19th Annual Conference of the British Association for Biological Anthropology and Osteoarchaeology (BABAO)

8th–10th September 2017
Liverpool John Moores University

Programme and Abstracts

www.ljmu.ac.uk/babao
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The Research Centre in Evolutionary Anthropology and Palaeoecology in the School of Natural Sciences and Psychology

Liverpool John Moores University

Welcomes you to the 19th annual BABAO conference 2017

Organising and Scientific Committee

Dr. Isabelle De Groote  Prof. Joel Irish  Dr. Constantine Eliopoulos  Dr. Matteo Borrini

Prof. Laura Bishop  Dr. Alison Brough  Dr. David Jordan  Dr. Linus Girdland Flink

Dr. Richard Jennings  Dr. Kyoko Yamaguchi  Dr. Emma Pomeroy
Welcome to the 19th annual British Association for Biological Anthropology and Osteoarchaeology conference 2017. The Research Centre in Evolutionary Anthropology and Palaeoecology at Liverpool John Moores University are proud to be hosting the conference in the **John Lennon Art and Design Building** from **8th – 10th September**.

Registration and poster installation will begin at **12pm on Friday 8th** in the **John Lennon Building Atrium**. A welcome talk by Professor Peter Wheeler (Dean of the Faculty of Science) will commence at **1pm**, followed by a series of interesting **podium presentations** on Palaeoanthropology and Primatology. The day will be broken up by **afternoon tea** and a poster session at **2:30pm**. The first wave of Bioarchaeology and Archaeological Science **podium presentations** will follow suit at **3:30pm until 5:30pm**. Friday’s events close with the BABAO **annual general meeting** followed by a drinks reception at **6:30pm “on the roof”**.

Saturday events will begin at **9am** in the John Lennon Art and Design Building with further Bioarchaeology and Archaeological Science **podium presentations**, followed by a **coffee break at 10:30am**. At **11:00am** the fourth round of **podium presentations** for the session entitled Variation, Adaptation and Molecules will commence. **Lunch** will be at **12:30pm** alongside **poster sessions A (12:30 – 1:15pm)** and **B (1:15 – 2:30pm)** in Studio 1. The fifth session of **podium presentations** entitled Palaeopathology will then start at **2:30pm** and will conclude at **3:30pm**. At 4pm there will be **afternoon tea** and the **public exhibition**. The **public lecture by Chris Stringer** will start at **5pm** and the evening will be completed by the gala dinner at **7pm** in **Lutyens Crypt, Metropolitan Cathedral**.

Sunday morning will begin at **9am** with a **professional development session**. The next set of **podium presentations** will commence at **10am** followed by a **coffee break at 11am**. The final session, on Forensic Anthropology will start at **11:30am** and the conference will close with the **announcement of student prizes** at **12:30pm**. Between **2pm and 5pm** we will have activities at the **World Museum**.

Prof. Joel Irish - Subject Leader in Anthropology and Archaeology
BABAO 2017 Sponsors

BABAO and LJMU would like to say a special thanks to the companies below, who have provided support towards this year’s conference.
Important Information

PODIUM PRESENTATION
We request that presentations are uploaded at the start of the break prior to your session.

POSTER PRESENTATION
Poster installation will begin at 12pm on Friday 8\textsuperscript{th} in the John Lennon Building Atrium. The posters must remain on display for the duration of the conference. If this is not possible please contact one of the organising committee members. The required format of the posters is A1 portrait.

CONFERENCE and PUBLIC EVENT MAP
Liverpool Lime Street and Liverpool Central train stations are located in the city centre and are within a 15-minute walking distance of all the venues. Taxis from the train stations should cost around £3-4 if booked privately.

- Conference location – John Lennon Building (red)
- Conference dinner – Liverpool Metropolitan Cathedral (green)
- Public events around the city (purple)
Conference Programme

Friday, 8th September

12:00pm-1:00pm  Registration. Poster installation. Arrival refreshments.  
     John Lennon Building Atrium
1:00pm-1:15pm  Welcome by Prof Peter Wheeler

Podium Session 1: Palaeoanthropology and Primatology
Chairperson: Laura Bishop

1:15pm-1:30pm  Sarah Crudgington and Todd Rae  
     Coronal suture shape at bregma differentiates some primate clades
1:30pm-1:45pm  Ashleigh Wiseman et al.  
     A 2D geometric morphometric approach to analysing the functional morphology of the hominin foot from the Pliocene to the Holocene.
1:45pm-2:00pm  Annabelle Lockey et al.  
     Enamel thickness variation within mandibular incisors in modern humans, Neanderthals and the Atapuerca-Sima de los Huesos population.
2:00pm-2:15pm  Alex K. Piel et al.  
     Figs are important, but not fallback foods for chimpanzees in the Issa Valley, Tanzania
2:15pm-2:30pm  Patrick S. Randolph-Quinney et al.  
     The origins of neoplastic disease in the human fossil record: new evidence from Swartkrans, Malapa and Rising Star Caves
2:30pm-3:30pm  Poster Session – Afternoon tea

Podium Session 2: Bioarchaeology and Archaeological Science 1
Chairperson: Richard Jennings

3:30pm-3:45pm  Ali Metin Büyükkarakaya  
     On the formation process of the BB collective burial from Tepecik-Çiftlik, Central Anatolia (Turkey)
3:45pm-4:00pm  Kirsi Lorentz  
     Cultural cranial modification within the first sedentary communities in Near East
4:00pm-4:15pm  Claudia Cunha and Patricia S. Almeida Prado  
     Taken from the cradle: paleobiological analysis of the partially mummified remains of an Inca infant.
4:15pm-4:30pm  Sam Walsh  
     Early Neolithic life, death, and burial in the Central Zagros region of Iraq
4:30pm-4:45pm  Janet Montgomery et al.  
     High spatial resolution intra-tooth Sr-isotope analysis of a modern migrant - how does a rapid relocation manifest in human tooth enamel?
4:45pm-5:00pm  Charlotte Roberts et al.  
     Ethics and archaeological human remains: let’s take a step back
5:00pm-5:30pm  Break
5:30pm-6:00pm  Annual General Meeting
6:30pm-8:00pm  Drinks reception “on the roof”
**Podium Session 3: Bioarchaeology and Archaeological Science 2**

*Chairperson: Alison Brough*

<table>
<thead>
<tr>
<th>Time</th>
<th>Speaker(s)</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>9:00am-9:15am</td>
<td>Caroline Wilkinson <em>et al.</em></td>
<td><em>The Face of Robert the Bruce</em></td>
</tr>
<tr>
<td>9:15am-9:30am</td>
<td>Sharon J. Clough <em>et al.</em></td>
<td><em>Hinkley Point Anglo-Saxon Cemetery</em></td>
</tr>
<tr>
<td>9:30am-9:45am</td>
<td>Jessica L. A. Palmer and Andrea L. Waters-Rist</td>
<td><em>Constant change: evidence for socioeconomic stability in post-medieval Aalst</em></td>
</tr>
<tr>
<td>9:45am-10:00am</td>
<td>Elina Petersone-Gordina <em>et al.</em></td>
<td><em>Looking for rural immigrants in St Gertrude Church cemetery (15th-17th centuries AD) in Riga, Latvia: an isotopic analysis</em></td>
</tr>
<tr>
<td>10:00am-10:15am</td>
<td>Geraldine G. Granados and Lourdes Marquez</td>
<td><em>Theoretical and methodological problems to interpret gender in funerary context from Monte Alban Tombs</em></td>
</tr>
<tr>
<td>10:15am-10:30am</td>
<td>Eóin W. Parkinson</td>
<td><em>Spatial variation in skeletal biomechanics among late Neolithic and Copper Age populations in the central Mediterranean.</em></td>
</tr>
<tr>
<td>10:30am-11:00am</td>
<td>Morning Coffee</td>
<td><em>Exhibition space</em></td>
</tr>
</tbody>
</table>

