Australasian Society for Human Biology

32nd Annual Conference, 5th to 7th December 2018
James Cook University
Townsville, Queensland, Australia

Advances in Human Biology:
Education, Research and Technology

Conference Programme and Abstracts

JAMES COOK UNIVERSITY
AUSTRALIA

Tuesday 4th December	
5:00 to 7:00pm	**Welcome Drinks** – Shaw and Co, City Lane, 383 Flinders St, Townsville. Registration bags will be available for collection.

Wednesday 5th December	
7:45am	**Bus transport** to *The Science Place*, JCU. Bus stop at 'Cactus Jacks' at 21 Palmer St.
8:15am	**Registration**
	Session 1: ANZACA and ASHB: Common Themes **Chairs:** Dr Monika Zimanyi and A/Prof Kate Domett
8:45am	**Welcome**
8:50am	**Secondary sex ratios following natural disasters in two primate species** Alison Behie
9:10am	**Student-created videos to aid learning in anatomy: benefits and limitations** Alexandra Webb, K Esteves and K Valter
9:30am	**Operation Lima Sea – Unidentified remains of a human torso in Queensland: Case report on the collaborative investigation and anthropological roles in the identification process** Donna MacGregor, Mikaela S Reynolds and Jon Birt
9:50am	**Comparison of hip stabiliser muscle activity during gait in people with hip osteoarthritis and matched controls** A Zacharias, T Pizzari, AI Semciw, DJ English, T Kapakoulakis and Rod A Green
10:10am	**Advances in Multidimensional Perspectives on How Teeth Grow** Tanya M Smith
10:30am	Morning Tea

11:00am	**Workshop 1A:** *Incorporating evidence-based strategies for Learning in your classroom* **Presenter:** A/Prof Danielle Royer	**Workshop 1B:** *Tweet your research* **Presenters:** A/Prof Sian Halcrow, Dr Justyna Miszkiewicz
	In this workshop, Dr. Royer will introduce key cognitive strategies for learning and review the evidence in support of each. She will discuss how she incorporates these strategies into her classroom, and highlight examples shared by participants. Participants will work together to develop a plan for incorporating the evidence-based strategies into their own classrooms.	This workshop will be an interactive 'how to' tweet your science, catering for beginners to Twitter to those with more experience with this social media platform. We will cover topics including establishing your Twitter purpose/s, developing your Twitter presence, social media etiquette, tips for positive engagement, and enhancing your research, and professional development and impact.
12:30pm	Lunch	
1:30pm	**Workshop 2A:** *Anatomy teaching for science and medical students: ideas and innovations* **Presenter:** Prof Simon Parson	**Workshop 2B:** *Increasing Research Impact through Strategic Publishing and Media Attention* **Presenter:** Dr Alison Behie
	We often focus on what we can deliver to our students, concentrating on a series of lectures and practical classes to 'cover' specific topics. An alternative approach is to consider what they might need or expect and how we might best enable that. Through a series of activities, we will explore different ways to think about course design and delivery for undergraduates and postgraduates.	With research impact becoming increasingly important for our professional development, this workshop will focus on two different, but equally important avenues to increase your own research impact. For this hands on workshop each participant will bring an abstract from a current research article or project. With assistance from your colleagues and an expert panel we will help you to think about the best journal in which to publish this work as well as the 'media hook' that will engage public interest.

3:00pm	Afternoon Tea
3.30pm	**Workshop 3: *Active learning tips and tricks*** **Presenters:** Dr Pam Megaw and A/Prof Peter Johnson
	Most of us will have all heard of 'active' learning as a way of getting students to engage in class and with their own learning process, but what is it really, and how do you do it? Can you do it in a class with lots of students or only in small classes? Do I need to be a master of technology to make this work in my classes? Can I do it during lectures? Can I use it for assessment? All this and more will be trialled and explained during this workshop. We will have technology based and not-so-technology based examples of learning activities you could implement in class sizes of 5-500. So come along and be prepared to be active, entertained, and astounded *If you do not wish to attend Workshop 3 we suggest you take an extended afternoon tea to catch up with colleagues until the bus departs*
5:00pm	End of Day 1
5:15pm	**Bus departs** for Palmer St

	Thursday 6th December
8.15am	**Bus transport** to *The Science Place*, James Cook University Bus stop outside 'Cactus Jacks' at 21 Palmer St
8:30am	Speakers for ALL today's sessions to upload presentations on PC. Please put up your poster on the boards on the ground floor.
	Session 1: Evolution **Chairs:** Dr Alison Behie and Ms Jade De La Paz
9:00am	**Male violence and self-domestication in human evolution** *Ben Gleeson
9:15am	**Palaeoneurology and digital anatomy: predicting skull-brain evolution in fossil platyrrhines** *Alannah Pearson, P David Polly and Emiliano Bruner
9:30am	**Wading, and other Waterside Hypotheses of Human Evolution** Algis V Kuliukas
9:45am	**Reconstructing the Last Common Ancestor of the Homininae: A subspecies approach** *Keaghan Yaxley and Robert Foley
10:00am	**Using cold-induced vasodilation response as one approach to testing evolutionary scenarios related to peopling of the Pacific** Bruce Floyd
10:15am	Discussion panel
10:30am	Morning tea
	Session 2: Community engagement and insight **Chairs:** A/Prof Siân Halcrow and Miss Ariane Maggio
11:00am	**Gaining community insight on the use of tuberculosis isolates grown from diagnostic sputum samples: A research project in progress** Anneka Anderson, Julie Park, Judith Littleton, Vic Arcus and Sally Roberts
11:15am	**An Example of Industry Engagement: A Western Australian Study of Grandparents Raising their own Grandchildren** David A Coall, Ruth Marquis, Francesca Robertson, Liz Wenden and Katrina Stratton
11:30am	**The perceived influence of grandparents on parents' paediatric vaccination decisions in a WEIRD society** *Shantha P Karthigesu, James S Chisholm, David A Coall

11:45am	**The Placenta Project: Characteristics in Assisted and Non – Assisted Pregnancy for a Western Australian Cohort**
	*Julie Sartori, Anna C Callan, Peter Roberts Michelle Tickner, Michelle Cannon, Julie Quinlivan & David A Coall
12:00pm	Discussion Panel
12:15pm	Lunch
1:15pm	**Session 3: Posters** *(presenters please stand by your poster)*

Putting your eggs in many baskets: A multidisciplinary approach to teaching forensics
Jemma A Berry, Anna C Callan, David A Coall and Peter Roberts

Skeletal Robusticity Analysis of North American Subsistence Strategies
Karen Cooke and Justyna J Miszkiewicz

The Incus – an indicator in Hominin Evolution
Marina C Elliott, Rolf Quam, Shahed Nalla, Darryl J de Ruiter, John Hawks, Lee R Berger

Less destructive technique for ancient DNA analysis from the human temporal bone: A case study from Neolithic Catalonia, Spain
Sharna Katzeff, Tina Jakob, Manuel Edo-Benaiges and Eva Fernández-Domínguez

"Stress" at Roonka: Anomalous or explicable?
Judith Littleton and Caitlin Smith

Do ante-mortem and peri-mortem trauma accelerate the skeletonization of surface deposited human remains in Australian conditions?
*Jennifer Menzies, Sarah Croker and Denise Donlon

Occipital bone histomorphometry reveals bias in sex estimation from human cranial macro-anatomy
*Chelsea E B Morgan, Siân E Halcrow, Catherine Frieman, Peter Bellwood and Justyna J Miszkiewicz

Preliminary findings from the bioarchaeological investigation of an ancient Mayan funerary cave from Moxviquil, Chiapas, Mexico
Stanley Serafin, Elizabeth H Paris, Roberto López Bravo, Breanna McGaughey, Hayley Van Den Berg and Jacqueline Harper

To what extent does rib microstructure reflect its non-strenuous macro-anatomical environment?
Tahlia J Stewart, Julien Louys and Justyna J Miszkiewicz

Evaluating the effectiveness of an e-book for Anatomy
Alexandra Trollope, Maria Bellei, Torres Woolley and Ryan Harris

Preliminary insights into enamel formation in a human tooth from Dong Son Metal Period Northern Vietnam
Stephanie M August, Justyna J Miszkiewicz, Patrick Mahoney, Rachel Wood, Lam My Dung, Nguyen Kim Thuy and Philip J Piper

	Session 4: Ecotourism, social dynamics and cognitive complexities
	Chairs: Dr Bruce Floyd and Miss Gabriela Guizzo Dri
2:00pm	**A preliminary investigation of the impact of tourist presence on the behaviour of the northern yellow-cheeked crested gibbon (*Nomascus annamensis*) in Cambodia**
	*Jessica Williams and Alison M Behie

2:15pm	**The Object Permanence Abilities of Two Gibbon Species: *Hoolock leuconedys* and *Nomascus leucogenys***
	*Amy King and Alison M Behie
2:30pm	**The habitat of the Cat Ba langur (*Trachypithecus poliocephalus*) and its potential for expansion**
	*Kirrily Apthorp, Alison M Behie and Nicholas Matzke
2:45pm	Afternoon Tea
	Session 4 (continued)
	Chairs: Dr Sarah Croker and Ms Cynthia Parayiwa
3:15pm	**Within-Group Social Dynamics and Pair Bonds in Captive and Rescued Javan Gibbons (*Hylobate moloch*)**
	*Jennifer Hale, Nicholas Malone and Bruce Floyd
3:30pm	**Site of significance: preliminary research on a population stronghold of the endangered silvery gibbon (*Hylobates moloch*)**
	Nicholas Malone
3:45pm	**Motion affects snake perception in the brown mouse lemur (*Microcebus rufus*)**
	Anja Deppe
4:00pm	Discussion Panel
4:15pm	**ASHB AGM**
5.30pm	**Bus departs** for Palmer St

