of public health campaigns aimed at screening, controlling and reducing its increased occurrence, specifically in the “MSM communities” (men who have sex with men). In this paper I examine what has been described as an epidemic of venereal syphilis in the city of Toronto, Canada from the year 2000 to 2010. I explore the increased prevalence of syphilis in the “MSM community” to ascertain whether syphilis is indeed increasing, and if it is interacting syndemically with other infectious ailments, specifically HIV/AIDs. I seek to investigate the underlying deleterious social circumstances that may have capacitated this interaction, creating a syndemic. Lastly, I question the appropriateness of the term “community” as applied to MSM in Toronto, and ask whether the epidemic of syphilis is better understood as an epidemic of syphilis testing among MSM. Underscoring this analysis are broader questions around the treatment and cure of syphilis. The reduction in rates of this infectious disease has been attributed to the development of antibiotics in the 20th century; however, it has been proposed that antibiotics are actually ineffective and only serve to suppress the symptoms but not the disease itself. This dramatic departure from what is considered a firmly established medical position is discussed further in light of the current worldwide syphilis increase, and its relationship with AIDS and HIV.

Percent of achieved adult growth of juveniles at the Campbell Site

[Session D]

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This study documents and interprets patterns of long bone growth in a Late Missippian sample from the Campbell site (23PM5) (ca. AD 1350 to 1540), Pemiscott County, Missouri. Occupants of the site were sedentary, maize agriculturalists. Sedentary, agricultural lifestyles are associated with increases in chronic infection and dietary deficiency. Stressors of this nature often negatively impact longitudinal growth. It is predicted that the percentages of achieved growth and age will significantly differ between the Campbell site and comparative samples and that the Campbell site percentages will be reduced when compared to groups with wider dietary breadth. Maximum diaphyseal lengths of the humerus, radius, ulna, femur, and tibia were collected from all available individuals from the Campbell site (n=132). Comparative data were derived from four samples, which span a diverse selection of time periods and subsistence strategies: Japan (Jomon, forager), Alaska (Point Hope, forager), Kulubnarti (Nubia, agriculturalists) and Mistihalj (Bosnia-Herzegovina, pastoralists). Age was estimated on the basis of dental eruption and formation. The results of this analysis indicate that individuals at the Campbell site were relatively small bodied in general and had significantly shorter femora than all of the comparative groups but the Jomon. The percentage of achieved adult growth for the Campbell site juveniles indicated that growth was delayed prior to the age of ten but after the age of ten catch-up growth occurs.

Iconography and Isotopes: Evidence of a Terrestrial-Marine Shift in Late Intermediate Period Diet in Northern Peru

[Session 5]

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The Jequetepeque Valley on the North Coast of Peru has many archaeological sites that have well preserved bioarchaeological (*sensu lato*) remains. In addition, the Moche and later societies left a rich artifactual and iconographic record. Changes in the iconographic representations that incorporate marine imagery appear to shift from being relatively sparse in Moche times to more abundant in Late Intermediate Period contexts. Faunal and botanical analyses suggest a similar shift in diet, as does the previous isotopic analysis of hair from the coastal site of Pacatnamu. That sample of hair was small and exhibited significant, unpatterned variability. We have extended this study by analyzing the carbon and nitrogen isotopic compositions of human bone, and continue to test the hypothesis that the menu suggested by the iconography and other archaeological data was translated into consumed meals. Sampling from both the coastal site of Pacatnamu and the inland site of San Jose de Moro in the Jequetepeque Valley data enables us to investigate how widespread the hypothesized dietary shift was and to speculate on the reasons for its occurrence. We also position these isotopic data among newly available isotopic analyses of other samples of human remains within the broader context of the landscape of the North Coast of Peru.

Appropriate Methods to Rank Individuals Using Cortisol Levels

[Session B]

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Cortisol is commonly used to compare physiologic stress between individuals. Often, however, researchers do not take into account the variation in basal cortisol production that exists among individuals. In naturalistic studies this source of variation can lead to important biases. To identify an appropriate analytical tool that takes into account inter-individual variation in basal cortisol production, we evaluate three alternative methods which could be used to appropriately compare cortisol values between individuals (raw values, Z-scores, and sample percentiles). These methods were evaluated using cortisol levels assessed in first morning urinary specimens collected thrice weekly from 14 cycling Mayan Kaqchiquel women. As expected, women varied substantially in terms of their cortisol mean, median and standard deviation (mean range: 1.9 to 2.7; median range: 1.9 to 2.8; standard deviation range: 0.26-0.49), as did their individual cortisol distributions. We found no significant correlations among cortisol values within women. Z-scores and sample percentiles presented similar levels of accuracy when used to assign rankings, and both methods were more accurate when compared to rankings based on cross-sectional raw cortisol values. We also present a simple simulation to estimate the appropriate sample sizes needed to apply the methods discussed. Those simulations suggest that 10 to 15 cortisol measurements per participant provide an acceptable degree of accuracy for ranking women

according to their cortisol levels in our population. The methods we present could be applied to compare stress levels across individuals using matrices other than urine.

Diet and Disease in Dalheim: An Isotopic Investigation of Skeletons from Medieval Germany

[Session D]

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The stable isotopic compositions ($\delta^{13}\text{C}$, $\delta^{15}\text{N}$, $\delta^{18}\text{O}$) of human tissues are used to explore the diet, health and geographic origins of individuals from a medieval (11th century) cemetery in Dalheim, northwest Germany. The burials were located in close proximity to a chapel and sheep stable associated with an early monastery at this site. Isotopic analysis was conducted on 24 samples of cortical bone representing both juveniles and adults from the larger skeletal series. The isotopic results for bone collagen ($\delta^{13}\text{C}$, $\delta^{15}\text{N}$) and carbonate ($\delta^{13}\text{C}$) do not indicate age or sex differences in the diet. A narrow range in carbon-isotope compositions suggests that neither C₄ plants (e.g., millet or sugarcane) nor marine fish were consumed in significant quantities by this population. Nitrogen-isotope compositions are more variable and could reflect either differential access to dietary protein or the influence of disease. Degenerative disease of the spine was the most common pathological condition in this group, but it is not associated with isotopic variability. Relatively uniform bone carbonate oxygen-isotope compositions ($\delta^{18}\text{O}$) indicate that the cemetery consisted of individuals who had lived locally. The combined isotopic and osteological data provide insight into the quality of life for people living in this region during the Middle Ages and situate this population within larger social and geographical contexts.

Stable isotope analysis of faunal remains from the first siege of the Fortress of Louisbourg

[Session D]

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From 2006 to 2007, human remains were located and excavated from the shores of Rochefort Point at the Fortress of Louisbourg National Historic Site of Canada. During the 1745-46 siege of the Fortress, the occupying French forces were defeated by the British with a force of British regulars, American colonialists and hired mercenaries. The invading British forces wintered over after their 1745 campaign and left some 2,000 soldiers stationed at the Fortress. Poorly provisioned and unprepared to stay the winter, some 60% or 1,200 of these soldiers lost their lives to disease, exposure and starvation. The recently burned properties of Rochefort Point provided open cellars in which to dispose of the dead when the frozen, rocky soil afforded no graves to be dug during the harsh winter months. Some 42 individuals were recovered from the excavations of a single property dwelling belonging to the Ste. Marie family. One of the main questions at Rochefort Point is to determine who these buried individuals were. Because none of

them were memorialised in any way, we are left to determine whether they are French and Mi'kmaq occupants of the town site, invading soldiers from the 1745 siege comprised of New Englanders, hired mercenaries and English regulars or some combination of these groups. No other analysis shy of DNA analysis is capable of making the complete distinction. Due to poor preservation, there are no available morphological differences in the skeletons of these populations to make this distinction. This project presents the results of isotopic analysis of carbon, nitrogen and oxygen of the faunal remains. It has established a baseline for further research into human remains in larger projects at this site, some currently underway. A distinction between domesticated (e.g., chickens, turkeys and pigs) and wild species (e.g., deer, squirrels and mice) also establishes the water sources most likely to be associated with human consumption.