**Podium Session 4: Variation, Adaptation and Molecules**

*Chairpersons: Emma Pomeroy and Linus Girdland Flink*

<table>
<thead>
<tr>
<th>Time</th>
<th>Speaker(s)</th>
<th>Title</th>
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</thead>
<tbody>
<tr>
<td>11:00am-11:15am</td>
<td>Åshild J. Vågene <em>et al.</em></td>
<td><em>16th century Salmonella enterica genomes from Teposcolula-Yucundaa - an early contact era epidemic cemetery in Mexico</em></td>
</tr>
<tr>
<td>11:15am-11:30am</td>
<td>Ana Curto <em>et al.</em></td>
<td><em>Stable isotope dietary comparison between apparently healthy individuals and those affected by infectious pathologies from medieval Tomar, Portugal</em></td>
</tr>
<tr>
<td>11:30am-11:45am</td>
<td>Samantha Leggett</td>
<td><em>Isotopes, Statistics and the Anglo-Saxons – Thinking Big and Thinking Straight</em></td>
</tr>
<tr>
<td>11:45am-12:00pm</td>
<td>Candace McGovern</td>
<td><em>A Woman’s World: Exploring the morphological and pathological conditions associated with obstetric dilemmas in an urban Romano-British population</em></td>
</tr>
<tr>
<td>12:00pm-12:15pm</td>
<td>Zarus Cenac and Richard Cook</td>
<td><em>Facial variability in the context of the other-race effect</em></td>
</tr>
<tr>
<td>12:15pm-12:30pm</td>
<td>Sarah-Louise Decrausaz <em>et al.</em></td>
<td><em>Hard tissue, soft tissue: An examination of the associations between body composition and pelvic dimensions in girls and women living in London.</em></td>
</tr>
<tr>
<td>12:30pm-2:00pm</td>
<td><em>Poster Sessions – Lunch (A:12:30pm-1:15pm B:1:15pm-2:00pm)</em></td>
<td><em>Studio 1</em></td>
</tr>
<tr>
<td>4. Palaeopathology (A)</td>
<td></td>
<td></td>
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<tr>
<td>5. Molecules and Isotopes (A)</td>
<td></td>
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<tr>
<td>6. Forensic Anthropology (A)</td>
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<tr>
<td>7. New and Emerging technologies in bioarchaeology (B)</td>
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<tr>
<td>8. Bioarchaeology and Archaeological Science 2 (B)</td>
<td></td>
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<tr>
<td>Time</td>
<td>Speaker/Title</td>
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</tbody>
</table>
| 2:00pm-2:15pm| **Rachel Schats et al.**<br>
Syphilis in the Netherlands. Dating and provenance of three syphilitic individuals from Kampen |
| 2:15pm-2:30pm| **Rose Drew and Gwyn Madden**<br>
Hard Life or Hard Times? Individuals from Tukthuset, the Oslo House of Correction |
| 2:30pm-2:45pm| **Maria M. Le Roi et al.**<br>
Inside and Out: Using X-ray to confirm macroscopic diagnosis of metastatic cancer |
| 2:45pm-3:00pm| **Tina Jakob and Joe W. Walser III**<br>
Bioarchaeological Research on Mograt Island, Sudan |
| 3:00pm-3:15pm| **Dawn Gooney and Carmelita Troy**<br>Grangegorman Lower Cholera Cemetery, Dublin |
| 3:15pm-3:30pm| **Christian Meyer et al.**<br>The Mass Grave of Halberstadt, Germany: A New Facet of Mass Violence in the Early Neolithic of Central Europe |
| 3:30pm-4:00pm| **Set-up Public Exhibition**<br>Afternoon tea<br>**Studio 1** |

**Public Session**

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
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<tbody>
<tr>
<td>4:00pm-5:00pm</td>
<td>Public exhibition – Studio 1</td>
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<tr>
<td>5:00pm-6:00pm</td>
<td>Public lecture by Professor Chris Stringer</td>
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**Conference dinner**

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<tr>
<th>Time</th>
<th>Event</th>
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<tbody>
<tr>
<td>7:00pm-12:00am</td>
<td>Conference dinner at the Liverpool Metropolitan Cathedral</td>
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### Sunday, 10\textsuperscript{th} September

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
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<tbody>
<tr>
<td>9:00am-10:00am</td>
<td>Professional Development session</td>
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<tr>
<td></td>
<td><strong>Podium Session 6: New and Emerging Techniques in Bioarchaeology</strong></td>
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<td></td>
<td><strong>Chairperson: David Jordan</strong></td>
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<tr>
<td>10:00am-10:15am</td>
<td>Francesco Simonit \textit{et al.}</td>
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<tr>
<td>10:15am-10:30am</td>
<td>Fabio Cavalli \textit{et al.}</td>
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<td>A densitometrical CT approach to study the temperature of cremation in archaeological remains. A preliminary study.</td>
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<tr>
<td>10:30am-10:45am</td>
<td>Emily Carroll \textit{et al.}</td>
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<td></td>
<td>Ashes to ashes: A new approach to the analysis of burnt human remains.</td>
</tr>
<tr>
<td>10:45am-11:00am</td>
<td>Joel Irish \textit{et al.}</td>
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<td></td>
<td>Skeleton2Go: a new tool for learning human skeletal anatomy</td>
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<tr>
<td>11:00am-11:30am</td>
<td>Morning Coffee</td>
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<td></td>
<td><strong>Exhibition space</strong></td>
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<td></td>
<td><strong>Podium Session 7: Forensic Anthropology</strong></td>
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<td><strong>Chairperson: Matteo Borrini</strong></td>
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<tr>
<td>11:45am-12:00pm</td>
<td>Winsome H.S. Lee \textit{et al.}</td>
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<tr>
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<td>Aetiology and Social Implications of Forearm Fractures in a Modern Cypriot Population</td>
</tr>
<tr>
<td>12:00pm-12:15pm</td>
<td>Keith K. Silika</td>
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<td>Forensic Anthropology in Zimbabwe contexts, Exhumation of mine shafts</td>
</tr>
<tr>
<td>12:15pm-12:30pm</td>
<td>Patricia S. Almeida Prado \textit{et al.}</td>
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<td>Estimations from human remains: a challenging task for biological and forensic anthropologists.</td>
</tr>
<tr>
<td>12:30pm-12:45pm</td>
<td>Matteo Borrini</td>
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<td>The assassination of Giuliano de Medici: a forensic investigation on a 500 years old attempted coup d'état</td>
</tr>
<tr>
<td>12:45pm-1:00pm</td>
<td>Student Prizes – close of conference</td>
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</table>

### Public Session at World Museum Liverpool

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
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<tbody>
<tr>
<td>1:00pm-2:00pm</td>
<td>World Museum Liverpool set-up</td>
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<tr>
<td>2:00pm-5:00pm</td>
<td>“Meet the Scientist”</td>
</tr>
</tbody>
</table>
Poster Programme

