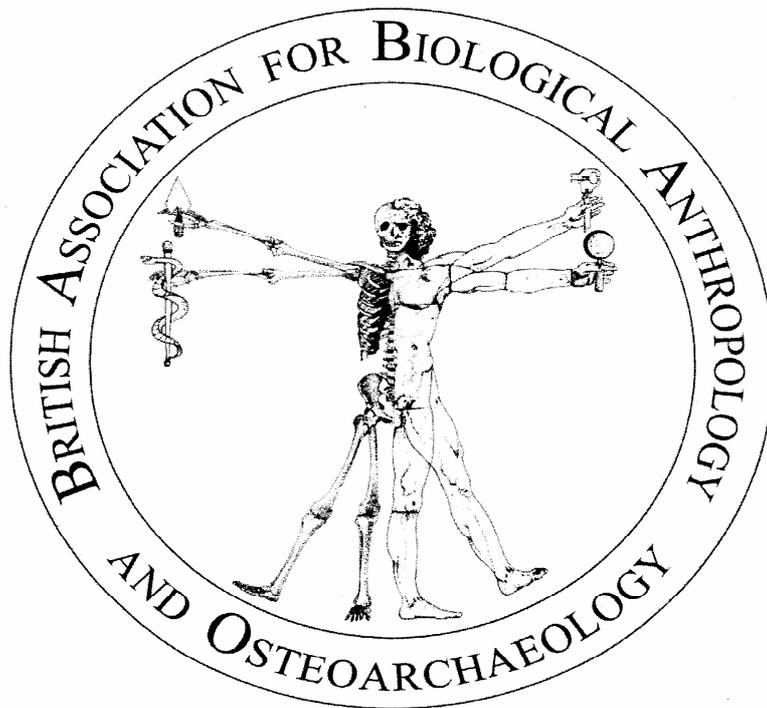


**13th Annual Conference of the
British Association for Biological
Anthropology and Osteoarchaeology**



Organiser

Dr. Kathleen McSweeney

**University of Edinburgh
School of History, Classics, and Archaeology**

Friday 2nd – Sunday 4th September 2011

Programme and Abstracts

This document is available in larger print, or on different coloured paper, or as unbound pages, on request. Please contact the Dr Kath McSweeney in person or by email kath.mcsweeney@ed.ac.uk or telephone 650 2373.

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Programme Summary

Friday 2nd September

- 1100 Registration desk opens in South Hall Complex, Pollock Halls.
Book into your rooms at Holland House, Pollock Halls. (please note: access to rooms will not be available until 14:00 hours, although luggage can be left in a locked store.)
- 1345-1800 Palaeopathology Session
- 1830 - 2030 Evening reception (Kirkland Suite, South Hall Complex, Pollock Halls)

Saturday 3rd September

- 0830 - 1230 Scientific Advances in Osteology Session
- 1230 - 1330 Lunch and Posters
- 1330 -1530 Forensic Anthropology Session
- 1530 - 1630 Coffee, Tea, Poster Break
- 1630 -1730 Forensic Anthropology Session Cont'd
- 1730 - 1830 BABA0 Annual General Meeting
- 1900 Conference Dinner (Pentland Suite, John McIntyre Conference Centre, Pollock Halls)

Sunday 4th September

- 0830 - 1315 Open Session
- 1315 - 1330 Announcement of Prizes
- 1330 Close of Conference



**Graduate School of
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Academic Programme

Friday 2nd September

1345 Welcome to the Conference. Kathleen McSweeney

Palaeopathology Session. Chair: Chris Knusel

1350 KEYNOTE SPEAKER: Prof. Donald Ortner: Paleopathology: Now and then.

1435 **Linda Fibiger.** Childhood and violence in Neolithic Europe.

1450 **Jonny Geber.** A palaeopathology of the great Irish famine: the Kilkenny Union Workhouse mass burials.

1505 **Charlotte Roberts, Abigail Bouwman, Romy Müller, Terry Brown, Sandra Bunning.** Understanding re-emerging infectious diseases: contributions on tuberculosis from palaeopathology and biomolecular science.

1520 **Paola V. Ponce.** Osteochondritis dissecans in archaeological and modern populations: a preliminary analysis.

1535 **Laura Bonsall.** A biocultural analysis of fracture patterns in a Late Roman population from Winchester, Hampshire.

1550 **Rebecca A. Storm, Keith Manchester, Andrew Holland, Rachel Holgate, Hassan Ugail, Jo Buckberry, Chris Gaffney, and Andrew S. Wilson.** From Cemetery to Clinic: New observations of palaeopathological changes in leprosy.

1605 Coffee/Tea/Posters

1700 **Evilena Anastasiou, Piers D Mitchell, Danny Syon.** Human Intestinal Parasites in Acre: Stories from a crusader cesspool.

1715 **Marlo Willows.** The palaeopathology of The Isle of May.

1730 **Anne E. Anderson and Jo Buckberry.** Skeletal trauma in children and adolescents during the Industrial Revolution in England.

1745 **Elina Petersone-Gordina, Guntis Gerhards, Tina Jakob.** Scurvy in a Post-Medieval Population from Jelgava, Latvia

1830 Reception (Kirkland Suite, South Hall Complex, Pollock Halls)

Saturday 3rd September

Scientific Advances in Osteology Session. Chair: Piers Mitchell

- 0830 KEYNOTE SPEAKER: Prof. Katerina Harvati.
- 0915 **Julie Beaumont, Jonny Geber, Natasha Powers, Julia Lee-Thorp, Andrew Wilson, Andrew Gledhill and Janet Montgomery.** The Great Irish Famine: producing “lifeways” for victims and survivors using isotopic ratios and elemental concentrations.
- 0930 **Charlotte King, R. Alexander Bentley and Una Strand-Viðarsdóttir.** Migrants in the Mun River Valley? Insight into migration and kinship using isotopes, nonmetrics and geometric morphometrics.
- 0945 **Andrew Holland, Jo Buckberry, Chris Gaffney, Chris Watkins, Hassan Ugail, Rebecca Storm, Keith Manchester, Tom Sparrow, Alan Ogden, Rachel Holgate, Andrew S. Wilson.** ‘From Cemetery to Clinic’: 3D Digitised pathological data from archaeological leprous skeletons.
- 1000 **Brenna Hassett.** Enamel Hypoplasia in Post-Medieval London: A Reassessment of Evidence of Childhood Health.
- 1015 **Michael Sandholzer, Maria Teschler-Nicola, Damien Walmsley, Philip Lumley, Gabriel Landini.** High-resolution micro-CT imaging as a novel tool in the analysis of cremated bones and teeth: A comparison of experimental results with Bronze Age human remains.
- 1030 Coffee/Tea/Posters
- 1115 **Muriel Masson.** Tuberculosis at the Late Neolithic Site of Hódmezővásárhely-Gorzsa, Hungary.
- 1130 **Oona Y-C. Lee, Houdini H.T. Wu, David E. Minnikin, Gurdyal S. Besra1 and Helen D. Donoghue.** Lipid biomarker combinations in the diagnosis of ancient leprosy and tuberculosis.
- 1145 **Marco Milella, Christoph P.E. Zollikofer, Marcia S. Ponce de León.** Quantitative paleopathology: using virtual reconstruction and geometric morphometrics to analyze pelvic pathologies.
- 1200 **Colin Smith, Vivien Standen, Bernardo Arriaza.** Palaeodiet at a weekly scale through carbon isotope analysis of amino acids from hair using LC-IRMS: preliminary studies on Chinchorro mummies.
- 1215 **K.A. Plomp, U. Strand Vidarsdottir, & C.A. Roberts.** Two-Dimensional Shape Analysis of Lower Thoracic Vertebrae with Schmorl’s nodes.
- 1230 Lunch/Posters/Book Stalls

Forensic Anthropology Session. Chair: Elena Kranioti

- 1330 **KEYNOTE SPEAKER: Prof. Sue Black.** Forensic Anthropology - a professional science or an amateur hobby?
- 1415 **Benjamin Osipov, Katerina Harvati, Elena F. Kranioti.** Sexual dimorphism of the bony labyrinth in modern humans: A pilot study.
- 1430 **Lucina Hackman.** The Applicability of the Greulich and Pyle Atlas to a Scottish Population.
- 1445 **Kathryn Waterhouse.** The effect of bone age on the fragmentation of burnt bone.
- 1500 **Nicky Town.** Chapel House Farm Medieval Cemetery: Establishing the relationship between human bone and its environment.
- 1515 **L. Watamanuik.** Positive Identification of Human Remains – Population Statistics and Quantifiable Probability.
- 1530 Coffee/Tea/Posters
- 1630 **Alexandria Young.** Fox hunting and badger baiting: investigating vertebrate scavenging patterns in Northwest European contexts.
- 1645 **Velissaria Vanna, Nicholas Marquez-Grant, Constantine Eliopoulos.** Diffuse idiopathic skeletal hyperostosis in a modern human skeletal collection from Greece.
- 1700 **Jo Buckberry.** Peri-mortem trauma at Stirling Castle.
- 1715 **Richard J. Slater, Martin J. Smith.** Hung Out to Dry: A Multidisciplinary Analysis and Recording of a Preserved Human Skin.
- 1730 BABA0 AGM
- 1900 *Conference dinner* (Pentland Suite, John McIntyre Conference Centre, Pollock Halls)

Sunday 4th September

Open Session. Chair: Mary Lewis

THIS SESSION IS DEDICATED TO THE MEMORY OF THE LATE BILL WHITE.

- 0830 **KEYNOTE SPEAKER: Prof. Don Brothwell.** The Challenges of Dental Archaeology
- 0915 **Alan R. Ogden.** Moon, Mulberry and Hutchinson; dental anomalies in congenital syphilis
- 0930 **Dawn Gooney.** Iron Age Infant Remains from the Knowe of Skea, Westray, Orkney.
- 0945 **Cecilia Medina-Pettersson.** Patterns of calcination in Bronze Age cremation burials: an analysis of urned cremation burials from mainland Scotland.
- 1000 **Katie Tucker.** Romano-British Decapitation Burials from Hampshire: A Post-Mortem Burial Ritual?
- 1015 **Aimee Carbaugh, Rocio Gomez Martinez, Helen Langstaff, Ben Irvine, Nicolle Thiemann, Elena F. Kranioti.** Dental analysis of two cemetery populations (Via Punica 34 and Joan Planells) from Ibiza, Spain.
- 1030 **Matthew A. Gasperetti.** The bioarchaeology of agriculture in the Southern Levant.
- 1045 Coffee/Tea/Posters
- 1145 **Megan Brickley.** Osteopenic Outliers: Obtaining Insights on Past Health Problems
- 1200 **Rachel K. Wentz.** Causal Factors for Heavy Attrition Levels at the 7,000-year-old Windover Site.
- 1215 **Claire Murphy.** Human Remains Excavated from the Anatomy School (1711-1825) Trinity College Dublin.
- 1230 **Pedro Andrade, Victoria Castro, and Diego Salazar.** Palaeopathology and Lifestyle Reconstruction in the interfluvial Coastal Desert of Northern Chile.
- 1245 **Efthymia Nikita, Marta Mirazón Lahr and David Mattingly.** Sahara: Barrier or corridor? Non-metric Cranial Traits and Biological Affinities of North African Late Holocene Populations.
- 1300 **Nicholas Marquez-Grant and Linda Fibiger.** Unity in diversity: Assessing laws and practice involving archaeological skeletal remains across the globe.

- 1315 Announcement of Student Prizes
- 1330 Close of Conference

Abstracts for Podium Presentations

Human Intestinal Parasites in Acre: Stories from a crusader cesspool

Authors: Evilena Anastasiou¹, Piers D Mitchell¹, Danny Syon².

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The aim of this paper is to present the recent parasitological discoveries from a crusader period cesspool dating in the 13th century. This should allow us to determine which parasitic worms were present in the intestines of the people using the cesspool. The cesspool was located in the coastal city of Acre, which at that time was part of the Frankish kingdom of Jerusalem. For the purposes of this research, soil samples were collected and analysed from the cesspool itself, along with control samples from the area adjacent to the cesspool to detect any evidence for contamination from later time periods. The soil samples were processed with chemicals and micro-sieves in order to separate the parasite eggs from the soil components, while the identification of the parasites' species was achieved with light microscopy. ELISA was also employed in order to investigate whether dysentery was also present among the people using the cesspool. The cesspool contained the eggs of two parasitic intestinal worms – roundworm (*Ascaris lumbricoides*), and fish tapeworm (*Diphyllobothrium latum*). The roundworm was widely distributed around the world in archaeological contexts and is an expected finding in a medieval latrine. On the contrary, the fish tapeworm has only been found in the Near East once before, in another crusader period latrine, but was common in northern Europe in medieval times. This suggests use of the cesspool by crusaders or pilgrims from northern Europe who travelled to the east carrying fish tapeworms in their intestines. These parasites lead to malnutrition and anaemia, and would have predisposed individuals to starvation during long sieges or famines.