The Effect of Skeletal Completeness on Cranial Trauma Analyses

[Session D]

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Skeletal completeness is an issue faced by all osteological researchers. The level of preservation and completeness can affect research results. In order to test for potential biases and inaccuracies in cranial trauma research and whether using cranial elements in varying levels of completeness affects the frequency of cranial trauma found, a trauma frequency analysis was undertaken on a skeletal sample (n = 75) from the skeletal collections of the medieval Augustinian Priory of St. Mary Merton and the post-medieval lower cemetery of St. Bride's Church. Forty-four individuals exhibited trauma on one or more cranial elements. Bones of the cranium were categorized as at least 75% complete and less than 75% complete. Crania were categorized as 100% complete and incomplete. Two frequencies were calculated (frequency of individuals with lesions and of individuals with multiple lesions) for each completeness category for the crania and each cranial element. The results illustrate a general trend towards a decrease in frequency as more fragmentary material is included. For example, the frequency of nasal bones with lesions dropped from 55.32% when the calculations was done on bones that were at least 75% complete to 12.50% for the fragmentary material. Additionally, the frequency of lesions on the frontal bones decreased from 12.24% to 4.76% between the more complete and more fragmentary categories. However, Fisher's exact tests do not show statistically significant differences between frequencies, except for individuals with lesions on the nasal bone. Further research into the effect of fragmentation and poor preservation in skeletal research, cranial trauma research in particular, is required.

Interindividual differences genesis: The development of depressive symptoms in childhood. A genetically and environmentally informed prospective study

[Session 7]

Adèle **Paul-Hus** and Daniel **Pérusse**

Université de Montréal

The idea of a universal human nature seems to contradict the tremendous individual variability encountered in the human species. Nonetheless, it is possible to reconcile these ideas that are at the origin of one of the most important debate in anthropology, the Nature-Nurture debate. In

fact, the human nature can be understood as a universal ensemble of developmental and psychological mechanisms, that were biologically evolved and genetically underwritten but that is being nevertheless variable in its expression depending on individual experiences linked to socialization and enculturation.

This presentation explores the Nature-Nurture aspects pertaining to the emergence of individual variation in the emotional regulation of a primary emotion, sadness, which is implicated in major depressive disorder. Using a genetically informative twin design, we explored the genetic-environmental aetiology of child depression. We then assessed the influences of maternal behavior and mental state on the development of children's depressive symptoms.

Our analysis of child depression shows an absence of genetic influence in the emergence of this mood disorder. Thus, individual variation in sadness regulation appears to be solely generated by environmental influences. Our results also show a strong and significant relation between maternal psychological state, assessed when the twins were 5 months of age, and children's depressive symptoms measured 8 years later. Maternal psychological state is considered to be one of the most reliable indicators of the quality of maternal treatment in childhood. Results support our hypothesis of suboptimal maternal treatment contributing to the development of later emotional dysfunction.

Pre-Columbian Diet and Health in the Quito Basin

[Session 5]

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In this paper we will present preliminary palaeopathological data and stable carbon and nitrogen data from human bone and dental collagen from the Pre-Columbian Ecuadorian highland sites of Tajamar and NAIQ. Our goal is to relate dietary and health patterns to cultural, political, environmental and social contexts among highland groups during the Integration Period (AD 700/800 to 1532). Ethnohistorical and archaeological evidence for the Integration Period in the northern highland region suggest general shifts towards increased maize cultivation, urbanization, population size and social and political complexity. Nonetheless, it is yet unknown how these cultural changes affected individuals and society at specific sites. Previous stable isotope research conducted in the Quito Basin by Ubelaker et al. (1995) has identified a lack of protein consumption differences based on status levels, a finding that was inconsistent with available ethnohistorical documentation. We extend this research by combining stable isotope and palaeopathological analysis at two contemporary sites that are located close to one another but exhibit different mortuary patterns (such as tomb depth, tomb shape, burial position and number of individuals present) and possible social differentiation as suggested by the presence of exotic goods in some of the burials. Pathology data (e.g. dental wear, trauma, arthritis, dental caries, cribra orbitalis and porotic hyperostosis) indicate a difference in the experience of illness and lifestyle at the two sites, and the paleodiet data also indicate differentiation with Tajamar diet focused more on maize consumption than NAIQ. Our findings for variation in lifeways are

consistent with those of Ubelaker et al. (1995) and clearly provide a different picture of life during Integration Period than the ethnohistorical evidence has given us to date.

Identifying disabling conditions in the archaeological record: Possible cases of cerebral palsy, Down's Syndrome, and cleft palate in nineteenth century North America

[Session D]

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This study presents diagnostic criteria for the identification of disabling conditions in the archaeological record. The primary data source for this project is a skeletal sample (n=100) associated with the Oneida County Asylum for the Mentally Ill (in operation circa 1865-1890) from central New York State, US. Standard methods for skeletal aging and sexing are followed in addition to differential diagnosis protocols to identify specific skeletal lesions. The analysis presents possible cases of cerebral palsy, Down's Syndrome, and cleft palate. Standard lesion markers are utilized to identify the conditions as well as additional potential non-standard markers. The individuals presented in this study also all demonstrated gracile long bones that distinguished them from the other adult remains in the skeletal sample. The context for this skeletal sample, an asylum for the mentally ill, was also documented to have housed the disabled as well. A goal for this study is to promote the identification of disabling conditions in the archaeological record so that cultural systems in place to accommodate that component of the population can be included in bioarchaeological analyses.

Two-Dimensional Shape Analysis of Lower Thoracic Vertebrae with Schmorl's nodes

[Session 1]

Kimberly **Plomp**, Una Strand **Vidarsdottir** and Charlotte **Roberts**

Durham University

Schmorl's nodes are the result of a herniation of the nucleus pulposus into the adjacent vertebral body and are commonly identified in both clinical and archaeological situations. Two-dimensional statistical shape analysis was performed on digital images of the lower thoracic spine (T10-T12) of adult skeletons from the medieval collections of Fishergate House, St. Mary Graces and East Smithfield Black Death cemeteries and the post-medieval Chelsea Old Church cemetery. The aim of the study was to identify possible vertebral shape correlations with Schmorl's nodes. The lesions have been scored on a basis of severity and the location of the lesion was recorded. The results indicate that there is no correlation between the shape of the vertebral body and the presence of Schmorl's nodes; there was, however, correlation between the shape of the spinal canal and Schmorl's nodes. The size of the spinal canal has been associated with lower back pain and age-related changes; the results of the current study indicate that the shape of the canal may be related to herniation of the intervertebral disc. The difference in shape related to the severity of the lesion was also analyzed. It was found that spinal canal shape has a stronger correlation with severe Schmorl's nodes than weaker ones, suggesting that the shape difference may cause or result in disc herniation, and possibly represent a natural shape which predisposes an individual to the condition.

Aerobic exercise influenced the evolution of hominin brain size and cognitive function

[Session 6]

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Hominin body shape was fundamentally reorganized approximately 2 million years ago in response to the adoption of increased endurance activity. Here we argue that the corresponding increases in aerobic capacity also enabled increased hominin brain size and improvement of specific cognitive functions. Recent experimental evidence in humans and animal models strongly supports causal relationships between both short- and long-term aerobic exercise and the volume of specific regions of the frontal and temporal lobes, as well as improved cognitive performance in tasks involving executive functions and spatial relational memory in both children and older adults. The developmental mechanisms underlying these changes are well understood from experiments on mouse models, with both brain size and cognitive effects being mediated by increased neurotrophin levels, especially Brain-Derived Neurotrophic Factor, IGF, and VEGF. We suggest that these proximate mechanisms linking exercise and neurobiology were altered by selection during human evolution. We provide an evolutionary mechanism for understanding how selection may have acted on factors important to endurance exercise, and suggest that such selection for locomotor performance resulted in increased neurotrophin levels resulting in increased brain growth and substantial advances in the cognitive abilities of human ancestors.