Friday, 8th September
2:30pm-3:30pm

Chairperson: Joel Irish

Poster Session 1: Primatology, Human Adaptation and Variation

1. Sarah Poniros
   The Bioarchaeology of Diversity: A Case Study in the Roman Empire

2. Stephanie Payne et al.
   Dexterity vs Thermoregulation: trade-offs in upper limb proportions of Himalayan populations

3. Nicola Koyama et al.
   Changes in appearance and desire across the ovulatory cycle in single and partnered women

4. Fotios Alexandros Karakostis et al.
   Assessing the effect of biomechanical stress on hand enthesal morphology: A histological approach

5. Emma Pomeroy et al.
   Relationship between lean mass, fat mass, and limb bone cross-sectional geometry: implications for estimating body mass and physique from the skeleton

6. Satu Valoriani et al.
   Intra- and inter-population variation among the Medieval English: a preliminary craniometric study

7. Christianne Fernée et al.
   It’s all in your head? Cranial morphological variation in modern human populations

8. Charlotte Henderson
   Multidimensional scaling for determining the effect of occupation on enthesal changes

Poster Session 2: Dental Anthropology

9. Christopher Aris et al.
   First histological evidence for a change in tooth enamel growth rates in ancient Britain

10. Rosie Pitfield and Patrick Mahoney
    Biorhythm correlates with human molar enamel thickness

11. Sammy Field
    Challenging Brothwell – a study of the differential rates of wear in the maxillary and mandibular molar dentition

12. Allison Card et al.
    Investigations of dental relatedness from early medieval populations in England

13. Mallory Anctil
    Interactions among Celtic and Etruscan populations during the Iron Age as revealed through dental nonmetric traits: a preliminary analysis

14. Tatiana Vlemincq Mendieta
    Prehispanic population dynamics in the central coast of Peru: evidence from dental morphology

15. Ian Towle et al.
    Dental pathology, wear, and developmental defects in fossil hominins and extant primates
<table>
<thead>
<tr>
<th>No.</th>
<th>Author(s)</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>17</td>
<td>Jelena Bekvalac and Gaynor Western</td>
<td>Radiographic revelations: Is that a blade in your back sir?</td>
</tr>
<tr>
<td>18</td>
<td>Iris Bollebakker et al.</td>
<td>Measurement of Age. An Evaluation of the Danish Non-Adult Ageing Method</td>
</tr>
<tr>
<td>19</td>
<td>Carla Burrell et al.</td>
<td>Osteological analysis of the skeletons from Halton Castle, Cheshire</td>
</tr>
<tr>
<td>20</td>
<td>Christine Cave and Mark Oxenham</td>
<td>Identifying the Invisible: a window on two lives from Anglo-Saxon Great Chesterford, Essex</td>
</tr>
<tr>
<td>21</td>
<td>Daniel Charters et al.</td>
<td>Morphometric Analysis of Maxillary Cave Bear Dentition from Scladina Cave (Belgium) and Kents Cavern (UK)</td>
</tr>
<tr>
<td>22</td>
<td>Shaheen Christie</td>
<td>Decapitation and Fragmentation Burial Practices in Western Roman Britain</td>
</tr>
<tr>
<td>23</td>
<td>Mairead Downey and Martin Smith</td>
<td>Tunnel vision: analysis of a disarticulated assemblage recovered from a natural rock fissure as an example of an understudied form of funerary practice</td>
</tr>
<tr>
<td>24</td>
<td>Monika Dzierlińska</td>
<td>The fragmentation analysis of cremated human remains from the Biala site 2, Zgierz, Poland</td>
</tr>
<tr>
<td>25</td>
<td>Hiroko Hashimoto</td>
<td>Experimental archaeological approach to understanding how the pilaster of femur was developed during Kofun Period in Japan</td>
</tr>
<tr>
<td>26</td>
<td>Cara Hirst</td>
<td>Reconstructing Missing Landmarks: Investigating How Accuracy Varies Among Methods and Samples</td>
</tr>
<tr>
<td>27</td>
<td>Emma Hook</td>
<td>In Sickness and In Health: A bioarchaeological and historical analysis of the medieval hospital of St James, Thornton Abbey, England.</td>
</tr>
<tr>
<td>28</td>
<td>Esme Hookway</td>
<td>Understanding the presence of children in late medieval hospitals in England, AD. 1050 - 1600.</td>
</tr>
<tr>
<td>29</td>
<td>Vail Johnson et al.</td>
<td>A novel analytical approach to burial position measurement from an early medieval cemetery</td>
</tr>
<tr>
<td>30</td>
<td>Alexis Jordan</td>
<td>Harlyn Bay: A Case Study in the Analysis of a Curatorially Commingled Skeletal Collection from Iron Age Cornwall</td>
</tr>
<tr>
<td>31</td>
<td>Jacinth Kilmartin and Jo Buckberry</td>
<td>Sex assessment of the sacrum – a morphological approach</td>
</tr>
<tr>
<td>32</td>
<td>Stephanie Johnson et al.</td>
<td>A Bioarchaeological Approach to the Excavations of La Grand Place de Sclayn, Meuse Valley, Belgium</td>
</tr>
</tbody>
</table>
Saturday, 9th September
A: 12:30pm-1:15pm   B: 1:15pm-2:00pm

**Chairperson: Dr. Isabelle De Groote**

**Poster Session 4: Palaeopathology (A)**

<table>
<thead>
<tr>
<th>No.</th>
<th>Authors</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>34</td>
<td>Nathalie Antunes Ferreira <em>et al.</em></td>
<td>Extracapsular fracture of the femur in an elderly male from Setúbal (Portugal)</td>
</tr>
<tr>
<td>35</td>
<td>Thomas Siek</td>
<td>A Review and Comparison of Paleoepidemiological Studies on Neoplastic Disease</td>
</tr>
<tr>
<td>36</td>
<td>Stephanie Evelyn-Wright</td>
<td>Dis/ability stories from the skeletons: a fictive narrative from the Romano-British cemetery at Alington Avenue, Dorset</td>
</tr>
<tr>
<td>37</td>
<td>Charlotte Primeau <em>et al.</em></td>
<td>Evaluation of infectious middle ear disease from CT images of archeological crania</td>
</tr>
<tr>
<td>38</td>
<td>R.L.J. Strong <em>et al.</em></td>
<td>An investigation of fractures and polio infection: A case study from a modern Cretan collection</td>
</tr>
<tr>
<td>39</td>
<td>Rebecca Venn</td>
<td>One Last Drop? Assessing evidence that an individual from post-medieval Manchester suffered from Alcohol Use Disorder</td>
</tr>
<tr>
<td>40</td>
<td>Ester Annunziata <em>et al.</em></td>
<td>Two unusual cases of atlo-axial complex malformation and the controversy about the aetiology of the “os odontoideum”</td>
</tr>
<tr>
<td>41</td>
<td>Katie Tucker <em>et al.</em></td>
<td>The Hand of Medieval Justice: An Archaeological Example of a Leibzeichen from Petrikirche, Berlin</td>
</tr>
<tr>
<td>42</td>
<td>Heather-Marie Tamminen and Elizabeth Craig-Atkins</td>
<td>The Differential Diagnosis of Hallux Valgus and Gout in Skeletal Remains</td>
</tr>
<tr>
<td>43</td>
<td>Jess E. Thompson <em>et al.</em></td>
<td>A Palaeopathological Approach to Commingled Human Remains: Case Studies from the Xaghra Circle Hypogeum, Gozo</td>
</tr>
<tr>
<td>44</td>
<td>Mario Novak <em>et al.</em></td>
<td>An unusual prehistoric mass burial from Jagodnjak, eastern Croatia – a bioarchaeological approach</td>
</tr>
<tr>
<td>45</td>
<td>Anne-Marijn van Spelde <em>et al.</em></td>
<td>Osteoporosis - a Modern Lifestyle Disease? An Interdisciplinary Study in Past Northern Europe</td>
</tr>
<tr>
<td>46</td>
<td>Solange Bohling <em>et al.</em></td>
<td>Physical impairment and disability in two later Anglo-Saxon populations: Investigating differential mortuary treatment and disability-related care</td>
</tr>
<tr>
<td>47</td>
<td>Megan Brickley <em>et al.</em></td>
<td>Micro-CT Analysis of Dental Structures to Detect Vitamin D Deficiency</td>
</tr>
<tr>
<td>48</td>
<td>Sharon Martin <em>et al.</em></td>
<td>Gloucester Infirmary burial ground: evidence of autopsy in the 18th and 19th centuries</td>
</tr>
<tr>
<td>49</td>
<td>Katerina Kalova <em>et al.</em></td>
<td>Serious chronic disease of the cervical spine and trauma in young female of Middle Ages (Czech Republic)</td>
</tr>
<tr>
<td>50</td>
<td>Kimtalie Ahuja <em>et al.</em></td>
<td>An analysis of the burial ground of a convent and Catholic community from nineteenth century Bristol</td>
</tr>
</tbody>
</table>
Agata Lunardini et al.
Borgo Cerreto Project: paleopathological study and facial reconstruction of a mummified individual of XVII century