Skeletal trauma in children and adolescents during the Industrial Revolution in England

Anne E. Anderson and Jo Buckberry

Archaeological Sciences, University of Bradford

In the 18th and early 19th centuries, when industrialisation was developing and urban areas were growing rapidly, children were exposed to an onslaught of dangers and potential sources of physical trauma. This paper investigates the occurrence of sub-adult trauma in the post-medieval cemeteries of St Peter's Wolverhampton, Chelsea Old Church and St Bride's, Fleet Street, London.

Trauma suffered by sub-adults throughout the Industrial Revolution could result from accidents, violence, strenuous or repetitive activity, or from cultural modifications to the body, such as corsetry. Here, the evidence of trauma is compared with populations from the medieval period to investigate how the changes in working patterns and increased urbanisation affected children. The study shows a marked rise in traumatic skeletal injuries to sub-adults in populations of the Industrial Revolution compared with the medieval period. This trend of increasing trauma is supported by studies of adults of similar populations. It is suggested that the Industrial Revolution exacerbated causes and frequencies of trauma to children by way of overcrowding, mass production techniques, few or no safety measures for the then-new living and working conditions and the slow enactment and enforcement of labour legislation.

Palaeopathology and Lifestyle Reconstruction in the interfluvial Coastal Desert of Northern Chile

Pedro Andrade¹, Victoria Castro,² and Diego Salazar³

¹Department of Sociology and Anthropology, Universidad de Concepción.

²Associate Researcher of CIHDE, Universidad de Tarapacá

³Department of Anthropology, Universidad de Chile

In this presentation we will be mainly focusing our attention in lifestyle and paleopathological conditions of the inhabitants of the Archaic and Formative Periods of the desert interfluvial coast of Chile (19°36' – 26°20' S). During our investigations in the area we had been able to identify several individuals with paleopathological conditions related with a hunter-gatherer lifestyle, but with certain features which seems to be somehow different from contemporary samples of neighboring areas, that we relate to the special geographical and environmental conditions of the interfluvial coastal desert of Chile. The diseases we identified are porotic hyperostosis, cribra orbitalia, enamel hypoplasia, among others. Also, we had been able to identify a series of activities, based in the observation of degenerative joint diseases, and muscular stress markers, pointing to a highly specific use and exploitation of the marine environment and resources, including evidence of navigation in the area. We propose that certain activities identified by us can be related with process of mineral extraction, considering the proximity of prehistoric iron oxide mines that were exploited during the Archaic Period. Furthermore, our research indicates an early complexity within these so-called

“simple” societies at different levels, including the existence of diverse productive activities that can be identified and understood archaeologically, but specially through the analyses of human skeletal remains.

The Great Irish Famine: producing “lifeways” for victims and survivors using isotope ratios and elemental concentrations

Julia Beaumont¹J.Beaumont1@bradford.ac.uk, Jonny Geber², Natasha Powers³, Julia Lee-Thorp⁴, Andrew Wilson¹, Andrew Gledhill¹ and Janet Montgomery⁵.

¹University of Bradford.

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⁴Oxford University.

⁵Durham University.

During the Great Irish Famine (1845-1852) millions of rural Irish poor left their homes, arriving in Britain as a stepping stone to other destinations or settling in major towns and cities: 108,000 settled in London during this period. Reconstructed diets can be used to determine status and origin (Trickett 2007, Muldner et al 2009). Based on documentary evidence which suggests differences in food consumption (Crawford and Clarkson 2003) and environmental exposure to heavy metals (Drummond and Wilbraham, 1939), this research examines whether there is a difference in isotopes and element concentrations between indigenous Londoners, first generation Irish migrants in Lukin Street, and those they left behind in the Kilkenny Workhouse.

Using bone, tooth and hair from individuals from the Cemetery of the Catholic Mission of St Mary and St Michael, Whitechapel (1843-1854), and the Famine Cemetery at the Kilkenny workhouse (1847-1851), analyses of isotope ratios and elemental concentrations have been carried out to compare the two populations and reconstruct “lifeways” for some individuals.

Results show these analyses can be used to discriminate between Londoners, first generation Irish, and other migrants.

Analysis of carbon and nitrogen isotopes using dentine sections reveals dramatic changes in diet during the development of the teeth with high temporal resolution. These results challenge some of the accepted interpretations of skeletal and dental manifestations of diet and the link between changes in nitrogen isotope ratios and physiology.

Thus, this project research questions:

1. Can carbon and nitrogen isotopes be used to identify Irish Famine survivors where no other evidence is available or are other isotope systems required?
2. How did the diet of Irish migrants change after they arrived in London?
3. Can isotope analysis distinguish nutritional stress (such as famine) from other dietary mechanisms that lead to high nitrogen isotope ratios in the tissues?
4. Given the short period of use of the cemetery, can high resolution isotope data from dentine identify nutritional stress in children living through the Famine period?

Forensic Anthropology - a professional science or an amateur hobby?

Sue Black

University of Dundee

Forensic anthropology is recognised as a scientific discipline that provides legally admissible evidence for the court as demonstrated through citation of its practitioners to appear as expert witnesses during trial. But is the science truly admissible? Does it meet the criteria laid down by legislation? How fit for purpose is the evidence if it is stripped down to its core components? If we accept the science, how do we show that the practitioner is competent to advise the court on the basis of this science in relation to the case in question? Are we truly a profession or are we just willing and eager amateurs?

A biocultural analysis of fracture patterns in a Late Roman population from Winchester, Hampshire

Laura Bonsall

School of History, Classics and Archaeology, University of Edinburgh.

Analysis of trauma patterns in ancient populations can reveal much about aspects of lifestyle in past communities, particularly when true prevalence rates (TPRs) are considered. For the Romano-British period, TPRs for fractures are available for relatively few sites. This study aims to help address this problem through an analysis of ante-mortem fractures in a population from Late Roman Winchester. The sample, comprising 200 adults, derives from sites in the North, East and West cemeteries Winchester. The remains date to the third and fourth centuries AD. Standard osteological methods were employed. Fractures were identified by macroscopic observation. Approximately 20% of individuals exhibited fractures. More males than females were affected. In males the most commonly fractured elements were the tibia and fibula (TPRs: 4.7% and 7.0%). In females, the fibula, ulna and clavicle had the highest fracture prevalence (TPRs: 4.7%, 3.2% and 2.6%). Two cases of healed cranial trauma were observed, both in males, but there was little evidence for inter-personal violence. At least seven individuals exhibited spondylolysis. In terms of the fracture patterns observed in women versus men, none of the differences reached the level of statistical significance, though the findings may point to gender-based differences in activity. When the results were compared with recently published data from the Lankhills site in Winchester's North Cemetery, some notable differences emerged, possibly indicating some degree of intra-cemetery segregation of the community within the burial grounds of Roman Winchester. The findings contribute further information on the population of an important Roman town.

Supported by The Carnegie Trust for the Universities of Scotland

Osteopenic Outliers: Obtaining Insights on Past Health Problems

Brickley, M¹. Watamaniuk, L¹. Ives, R². Adams, R¹. Prowse, T¹.

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

The Challenges of Dental Archaeology

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It seems to me that there are a number of separate lines of research associated with Dental Archaeology. First there is Comparative Odontology, which may seem marginal to our subject, but provides a worthwhile perspective. Secondly, there is the question of genetic and environmental influences on dental development and variation. Linked to these are demographic factors, and perhaps especially ethnic movements, mixing and isolation of groups. From this basic oral biology, we move to time and the considerable research literature on the evolution of jaws and teeth. Although there are plenty of stories concerned with teeth through time, a more critical viewing would not be a bad thing. Holocene populations still show variation, metric and non-metric, but I for one have been neglectful in my studies of these aspects, and there is a need to review what should be done in the future. And if some of us today still display evidence of taurodonty, then could this be evidence of Neanderthal genes living on?

Oral pathology is a very different can of worms. DNA and other factors can produce abnormality in development. After dental eruption, acid or carbohydrate foods may result in enamel loss by one or other means, while fluorine intake may reduce caries

prevalence. There is a vast and growing literature on the history of caries, but still questions to be asked. Other pathology is not so well analysed, and in particular, it seems to me that the scoring methodology linked to recording periodontal disease needs to be further reviewed. And have oral microbes changed at all, at least those we see captured in calculus? Finally, what of the variation in the oral pathology of children? Clearly, dental archaeology is a vast field, with plenty of questions left for us to think about.

Peri-mortem trauma at Stirling Castle

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The Scottish Wars of Independence have long ignited public interest, however to date little skeletal material relating to them has been excavated or analysed. In 1997 a small population dating to the 13th to 15th centuries was excavated in a lost royal chapel at Stirling Castle, one of the key garrisons of the wars. Shortly after the excavation skeletal analysis revealed that one individual suffered healed sharp force trauma to the frontal and a second had possible peri-mortem puncture wounds to the cranial vault. Recent re-analysis has identified an abundance of previously unidentified peri-mortem trauma within this small group. Most of this is blunt force trauma, with small numbers of sharp force and penetrating trauma present. One individual suffered over 80 peri-mortem fractures, many to his post-cranial skeleton.

This paper will present the evidence of trauma from Stirling Castle, highlighting the diagnostic criteria for peri-mortem blunt force post-cranial injuries, which are rarely reported on in palaeopathology. While many of the fractures found in isolation could easily be attributed to accidents, a small number of injuries clearly relate to inter-personal violence. It is argued that this, alongside the significant burial location within a royal castle, indicates that these individuals died in encounters relating to the Scottish Wars of Independence.

Dental analysis of two cemetery populations (Via Punica 34 and Joan Planells) from Ibiza, Spain.

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The study of dental remains from two sites, Via Punica 34 and Joan Planells, which are from the same Roman necropolis in Ibiza, Spain, is presented here for the purpose of examining the health and diet of the cemetery population. The preservation of the tooth sample, frequencies of non-metric traits for adults and subadults and association of traits with side and sex are reported. Dental wear and pathologies were also studied. The teeth were well preserved and the majority of individuals have 50% or more of their dental arcade present. The majority of the cemetery population is adults over the age of 17 years old.

The preliminary findings are that the total frequency of all dental pathologies in this Roman population appears to be low. For Via Punica 34 females appear to have a higher frequency of caries than males. This may indicate that females ate a higher carbohydrate diet. Further support for this idea is that the males have a higher frequency of calculus than the females. Other findings for Via Punica 34 include the anterior teeth having a higher rate of linear enamel hypoplasias than the posterior teeth. Also, the posterior teeth have more instances of caries. The total pathology frequencies for Joan Planells 03 are similar to those of Via Punica 34, except the male and female frequencies are reversed.

The findings also were compared to those of the medieval Can Fonoll site (Ibiza, Spain). For this specific analysis, 1542 teeth were studied for a total of 32 nonmetric traits. The results suggest that frequencies match with those expected for a European population. Finally, the comparative analysis indicates that Can Fonoll's individuals differ significantly from the pre-islamic sample, and thus suggesting that the individuals inhumated at Can Fonoll might be new settlers (or their descendants) who arrived to the island after 902 AD.

Childhood and violence in Neolithic Europe

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Non-accidental traumatic injuries, particularly cranial trauma, offer rare evidence of specific, short-term events that shaped and altered the lives of individuals and communities. If the affected individuals are children, these events take on a particular significance. Osteoarchaeological analysis of children has mostly focused on broader issues of childhood health and disease, with discussions of violence-related trauma mostly absent. Generally, children in the past are believed to be less frequently affected by violence and then only in exceptional circumstances. This presentation discusses the effect of interpersonal violence on children in early prehistory through an examination of cranial trauma data for 215 skeletal individuals from Neolithic Germany. Although cases of violent trauma affecting children are known from the period, no population-based skeletal study has been carried out in the region to date. Cranial trauma data will be used to explore questions of social and functional age in relation to interpersonal violence and to examine the impact of violence on this segment of society in Neolithic Europe. The results raise important questions about the concept of childhood in prehistory as well as the physiological limitations of children (those individuals still growing and developing) during fighting, raiding and defending, and the potential value placed on their lives and skills.