The development of medial and lateral pillars of the femur in hominoids : growth and influence of locomotion

[Session 6]

Marine **Puech**

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Body mass and direction of loads affect the development of metaphyseal morphology. This study analyzes the relationship between distal femur morphology and locomotion through ontogeny in hominoids and in *Australopithecus afarensis* (A.L. 333-140/110/111). The comparative sample consists of juveniles from *Pan* (n=32), *Pongo* (22), *Gorilla* (31) and *Homo* (45). Linear measurements from the distal femora were tested for allometry with bootstrap and T- tests, while taxa were compared with Kruskal-Wallis or ANOVA tests. In apes the lateral pillar develops as fast as the medial and there are no anteroposterior length differences. In humans the lateral pillar grows faster than the medial and it gets relatively longer through ontogeny. Relative to the mediolateral width of the metaphysis, the medial and lateral pillars grow faster in apes, while in humans, only the lateral pillar is positively allometric. In apes the mediolateral width is greater than the anteroposterior depth giving a rectangular form to the metaphyseal surface while in humans it is more squarish. In apes, faster anteroposterior growth of the femoral pillars relative to the mediolateral width during ontogeny reduced the proportional difference between the pillars and the distal width and gives the metaphysis a more squarish shape with age, although without ever reaching the human morphology. In humans the most noticeable proportional change occurs around 6-8 years of age, resulting in a late acquisition of the adult morphology with the anteroposterior elongation of the lateral pillar, while in apes there

is no clear change through ontogeny. Absence of difference between medial and lateral pillars for *A. afarensis* juveniles or adults supports the finding of previous studies. The more ape-like morphology of *A. afarensis* suggests to some a gait different from that of humans, such as a "bent-hip, bent-knee" position, others suggest, instead, that it reflects their low body weight.

Muscle architecture and bone morphology of the humerus in orangutans: implications for the study of fossil hominoids

[Session 6]

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Dept. of Anthropology, University of Toronto

Muscle attachment sites are the main observable record of muscle structure and function on the skeleton and may be important indicators of behaviour. Given that muscle markers seem to be developing in response to muscle use and size, they are often used as a surrogate of the strength of the muscles when reconstructing lifestyles in past or extinct populations. Although more studies are investigating the dimensions of muscles in hominoids, there is little information regarding muscle architecture and its direct relationship with muscle attachment. The main goal of this project was to investigate whether muscle markings of the humerus reflect muscle size, strength and activity of captive Sumatran orangutans, to not only refine current ideas about musculoskeletal structures and function in living primates, but also our behavioural interpretations in fossil primates. Sixteen muscles of the forelimbs that cross the shoulder and the elbow were examined in two orangutans (one male and one female) from the Toronto Zoo. During the dissections, careful attention was given to each muscle attachment, and pictures were taken before the removal of muscles to document attachment contours. This method enabled visual definition of the attachments and reduced error. Results indicate that the shoulder abductors have the lowest capacity of power. In a suspensory position, the arm is fully abducted under the influence of gravity, making the arm abductors less important in orangutans. At the elbow, there seems to be dominance with the extensors. This is contrary to past studies, where the flexors were found to be dominant. The large triceps, which tends to enhance terrestrial locomotion, might be associated with the nature of the zoo animals. Preliminary results show that muscle attachment area seems to correspond to the physiological cross-sectional area and the fasciculi length values. To better quantify this tendency, site morphology, mechanical properties and activity patterns of the muscles will be further investigated.

Classical calibration for histological age-at-death estimation

[Session 2]

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The reliability of methods for estimating age-at-death in adult individuals has always been a problem in anthropology, partly because of statistical bias. Most of the histological age estimations uses linear regression as a statistical method, where x is an indicator of age and y is the chronological age. However, this method introduces a bias for several reasons. First, when the correlation between the indicator and the age is not high, linear regression overestimates the age among younger individuals and underestimates age in older individual. Second, from a biological perspective, age does not depend on the osteon population density (OPD) but rather

the opposite. The classical calibration method avoids the first problem and responds directly to the second but reduces the efficiency of the estimates. This paper presents a comparison of the two methods on a sample of 54 male and female right second metacarpals from an historic European sample from Ontario, Canada (30 males and 24 females). The OPD (intact and fragmentary osteons/mm²) was calculated for each quadrants (anterior, posterior, medial, lateral), sampling two periosteal to endosteal columns separated by one column width. As expected, results obtained by classical calibration are less accurate than those by linear regression, however the standard error of estimates for the classical calibration are comparable to macroscopic age-at-death estimations from classic methods such as auricular and pubic symphyseal surfaces. In order to increase the reliability of histomorphometry in age estimation, the use of classical calibration is recommended, particularly for the younger or older individuals.

Isotopic investigations of ancient Maya diet at Caledonia, Cayo District, Belize

[Session 9]

Asta **Rand**

Trent University

This study implemented stable isotope analysis to investigate the diet of the ancient Maya from Caledonia, located in the Cayo District of Belize and dating from the Late Preclassic to Late Classic periods. During archaeological excavations, limited evidence of subsistence was recovered from this site. Thus, stable carbon and nitrogen isotope analysis of human skeletal and dental tissue was employed to reveal the types of foods consumed by the Caledonia Maya. Twenty samples of human bone collagen, and structural carbonate in eighteen samples of bone apatite and five samples of tooth enamel apatite were prepared for isotopic analysis. Diet, as inferred from the isotopic results, was compared to pathological conditions, and was investigated based on social (age, sex and social status), temporal and regional factors.

The isotopic results indicate that the diet of the Caledonia Maya was based on maize, supplemented with maize-fed terrestrial animal protein and some freshwater mollusc protein. No statistically significant relationships between diet and pathology, age, sex, social status or time period were discerned. However, it appears that maize consumption decreased with increasing age, young adults consumed more protein than older adults, and females consumed more maize than males. The individuals interred in the tombs consumed more maize and maize-fed terrestrial protein than those interred in simple or cist burials. Temporally, the consumption of maize increased from the Preclassic to early Late Classic periods, and decreased slightly during the remainder of the Late Classic period. Finally, the diet of the Caledonia Maya was more similar to the diet at sites in Guatemala than to the diet identified at other Belizean sites, excluding the nearby sites of Pacbitun and Caracol. This indicates that among the ancient Maya, diet was determined not only by the local environment, but also by political, economic and cultural factors.

Contribution of two paleonutritional case studies to Quebec bioarchaeology: the cemeteries of Notre-Dame (Montreal, 1691-1796) and Saint-Matthew (Quebec City, 1771-1860)

[Session 8]

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To complement both historical and archaeological data, paleonutritional studies help explore past foodways and various related socio-economic factors such as subsistence shifts, food access and social stratification. The present study provides a synthesis of the key contributions of this approach to Quebec bioarchaeology. Post-2009, the first stable isotope analysis has been completed on two historic Euro-Quebecois populations, dated between the 17th and 19th centuries AD. Our objectives are to understand clearly the evolution of the urban dietary patterns, covering a period from the establishment of Nouvelle France, up to the British Conquest (1524-1763). Nutritional variation is therefore explored both within and between groups in relation to age, sex and the socio-economical context.

Carbon and nitrogen stable isotopes analyses from human bone collagen (rib samples) were performed at GEOTOP Laboratory on two cemetery populations: 50 samples from Notre-Dame's first church cemetery (Montreal, 1691-1796); and 82 samples from Saint-Matthew (Quebec City, 1771-1860).

According to $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values, the Euro-Quebecois diet was based mainly on C_3 resources (cereals, vegetables and fruits), a few protein-rich foods (meat and fish) and occasionally on C_4 resources (corn and sugar cane). The values were not significantly different between males and females. However, marked dietary differences especially in relation to nitrogen values were found between two age groups (0-2 years and older than 2 years of age). This fact supported previous bioarchaeological analyses (based on decidual dental wear) suggesting a weaning age around 1½ and 2 years. For the Saint-Matthew sample, dietary differences were also observed between weaned children (2 to 11 years old) and adults, possibly indicating cultural variations in nutritional habits throughout life.

So far, nutritional patterns from Notre Dame and Saint-Matthew populations indicate a rather mixed diet that is very similar to the variation observed for other Europeans living in North America, but very different from Native American groups. Further intra-group variation needs to be explored to ascertain whether there is a link between diet and various other data (historical context, health, Catholics vs Protestants).

Validation using CT data of Ribeiro's (2000) Method of Measuring the Frontal Sinuses for Forensic Anthropological Applications

[Session A]

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Identification of unknown individuals is important in forensic cases to notify next of kin and to execute legal matters. Several anatomical regions have been considered because of the variation in the condition of the remains and available resources. Included in these approaches is the morphological variation of the frontal sinuses. These structures are considered unique to each

individual and were first used to resolve identity in the 1920s. Due to their location inside the skull, between the inner and outer tables of the frontal bone, visualisation is achieved through radiographic imaging, typically X-Ray or computed tomography (CT). Basic visual comparison, overlaying an antemortem image of the frontal sinuses over a postmortem image to identify a match, has given way to several methods which have attempted to quantify the morphological variation seen in these structures. Recently, increased emphasis has been placed on quantification methods and testing to develop standards within forensic anthropology (e.g. the Daubert ruling). Therefore, it is crucial that methods employed within the discipline be tested on independent samples.