Friday 7th December	
8:15am	**Bus transport** to James Cook University: Bus stop outside 'Cactus Jacks' at 21 Palmer St
8:30am	Speakers for today's sessions to upload presentations
	Session 5: Qualitative and quantitative approaches to establishing identity and their forensic applications
	Chairs: Ms Donna MacGregor and Miss Kirrily Apthorp
9:00am	**The Relationship Between Soft Tissue Anatomy and Skeletal Sexual Dimorphism in the Cranium and Clavicle: A Metric Approach to Morphological Sex Estimation Methods in Forensic Anthropology**
	*Jade S De La Paz, Stephanie Woodley, Hallie Buckley and Siân E Halcrow
9:15am	**Quantitative histological age estimation of the femoral cortex: a test of Singh and Gunberg (1970) and Goliath et al. (2016)**
	*Ariane Maggio, Ambika Flavel and Daniel Franklin
9:30am	**Temperature variations in the micro-climates of surface-deposited human remains: further factors to consider in time-since-death estimation**
	Sarah Croker, Jennifer Menzies and Denise Donlon
9:45am	**The Caldwell & Moloy Classification of Female pelvic shape: Still Relevant after 80 years?**
	Lesley J Kuliukas
10:00am	Discussion Panel
10:15am	Morning Tea
	Session 6: Maternal and childhood health
	Chairs: Dr Justyna Miszkiewicz and Ms Shantha Karthigesu
10:45am	**Subsistence Strategies and Child Growth in Two Rural Communities in Timor-Leste**
	Debra S Judge and Phoebe R Spencer
11:00am	**Effects of prenatal maternal stress on birth outcomes following tropical cyclone Yasi in Queensland, Australia (2011)**

	*Cynthia Parayiwa and Alison M Behie
11:15am	**Dietary Assessment Methods, Household Dietary Diversity and Child Growth in Rural Timor-Leste** *Gabriela Guizzo Dri, Katherine A Sanders and Debra S Judge
11:30am	**The effects of prenatal exposure to seasonal food shortage on childhood growth trajectories in rural Timor-Leste** *Phoebe R Spencer, Katherine A Sanders and Debra S Judge
11:45pm	Discussion Panel
12:00pm	Lunch
	Session 7: Unlocking secrets of the skeleton **Chairs:** A/Prof Tanya Smith and Ms Lucy Pedersen
1:00pm	**The potential use of vibrational spectroscopy in the geographic profiling of human teeth** *Nellie Elizabeth Pretorius
1:15pm	**Investigating settlement patterns and questions of mobility in Mithaka country, on the eastern edge of Australia's arid centre** Michael C Westaway, Shaun Adams, Douglas Williams, Kelsey Lowe, Justyna Miszkiewicz, Betty Gorringe and Max Gorringe
1:30pm	**Exploring the effects of insularity on skeletal growth dynamics in ancient humans and fossil rats from Indonesia** Justyna J Miszkiewicz, Patrick Mahoney, Julien Louys, Sue O'Connor, Bronwyn Wyatt and Peter Bellwood
1:45pm	**An investigation of the impact of maternal condition during pregnancy and birth on the microstructure of children's teeth** Alison M Behie and Justyna J Miszkiewicz
2:00pm	Discussion Panel
2:15pm	Afternoon Tea
	Session 8: Qualitative and quantitative approaches to establishing identity and their bioarchaeological application **Chairs:** Dr Nicholas Malone and Ms Chelsea Morgan
2:45pm	**Poor Old Women: unfurnished female burials in Early Anglo-Saxon England** Christine Cave
3:00pm	**A bioarchaeological examination of two Late Neolithic commingled skeletal assemblages from Marge del Moro cave and Can Figueres cave, Catalonia, Spain** Sharna Katzeff, Tina Jakob, Concepció Castellana-Perelló, Pablo Martínez-Rodríguez, Manuel Edo-Benaiges and Eva Fernández-Domínguez
3:15pm	**Burials Among the Megaliths: Recent bioarchaeological research at 'Plain of Jars' Site 1, Xieng Khouang, Laos** Siân Halcrow, Kate Domett, Dougald O'Reilly, Louise Shewan and Thonglith Luangkoth
3:30pm	Discussion Panel
3:45pm	**Student Prizes Announced**
4.15pm	**Bus departs** for Palmer St
6.30pm	**Conference pre-dinner drinks and dinner:** Kingston Room, **Rydges Southbank** 23 Palmer St (07 4726 5265). For those who have booked the conference dinner we will meet at 6.30pm for a pre-dinner drink (one free drink is included), followed by dinner starting at 7pm (two course, alternate drop).

*These are student presentations eligible for the "ASHB Student Prize".

Gaining community insight on the use of tuberculosis isolates grown from diagnostic sputum samples: A research project in progress

Anneka Anderson[1], Julie Park[2], Judith Littleton[2], Vic Arcus[3] and Sally Roberts[4]
[1] Te Kupenga Hauora Māori (Dept. of Māori Health), The University of Auckland
[2] Anthropology, School of Social Sciences, The University of Auckland, New Zealand
[3] Biological Sciences, the University of Waikato
[4] Auckland District Health Board

Sensitivities about human tissue used for research are well known. This project investigates the issues and sensitivities around approaches to human-derived microbial-pathogen laboratory research, with a focus on tuberculosis (TB) isolates, of three New Zealand community groups. Findings from the study will inform guidelines for the treatment, management and use of human-derived pathogen samples for future research. The research is multidisciplinary, including anthropologists, biological and medical scientists. The research used a qualitative, kaupapa Māori-consistent approach. This framework incorporates the key principle of partnership, operates under a critical structural analysis and promotes benefits to communities through the inclusion of Māori and non-Māori participants and researchers. Data collection included: consultative meetings; focus group interviews; individual or pair interviews. The three participating community groups were: 1. Māori; 2. a community which has (mainly) migrated relatively recently to New Zealand from Oceania; 3. a community which has (mainly) migrated relatively recently from the greater 'Asia' area. Preliminary observations indicate that there are a range of sensitivities about the use of isolates: from no sensitivity to specific concerns. There is high sensitivity about the use of data produced and about the privacy of those who gave the original samples. Community sovereignty and governance of research processes involving isolates are highly valued. As well as informing approaches to human-derived microbial-pathogen laboratory research, this project demonstrated the importance of a partnership approach and inclusion of community voice.

The habitat of the Cat Ba langur (*Trachypithecus poliocephalus*) and its potential for expansion

*Kirrily Apthorp[1], Alison M Behie[1] and Nicholas Matzke[2]
[1] School of Archaeology and Anthropology, The Australian National University, Australia
[2] Department of Biological Sciences, The University of Auckland, New Zealand

The Cat Ba langur (*Trachypithecus poliocephalus*) has a total population of 66 individuals, making it one of the most critically endangered primates in the world. Endemic to Cat Ba Island, Vietnam, the only wild breeding population is split into two main groups, separated from one another by a 23km coastline. Undertaking the first analysis of the Cat Ba langur's habitat and ecology, this study examines the ecological profile of the two main langur habitats and compares them to an area identified as a potential corridor to unite the two groups. The home ranges of the langurs and the corridor area were sampled by 36 ecological plots, each measuring 100m². Vegetation densities, species identification, and diameter at breast height, were all recorded to establish a full profile of the limestone forest used by the langurs. Distribution modelling using GIS techniques were also used to determine the actual and potential distribution of the langurs, in association with traditional statistical analysis to compare the three regions. Results suggest that the Cat Ba langur has adapted to a heterogeneous habitat in response to substantial human intervention on the island. As the potential corridor area does not significantly differ from the two home ranges, this study suggests that the region should be protected against development and further studied as a strong candidate for a connecting vegetation corridor or habitat expansion. This research provides a critical insight into the habitat of the Cat Ba langur and offers suggestions for future conservation efforts on the island.

Secondary sex ratios following natural disasters in two primate species

Alison M Behie
School of Archaeology and Anthropology, The Australian National University

It is generally thought that in human male offspring are produced less under stressful conditions with a reduction in the number of males born relative to females following economic crises and natural disasters. While this is assumed to be due to increased stress, it is hard to isolate stress from cultural influences in humans. This study is the first to explore sex ratio at birth, or secondary sex ratio (SSR) in primate species following disasters to better isolate the role of the environmental change itself. Birth patterns and SSRs of black howler monkeys (*Alouatta pigra*) and Yucatan spider monkeys (*Ateles geoffroyi yucatanensis*) are reported both before and after two separate hurricanes in Belize. Neither species had any births in the year following each hurricane. In the first three years after this, howler monkeys showed a sex ratio not different from expected at 1:0.85 (54% infants born were male) while spider monkeys showed a largely male biased SSR at 11:1 (92% of infants born were male). This was a significant deviation from the 1:1.6 pre-hurricane SSR in the same population. Infant mortality was 61.5% in howler monkeys and only 9% in spider monkeys, with a tendency for more male infants to die in the first year of life than females. While preliminary, results show the opposite SSR skew that is expected in humans, with more males being born in the aftermath of a natural disaster. This suggests there is no clear pattern across primates regarding how stress impacts offspring sex production.