The Bioarchaeology of Agriculture in the Southern Levant

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The current research examines the biological response of human populations to the many dietary, environmental, socio-cultural and behavioural changes that coincided with the transition from hunting-and-gathering to sedentary agriculture and urbanism in the prehistoric southern Levant. Agricultural domestication was one of the most revolutionary innovations of the Holocene, allowing surplus food production and profound socio-cultural and technological innovation. In order to study the affect these changes had on human skeletal biology, skeletal material from the Natufian (14,600–11,500 cal BP), Pre-pottery Neolithic (11,500–8,500 cal BP), Pottery Neolithic (8,500–7,700 cal BP), Chalcolithic (7,700–5,500 cal BP), Early Bronze Age (5,500–4,000 cal BP), and Middle Bronze Age (4,000–3,650 cal BP) was examined. This material is from Natufian 'Ain Mallaha, Nahal Oren, Hayonim, and Rakefet; Neolithic 'Ain Ghazal, Wadi Shu'eib, Abu Ghosh, Netiv Hagdud, and Jericho; Chalcolithic Peqi'in, Wadi Makkuk, Gilat, and Shiqmim; and Bronze Age Jericho, Bab edh-Dhra', and Lachish. Data were recorded from dentitions, crania, mandibular corpi, and long bones. This allowed diachronic change in dental attrition, oral pathology, and linear enamel hypoplasia (LEH) to be scored. Changes in long bone and mandibular cross-sectional geometry, as well as changes in cranial and postcranial morphology, were also quantified. The results of these analyses are contextualized within a biocultural framework and are compared diachronically across the transition to agriculture. Using multiple indicators, the current research examines many osteological changes associated with sedentary life and prehistoric agriculture in the southern Levant, while placing the region within a wider archaeological context.

A Palaeopathology of the Great Irish Famine: The Kilkenny Union Workhouse Mass Burials

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Human remains dating the Great Irish Famine were discovered within the grounds of the former union workhouse in Kilkenny City, Republic of Ireland in 2005. These were made subject to an archaeological excavation in 2006, during which 63 mass burials containing the skeletons of 970 individuals were found. The burials have given the opportunity to explore a new aspect of the Famine, through the study of the skeletons of those who did not survive this catastrophe.

The aim of the research is to explore the human experience of the Famine, through a biocultural perspective. The Great Famine (1842-52) is a watershed in Irish history, which resulted in the death of one million people. While the potential of applying the archaeological method to research of the period has previously been explored, this project is the first where a palaeopathological research perspective is undertaken.

The analysis of the skeletons has revealed a population under severe stress, indicated by skeletal indicators of infectious and metabolic disease. The population is also characterized by a high proportion of non-adults, likely to be a reflection of both the mortality risks and the underlying demography of the workhouse institution.

This paper highlights the potential in palaeopathological research for the purpose of obtaining further understandings to the realities of the Famine. The study also focus on the health and living conditions of the pauper and lower classes in 19th century Ireland, a social stratum that was very poorly treated by the contemporary Victorian society.

Iron Age Infant Remains from the Knowe of Skea, Westray, Orkney.

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The Knowe of Skea is a multi-phase site on the island of Westray in the Orkney Islands which included an Iron Age cemetery excavated between 2000 and 2009. The human remains from the site are being examined as part of a PhD project sponsored by Historic Scotland in the University of Edinburgh. Though upwards of forty-five discreet inhumation burials were excavated, infant remains tended to occur in concentrations with mixing of individuals and only partial articulation in places. The actual number of individuals buried on the Knowe of Skea therefore is much higher when infant remains are added to the total. Ages recorded from bone measurements have revealed that the vast majority of these infants were aged between 38 and 40 weeks. Some of the remains show pathologies indicating that newborns may have died from infections or illness contracted at the time of their birth and may have parallels in the more recent past. In this paper I will describe the collection and the early results of skeletal analysis with particular emphasis on the infant remains and the issues that arise when dealing with such a collection.

Supported by Historic Scotland

The Applicability of the Greulich and Pyle Atlas to a Scottish Population

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The recent report from the Law Commission highlights the need for forensic practitioners to ensure that the methods which they are utilising in a forensic context are both applicable and reliable. The Greulich and Pyle atlas was originally developed to track the skeletal maturation of children as they develop rather than for the purpose which it is now more commonly utilised; age estimation in the living. This study used radiographs collected from a large teaching hospital in Scotland to test the accuracy of the Greulich and Pyle atlas to a modern Scottish population. A total of 403 radiographs (156 female

and 247 male) of children between birth and 20 years of age were assessed using the Greulich and Pyle atlas. Linear regression analysis of each group presented R values which were high indicating that this atlas method is relevant to a modern population. Further analysis shows that the atlas is more likely to under-age an individual prior to puberty, but once puberty is reached it consistently over-ages the individual. This study indicates that whilst the use of the Greulich and Pyle atlas in age estimation of a modern population is appropriate the forensic practitioner should be aware of when the atlas over or under-ages juveniles in order to be able to take this into account when assessing age.

Neanderthals: Evolution, paleobiology and fate of our closest relatives

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Neanderthals inhabited Western Eurasia from approximately 300 to 30 thousand years ago. They are distinguished by a unique combination of cranial, dental and postcranial traits, and are commonly associated with Middle Paleolithic Mousterian industries. Current consensus among paleoanthropologists is that they represented a distinct Eurasian human lineage, which evolved in isolation from the rest of the Old World and which shared a common ancestor with modern humans in the Middle Pleistocene. Whether they can be accommodated within *Homo sapiens* or represent a different species, *H. neanderthalensis*, is still a matter of debate. It is thought that some aspects of the distinctive Neanderthal anatomy evolved in response to selection related to the extreme cold of the European glacial cycles. Nevertheless genetic drift seems to be responsible for the evolution of at least some of these traits. The last appearance of Neanderthals in the fossil record dates a few millennia after the first appearance of modern humans in Europe (ca 40 ka BP). The causes for the Neanderthal extinction are not well understood. Worsening climate and competition with modern humans are implicated in most hypotheses, with demographic aspects probably having played a key role.

Enamel Hypoplasia in Post-Medieval London: A Reassessment of Evidence of Childhood Health

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The aim of this paper is to provide a reassessment of presence and prevalence of evidence of disruptions to growth during childhood in different socio-economic groups in Post Medieval London. Evidence of disruptions such as fever, disease, and malnutrition are found in the form of dental enamel defects, specifically enamel hypoplasia (EH). Studies have suggested that defects are more prevalent in lower socio-economic status groups. However, this result is not always seen in the archaeological record, and as the individuals with EH are clearly those who survive such an illness, EH may not always reflect an underlying frailty in an individual. In this study, a comparison of standard

methods and a novel microscopic quantified method for identifying enamel hypoplasia is presented, using the unworn permanent teeth of children from five assemblages of different socio-economic status from Post Medieval London (St Bride's Crypt, Old Church Chelsea, St Benet Sherehog, St Bride's Lower Churchyard, and the New Churchyard). The results demonstrate that variation in methodology may contribute substantially to the lack of a consistent pattern in prevalence of EH in different socio-economic groups. By different measures, either the highest status assemblages or the lowest can be shown to have a 'greater' experience of childhood growth disruptions, suggesting that the method of identification and interpretation of EH occurrence is critical in assessing childhood health from archaeological remains.

'From Cemetery to Clinic': 3D Digitised pathological data from archaeological leprous skeletons

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The paper provides an overview of a recent JISC-funded project to produce a unique interactive 3D digital resource on the pathological manifestations of leprosy from the Medieval *Leprosarium* of St. James and St. Mary Magdalene, Chichester. The collection offered a highly significant study sample as it represents one of the largest assemblages of skeletons with the bone changes of leprosy and is of international importance since it remains the only large scale excavated and published archaeological assemblage of *leprosarium* patients in the UK, and one of only a handful worldwide.

A key aim was to ensure that the fragile pathological remains within the Chichester collection can be accessed more widely by students, the public and other diverse groups whilst having a low impact on the remains themselves. In addition, the project aims to provide globally accessible reference material for the training of clinicians and their recognition of leprous changes in patients.

We describe the methodology used to achieve this through the production of high resolution 3D digital models of the skeletal remains using a FARO Quantum arm 3D laser scanner. The paper will then examine the benefits and methodological challenges of combining the high resolution models with high pixel count digital photography to accurately colour and texture the models.

We present examples of artefacts that manifest as pseudo-pathology occurring as anomalies within 3D digitised recording. Finally we summarize the potential of 3D digitisation of human remains as a valuable tool for the teaching and research of human palaeopathology.

Migrants in the Mun River Valley? Insight into migration and kinship using isotopes, nonmetrics and geometric morphometrics

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The impact of migrant individuals on the evolution of social complexity is an issue which has long interested archaeologists in Southeast Asia. The study of migration may be undertaken by tracing the diffusion of ideas or material culture but this does not necessarily equate to movement of people. As osteoarchaeologists, however, we have a unique opportunity to study processes of migration and social evolution by examining the individuals involved. Here we present new isotopic evidence from the site of Ban Non Wat in Northeast Thailand. As one of the largest cemetery samples in the country this site has huge potential to shed light on processes occurring in the region during prehistory. Results indicate that population growth and social evolution is likely to have been driven by intrinsic rather than extrinsic factors, as migration is not a dominant process in the site. There does, however, appear to be slight sexual bias in migration in the early phases of the site, as well as some sex based differences in isotopic ratio within the local population. This suggests that sexual differentiation occurred prior to status differentiation in the site, and that the introduction of a social hierarchy based on wealth overprinted this sex-based separation. As sexual biases are often related to kinship and marriage structures, we intend to use dental non-metric traits and geometric morphometric analysis of cranial shape, to see if isotopic signatures are correlated with hereditary osteological markers.

Lipid biomarker combinations in the diagnosis of ancient leprosy and tuberculosis

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Aim. The use of specific biomarkers is established in the diagnosis of ancient tuberculosis and leprosy. The analysis of ancient DNA, if preservation allows, provides highly discriminative information about the infecting agent. This presentation will investigate patterns of mycolic acids, phthiocerol dimycocerosate waxes and mycolipenic acids to determine whether each biomarker class is equally well preserved. The possibility of using quantitative lipid profiles to estimate the relative amount of tuberculosis and leprosy infection in a particular bone will be explored.

Materials and Methods. Lipids were extracted from representative ancient skeletal material and fractionated by established protocols to obtain distinct fractions for analysis. Mycocerosic and mycolipenic acid pentafluorobenzyl ester profiles were recorded by negative ion chemical ionisation gas chromatography mass spectrometry. The presence

of mycolates and phthiocerols was investigated by fluorescence high performance liquid chromatography (HPLC) of pyrenebutyric acid esters.

Results, Discussion and Conclusions. The expression of the different biomarker types was variable. For a 17,000 year old extinct bison, mycolate profiles were very weak but mycocerosic and mycolipenic acids were very strong. In other cases, strong mycolates were not complemented by good mycocerosate signals. In the case of tuberculosis-leprosy co-infections, it was possible to provide an estimate of the prevalence of each disease. It is clear that preservation of individual lipid biomarkers varies, presumably depending on environmental factors.

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Unity in diversity: Assessing laws and practice involving archaeological skeletal remains across the globe

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This paper presents a critical look at the legislation and methodology governing the excavation, analysis and curation of archaeological skeletal remains from a global perspective. Rising numbers of studies involving human skeletal remains have resulted in an increase in cross-country collaborations between archaeologists, anthropologists, curators and other archaeological scientists, often highlighting different research traditions as well as diverse practical and legislative approaches during excavation and analysis. These diverse approaches may affect the definition of what constitutes archaeological skeletal remains, who is qualified (and allowed) to excavate and analyse them, which methods are deemed appropriate for analysis, how osteology/physical anthropology is taught in universities, where skeletal collections are housed, etc. Examining information from over 50 countries from across the globe in view of these different aspects, we argue that diversity presents an opportunity rather than a barrier. While there is no universally 'right' way of dealing with archaeological human remains, best practice and the protection of remains unite apparently diverse osteoarchaeological practices in many countries around the world. Greater awareness of 'different ways of doing things' presents an opportunity not only for countries which are still in the process of establishing osteoarchaeology/physical anthropology as a discipline but also those with long-standing osteoarchaeological traditions, such as the UK.

Tuberculosis at the Late Neolithic Site of Hódmezővásárhely-Gorzsa, Hungary

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This study derives from the macroscopic analyses of a Late Neolithic population from the Great Plain of Hungary (Tisza culture). Seventy-one individuals in total were recovered

from a tell settlement at Hódmezővásárhely-Gorzsa (4970 to 4594 BC). Fifty-six individuals had been buried in graves within the settlement and the partial remains of a further possible fifteen were recovered from pits, ditches, houses and as stray finds. Pathological analyses revealed numerous cases of infections and non-specific stress indicators on juveniles and adults, metabolic diseases on juveniles, and evidence of trauma, with mostly well-healed fractures, as well as mechanical changes on adults.

