



## ABSTRACTS

### Proceedings of the Australasian Society for Human Biology

Abstracts of papers presented at the 20th Annual Scientific Meeting of the ASHB, Melbourne, Australia, 3–6 December 2006.

The abstracts are printed in alphabetical order of authors.

#### **A multivariate analysis for sex determination from deciduous, morphometric crown traits**

C.J. Adler, D. Donlon (The University of Sydney, Australia), [ddonlon@anatomy.usyd.edu.au](mailto:ddonlon@anatomy.usyd.edu.au)

Sex identification of juvenile skeletons is difficult due to the subtle expression of sexual dimorphism. Previously sexual dimorphism has been observed in the traditional measurement of overall deciduous crown size. There has been little investigation of alternative morphometric crown traits or application of these to multivariate analysis in order to classify sex. It was hypothesised that using multiple crown traits, including metric and morphological parameters, would increase the information about the crown, improving the sex classification accuracy.

The data were collected from 151 Caucasoid children from Sydney, Australia. The variables were recorded on the deciduous teeth in the mixed dentition, including overall crown size, trigonid size, talonid size, Carabelli's trait and molar cusp number. The accuracy of sex classification was assessed by two types of multivariate analysis, linear functional discriminant analysis and binary logistic regression.

Males exceeded females significantly in the metric crown traits only. The morphological crown traits were non-significantly different between the sexes. The level of dimorphism ranged from –3.55% to 11.11%. The highest was observed in the trigonid of the first deciduous molar. This is particularly high compared to previous studies of the measurements. Using all 27 variables, sex was classified with an accuracy of 76.5%–79.5%. Selecting only the maxillary variables, sex

classification dropped to 57.0%. The mandibular variables classified sex with an accuracy of 78.8%. Compared with published data on similar samples, the accuracy of sex classification was improved by the addition of alternative tooth measurements to crown size.

### **Social sources of resistance to evolutionary theory: Results from an Australian public opinion survey**

M. Anderson (Centre for Health Economics, Monash University, Australia), [m.anderson@unimelb.edu.au](mailto:m.anderson@unimelb.edu.au)

The theory of evolution stands at the bedrock of virtually all the natural sciences, yet it is far from universally accepted among the general public. The emergence of creation science theories and intelligent design (ID) campaigns – along with spirited and at times heated responses from the scientific community – raise the need to carefully probe the social and ideological motivations of opposing groups. The interests of good science teaching in public educational facilities, along with the growth of parallel educational institutions in Australia (at both secondary and tertiary level), may be better served when the social sources of resistance to evolutionary theory are understood. This paper reports on a 21-item evolution and science module included in a recent Australian social science survey which has as its centrepiece an extensive suite of social, political, ethical, religious, and personality scale items.

### ***Homo floresiensis*: A cladistic analysis**

D. Argue (Australian National University, Australia), [debbie.argue@anu.edu.au](mailto:debbie.argue@anu.edu.au)

In October this year we (Argue et al., 2006, *J. Hum. Evol.*) published a morphometric and morphological comparison of the skeletal remains of LB1 to modern humans, including two microcephalics; Australopithecines, *Homo habilis*, *Homo ergaster*, *Homo erectus* and the Dmanisi remains. Our results, reported last year at ASHB, showed that this skeleton is unlikely to be a microcephalic *H. sapiens*: the only similarity it shows to this morphology is its small endocranial volume. Nor does LB1 approximate pygmy or ‘pygmoid’ morphologies. Conversely, it shows many characters found in early *Homo* although we predicted that it probably did not evolve from *H. erectus*, from which it differs in cranial shape, degree of prognathism, and limb proportions. Cranially it appears to be most similar to *H. ergaster* KNM-ER 3733 and *H. habilis* KNM-ER 1813. Postcranially, it exhibits the primitive limb proportions presented by *A. garhi*, having a long radius relative to its femur, assuming the estimated length for the radius is correct. We supported the attribution by Brown and colleagues (2004, *Nature*) of LB1 to a new species: *H. floresiensis*.

This presentation will describe a cladistic analysis based upon 149 craniofacial characters. The objective of the analysis is to elucidate to which species, if any, LB1 might have a phylogenetic relationship: modern *H. sapiens*, *H. heidelbergensis*, *H. erectus*, *H. ergaster*, *H. habilis* or the Dmanisi remains.

### **Whole genome amplification to assist trace DNA genotyping**

K. Ballantyne (Forensic Services Department, Victoria Police, and La Trobe University, Australia), [kaye.ballantyne@police.vic.gov.au](mailto:kaye.ballantyne@police.vic.gov.au), R. van Oorschot (Forensic Services Department, Victoria Police, Australia), [roland.vanoorschot@police.vic.gov.au](mailto:roland.vanoorschot@police.vic.gov.au), J. Mitchell (La Trobe University, Australia), [john.mitchell@latrobe.edu.au](mailto:john.mitchell@latrobe.edu.au)

Trace DNA is rapidly becoming an invaluable resource for forensic profiling, but can pose special challenges for its recognition, collection, extraction and amplification. Samples containing less than ~20 human cell equivalents may be regarded as 'trace'. These cells originate from the deposition of minute quantities of biological material, such as epithelial cells on touched objects, minute blood splashes, bone fragments or shed (telogen) hairs. A particular challenge can be the PCR amplification of such small samples, with allelic dropout, the presence of false alleles and peak height imbalance common from samples containing less than 100 pg.

A relatively new technique, Whole Genome Amplification (WGA), may be applied to increase the profiling success of trace samples. Standard multiple displacement amplification or MDA (GenomiPhi, GE Biosciences) can increase the profiling success of 10 pg of DNA by up to 60%. The use of crowded MDA, using non-target DNA or polyethylene glycol, can further significantly increase the profiling success. Although there is an increase in amplification bias, the MDA technique is suitable for small quantities of DNA or moderately degraded DNA, and the product is suitable for routine STR genotyping. WGA can assist in increasing the profiling success rates for human identification and individualisation.

### **Antibiotic resistant strains of *Staphylococcus aureus* outside the hospital setting in Australia**

C.M. Bennett (University of Melbourne, Australia), [c.bennett@unimelb.edu.au](mailto:c.bennett@unimelb.edu.au), P.D.R. Johnson (Infectious Diseases Department, Austin Health, USA)

*Staphylococcus aureus* is one of the most important bacterial pathogens of humans, and is responsible for many thousands of infections in both hospitals and the community in Australia each year. *S. aureus* infections occur in all age-groups and range from mild folliculitis to life-threatening septicaemia. The beta-lactams are the first-line antibiotics for *S. aureus* infections and have proven themselves to be

safe, low-cost and effective, however beta-lactam-resistant strains (MRSA) have become common in many Australian hospitals. Surprisingly little is known about the persistence of hospital-acquired MRSA carriage in the community, or the recent emergence of MRSA infections occurring outside the hospital setting. The lack of information on MRSA epidemiology in the community complicates the treatment of patients who present with clinical syndromes suggestive of a SA infection as it is no longer possible to accurately predict which infections are likely to involve resistant strains.

We investigated carriage of hospital acquired methicillin resistant *S. aureus* in follow-up study of 35 patients known to be colonised with MRSA who were discharged to home from a large tertiary hospital between June and December, 2003. We continued to monitor for MRSA carriage for 4 months post-discharge, and also screened their household contacts for MRSA carriage over this period. Weekly nose and skin swabs taken for the 1st month post-discharge, and final swabs at 4 months, revealed that MRSA carriage persisted for 4 weeks in half the patients and that intra-household transmission was uncommon, occurring in only one household contact of a known persistent carrier out of 27 patients who returned to shared households (proportion = 0.037, 95% CI: 0.01, 0.18). This was the first community-based MRSA colonisation study in Australia, and the findings support the view that hospital acquired MRSA is not a contributor to community carriage of MRSA.

### **The changing role of forensic anthropology in the 21st century**

C. Briggs (Victorian Institute of Forensic Medicine, and The University of Melbourne, Australia)

Forensic anthropology deals with more or less skeletonised remains, known to be or suspected of being human. Forensic anthropologists commonly address questions related to personal identification in a domestic scene (i.e. assisting crime scene investigators), generally from examination of a whole skeleton or from skeletal parts. Since the 1980s forensic anthropologists have also been involved as members of teams investigating mass disasters, disappearances, bombings, atrocities committed during ethnic cleansing, incidents of genocide and of mass killings. In such circumstances, for both legal and compassionate reasons, there is a need to ascertain not only how many individuals are present but, as far as possible, to provide clues as to the identity of each. While indices for age, sex and stature determination have been published for a variety of groups, together with methods of determining ethnic affinity, it is apparent that the statistics on which many conclusions are based are not necessarily applicable to all populations. One reason for this apparent anomaly may be, in part, the intermingling of races, which has occurred in the latter part of the twentieth century, due to a breakdown of traditional barriers to migration. In recent years, it has become apparent that the basis for many anthropological formulae may be becoming less applicable when applied to modern populations and populations

different from those upon which the formulae are based. Attempts are currently being made to redress this situation, by the use of new imaging techniques to determine age- and sex-related skeletal changes in a contemporary Australian population.