An investigation of the impact of maternal condition during pregnancy and birth on the microstructure of children's teeth

Alison M Behie and Justyna J Miszkiewicz
School of Archaeology and Anthropology, The Australian National University, Australia

Deciduous dental enamel forms *in utero* through a controlled process which is sensitive to physiological disruptions. The neonatal line (NL) is a microscopic marker that can be used to investigate a baby's pre- and postnatal environment. Despite existing evidence that maternal condition impacts the health of a baby, limited research has been undertaken to examine dental microstructure in children of mothers with known pregnancy conditions. Here, we evaluate the effect of maternal health factors (including stress, illness, alcohol consumption, smoking, delivery method) on the thickness of NL and enamel in deciduous teeth. Mothers (n=53) donated their children's teeth (n=65) and were interviewed about health during pregnancy and their experience of birth. Collected teeth were analysed histologically to record NL and enamel thickness. Our analyses found no statistically significant relationships between maternal health measures and NL or enamel thickness, except for alcohol consumption during pregnancy and the ratio of NL: enamel thickness (n = 62, U = 374.000, p = 0.029). Descriptive analysis found a preliminary pattern of thinner NL and enamel in children whose mothers smoked during pregnancy, and for siblings whose mother had different pregnancy health experiences with each child. These results highlight the complexity of the mother-offspring relationship and its link to enamel formation. They also suggest lifestyle choices of alcohol consumption and smoking appear to have negative effects on developing deciduous teeth. This has implications for our current understanding of mother-health biology as well as the reconstruction of human life history from ancient human dental remains.

Putting your eggs in many baskets: A multidisciplinary approach to teaching forensics

Jemma A Berry[1], Anna C Callan[1], David A Coall[1,2], and Peter Roberts[1]
[1] School of Medical and Health Sciences, Edith Cowan University, Australia
[2] School of Medicine, The University of Western Australia, Australia

The popularity of crime shows like CSI: Crime Scene Investigation, Bones and NCIS, has led to an increased interest in forensic degrees. There has not, however, been a parallel surge in forensic job opportunities, leaving many specialist forensic graduates with limited opportunities to practise their skills. In establishing a Forensics Major, Edith Cowan University has taken a multidisciplinary approach, embedding the essential forensic skills within the broader framework of the already successful Biomedical Science degree. Students at ECU receive training in a variety of forensic skills across the 8 units that comprise the new major, two units are designed around digital technologies, two units cover the application of genetics in a forensic setting, one unit deals with coronial law and mortuary practise, whilst the remaining three units are dedicated to the development of a broad range of practical forensic laboratory and field work skills. The remaining 16 units that comprise the core Biomedical Science degree provide further theoretical and practical skills training in fields such as genetics, chemistry, biochemistry, microbiology, anatomy and physiology, anthropology, reproductive biology and ethics. Building the Forensics Major around a more universal skills framework allows our students to follow their passion for forensics, whilst also developing an extensive base from which to enter the workforce. Ultimately, we hope this increases their opportunities to enter specialist forensics employment.

POOR OLD WOMEN: unfurnished female burials in Early Anglo-Saxon England

Christine Cave
School of Archaeology and Anthropology, The Australian National University, Australia

Research has shown that in general old women receive a lesser treatment in their burial in Early Anglo-Saxon England than their menfolk, although there are some exceptions. Left out of such studies are those who receive no grave goods (or at least none able to survive almost two centuries of taphonomic processes). There are many possible reasons for depauperate burials, including poverty, a different ethnicity to the majority or the death of a passing traveller. Of 367 burials in the three Early Anglo-Saxon cemeteries of Great Chesterford Essex, Mill Hill Deal Kent and Worthy Park Kingsworthy Hampshire, 12 (3.3%) were unfurnished female burials (compared to 13 unfurnished male burials). Of these, five were aged at greater than 45 years, six younger than 45, and one was unable to be aged. This paper examines the graves and the remains of these women to attempt to discern possible reasons for their 'poor' status in death. We find that these women were buried in smaller graves by volume on average than other women, despite the graves being (on average) deeper; they were also more likely to have been placed carelessly in the grave. These poor women were more likely to display cribra orbitalia, linear enamel hypoplasia, osteoarthritis and evidence of trauma than their wealthier sisters, but were less likely to have dental caries or antemortem tooth loss. These conclusions suggest that their theorised poverty was actual poverty and their position may have been that of slaves or very low status servants.

An Example of Industry Engagement: A Western Australian Study of Grandparents Raising their own Grandchildren

David A Coall[1,2], Ruth Marquis[1], Francesca Robertson[3], Liz Wenden[1] and Katrina Stratton[4]
[1] School of Medical and Health Sciences, Edith Cowan University, Australia
[2] School of Medicine, The University of Western Australia, Australia
[3] Kurongkurl Katitjin, Edith Cowan University, Australia
[4] Wanslea Family Services, Belmont, Australia

The interdisciplinary nature of human biology provides a useful framework for research engagement with industry partners. This paper details an interdisciplinary industry collaboration with Wanslea, a non-government organization (NGO) that utilized expertise across the disciplines of human biology, occupational therapy, psychology and social work. Wanslea, a NGO that provides services for grandparents who are raising their own grandchildren, identified the need to understand the health, experiences, needs and service availability for these grandparents when taking on the work of full-time parenting again. This research project aims to provide the quality data necessary to guide policy and practice into the future. This paper will present an overview and progress of three studies across the first year of this state-wide project. First, an overview of the first 300 surveys completed by grandparents who are raising their own grandchildren will be presented. Second, innovative methods used to access the voices of marginalized grandcarers in the Kimberly region of Western Australia will be described. Finally, based on previous research, the views of grandchildren from grandcarer families will be accessed through the evaluation of respite and skill development camps. The structure of these camps will be outlined. This project illustrates how a research program grounded in human biology can be specifically designed to meet the needs of industry partners, attract industry funding and ultimately, inform service delivery and policy development.

Skeletal Robusticity Analysis of North American Subsistence Strategies

Karen Cooke and Justyna J Miszkiewicz
School of Archaeology and Anthropology, The Australian National University, Australia

As populations adopt new subsistence strategies, significant changes to activity and mobility accompany these developments. This manifests in human limb robusticity variation per individual and population, as the skeleton undergoes long-term adaptation to changing biomechanical loads. Many studies scale their robusticity evaluations using body mass estimates (BME) calculated from bone tissue data, but these introduce an increased error of estimate. Here, we standardise prehistoric North American bone midshaft size by its maximum length to investigate 1) whether subsistence strategies are reflected in bone robusticity, 2) whether these changes differ by sex and activity type within each subsistence group.

Right femur and humerus data from the Goldman Osteometric source were examined on groups of foragers (n=74), horticulturalists (n=119), agriculturalists (n=150), and Alaskan foragers (n=159) to calculate antero-posterior (AP) and medio-lateral (ML) robusticity indices. Results reveal that AP and ML robusticity of long bones was 1) significantly ($p < 0.001$) related to subsistence strategy with Alaskan foragers being the most robust, 2) significantly different between males and females in all strategies, but unexpectedly inconsistently variable in direction of activity within subsistence. Results agree with rigorous biomechanics in Alaskan foragers and agriculturalists, and support the effect of sex-division of labour on skeletal adaptation. Comparisons of our findings to skeletal robusticity results based on equations that include BME or cortical area demonstrate disparate outcomes. This is clear even when examining the same bone and geographic origin. Future studies into ancient human skeletal robusticity should consider these differences in results when selecting methodologies.

Temperature variations in the micro-climates of surface-deposited human remains: further factors to consider in time-since-death estimation

Sarah Croker, Jennifer Menzies and Denise Donlon
Discipline of Anatomy and Histology, School of Medical Sciences, The University of Sydney, Australia

This study compared the temperatures experienced by two donor bodies 10 metres apart at AFTER, western Sydney, NSW. Temperature is thought to be the most important factor affecting the decomposition of a body. Yet temperature can potentially vary over very short distances, depending on proximity to the ground and exposure to sunlight. Temperature was recorded hourly at the soil surface and one metre above each body, and compared with data from the closest official weather station (10 kilometres away, temperature recorded 1.2 metres above ground in shade). Mean soil temperature was higher than air for both bodies (by 0.80° and 0.95°). Mean air temperature was 0.3° higher for one body, driven by greater spikes in high temperatures during the day (maximum of 60° compared with 52°), though they were similar at night. Both bodies recorded higher air temperatures than the official weather station, due partly to the sunny position of the data loggers. In most taphonomic studies, daily maximum and minimum temperatures are averaged to represent daily mean temperature, but this did not reflect the average of 24 hourly readings for our bodies, due to brief but intense increases in temperature in direct sunlight. Although recordings taken in sunlight may seem to artificially inflate the maximum temperature, these are nevertheless what the body has experienced and are therefore valid. Temperature is only one of many factors affecting decomposition rates, but as it is an important one then subtle variations due to a body's specific site of deposition should be considered.