Ribeiro's measurement method was originally developed using X-ray images, but this study employed a postmortem CT data sample from the University of Copenhagen. This represents the first independent validation of this methodology. This poster describes the protocol used in this research, summarises the variation observed in this sample and evaluates the method proposed by Ribeiro (2000). The results suggest that the four measurements taken in this method are able to characterise some of the uniqueness seen in the frontal sinuses and are consistent with previous research recognising individual variation in this structure. The results of tests of identification success, as well as the influence of age and sex are also presented. This method was found to be highly repeatable and easy to execute on a CT data set.

The evolution of the upper limb after *Australopithecus*: Integrating paleontology and experimental functional morphology

[Session 6]

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Understanding the origins of human adaptations for manual dexterity and tool use requires a combination of in vivo functional analyses of the hand and evidence from the fossil record about the pattern and timing of morphological changes. Here, we investigate the evolution of hominin thumb robusticity in the context of experimental work on the biomechanics of stone tool-making to test the hypothesis that thumb robusticity evolved in early *Homo* in response to selective pressures for greater force production involved in making stone tools.

To examine fossil hominin thumb robusticity, we collected linear measurements of the first metacarpal and other upper limb bones in a sample of modern humans, great apes, and fossil hominins, including fossils from sites in South Africa (Malapa, Sterkfontein, Swartkrans) and east Africa (Hadar, Koobi Fora, West Turkana). We investigated thumb biomechanics using a dynamic pressure sensor system (200 Hz) to collect normal forces and pressures acting on the digits of experienced knappers while making Oldowan tools.

Our analyses show that the earliest evidence of robust thumb morphology is associated with early *Homo erectus*/*H. ergaster*, while first metacarpals associated with *Australopithecus* retain a relatively gracile morphology. Contrary to the tool-making hypothesis, the experimental results show that normal forces acting on the thumb are not higher, and are often significantly lower, compared to the forces acting on digits II-III during early Paleolithic stone tool production. These results suggest that stone tool making per se cannot explain the evolution of greater thumb

robusticity in early *Homo*. We propose that tool use rather than tool making led to the evolution of the robust thumb in our genus.

A Small-Bodied Later Stone Age Skeleton from Southern Tanzania

Competing for student prize [Session 2]

Elizabeth **Sawchuk**

Dept. of Anthropology, University of Alberta

The Mlambalasi rock shelter, located in the Iringa region of Tanzania, possesses terminal Pleistocene and Holocene archaeological deposits spanning the Later Stone Age (LSA), Iron Age, and historic period. Excavations in 2002, 2006 and 2010 yielded fragmentary human remains as well as pottery, iron, stone tools, faunal bone, rock art, and ostrich eggshell beads. Four individuals are present: two adults and a juvenile found in the same LSA burial feature, and another adult associated with the Iron Age. The most complete skeleton is a middle adult of indeterminate sex that was found partially articulated in an LSA context. Charcoal from the burial was AMS radiocarbon dated to $12,765 \pm 55$ uncalibrated years BP (OxA-24620), which is consistent with radiocarbon dates on giant land snail shells from above and below the remains. The skeleton exhibits a series of pathological changes, such as extensive dental wear and caries, as well as pseudopathological lesions most likely caused by termites. However, the most striking aspect of the skeleton is its small size: stature and body mass estimations place it in the range of historic Khoesan from southern Africa. Archaeological, linguistic, physical anthropological and, most recently, genetic evidence has been used to argue for an ancient Khoesan presence in eastern Africa. The theory remains contentious, in part due to the rarity of Upper Pleistocene human remains. New discoveries such as this small-bodied LSA skeleton are therefore important in expanding our knowledge of human ecology and variation during this poorly understood period in our evolution.

In The Time of Crisis Mortality: Deconstructing the Impact of Yellow Fever and Cholera Epidemics

[Session 10]

Larry **Sawchuk** and Lianne **Tripp**

University of Toronto

Crisis mortality continues to be a potent agent for biological change at the population and species level. Here we use Bouckaert's (1989) definition of crisis mortality as the sudden and dramatic increase in the death rate arising from a common, unusual casual factor operating for a limited period. While there is little issue identifying agents (famine, flood, drought, epidemic) that can trigger a crisis event, problems arise when one is asking to provide a clear and operational definition of the triggering agent. One such excellent example can be seen in the discourse on what constitutes a disaster by Howe and Devereux 2004. Similar questions were raised by Green and co-workers (2002) on the subject of epidemics noting that the term was fraught with ambiguity and interchangeable expressions that are often emotionally charged and mutable over time and space. This paper provides an operational based definition of an epidemic that evaluates the event relative to the normal or background mortality experience of a population. Further, our method uses a non-arbitrary statistical framework to establish meaningful threshold markers of crisis events. During the 19th century the inhabitants of Gibraltar encountered a series of deadly

epidemics that caused widespread morbidity and mortality in this small British colony. A case in point was the epidemics of yellow fever in 1828 and cholera in 1834. Using our refined methodology to examine crisis mortality: it is readily apparent yellow fever ($M=19.62$) had a significantly larger impact than the cholera epidemic ($MI=5.31$).

Metric Analysis of the Dentition of a Fossil Orangutan from Vietnam

[Session 6]

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The presented research examines the phenetic affinities of the Vietnamese Hoa Binh fossil specimen relative to extant and Pleistocene fossil orangutan species, as well as Miocene hominid taxa thought to be closely related to the genus *Pongo*. Our study is based on a multivariate analysis of twelve postcanine dental dimensions. Specifically, we examine the suggestion by Bacon and Long (2001) that the Vietnamese specimen more closely resembles Pleistocene species than extant *Pongo pygmaeus* and *P. abelii*. Our results indicate the Vietnamese fossil appears to be most similar to the Pleistocene fossil taxa *Pongo fromagei* and *Pongo weidenreichi* based on a direct comparison of phenetic shape distances. When all pair-wise distances are considered together, the Hoa Binh fossil specimen is morphologically similar to other members of the genus *Pongo* rather than any of the Miocene fossil taxa, including *Lufengpithecus*, which has been suggested as a primitive sister taxon to the subfamily comprising the genus *Pongo*. A size gradient from early (large) to more recent (smaller) taxa was apparent along the first principal component within the *Pongo* grouping. The large size of the Hoa Binh specimen suggests, therefore, that this fossil is older than either *Pongo weidenreichi* or *Pongo paleosumatensis*. In conclusion, our study, like that of Bacon and Long (2001) suggests the fossil specimen from Hoa Binh, Vietnam likely represents an early, somewhat larger, member of Ponginae.

Non-aggressive gain of alpha status is associated with fecal androgen and cortisol increase in a male white-faced capuchin, *Cebus capucinus*

[Session C]

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Several studies on non-human primates report that dominant males have higher androgen and cortisol (CORT) levels than their subordinates, but little is known about the timing of hormonal changes associated with changes in dominance status. We report on differences in androgen and CORT between alpha and subordinate males in a case of rank acquisition within a group of *Cebus capucinus* in Santa Rosa, Costa Rica. We describe the hormone changes of an immigrant male (CY) who, two months after his initial immigration, became alpha male when the resident alpha male (CB) disappeared. CY's acquisition of alpha position was not associated with aggression with either the resident alpha male (CB), subordinate male (WW), or any other group member. We measured androgen and CORT from feces collected ($n=116$) from the above mentioned three males between July – November 2006 and February – July 2007. Hormone

analyses were conducted at the Wisconsin Primate Center in 2007. Prior to the rank change, the resident alpha male (CB) had higher mean androgens than both the immigrant CY and the subordinate WW, but there was no difference between the two subordinate males CY and WW. In the period immediately following CY's acquisition of the alpha position, he had higher mean androgen than WW and this difference persisted for at least ten months. Prior to the rank change, the resident alpha male (CB) had higher mean CORT than the subordinate WW, but not the immigrant male CY. There was no difference between the two subordinate males (CY & WW) until after CY became established as alpha male, when his mean CORT was higher than his subordinate WW. Our results suggest that, in the case of peaceful rank acquisition, elevated androgen and CORT levels observed in alpha male capuchins are associated with high dominance status, rather than with the acquisition of alpha status.