### **Victims and voyagers: Aboriginal victorians and colonialism**

R. Broome (History Program, La Trobe University, Australia)

The recent History Wars revived the emphasis of Aboriginal historians a generation ago on the frontier period and its destructiveness. While the level of violence on the frontier is now more disputed, the Aboriginal decline is still at the centre of the debate. There is certainly much evidence for the frontier being destructive, because Aboriginal people living in what became known as Victoria, were reduced by almost 90 per cent in a generation of colonial contact after 1834. Besides physical violence and disease, a white racial discourse and indifference also prevailed. However, such a preoccupation with destruction – the fatal impact of European colonization – poses Aboriginal people as victims.

I will demonstrate that Aboriginal people on the frontier and beyond were also voyagers into new worlds, people who displayed power and agency over their lives in the colonial situation, such that a significant number survived – sufficient enough to ensure the continuity of Aboriginal genes and culture. Melbourne was their domain, which they did not easily surrender to the newcomers, not by being aggressive, but by accommodating themselves to the strangers through the traditional media of exchange and kinship. Aboriginal people also appropriated items of material culture in a wave of intellectual curiosity and flexibility, tried to impose Aboriginal ideas of right behaviour on to Europeans, and eventually embraced new ideas such as farming, the written word and Christianity, while remaining Aboriginal.

### **The people of Teouma: Update on research findings concerning health and disease**

H.R. Buckley, N. Tayles (University of Otago, New Zealand), [hallie.buckley@stonebow.otago.ac.nz](mailto:hallie.buckley@stonebow.otago.ac.nz)

The Lapita-associated cemetery site of Teouma, Efate Island, Vanuatu, has provided researchers with a unique opportunity to begin to unravel the mysteries surrounding aspects of health and disease of the elusive ‘Lapita people’. There have been excavations of the cemetery site in 2004, 2005 and 2006. To date, a total of 49 inhumations, consisting of more than 60 individuals, have been excavated. This presentation will outline the findings on health and disease from the human skeletal remains excavated in the first two field seasons. The sample consists of the skeletal remains of 7 infants (less than 1 year of age) and 19 adults, but no children (between

1 and 20 years of age) have yet been discovered. Adults, over 20 years of age, account for 80% of the sample. In the adults, there is a predominance of males over females. This ‘demographic’ pattern at Teouma may be explained by the fact that there were special areas of the cemetery for children and females, which have simply not been discovered yet. Field observations on age and sex from the recent excavation in 2006 are also discussed.

The findings on health and disease on the first two field seasons’ remains indicate some chronic stress during childhood affecting growth, poor dental health, and heavy work loads in both sexes. There is also some evidence of chronic infectious disease and possible metabolic disorders.

### **Were Australian Aborigines capable of civilization?**

H. Bulth (Monash University, Australia), [Heather.Bulth@arts.monash.edu.au](mailto:Heather.Bulth@arts.monash.edu.au)

The presumption of a generalised Australian Aboriginal egalitarianism as a result of social and environmental limitations is a flawed anthropological theory. Recent archaeological and anthropological research has found that immediately prior to European occupation Gunditjmara clans in south western Victoria had developed a complex society complete with an elite governing class. Based on the manipulation of a reliable, seasonally abundant and highly nutritious resource, the catadromous short-fin eel (*Anguilla australis*), the species can be compared to the anadromous *Salmonidae* whose annual migrations are claimed to be the precondition for the emergence of social complexity in Northwest America.

This talk describes the research results and the social implications of this resource exploitation for Gunditjmara. On a global scale these findings reposition Australian Aboriginal social and economic development.

### **Types of microcephaly in *Homo sapiens*, and where the New Caledonian example belongs**

D. Bulbeck, M. Oxenham (The Australian National University, Australia), [David.Bulbeck@anu.edu.au](mailto:David.Bulbeck@anu.edu.au), [Marc.Oxenham@anu.edu.au](mailto:Marc.Oxenham@anu.edu.au)

One school of thought disputes the nomination of the new species *Homo floresiensis* (Brown et al., 2004, Nature) on the basis that the type specimen may be a microcephalic *Homo sapiens* of “Australoid” racial affinity. The authors are currently testing this explanation by recording up to 200 variables (232 including tooth diameters) on microcephalic and non-microcephalic skulls from populations across the world. Analysis of the database should divide the archaic traits ascribed to *Homo floresiensis* between those that can be attributed to microcephaly and those that cannot. At this stage of our investigations, we can recognize three categories of

human microcephaly: bird-headed dwarfs, proportional dwarfs, and a third miscellaneous category, which includes some skulls of strikingly archaic appearance. Only the last category is of possible relevance to the debate over the status of *Homo floresiensis*. Our museum work has come upon an “Australoid” microcephalic, which is the skull of a New Caledonian sorcerer, but it can be assigned to the category of proportional dwarfs and is entirely different from *Homo floresiensis*.

### **Investigating evidence of tuberculosis in prehistoric Polynesia: Re-evaluation and planning future research**

K. Butterfield (University of Auckland, New Zealand), [kbut021@ec.auckland.ac.nz](mailto:kbut021@ec.auckland.ac.nz)

Tuberculosis has been present in human populations for approximately 9000 years. Its antiquity has been documented primarily through skeletal lesions associated with tubercular infection. More information has since been gathered through the identification of ancient tubercular DNA in human remains. While there is information regarding the distribution of tuberculosis in populations across the globe, no studies have focused on the possibility of tuberculosis existing in Polynesia prior to European contact.

In response to a comment by Roberts and Buikstra (2003) on the ancient Pacific as a possible location for ancient tuberculosis, this possibility was explored through several perspectives: An assessment was made of the prehistoric population size of various island groups, in relation to possible disease maintenance in prehistory. I then analysed the existing publications of skeletal material for evidence of tuberculosis, using an independent set of diagnostic criteria created for this research project. Due to the ambiguity of many skeletal diagnoses I have suggested that molecular methods of tuberculosis identification be employed in the Pacific. I have reviewed previous successful applications of aDNA analysis in tuberculosis investigations, and provided a preliminary plan for one based in Polynesia.

The results of this research indicate that ancient Polynesian populations had the size and density necessary for endemic tuberculosis, and at least one site in Hawaii indicates tuberculosis in the remains of multiple individuals. The suggested aDNA study provides the next logical step in the study of tuberculosis in the Pacific, and in the study of the health of ancient Polynesian populations.

**Comparing morphological and genetic distances within the *Catarrhine***

J.A. Coate, D. Curnoe (University of New South Wales, Australia), [j.coate@student.unsw.edu.au](mailto:j.coate@student.unsw.edu.au)

Two types of evidence, skeletal morphology and genetic data, are heavily drawn upon to examine, generate and argue for or against theories related to human and primate evolution as well as influencing biological classification. However, the results of these two different datasets can produce varied interpretations. To assess and quantify the similarities and differences between these forms of evidence direct comparison between their results was necessary. To achieve this, cranial morphometrics representing all the genera of the *Catarrhine* were collected to generate morphological distances and measured in contrast to genetic distances. Morphological and genetic distance matrices were compared by Mantel's matrix correlation as well as subjecting matrices to non-metric multidimensional scaling. The implications emerging from comparisons between these different datasets provide an opportunity to examine macroevolutionary trends of the *Catarrhine*. Although both forms of evidence are equally valid, they offer different resolution to the evolutionary history of this group, which will in turn affect current classification schemes.

**A radiographic comparison of the cortical bone thickness in the radius of humans and kangaroos**

S.L. Croker, W. Reed, D. Donlon (University of Sydney, Australia), [scroker@anatomy.usyd.edu.au](mailto:scroker@anatomy.usyd.edu.au), [w.reed@fhs.usyd.edu.au](mailto:w.reed@fhs.usyd.edu.au)

Identification of bones as human or non-human is often aided by an understanding of the different body proportions and bone shapes that result from the bipedal stance of humans compared with the quadrupedalism of most non-human mammals. This could possibly extend to a difference in thickness of the long bone cortex, used by some workers to aid identification of bone fragments. In Australia, bones of kangaroos, being bipedal hopping animals, can be confused with human remains, as similarities in function, particularly the upper body, are reflected in similar bone shapes. This is particularly notable in the radius, which is studied here to determine whether differences in the thickness of the bone cortex exist, despite the similar external morphology of the human and kangaroo radius. For this preliminary study, 20 human and 20 kangaroo (*Macropus* sp.) radii were radiographed, and measurements taken of the bone diameter, medulla cavity and cortices at three sites along the shaft. The proportion of cortical bone to the whole bone diameter was calculated in order to make functional comparisons between the groups. This showed the human radius to follow the expected long bone pattern, with an increase of cortical thickness in the centre of the shaft. The cortex of the

kangaroo radius, however, gradually thinned from the proximal to the distal end. Raw data were also compared (individual measurements of cortical thickness being most useful in the identification of fragments), showing differences at the midshaft and distal shaft sites, but not at the proximal shaft.