The relationship between soft tissue anatomy and skeletal sexual dimorphism in the cranium and clavicle: a metric approach to morphological sex estimation methods in forensic anthropology

*Jade S De La Paz, Stephanie Woodley, Hallie Buckley and Siân E Halcrow
Department of Anatomy, University of Otago, New Zealand

In forensic anthropology, an absent pelvis requires the use of other morphological sex estimation methods. However, these methods can lack reliability due to population variation and the subjectivity and experience required for scoring skeletal morphology. This proposed research seeks to improve accuracy in sex estimation from the cranium and clavicle, using both clinical anatomy and biological anthropology in a multidisciplinary approach. The main aim is to determine if skeletal sexual dimorphism is similarly expressed in skeletal and soft tissues and if this can improve sex estimation in anthropology. The nuchal crest and mastoid processes of the cranium, and the rhomboid fossa of the clavicle will be studied using bequeathed cadavers from modern European New Zealand and Thai populations. Muscles and ligaments associated with these sites will be dissected and analysed for size/volume, while the skeleton will be assess for robusticity. A positive correlation is hypothesized to exist between sex, skeletal robusticity, and muscular size at these sites, however, factors, such as activity and age will also be considered. Following this, collected data will be used to develop a novel metric sex estimation method, which will be validated on temporally variable skeletal populations from New Zealand, Thailand and Tonga. Development of a population-specific metric sex estimation method will compliment and strengthen established morphological methods and contribute to improving the accuracy of sex estimation from the cranium and clavicle. It will also add valuable comparative data to the literature and have a direct impact on accuracy of sex estimation in practical casework.

Motion affects snake perception in the brown mouse lemur (*Microcebus rufus*)

Anja Deppe
School of Archaeology and Anthropology, The Australian National University, Australia
Centre ValBio, Ranomafana, Madagascar

The tiny mouse lemurs are subject to high levels of predation by birds, mammals and snakes. This study investigated how brown mouse lemurs (*Microcebus rufus*) captured in Ranomafana National Park, Madagascar, perceived snakes under three experimental conditions: motionless, moving, or invading. Ninety-one subjects were exposed to a snake model and a novel control object (glove) in an experimental enclosure. Behavioral responses were categorized into four outcomes: High Fear, Fear, Curiosity and Ignore. Overall, mouse lemurs perceived the snake as significantly more dangerous ($p<0.01$) than the control. The moving snake was perceived as significantly more dangerous than the moving control, and as significantly more dangerous than the still snake. Movement might simply direct attention or could indicate that an object is alive. The invasion condition where the stimulus was placed into the enclosure from above was the only condition that triggered aggressive behaviors such as lunging and biting. While attacking a predator seems maladaptive, it might be warranted in situations of acute and immediate danger. This study suggests that brown mouse lemurs are able to distinguish a predator (snake) from a non-predator, and that they use shape and motion cues to make risk assessments. Behavioral variation among mouse lemurs further suggests that snake recognition and making judgements about risk may be affected by learning and experience.

The Incus – an indicator in Hominin Evolution

Marina C Elliott[1], Rolf Quam[2,3,4], Shahed Nalla[1,5], Darryl J de Ruiter[1,6], John Hawks[1,7], Lee R Berger[1]

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[5] Department of Human Anatomy and Physiology, Faculty of Health Sciences, University of Johannesburg, South Africa
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Three fossil incus bones were recovered during sieving of excavated sediments within the Dinaledi Chamber in the Rising Star cave system in South Africa. These elements form part of a large assemblage of fossils associated with the new hominin species, *Homo naledi*. Morphologically and metrically, the Dinaledi ossicles resemble those of chimpanzees and *P. robustus* more than later members of the genus *Homo* and fall outside of the modern human range of variation. When overall size is considered, functional lengths in *H. naledi* and *P. robustus* are very similar to those predicted for a human with a similar-sized incus. Both taxa would seem to show a relatively elongated functional length, distinguishing them from chimpanzees. The functional length in *H. naledi* is slightly longer in absolute terms than in *P. robustus*, suggesting *H. naledi* may show a slight increase in the incus functional length compared with early hominins. *H. naledi* lacks the more open angle between the long and short processes found in modern humans, and which is a derived feature within genus *Homo*. PCA of standardized variables shows *H. naledi* falling outside of the recent human range of variation, but within the confidence ellipse for gorillas. DFA classified *H. naledi* with gorillas. The generally primitive nature of the incus is consistent with other primitive features of *H. naledi*, such as the very small

cranial capacity. These elements provide important new data on the morphology of *Homo naledi* and possible insights into the behavior and phylogenetic place of this new species.

Using cold-induced vasodilation response as one approach to testing evolutionary scenarios related to peopling of the Pacific

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Austronesian speakers in Polynesia are significantly taller with greater skeletal breadths than other closely related peoples in Island Southeast Asia. One hypothesis is that this is the result of intense selection from hypothermia during long-distance voyages of colonization of Remote Oceania. In the presentation I evaluate this hypothesis by comparing the distributions of cold-induced vasodilation response among a number of Asian peoples, including Austronesian speaking participants in the Philippines, Indonesia and Malaysia, with those of Polynesian participants. So far data from 197 participants have been gathered with 138 of the participants being tested two or more times. Following submersion of participants' right hands to wrist level in $8^{o}C$ water, the capacity to rewarm the middle finger in response to cooling by periodically increasing peripheral blood flow was assessed. The average temperature difference between skin and water temperatures measured every two seconds from the first minimum value to the end of 30 minutes was the primary outcome variable. I anticipate that if the hypothesis is true, then Polynesian participants should have a distribution of average temperature differences significantly lower than for other Austronesian-speaking participants. Although data are not fully analysed, evidence suggests similar levels of CIVD response among Austronesian-speakers thus rejecting the hypothesis.

Male violence and self-domestication in human evolution

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Replicated experimental evidence demonstrates the emergence of a syndrome of correlated traits among domesticated vertebrate populations in response to selection for less aggressive reactivity. Both Y-DNA and existing fossil evidence suggests early animal domestication occurred via unconscious selection for less reactive and dangerous males. Fossil morphology shows human self-domestication also occurred primarily as a reduction in physiological masculinity, implying corresponding selection against male behavioural reactivity and violence. Several recent authors identify this process as an essential component in the expansion of human sociability and 'hyper-cooperation' that allowed for the emergence of complex languages, technology, and civilisations. However, civilisation has not banished all human violence. In fact, with greater sociability, new forms of collective violence are possible. Notably, present social metrics continue to reflect a bimodal distribution of violence, with males being relatively more predisposed to violent behaviour. Despite the above, current depictions of 'human' violence often obscure or ignore these sexual differences as well as the essential role of reduced interpersonal aggression in recent human evolution. I conclude by considering what this assessment of humanity's evolutionary history of male violence means for existing social and scientific discourse.

Dietary assessment methods, household dietary diversity and child growth in rural Timor-Leste

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The association between household food diversity and child growth in Timor-Leste has not yet been demonstrated. Due to the memory-reliant nature of 24-hour recalls, variations in household dietary diversity have been difficult to capture. This study determines the extent of agreement between 24-hour recalls and a new food card reporting method, and relates variations in household dietary diversity children's growth.

Households were interviewed in Natarbora, a rural Timorese community. The height and weight of children were measured, and short-term growth, as measured by weight-for-age and Z-BMI scores, were calculated. Lead household females were asked to place picture cards into a box for each corresponding food that was prepared throughout the day. Twenty-four-hour recalls, coinciding with the card activity period, were compared to measure their extent of agreement. Household dietary diversity was measured via Food Variety Scores (FVS) and Dietary Diversity Scores (DDS).

Card FVS and DDS differed significantly from their equivalent 24-hour recall (FVS: $p=0.001$, DDS: $p=0.013$, Wilcoxon-sign-rank). Staple starches, vitamin-A-rich foods, vegetables, and eggs were typically underreported in recalls ($p<0.05$), while most households had similar reporting frequencies for fruit, legumes, animal-sourced-foods, and sugar consumption. Children in households with greater FVS and DDS had significantly better weight-for-age and Z-BMI scores. The FVS was a better predictor for weight-for-age ($t=3.093$, $p=0.003$) while DDS was a better predictor for BMI ($t=2.677$, $p=0.009$). This study reveals that there is a trend to under-report food consumption in 24-hour recalls; future studies need to take under-reporting into consideration when measuring household dietary diversity in Timor-Leste.

Burials Among the Megaliths: Recent bioarchaeological research at 'Plain of Jars' Site 1, Xieng Khouang, Laos

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The Plain of Jars near Phonsavan in Xieng Khouang Province, Laos was first explored archaeologically by Madeleine Colani in the 1930s but only limited research has been undertaken since that time. This paper details the first detailed bioarchaeological findings from the excavation of 'Site 1', a megalithic jar site with nearly 400 jars of varying size. In total, a minimum number of eighteen individuals were recovered. The site has a good representation of individuals of different ages, with a high proportion of foetuses, infants, and with at least one male and one female adult preserved. A high percentage (11/18, 61%) of individuals were infants and children, with almost half of these dying at the foetal stage or in early infancy. This is typical of a growing population, and/or one suffering from high stress. The bone preservation is mostly very poor with some evidence for termite damage affecting the integrity of the bones, limiting detailed analyses of the age and sex for most of the adults and any non-dental palaeopathological analyses details. Our research reveals the existence of a range of mortuary behaviour and the potential relationship between the internments and the megalithic jars. The results are interpreted within the context of new preliminary dating for these interments.