Anna Davies-Barrett et al.
A new method for recording and presenting the true prevalence of rib lesions related to respiratory disease

Paola Ponce et al.
Syphilis among the soldiers buried at the Queen’s Chapel of the Savoy, London

Hilarie Huley et al.
Paleopathology of the Ventarrón Complex: Biological Stress, Diet, and Subsistence Economy at the Origins of Social Complexity in the Lambayeque Valley

Swantje Krause et al.
A challenging task - Recognizing Down’s syndrome in human skeletal remains

Eleanor Dove et al.
An investigation into childhood stresses between an urban and rural sample dating from the 12th to 17th centuries

Indigo Reeve
Health and the environment in Medieval London and Scotland

Norman Sullivan et al.
Case Studies of Tuberculosis from an Almshouse Cemetery and the Epidemiological Transition in Early Twentieth Century Milwaukee

Rebecca Cessford
More than Pott’s Spine: The Pre-Antibiotic Distribution of Skeletal Tuberculosis

Emma Louise Saunders and Nicholas Marquez-Grant
Osteitis Pubis...Contributions to Bioarchaeology and Forensic Anthropology

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A rare case of rib osteomyelitis from Bronze Age China
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Abstracts

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Disclaimer: abstract text has been taken directly from the author’s online submission and have not been edited by us. Any mistakes that have been made are the responsibility of the author and are not the fault of the BABAO organising committee.

An analysis of the burial ground of a convent and Catholic community from nineteenth century Bristol

Authors: Kimtalie Ahuja¹, Heidi Dawson-Hobbis¹, Katherine Robson Brown¹

Affiliation(s): University of Bristol¹

The site of St Catherine’s Court and its associated burial ground was actively used from 1842 until circa 1898 initially by a Catholic community and subsequently by a convent. Human remains were uncovered from an excavation of the site in 2007, comprising of 72 articulated remains and the MNI of the disarticulated remains was 7 individuals. These remains were analysed for demography and health, and the findings compared to historical information for Bristol in the 19th century. This was done in part using the historical information at the Bristol Archives on BRI inpatient records, and the parish and burial records for the chapel of St Augustine from 1842 until 1898. The aim of the research was to contribute to the osteological record for the 19th century and provide insight into the daily life of the Catholic population in Bristol. Historical literature shows this population mainly comprised of individuals with occupations such as merchants and professionals (De La Beche, 1945: 12). Dental pathology comparatively was good, with 0.12% of teeth displaying caries. The prevalence of cribra orbitalia was low with 1.53% of orbits affected, and rickets was present in 3 individuals. There was some evidence of trauma, mostly well healed, however one juvenile individual had a peri-mortem injury to the third lumbar vertebra. Finally, there are two individuals from the collection with evidence of craniotomies, one adult and one juvenile. This indicates some relationship between this site and that of the Bristol Royal Infirmary, and provides evidence for early post mortem dissection practices.

Estimations from human remains: a challenging task for biological and forensic anthropologists.

Authors: Patricia Shirley Almeida Prado¹, Maria de Fátima Teixeira Guimarães², Laisa Caldas Fernandes¹

Affiliation(s): Department of Biomorphology, Federal University of Bahia¹; Anthropological Forensic Lab of Medico-legal Institute Nina Rodrigues²

The forensic anthropology is the application of the biological anthropology knowledge with legal purposes. The central purpose of forensic anthropology is: sex, age at death, stature and ancestry estimation aiming the human remains identification. The main objective of this study is to compare the mostly used protocols for sex, age at death and ancestry estimations with data from identified skeletons. At the Department of Anatomy of the Federal University of Bahia there is a program for body and skeletal donations, these human remains are donated by the family to research and education purposes. Approved by ethical committee we are analysing these skeletons, the anthropological analysis are performed at the forensic anthropological laboratory of the Medico-legal Institute Nina Rodrigues, Salvador. We have already performed six complete analyses and with interesting divergent results. The Hefner (2009) protocol for cranial nonmetric traits ancestry estimation, estimated all skulls as 99% as African ancestry while they were all white mixed ancestry; when using the AncesTrees protocols we had more accurate results. The protocol for cranial nonmetric traits in sex estimation was more precise. These are preliminary results but we are bringing up the discussion concerning the use of ancestry estimations protocols in very mixed populations as in Brazil.

Funding: CNPq - Brasil
An osteometric method for reassociating the skeletal elements of the hip joint in commingled contexts

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Affiliation(s): Department of Forensic Medicine and Toxicology, School of Medicine, National and Kapodistrian University of University of Athens, Athens, Greece

In commingled archaeological or forensic contexts, assessing that a femoral head is consistent with an acetabulum could become a primary step for accurately sorting human skeletal remains. Commingled remains are usually located in sites where multiple individuals are interred in a single grave or in cases of surface deposition and scattering of human remains due to mass incidents or criminal events. For this purpose, the maximum diameters of the femoral head and the acetabulum were measured in 204 individuals (108 males, 96 females) from the Athens Collection. This skeletal collection consists of individuals of known sex, age, occupation, and cause of death who lived in the second half of the 20th century in Athens, Greece. Their biological age ranged between 19 and 99 years. Simple linear regression analysis produced an equation for predicting the maximum head diameter of the femur using the maximum diameter of the acetabulum. The standard error of the estimate was calculated to be 1.28mm. Pearson’s correlation analysis demonstrated statistically significant strong positive correlation among measurements (r=0.94, p<0.05). The coefficient of determination (r2) scored 0.88. Bilateral asymmetry and sex did not have an effect on the accuracy of the method. In conclusion, the regression equation developed in this study is found to be suitable for reassociating the skeletal elements of the hip joint. Future research is necessary to further develop similar methods for sorting bones of the human skeleton.

Interactions among Celtic and Etruscan populations during the Iron Age as revealed through dental nonmetric traits: a preliminary analysis.