One of the most important discoveries from this 7000 year old site was the evidence of tuberculosis. The initial macroscopic diagnosis of five cases was confirmed by lipid biomarkers analyses, three of them corroborated by DNA analyses. The five individuals were all very young adults. HGO-53 was a male with a strikingly symmetrical diffuse periostitis typical of secondary hypertrophic osteoarthopathy (HOA), revealing changes on the ribs and cavitations in the vertebral bodies. HGO-08 was a female with resorptive lesions on the vertebrae. HGO-10 (male) and HGO-21 (female) both presented evidence of hypervascularisation on the vertebrae and periosteal remodelling on the ribs. Finally, HGO-48 was a female with abnormal blood vessel impressions and a possible lesion on the endocranial surface of the skull. At present, these are the oldest cases of tuberculosis in Europe in the archaeological record.

Patterns of calcination in Bronze Age cremation burials: an analysis of urned cremation burials from mainland Scotland

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Cremation reduces the human body to fragments of bone through the combustion of organic components and evaporation of moisture. Complete calcination, where only the mineral components of the bone remain, results in a white colour. Nuances of black and grey indicate areas where combustion is incomplete, caused by lower temperature and/or insufficient supply of oxygen.

These patterns of calcination have been used previously to discuss past mortuary ritual, such as construction of the funerary pyre, the overall skill of the cremators in achieving and maintaining a high temperature. More specifically, poorly calcined fragments have been used to estimate the position of the body on the pyre. Less calcined bones have been interpreted as belonging to body parts that have stuck out of the hottest area of the pyre, or as buried beneath debris and deprived of oxygen.

The aim of this study was to analyse patterns of calcination to understand past cremation ritual and technology in Bronze Age Scotland. Macroscopic analysis was performed on 75 urned Bronze Age cremation burials from mainland Scotland, provided by the National Museum of Scotland. Over 10,000 bone fragments were identified and for each identified fragment, the nature and areas of poor calcination were recorded. About a quarter of the identified fragments showed evidence of poor calcination. A detailed exploration of the distribution of calcination patterns is offered.

Quantitative paleopathology: using virtual reconstruction and geometric morphometrics to analyze pelvic pathologies

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Developmental anomalies and pathologic alterations of the pelvic girdle have a direct impact on an individual's locomotor abilities, and thus play a central role in paleopathological studies. However, it is often difficult to quantify how the pelvic morphology of an affected individual deviates from the normal, healthy condition. Here we propose a new approach to tackle this issue. Using paleoanthropological methods of virtual reconstruction, we recover the three-dimensional morphology of fragmentary archaeological pelvic specimens. Then we apply methods of 3D Geometric Morphometrics (3D-GM) to quantify pelvic shape. 3D-GM is well-suited to analyze and visualize patterns of normal pelvic variation (e.g. sexual dimorphism) versus patterns of pathological variation. We demonstrate the potential of this approach with the analysis of a previously unknown case of hip dysplasia: a bilaterally non-ossified triradiate cartilage in an overall healthy old male subject from the Swiss High Middle Age (9th-10th century AD).

Human Remains Excavated from the Anatomy School (1711-1825) Trinity College Dublin

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A large quantity of human skeletal remains was recovered during an excavation from a site belonging to the old Anatomy School in Trinity College Dublin. The old Anatomy School was in existence from 1711 to 1825 and the material on which this study was based is an atypical one, the bones recovered were the skeletal remains of bodies used in the teaching of medicine in the Anatomy school over approximately a one hundred year period. The collection is disarticulated and commingled with an MNI of 233.

Medical education was undergoing considerable changes with the establishment of university anatomy schools. The aim of this talk is to examine what information the collection reveals about medical education over the course of the eighteenth century.

This paper describes how a biocultural methodology was applied in which the archaeological record and the scientific analysis of the skeletal remains was integrated with the cultural environment to provide an insight medical education in eighteenth century Dublin.

The results show that advances were made in the curriculum with the introduction of topics such as obstetrics and comparative anatomy into the course. The implications for

this in the context of the eighteenth century were discoveries made in the structural anatomy of the body preceded knowledge of appropriate treatments for patients. In summary, the osteological evidence from the human remains in this collection offers an important contribution to the knowledge of the study of anatomy and surgical techniques in the Anatomy School, Trinity College Dublin.

Sahara: Barrier or corridor? Non-metric Cranial Traits and Biological Affinities of North African Late Holocene Populations

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The Garamantes flourished in southwestern Libya, in the core of the Sahara Desert approximately 3,000 years ago and largely controlled trans-Saharan trade. Their biological affinities to other North African populations, Egyptian, Algerian, Tunisian and Sudanese, roughly contemporary to them are examined. The aim is to shed light on the extent to which the Sahara Desert inhibited extensive population movements and subsequent gene flow. This issue is addressed by means of analyses of non-metric cranial and mandibular traits.

Our results show that the Garamantes possess distant affinities to their neighbors. This may relate to the Central Sahara forming a barrier among groups, despite the archaeological evidence for extended networks of contact. The role of the Sahara as a barrier is further corroborated by the relative biological proximity of populations which are located along the Nile or the Mediterranean coast, such as the Kerma and Gizeh, the Algerians and Alexandrians, the Soleb and Alexandrians. Finally, females overall exhibit smaller pairwise biodistances compared to males, possibly due to the greater gene flow in the female population as a result of their greater mobility because of various marital networks.

To conclude, the Sahara Desert restricted population contacts in the Late Holocene, once it had turned hyper-arid. The trade networks must have involved only a specialized sub-set of merchants, while females dispersed more widely, possibly due to patrilocal marital networks.

Moon, Mulberry and Hutchinson; dental anomalies in congenital syphilis

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This extensively illustrated paper presents a study of hypoplastic first permanent molars and suggests how “Mulberry” or “Moon’s” molars may be distinguished from each other and from non-specific Cuspal Enamel Hypoplasia, thus enabling confident diagnosis of congenital syphilis in archaeological populations. Molars survive burial and excavation well and can be more unambiguously identified than “Hutchinson’s” incisors, which will also be discussed.

The abnormal development of these teeth and the likely causes will be discussed in detail using many previously unseen images.

Paleopathology: Now and then

Donald Ortner

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The history of paleopathology extends back more than 150 years. Throughout most of this history the emphasis has been on describing and diagnosing abnormalities encountered in various sources of information including ancient remains, medical texts and art. Diagnosis was always, and remains, a challenging exercise. However the publication of major reference works on human paleopathology in the latter part of the 20th Century and continuing in the current century, as well as the creation of courses and workshops on the subject, has provided important tools in improving diagnostic competence of paleopathologists for interpreting anatomical evidence of disease. The relatively recent developments of biomolecular methods, as well as the emergence of stable isotopes, as a source of data on ancient health have provided powerful tools in understanding the presence and significance of disease in past human groups. The scientific discipline of paleopathology is at or near the stage where we can begin to explore important questions such as the significance of disease in human history and evolution. There remain theoretical and methodological issues that need further thought, such as the adequacy of archaeological skeletal samples in making inferences about the health of past living populations. However as scientists we must not be paralyzed by these problems. The disciplines of paleontology and geology have enriched our knowledge of our planet's history despite the theoretical and methodological limitations inherent in their ability to make inferences. Paleopathologists need to make at least tentative inferences about the health of past populations and the factors that influenced it understanding as we do, that science is iterative and revision of conclusions is both inevitable and normal.

Sexual dimorphism of the bony labyrinth in modern humans: A pilot study

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Sexing is a fundamental step in the creation of a biological profile for unknown skeletal material. Human remains are often recovered in a fragmented state and age variation can make it difficult to decide upon an appropriate sexing standard. The purpose of this study is to assess the feasibility of determining sex by metric analysis of 3D reconstructions of the bony labyrinth of the inner ear.

A sample of 52 CT scanned skulls from a Cretan population was used to create 3D reconstructions of the left and right bony labyrinths using the AMIRA software package. Measurements of the height and width of the semicircular canals and cochlea were taken

according to Spoor 1993. Indices of the height divided by width were also calculated to test for differences in shape. Subsequently statistical analysis was done with SPSS software.

All measurements except lateral canal width, right cochlea width, and the height and width of the left cochlea demonstrated significant dimorphism. Bilateral asymmetry was also tested and found to exist in the cochlea and semicircular canals. Discriminant functions were created to sex unknown individuals. Univariate equations yielded a maximum cross-validated accuracy of 76% and multivariate analysis improved accuracy to almost 79%.

The Bony labyrinth completes growth before birth and preserves well under harsh taphonomic conditions. Thus developing discriminant function equations for sexing this structure would allow for the same sexing standards to be applied to individuals of any age. Although sample size is small, this 3-D reconstruction technique appears to have great potential for the sexing of fragmentary remains and individuals of uncertain age.

Scurvy in a Post-Medieval Population from Jelgava, Latvia

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The aim of this research was to assess the presence of scurvy as an indicator of environmental stress in a high status German population from Jelgava, Latvia. The skeletal material used in this study came from a recently excavated church cemetery, with most of the burials dating to the 17th – 18th centuries. In total, 108 individuals were analysed (80 adults and 28 non-adults).

To diagnose scurvy, cranial and post-cranial elements in adult and non-adult individuals were studied macroscopically to find a distinctive pattern of abnormal porosity and/or new bone formation. No clear evidence suggestive of scurvy was found in the adult individuals, but two definite, two likely and two possible cases were identified among the non-adult individuals. The condition was believed to represent seasonal availability of fresh fruit and vegetables in the country, as well as food shortages due to frequent wars and famines reported in historical sources from the period.

During the skeletal analysis two main problems with diagnosing scurvy were encountered. First of all, as several factors can influence the severity of scurvy, a broad range of bone response can be expected, especially in children, making the condition harder to recognise. Secondly, due to rapid bone growth in the first year of life we found it difficult to recognise abnormal bone reactions in children aged less than one year. It was felt that to overcome the problem more understanding would be necessary of how the stages of skeletal development in younger children appear in archaeological remains.

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

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

Osteochondritis dissecans in archaeological and modern populations: a preliminary analysis

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Osteochondritis dissecans (OD) is a rare condition affecting the diarthrodial joints of the immature skeleton, causing a gradual detachment of articular cartilage, or both cartilage and subchondral bone from its normal position at the joint. Population studies of OD in archaeological and clinical literature are scarce. Because it is a rare condition, what is known about it comes from individual case reports. This paper aims to report on the presence of OD affecting the joints of British skeletal populations by comparing them to those reported in clinical literature, including examples that were gathered from published and unpublished skeletal reports. A hundred and forty-four OD cases from seven skeletal collections from different time periods, geographic locations, sexes and ages held at two British institutions were analysed for this study. The joints most commonly affected by the condition were found to be in the foot (1st metatarsal and 1st foot phalanx), followed by the knee, ankle and elbow. In contrast, clinical literature suggests that the knee, followed by ankle and elbow are the joints most commonly affected. Osteochondritis dissecans of the small joints of the foot, a location commonly overlooked by clinicians, could be said to be asymptomatic to patients. In turn, it could also be suggested that bioarchaeologists over-diagnose the condition, often mistaking it with osteoarthritis, taphonomic abnormalities, concavities, pitting and developmental defects. In conclusion, future development should involve creating diagnostic criteria to

differentiate OD from other similar pathological conditions so that it is not over-diagnosed or underestimated.

Understanding re-emerging infectious diseases: contributions on tuberculosis from palaeopathology and biomolecular science

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Tuberculosis (TB), caused by *M. tuberculosis* complex organisms, is a re-emerging infectious disease, infects 1/3 of the world's population today, and was responsible for 1.7 million deaths in 2004. The first clear historical evidence for TB dates back to China at 2700 BC, and the first skeletal evidence derives from Italy dated to 5800±90 BC. In Britain the first skeletal evidence (confirmed with ancient DNA analysis) is from the Iron Age (400–230 BC). Key questions to be answered are how, when and where did TB originate? It has been demonstrated that *M. tuberculosis* has extensive genetic variation which has, at least in part, a geographical basis. The aim of this paper is to describe a current NERC funded project which focuses on the origin and evolution of the causative agents of TB in Britain and other parts of Europe. Using real time PCR assays of IS6110, IS1081 and rpoB targets, bone samples from 488 individuals have been analysed for *M. tuberculosis* complex DNA (177 European from 64 sites, and 311 British from 78 sites). These analyses produced 148 positive samples for *M. tb* complex. 101 of those extracts that contained authentic *M. tuberculosis* complex DNA are now being further tested to distinguish between members of the complex and to obtain strain data (through next generation sequencing - NGS). The final results for NGS will have implications for understanding how the TB bacterial strains have evolved through time, and what that means for the future control of TB.