Within-Group Social Dynamics and Pair Bonds in Captive and Rescued Javan Gibbons (*Hylobate moloch*)

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Gibbons (Hylobatidae) are the only apes, and of few of the primates, to typically form monogamous, two-adult, pair-bonded groups. Gibbon social dynamics were once thought to be simple and fixed. However, evidence for the flexibility of gibbon social dynamics across species and contexts is growing. The 18 species of hylobatids are also at risk of extinction, with one classified as vulnerable, 13 as endangered, and a further four considered critically endangered (IUCN Red List 2018). An in-depth understanding of gibbon social behavior is necessary to implement successful conservation programs and aide captive management. Here, I investigate the within-group social dynamics of Javan gibbons (*Hylobates moloch*) at Perth Zoo and at the Aspinall foundations Javan Primate Rescue Center. In both settings I observed groups that do not fit the usual nuclear family model. I investigate within-group relationships using proximity data and behavioral interactions. At Perth Zoo a single group of three individuals was observed for 100 hours using 30 minute focal animal sampling. At Aspinall Foundations Javan Primate Rescue Center, two pairs were observed using the same methodology for a total of 36 hours each. Using Hinde's Index I identify which individuals in a group are responsible for initiating and maintaining proximity and contact with other individuals. The nature of within-group relationships is further examined using data on affiliative and aggressive interactions. This research is presented as an initial investigation into within-group social dynamics in Javan gibbons. I hope to further this study with more data on a range of social groupings in different contexts.

Subsistence Strategies and Child Growth in Two Rural Communities in Timor-Leste

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Human subsistence requires that time and energy be allocated among a suite of competing activities and opportunities. Traditional subsistence farming practice can be guided by culturally transmitted rules for the appropriate timing of, and attention to, various tasks. Over time, rules guiding successful practices persist, and can be "adaptive" in the sense of decreasing risk, increasing nutrient acquisition, and increasing reproductive success. Environmental changes such as social disruption, economic development, or climate change disrupt historical experience, constrain some traditional options, and introduce others. Under these conditions, long-standing 'rules' are less likely guides to successful strategies. In rural Timor-Leste, it has proven difficult to find reliable independent ecological predictors of children's growth. Spencer et al. (2018) correlated subsistence behaviours using principal components analysis (PCA) and relate household scores on the resulting independent components to child growth. There are relationships between household composition, income and agricultural participation and some of these sets are related to child growth; however, the ecological setting remains an independent predictor. Here, we jointly examine household composition, income sources, and subsistence strategies for a mountain community and a coastal plains community in rural Timor-Leste. The coastal plains community has better child growth than the mountain community. Differences in principal components suggest hypotheses for inter-site differences, but provide only limited explanations for growth variation within communities.

The perceived influence of grandparents on parents' paediatric vaccination decisions in a WEIRD society

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Global reductions in childhood infectious diseases can largely be attributed to the success of worldwide immunisation campaigns. However, vaccination programs appear to be losing momentum in the wake of negative, unfounded claims about the safety of vaccines. In the current age of vaccine hesitancy, where research-informed arguments are not always persuasive, grandparents, through their experience of the diseases may positively influence paediatric vaccine uptake. Using a mixed-method research design, this study investigated the perceived influence of grandparents on parents' paediatric vaccination uptake in Perth, Western Australia. Qualitative data generated through focus group discussions with mothers, fathers, grandmothers and grandfathers (N=73) revealed parents are indirectly influenced by grandparents. This data then informed the development of a questionnaire to explore the effects of beliefs, attitudes and perceived sources of influence on paediatric vaccine uptake. Participants (N=278) generally recognised the benefits of paediatric vaccines, reported positive social group influences and low vaccine anxiety. This was reflected by high confidence levels on the information available to them and the protection conferred to their children by vaccines. Grandparents with high scores on knowledge and positive group influence reported they would advise parents on vaccinations for their grandchildren. The findings suggest that grandparents could have a positive impact on parents' decision to vaccinate their children if parents welcome or ask for their input. Future studies must target vaccine hesitant parents within different cultural groups to discern whether grandparents could act as proxy public health agents within families and communities to promote paediatric vaccine uptake.

A bioarchaeological examination of two Late Neolithic commingled skeletal assemblages from Marge del Moro cave and Can Figueres cave, Catalonia, Spain

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Megalithic tombs or caves, are typical of the funerary customs for Late Neolithic in Catalonia, however, there are only a few studies examining the Neolithic human remains from the region. Most of these studies have concentrated on dental morphology with a limited focus on the entire skeletal assemblage. Therefore, this study aimed to expand our osteological data for the Late Neolithic and examine two caves with commingled skeletal assemblages; Marge del Moro (4160 ± 90BP) and Can Figueres (Final Neolithic). A full skeletal and dental analysis of the assemblages revealed a discrepancy between determining the minimum number of individuals (MNI) for Marge del Moro when using teeth (MNI=29) in comparison to using skeletal elements (MNI=8). Both sites had a similar percentage of non-adults within the assemblage and this was consistent with other Late Neolithic and early Chalcolithic caves in Iberia. Further, the sites showed unique differences in dental wear between anterior and posterior teeth. Dental pathologies for Marge del Moro were less than other recorded sites for calculus (11%) and linear enamel hypoplasia (3.78%). Further, only Marge del Moro was found with dental non-metric traits (3.2%). These results could be attributed to the subset of material analysed from each site. Nevertheless, this study shows the importance of considering the skeletal assemblage and individuals present. With ongoing excavations in Catalonia, understanding the osteological data, and Middle and Late Neolithic funerary patterns, is necessary to understand the impact this has on the samples that could be chosen for molecular analysis.

Less destructive technique for ancient DNA analysis from the human temporal bone: A case study from Neolithic Catalonia, Spain

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The discovery that the human temporal bone contains high quantities of endogenous ancient DNA has resulted in a constantly growing demand for temporal bones from skeletal assemblages. However, extracting DNA from the temporal bone, specifically the inner bony labyrinth, is a highly destructive process. Very few studies have considered ways to refine access and provide a less destructive technique to access the bony labyrinth within the temporal bone. As a result, this study considered the anatomy of the temporal bone to identify landmarks and develop guidelines for both osteologists and geneticists for a less

destructive method of extracting the bony labyrinth for genetic analysis. Temporal bones from Middle (I and II) Neolithic (MN) and Late Neolithic (LN) archaeological sites from four different caves in Catalonia; Can Sadurni (MNI-LN), Can Tintorer mines (MNII), Marge del Moro (MNII-LN) and Can Figueres (LN), and were used to design and test the new extraction technique. We propose that drilling between the internal acoustic meatus and arcuate eminence, two easily identifiable and often preserved landmarks reduces the amount of destruction to the temporal bone whilst accessing the bony labyrinth. All samples drilled between these landmarks resulted in successful DNA extractions with positive PCR results. This study provides a detailed guideline and consideration for isolating the bony labyrinth within fragmentary temporal bones found in archaeological assemblages. Further, the use of less destructive techniques provides a greater chance of accessing temporal bones in museum collections and increase opportunities for other molecular analyses, particularly in commingled assemblages.

The Object Permanence Abilities of Two Gibbon Species: *Hoolock leuconedys* and *Nomascus leucogenys*

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The ability to reason about non-perceived objects is considered the most basic component of a capacity to 'think'. Such understanding is often explored via object permanence tasks. Object permanence is the understanding that objects continue to exist even when they are out of sight. In primates, only great apes have demonstrated fully developed object permanence abilities when appropriate controls have been employed. In this presentation, I will discuss the results of two experiments designed to assess the object permanence abilities of two gibbons species: *Hoolock leuconedys* (n =6) and *Nomascus leucogenys* (n =5). In the first experiment, I investigated whether a novel vertical design would enhance the gibbons' performance on a simple visible displacement task, compared to a traditional horizontally-arranged apparatus. The vertical design significantly improved the accuracy of the gibbons' responses. In the second experiment, I used this vertical design to test the object permanence abilities of gibbons using single visible, single invisible and double invisible displacement tasks, with drop-first, drop-last, and blinding controls. In all tasks, the gibbons' performance was significantly above chance. However, individual analyses revealed great variability, with only two gibbons solving all three tasks in a manner consistent with fully developed (stage 6b) object permanence abilities.

Wading, and other Waterside Hypotheses of Human Evolution

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The so-called "aquatic ape hypothesis" is approaching 60 years old, if you take its starting point as Alister Hardy's talk to the Brighton sub-aqua club in 1960. Like all ideas about human evolution, it has evolved a lot since then, both in response to criticisms and also to emerging evidence. Here, the history of the idea is briefly reviewed which culminated, for the presenter, in a PhD on the subject. The wading hypothesis is offered as one of the most plausible ideas under the "more aquatic" umbrella and arguably the best published model for the origin of hominin bipedalism in the literature. It is argued that the energetically efficient, striding gait of modern humans could have most plausibly evolved in hominins adapted to coastal foraging though relatively long-distance beach-combing. Other unique human characteristics may also be explicable in terms of waterside hypotheses, such as the evolution of infant and mother adipocity – as an adaptation to reduce the risk of drowning, encephalisation – through a change to a diet rich in the marine food chain, early adoption of stone tools and dental and masticatory reduction – through foraging for sessile shellfish, the human body hair pattern – as an adaptation to reduce drag in water, and fine voluntary breath control, the essential precursor to speech – as an adaptation to swimming and diving.

The Caldwell & Moloy Classification of Female pelvic shape: Still Relevant after 80 years?