Authors: Mallory Jaie Anctil1

Affiliation(s): Liverpool John Moores University

Dental anthropological study of the Proto-Celts, the continental, non-continental Celts and their subsequent interactions with the Etruscans during the Iron Age, particularly its applicability in estimating biological affinities among these populations has been generally overlooked. The present study provides a preliminary analysis of the population history among these populations. The objective of the present study was to determine whether the hypothesis that trade between the Celts and Etruscans may have been accompanied by concomitant biological change, was examined through dental nonmetric trait analysis. 36 morphological traits in 220 dentitions from five regional Iron Age samples, representing the proto-Celts, the continental, non-continental Celts, the Etruscans and a comparative European Iron Age sample, were recorded and analyzed. Frequencies of occurrence for each dental nonmetric trait were recorded for each sample. The suite of traits was then compared among samples using principal components analysis, and the Mean Measure of Divergence distance statistic. These biological distance estimates suggest the following: 1) dental phenetic heterogeneity is evident across the samples, 2) there is a significant difference among the Celtic and Etruscan samples, 3) there is a significant difference among the Celtic, Etruscan and comparative samples, and 4) there is a greater degree of genetic diversity among these populations than previously believed. The comparative results suggest that these groups represent biologically distinct populations, thus the hypothesis is not supported. Thus trade among the Celts and Etruscans may have been primarily a cultural transition; accompanied by little to no biological interaction.
Extracapsular fracture of the femur in an elderly male from Setúbal (Portugal)

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Hip fractures were certainly present in past communities, if not reasonably frequent. Often an outcome of osteoporosis and increased risk of falling among the elderly, these fractures affect predominantly older women but also aged men. In this case-study, an extracapsular fracture of the femur in an elderly man is described and contextualized. An aged (50+ years) male exhumed in the church of Nossa Senhora da Anunciada (Setúbal, Portugal, 1531-1829 AD) presented a well-healed fracture in the right proximal femur. The macroscopic observation revealed a lesion in the intertrochanteric ridge with new bone deposition, and shortening and posterior rotation of the femoral neck. Secondary alterations include the overall shortening of the femur and extensive bone formation in the iliopsoas insertion site at the lesser trochanter – but not osteoarthritis. The described fracture is consistent with an extracapsular fracture of the hip, of the intertrochanteric type 1 (stable, single fracture line without displacement). The extensive bone remodeling in the affected femoral region suggests long-time survival after fracture, and familial and/or community care during recovery.

Funding: FCT - Fundação Ciência e Tecnologia (SFRH/BD/70158/2010)

First histological evidence for a change in tooth enamel growth rates in ancient Britain

Authors: Christopher Aris¹, Chris Deter¹, Patrick Mahoney¹

Affiliation(s): University of Kent¹

One of the key developmental changes in the human oro-facial apparatus occurred at the end of the Holocene period, as human societies commenced the transition from hunter-gathering to a farming lifestyle in the Near East. The transition was associated with a reduction in human tooth size. The impact of subsequent socio-economic developments on human dental development has received less attention in the anthropological literature. Here, we employ a histological approach to examine the mechanisms underlying dental development in a range of past societies from Britain, which date between the 5th and 16th centuries AD. For this preliminary study, we examined 57 molars from three populations (early Anglo-Saxon, (n=20); late Anglo-Saxon, (n=17); Medieval, (n=20). Data was collected from histological sections of first or second permanent molar. Results indicate that there was decline in the daily secretion rates of lateral enamel formation when compared between the time periods. Molars from the late Anglo-Saxon and Medieval periods had a significantly slower rate of enamel secretion compared to early Anglo-Saxon. Our research provides the first evidence for a change in enamel growth between archaeological samples of modern human populations in Britain. Ongoing PhD research will use larger sample sizes from additional populations.
A rare case of rib osteomyelitis from Bronze Age China

Authors: Jennifer Austen¹, Jenna M Dittmar², Ivy Yeh³, Ruilin Mao⁴, Wang Hui⁴

Affiliation(s): University of Dundee¹; McDonald Institute of Archaeological Research, University of Cambridge²; School of Humanities and Social Sciences, Nanyang Technological University, Singapore³; Gansu Provincial Institute for Cultural Relics and Archaeology, Lanzhou, China⁴

This study presents a unique case of osteomyelitis in the rib of an adult male (M995: R2) excavated from a large Bronze Age cemetery in use from 2100-1700 BCE in Lintan County, Gansu Province, China. Commonly caused by bacterial and mycobacterial infectious agents, osteomyelitis most frequently affects the long bones in the lower limb and less than <1% of modern cases present with rib involvement. As evidence of rib osteomyelitis in clinical and archaeological literature is limited, the aim of this research is to describe the osteological changes to determine the symptoms this individual may have suffered. A macroscopic examination of the skeletal remains revealed several large sequestra and multiple cloacae on the right 6th rib. Approximately one third of the cortical bone on the dorsal surface of the midshaft was completely obliterated, exposing the internal structure of the rib. Additional changes resulting from this infection were present in the form of bone destruction on the sternal aspect of the left 7th rib and new plaque-like bone formation on the anterior and posterior aspects of the distal sternum. The severity of the osteological changes suggests that this infection was chronic, with this individual likely suffering from debilitating symptoms such as chest pain, fever, and the formation of a draining sinus or abscess in the chest wall. This case study enhances our understanding of the physical side effects associated with a rare expression of a relatively common condition experienced within prehistoric cultures.

Myco Spikes': a proposed standard for fossil calibration in evolutionary tuberculosis studies

Author: Bjørn Peare Bartholdy¹

Affiliation(s): Leiden University¹

Ever since the discovery of a clock-like rate of genetic substitution in organisms, the applications of the molecular clock have been numerous. Of specific interest to paleopathology, is the use of the method to document the evolution and distribution of specific diseases such as tuberculosis (TB). These studies have been numerous in recent years, but have all lacked standardization when it comes to the selection of fossil calibration points. These points are commonly segments of pathogen DNA extracted from ancient human remains, providing temporal constraints for the statistical analyses and are essential for the accuracy and precision of the molecular clock method. The borders of geological stages are defined by global boundary stratotype sections and points (GSSPs, or ‘golden spikes’), which are carefully scrutinized by the International Commission on Stratigraphy. This study proposes that a set of criteria analogous to the GSSPs should apply to the use of fossil calibration points in molecular analyses on the evolution of TB. These are based on the combination of detailed osteological examination and authenticated molecular analysis (primarily ancient DNA). Furthermore, past studies will be evaluated regarding their suitability as a potential ‘Myco spike’, and to serve as an example of how future studies should be conducted.
Intrapopulation growth variation analysis using femur length: the case of Martigues plague victims (south of France – 1720-1721)

Authors: Luana Batista-Goulart¹, Stefan Tzortzis², Isabelle Séguy³, Gérald Quatrehomme⁴

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An individual’s living conditions, which comprises e.g. nutritional state, social status, gender inequalities and access to medical care, can influence his/her stature by 20%. Therefore, in the bioarchaeological context, stature analysis has been used to evaluate past populations’ living conditions. To reconstruct stature, researchers usually apply regression models based on length of long bones, especially the femur, which best represents stature. In this work, we examine femur length of 96 adults from mass graves located at the city of Martigues (Provence - France). They were victims of the plague episode that affected Provence region in 1720-1722, known as the Great Plague of Marseilles. It is known that, before the epidemic, inhabitants of Provence suffered several starvation episodes. Hence, we aim to (1) evaluate whether all social groups, divided according to age, gender and location at the archaeological site, were equally affected by these famines; (2) investigate how differently men and women suffered from them; and (3) link the age classes with three starvation episodes in that region, whose periods are known. Unlike previous studies, we directly analyse the measured femur lengths instead of predicted statures, to avoid modelling errors.