High-resolution micro-CT imaging as a novel tool in the analysis of cremated bones and teeth: A comparison of experimental results with Bronze Age human remains

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Over the past years, close co-operation of archaeologists and anthropologists has substantially increased our knowledge about cremation practices in prehistory. Macroscopic investigations of cremated human remains recovered from the bi-ritual middle Bronze Age cemetery of Pitten (Lower Austria, Austria) suggested a cremation temperature between 700 and 900 °C based on the analyses of size, discolouration and hardness of the bone fragments and teeth. In this study high-resolution imaging was used to investigate and visualise heat-induced micro-structural alterations of bones and teeth.

High-resolution micro-CT scans (voxel-size 10.1–13.5µm, SkyScan 1172) were performed on 25 cremated bone fragments and teeth from four individuals of the Pitten cemetery and compared with experimental results from 30 animal femora and 75 human teeth. The femora and teeth were heated with electric furnaces at three target temperatures (400, 700 and 900 °C). Three-dimensional image analysis was performed with Slicer3, measured with ImageJ 1.45 and resulting data were analysed statistically with SPSS 17.

The results obtained by macroscopic inspection confirm previous observations on heat-induced changes in burned human remains. The discoveries at the microscopic level, which are based on three-dimensional models reconstructed from high-resolution micro-CT scans, showed a temperature-dependent increase of heat-induced cracks, as well as a specific distribution pattern of fracture lines and fragmentation.

The experimental results are consistent with the previous investigations, and imply a temperature exposure of a minimum of 700 °C, more likely 900 °C at the Pitten cremation site. Moreover, it was shown that micro-CT is an excellent additional tool in the analysis of burned human remains.

Hung Out to Dry: A Multidisciplinary Analysis and Recording of a Preserved Human Skin

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This investigation centres on using a multidisciplinary approach to investigating the provenance of a preserved human skin, and to document it for posterity, using forensic photographic applications and chemical analyses.

'Bonheur' is the name given to the anterior portion of human skin which, stuffed with hair and cloth, has been nailed to a wooden mount. Adorning the skin are a number of tattoos and the chest area bears evidence of dissection. The associated story is that the skin was that of a sailor in Marseilles, convicted of rape and murder and sentenced to death by hanging, before his body was dissected, and his skin flayed and exhibited in the courts as a deterrent to others.

As a result of taphonomic processes and techniques of preservation some of the tattoos have become obscured, multispectral photographic techniques were applied to elucidate as much of the images as possible, Bonheur was then laser scanned and a 3-dimensional model created. Samples were taken for analysis through FTIR and SEM in order to analyse the chemical composition of the tattoos.

Stylistic analysis of the tattoos reveal a number of interesting clues as to the provenance of this unusual artefact, and microscopic examination contradicts the associated history, highlighting the need for objective investigation. As a result of this study a digital record of Bonheur is available for study whilst access to the original artefact is limited by private curatorship.

Palaeodiet at a weekly scale through carbon isotope analysis of amino acids from hair using LC-IRMS: preliminary studies on Chinchorro mummies

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Sequential isotopic analysis of hair, when it is preserved in archaeological contexts provides a powerful means to investigate subsistence patterns at an individual level. Hair grows rapidly and sequentially, recording dietary information at about 1 month/cm, in contrast to bone collagen that has a slow unspecific turnover rate and is therefore a long-term dietary record. Studies using traditional stable isotope measurements have sequentially analysed bulk hair protein, from many hairs at a scale of 1-2cm (typically 600-3000ug), resolving palaeodiet at a monthly or bi-monthly scale. Liquid chromatography isotope ratio mass spectrometry (LC-IRMS) is a technology capable of analysing carbon isotopes in the amino acid constituents of proteins. The principal advantages that it has are (a) that small samples (10-20ug) can be used, facilitating the sampling of a single hair at a fortnightly or even weekly scale and (b) it enables the potential investigation of different dietary inputs of carbon: protein only (essential amino acids) and carbohydrate/lipid/protein (non-essential amino acids). We present here preliminary isotopic data from LC-IRMS analysis of Chinchorro mummy hair. We will discuss the data in terms of palaeodietary interpretation, evaluate the LC-IRMS approach and how the technique will be used as part of an on going investigation into Chinchorro subsistence patterns.

‘From Cemetery to Clinic’: New observations of palaeopathological changes in leprosy

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Specific skeletal changes in leprosy are determined by the immune status of the infected person. Apart from rhinomaxillary syndrome, it is the composite pattern of skeletal changes throughout the skeleton that is diagnostic of the disease, and which may differentiate the two polar clinical types of the disease, one infectious and the other non-infectious. This paper presents findings from the re-examination of the human remains from the leprosy cemetery of SS. James and Mary Magdalene, Chichester, for the JISC funded project “‘From Cemetery to Clinic’: Digitised pathological data from archaeological leprous skeletons,” which enabled an in-depth analysis of pathological bone changes that are a direct or indirect result of infection by *Mycobacterium leprae*. During the project new patterns in the progression of lesions in the skeleton and facial cranium were documented and a host of new osseous lesions were identified, including erosive changes to the hands and feet, plantar and palmar bowing of the phalanges, absorptive and proliferative changes to the internal frontal process and sphenoid, and

plantar tarsal enthesophytes. With these new findings it is believed that more confident diagnoses of leprosy can be made in other skeletal collections in order to further understand the origins, geographic distribution, treatment, and pathogenesis of the disease in the past.

Chapel House Farm Medieval Cemetery: Establishing the relationship between human bone and its environment

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The skeletal remains from the medieval cemetery at Chapel House Farm, Poulton, Cheshire, are in remarkable state of preservation and were chosen for study to establish the genetic origins of the people who once lived there. However, results have been difficult to obtain as the DNA has suffered from degradation and contamination from soil components, despite applying some of the most up to date extraction techniques to it. This has provided the opportunity to investigate the relationship between the remains and their environment and has allowed the mechanisms that affect the DNA to be established. These mechanisms have included the storage conditions post excavation, the role of soil components and environmental conditions on the degradation of bone, the inhibition of DNA amplification, as well as the interaction of humans and the site over time. The study used a variety of destructive and non-destructive techniques on both soil and bone. The results of the study demonstrated a complex relationship between bone and its environment, especially the movement of metals. This work could have applications in both the archaeological and forensic disciplines for assessing complex samples of DNA from human bone, in order to optimise the chances of a successful outcome.

Romano-British Decapitation Burials from Hampshire: A Post-Mortem Burial Ritual?

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Decapitation burials, in which the head has been removed and replaced elsewhere in the grave, are a relatively common late Romano-British phenomenon and have usually been interpreted as a post-mortem burial rite with the neck being carefully sliced through from the front. The author has re-examined seventeen such burials excavated from Romano-British cemeteries in Winchester, Andover and Basingstoke with a particular focus on the osteological evidence for decapitation. This paper will present the results of this analysis and will demonstrate that, far from all decapitated burials showing evidence for carefully administered incised cuts to the anterior of the neck, there is a wide variety of different methods of decapitation only a small number of which seem to involve careful removal of soft tissues and disarticulation of the cervical vertebrae by incised cuts. Other individuals demonstrate slitting of the throat and then head removal by chopping through the posterior of the neck, whilst others display only chopping blows to the posterior of the neck, sometimes associated with probable defensive and incapacitating injuries. Some

of these individuals demonstrate a large number of chopping blows to the cervical vertebrae and/or mandible, clavicular and sternum, some of which were delivered whilst the neck was flexed, which is suggestive of decapitation as the mechanism of death. The analysis demonstrates the variety of techniques employed during the process of decapitation and suggests the need to rethink the overarching assumption that all such burials are the result of a “careful and precise” post-mortem ritual.

Diffuse idiopathic skeletal hyperostosis in a modern human skeletal collection from Greece

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Evidence on diffuse idiopathic skeletal hyperostosis (DISH) is derived from either human remains from archaeological contexts or clinical/radiographic assessment of contemporary living populations. The present research offers the exceptional opportunity to record DISH in a modern (20th century) skeletal assemblage from Greece. The purpose of this study is to report the frequency of the condition in the adult population (n=206), observe the distribution patterns among the subsamples within it, and explore the issue of a possible correlation between biological and social factors, i.e. sex, age, socioeconomic status (SES) and activity, and DISH presence.

The results showed that the disease affected 18.0% of the population sample, its frequency steadily increased with age from 3.2% in the “40-49 years” age group to 80.0% in the “90-99 years” age group, and the age of onset was 47 years. In contrast to most studies showing a considerably higher male prevalence, female individuals in the population under study were more frequently affected by the disease (19.1%) than their male counterparts (17.0%). Females were also afflicted earlier in life (mean=75.6 years) than males (mean=77.2 years). Moreover, chi-square analysis indicated that DISH was positively associated with higher social status ($p<0.000$); incidence among low SES individuals was 5.7% while for the middle/higher SES was 17.9%. No evidence for an association between its occurrence and activity was found. The findings suggest that the frequency of DISH is linked to risk factors associated with socioeconomic conditions as well as biological parameters such as sex and age.

Positive Identification of Human Remains – Population Statistics and Quantifiable Probability

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The role of the forensic anthropologist has increasingly expanded from the analysis of the biological profile to include the identification of human remains, particularly where DNA and/or dental records are unavailable. The aim of this discussion is to propose a statistically supportable, legally admissible, bio-social model of positive identification for groups of 'high risk' individuals (e.g. the missing persons pool). Comparison of ante and post mortem radiographs has often been used where so-called 'unique' identifiers, such as fractures and pathological lesions are present. But how is uniqueness demonstrated in a way considered admissible in a court of law? This has been accomplished both via twin studies (e.g. frontal sinus) and by the quantification of uniqueness with probability statements (e.g. cranial sutures). In order to quantify uniqueness, population statistics must be calculated for both the frequency of skeletal features, as well as their location, size and morphological variation. Deciding which features are valuable in making an identification relies upon understanding the group of individuals against which remains will be compared to determine identity. The proposed model includes: description and quantification of the skeletal markers of events and behaviours typical of a particular group; calculation of population frequency statistics for those markers; and, identification of which markers vary independently and which are likely to co-occur. Frequencies of independently occurring traits can be multiplied together to produce a probability statement, in effect quantifying the strength of an identification, allowing a statistically supportable method of identification to be made via anthropological methods.

The effect of bone age on the fragmentation of burnt bone

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This research aims to investigate how age-associated bone differences, such as density and composition, affect the fragmentation and subsequent recovery of burnt bone. The lower density and higher organic content of bone from younger individuals suggest more significant bone breakdown compared to bone from older individuals; however previous research has shown that neonate bone can be difficult to destroy in a burn environment, requiring higher temperatures and longer burn times. My research aims to delve further into this question and investigate the effect of bone age on fragmentation by comparing and contrasting recovered calcined fragments following the burning of pig limbs of different densities. Younger, less dense material is seen to fragment less with more identifiable bone fragments surviving the burn environment compared to the older, denser bone samples. Burning of the higher density, older samples, however, typically results in larger fragments that are easier to locate and recover from the burn scene. The outcomes of this research make valuable contributions in the bone recovery effectiveness of investigators at fire scenes. Recovery procedures can be adapted to take size and fragmentation into consideration, potentially increasing the quantity and quality of material recovered.

Causal Factors for Heavy Attrition Levels at the 7,000-year-old Windover Site

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Windover is an Archaic mortuary pond located on the east coast of Florida. The well-preserved remains of 168 individuals were excavated from the base of the pond, along with a vast assortment of grave goods. Tools of bone, wood, antler and stone, along with elaborate textiles encasing their bodies have provided insight into their technology and material culture. This research examines the heavy rates of attrition within the population, differentiating diet-related wear from that caused from extramasticatory activities and correlating these activities with the cultural materials recovered from their graves. Causal factors include the preparation of hides as well as the processing of palm fibers for the production of textiles. This paper highlights the need for additional studies that integrate skeletal analyses with the material culture of ancient populations for greater insight into their life histories and practices.

The Palaeopathology of the Isle of May

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The Isle of May is a small island in the firth of forth. During the medieval period, the Isle of May was a pilgrimage site with a monastery dedicated to St. Ethernan. Excavations on the Isle of May were carried out between 1992 and 1997 by the Glasgow University Archaeology Research Division. The excavations revealed fifty-seven articulated burials dating between 430 to 1580 CE. Although published, the original analysis did not focus on the pathological conditions of the skeletons. As part of a PhD with the University of Edinburgh, the articulated burials were re-examined with the aim to examine in detail the health of these individuals. This paper will present this recent analysis of the skeletons buried at the Isle of May as well as compare the population with 3 other Scottish medieval populations to put the burials into context. The significantly higher prevalence for disease as well as the variety of rare diseases found makes it probable that religious pilgrimage was not the only purpose for the monastery. These findings re-emphasize the claim that the Isle of May was most likely a place of healing and acted as a sort of hospital and when necessary acted as what we would now consider hospice care. This new research has revealed interesting data about health during the medieval period in Scotland that will be important for palaeopathologists and historians alike.