The Kids Are Not Alright: A Bioarchaeological Examination of Childhood Health at the Drawsko 1 Cemetery Site

[Session 1]

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Childhood health is an important area of focus in bioarchaeology as it provides specific information regarding the youngest members of a community and more generalized information regarding the larger community as a whole. The Drawsko 1 cemetery site (17th – 18th century) is located in north-western Poland and is arguably a cholera epidemic cemetery. Approximately 70 subadults from this sample, ranging in age from neonate to 16 years, were examined for markers of stress (i.e., porotic hyperostosis/cribra orbitalia, linear enamel hypoplasias), infection (i.e., osteoperiostitis and specific infectious disease), and dietary deficiency (i.e., scurvy, rickets). While no evidence of specific infectious disease or rickets was found, all other markers of stress, infection, and dietary deficiency were observed in this sample. The most common pathological condition identified was cribra orbitalia, which was present in approximately 15% of the subadult sample. Comparisons of these results to those of other European post-medieval samples, and dietary and cultural information regarding the Drawsko population is utilized to explain the overall health of these children. Additionally, the generally low prevalence of these pathological conditions suggests that children succumbed quickly before the skeleton was affected. This may support the hypothesis that Drawsko 1 was an epidemic cemetery. Based on childhood health, we conclude that a variety of challenges were faced by this rural farming population.

A Test of Age and Sex Determination Methods on Documented Skeletal Collections: Why Subjectivity Should Not Be a Dirty Word

Competing for student prize [Session 2]

Jennifer **Sharman**

Durham University

Sex and age identification of human skeletal remains is essential in forensic anthropology, bioarchaeology and paleodemography. As such, accuracy of estimation methods is crucial. Many methods exist and are generally applied to skeletal remains from archaeological sites from all time periods and geographic locations, despite studies showing differences in expression of

sex characteristics and ageing rates within and between populations. Most studies analyzed only one or two populations; interobserver error renders comparison of results inappropriate. The aim of this project was to study variation in the ageing process and sexual dimorphism in six populations of different geographic locations and/or time periods. Age and sex methods were tested on adult skeletal collections of known age and sex, from the 17th to early 20th century, from Canada, England, South Africa, and Portugal. Age determinations were based on the fourth rib, cranial sutures, pubic symphysis and auricular surface. A more subjective age estimate for each individual included informal skeletal age indicators alongside formal methods. Sex determinations were based on the Phenice method, skull morphology, and a metrical method. This presentation discusses preliminary results, outlining population differences in sexual dimorphism for certain traits and ageing rates. The evidence suggests that using all available informal age indicators and formal methods results in better age estimates than using only formal methods. Experience of the user is important, as interpretation is subjective – while this is contra the supposedly more objective use of formal methods, it is important to acknowledge the subjectivity of formal method application. Subjectivity should not be a dirty word; valuing experience and applying both formal methods and informal indicators results in improved estimates. While population variation in ageing and sexual dimorphism remains a challenge, it is hoped that results presented here will help future studies. The ultimate aim is to recognize and avoid possible error in sex and age estimates, or at least accommodate them, providing more confidence in data produced from such studies.

Early Paleocene Primates from the San Juan Basin: new insights into the first chapters of primate evolution

[Session 6]

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The San Juan Basin extends from northwestern New Mexico into southwestern Colorado, and includes deposits that range from the Late Cretaceous to the early Eocene. Of particular importance to the study of early primate evolution are fossils from the Nacimiento Formation, dated to between 64.5 and 62 mya, which comprise the type faunas for the early Paleocene Puercan and the Torrejonian North American Land Mammal Ages. Although there are currently no primates known from the Puercan deposits, Torrejonian fossils previously described from the Formation represent 6 different species of palaechthonid and paromomyid plesiadapiforms. However, all of these species are known from very limited material—prior to this report the total number of primate specimens described from the Nacimiento Formation of the San Juan Basin was less than 25.

The current report increases the sample of primates more than fivefold. Included in the new material is the first picrodontid plesiadapiform specimen from the Torrejonian of the San Juan Basin, referable to *Picrodus calgariensis*, a species known previously from Alberta and Wyoming. Also included in the new sample is the first paromomyid specimen complete enough to allow for a species level taxonomic assignment, which represents a new species of *Paromomys*. With respect to the Palaechthonidae, the current report includes the first new specimens attributed to *Plesiolestes nacimienti* and *Anasazia williamsoni*, and large collections pertaining to *Torrejonia wilsoni* and *Palaechthon woodi*. These collections demonstrate

previously unknown morphological variants, including the presence of a metaconid on p4 of some specimens of *T. wilsoni*, which supports previous inferences about a close relationship between that taxon and *Plesiolestes problematicus*. This new sample considerably enhances our knowledge of the poorly understood Palaeoanthropidae, and about the biostratigraphy, biogeography, and early evolution of North American primates.

Comparing the Reconstructed Child and Adult Diets from a Caribbean Population using Carbon and Nitrogen Stable Isotope Analysis

[Session 9]

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The cemetery of l'Anse Sainte Marguerite (Guadeloupe), dated from XVIII – XIXth cent., was excavated and a slave population of approximately 200 burials were recovered. Stable carbon and nitrogen isotope signatures were determined for 43 of these individuals using bone and dentin collagen for dietary reconstruction. The isotopic values of the two tissues for each individual were then compared to establish dietary changes during their lifetime. Comparison to predicted dietary ranges for the West Indies, West Africa and Europe that were developed using data from previous isotopic studies to represent the various groups of people found in the West Indies during the period of use for the cemetery was also carried out. Many of the individuals in this population are thought to be slaves because their isotopic values correspond with predicted dietary ranges for slaves in the Caribbean. There were 4 individuals with dental modification, a practice common in Africa, who showed dietary changes that reflect a probable geographic movement during their lifetime. This study will illustrate the dietary changes over time and offer suggestions to how these changes in diet occurred over an individual's life.

The Taphonomic Analysis of Human Skeletal Remains from Cerro Amaru, Peru

[Session 5]

Sheryl **Spigelski**

University of Toronto

This presentation examines the taphonomic changes on skeletal material recovered from the ancient site of Cerro Amaru by the Huamachuco Archaeological Project in the 1980s. The remains were recovered from inside a Mausoleum. The skeletal material from inside the Mausoleum at Cerro Amaru was very fragmentary and affected by non-cultural taphonomic processes. The remains are from males and females ranging in age from juvenile to older adult. Contextually, the Mausoleum contained rich and diverse grave goods, possibly indicative of a wealthy ally or extended family burial plot.

Spina bifida as a means of identification in forensic contexts

[Session A]

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This poster presents an examination of the feasibility of utilizing spina bifida as an individualizing feature to make identifications in a forensic context. First, the incidence of spina bifida as well as the appearance in radiographs and dry bone are considered. This is then followed by a discussion of the use of morphological features in identifying human remains of forensic significance, particularly in reference to antemortem radiographs. Finally, the implications of the presence of spina bifida in remains when making such identifications is considered. Comparison of postmortem and antemortem radiographs, particularly in severe cases, may be sufficient to identify a decedent with spina bifida.