### **Patterns of morphological variation in the dentition of selected Marsupials**

N. Cunin, R.S. Kidd (The University of Western Sydney, Australia), [B.Kidd@uws.edu.au](mailto:B.Kidd@uws.edu.au)

This study aims to examine patterns of morphological variation in the dentition of a selected group of marsupial species. A suite of data based loosely on the works of Freedman (1957, An. Transvaal Museum) and Hayes et al. (1996, Int. J. Primatol.) were obtained from the upper and lower permanent dentition of six species, chosen so as to cover each of the dietary groups of herbivores, omnivores and carnivores. Species chosen were wallabies, koalas, wombats, possums, bandicoots and quolls. A sample size of five was considered adequate within the context of this project. The sex of most specimens was unknown and they were thus pooled. While this is not entirely satisfactory due to the sexually dimorphic nature of teeth, it was considered acceptable as the variation between sexes within a species is likely to be small when compared to differences between species.

The data were initially analysed in a univariate fashion, which revealed interesting but simplistic results. They were therefore subjected to the multivariate techniques of principal components analysis (PCA) and canonical variates analysis (CVA).

Much of the morphological discrimination found could be directly related to functional habits in terms of diet. That is, those species with similar dietary habits were closely affined while those of differing habits were positioned distantly. However, some patterns of discrimination did not seem to be directly related to function; in this instance it seems that phylogenetic patterns are being described. This is well demonstrated by the close affinity of wombats and koalas.

### **Energetics of mechanical behaviour of upper limbs in adolescents and adults during walking at moderate speed**

R. Degabriele (University of Western Sydney, Australia), [r.degabriele@uws.edu.au](mailto:r.degabriele@uws.edu.au), B. Gutnik (Unitec, Auckland, New Zealand), [bgutnik@unitec.ac.nz](mailto:bgutnik@unitec.ac.nz)

We investigated differences between kinetic and potential energies during periodic motion of the human arm during normal walking.

Ten healthy adult (30–40 years old) and 10 preadolescent (12 years old), strongly right-handed males walked on a treadmill with a velocity of  $1.1 \text{ m s}^{-1}$  (a comfortable

speed). Video analysis with Silicone software measured the different angles of shoulders and forearms. The initial, final and interim angular positions of shoulders and forearms and their centre of mass locations were calculated in 10 cycles for each participant and were compared in terms of kinetic and potential momentary energy. Both the variants of mechanical energy were calculated in relation to momentary, spatial and temporal data as well as angular velocities from both limbs. We calculated kinetic and potential energy for the left and right limbs separately.

All participants exhibited greater values of kinetic than potential energy. A possible explanation is that the biological motion system of the arm during walking is not based on purely physical elements and cannot be totally based on the properties of a pendulum.

To charge the limb with appropriate energy for movements, the system must add muscular energy to the energy of gravitation and inertia. The average difference between the indices representing kinetic and potential energies is  $34.75 \pm 5.38\%$  in preadolescents and  $20.39 \pm 4.44\%$  in adults ( $P < 0.05$ ). Thus, during late ontogenesis (from 12 years old to adulthood), humans use a higher range of inertial and gravitational forces of the upper segments in locomotion.

### **Potential energy of upper limbs in preadolescent children in normal walking: Individual variation and lateralisation in cyclic behaviour**

R. Degabriele (University of Western Sydney, Australia), [r.degabriele@uws.edu.au](mailto:r.degabriele@uws.edu.au), B. Gutnik (Unitec, Auckland, New Zealand), [bgutnik@unitec.ac.nz](mailto:bgutnik@unitec.ac.nz)

Arm dominance in voluntary motor control is fully developed in preadolescence. However, because assessment of the level of lateralisation of the arms during normal walking is largely unknown, we investigated the situation in preadolescents.

Ten healthy, strongly right handed, 12-year-old males walked on a treadmill at a velocity of  $1.1 \text{ m s}^{-1}$  (a comfortable speed). The lengths of arms, forearms and wrists were measured. Video analysis with Silicone software measured the angles of the arm and forearm. The initial, final and interim angular positions of shoulders and forearms in 10 cycles of each participant were compared at corresponding phases of each cycle. The mass of the arms and the location of the centre of mass of the total limb (left or right) were calculated.

We recorded large individual variation in potential energy from the limb: some showed a greater range of flexion and extension of the arm; others used more energy. There were no significant differences in potential energy between right and left limbs; just a greater tendency of the right hand to flex and extend with greater range of motion. Participants exhibited less regularity for the distal segments. Spatial and temporal variations in the dominant limb were also greater than the non-dominant limb. This may be due to a larger contribution from the right-sided muscles that are the main contributing factor to motion of the dominant limb during walking rather

than gravity acting alone. This information may assist in identification of the level of dominance of the limb, in addition to “traditional” handedness.

### **Identification of the unknown Sailor from *HMAS Sydney II***

D. Donlon (The University of Sydney, Australia), M. Blenkin (Department of Defence, Canberra, Australia), J. Duffou (Department of Forensic Medicine, Sydney, Australia), R. Lain (Sydney Dental Hospital, Australia), T. Lowe (Casey and Lowe Pty Ltd., Sydney, Australia), J. Parsons (Department of Defence, Canberra, Australia), [ddonlon@anatomy.usyd.edu.au](mailto:ddonlon@anatomy.usyd.edu.au)

In November 1941 *HMAS Sydney II* was sunk along with 645 men in the Indian Ocean. This was Australia’s greatest naval disaster. In early 1942 an unidentified sailor was recovered from a Carley float as it drifted by Christmas Island and he was later buried in the Old European Cemetery on the island. Assuming this sailor is indeed from *HMAS Sydney II* then he is possibly the only physical link with the ship and the disaster. In 2006, a team engaged by the Royal Australian Navy located and excavated the grave, recovering a skeleton. This presentation gives some background to the disaster and excavation and also background to the methods being used to attempt to identify this man. Approximately 50% of the crew’s dental records are available for comparison as well as limited medical histories and records of height and birthplace. Artefacts found in the grave as well as trauma sustained by the man may also assist in the identification. Extreme interest from possible family members has meant that an attempt may be made to use DNA analysis for identification.

### **Let’s have an argument: A scientific approach to teaching argumentation skills**

J. Donovan, V. Dawson (Edith Cowan University, Australia), [jdonovan@q-net.net.au](mailto:jdonovan@q-net.net.au)

This paper will report on the pilot study that we have been conducting this year on the teaching of argumentation skills in science. Worldwide, there has not been abundant research in this field, but what exists tends to show that such skills are “taught and not caught”. Specifically, we are interested in the skills required to reach and substantiate a decision in a bioethical dilemma in the field of genetics. Scenarios presented to year 10 students include those concerning genetically modified foods, genetic counselling and cloning issues. We are working with year 10 students (approximately 15 years of age), as this is both the year in which they receive most specific instruction in genetics, and the last opportunity for all students to acquire essential knowledge and skills required by adults in a society increasingly impacted by genetics. We hope that by achieving understandings of the past and present, students will be better equipped in the future to make informed decisions. The pilot

study involves a pre-survey and pre-interviews, then the regular teaching of genetics by classroom teachers, followed by a post-survey and post-interviews. In addition, some of the students received a special lesson on argumentation, so internal comparison will be possible between them and the rest of the cohort in the post-data. This paper will focus on the professional learning undertaken by teachers in order to teach the lesson on argumentation, how they chose to conduct these lessons, and may take a brief look at preliminary results.

#### **Year 5: Is this the critical time to establish understandings of genes and DNA?**

J. Donovan, G. Venville (Edith Cowan University, Australia), [jdonovan@q-net.net.au](mailto:jdonovan@q-net.net.au)

This paper will report on the culmination of our research into student conceptions of genes and DNA. Previously we have reported on the research with a year 2 class in which students showed themselves to be capable of learning the basic terminology and relationship between DNA, gene, allele and chromosome, with the help of an innovative wool model. Work with a year 12 class showed these students were capable of achieving high-level understandings with the appropriate input and facilitation. Work with a year 9 class was rather disappointing in that these students showed a regression in basic biological understandings and a relative lack of interest in acquiring understandings about genes and DNA, although some were successful in gaining these. However, work with a year 5 class was the most promising overall, with these students being relatively uncontaminated by inaccurate information and incredibly keen to acquire new knowledge and understandings. This paper will focus on the work with this group and postulate that this may be the critical time to establish these understandings.

#### **Dental development assessment in Western Australian subadults**

S. Flood, D. Franklin, C.E. Oxnard, J. Meyer, I. Dadour (The University of Western Australia, Australia), [sflood@anhb.uwa.edu.au](mailto:sflood@anhb.uwa.edu.au), [dfranklin@anhb.uwa.edu.au](mailto:dfranklin@anhb.uwa.edu.au)

Forensic age determination of subadult individuals relies primarily on the degree of dental development, mainly because skeletal maturation methods are generally more susceptible to environmental influences, and can thus be less reliable. Currently there are no population specific standards for determining the chronological age of Western Australian subadults, so the aim of this study is to determine the degree of error involved in applying well established, but foreign, forensic standards (e.g. Demirjian, 1973 – an eight stage dental development method based on French-Canadians; Ubelaker, 1978 – dental development and eruption method based on

Native American individuals; Mincer, 1993 – third molar mineralisation method) to an Australian population.