Fox hunting and badger baiting: investigating vertebrate scavenging patterns in Northwest European contexts

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Mammalian scavengers can greatly hinder the recovery, identification and analysis of human remains. Understanding patterns of scavenging and between-species differences can provide important information for the design of search and recovery techniques. Forensic studies of species-specific scavenging are rare, and most focus on larger North American and African species rather than the smaller canid and mustelid scavengers commonly found in Northwest Europe. This study investigates the scavenging behaviour of red fox (*Vulpes vulpes*) and Eurasian badger (*Meles meles*), the prevalent modern wild scavengers in Northwest Europe. It aims to characterise and provide new information on the scavenging behaviour and bite marks of these species. The scavenging activity of red foxes and Eurasian badgers in captivity was compared to their wild behaviour in a British woodland. Results show that foxes and badgers scavenge, disarticulate and scatter remains in a pattern that differs from the most commonly cited North American scavenger species (coyotes, wolves, bears etc). In contrast to larger canid scavengers, foxes prefer to remove remains from their deposit site so that they can disarticulate and cache remains for later consumption. Additionally, the cohabitation of badger setts by foxes and badgers allowed both species to take skeletal elements deep within the sett. Search and recovery techniques based on the behaviour of larger scavengers may lead to lower rates of recovery when remains have been scavenged by foxes and badgers.

Abstracts for Poster Presentations

Bronze Age cist in the Scottish Highland

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A Bronze Age cist burial was excavated by GUARD in February 2009 as part of the Human Remains Call-off Contract from Historic Scotland in Langwell Farm, Strath Oykel. Its excavation revealed a mostly complete adult skeleton of a female and well-preserved organic deposits associated with the burial.

The aim of this poster is to present the findings of the excavation and subsequent post – excavation analysis, which includes radiocarbon dating, conducted on the skeleton and the organic material and to study the setting of this burial within the burial tradition of this period across Scotland.

Bronze age burial practices are varied and complex; they do not follow a set pattern. They include inhumations, cremation, a combination of both and even secondary depositions. The significance of this cist however lays on the organic deposits encountered. Botanical analysis and animal fibre analysis of some of these materials, has revealed remains of a cattle hide and possible fragments of hazel wood. The preservation of this material is a rarity hence the importance of the discovery.

Demographic analysis of two cemetery populations (Via Punica 34 and Joan Planells) from Ibiza, Spain.

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Osteological data in addition to historical and archaeological information make for a more accurate analysis of ancient populations. Excavations conducted between 2003 and 2007 at two Roman sites in Ibiza, Spain are utilized for this study. In May 2011 students of the University of Edinburgh trained in Forensic Anthropology, Osteology and Human Osteology went to Ibiza to carry out analysis on the skeletal remains. A total of 132 individuals were analysed and where possible sex and age were determined using traditional skeletal assessment as well as metric analysis. Using traditional techniques and metric analysis the sex of 24 adult females and 24 adult males were assigned. Analysis of skeletal traits and dental attrition enabled the approximate ages of 71 adults and 19 juveniles to be established. The majority of the individuals were estimated to be young adults. Pathological analysis showed a clear difference between the two necropolises; individuals at Joan Planells had many more traumas and pathological lesions than those buried at Via Punica 34. A variety of pathologies such as Spina Bifida, auditory exostoses, Cribra Orbitalia, ruptured discs, Schmorl's nodes and sclerotic

bone deposition were exhibited by the Joan Planells population, whereas pathologies exhibited by the Via Punica 34 population were mainly confined to Schmorl's nodes and Cribra Orbitalia, and even then, only in a handful of individuals. Further research on archaeological populations excavated in the island would allow a more comprehensive study of the past populations that lived in the island.

Investigating the use of coca and other psychoactive plants in Andean archaeological populations

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There is ample evidence in the archaeological record that psychoactive plants have played a significant role in Andean cultures for millennia e.g. snuff trays and tubes from San Pedro de Atacama (c. 200-900 AD) and in situ coca leaves in the cheeks of Chiribaya mummies (c. 1150-1300 AD). A number of practices involving psychoactive plants are still practiced in the Andes. Despite the archaeological evidence, the use of these plants is not fully understood. This is particularly true for plants imbibed as decoctions that do not require a specific vessel or equipment for ingestion.

The aim of this study was to apply LC-ESI-MS/MS methods to determine the use of psychoactive plants in a Cabuza (c 500-1000 AD) assemblage by analysing hair for active drug compounds. Thirty-six individuals from three cemeteries (AZ-6, AZ-71, AZ-141) in the Azapa Valley were included.

Eight individuals tested positive for BZE (a coca metabolite) and 2 individuals tested positive for bufotenine, the active alkaloid in *Anadenanthera* snuff, a preparation made from tree bark that is inhaled using distinctive paraphernalia. One of the two individuals (male, aged approximately 30) who tested positive for bufotenine was an "Orejone", a man who wore ear spools in life, suggestive of a high social status. Snuffing has also been linked with high social status. The other individual, a female aged approximately 20, is lacking contextual information so further interpretation is not possible. However, it tentatively suggests that snuffing was not purely limited to males as has previously been suggested.

The skeletal distribution of strength: Detecting behaviour from whole-bone robusticity profiles

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This study applies a whole-bone approach to enhance our understanding of activity-driven variation in human long bones. Variation in strength properties at key sites on skeletal elements reflects behavioural variation, particularly with respect to mobility and foraging activities (Stock, 2001). The hypothesis to be tested is that variation across whole bones, both bilaterally and from proximal to distal locations, in the upper and lower limb, reveals differential influences of diverse foraging activities on limb use.

Femora, tibiae, humeri and radii of 184 individuals from 6 hunter-gatherer or early agricultural populations were studied (Inuit, Fuegian, Andaman Islander, Chumash, Aborigine Australian, and Ancient Egyptian samples). 923 individual skeletal elements were laser scanned using Nextengine 3D Desktop Scanners. Utilising custom-built software, biomechanic and curvature properties were calculated from coordinate cross-sections at every 1% of bone length.

Considerable intra- and inter- population variation in the distribution of strength across and between bones of both the upper and lower limbs was identified. Associations between known activity information and the distribution of strength suggest a greater range of behavioural information is contained within the skeleton than is revealed by analysis of only key sites. Further, a relationship between biomechanic properties and distal humeral curvature raises the importance of integrating diverse markers.

Taking a whole bone and integrated approach to morphological variation holds great potential to reveal past behaviours from skeletal material. This approach offers a path towards enhancing the potential specificity of behavioural predictions with application across a range of evolutionary and archaeological contexts.

An Examination of Human Dissection Cut-Marks From The 19th Century Using Scanning Electron Microscopy

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We present osteological evidence for the varied types of instruments used during 19th century human dissection and surgical procedures from skeletal remains excavated at the Royal London Hospital site, Whitechapel. These excavations, conducted by Museum of London Archaeology (MOLA) in 2006, recovered 265 burials and 89 coffins containing dissected human body portions dating to the early 19th century. The aim of this research was to develop a method to differentiate between types of medically-relevant post-mortem modification on archaeological skeletal remains. The objectives were to identify the nature of the surgical instruments used based on the analysis of cut marks, and to consider the use of human dissection as an anatomical teaching tool, as well as a

medium for developing surgical procedures that advanced the field of medicine. To develop a method for analysing the varied cut marks encountered, modern sheep flanks were dissected using instruments that resembled 19th century medical instruments (4 knives, 2 saws). Silicone impressions of the tool marks and the cutting edges of the instruments were created and analysed using scanning electron microscopy (SEM). This method was perfected and used on a sample of individuals from the Royal London Hospital site and several 19th century surgical instruments. Electron micrographs were used to specify the category of tool and the techniques used during human dissection. The criteria developed and implemented within the study have broad relevance to forensic science and human osteology for describing post-mortem modification in both modern and archaeological contexts.

Metric analysis of sexual dimorphism at the acetabulum and auricular surface. A test of their potential for use in sex assessment

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There are many locations on the skeleton utilised for sex assessment. Uniquely, sexual dimorphism at the pelvis is based on function rather than robusticity as at other locations. The acetabulum and the auricular surface were chosen for this study as the morphology of both locations is directly influenced by the physical requirements for gait and childbirth; they also have among the highest rates of survival in the burial environment indicating that these locations may offer an opportunity to sex very fragmented human remains. This research was conducted to identify the degree at which sexual dimorphism was being transferred through the pelvis and into these locations. Twelve measurements were chosen and data collected on 230 individuals from the Biological Anthropology Research Centre at the University of Bradford. Ten of the measurements showed a highly significant statistical difference between males and females indicating the areas may be used to determine sex together or separately. A set of ranges was established to utilise the data as a method for sex assessment and tested on the known sex assemblage from St. Bride's, London. One hundred adult individuals were tested at St. Bride's. While the acetabulum correctly identified the sexes more accurately than the auricular surface, when the results of all 10 measurements were averaged for each individual all 100 individuals were correctly sexed. This method has the additional advantage of being able to be used on very fragmented skeletal remains.

Osteological Analysis of Cremated Remains from Madi, Estonia

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The 1,370 square meter flat cairn grave of Madi, Estonia was originally excavated between 1921 and 1965, and the cremated remains of humans and animals have been recovered from the site and stored according to their proveniences at the University of Tallinn Institute of History in Estonia. The Madi burial complex has been dated to the 11th-13th centuries by artifacts found commingled with the remains, but no previous osteological analysis has been performed on the 3 kilograms of bone recovered. Current work at the University of Southampton seeks to examine the skeletal remains from Madi in order to shed light on the individuals interred there and the funerary rituals performed at the site. The species, minimum number of individuals, and ages of the individuals present will be estimated, and the temperature and duration of the pyres in which the bodies were cremated, an activity which likely occurred on-site, will also be inferred from the bones. An analysis of the distribution patterns of the species and skeletal elements within the burial complex will additionally further our understanding of the way in which this mortuary place was utilized. Finally, collaborating with PhD candidate Marge Konsa of the University of Tartu to create more thorough and dynamic representations of the way that the osteological remains are spatially situated alongside other features of the site will contribute to an increased knowledge of cremation practices in Estonia and worldwide.

The Holy Shroud: comparison between body position related to features and gravity/microgravity conditions

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When a person dies the heart stops beating and blood collects in the most dependent parts of the body (livor mortis), the body stiffens (rigor mortis), and the body begins to cool (algor mortis).

The blood begins to settle in the parts of the body that are the closest to the ground, usually the buttocks and back if a corpse is supine. The skin becomes pale as the blood drains into the larger veins. Within minutes to hours after death, the skin is discolored by livor mortis, or what embalmers call "postmortem stain," the purple-red discoloration from blood accumulating in the lowermost (dependent) blood vessels. Immediately after death, the blood is "unfixed" and will move to other body parts if the body's position is changed. After a few hours, the pooled blood becomes "fixed" and will not move. Pressing on an area of discoloration can determine this; if it blanches (turns white) easily, then the blood remains unfixed. Livor mortis is usually most pronounced eight to twelve hours after death. The skin, no longer under muscular control, succumbs to gravity,

forming new shapes and accentuating prominent bones still further. The body then begins to cool.

At the moment of death, the muscles relax completely—a condition called "primary flaccidity". The muscles then stiffen, perhaps due to coagulation of muscle proteins or a shift in the muscle's energy containers (ATP-ADP), into a condition known as rigor mortis. All of the body's muscles are affected. Rigor mortis begins within two to six hours of death, starting with the eyelids, neck, and jaw. This sequence may be due to the difference in lactic acid levels among different muscles, which corresponds to the difference in glycogen levels and to the different types of muscle fibers. Over the next four to six hours, rigor mortis spreads to the other muscles, including those in the internal organs such as the heart. The onset of rigor mortis is more rapid if the environment is cold and if the decedent had performed hard physical work just before death. Its onset also varies with the individual's age, sex, physical condition, and muscular build.

A few adult corpses may not undergo perceptible rigor mortis. Folklore in Britain, the Philippines, and elsewhere ascribed fearsome supernatural powers to these "limber corpses."

The body position in the Holy Shroud is atypical for a corpse. In this study we examine the visible body position changes and appearance in the Holy Shroud related to gravity / microgravity conditions according to physics and aims to both connect the things observable to root causes, and then connect these causes together.