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The Caldwell-Moloy (1933) classification of four groups of female pelvic shape, Gynaecoid, Anthropoid, Android and Platypelloid, has been traditionally taught to students of midwifery and medicine and is still reported in the most recent midwifery and gynaecological textbooks. For decades, midwifery students have been instructed that knowing a woman's pelvic shape would help evaluate possible disruptions to the normal progress of labour. However, the use of these classifications was always dubious, as it was difficult, if not impossible to categorise a woman into her pelvic "type" by her body shape. Using modern pelvimetric methodologies and geometric morphometric (GM) analysis techniques, on an albeit small sample, we found that the real morphometric variation present in the female human pelvis does not reflect the classification. GM analysis was carried out on sets of pelvic landmarks from scans of women living in Western Australia. 64 anonymous female multi-detector computer tomography (MDCT) scans were used for most of the study and 51 male scans were also examined for comparison. Principle component analysis (PCA) found that there was no obvious clustering into the four distinct types of pelvis in the

Caldwell-Moloy classification, but rather an amorphous, cloudy continuum of shape variation. Until more data is collected to confirm or deny the statistical significance of this shape variation, it is recommended that teachers and authors of midwifery, obstetrics and gynaecological texts be more cautious about continuing to promote the Caldwell-Moloy classification, as our results show no support for the long taught 'four types' of pelvis.

"Stress" at Roonka: Anomalous or explicable?

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The general survey of Aboriginal palaeopathology by Stephen Webb (1999) has been extremely influential in Australian archaeology. His survey of skeletal lesions from human remains across the continent altered the perception of Aboriginal hunter-gatherers from a model of 'living lightly on the land'. He interpreted the frequency of skeletal markers such as cribra orbitalia, hypoplasia and non-specific infection as indicative of stress at levels suggestive of high population density and possible sedentism, particularly along the Murray River. At the site of Roonka, on the Murray River, we have recorded cribra orbitalia and enamel hypoplasia among the 217 individuals excavated from the site. Their burials date from c. 6000 BP to the immediate postcontact period (at least 2-3 burials). What is striking, however, is the difference in the frequency of these skeletal indicators of 'stress' compared to the levels recorded by Webb, particularly once age is considered. In this paper we explore the possible reasons for this difference: recording protocols, the nature of the samples, interpretative differences and/or a real difference reflecting the diverse ecology of the River Murray. The exercise demonstrates the difficulty of interpreting disease among human remains.

Operation Lima Sea – Unidentified remains of a human torso in Queensland: Case report on the collaborative investigation and anthropological roles in the identification process

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In October 2013 in Southeast Queensland, Queensland Fire and Rescue (QFRS) were called to a grass fire. Once extinguished a human torso was located. The head and hands had been severed, and the lower body from the mid lumbar region had also been removed. Due to the limited nature of the remains standard confirmatory identification techniques of fingerprints and dental could not be utilized in this matter. DNA was collected however did not match any national database. Familial DNA was investigated however also presented no matches. Toxicology was also conducted for a full drug screening. Investigators conducted exhaustive searches of mobile phone tower activity, Medicare files, immigration files and interstate missing person searches to try to identify the remains.

Investigators then engaged the services of their police anthropologist to assist with the identification. Using multi-slice computed tomography (MSCT) DICOM data (0.5/0.3mm) of the torso collected at the Brisbane Mortuary, three dimensional (3D) virtual reconstructions of the bone surface were created. These reconstructions were uploaded into a specialized CAD program, Geomagic X ©, where virtual measurements were conducted to determine sex and stature. The measurements were conducted using a new protocol developed by the Skeletal Biology and Forensic Anthropology Research Laboratory (SBFAR) at the Queensland University of Technology. An attempt was made to determine age of the individual using the sternal end of the fourth rib however the CT resolution and the small surface area presented difficulties. Subsequently, the State Coroner granted approval for the sternal rib end of the fourth rib to be excised and macerated (i.e. soft tissue removed from the bone) using dermestid beetles. A final age range, sex and stature were provided to investigators.

Ultimately, all the information collected by investigators, toxicological reports and the anthropology contributed towards the identification of the individual in July 2014. This presentation will discuss the identification process in more detail.

Quantitative histological age estimation of the femoral cortex: a test of Singh and Gunberg (1970) and Goliath et al. (2016)

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Bone is continually re-modelled at the cellular level over the lifespan of an individual as part of normal bodily growth and repair mechanisms. Histological methods can be used to estimate age-at-death based on patterns of change in osteon shape, size, and population density. The present study examines the applicability of an existing histological age-at-death estimation method as applied to an Australian population. The study sample comprises 50 microradiographs of human mid-shaft femora (25 per sex) obtained from the Melbourne Femur Reference Collection (MFRC), with stated chronological age-at-death ranging 18 to 88 years of age. Osteon shape metrics are measured using ImageJ and the age-at-death prediction formulae of Singh and Gunberg (1970) and Goliath et al. (2016) applied. Statistical analyses are performed to assess the relationship between estimated and actual age-at-death. The two methods demonstrate pooled and sex-specific SEE values in excess of 20 years

(pooled sex ±22.69 and ±35.07, males ±20.49 and ±32.02, and females ±24.70 and ± 37.88 years, for Singh and Gunberg and Goliath et al. respectively). Stepwise linear regression is performed on the raw osteon metric data, resulting in a predictive formula with comparatively lower calculated SEE values (pooled sex ±17.01 years, males ±16.54 years, females ±17.46 years), and a statistically significant correlation with actual age-at-death (r=0.570, p<0.01). The present study represents a preliminary investigation of existing histological age-at-death standards and the formulation of population specific formulae for use in Australia. Initial indications suggest accuracy may be comparable to adult age estimation methods utilizing gross skeletal anatomy.

Site of significance: preliminary research on a population stronghold of the endangered silvery gibbon (*Hylobates moloch*)
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Nature-based ecotourism, including spiritual pilgrimages to sacred natural features, represents a relatively minor source of human-wildlife conflict (when compared to hunting or habitat destruction). Nevertheless, studies on the impacts of ecotourism on primate populations are equivocal with respect to the overall costs and benefits to wildlife conservation. In the conservation and tourist site of Ujung Kulon National Park (UKNP) human livelihoods and primate populations persist amidst an array of competing stakeholder interests. Despite ancestral beliefs designating UKNP a sacred forest where activities such as the gathering of forest products is forbidden, encroachment by the approximately 50,000 people residing within the park's buffer zone (±19,500 hectares) is commonplace. UKNP's status as a World Heritage Site, and the refuge of the last 50-60 Javan rhinos (*Rhinoceros sondaicus*), ensures its continued prominence among tourists, researchers and conservationists. My research focuses on the endangered silvery gibbon (*Hylobates moloch*), endemic to West and Central Java, Indonesia. How are the activities of tourists and the associated infrastructure impacting primate populations? Are the belief systems of local actors or the attitudes of tourists in alignment with the principles of conservationists? Here I present an analysis of historical, social and ecological factors salient to the future conduct of primate research activities within the park. While economic concerns and managerial perspectives dominate the discourse on conservation in this region, a rich understanding of socio-cultural realities is required in order to completely understand the human factors shaping primate populations.

Do ante-mortem and peri-mortem trauma accelerate the skeletonization of surface deposited human remains in Australian conditions?
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Since 2013, a unique University of Sydney project has studied human remains placed on the ground surface near Belanglo State Forest south of Sydney. The major aim is to analyse changes to the bones to refine methods for estimating time since death. The presence of healed (ante-mortem) and unhealed (peri-mortem) trauma to some remains presents an opportunity to examine effects of trauma on decay processes.

In 2014, two defleshed femora from an individual differed in that the left femur had undergone hip replacement surgery close to the time of death while the right femur was without trauma. The left femur with the replacement showed no evidence of healing (i.e. peri-mortem trauma). In 2015 a donor's fleshed, disarticulated limbs were placed at the same site. Again, one femur had undergone a hip replacement, but the bone had healed ante-mortem. At a different site (AFTER facility, Western Sydney), a cadaver was placed out in 2016 with peri-mortem trauma from bone sampling on one tibia.

Comparisons were possible between bones with no trauma, healed ante-mortem trauma and peri-mortem trauma as decomposition and weathering progressed. Peri-mortem trauma was associated with accelerated decomposition whereas ante-mortem trauma was not. For example, bone exposure and disappearance of soft tissue along with the formation of a grease halo in surrounding soil occurred much earlier for the tibia with peri-mortem trauma at AFTER than the corresponding tibia. However, there was no obvious difference in the degree of visible decomposition of the femur with ante-mortem healing and its corresponding element.

Exploring the effects of insularity on skeletal growth dynamics in ancient humans and fossil rats from Indonesia
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While there is much evidence for insularity manifesting in living populations, little is known about its effect on skeletal growth dynamics in prehistoric humans and other animals. Here, we reconstruct: 1) femur bone metabolism in ten Timor Island giant and small fossil (late Quaternary ca. 5- 18ka) rats, 2) femur bone and tooth enamel growth links in three adult males of 152.9-164 cm stature, recovered from the Maluku Islands (BCE/CE junction Morotai, and 2314–1415 cal. BP Gebe). Osteocyte lacunae

density (Ot.Dn) and products of bone remodelling were recorded in human and rat femoral midshaft thin sections. Lateral enamel daily secretion (DSR) and root extension rates were calculated from upper first and second human molar histology. Results reveal significant and negative relationships between Ot.Dn and rat body size, with giant specimens showing low Ot.Dn (Rho min. = -0.891, max. = -0.976, p <0.001). The DSR of 3.9μm (mid-enamel) to 4.6μm (outer enamel) for the human crowns is similar to modern day molars, but the daily extension rate of 7.61μm over the first 2 mm of root growth is faster than the rate roots form over this distance in modern clinical samples. Bone remodelling data indicated increased bone deposition (21.18–27.86#/mm^2) despite the short adult stature. Findings from our ancient human and rat model experiment suggest that island living may affect internal dynamics of skeletal growth. Giant rats may have slowed down their bone metabolism, whereas short humans increased their growth rates to facilitate a physiological adaptation to island environments.