Radiographic revelations: is that a blade in your back sir?

Authors: Jelena Bekvalac¹, Gaynor Western ²

Affiliation(s): MUSEUM OF LONDON¹; OSSAFREELANCE ²

The application of medical imaging for archaeological human skeletal material has been limited in the past with the use of wet film but with the advent of digital equipment and portability of kit this has opened up enormous opportunities for the application to be more readily available. Aiding a more in depth analysis and interpretation of the skeletal material and providing greater insight to the effects of pathologies that may not always be visible with macroscopic analysis. The Impact of Industrialisation on London Health project is utilising radiography as a tool to allow a large scale synthesis of over 2,000 aged and sexed adults from London and non-metropolitan sites from the pre-industrial and industrial periods of how our health has changed as a result of industrialisation in the UK. The radiographic findings are not always what are expected, as is the case of the young male from a post medieval London site with what appears to be a sharp tipped object in a lumbar vertebra, having entered at an angle from the front it is an interesting find. The use of radiography and it findings in this case highlight its importance as a tool for archaeology and forensics for being able to locate and show objects that are hidden from view and the implications that this can have for analysis and interpretation of the individual and collections.

Funding: City of London Archaeological Trust (CoLAT), Rosemary Green Grant
Influence of dimorphism and cranial shape on the morphology of the temporal fossa: a GMM analysis of the origin of temporals

Authors: Sarah B. Berry¹, Patrick S. Randolph-Quinney, ¹

Affiliation(s): School of Forensic and Applied Sciences, University of Central Lancashire¹

The temporal fossa is a depression on the lateral surface of the skull bounded by the temporal lines. The fossa represents the area of origin of the temporalis muscle, one of the primary muscles of mastication, and one which functions to elevate and retract the mandible. As such, the volume of the temporalis muscle and its overall size is under significant functional influence. Whilst previous studies on human, primates and cetaceans have investigated the effects of allometry and overall dimensions of the temporal fossa, none have focussed specifically on the shape of the fossa as a consequence of overall cranial form. This study uses geometric morphometric methods (GMM) to investigate covariation and modularity in temporal fossa morphology and morphology of the overall cranium. Data is derived from both 3D coordinate and surface capture. The study uses 120 crania of known or assessed sex from cadaveric and archaeological populations, to which are applied 50 discrete 3D landmarks, and a suite of sliding semi-landmarks which are used to define the borders and floor of the fossa. Landmark superimposition was undertaken using a generalised Procrustes analysis, with post-hoc statistical tests including Principal Components Analysis (PCA) to assess and describe overall variation, and Partial Least Squares (PLS) to investigate covariation between functional units, and the effects of dimorphism on these. The analyses combine multivariate assessments of shape and size variation, and more critically assess possible effects of modularity between the gnathic skeleton and neurocranium, regions which are bridged by the temporal fossa.

Funding: School of Forensic and Applied Sciences, University of Central Lancashire

Waisted diagnosis. Beauty standards or treatment of spinal deformations: overlooked cases of corsetry by males in 16th-19th-century Europe.

Authors: Alette Blom¹, Andrea Waters-Rist¹

Affiliation(s): Leiden University, The Netherlands¹

Corsetry by both males and females to obtain a more fashionable silhouette or as medical treatment for spine and chest deformities are well-known in the historic literature. Corsetry is associated with over 40 soft tissue effects, including uterine haemorrhage, atrophy of muscles, and for females a heightened risk of miscarriage. Thus, corsetry deserves more attention in paleopathology to better understand what diseases and deformities might have been present and the possible morbidity and mortality risks of corsetry. Corsetry (especially tight-lacing) is associated with a variety of skeletal changes such as an anterolateral deviation of spinous processes, flattening of the ribs and accentuation of their angle, and changes in the clavicle and manubrium. However, these changes to the skeleton have been documented much more infrequently than would be expected from the widespread historical occurrences of corset wearing, especially in males. Males are often not associated with being subject to such fashion rules, but between the 18th and 19th century, corset wearing was considered highly fashionable for both sexes. This study includes a description of the skeletal changes associated with corsetry, a differential diagnosis of pathological lesions whose bony changes can resemble corsetry, and includes eight males in the archaeological literature who might have been subject to corsetry. One of which is an actual recently reported archaeological case, and two others, Carlo de’Medici and Richard III, are known to have worn corsets, yet skeletal signs of corsetry have not been considered of assessed. The remaining individuals are of lesser status, but corsetry has been recorded for the females on the same cemetery.
Physical impairment and disability in two later Anglo-Saxon populations: investigating differential mortuary treatment and disability-related care.

Authors: Solange Bohling¹, Jo Buckberry¹, Karina Croucher¹

Affiliation(s): School of Archaeological and Forensic Sciences¹, University of Bradford¹

This project aims to investigate attitudes towards physically impaired individuals and to explore disability-related care in later Anglo-Saxon England. Physically impaired individuals identified from previous osteological reports from two sites, Raunds, Northamptonshire, and Blackgate, Newcastle-upon-Tyne, were analysed. Particular attention was given to evidence of atrophy, limb asymmetry, deformity, or alterations resulting in abnormal locomotion. The funerary treatment of the physically impaired individuals was compared to the rest of the population. At Raunds it appears as if the physically impaired were differentiated through marginal burial placement and the use of less frequent burial treatment types. However, at Blackgate there appears to be no differential treatment of the physically impaired. But, as the cemetery was not fully excavated, it is impossible to determine the status of any marginal burial location. Blackgate 442, a young adult male, was buried supine in a plain grave with his arms and legs in typical positions for this cemetery. This individual had gracile long bones suggesting limited use, volar grooves indicating a hand deformity, severe scoliosis, and inversion of both feet. These alterations are indicative of a neuromuscular condition which resulted in abnormal locomotion, visible deformity, and possibly mental disability. All these factors suggest that 442 would have required care to ensure survival. It appears as if burial treatment of and attitudes towards physically impaired individuals varied between populations in the later Anglo-Saxon period, emphasising that regional and even personal influences on human attitudes must be appreciated when performing archaeological disability studies.

Measurement of Age. An Evaluation of the Danish Non-Adult Ageing Method

Authors: Iris Bollebakker¹, Rachel Schats¹, Menno L.P Hoogland¹

Affiliation(s): Leiden University¹

The most accurate ageing methods for non-adult individuals are based on dental development and eruption. However, archaeological skeletal remains are often fragmented or incomplete, as a result of which teeth may be lost or severely damaged. Recently, Primeau et al. (2016) developed a method to estimate age-at-death of non-adults with the use of the diaphyseal length for all major long bones. This study aims to evaluate the accuracy and reliability of the quadratic regression formulae on a post-medieval Dutch population. Long bone lengths were measured for a total of 61 individuals from the Middenbeemster skeletal collection, ranging from birth to 21 years of age. Regression ages were assigned, and subsequently compared to the known ages of 38 individuals, and estimated dental ages of 23 individuals. The results show a rather low accuracy of the method when all age groups are combined, but this is mainly caused by the inaccurate regression ages produced for the long bones of the infants, and some of the bones of the children in the sample. This discrepancy might be partly explained by a difference in size between the Middenbeemster and Danish individuals. For the juvenile and adolescent age categories, no significant differences in means were found, suggesting that the regression formulae can be used to estimate age-at-death accurately for non-adults above the age of 6 years.
The assassination of Giuliano de Medici: a forensic investigation on a 500 years old attempted coup d’état