For the Record: a preliminary survey of the crania in St Leonard's Church, Hythe Kent

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The ossuary at St Leonard's Church in Hythe, Kent has been in existence since at least 1679 and is the larger of only two such sites in the UK which remain open to the public; it is believed to contain the remains of approximately 4,000 people. While the collection has been written about historically, and many theories for its existence postulated, limited bioarchaeological research has been undertaken. As no current or complete reference existed the St Leonard's Osteological Research Group was formed in 2009 to catalogue the material and establish a potential resource for further research. This preliminary survey focuses on the 976 crania on shelves, with each cranium being cleaned, re-numbered, and bioprofiled. To date, 750 crania have been profiled, indicating the ossuary contains adults (93%) and subadults (7%), and both males (32%) and females (47%). Pathological findings are limited due to only having the cranium of each individual, however a range of conditions have been recorded, from dental disease (9%) to trauma (1.5%). The research has already enabled us to dispel some of the myths which have developed around the collection, particularly that they were the remains of men fallen in battle, and lend credence to other theories, for example that they are the result of graveyard overflow. It is hoped that this and future research will lead to a better understanding of where the remains in the ossuary came from, and inform both bioarchaeological research and the general public visiting the ossuary.

Mating Systems of the Prehistoric Jomon People from the Mainland Japan indicated by Dental Traits

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The prehistoric Jomon people actively exchanged goods with people lived in other area in the Mainland Japan. Although strontium analysis is used to determine who immigrants were, and/or where the people came from, this method require braking a certain quantity of skeletal remain. Japan is mainly covered by acid soil, and then skeletal remains are usually in very bad condition. A skeletal remain in bad condition has a risk of contamination, and a skeletal remain in good condition is precious. Therefore non-destructive method of migration analysis is strongly required in Japan.

The aims of this study are to determine whether the dental measurements and the non-metrical traits can be used for migration analysis, and to determine mating system in prehistoric Jomon period. The results of both dental measurements and non-metrical traits showed that male specimens made two large clusters according to regions (one was Kanto and Tohoku region and the other was Central region). On the other hand female specimens made much smaller clusters depending on areas and periods. These results indicated that males moved longer distance for marriage than female during the Jomon period.

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Initial analysis of demographic patterns in trace element exposure in South Africa

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This project will identify trends in environmental exposure to toxic elements such as lead, cadmium and magnesium, between individuals of different socioeconomic strata and ethnic backgrounds before and during the Apartheid era in the Republic of South Africa. During the Apartheid era, differential exposure to environmental pollution among ethnic groups remained largely unstudied. Although it has been assumed based on sociological evidence, and on more recent studies of blood element levels, that black South Africans were more likely to be exposed to toxic elements, there was relatively little clinical data gathered during Apartheid regarding trace element toxicity within this population. Exposure to toxic trace elements is highly co-morbid with both infectious and non-infectious disease including metabolic bone disorders, hypertension, cardiovascular disease developmental delays and neurological disorders, malaria and others. Initial analysis was conducted on skeletal material from the Pretoria Bone Collection at the University of Pretoria, South Africa. Approximately 135 skeletal remains of South

Africans were examined among both white and black populations from the pre-Apartheid and Apartheid eras. Core samples of femoral cortical bone were removed from the remains and analysed via Inductively Coupled Plasma Mass Spectrometry (ICP-MS). Given the socioeconomic differences between the black and white populations of South Africa, it is expected that remains from black South Africans will yield higher trace element concentrations than white South Africans. It is also expected that all trace element concentrations in all individuals will increase over time.

The Friary Church of Medieval Southampton: An analysis of Burial Locations

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Although death is often referred to as the “great equalizer”, burial during the medieval period was bounded by division, with spaces inside the church typically being reserved for those in the prevailing monastic order and those who could afford to purchase the extravagant plots. Analysis of skeletal evidence can reveal vital information as lifestyle, with differing activities distinct markers, each providing valuable clues as to the foods they ate and the leisure and labour activities they participated in. This study offers a unique opportunity to directly compare differences in the population of the medieval town of Southampton buried inside (SOU 199) the church to those that were buried outside (SOU 1355). It analyses a wide range of factors including diet, dental health, activity markers that denote stress levels on certain elements of the body, as well as pathological diseases such as osteoarthritis, cribra orbitalia and diffuse idiopathic skeletal hyperostosis (DISH). Through a detailed examination of disease patterns and activity markers commonly considered distinctive to members of upper- or lower- classes I will be able to chart the lifestyle patterns of the individuals buried both within and outside the church. It will specifically question if class rank played a major role in burial location. Additionally, this project will contribute vital information as to how the presence of Franciscan friaries and their religious doctrine in towns throughout England may have influenced the interactions of individuals within their communities.

The Frequency of Congenital Defects in Late and Post-Medieval Britain (1050-1850 AD)

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Congenital defects have occurred throughout history and are known to be caused by certain environmental factors (teratogens) such as air pollution, water pollution, infectious diseases, and malnutrition. All of these are common problems of towns from the late medieval period in Britain (12th-16th century AD), but especially those operating in the start of the Industrial Revolution. By undertaking a population based approach for the urbanising and industrialising late and post-medieval periods in Britain, changes in the frequency of congenital defects can be observed. From these patterns, it may be possible to infer connections between deteriorating living standards and rises in congenital defects. Few population studies have been undertaken, making it difficult to

track changes spatially and temporally. A literature review of both published and unpublished skeletal reports was undertaken looking for the presence of seventeen defects at 53 sites throughout England and Scotland with data collected as crude prevalence rates. The results show congenital defects were more common in urban settings than in rural ones and that congenital defects increased over time, with a higher prevalence rate in the post-medieval period. When compared to clinical data, these past populations had higher prevalence rates. These trends mirror the decline in standards of living associated with urban environments and industrialisation, particularly during the post-medieval period. This research was undertaken as a Master's dissertation and is being continued as a PhD project where data will be collected in an effort to further draw links between poor standards of living and congenital defects.

A cut above the rest – an 18th century private anatomy school in London

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During the renovation of Benjamin Franklin house in 1998 a unique discovery was made, when human and faunal skeletal remains from one of London's private anatomy schools were uncovered. Dating from the late 18th century (1772-1778) the school was founded by Mr William Hewson (1739-1774), famous for his research into haematology, as well as his association with Dr. Hunter and Dr. Franklin. The remains were analysed to provide demographic information, variation of species and methods of dissection. A disproportionately high ratio of children was noted whilst the faunal remains revealed both domestic and exotic species. Interesting results on differential methods of dissections were distinguished as well as the practice of "body sharing". Several hospital anatomy schools have been excavated in recent years but this is the only private anatomy school ever uncovered archaeologically. It provides a rare insight into the running of such an establishment prior to the anatomy act of 1832, where very few bodies for dissection could be obtained through legal means. The relatively short time span of the school and the link to some of the most famous scientists and anatomists of the 18th century makes this a unique opportunity to research the skeletal remains in the light of historical records. The clandestine way in which bodies were acquired and the fact that private schools were not required to register with any official body has left a large void in the historical archive and archaeological discoveries may shed light on the more furtive activities at the schools.

Cnip Headland, Uig, Isle of Lewis – post mortem manipulation of body parts in the bronze age

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The Human Remains Call-Off Contract (HRCC) was established by Historic Scotland in 2000 to provide rapid response for the recovery of archaeological human remains that are unexpectedly discovered. This poster aims to showcase the results of this work by

focusing on one of these projects Cnip on the Isle of Lewis where human bone was found eroding from a sand dune system.

In total the remains of 8 individuals were recovered and included a semi-articulated crouched inhumation. In this instance several bones had been placed in un-anatomical position suggesting that decomposition must have commenced prior to final deposition. Other remains were found nearby in a small sandy mound and included the very incomplete and predominantly disarticulated remains of 4 individuals of adult and sub-adult age. Interestingly several bones appeared to be sorted in relation to anatomical association, i.e., the hand and foot bones were placed together as were several long bones suggesting their deliberate selection and deposition. A further fragmentary and disarticulated adult burial was also recovered that contained the remains of an infant positioned below the adult pelvis. Post-excavation work is currently underway and includes radiocarbon dating, macroscopic and isotope analysis, artefact and botanical analysis, preliminary results date the inhumations to the Bronze Age

While the above work provides a wealth of information relating to burial practice it also suggests that the treatment of the dead could be highly complex and consisted of multi-phase events. It provides an interesting insight into the diverse treatment of the dead pre and post deposition within the Western Isles which has already produced several unique burial sites of prehistoric date including Cladh Hallan and Hornish Point.

A Comprehensive Study Of An Unusual Burial In The Calvinist Church Of Soly, Hungary

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Our research focused on an unusual case of two male skeletons, buried inside the church of Soly, thrown into a pit together in a random position. The anthropological analysis found evidence for decapitation. Since the grave can be dated back to the time of Ottoman invasion of the Hungarian Kingdom (15th-17th centuries) we assumed that the origin of the individuals is different from that of the local population. Nevertheless, their skulls show similar characteristics to a population of settlers nearby. A stable isotope analysis has been conducted to explore the oxygen and strontium isotope ratios of the two individuals. Their oxygen ratios seem to prove our assumptions that their place of origin was different from that of the local population. Our case presents the first isotopic evidence for different ethnic origin in this area regarding this era of Hungarian history.

Myths and reality in the recognition of mycolate profiles for ancient tuberculosis

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Aim. Mycolic acids, essential components of the mycobacterial cell envelope, are established as biomarkers in the diagnosis of ancient tuberculosis. These long-chain fatty acids occur as complex mixtures with distinct profiles for *Mycobacterium tuberculosis*. Recognition of these diagnostic patterns has been achieved by use of sensitive fluorescence high performance liquid chromatography (HPLC). Mass spectrometry (MS) is an alternative way to record mycolic acid profiles and the use of MALDI-TOF MS has been proposed by Mark and co-workers for ancient tuberculosis. The aim of this communication is to objectively assess the validity of these two approaches to the diagnosis of ancient tuberculosis.

Methods. Published HPLC and MALDI-TOF MS profiles, considered to represent mycolic acids in archaeological material will be compared with those from standard *Mycobacterium tuberculosis*. Consistency and reproducibility between mycolate patterns published on different occasions, for the same bone sample, will be explored.

Results, Discussion and Conclusions. It will be demonstrated that HPLC mycolic acid profiles from a range of archaeological materials are informative and correlate well with those from standard *M. tuberculosis*. However, supposed mycolic acid patterns recorded by MALDI-TOF MS will be shown to be disappointingly inconsistent and inconclusive, there even being problems in recording satisfactory profiles for standard mycolic acids. Attention will also be drawn to unsatisfactory procedures in the process leading to the publication of the MALDI-TOF MS results.

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Preliminary Findings from the Links of Noltland Bronze Age Cemetery

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EASE Archaeology

Excavations in the scheduled area of the Links of Noltland in Westray, Orkney, have revealed a potentially significant Bronze Age cemetery. The cemetery extends over quite a large area and both inhumed and cremated remains have been excavated and examined from this site. Since 2009 approximately 27 inhumations, which include a multiple burial of 15 individuals, and over 30 cremations have been recorded. The remains from 2009 – which consisted of 2 inhumations and disarticulated scatters of bone, have been catalogued and examined as part of the interim report for the site while the results from the 2010 and 2011 excavations are pending. The poster for this session will focus on the osteological findings thus far. It will give a brief outline of the general health of the population and the potential implications this site may have in a wider Bronze Age context.

A palaeopathological example of Legg-Calvé-Perthes disease from Argentina

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Legg-Calvé-Perthes disease is a very rare condition that affects one in 10,000 paediatric patients. Examples described in palaeopathological literature are scarce and for this reason the exceptional examples found in this field are worthy of analysis, description and report. This study reports a case of Legg-Calvé-Perthes disease in a skeleton from Argentina in an attempt to contribute towards the general knowledge of the condition and its manifestations. The skeleton 12 Cápiz Alto (12CA) was one of 19 individuals found buried in Cápiz Alto, a cemetery used during the first century of the post-European contact period (late 16th and 17th centuries) of the province of Mendoza, Argentina. Sex assessment of the skeleton suggested that it was probably that of a female aged 14-16 years old who exhibited the right femoral head flattened with a mushroom-like appearance concomitant with a shortened femoral neck. The left femur did not show signs of pathology or disease. In line with observations and descriptions made by clinicians, plain film radiography of the right femur showed that the metaphysis is widened and the femoral head exhibits some degree of sclerosis. Legg-Calvé-Perthes disease is often confused with slipped capital femoral epiphysis; hence, using the diagnostic criteria of Resnick (2002), we accepted the former and rejected the latter. In conclusion, skeleton 12 Cápiz Alto (12CA) represents the natural history of untreated Legg-Calvé-Perthes disease in a 16th-17th century skeleton from Argentina. Examples of this nature have not been found in Argentinean palaeopathological literature; therefore this case study probably represents the first case reported in this field.