Occipital bone histomorphometry reveals bias in sex estimation from human cranial macro-anatomy

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Current methods used to estimate sex from the human skull rely predominantly upon differences in robusticity, where features are categorised as 'masculine' or 'feminine'. The reliability of this purely macroscopic approach is limited as the idea of 'masculine' or 'feminine' can be heavily influenced by social and cultural biases. However, our understanding of the extent to which sex influences bone macro-microscopic growth remains largely unexplored in a population specific context. Here, we investigate relationships between macro- and microscopic markers of bone morphology and growth in human crania of known sex as determined from aDNA. Four adults from the same archaeological site (Maluku Islands, Morotai, Indonesia, BCE/CE junction) were scored for sex-specific morphology as per standard bioarchaeological methods. This was followed by a blinded histomorphometric analysis of the superior nuchal line on the occipital bone, a site frequently used in sex estimation procedures. Results revealed a mismatch between macro- and microscopic data. Despite all skulls having a male aDNA signature, their macro-anatomical expression ranged from gracile to robust. Occipital bone histological markers ranged from low (14 #/mm^2) to high (21.5 #/mm^2) vascularity, suggesting inconsistent bone growth across the sample. These findings indicate variation in how bone metabolises within four individuals of the same sex and the same cranial region, and demonstrate a gendered bias in sex estimation from ancient Southeast Asian human crania. We recommend a more multi-disciplinary approach towards sex estimation from ancient skeletal remains.

Effects of prenatal maternal stress on birth outcomes following tropical cyclone Yasi in Queensland, Australia (2011)

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Maternal exposure to prenatal environmental stressors can lead to a shift in reproductive strategies. This study aimed to statistically analyse maternal and infant health risks by studying birth outcomes following maternal prenatal exposure to tropical cyclone Yasi in Queensland, Australia. Queensland state birth records collected under the Queensland Perinatal Data Collection from January 2008 to December 2012 were analysed. A confounder controlled binary logistic regression model was used to compare birthweight and gestation length in cyclone Yasi affected and unaffected Queensland local government areas (LGAs). Women in cyclone Yasi affected LGAs, had a significantly higher proportion (9.6%, p=0.008) and significantly higher odds (OR=1.26, 95% CI: 1.06 – 1.47) of having a preterm birth, compared to women in unaffected LGAs (7.9%). Women in affected LGAs during the year of cyclone Yasi (2011) also had a higher proportion of low birth weight births compared to women in the same LGAs during non-cyclone Yasi years (2008,2009,2010,2012). The study supported a significant increase in the proportion of preterm births recorded for women pregnant in areas severely affected by cyclone Yasi. Current research will look to expand upon the findings of this study by exploring the impact of multiple tropical cyclones on perinatal health in Queensland using survey, statistical and spatial analysis. Such multi-method research into human biology continues to support the development of effective post-disaster perinatal health related policies and the ongoing improvement of disaster risk mitigation for vulnerable groups.

Preliminary findings from the bioarchaeological investigation of an ancient Mayan funerary cave from Moxviquil, Chiapas, Mexico

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This paper presents preliminary results of the bioarchaeological analysis of a large deposit of human remains recently excavated in a cave at the small Late Classic/Early Postclassic (ca. AD 600-1250) site of Moxviquil in highland Chiapas, Mexico. The ancient Mayans generally interred their deceased under or near the house, though archaeological excavations have

recovered human skeletal remains in a wide variety of other contexts as well, including palaces, shrines, temples, under plaza floors, and in dry and wet caves. Human remains recovered from dry caves have received less attention, in part owing to difficulties of interpretation. Burials in dry caves are frequently disturbed owing to ease of access and often lack associated artifacts that might help to explain the purposes of these human placements. While the Moxviquil cave showed clear signs of disturbance, the large quantity of remains recovered and presence of some associated artifacts enable fruitful interpretation of the function of this deposit. In this paper, basic demographic parameters such as MNI, age and sex are presented for the portion of the deposit analysed thus far, as is evidence for or against protracted funerary rituals and body modification practices that may inform us as to the social identities of the individuals chosen for placement here. Comparison is made with cave burials reported elsewhere in the Maya area for insights into the significance of cave burials amongst the ancient Mayans more broadly and how this varied geographically and through time.

Palaeoneurology and digital anatomy: predicting skull-brain evolution in fossil platyrrhines

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In palaeoneurology, untangling the complexities of the cerebrocranial systems is evident in the reciprocal changes to the basicranium, specifically the middle cranial fossae (fossa), and the temporal lobes of the brain. In utilizing digital imaging sourced from *ex-vivo* cranial CT and *in-vivo* brain MRI, we investigated the association between fossa dimensions and temporal lobe volume in 11 extant anthropoid species before examining the reliability of the fossa to predict temporal lobe volume in two Early Miocene fossil platyrrhines, *Homunculus patagonicus* and *Tremacebus harringtoni.* Our findings indicate a strong correlation between fossa dimensions and temporal lobe volume in extant anthropoids. The fossil platyrrhines, *H. patagonicus* and *T. harringtoni*, possessed unique fossa morphology compared to extant platyrrhines generating uncertainty in the fossil predicted temporal lobe volumes. Our findings emphasize an important caveat; the role of extant comparative species to predict fossil species, especially where fossil species lack analogous, morphologically similar extant species, the potential impact on fossil prediction outcomes is crucial.

The potential use of vibrational spectroscopy in the geographic profiling of human teeth

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Vibrational spectroscopic techniques provide a solution to past difficulties experienced with analysis of multivariate samples because it is capable of analysing complex mineralised structures such as teeth in situ. This method is non-destructive and necessitates no or minimal sample preparation resulting in samples that remain intact for use at a later stage if needed. Despite being used successfully to formulate geographic profiles for use in agriculture and wildlife and biodiversity research where it has applications in taxonomy, physiology, habitat evaluation and population monitoring, the application of vibrational spectroscopic techniques in the geographic profiling of human subjects has not been investigated.

Because the mineral composition of teeth is influenced by exogenous mineral absorption in a manner similar to the way in which the chemical composition of plants is influenced by their geographic location, the author hypothesised that vibrational spectroscopy could facilitate the development of area specific dental 'maps' or 'fingerprints' which could potentially be used to:
- study the prevalence of specific chemicals (e.g. fluoride) in teeth of people from different geographic locations;
- investigate the prevalence of dental decay and developmental disorders (e.g. amelogenesis imperfecta, dentinogenesis imperfecta and fluorosis) in teeth from people from different geographic locations;
- investigate correlations between the chemical composition of teeth and the length of time that an individual has resided in a certain geographic location; and
- make inferences about the geographic origin of a person based on the chemical composition of their teeth.

Findings could potentially facilitate geographically specific policy changes around the management of oral health.

The Placenta Project: Characteristics in Assisted and Non – Assisted Pregnancy for a Western Australian Cohort

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Over 350 000 babies are born in Australia each year, a majority of which are conceived by natural (non-assisted) conception. However, an increasing infertility rate [currently above 15%] has seen a rise in the number of Australian couples conceiving via Assisted Reproductive Technologies [ART]. Routine ART procedures such as in-vitro fertilisation (IVF) and intracytoplasmic sperm injection (ICSI have been associated with poorer pregnancy outcomes. To investigate this further, we examine maternal, fetal

and placental characteristics from assisted and non-assisted pregnancies.

As part of the Placenta Project, 630 pregnant women were recruited from private and public hospitals in Perth, Western Australia. Of these, 538 women conceived via natural conception and 92 conceived using ART. Data collected from all participants included a survey questionnaire (Maternal Health Questionnaire, which includes paternal demographic data), Gross Placental Examination, Digital Placental Imaging, Maternal and Natal Health Records. Statistical analyses were conducted using SPSS Version 24.

When the assisted and non-assisted pregnancies are age-matched, there are few differences between them. When the comparison is across the entire non-assisted cohort, infant birth weight, placental shape, and umbilical cord insertion remained similar. However, the mothers and fathers of pregnancies resulting from ART were older in age. Further to this, there are key aspects (placental morphology, maternal mental health and morning sickness) that appear to show clinically significant differences that would benefit from further investigation. These findings highlight the importance of research to promote a greater understanding of both Non - ART and ART pregnancies.

Advances in Multidimensional Perspectives on How Teeth Grow

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A major challenge in the study of human growth is the difficulty of assessing three-dimensional (3D) development through time. Knowledge of human dental formation historically derives from cross-sectional studies of fetal tissue, observations of clinical eruption, and longitudinal radiographic studies. These studies have revealed patterns or sequences of tooth calcification and eruption, although less is known about the spatiotemporal progression of these events. Here I show how microCT imaging is revolutionizing the study of hard tissue biology, best exemplified by the use of phase contrast X-ray synchrotron microtomography. It is now possible to visualize the cellular mechanisms that generate highly ordered dental tissues, as well as the 3D progression of tooth mineralization. Enamel-forming cells travel complex paths during enamel secretion, which impacts histological assessments of crown formation time. Virtual studies of tooth mineralization reveal that the innermost enamel layer matures more quickly than other parts of the crown, meaning that this region preserves elemental and isotopic information that can be related to temporal records with more fidelity. Moreover, novel comparisons of volumetric developmental rates reveal that human and chimpanzee first molars grow faster than those of rhesus macaques, but slower than those of Neanderthals. Given that the rate of individual cellular secretion is similar in these groups, this implies that the number of active secretory cells differs amongst them. Virtual and conventional histological studies are helping to clarify the developmental transitions that occurred between humans and our closest living and extinct evolutionary relatives.