Author: Matteo Borrini, PhD

Affiliation(s): Liverpool John Moores University

During Ascension Sunday Mass 1478, in the Cathedral of Florence, the two powerful leaders of the Florentine state, Lorenzo and Giuliano de’ Medici, were attacked. Stabbed 19 times, Giuliano died while Lorenzo, even if wounded, was able to escape. A coup d’état planned by the rival Pazzi’s family. To reconstruct the conspiracy events and Giuliano’s murder, the Author compares the crime’s descriptions by the eyewitnesses, preserved in ancient publications, with physical pieces of evidence from the victim’s body. Giuliano’s remains had been exhumed in 1947 by the anthropologist and physician Giuseppe Genna and the physician Gaetano Pieraccini. Even if it was only partially published, their documentation (pictures, X-rays, handwritten notes, plaster casts) could be now examined by a modern forensic point of view. The reconstruction of the crime dynamic based on historical testimonies compared with physical pieces of evidence demonstrates how a scientific forensic approach can increase historical data regarding events and murders of more than five hundred years ago.

Skeleton2Go: a new tool for learning human skeletal anatomy

Authors: Joel Irish, Alison Brough, Isabelle De Groote, Constantine Eliopoulos, Matteo Borrini, Emma Pomeroy

Affiliation(s): Liverpool John Moores University

Offering more flexible opportunities for students to perfect practical skills when the materials they need must be studied under supervision in a lab presents a significant challenge. For Anthropology students learning skeletal anatomy, lab space and staff time constraints make it impossible to increase hands-on access to human skeletons. Available anatomical models do not adequately represent the ‘real world’ specimens students will encounter in forensic or archaeological settings. Skeleton2Go provides boxes of 3D printed specimens with accompanying study guides covering different levels of learning, which students can borrow from the library. Particular benefits are envisaged for disabled students or those with special learning needs, allowing them to learn at a time and pace that is compatible with their educational requirements and in a location they can select. Producing Skeleton2Go is an LJMU in-house endeavour, involving students in all stages of planning, creation and evaluation. As well as benefitting future students, Skeleton2Go offers new learning opportunities for the current cohort. Curriculum Enhancement interns have been involved for 3D scanning and printing the specimens. This new teaching tool will be available during the academic year 2017/18: feedback will be collected and analysed to offer further opportunities for students interested in teaching techniques to get involved. We envisage that in the future, Skeleton2Go will be offered to other institutions and serve as a model for developing flexible teaching resources in other disciplines.

Funding: Create Education (Ultimaker Ltd.) and LJMU
Micro-CT Analysis of Dental Structures to Detect Vitamin D Deficiency

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The role of vitamin D deficiency in current health has highlighted the importance of identifying past occurrence of the condition. Skeletal changes develop readily in individuals undergoing rapid skeletal growth, during infancy and early childhood, but are slower to manifest in older individuals, and bone remodelling can make it difficult to recognise previous episodes of deficiency. This investigation tested the potential of micro-CT analysis to detect interglobular dentine (IGD) representing vitamin D deficiency. Nineteen individuals from an archaeological site (9th-12th c AD) in Toulouse, France, that had at least one permanent molar were selected. Dental x-rays were obtained and assessed using the methodology of D’Ortenzio and colleagues. Five individuals showed changes consistent with deficiency and these plus three with no changes all underwent micro-CT analysis at 11μm. Micro-CT analysis showed evidence of systemic IGD – mineralisation defects following incremental lines, in teeth of four of the five individuals, with two having multiple episodes. Skeletal changes consistent with healed rickets were present in one of these individuals. Histological assessment of teeth from three of the individuals confirmed that IGD scored Grade 2 and above can be detected using micro-CT, but Grade 1 episodes will be missed. Dental wear was determined to have created a false positive X-ray result in one individual. Although destructive analysis is required to detect slight episodes of vitamin D deficiency (Grade 1) more severe episodes can be detected along with the number and approximate age of occurrence. Where destructive sampling is not possible micro-CT can make a valuable contribution to detecting vitamin D deficiency.

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Two unusual cases of atlo-axial complex malformation and the controversy about the aetiology of the “os odontoideum”.

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The os odontoideum is a rare anomaly of the atlo-axial complex in which the normal odontoid process of the axis is replaced with an ossicle with smooth circumferential cortical margins. These margins have no osseous continuity with the body of the axis and the os odontoideum articulates with the anterior arch of the atlas. The pathogenesis of this lesion remains controversial with arguments on both acquired and congenital causes reported in the literature. In 1883, Guglielmo Romiti, the director of the Anatomical Museum of Siena, described the case of the axis of an elderly man with the odontoid apophysis detached from the body in the shape of a triangular pyramid and fully adherent to the median portion of the rear face of the anterior arch of the atlas. Moreover, its lower facet was articulated to the rest of the odontoid through an articular facet of the same size. This description is the first published evidence of an anterior fusion of an os odontoideum, rarely reported in the literature. The purpose of this work is to present a similar case from a medieval burial, namely a fusion of an os odontoideum with C1 anterior arch, studied by MDCT and CBCT. This type of variation, which can be ascribed both to the atlo-axial fusions and to the os odontoideum classifications, can contribute to the debate on the aetiology of this anomaly. For this purpose, this case will be compared to another complex case of os odontoideum, which caught our attention a few years ago during a forensic post-mortem CT examination.
Osteological analysis of the skeletons from Halton Castle, Cheshire

Authors: Carla L. Burrell¹, Eleanor R. Dove¹, Thomas Fildes¹, Silvia Gonzalez¹, Lynn Smith¹, Joel D. Irish¹

Affiliation(s): Liverpool John Moores University¹

A community archaeological excavation was commissioned by Norton Priory Museum and Gardens to explore the ruins of Halton Castle in 2015. This Castle stands on a rocky hill above the former village of Halton and it remains to this day as a prominent feature within the landscape, overlooking the River Mersey. Halton Castle has an extensive history from its establishment and collapse in the Middle Ages and the later sieges of the Civil War. The planned excavations were intended to explore the structures of the outer bailey of the Castle and to further investigate features previously identified during the 1980’s excavations. Surprisingly, a discovery during the final days of the excavations revealed two well preserved human skeletons. The bodies of two human skeletons where found buried within two meters of each other however, the results of AMS radiocarbon dating analysis suggest they were buried c.100 to 200 years apart. The discovery of these remains prove to be a mystery as very few skeletons are found in such contexts. Further excavations took place this summer revealing more about this fascinating site. Here, this paper presents the osteological analysis conducted on both individuals to identify their pasts, exploring the mystery of the ‘bodies in the bailey’. Funded by te Heritage Lottery Fund: ‘The Halton Castle Project’.