Using Stable Carbon and Nitrogen Isotopes to Investigate Chronological Trends in Ancient Maya Diet at Minanha, Belize: A Preliminary Analysis

[Session 9]

Shannen **Stronge** and Jocelyn **Williams**

Dept. of Anthropology, Trent University

The study of ancient human diets has become an increasingly important area of research within the field of bioarchaeology for understanding various aspects of past societies, such as: subsistence strategies, personal or group identity, sociopolitical organization, and religious beliefs. This presentation is concerned with the reconstruction of diet at the ancient Maya site of Minanha through the use of stable carbon and nitrogen isotope analysis of bone collagen and bone bioapatite. Minanha was a royal court complex located in the North Vaca Plateau, Belize, and was occupied for over a millennium, from about 100 BC to 1200 AD. Bone samples collected from 34 skeletal sources (32 human, 2 faunal), representing all burial contexts and levels of social status, were chemically processed and analyzed. The purpose of the research discussed is to: 1) investigate chronological trends in the stable isotope data by comparing isotope data and radiocarbon dates produced for each sample; and, 2) investigate whether temporal differences in diet correlate with known sociopolitical and paleoenvironmental events within the region. Preliminary results from the chronological investigation of diet at Minanha demonstrate that, in general, this site follows previously observed chronological trends of ancient Maya diet. In particular, these data indicate an increase in the reliance on maize as a staple food during the Classic period (250 to 900 AD). The significance of this research is three-fold. Firstly, this study is unique in that it combines stable isotope data with the most thorough chronological data produced to date for the ancient Maya region of Mesoamerica; this allows for a very fine-grained interpretation of chronological dietary trends. Secondly, it will contribute an additional dataset to the current body of stable isotope literature available on ancient Maya diet. Lastly, it will contribute to a better understanding of the rise and fall of ancient Maya civilizations, which will help inform on how contemporary populations can respond to current issues that are causing stress, such as global warming.

Sexual Conflict in Primates

[Session 6]

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Within the past decade, increased awareness and incorporation of sexual conflict theory into primate research has transformed our understanding of primate evolution and interactions between the sexes. To date, most research on sexual conflict has been conducted on insects. However, with their diverse mating and social systems, primates hold enormous potential to contribute to a more unified understanding of sexual conflict. Here we introduce a framework for understanding the behavioral, anatomical, and genetic expression of sexual conflict across primate mating systems. We test the model using published data and evidence for sexual conflict within the Order Primates. Our findings suggest that sexual conflict holds great potential for explaining variation in primate behavior and morphology.

Lead localization in the bone microstructure of historical Antigua bone samples through the use of synchrotron radiation x-ray fluorescence

[Session 9]

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Trace element analysis of archaeological bone is one way of determining diet components in past populations. Since there is the potential for incorporation of trace elements from the burial environment into bone, it is important to discern diagenetic vs. biogenic origin of the elements. One way to approach this issue is to use synchrotron radiation x-ray fluorescence (SR-XRF) to identify the spatial distribution of the trace elements as it relates to the bone microarchitecture. We have successfully used this approach on cortical fragments associated with a nonsegregated Royal British Naval cemetery population (1793-1822) located in Antigua, West Indies. It has been suggested that lead poisoning was one factor that undermined the British Royal Navy in the early nineteenth century. By matching histological images of the bone samples with elemental maps of lead created with SR-XRF, evidence of a biogenic uptake of lead was obtained. These results suggest that lead may have had an impact on the health of the members of the Royal British Navy. While the use of SR-XRF is not novel, the successful application of this technique where the spatial distribution of lead is mapped to discrete bone features holds new promise for the area of trace element research.

Isotopic Effects of Fertilization in the Andes: Implications for Dietary Reconstruction

[Session 5]

Paul **Szpak**¹, Jean-François **Millaire**¹, Fred J. **Longstaffe**² and Christine D. **White**¹

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Dietary reconstruction using stable isotopes depends on a thorough understanding of the sources and patterns of isotopic variation in the foods consumed. The potential importance of manured crops has been recognized as a confounding factor in the interpretation of animal protein consumption in Europe due to high plant $\delta^{15}\text{N}$ values. In the Andes, the practices of fertilization with both llama dung and seabird guano mined from offshore islands is known to have occurred historically, and the high agricultural productivity in regions with low nutrient levels has led some to suggest that the addition of exogenous nitrogen from animal sources was necessary. In the absence of written records, however, the importance these fertilizers have been difficult to determine. This paper presents the results of a series of controlled experiments examining the influence of seabird guano and llama dung on maize. We discuss the implications of this study for the reconstruction of subsistence practices in the prehispanic Andes.

La pensée bioarchéologique québécoise : confusion récente et perspectives d'avenir

[Session 8]

Étienne **Taschereau**

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La définition de la bioarchéologie est tributaire d'une pluralité de phénomènes. Certains sont structurels (modèle économique et politique, échelle socioprofessionnelle) ou conjoncturels (tendances sociales et idéopolitiques). D'autres sont de nature historique, comme le bagage des traditions et l'évolution des courants de pensée en sciences. Les frontières entre les disciplines est aussi teinté par l'histoire de leurs institutions de recherche, de conservation et d'enseignement, par l'apport de ses figures dominantes, par le profil de ses contributeurs et par le renouvellement de la participation.

La définition de bioarchéologie est changeante et à géométrie variable. Elle est le produit d'un échange dialectique entre une conception à la fois globale et locale, à la fois conventionnelle et marginale, à la fois consensuelle et conflictuelle. De plus, sa conception, qui émane de ceux qui sont au centre des recherches, est constamment confrontée et altérée par la perception que nous renvoie les intervenants (chercheurs de disciplines connexes, étudiants, administrateurs, media, grand public) qui gravitent autour.

Au Québec, la communauté bioarchéologique est restreinte et son histoire récente. On peut retracer ses principales influences relativement facilement. Nous tenterons de mettre en perspective le sens et la forme qu'a pris la bioarchéologie québécoise dans les années 1980 à 2000 avec : 1- des changements survenus antérieurement dans les sociétés québécoise et occidentales, 2- ce qui s'est fait ailleurs durant ces deux décennies, et 3- les changements survenus ici depuis une dizaine d'années. La bioarchéologie d'ici est, à l'image de la culture québécoise, un modèle hybride et unique de plus en plus ouvert aux influences extérieures. Le temps est venu de faire le point et de la redéfinir d'une manière qui actualise l'histoire récente et qui est cohérente à la fois avec le contexte québécois et avec un cadre global.

What's in a Tooth: A method for collecting histological, trace element, diagenetic, and isotopic data from single teeth

[Session D]

Mathew **Teeter** and Alexis E. **Dolphin**

Dept. of Anthropology, The University of Western Ontario

A fundamental research concern within contemporary biological anthropology is the sensitive balance between the preservation of human remains and the use of destructive analyses to collect information. This poster describes how multiple destructive/semi-destructive techniques may be carried out using only a single tooth. Single teeth representing 27 individuals who lived during the early medieval period in Bergen, Norway (AD 1170-1198) were subjected to histological, trace element (LA-ICP-MS), diagenetic (FTIR), and isotopic analyses (N, C, O, using micromill/ICP-MS). The information which was obtained through this partial loss of material was immense. For example, histological and trace element analyses helped to reconstruct childhood health within the population during this time period; FTIR analyses allowed us to address and determine diagenetic alterations to the material due to the burial environment; and isotopic analyses aid in the reconstruction of changes in paleodiets and movement across the physical landscape during a period of significant social/political/economic change in Scandinavia. The ability to combine these analyses was made possible through recent advancements in microspatial analytical techniques and the utilization of a multidisciplinary approach. Along with outlining the multi-technique approach taken and its particular successes and limitations, suggestions for future modification of the approach will be presented.

Breakfast in bed: use of sleeping trees by ursine colobus monkeys (*Colobus vellerosus*) in Ghana

[Session 3]

Julie A. **Teichroeb**¹, Teresa D. **Holmes**² and Pascale **Sicotte**²

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Primates spend half their time in their sleeping sites and the choice of these areas can have important fitness consequences. We investigated sleeping tree choice by *Colobus vellerosus* at the Boabeng-Fiema Sanctuary, Ghana using three non-mutually exclusive hypotheses: predation avoidance, access to food, and range and resource defence. Sleeping tree selection was determined for four groups on 299 nights in 2004/05. *C. vellerosus* slept in large, emergent trees that were among the largest in the home range. Thirty-one species of tree were utilized and favoured species differed per group depending on their availability in the home range. Our data most strongly support the access to food hypothesis and show that *C. vellerosus* are minimizing their travel costs by selecting sleeping trees near feeding areas. 80.6% of sleeping trees were food species, despite the fact that 56.9% of trees in the home ranges were food trees. Indeed, 90.6% of sleeping tree species had been seen to be fed upon that month. Of actual sleeping trees, at least 20.5% were fed upon in evening when the monkeys entered the tree and 29.4% were fed upon in the morning. On 91.7% of nights the monkeys fed in the vicinity of the sleeping trees in the morning or evening. However, by sleeping high in the canopy, away from the main trunk, in trees with dense foliage, and few or no lianas, and by showing low rates of site reuse, *C. vellerosus* also appear to be avoiding predation in their sleeping site choices. Groups slept in areas of their home range that did not overlap with other groups more often than expected

($\chi^2=135.2$, $df=1$, $p=0.0001$). However, when other groups were spotted on the edge of the core area, focal groups would approach the intruders, behave aggressively, and sleep within 50 m of them, seemingly to prevent an incursion into their core range. This study suggests that access to food, predation avoidance, and range and resource defence were all important considerations of sleep site selection.