The effects of prenatal exposure to seasonal food shortage on childhood growth trajectories in rural Timor-Leste

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Humans display *in utero* responses to external environmental cues that can change the individual's developmental trajectory and adult phenotype. Much of the evidence for developmental programming in humans arises from acute food shortages, such as the Dutch famine. Subsistence agriculture populations face seasonal fluctuations in food availability that mean children are exposed to both good and bad conditions during early development. In rural Timor-Leste, there is a 6-month period of food shortage every year known as the hungry season. We examine how the length and timing of exposure to the hungry season *in utero* contributes to variation in postnatal growth trajectories in 581 rural East Timorese children using anthropometry and linear mixed modelling on mixed longitudinal data. In boys, z-height-for-age and z-BMI-for-age at age 0-2 is associated with prenatal exposure to the hungry season, whereas girls are unaffected. Boys are taller if they spend only the first trimester in the hungry season, compared with boys spending the first two trimesters in poor conditions ($p = 0.022$). Children who perform better at age 0-2 than others exposed to the same *in utero* conditions are taller ($p < 0.001$) and heavier ($p < 0.001$) at ages 2-5. We suggest that children who are less sensitive to changes in food availability have better postnatal growth, and that growth trajectories are established before the age of two. Greater male sensitivity to poor conditions during early development explains why males in this population have poorer growth during childhood than females.

To what extent does rib microstructure reflect its non-strenuous macro-anatomical environment?

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There has been a consensus that the human rib, unlike most limb bones, is the least affected by mechanical strain at the microscopic level. Consequently, it has been argued that rib bone remodelling reflects human physiological homeostasis and can be used to infer dietary and other states of health or disease. However, the absence of mechanical load effect on rib tissue

microstructure is yet to be demonstrated experimentally. We use a vertebrate animal model adapted to extremes of function, to evaluate microstructural variation with strain intra-skeletally. Humerus, ulna, radius, femur, tibia, fibula and two ribs of an eastern grey kangaroo (*Macropus giganteus*) were sectioned at the midshaft and studied histologically to estimate metabolic rates. Following beam theory principles in structural biology, we recorded vascularity/1 mm^2 of sub-periosteal caudal cortex targeting biomechanically competent tissue. Data were further corrected by cortical thickness. The highest bone vascularity was estimated in the fibula (30.99) and ribs (29.27, 19.43), with the ulna showing the lowest values (4.69). Our data indicate that ribs are indeed less mechanically affected than other skeletal elements. The powerful hind limbs and more gracile fore limbs reflect a kangaroo's unique locomotive adaptation to bipedal hopping, which is echoed in the variability of bone quality and quantity. This study is the first to examine kangaroo bone histology in a biomechanical context. We recommend that future studies consider the fibula as well as the rib as sites for histological analyses of health. Replication on human samples is necessary to validate our findings.

Evaluating the effectiveness of an E-book for Anatomy

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This project explored student engagement and learning with a custom-made e-book summarizing the embryological development of organs. E-textbooks have several advantages over conventional paper textbooks, including portability and being able to incorporate interactive mediums (sound and videos). Additionally, if academics develop their own e-books, they can: easily update the resource every year; include materials specific for their subject; provide links to relevant websites; and, include practice quizzes. However, it is very time consuming for academics to generate their own e-books, and there is limited evidence on the effectiveness of using e-books as a teaching resource in tertiary education. Therefore, it comes as no surprise that current literature shows little uptake of e-books in tertiary education. Empirical data is needed to demonstrate the effectiveness of e-books in tertiary education.

The use of Embryology e-books significantly improved JCU health science students' learning experiences in the Anatomy practical class across 'overall quality' (p<0.001), 'level of engagement with the resources' (p<0.001) and 'overall enjoyment of learning Embryology' (p<0.001). In particular, the e-book resource made the most significant difference to male students' across all of the areas assessed. Feedback from focus groups have shown that students preferred to use the e-book in combination with the prescribed textbook to do their study, but specifically liked the e-book for its search function, the test quizzes, and for the animations which showed embryonic changes and folding visually in 3-D. Overall, students thought that the e-book provided a "really good summary" that complemented the textbook.

Preliminary insights into enamel formation in a human tooth from Dong Son Metal Period Northern Vietnam

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Human dental enamel forms in a regular fashion, producing incremental and periodic layers that can be studied microstructurally. Long-period lines, known as striae of Retzius, are used by histologists to reconstruct dental growth and development in modern and ancient human populations. Here we report first and preliminary insights into enamel formation rates in an ancient human upper third molar representing a Dong Son Metal Age (*c*. 2000 BP) sample from northern Vietnam. Nine Retzius lines (RL) from the lateral enamel on the mesiobuccal paracone cusp were measured in a thin section to estimate the average Retzius periodicity (RP) between two adjacent RL's. The average RL thickness was then analysed using daily secretion rates that range from 3.5 to 4.5 μm. The average RL thickness measured approximately 34.95 μm. The RP for this tooth lay between 7.77 and 9.99 days which suggests a single RP value that lies between 8 to 10 days. Our estimate of RP for this ancient Vietnamese individual's tooth is higher when compared to data available for modern Chinese and Chinese-Singaporean populations. However, the RP for this individual from northern Vietnam lies within the range of RP's between 6 to 12 days for modern human permanent teeth. Ongoing research will aim to source more dental samples to expand the RP dataset.

Investigating settlement patterns and questions of mobility in Mithaka country, on the eastern edge of Australia's arid centre

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Reconstructing mobility patterns is critical to understanding the nature of hunter-gatherer systems and indeed how they may have changed over time. In this context, the development of increased sedentism in foragers is often interpreted as an indicator of increasing socio-economic complexity. Our understanding of pre-contact Aboriginal mobility patterns is quite limited, and has largely been influenced by ethnohistory and the study of the distribution of exotic raw materials from trade and exchange systems. Sedentism has been reconstructed also by reference to ethnography, and also through the emergence/presence of new sites types, e.g. earth mounds, stone fish traps and weirs, domestic structures, cemetery sites etc. Survey and remote sensing undertaken by Griffith University and the Mithaka Aboriginal Corporation over the past two years has documented an extensive network of site complexes associated with the desert channels within Mithaka country. Combined with the available ethnography, they indicate a degree of sedentism. We have commenced reconstructing mobility patterns through a study of the ancestors of the Mithaka people by employing Sr isotopes, and here present our initial bioarchaeological results highlighting the importance of this approach for reconstructing patterns of mobility and sedentism.

A preliminary investigation of the impact of tourist presence on the behaviour of the northern yellow-cheeked crested gibbon (*Nomascus annamensis*) in Cambodia

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The tourism sector is a fast-growing contributor to the global economy and nature based tourism (NBT), particularly in Asia and Africa, is booming. Through the creation of jobs and revenue NBT has the potential to combat deforestation in poverty-stricken regions, which are often also areas of high biodiversity value. Inspired by the success of gorilla tourism in Uganda and Rwanda several tourism projects have been initiated in Southeast Asia and China utilising gibbons. Despite the existence of these programs no research has been done to investigate the impact of tourism on the behaviour of gibbons. While NBT is driven by altruistic ideals, programs which are developed rapidly and without proper monitoring can have detrimental effects on the habitats and wildlife they are trying to protect. We conducted a preliminary study to investigate the behavioural response of a group of northern yellow-cheeked crested gibbon (*Nomascus annamensis*) to the presence of tourists at Veun-Sai Siem Pang National Park (VSSPNP), Cambodia. Data was collected using focal behavioural sampling, and analysis using linear mixed models found that the gibbons spent less time resting when in the presence of tourists (p= 0.015, X^2= 5.91, DF= 1). The group was also less likely to call on days following tourist visits although this was not significant. While these results are preliminary they indicate that tourism is having an effect on the activity budget and morning duet frequency of gibbons. We are continuing to collect data at VSSPNP and Galigongshan National Nature Reserve, China with the aim of producing best practice guidelines for tourism involving gibbons.

Reconstructing the Last Common Ancestor of the Homininae: A subspecies approach

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African great apes are our closest living relatives and are thus invaluable to understanding the evolution of the human species. This, combined with the fact that these animals have been intensively studied, makes them prime candidates for Ancestral State Reconstructions (ASRs). Yet the applications of these techniques are complicated by the extensive within-species phenotypic variation exhibited among the Homininae and the poorly resolved branch lengths of the Homininae phylogeny. I sought to determine if these problems could be overcome, by undertaking a subspecies level ASRs of the Homininae that explicitly explored the effects of phylogenetic uncertainty on its estimates. To do this I collated data on fifteen continuous traits that varied among subspecies and estimated five alternative phylogenies for the Homininae. Maximum Likelihood ASRs were implemented for each of the traits across all five phylogenies. A comparison of the ancestral state estimates of these alternative phylogenies revealed similar values across each tree, suggesting that my method was robust to the effects of phylogenetic uncertainty. Phylogeny was found to be a significant predictor of body size, gestation length, geographic range and community size. From these estimates, I inferred that while the last common ancestor of humans, bonobos and chimpanzees was probably chimpanzee-like, the last common ancestor of the Homininae was likely a different animal, being larger than chimpanzees and living in smaller groups. These findings demonstrate the utility of using subspecies-level ASRs to investigate the major events of human evolution.