The sample examined comprises 225 known age and sex subadult Western Australians; 119 male and 106 female – stated age range 2.8–20.7 years. Orthopantomograms (OPGs) of each individual were evaluated using the dental development standards of the three authors; standard error rates in age prediction were then calculated. Age-related variations in prediction accuracy were found; standard error rates were found to be less in the younger age groups ( $\pm 1.080$ ) compared to a higher error rate in the older groups ( $\pm 3.480$ ). This is most likely because younger individuals can be assessed with greater accuracy as more teeth are still developing, as well as the intervals between each morphological stage are shorter and therefore more precise. The study shows that the Demirjian method (involving an eight stage dental development chart) has the lowest total predicted error and is thus the most accurate technique for determining the chronological age of Western Australian subadults.

### **Do offspring of taller parents experience greater increases in relative leg length?**

B. Floyd (University of Auckland, New Zealand), [b.floyd@auckland.ac.nz](mailto:b.floyd@auckland.ac.nz)

This study used anthropometric and life history data gathered with the cooperation of 85 Taiwanese families. It tested the hypothesis that young adult offspring's relative leg lengths were significantly positively associated with midparent heights. Individual relative leg length was represented two ways, either as the difference between sex-specific  $z$ -scores of sitting height and subischial leg length ( $z_D = z_{SH} - z_{LL}$ ) or as the difference between sitting height and knee height ( $z_D = z_{SH} - z_{KH}$ ). Midparent relative leg length, calculated in the same ways as for offspring, was introduced as a covariate in each test to statistically control for familial genetic and shared developmental influences on body proportions. Offspring composite developmental environmental scores were also included as a covariate to partially control for variation in offspring developmental circumstances. Assumptions of approximate normality, independence and constant error variance of residuals were checked.

Results of hierarchical regression analysis indicate that midparent heights were significantly associated with offspring relative subischial leg length ( $p = 0.023$ ) as were the covariates midparent relative subischial leg length ( $p < 0.0005$ ), offspring environmental score ( $p = 0.006$ ), and study location ( $p = 0.007$ ). Midparent heights were even more significantly associated with offspring relative knee height ( $p = 0.002$ ). Comparison of slope estimates suggested that variables were more strongly associated with offspring relative knee height than with relative subischial leg length. Differences were not, however, statistically significant.

### **Population variation in southern African crania: Quantification using geometric morphometrics**

D. Franklin (The University of Western Australia, Australia), [dfranklin@anhb.uwa.edu.au](mailto:dfranklin@anhb.uwa.edu.au)

This paper reports on new morphometric data examining cranial variation in 12 modern human populations from southern Africa. A total of 298 male (female specimens too few for analysis) Bantu-speaking (Zulu, Swazi, Xhosa, Southern Sotho, Tswana, Venda, Shangaan, Ndebele, Kalanga and Malawi) individuals drawn from the Dart Collection are studied. In addition, a small Khoisan (Khoikhoi and San) series comprised of either documented ‘known-in-life’ individuals, or archaeological specimens with adequate associated cultural evidence suggesting a specific ethnic identity, are also examined.

A series of 96 three-dimensional landmarks were designed and then acquired using a Microscribe 3DX portable digitizer. The ‘Morphologika’ shape analysis software is used to analyze the three-dimensional coordinates of the landmarks. Interpopulation variation is examined by calculating Procrustes distances between the groups; a cluster analysis is then used to summarize the phenetic relationships. A principal components analysis explores the relationships of the population means; the shape differences are visualized and explored using three-dimensional rendered models, and further interpreted using thin-plate splines.

Morphological differences are present within and between the crania of the Bantu-speaking and the Khoisan individuals. The Khoisan demonstrate features (e.g. a pentagonoid vault; more rounded forehead contour; smaller, less prognathic face) that clearly distinguish them from the Bantu-speaking populations. Although the Bantu-speaking populations are closely related, they do show population-specific features (e.g. crania of the more southerly populations – Xhosa, Southern Sotho, and Zulu – are characteristically more brachycephalic and less prognathic). This study shows that differential admixture with adjacent Khoisan peoples has contributed to diversity within southern African Bantu-speaking populations.

### **Cranial morphology in contemporary East Asia: A 3D approach**

H. Green, D. Curnoe (University of New South Wales, Australia), [h.green@student.unsw.edu.au](mailto:h.green@student.unsw.edu.au)

The use of craniometric data for reconstructing biological relationships between and within populations, for the past and present, has a long history in biological anthropology. There is a considerable collection of linear cranial measurements in the literature produced by standard anthropometric instruments. Recently, a new technique has been introduced using a digitiser to acquire three-dimensional (3D)

landmark co-ordinates. The method is non-invasive, and provides a means of quantifying shape differences of variable traits that cannot be directly linearly measured. The method also allows for preservation of information for visualisation and analysis at a later date, and data generated are comparable to traditional linear studies.

A *Microscribe 3DX digitiser* was used to collect 55 3D landmark co-ordinates from 547 crania from 17 contemporary East Asian populations and 7 comparative populations of mixed sex. Linear measurements generated from the co-ordinate data underwent PCA and cluster analysis, while the co-ordinate data was analysed in ‘Morphologika’, a program designed for analysis and visualisation purely of shape differences.

While there have been extensive studies on the population histories of living and past East Asians, particularly in China and Japan, studies on the defining cranial features of contemporary East Asians are at times ambiguous, and rarely described metrically. Thus, the current study employs the 3D method for the first time in East Asian populations from Siberia to Indonesia, in an aim to comprehensively survey recent cranial morphology, and in the process, broadly define modern ‘Mongoloid’ cranial features.

### **Speciation in hominin evolution**

C. Groves (The Australian National University, Australia), [colin.groves@rmit.edu.au](mailto:colin.groves@rmit.edu.au)

We can expect that human beings were subject to the same evolutionary forces and principles as other sexually reproducing animals, at any rate in the earlier stages of the evolution of the human clade (until cultural factors became so pervasive as to be overriding). This at once requires that we examine the question of species in the human clade, because it is at the point of speciation, and (more controversially) during the course of a species’ existence, that evolutionary change takes place. I will also comment on higher taxonomic levels, especially the question of genera in the human clade.

### **Mechanical resistance of human skeletal muscle to compression as measured *in vivo*: Part 1**

B. Gutnik, D. Nash, G.Y. Al-Araji (Unitec, Auckland, New Zealand), [bgutnik@unitec.ac.nz](mailto:bgutnik@unitec.ac.nz)

Stiffness may be an important criterion of muscle’s resistance to any mechanical deformation. Although a number of techniques have been employed to measure

muscle stiffness, there are no totally effective and validated methods of measuring the level of skeletal muscle stiffness *in vivo*.

The aim of this study is to establish the reliability and validity of the ‘physical spring model’ in representing muscle stiffness as measured *in vivo*.

Fifteen young adult males (18–30 years of age) in good health with no background of specialized training, and strongly right-handed, participated. Data were obtained using a uniquely designed automatic viscoelastometer incorporating a monitoring stylus with a diameter of 3.5 mm, providing a sensitivity of  $1 \times 10^{-3}$  N. The viscoelastometer was connected to a signal amplifier and computer. The stylus mechanism progressively compressed the soft tissue over the central point of the biceps of the non-dominant arm in a vertical direction, perpendicular to the orientation of fibres. The sensory transducer within the stylus measured the momentary resistive forces (in N) over each distance interval of 0.05 mm, and the rate of deflection is 1 mm/s. These measurements were correlated with time by the software. During deformation of the soft tissue the values of deflection,  $x$  (in mm) and force of resistance,  $y$  (in N) were calculated. The number of  $x$  and  $y$  data were 180–400 for each individual trial. Each participant was tested 6 times during 2 days (3 trials per day, and 1 week between the two experimental days).

In primary data analysis half of the skin fold measurement at the compression location was subtracted from each depth of deflection (on the  $x$ -axis in each plot). The rest of the plot was divided into three equal segments. Each segment consequently represents the stress–strain behaviour of the various muscle layers of the same muscle (superficial, middle, profound). Then the plot of each segment was approximated to a straight line to which the formula:  $y = kx + b$  could be applied. The coefficient of similarity ( $R^2$ ) in each case was  $>0.95$ . The same stress–strain model is frequently used to describe the stiffness of the ideal physical spring.