Metric and Morphological Analysis of the Human Sternum - a surprisingly neglected Skeletal Element

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Morphological and metric analysis of the sternum was undertaken in this preliminary study to investigate its potential as an indicator of sex and population affinity. A set of 11 standard measurements was devised to record 162 sterna from males and females of European, African and Asiatic ancestry from skeletal collections at the School of Applied Sciences (Bournemouth University), the Duckworth Laboratory (University of Cambridge) and the Centre for Human Bioarchaeology (Museum of London). Statistical analyses including Pearson's chi-square, Spearman's correlation, the Kolomogorov-Smirnov test, t-test and one-way ANOVA were used to characterise differences in dimensions and morphology between and within sexes and ancestral groups. Length of the manubrium was observed to vary according to sex, whereas width of the third sternal segment exhibits the greatest observed differences between ancestral groups. Observations on sternal measurements, indices and ratios were discussed in light of similar studies with comparable methodologies and results. Sternal morphology was categorised according to Ashley's (1956a, 1956b and 1956c) three types of human mesosternum. The findings here were compared and contrasted to Ashley's (1956b) observations and differences

were found between both studies for sternal morphology of European and African individuals. For Asiatic individuals in particular, this study presents the first effort to summarise sternal morphology and metrics for an ancestral group. However, the lack of comparative materials prevents a critical evaluation of the results. Overall, relationships between sternal morphology and both ancestry and sex have been statistically proven and may be applied to practical osteological work in archaeology and anthropology.

An examination of Juvenile Paleopathology in the Anglo-Saxon Population of Great Chesterford

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Pathological and growth data has been collected from the non-adult (under 17 years) skeletal remains of the Anglo-Saxon site of Great Chesterford. The Great Chesterford collection consists of 167 individuals, 87 of which make up the non-adult sample for this study. Each non-adult skeleton has been examined for possible pathological lesions. A number of scoring methods and case studies have been used to diagnose possible cases of cribra orbitalia, enamel hypoplasia, rickets, and specific and non-specific infection.

In addition, the age of each individual was calculated using both long bone diaphysis and dental development and eruption. Examination of juvenile dentition has been used as a means of gaining a reliable chronological age for the Great Chesterford population. In comparison, long bones have been found to be more likely influenced by the impact of environmental factors, such as nutritional stress or disease and can be slower to develop. In order to understand arrested growth in this population, evidence for disease and stress factors were compared to discrepancies in the dental and long bone ages. The results of this study show that there is a correlation between evidence of stress and disease and discrepancies in aging methods.

The study of children during the Anglo-Saxon period has been hindered by the underrepresentation of non-adults in the mortuary populations. The Great Chesterford collection creates a unique opportunity to study a large juvenile population and allows us to investigate pathology and arrested growth in this period.

The Alkmaar Mass Graves

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During June-July 2010, the cemetery of the Franciscan monastery in the Dutch city of Alkmaar was excavated. Unexpectedly, this late medieval graveyard dating between 1448 and 1572 revealed the presence of two mass graves, containing 21 and 10 individuals respectively. Upon discovery, it was hypothesised that these were related to the siege of Alkmaar by the Spanish forces in 1573 during the Dutch Revolt. During this period, the city was protected by foreign soldiers known as Beggars. Historic accounts

confirm deaths amongst the citizens of Alkmaar as well as amongst the soldiers. The physical anthropological analysis conducted at Leiden University showed some interesting preliminary results. All but one of the individuals were of the male sex, of a relatively young age, ranging from 14 to 30 years old and they were very robust with heavy muscle attachments. In addition, several of the individuals displayed traumatic injuries such as gunshot wounds and blunt force trauma, both healed and peri-mortem. Furthermore, the vertebral columns of the majority of the skeletal remains showed signs of strain on the lower back. Based on these preliminary findings, the mass graves are most likely comprised of the remains of soldiers or people with military background. Whether the individuals are indeed the foreign Beggars that defended the city will be further researched by the means of strontium isotope analysis in the coming months.

Topographical analysis of late Miocene catarrhines molars from Nakali in Kenya.

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One of the most interesting issues for research on the fossils is to shed light on ecological reconstruction of these fossil species. Dental remains can be a very good indicator for dietary adaptation of the species. The topographical analysis using the geographic information system for molars can tell us general diet pattern. Higher occlusal relief and longer shearing crests indicate more folivorous diet. And lower occlusal relief and shorter shearing crests or larger occlusal basin indicate more frugivorous diet. Nakali, a Late Miocene fossil site in Kenya, had a great diversity of primates. Two species of large hominoids, at least three species of small non-cercopithecoid catarrhine, and several old world monkeys include colobine monkey have been recovered from Nakali. There would be food segregations among Nakali primate species. The purpose of this study was to investigate dietary adaptation of Nakali fossil primates using the topographical analysis for outer morphology of molars, and to compare with living African cercopithecoid primates. Colobine monkey from Nakali had higher occlusal relief and longer shearing crests than other species from Nakali or living guenons but lower occlusal relief and shorter shearing crests than living colobus. This early colobus already had more folivorous diet than living guenons or other species from Nakali.

Musculoskeletal stress markers (MSMs) among the Holocene Chinese

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The present study investigates the relationship between habitual labour and mobility on the enthesal morphology in Chinese populations which have practiced different subsistence strategies. Musculoskeletal stress markers (MSMs) of 533 individuals from seven archaeological and ethnographical sites, ranging from the mid-Neolithic to the present were compared. This study employed the visual scoring system developed by Hawkey and Merbs (1995) to quantify robusticity and stress lesions of 26 upper limb and

14 lower limb entheses. Overall patterns of MSM variation were similar across the seven populations, although there was significant sexual dimorphism among most populations ($p < 0.05$); however, the rank orders of the mean MSM scores of both sexes do not show a marked difference. The findings of the present study are not consistent with previous archaeological studies. The homogenous muscle use patterns indicate that the studied populations may have practiced activities with similar muscular recruitment despite archaeological evidence for changing patterns of behaviour. Furthermore, the results suggest minimal gender-based division of labour during the Holocene in China. This study not only provides new insights into the past habitual behaviours of ancient Chinese populations, but also demonstrates that MSMs may not work well at distinguishing subtle differences in activity.

Isotopic Analysis of Food Pathway Variance in Neolithic Japan

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Isotopic analysis of carbon and nitrogen is gaining popularity as a means of reconstructing subsistence patterns in past populations. The coastal Jomon people of Neolithic Japan (11000-300 BCE) are assumed to have utilized a higher ratio of marine resources compared to inland Jomon. However, cautious interpretation of isotope analyses in a cultural context is key to understanding dietary patterns in the archaeological record. $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values ($n=122$), collected by previous researchers from Jomon skeletons, are compared using statistical analysis (ANOVA and ANCOVA) to test previously proposed subsistence practices. ANCOVA testing indicates there are significantly different subsistence patterns between inland and coastal sites, as suggested by previous research ($p < 0.05$). However, ANOVA testing between archaeological sites also present significant difference ($p < 0.05$). Ultimately, caution must be taken when assuming diet-based similarities between populations.

A Study on Femoral Harris Lines from the Juveniles of the Anglo Saxon population of Great Chesterford

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The aim of this research is to examine the femora of the juveniles of Great Chesterford for Harris Lines. The adult remains of this population have been well documented and studied, whilst the juveniles have been largely ignored. This population has a high number of juvenile remains for an Anglo Saxon population which are also exceptionally well preserved.

The individuals for this study were aged via two methods: femur length and dental eruption. Of the eighty nine juveniles present, fifty three were suitable for radiographing for this study.

The hypothesis for this study was that Harris Lines were expected to be present due to the poor nutritional intake, famine and illness of children within this time period. Preliminary results suggest that this may not be the case. The results indicate that Harris Lines are not as prolific as was expected, suggesting the children either died prior to the Harris Lines developing, or that the environmental and nutritional stresses did not manifest as a Harris Line within the femurs radiographed.

In conclusion this study shows that the Anglo Saxon juveniles of Great Chesterford do not exhibit as many Harris Lines as first hypothesized.

A Re-Interpretation of the Mutilated Skeleton Q1 from Maiden Castle Long Mound

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The severely mutilated skeleton known as Q1 found buried on the Long Mound at Maiden Castle, Dorset was originally believed to be a Neolithic victim of cannibalism but was re-interpreted by Don Brothwell in the early 1970s as a Saxon dismemberment (the burial was C14 dated to 555-715AD). However, the skeleton was on display in Dorchester Museum still encased in the soil matrix and Brothwell was only able to remove the larger bones. As part of the author's research, the museum allowed all of the skeletal elements to be removed from the display, probably the first time this has been done. A detailed examination of the peri-mortem trauma indicated a number of sharp force injuries to the cranium and mandible, including blows that would have decapitated the individual, as well as chopping injuries to all of the limbs, the pelvis and both pectoral girdles. The vertebral column had also been chopped vertically and the ribs fractured, also in the peri-mortem period. The pattern of injuries suggests the individual was subject to a number of cranial blows, was decapitated, probably disembowelled, the body was divided horizontally at the level of the superior os coxae and vertically through the spinal column, the upper and lower limbs were then removed from the torso and chopped into a number of segments. The injuries are very similar to those seen in the quartered Medieval individual from Hulton Abbey suggesting that skeleton Q1 is a very early example of such a punishment.

A comparative study of congenital and developmental spinal defects in two populations

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Congenital spinal defects occur during embryonic development, whilst developmental ones occur prior to complete spinal development at puberty. This study focused on the occurrences of both varieties of defects within two populations.

The first population is from Ancaster, Lincolnshire. This assemblage is from the Romano-British period and consists of 195 adults and 68 children. Occurrences of spina

bifida occulta, block vertebra, border shifting and other minor defects were discovered during this study; mainly in the adult remains.

The second population is from Great Chesterford, Cambridgeshire. This assemblage is from the Anglo-Saxon period and consists of 98 adults and 69 juveniles. Congenital scoliosis, spina bifida occulta, block vertebrae, border shifting and minor fusion defects were all observable.

The main aim of this study was to ascertain if there were any changes in the occurrence rate and types of spinal defects during the Anglo-Saxon period; and if a change occurred to provide some valuable discussion as to possible causal factors. Although it is freely admitted that a greater number of comparative data-sets would undoubtedly be more ideal, within the time limits of the present work this was not possible, it is hoped that this research will provide a solid grounding for future work.

The Ancaster assemblage is currently stored by English Heritage and the Great Chesterford assemblage is currently stored at the University of Southampton.

The effect of short term delay preceding recovery on burnt bone fragmentation

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This research aims to assess how short term delays in time-until-recovery can affect the quality and quantity of burnt bone recovered from a scene. A fatal fire scene is a complex environment with many factors affecting when remains recovery can occur. Whether these delays in recovery have a negative impact on the material recovered from the scene, or how time-sensitive remains recovery is, are not well understood and warrant further investigation. Understanding how delays in recovery affect fragmentation will enable investigators to prioritise remains recovery amongst the needs and requirements of investigators at a scene to ensure maximal benefit to the investigation. Knowledge of remains fragmentation will also assist in the recovery process by giving some indication of the condition of the remains.

By comparing calcined bone fragments recovered at 24 hour, 56 hour and 168 hour (1 week) intervals this research aims to describe remains fragmentation and how it is affected by delays in recovery. A total of 11 pig forelimbs were burnt in two fires (5 and 6 limbs in each, respectively) with two legs recovered from each fire scene at each of the three time intervals (only one leg was recovered in one instance). Bone fragments were then sorted by size and the proportional weight of each size category compared to observed differences in fragmentation between different delay periods. Results reveal minor differences in fragmentation over the time period with some increase in fragmentation noted, although not all fragment sizes show similar patterns of change.

Necropolis 6 of the Roman city of Sanisera: Initial Stable Carbon and Nitrogen Isotope Results

Margaret Ziriak

This is the initial report of a multi-element isotopic study that is being conducted on Necropolis 6 of Sanisera (123 BC to AD 550), one of the three major Roman cities on the island of Minorca. Carbon and nitrogen isotope analysis was conducted on bone collagen of individuals from Necropolis 6 (n=20) and faunal samples (n=16) from the city site. The human results ($\delta^{13}\text{C} = -18.6 \pm 0.35\text{‰}$ and $\delta^{15}\text{N} = 11.3 \pm 1.14\text{‰}$) reflect a predominantly terrestrial C₃ based diet of plants and animal protein with a limited contribution of marine resources. This is congruent with the terrestrial C₃ plant based diet of the faunal samples and with other contemporary sites along the southern coast of Europe. The tombs can be further divided into Zones 1 and 2 based on location, and 2A and 2B based on tomb construction. Zone 2B ($\delta^{13}\text{C} = -19.1 \pm 0.05\text{‰}$ and $\delta^{15}\text{N} = 10.7 \pm 0.17\text{‰}$) has significantly different results from the other two zones. Coupled with the poorer construction of tombs in Zone 2B, these results suggest dietary variation based on status or origin. While only preliminary, these results lay the groundwork for the larger isotopic study to investigate the origins of individuals from Necropolis 6.