Honouring Canada's leading physical anthropologists: A citation analysis

[Session D]

Ferenc **Toth**

University of Southampton

This research seeks to honour the leaders of Canadian physical anthropology through citation analysis. Citation analysis is a way to assess the value of publications by analysing the frequency with which a research paper or an author is being cited. The electronic database Scopus was searched to obtain the number of citations of every journal publication for each full-time physical anthropology faculty member at a Canadian university. A list of full-time academics was gathered by visiting department websites. The journal publication record was analyzed for 67 academics who are employed at 22 Canadian universities. Three types of analyses were performed for each individual: total citation count for all research papers indexed in Scopus, number of citations for each journal publication, and the Scopus h-index. This poster presents the top 10 physical anthropology academics through the following categories: number of career citations, number of citations for first-authored papers, most highly cited first-authored publications, number of citations for all papers (not first-authored), most highly cited publications, and the Scopus h-index for all publications. This poster recognizes the scholarly leadership of Canadian physical anthropologists by the constructive application of citation analysis.

Social implications of disability for adult female Japanese macaques

[Session 3]

Sarah E. **Turner** and Linda M. **Fedigan**

Dept. of Anthropology, University of Calgary

Recent debate about inferring conspecific care in ancestral hominin from skeletal remains relies on evidence from extant primates, yet little is known about conspecific care and physical disability in primates. A group of free-ranging Japanese macaques (*Macaca fuscata*) at the Awajishima Monkey Center (AMC) in Japan, presents a unique opportunity to investigate the relationships among physical impairment and social behaviour, in the context of congenital limb malformation in adult nonhuman primates. We collected behavioural data on 23 focal animals using 30-minute continuous time samples on adult females during three consecutive birth seasons (May-August 2005, 2006, and 2007) at the AMC. Disabled females rested significantly more and socialized significantly less compared to controls, a pattern that was evident from a variety of measures: disabled females had fewer other monkeys in proximity at the start of focal follows, fewer adult female affiliates per follow and grooming partners, less total passive social contact time, and spent less total time engaged in grooming with adult females. Some measures suggested that disabled females were responsible for reduced social involvement. In particular, disabled females were equally successful at soliciting grooming and there was no difference in

the ratio of disabled and nondisabled affiliates among focal animals; that is, there was no apparent preference related to the disability status of affiliates. Disabled females received a lower frequency of intensive agonism, and fell somewhat lower in the dominance hierarchy than expected according to kin relationships. However, the general social behaviours in which disabled females engaged were very similar to those of nondisabled females, and overall there was an undifferentiated neutral response to disability. Differences in the social involvement of disabled females may be best explained by the behavioural flexibility of disabled animals in meeting their energetic needs.

Grooming patterns in wild white-handed gibbons (*Hylobates lar*)

[Session 3]

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Among non-human primates, grooming is one of the most common affiliative behaviours. One of the most basic benefits of grooming is the cleaning and removal of ectoparasites from the skin and fur. Grooming in gibbons seems to have a hygienic function, however, the direction and amount of grooming between group members has never been looked at. The purpose of this study was to describe the grooming patterns observed in four groups of wild white-handed gibbons (*Hylobates lar*). The total amount of time spent grooming was on average 8.1% of their daily activity budget, but varied from about 5% to 11% for individual groups. Our data show that times spent grooming per day may vary with season, environmental conditions, group composition, and perhaps factors affecting the demography and dynamics of groups. Grooming by adult pair (male–female) dyads constituted on average 72% of all grooming observed per group, but varied from 27% (group N) to 100% (group M), and was always reciprocal. In all four study groups, grooming sessions were mostly dyadic. The adult male in group N performed 68% of all active grooming in the group, and was engaged in grooming dyads for approximately 9.5% of the active period. We conclude with three possible explanations for the direction and amount of grooming we found in our study groups. Grooming may increase the direct fitness of the groomer, for example, through grooming of offspring by parents. Second, indirect fitness could increase through kin selection, for example in groups with older siblings grooming younger ones. Finally fitness could increase through reciprocal altruism, which may explain a number of grooming relationships in gibbons, especially those involving extra males or subadults.

Study of a burial discovered at Parc Montmorency (11G3F7), location of the first cemetery in Quebec City (1608-1688)

[Session 8]

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In 1972, renovation work was done on the ramparts surrounding old Quebec city, near Montmorency Park. At that time, it was decided to replace a cross located in the north-east

section of the park. While digging the trench, a single human burial associated with only a few animal bones was found by Parks Canada's archaeologists. In fact, the area excavated corresponds to the town's first cemetery. People were buried there between 1608 and 1688. According to various historians, this Catholic cemetery may contain burials of the settlers, who died from scurvy during the winter of 1608-1609. The analysed single human skeleton seems to correspond to a mature adult individual, possibly male but of unknown origin. Several palaeopathological conditions have been observed related to various dental (caries, abscess, malposition) and bone (possibly infection and/or trauma) diseases. Carbon and nitrogen isotope analyses were carried out on the bones, so as to further document the diet of the first inhabitants of Quebec city. Mean ^{13}C values (-12‰ vs VPDB) indicates a diet based on C_4 plants (containing maize and possibly sugar cane) and/or marine fish. Mean ^{15}N value (12.5 vs AIR) corresponds to the trophic level of meat and/or fish consumers. A C_4 "signature" can also be obtained by eating animal meat that ate maize. However, isotopic analysis carried on a ovicaprine (sheep or goat) bone found with the burial shows that it was fed on C_3 type foods (^{13}C : -20.18 vs VPDB). When comparing this individual with other North-Eastern American populations, the isotopic composition is similar to First nation people who cultivated maize. If further bone analysis leads to the identification of this individual being of European descent, these results could provide information on the use of local/indigenous food by (immigrant) settlers. Further work will be done here with additional comparative data and specialised techniques using other isotopes related to mobility and ancient DNA in order to better identify this specimen. The latter represents one of the oldest burials related to the settlement of Quebec city.

A test of the hypothesis that high dietary fat intake contributes to elevated ovarian steroid levels

[Session 7]

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Comparisons of ovarian steroid levels have consistently reported lower levels of progesterone and estrogens in samples from non-industrialized and non-“Western” populations (e.g., Democratic Republic of the Congo, Nepal, Bolivia, Bangladesh, China, Japan) than in those from industrialized Western populations (e.g., USA, UK). Many bioanthropologists have attributed this hormonal variation to differences in energetic factors (i.e., relatively lower caloric intake and/or higher caloric expenditure). On the other hand, some epidemiologists have proposed that specific nutrients, especially dietary fat, are of greater importance than total caloric intake. The hypothesized role of dietary fat in steroid-level variation is supported by animal studies but has been difficult to evaluate in humans, in part because dietary fat and caloric consumption are typically highly correlated in human dietary regimes. To break the degeneracy between fat and caloric intake, we compared progesterone levels in Mongolian nomadic herders (n=30) to those in German women (n=60). Both groups typically consume high levels of dietary fat (at least 40% of the diet), but Mongolians consume fewer total calories (about 20% less) and have an

energetically more demanding lifestyle than Germans. Based on enzyme immunoassays of saliva and urine collected daily throughout a complete ovarian cycle for each woman, we found that progesterone and progesterone metabolite levels in ovulatory cycles are significantly higher in Mongolians than Germans. This observation is consistent with the hypothesis that dietary fat consumption, independent of caloric intake, is an important (but not necessarily exclusive) determinant of human variation in ovarian steroid levels. These findings highlight the necessity for further investigation into factors, in addition to energy intake and expenditure that may generate variation in women's reproductive functioning and health. This research is supported by Wenner-Gren Foundation, Fulbright Senior Fellowship, MPI-EVAN, The Kinsey Institute and Indiana University (Bloomington).