The coefficient  $k$  in these equations represented the physical stiffness of the muscle. Because we have recorded three approximated linear equations we can imagine the compressive portion of the biceps as three consecutively connected springs with average stiffnesses of  $k_1$ ,  $k_2$  and  $k_3$  ( $k_1 = 0.276 \pm 0.074$  N/mm;  $k_2 = 0.509 \pm 0.157$  N/mm;  $k_3 = 1.069 \pm 0.493$  N/mm). Thus  $k_3 > k_2 > k_1$  ( $F = 684$  in comparison to  $F_{\text{critical}} = 3.85$ ;  $P < 0.01$ ). The total compressive stiffness was calculated as  $k_{\text{total}} = k_1 + k_2 + k_3$  ( $k_{\text{total}}$  for the group =  $1.863 \pm 0.626$  N/mm). The two-way ANOVA method demonstrated a significant difference in  $k_{\text{total}}$  between individual participants ( $F = 18.15$ ;  $P < 0.001$ ) but did not suggest any statistical difference between any participant’s 6 trials ( $F = 0.72$ ;  $P > 0.05$ ).

We conclude that stiffness of skeletal muscle may be a reliable and valid index, which may be useful for describing the state of skeletal muscle under specific conditions.

**Effects of muscle energy technique on resistance of muscle to compression as measured in vivo: Part 2**

B. Gutnik, D. Nash, G.Y. Al-Araji, S. London (Unitec, Auckland, New Zealand), [bgutnik@unitec.ac.nz](mailto:bgutnik@unitec.ac.nz)

Muscle energy technique (MET) is widely used by manual therapists to treat many different muscular and fascial components as well as to increase muscular metabolic rate. This procedure involves the voluntary contraction of the patient’s muscle in a controlled direction at varying levels of intensity, against a counter resistance applied by the therapist’s hand. There is no recognised objective control of this procedure. We believe that some indices that represent the mechanical muscular resistance to deformation may be successfully used in osteopathic practice.

The aim of the research was to explore the short-term effect on mechanical resistance of muscle attributable to MET.

The stylus mechanism of a viscoelastometer locally compressed the soft tissue over the central point of the non-dominant biceps in a vertical direction at a constant rate of compression ( $\approx 1$  mm/s). Muscle activity was monitored by a superficial EMG (Biolab). Fifteen healthy young right-handed male adults (18–30 years old) participated in 6 control trials and 3 post-intervention trials after MET. An experienced specialist performed five 10-s consequent cycles of MET standard practice as the intervention. The effectiveness of MET was evaluated using two specific indices representing muscular resistance to mechanical deformation; (a) total stiffness of skeletal muscle (see Part 1), and (b) specific power of resistance of muscle tissue to deformation ( $P_{\text{resist}}$ ). The last index was calculated as an integral of products of all momentary plotted data of force ( $F_i$ ) and all momentary speeds ( $V_i$ ) of deflection of the stylus (over each mm of deflection).

$$P_i = F_i \cdot V_i; \quad P_{\text{resist}} = 1/n \sum_0^n P_i(\text{in W}) \text{ and } P'_{\text{resist}} = P_{\text{resist}}/l(\text{in W/mm}),$$

where  $P_i$  is momentary power of resistance;  $P_{\text{resist}}$  is the average power of resistance over the total number of plotted forces, and;  $P'_{\text{resist}}$  is the specific resistant power over 1 mm of deformation.

All our experiments were performed when the EMG signal was minimal (less than  $50 \mu\text{V}$ ). Total stiffness ( $k_{\text{total}}$ ) in the group of 15 participants was diminished after MET. The mean group total stiffness before intervention was 1.927 N/mm and after intervention was 1.794 N/mm ( $F = 4.31, P = 0.042$ ). The specific power of resistance of the biceps during compression was significantly reduced after MET from before intervention when the specific power of resistance was 0.1950 mW/mm, to an after intervention value of 0.1859 mW/mm ( $F = 6.63, P < 0.05$ ).

Because all experiments were performed on quiescent muscle we suppose that in the short-term MET changed the viscoelastic properties of the elastic elements of

muscle tissue rather than the contractile elements. In our future experiments we would like to investigate the long-term effect of MET.

**Causes of childhood obesity in Malaysia: Potential interaction of food availability, children's lifestyle choices and eating behaviour**

S. Kamarzaman, N. Bruce (University of Western Australia, Australia),  
[kamars01@student.uwa.edu.au](mailto:kamars01@student.uwa.edu.au), [nbruce@anhb.uwa.edu.au](mailto:nbruce@anhb.uwa.edu.au)

Childhood obesity has become a global crisis, now evident in developing as well as affluent countries. In Malaysia, the prevalence of childhood obesity is rising with the highest rates among the Malays. This country has undergone a transition from undernutrition to overnutrition within a period of 20 years.

Here, we review the actual changes in prevalence of obesity among Malaysian children, consider the possible causes, generate a theoretical model as a basis for future field studies and briefly outline a proposed investigation. The working model, designed to best fit Malaysian conditions is that: children's weight status will be mainly determined by food intake rather than exercise status. Food intake will be a function of food availability (home food and away-from-home food) and the child's eating choice. Eating choice is predicted to be a function of pocket money, family, siblings, schools, media, peers and psychological factors. Affecting both food availability and eating choice will be socio-cultural factors including urbanization, ethnicity, family structure, socio-economic status and socio-educational environment. The interaction of all these factors will then explain how children decide on their food, what influences their decisions and how their decisions affect their body weight.

The model will be tested by examining up to 1500 primary school children from both higher and lower socio-economic status schools: data will include anthropometric measures and interview/questionnaires delivered to children and parents. The outcome of the project is expected to assist government, private health sectors and parents to improve the nutritional status of our young generation.

**It's not my fault I had an affair: The association between early psychosocial stress and extra-pair copulations**

N. Koehler, J. Chisholm (University of Western Australia, Australia)

Cheating on a current mate, known as an extra-pair copulation (EPC), is considered unacceptable by most individuals. Nonetheless a large number of individuals still engage in such risky sexual behaviours. Because individuals with high, as opposed to low, levels of early psychosocial stress are more inclined to partake in risky activities and are more likely to be insecurely attached, the aim of

the present study was to test the prediction that individuals who engage in EPCs may have higher levels of early psychosocial stress than those that do not. Two types of EPC relationships were examined: EPCs (self), having sex with someone other than one's current mate, and EPCs (other) having sex with someone who is already in a relationship with someone else. In a sample of 229 women and 161 men, significantly higher levels of early psychosocial stress were found amongst those that reported at least one EPC (self) than those that reported none. Furthermore, the more EPC (self) relationships men, but not women, reported, the higher their early psychosocial stress levels. Early psychosocial stress levels did not significantly differ between those that did and did not report an EPC (other) relationship. A possibility of why early psychosocial stress was higher in individuals engaging in EPCs (self), but not EPCs (other), will be discussed.

### **The relative cost of the bent–hip–bent–knee gait is reduced in water**

A.V. Kuliukas (The University of Western Australia, Australia), [akuliukas@anhb.uwa.edu.au](mailto:akuliukas@anhb.uwa.edu.au)

The debate about how early hominid bipeds might have moved can be characterised as two conflicting hypotheses: One is that they moved like we do, in a fully upright human-like (FUHL) gait; the other that they moved with a bent–hip bent–knee (BHBK) gait. Proponents of the former argue that BHBK is too costly (about 60% more) and heat-producing. However, all of the models supporting this view to date have been based on the assumption that this bipedalism would have occurred largely on land.

Here, I report the results of my study which show that the energy cost differential of BHBK gaits is reduced in water. The greater the knee flexion and the deeper the water, the more the cost was reduced. At low speeds (around 0.3 m/s), with a 50° knee flexion and in deep water (sternum depth), the extra cost of BHBK gait was essentially eliminated. Furthermore, it was clear from the results that highly non-optimal gaits, involving degrees of knee flexion greater than 70°, in chest deep water, would actually be more efficient in water than on land at low speeds.

As the palaeohabitats of some early hominids are dominated by nearby wetlands and that all four great ape species are perhaps most predictably bipedal in shallow water, it is argued that this finding has significant implications in understanding the causal factors of hominid bipedalism.

**Local ecologies: Tuberculosis in Auckland**

J.H. Littleton, J.K. Park (University of Auckland, New Zealand), R. King (Auckland Regional Public Health, New Zealand), [j.littleton@auckland.ac.nz](mailto:j.littleton@auckland.ac.nz), [j.park@auckland.ac.nz](mailto:j.park@auckland.ac.nz)

Since 2002, we have explored the patterns of tuberculosis and the experiences of those with tuberculosis disease (TBD) in Auckland. One of the major issues in terms of TB control is both the diagnosis of people with TB disease and their adherence to the long treatment regimes. Our aim was to explore the factors that promote rapid diagnosis and successful treatment or create barriers. Moving from this focus it then became possible to begin to isolate some of the relationships between the aftermath of developing active TB and the epidemiology of the disease.

The following paper presents our findings from the study focussing on the relationship between the epidemiology of tuberculosis in particular ethnic groups and the experience of people from these same groups. In this we are combining GIS data using the Epidemiology Surveillance Data from 1996 to 2004 in the Auckland region, with qualitative data collected during several community studies, along with analysis of the media.

The GIS analysis has allowed us to visualise and identify a correlation between the geographical patterning of the illness and the experiences of individuals who had contracted TBD, highlighting themes of isolation, social deprivation, poor access to services, stigma and social suffering. We argue that despite TB being one infectious disease, experienced in one urban area under one health system, different ethnicities experience distinctive local ecologies of infection presenting challenges both to those providing health services and those setting policy agendas.

**The effect of a low glycaemic load diet on *acne vulgaris***

N. Mann, R. Smith (School of Applied Sciences, RMIT University, Australia), G. Varigos, A. Braue (Department of Dermatology, Royal Melbourne Hospital, Australia), [neil.mann@rmit.edu.au](mailto:neil.mann@rmit.edu.au)

Acne is a common endocrinopathy affecting the majority of adolescents in Western Society, despite an almost complete absence in societies consuming a primitive diet. However, the rate of acne in these societies is similar to western levels once a shift to processed food consumption occurs. Chronic glycaemic elevation by continuous consumption of refined carbohydrate foods leading to hyperinsulinemia has been implicated in acne pathophysiology because of its association with increased androgen bioavailability and free levels of insulin-like growth factor-I (IGF-I). Low glycaemic load (LGL) diets typical of unacculturated societies may play a dual role in the prevention of hyperinsulinemia by decreasing circulating

insulin levels directly and improving insulin sensitivity. Therefore, the aim of the present study was to compare the effect of a LGL diet with high glycemic load habitual diets on the severity of acne symptoms and endocrine variables associated with insulin resistance.

Forty-three male acne sufferers were randomised to either a LGL diet or control diet for a period of 12 weeks. Low-level acne therapy was standardized for both groups and facial acne was assessed every 4 weeks. Venous blood was collected at baseline and 12 weeks for assessments of insulin sensitivity [determined by the homeostasis model of insulin resistance (HOMA-IR)], testosterone, sex hormone binding globulin, free androgen index (FAI), dehydroepiandrosterone sulfate (DHEA-S), insulin-like growth factor (IGF)-I and IGF-binding proteins 1 and 3.

A significantly greater percentage reduction in total lesion count was observed in the LGL group compared with the control group as well as reductions in FAI, HOMA-IR and an increase in IGFBP-1 when compared to the control group.

This data suggests that a LGL diet may reduce androgenic activity and may oppose the growth promoting effects of IGF-I by increasing levels of its binding protein, IGFBP-1. This implies that a LGL diet may reduce hormonal influences involved in acne pathogenesis and may explain the observed absence of acne in primitive societies who consume a diet generally low in refined carbohydrate foods.

### **Convergence and remarkably consistent constraint in the evolution of carnivore skull shape**

N. Milne (University of Western Australia, Australia), [milne@anhb.uwa.edu.au](mailto:milne@anhb.uwa.edu.au),  
S. Wroe (University of New South Wales, Australia), [s.wroe@unsw.edu.au](mailto:s.wroe@unsw.edu.au)

Phenotypic similarities between distantly related marsupials and placentals are commonly presented as examples of convergence and support for the role of adaptive evolution in shaping morphological and ecological diversity. Here, we compare skull shape in a wide range of carnivorous placentals (*Carnivora*) and non-herbivorous marsupials using a 3D geometric morphometric approach. Morphological and ecological diversity among extant carnivorous placentals is considerably greater than is evident in the marsupial order *Dasyuromorphia* with which they have most commonly been compared. To examine convergence across a wider, but broadly comparable range of feeding ecologies, a data set inclusive of non-dasyuromorphian marsupials and extinct taxa representing morphotypes no longer present was assembled. We found support for the adaptive paradigm, with correlations between morphology, feeding behaviour and bite force, although skull shape better predicted feeding ecology in the phylogenetically diverse marsupial sample than in carnivorous placentals. However, we also show that remarkably consistent but differing constraints have influenced the evolution of cranial shape in both groups. These differences between carnivorous placentals and marsupials, which correlate with brain size and

bite force, are maintained across the full gamut of morphologies and feeding categories, from small insectivores and omnivores to large meat-specialists.

### **Physiology and mythology of the shrinking penis**

D. Mitchell (Monash University, Australia), [David.Mitchell@med.monash.edu.au](mailto:David.Mitchell@med.monash.edu.au)

Physiological retraction of the penis is not treated as a problem in medical texts in spite of its reported occurrence in exposure to cold, amphetamine intoxication and coital failure. There is little factual information available about its frequency, the degree of retraction possible or the circumstances in which it can occur.

In the folk illnesses grouped together as the genital retraction syndromes both the victims and the healers that treat them claim that the shrinking of the penis is real and extreme. This is normally claimed to be illusory and due to the power of suggestion, but an alternative proposed is that physiological penile retraction regularly occurs in anxiety states and can proceed to its physiological extremes in panic attacks. This paper reviews the considerable evidence available for anxiety-related retraction of the penis in the human male. The role of culture in pathologising this obscure aspect of human biology in some social settings is examined. At the same time this peculiar hiatus in knowledge provides an example of how a topic can be trivialised and information can be suppressed or lost.

A final conclusion about a physiological basis for genital-retraction panic is not yet possible but the issue clearly does have some importance. An adequate understanding of retraction may illuminate broader issues such the nature of the culture-bound disorders in general, and the evolution of a protruding non-retracted penis in the human male.

### **Taste sensitivity to phenylthiocarbamide (PTC) – How molecular genetics has reopened an old field of study**

J. Mitchell, S. Drew, T. Rintoull (La Trobe University, Australia), [john.mitchell@latrobe.edu.au](mailto:john.mitchell@latrobe.edu.au), [s.drew@latrobe.edu.au](mailto:s.drew@latrobe.edu.au), [audrew@latrobe.edu.au](mailto:audrew@latrobe.edu.au)

Phenylthiocarbamide (PTC) taste sensitivity has been used for many years as a classic example of Mendelian (single gene) inheritance in humans. After tasting varying concentrations of this bitter substance, most humans can be divided into non-tasters and tasters, and family studies indicated that ‘non-tasting’ was a recessive trait. Intriguingly, the putative non-tasting allele, *t*, has a frequency of over 40% in most populations and in some reaches >60%. This high frequency was assumed to be the result of heterozygote advantage, and most probably related to responses to dietary items throughout our evolution.

A gene discovered in 2004 apparently explains this tasting polymorphism at the molecular level and further analysis showed that it results from variation at only 3 nucleotide positions. These 3 sites generate 9 possible haplotypes, yet 2 of these predominate in populations investigated so far; one coding for sensitivity and the other for insensitivity to PTC. The discovery of this gene allows (a) investigation of populations that otherwise would be impossible using the field PTC testing and (b) comparison of the findings from the field testing approach with this genetic polymorphism. Hopefully, by using this genetic approach in populations that have used food resources with very different arrays of bitter compounds for millennia, we will detect the selective forces that have acted to maintain an allele that fails to recognise bitter substances in high frequency. We report our initial findings on this PTC polymorphism in human populations that use very different food resources.

### **Island biogeography: Endemism and the hominins of Flores in context**

M. Morwood (University of New England, Australia), [mmorwood@mail.une.edu.au](mailto:mmorwood@mail.une.edu.au)

You do not expect to find a new human species living until just 12,000 years ago on Flores, a remote island in East Indonesia. But this is exactly what our Australian–Indonesian team reported in describing *Homo floresiensis* or ‘Hobbit’ as the species holotype has become known. Professional and public reaction to the find has been unparalleled because it was so unexpected. Why?

Firstly, Indonesia, at the periphery of the Old World, has also been considered peripheral to major events in hominin evolution. A view supported by the fact that only two hominin species have been previously reported from the region despite over 100 years of active field research – *H. erectus* and modern humans, *H. sapiens*.

Secondly, there are the characteristics of the new species – people only a metre tall, with a tiny brain and ape-like limb proportions. The species does not fit with many preconceptions about where, how and when humans evolved, and what they should look like.

In this lecture, I will describe some common evolutionary trends on islands, including changes in brain size, body size, dentition and limbs, and will argue that *H. floresiensis* encapsulates two contradictory aspects of island evolution which have been replaced elsewhere, namely

- (a) Innovation and the development of new traits.
- (b) Conservatism and the retention of primitive lineages and traits.

I will also argue that the characteristics of *H. floresiensis* and its presence on an Indonesian island, while definitely pushing the boundaries, also fit with what little we know, or what we obviously do not know, about animal dispersal and evolution in Asia.