Re-evaluating Classical Stereotypes in the Body Cavity Treatment of Ancient Egyptian Mummies

Competing for student prize [Session 4]

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Descriptions in the popular and academic literature, of the evisceration process, organ treatment, and body cavity treatment as part of the Egyptian mummification tradition, are derived largely from accounts by Herodotus and Diodorus Siculus. Our reliance on these normative descriptions obscures the wide range of techniques practiced, and so stifles the study of geographic, chronological, and social variations in the practice and their causes.

Using published descriptions in the literature and 3D reconstructions from computed tomography data, this study compares empirical data with classical descriptions of evisceration, organ treatment, and body cavity treatment. This empirical data is drawn from two samples: (1) a literature-based sample of 150 adequately described mummies, and (2) a sample of 9 mummies examined directly using computed tomography.

Techniques for accessing the body cavity, removal and treatment of the organs, and treatment of the eviscerated body cavity vary between time periods, sexes, and statuses, and are discussed in relation to their treatment in the literature and their radiological appearance.

In spite of the high degree of variability apparent in the literature as an aggregate, researchers continue to focus on stereotypes rather than on the rich variability in the Egyptian mummification tradition as it evolved across Egypt over the course of more than three millennia. In particular, the dogmatic contention that the heart was universally retained in situ, or replaced if accidentally removed, is greatly exaggerated.

"Stink Flirting" in Ring-tailed Lemurs (*Lemur catta*): Male Olfactory Displays Operate as Costly Signals Impacting Female Choice and Male Mating Success

[Session C]

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Ring-tailed lemurs (*Lemur catta*) communicate primarily via chemical signals and the visual and auditory displays associated with scent communication. Males engage in tail anointing and wafting displays towards both male and female targets. We examined the function of these

displays from male senders to female receivers in a mating context. Data were collected on two groups of wild ring-tailed lemurs at Berenty Reserve, Madagascar. Male tail anointing and wafting displays were shown to operate as costly signals of male genetic quality to pre-oestrous and oestrous females in three ways. First, tail anointing displays placed a male at risk, as males were targeted for aggression at a higher rate in the 40 seconds after tail anointing ($X + SE = 0.93 + 1.083$ g, $N = 120$) than they were during matched controls ($X + SE = 0.08 + 0.433$ g, $N = 120$). Second, females exhibited preferential mate choice for males who directed tail anointing and wafting displays towards them, even after controlling for male rank (anoint: $Trw, xy, z = 0.31, P = 0.01$, waft: $Trw, xy, z = 0.25, P = 0.02$). Finally, male mating success (copulations) correlated with the performance of tail anointing and wafting displays when male rank was controlled for (anoint: $d.f. = 12, r = 0.53, P = 0.05$, waft: $d.f. = 12, r = 0.55, P = 0.04$). This study provides the first evidence that male tail anointing and wafting displays impact mating outcomes in this species. These findings show how male ring-tailed lemurs use a species-specific behavioural display to bypass the bulletin board effect inherent in scent marking. These olfactory displays act as honest signals of genetic fitness while allowing a means for the efficient chemical transfer of genetic quality information from male to female.

Non-age Related Osteopenia: Implications for Paleopathological Analysis

[Session 1]

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In the last twenty years increasing attention has been paid to age-related and postmenopausal bone loss and osteoporosis in bioarchaeological research, as the importance of these conditions for knowledge of past communities and our understanding of current health issues have been recognised. There are however a wide range of other reasons why osteopenia and potentially osteoporosis might develop, and the authors were prompted to consider these when analysis of a the skeleton of a young male excavated from the Chalcolithic site of Wadi Fidan, Jordan revealed evidence of severe disuse osteopenia. Re-examination of data from two studies of age-related bone loss available to the authors revealed that both contained outliers, but no attention had been paid to these individuals during the original investigations. Examination of data from St. Martin's Birmingham revealed four young and seven middle adults with osteopenia. Examination of the skeletons was not possible due to re-burial, but records available from the site were good, and allowed conditions potentially associated with the low bone amount to be suggested for at least two individuals. This study demonstrates that consideration of potential reasons for lower than expected bone levels in outliers provides a fresh view on potential health problems faced by these individuals, in particular as a non-specific indicator of stress. An understanding of age-related bone loss in the past is important, but full consideration of outliers in future studies, would provide significant insights into a wide spectrum of health problems faced by individuals in the past.

Residential mobility at Cahuachi in the Nasca Region, Peru: Oxygen-isotope analysis of archaeological bone and enamel

[Session 5]

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The use of oxygen-isotope analysis to determine place of origin is based on the principle that tissue isotopic compositions primarily reflect the isotopic composition of drinking water, which in turn reflects the isotopic composition of environmental water. Here, oxygen-isotope analyses of enamel and bone from twenty individuals buried at Cahuachi are used to explore residential mobility in the Nasca Region, Peru. Enamel forms during childhood and is metabolically inactive, whereas bone undergoes continuous biochemical turnover throughout life. Comparing the isotopic compositions of bone and enamel pairs from the same individual can thus be used to detect changing place of residence during life. Further comparison of tissue isotopic compositions with environmental water baseline oxygen-isotope data for the Nasca Drainage allows more refined interpretations of geographic origins and relocation.

The isotopic data suggest that residential mobility, potentially over large distances, was common in Nasca society. The $\delta^{18}\text{O}$ phosphate enamel-bone differences range from -3.3‰ to +3.2‰, and $\delta^{18}\text{O}$ drinking water enamel-bone differences similarly range from -5.0‰ to +4.9‰. Of the twenty individuals described here, five are likely to have relocated during their lifetimes. Moreover, three individuals lived away from Cahuachi for most of their lives, moving to or being transported to the site for burial. The influence of Cahuachi as a ceremonial centre thus appears to have been spatially extensive, and the patterns of residential mobility inferred from the oxygen-isotope data may also have supported important inter-community relationships among dispersed Nasca settlements.

Women on the prehistoric Yorkshire Wolds: Changing quality of life from the Bronze to the Iron Ages

Competing for student prize [Session 1]

Katie **Whitaker**

University of York

The Yorkshire Wolds in England provided a unique opportunity to explore the changing well-being of individuals from prehistory owing to the prominent and extensive number of funerary monuments in the region. Eight sites spread over both periods resulted in a sample of 100, which were assessed to determine the quality of life experienced by these inhabitants. Inadvertently it was found that there was a significant demographic shift with an increase of females dying before the age of 35 from 46.2% of all females in the BA to 76.2% of females in the IA. At the same time the number of young adult males actually decreased from 51.4% in the earlier period to 41.7% in the later. As both sex and age were found to be statistically significant with respect to time period, this suggested that different mechanisms were at play with regards to health and longevity. Coupled with this alteration, subadult age at death also shifted towards the younger age categories with 100% of observed subadults aged at over 3 in the BA compared to the IA in which foetus and infants under 2 accounted for 45.45% of total subadults. As statistical associations were found for age and site for subadults in and between both periods this further

supported the belief that an alteration in the quality of life of individuals had taken place in the IA. An analysis of additional findings at adjacent sites on the Wolds provided auxiliary evidence to support this temporally-related theory. Supplementary investigations of a number of non-specific stress and degenerative variables as well as diet were also surveyed which continued to support the notion that the well-being of females during their developing and adult years decreased, which ultimately had a negative effect on the health and mortality of later generations. Overall, these findings suggest that it was much more difficult to be a female in the IA on the Wolds as only 23.8% reached middle age compared to 58.33% of males.

Relating Outcome Variables to the Bony Changes in Knee Osteoarthritis

[Session 1]

Janet Young

Canadian Museum of Civilization

This study examines osteoarthritic changes in the distal femur and how these changes relate to the pain and impairment experiences of a clinical sample population. Using MRIs, femoral condyles were examined for characteristic changes associated with osteoarthritis. Based on these observations, each femur was placed into a grade of severity with four categories, none to advanced, being used. Pain and impairment outcome variables associated with each knee were then collated for these four categories providing a range of experiences for each grade of osteoarthritis severity. The results suggest that those with advanced pathological changes have greater mobility limitations, greater disability during bending activities and were more likely to have pain interfere with work than those with little to no changes. Applying this information to archaeological populations will improve our understanding of the impact of disease on the individual and their role in ancient society.

NOTES