**Crossing ‘Wallace’s Line’: A palaeoanthropological puzzle**

S. Munro (Australian National University, Australia), L. Broadhurst (US Department of Agriculture, USA), M. Crawford (University of North London, UK), M. Verhaegen (Studiecentrum Antropologie, Mechelbaan, Belgium), [Stephen.munro@anu.edu.au](mailto:Stephen.munro@anu.edu.au)

To reach Flores, the ancestors of *Homo floresiensis* had to cross Wallace’s Line, and this traditionally poses a puzzle for palaeoanthropologists (Argue et al., 2006, *J. Hum. Evol.*). Our studies show, however, that this puzzle might be solved if, instead of considering only terrestrial or savanna models of human evolution, we also consider waterside models, in which dispersal around coasts may have been important. A coastal dispersal for early *Homo* populations could explain a number of human features, such as large brains and tool use, and the idea of a coastal hominid dispersing to an off-shore island is easier to envisage than a non-coastal hominid. Humans are well adapted to exploit waterside environments, such as coasts, where hunting and foraging for food can be undertaken on land and in water. In fact, evolution in a littoral environment could be the simplest explanation for man’s current anatomy, physiology, and nutritional requirements, and is perfectly consistent with the location and presumed palaeoenvironments of all *Homo* fossils and artefacts. Our research suggests that the transformation from tree dwelling (predominantly fruit eating) ape, to non-tree dwelling (omnivorous) human, may have been accompanied in the early stages by increased partial reliance on slow or sessile waterside foods such as crabs, turtles and molluscs.

**A model for the Liang Bua hominins based on endemic cretinism**

P.J. Obendorf (RMIT University, Australia), [peter.obendorf@rmit.edu.au](mailto:peter.obendorf@rmit.edu.au), C.E. Oxnard (University of Western Australia, Australia), [coxnard@anhb.uwa.edu.au](mailto:coxnard@anhb.uwa.edu.au)

We have previously presented evidence that the skeletal remains found at Liang Bua cave, Flores, may be human endemic cretins (Oxnard and Obendorf, 2006, 20th Annual Meeting of the ASHB). Here we develop and support an ecological model which shows how cretins could have arisen on Flores, and how they may have been differentially preserved at Liang Bua. A seasonally mobile population of hunter-gatherers in the environment of Ice-Age Flores uses inland and not coastal resources. Iodine and selenium deficiency is likely as in other similar locations in Indonesia. Increased serum thiocyanate could arise from cyanogenic plant foods, including native bamboos and yams. These three factors can generate myxedematous endemic cretinism, which has been observed in human populations in Africa and Asia at up to 5% prevalence. Such cretins show extreme dwarfism, mental retardation and lessened mobility, but survive to adulthood by which stage they may live

independently of the normal population. Assuming 1% rate of cretinism, and 50% child mortality, a population of 100 would give rise to about 15 adult cretin deaths per thousand years. Unlike normal individuals buried throughout the range, skeletal remains of cretins may differentially accumulate in a cave used for shelter. The model shows striking consistencies with oral traditions previously recorded among the Nage, a group partly descendant from the aboriginal population of western Flores.

### **Differentiating early *post mortem* artefacts from *peri mortem* trauma on skeletal material (*Sus scrofa*)**

R.C. O'Brien, J. Meyer, I. Dadour (University of Western Australia, Australia), [cobrien@anhb.uwa.edu.au](mailto:cobrien@anhb.uwa.edu.au), [jmeyer@anhb.uwa.edu.au](mailto:jmeyer@anhb.uwa.edu.au), [idadour@cyllene.uwa.edu.au](mailto:idadour@cyllene.uwa.edu.au)

Differentiation of artefacts of trauma inflicted on bone in the *primortem* and early *post mortem* interval could be of use in distinguishing fatal injuries from those occurring in situations such as secondary burials and mass reburials. A pilot study was conducted to investigate the difference in the appearance of artefacts created in *peri mortem* and early *post mortem* periods, and to create a methodology that could be employed by non-experts. The major aims of this study were to relate the appearance of artefacts to the state of decomposition of the bone and calibrate decompositional changes to local and seasonal conditions. Injuries were created on dead pigs (*Sus scrofa*) weighing ~40 kg with blunt and sharp implements at different intervals after death. The carcasses were allowed to remain in the field for varying periods before collection, and then they were cleaned and examined using a dissecting microscope and radiographic imaging. A microanalysis of two indicators of bone condition was conducted to determine the amount of weathering that had occurred in each *post mortem* period. Systematic relationships between weathering time (accumulated degree days), bone density, and the pattern of pitting on the surface of the bone were demonstrated. Macroscopic examination of the injury site for the effects of the loss of organic components from the matrix of the bones in chipping, cracking, and splintering of the edges of the wound revealed little differentiation in the appearance of the injury sites with the *post mortem* timing of injury.

### **Could the Flores fossils be endemic cretins?**

C. Oxnard (University of Western Australia, Australia), [coxnard@anhb.uwa.edu.au](mailto:coxnard@anhb.uwa.edu.au), P. Obendorf (RMIT University, Australia), [peter.obendorf@rmit.edu.au](mailto:peter.obendorf@rmit.edu.au)

The anatomical features of the fossils from Liang Bua, Flores, referred to a new species, *Homo floresiensis*, give rise to contradictory assessments. Some

characteristics (e.g. endocranial, cranial, facial and dental) seem clearly human suggesting a form of genetic microcephaly. Some features (e.g. cranial and body size) have been interpreted as island dwarfing in some more ancient species. Yet other characters (e.g. increased limb bone robusticity, reduced humeral torsion, large feet) seem similar to *Homo erectus*. Some measures (e.g. high intermembral index, deep temporal fossa) resemble, separately, australopithecines and chimpanzees. Features such as short, wide pelvis presuming bipedality, and relatively long arms supposing climbing, could be speaking to functional adaptations without specifying species.

In contrast, almost all Liang Bua characters also occur in human myxedematous endemic cretinism. Limb bones are robust, not because of relatedness to *Homo erectus*, but because a reduced thyroid state reduces long bone widths (subperiosteal growth reduction) less than lengths (epiphyseal growth reduction). Intermembral indices are high, not because of adaptations to arboreal activities like australopithecines, but because hypothyroid reduction in growth of the non-weight bearing arms is less than the reduction in growth of weight bearing legs. Other characteristics of cretins include absent or very small styloid, vaginal and clinoid processes, open fontanelles, sutures, epiphyseal plates and synchondroses, reduced chins, and mixed dentition. These are all present in the Liang Bua fossils, and explicable by an ecological model (Obendorf and Oxnard, 2006, 20th Annual Meeting of the ASHB). Supported by ARC and Leverhulme Trust, UK.

### **Craniofacial variation among Asian Old World monkeys: An implication to divergence differences between colobines and macaques**

R.L. Pan (University of Witwatersrand, Johannesburg, South Africa), [rulian.pan@Wits.ac.za](mailto:rulian.pan@Wits.ac.za), C. Groves (Australian National University, Australia), [colin.groves@anu.edu.au](mailto:colin.groves@anu.edu.au)

Although it is generally considered that Asian colobines and macaques left Africa separately at about 14 and 6 millions years ago, the arrival times and dispersal patterns for the two groups of nonhuman primates in Asia are still debatable. In order to clarify some hypotheses on these issues, 14 craniofacial variables of the monkeys were analyzed with univariate and multivariate analyses. The results indicate that macaques show a greater intra-generic variation – a longer spectrum of Euclidean Distance (EUD) and a larger EUD mean – than do colobines. It is thought that this may relate to the wider geographic distribution of the macaques. The main differences between the two groups are associated principally with the variations in phylogenetic development and divergence history initiated in Africa. Thus, a larger intra-generic variation among the macaques also implies that the species diverged earlier than they did in the colobines in Asia, and even that the latter departed Africa earlier than the former. Quite different from the scenarios experienced by the colobines, the accelerated uplift of the Himalayas and Qinghai-Tibet Plateaus in the Pliocene and Pleistocene blocked macaques spreading further

east, but made possible their radiation along coastlines, on plains and in middle-high mountains.

### **The Skeletal Provenancing project: Results and evaluation**

C. Pardoe (Colin Pardoe Bio-Anthropology and Archaeology, Australia), [colin.pardoe@ozemail.com.au](mailto:colin.pardoe@ozemail.com.au)

The Skeletal Provenancing project was established in 1995 with the aim of identifying as closely as possible the region of origin of the roughly 15% of Indigenous skeletons in Australian museums that have no known provenance.

Extensive data collected from more than 3000 individuals of known location include measurements taken as part of the project (where permission was given) and data from a comprehensive range of historical and contemporary research. More than 500 unprovenanced individuals were measured. Individuals may be identified to their correct tribe or adjacent neighbour in about 87% of cases. Examples of biometric analysis as part of repatriation works are provided. The impact of these biometric analyses on repatriation, reconciliation and the role of science in society will be considered.

### **Under or overexposed? Investigating the sun exposure behaviours of Pacific and South Asian women aged 18–40 in Auckland, New Zealand**

F. Pettit (The University of Auckland, New Zealand), [mpettit@xtra.co.nz](mailto:mpettit@xtra.co.nz)

In Australasia skin cancer is a major public health issue. Recently there has been concern that advice to limit sun exposure may increase the risk of vitamin D deficiency, yet there is no allowance in the public health message for differences in pigmentation or ethnicity. In New Zealand South Asian and Pacific populations are relatively recent migrants. Little is known about sun exposure behaviours in these groups, but there is evidence that they may be at increased risk of vitamin D deficiency in New Zealand.

My research was aimed at analysing the degree of sun exposure in Pacific and South Asian women aged 18–40 and investigating underlying factors. I carried out observations for 100 women in each group in public places to examine the proportion of skin exposed in summer and winter. I also interviewed 15 women from each group and analysed the data for themes relating to sun exposure. Observational data revealed that while Pacific women frequently exposed their skin, South Asian women were more likely to dress conservatively. The observational data were confirmed by the interviews, which revealed a set of factors influencing sun exposure.

The research demonstrates the complex relationship between sunlight, biology and health, and how it interacts with perceptions of the risks of sun exposure, individual

biology and socio-economic variables, which affect opportunities for sun exposure. This interaction creates local biologies that may place some Pacific women at risk of skin cancer, while some South Asian women may be at higher risk of vitamin D deficiency.

**Increased rates of survivability with Group A Streptococci infections in Victoria, 1850–1900: Evidence supporting the Osteological Paradox**

P. Roberts (Australian National University, Australia), [philr@cgoldshire.vic.gov.au](mailto:philr@cgoldshire.vic.gov.au)

This presentation is an extension of my Master of Arts thesis, and will show how in Victoria, from 1853 to 1900, Group A Streptococci bacterial infection patterns and rates changed. This is displayed by decreases in initial disease forms (Scarlet Fever and Erysipelas) and increases in infections that had advanced past the initial disease form (Rheumatic Fever and Nephritis).

The project involved examined terminology usage in Victoria's Registrar Generals reports from 1853 to 1900 that could be considered to refer to Group A Streptococci bacterial infections.

What was shown is the use of the term 'scarlet fever' appearing to display an epidemic cycle, which ended after the 1875–1876 epidemic. Following this, rates of the use of the term 'erysipelas' decrease, use of the terms 'puerperal fever' and 'rheumatic fever' can be observed to clearly increase and rate of use of terms that could be used to describe kidney diseases ('Nephritis', 'Nepria' and 'Bright's Disease') possibly including glomerulonephritis, increase by between four and six times. This suggests that people were surviving longer with group A Streptococci bacteria.

It is unclear what caused this change, possibly survivability increased as a result of the medical developments of the second half of the nineteenth century or because the bacteria mutated into a less virulent form.

However, this potentially supports the hypothesis proposed by Wood et al. (1992), the Osteological Paradox. This being that skeletal markers of infectious disease in osteo-archaeological studies actually show individuals who had the ability to live with an infectious disease long enough for it to infect the bones.

**Form and function of the primate pelvis and scapula: A multivariate study**

M. Sowmi, R. Kidd (The University of Western Sydney, Australia), [B.Kidd@uws.edu.au](mailto:B.Kidd@uws.edu.au)

This study is concerned with patterns of morphological variation in the scapula and pelvis of selected primates. A suite of data was obtained from hominoids and

various Old World monkeys as available. In addition, pelvic fragments of available fossils were included in the latter part of this study. All dimensions were chosen so as to reflect as much as possible functionally relevant features.

An initial univariate analysis was undertaken which revealed interesting but simplistic trends; thus, multivariate analysis was essential. Multivariate investigations were undertaken to identify patterns of morphological variation in the pelvis and scapula of selected extant primate species. Initial principal components analysis achieved the separation of groups according to mainly size and shape. Subsequent canonical variates analysis discriminated these groups in terms of functional attributes. The pelvis part of the study provided a clear discrimination into the three broad groups of humans, great apes and monkeys. The scapula part of the study demonstrated separation based upon arm-raising ability, with the gibbons, great apes and humans being together, clearly separated from the baboon and other monkeys.

An indexed version of the data was used for the fossil part of the study so as to emphasise biomechanically important features. Due to the fragmentary nature of the fossil material only some of the indices could be used. Findings varied considerably depending upon which indices were used and emphasise yet again that due caveat must be observed with fragmented materials.

### **Morphological variations in selected vertebrae among some marsupials**

E. Tjong, R. Kidd (The University of Western Sydney, Australia), [B.Kidd@uws.edu.au](mailto:B.Kidd@uws.edu.au)

This is a study on the patterns of morphological variation present in selected vertebrae of a group of marsupial species, namely the axis (C2), a thoracic and lumbar vertebra (T3 and L4), and the sacrum. A suite of seven inter-landmark distances was obtained from each of the four bones from six diverse species of marsupial: possum, bandicoot, quoll, koala, wallaby and wombat. All dimensions were chosen so as to represent as far as is possible functional attributes of the bones; that is, they were reflective of locomotor adaptations. A sample size of five was considered sufficient for this project. The sex of most specimens was unknown and thus sex was pooled. This was considered acceptable within the context of this study, as variation within the sex of each species was small when compared to the variation between species.

The data were initially subjected to a simple univariate analysis, which provided interesting but essentially simplistic results. The data were then subjected to the multivariate analyses of principal components analysis (PCA) and canonical variates analysis (CVA). These results revealed clear discriminations that could not be explained entirely upon the basis of functional affinity.

The main conclusions from this study are that patterns of morphological variation in the axis, T3, L4 and the sacrum, are similar in species with similar forms of

locomotion but also reflect a closeness in phylogeny. Thus, while many of the patterns are functionally significant, some are best explained on the basis of phylogenetic relationship.

### **Getting the most out of crime scene samples**

R.A.H. van Oorschot (Forensic Services Department, Victoria Police, Australia), [roland.vanoorschot@police.vic.gov.au](mailto:roland.vanoorschot@police.vic.gov.au)

DNA profiling has had a significant impact in criminal investigation over the past 15 years. Use of PCR, highly discriminating short tandem repeat loci, identification of core STRs and use of DNA profile databases have assisted this advance as has the development of commercially available kits and equipment technologies.

Much of the current focus is on: improving the retrieval of DNA (collection and extraction); amplification and typing of difficult samples such as old, degraded and trace quantities; automation; and analysis software. We have focussed much of our research on improving the retrieval and typing of trace amounts of DNA and attempting to understand issues relating to the transfer of trace amounts of biological samples. We know that multiple swabbing techniques improve retrieval rates; the use of tape rather than swabs on clothing improves typing success; much of the DNA that is retrieved by a swab is lost during extraction; there are significant differences in DNA extraction methods in their ability to retrieve good quantities of quality DNA; use of laser microdissection and pressure catapulting can assisted retrieval of targeted minor components from cell mixtures; modifications to PCR protocols and use of pre-PCR whole genome amplification can assist in generating profiles where they may otherwise not have been obtainable.

Efforts for future benefit are being focused on miniaturisation and acquisition of further information (including identification of physical traits) from retrieved DNA that may be useful in investigations of criminal activities.

### **Writing with the non-dominant hand: Cross-handedness trainability in adult individuals**

L. Walker, M. Henneberg (University of Adelaide, Australia), [leandra.walker@alumni.adelaide.edu.au](mailto:leandra.walker@alumni.adelaide.edu.au), [maciej.henneberg@adelaide.edu.au](mailto:maciej.henneberg@adelaide.edu.au)

Adult volunteers (8 males and 13 females) aged 20–56 years, both right- and left-handed were asked to train their non-preferred hand to write two standard sentences by practising daily over a 28 day period. At the end of this period their non-preferred handwriting was of good quality and participants felt quite comfortable performing this task. The quality of non-preferred handwriting achieved was unrelated to age. We postulate that handedness, in terms of actual

performance, may be less pronounced than is suggested by studies of hand preference.

**Skeletal evidence for pedal first ray divergence in modern humans: Atavistic or acquired?**

B. Zipfel (University of Johannesburg, South Africa), [bzipfel@twr.ac.za](mailto:bzipfel@twr.ac.za), R.S. Kidd (University of Western Sydney, Australia), [B.Kidd@uws.edu.au](mailto:B.Kidd@uws.edu.au)

The ape foot has a divergent first metatarsal ray associated with an opposable hallux required for arboreal locomotion. Morphometric analysis of ape and human first metatarsals captures this associated functional pattern. A common discrete feature in both *Homo sapiens* and some extinct hominins is an area of contact for the second metatarsal dorsal to the first metatarsal peroneal tubercle. In humans, this area of contact presents with three distinct variations and the presence of an articulating facet is a suggested marker for a non-opposable hallux.

The examination of both recent (Sotho, Zulu and European) and Late Stone Age (LSA) South African human skeletal samples reveal that a smooth area with indefinite margins is most common, followed by a smooth area with well-defined margins and rarely an absent area for articulation. A comparison of frequencies between the recent and LSA sub-groups show no statistically significant difference between them. This suggests that environment and habitual behaviour play little or no role in this variation. A number of specimens presented with well-developed lateral articular facets that may have been acquired to gain stability for a divergent inter-metatarsal angle.

We concluded that the absence of the articular facet in humans suggests an atavistic feature, but may acquire a pseudo-facet in response to first ray hypermobility. This suggests that the articulation between the first and second metatarsals is essential to efficient habitual bipedalism, but may not always be a marker for a lack of a divergent ray in bipeds.