On the formation process of the BB collective burial from Tepecik-Çiftlik, Central Anatolia (Turkey)

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The Neolithic transformation deeply affected human ecology in both a biological and a socio-cultural sense. Some reflections of this interaction can be observed in mortuary contexts. By examining human skeletal remains with a synthetic approach it is possible to obtain very important information on health and lifestyle as well as to examine the behaviour of past human societies. This study focuses on commingled human remains called BB collective burial from Tepecik-Çiftlik (Central Anatolia), which is dated to the Neolithic period, and examines its formation process by using different approaches. The formation of the burial has been investigated by bioarchaeological and archaeothanatological approaches. Sex and age were estimated by conventional methods, and for determining the possible number of individuals in the grave Minimum Number of Individuals (MNI) and Most Likely Number of Individuals (MLNI) methods were used. It has been determined that skeletal elements belonging to both sexes and to each age group were found in the grave, but not to infants younger than 1.5 years old. According to the MNI at least 42 individuals were represented in the grave. In the field study, it has been observed that there were skeletal elements/element groups that have lost articulation beside individuals all of whose bones were in the anatomically correct position. The findings indicate that the variety of mortuary behaviour of the community and some biocultural factors (e.g. weaning time) were determinant to the formation. In addition, it is argued that the human factor is a strong taphonomic agent and the synthetic approach is also useful to work on human behaviour in the past.
The Preauricular Sulcus and its link to parity status: a study of the relationship using the Christ Church, Spitalfields Skeletal Collection

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The aim of this research is to examine the relationship between the preauricular sulcus and parity status. In order to do this a grading system was used that had been developed in previous studies. The grading system was designed to describe the changes in depth to the sulci. The grades range from 0-4: Grade 0 when no preauricular sulcus is present and Grade 4 for a large, well-defined sulcus. This system was based on morphological data collected from multiple temporal and geographic samples. However, there was no parity information associated. This study was carried out on the documented collection of Christ Church, Spitalfields (Natural History Museum, UK) which included 77 females whose information on parity status was available, 147 separate os coxae were examined. In the majority of cases the number of births, the ages at which the individuals gave birth, and the spacing between the births had been recorded. The results show that the preauricular sulcus was present in 93% of the individuals and was only absent in 7% of the sample. The distribution of the grades were: 16% Grade 1, 29% Grade 2, 33% Grade 3 and 15% Grade 4. Previous studies have shown that there is a correlation between grades and sex. However, the results of this research showed that there was no correlation between grades and parity status. Additionally, no correlation was found between age at first birth and preauricular sulcus grade. Although the morphology of the preauricular sulcus varies in females the results suggest that pregnancy and parturition are not the causes of this variability.

Investigations of Dental Relatedness from Early Medieval Populations in England

Authors: Allison Card¹, Duncan Sayer¹, Patrick Randolph-Quinney¹

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This presentation will demonstrate the value of using human dentition to explore shared biological traits within skeletal assemblages from early medieval populations. Continuous and non-continuous trait data from tooth morphology from two early Anglo-Saxon cemeteries in the South-East England have been collected and analysed. Statistical testing of the data has taken an investigative approach focused on hierarchical testing, including principal component and shape analysis. Thus far, results have shown that individuals within each cemetery display varying levels of dental relatedness from their tooth morphology, a biological characteristic which has major implications for understanding the social organisation of early Anglo-Saxon, and other rural community focused populations. The identification of kinship patterns and social organisation in archaeological populations has traditionally focused on presenting contextual data from artefacts or grave goods and biological data collected from skeletons. There have been fewer attempts at combining these approaches to highlight limitations of certain data types as well as exploring the benefits of a multifactorial investigation into such concepts. Recently, researchers have demonstrated the importance of comprehensive and interdisciplinary studies of past populations; using multiple lines of evidence equally to form conclusions, including contextual and biological data. Human teeth are a useful medium through which to discover information pertaining to genetic and environmental connections shared between individuals within large skeletal assemblages. To date, few studies utilising human dentition in this way have been conducted on Anglo-Saxon cemeteries in South-East England.
Technical note: generating virtual 3D models from dry skeletal material using computed tomography (CT)

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Virtual (or computer) 3D modelling of osteological material has facilitated the production of high impact images with countless applications, including the demonstration of evidence in a court of law. This research investigated the metrology and methods behind producing 3D printed osteological models, in order to validate the process for use in court. Three dry bone samples were scanned using computed tomography (CT) and the data modelled using two open-source programs: 3D Slicer (for initial development), and Blender (for further refinement). Several stereolithic (STL) models of each sample were generated using different parameters and compared with dry skeletal measurements. It was identified that, 1) The choice of viewing program can alter the ‘appearance’ of a model. 2) Both auto-smoothing in 3D Slicer and secondary smoothing in Blender, aid production of a model with less ‘stepped’ edges. 3) Fine/fragile bony elements (e.g. sutures or orbital bones) are not always fully included in the initial CT scan data/model. 4) Adjusting the ‘label’ (threshold map) in 3D Slicer can aid inclusion of these. The virtual models produced had an acceptable average observable difference (<1 mm to the dry material), but with larger varying ranges. Measurement precision and observer error varied with the methods, bones and landmarks used. These findings indicate further analysis into the effect of label maps, smoothing factors and viewing platforms is needed. The generation of accurate virtual 3D models relies on parameters being consciously selected based on empirically tested analysis. It is also suggested that guidelines must be created for valid use of 3D modelling in the presentation of evidence in court.

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Ashes to ashes: a new approach to the analysis of burnt human remains.

Authors: Emily Carroll¹, Dr Gundula Müldner¹, Dr Mary Lewis¹, Dr Joanna Brück²

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Over the last two decades, the scientific study of cremated human remains has seen substantial methodological developments, and is currently one of the most dynamic fields of research in UK bioarchaeology. It is now widely accepted that these remains can provide a multitude of data that can greatly enhance our understanding of this ancient mortuary practice, which dominated the funerary record for large parts of British pre-history. Research has found that the macro, micro and ultra-structural alterations that occur to bone once exposed to extreme heat can be used to reconstruct the pre-burning treatment of the individual, the firing temperatures archived, as well as the quality and duration of burning. This paper compares traditional macroscopic analysis of burnt bone with recent histormorphic methods in the assessment of cremation quality. It also introduces a new quantitative method that measures the extent of ultra-structural thermal alteration within burnt bone thin sections. Attention is given to both the methodological advantages and drawbacks in employing qualitative and quantitative technologies in the assessment of burnt human remains, and discusses the potential for future research.

Funding: SWW DTP
A densitometrical CT approach to study the temperature of cremation in archaeological remains. A preliminary study.

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The study of ancient cinerary urns with MDCT allows a non-destructive study of this kind of artifact. Our research group has been considering for a few years the possibility of running a complete study of the cinerary through CT scans only. Although an almost complete study of the container morphology and the content of the cinerary and its characteristics is possible, one of the crucial problems is the cremation temperature. In order to verify the possibility to define densitometrically the bone cremation temperature, experimental cremation of pig bone samples obtained from the back femur of single subjects was performed. The bone was cremated in oven from 0 °C to 1200 °C with 300 °C intervals for a time from 30' to 120' with 30' intervals. After cremation, the samples were scanned with MDCT and high definition CBCT. The density of each voxel of the sample was registered, classified by frequency and deconvoluted with a software designed by our group to obtain the mean and standard deviation of the component at higher density. The same operation was carried out on isolated samples obtained by micro-excavation from cinerary urns of the Etruscan period and on samples coming from a modern crematorium. The microstructure of cremated samples was also studied by micro-CT. The obtained results seem to show that there is a modification of the X-ray density of the cremated bone depending on the temperature and corresponding with the chemical-physical modification of hydroxyapatite during its heating. This result opens up a serious perspective on the non-destructive analysis of the ancient cineraries by MDCT, but requires further experimental confirmations on a larger number of samples.

Identifying the Invisible: a window on two lives from Anglo-Saxon Great Chesterford, Essex

Authors: Christine M Cave, Marc F Oxenham

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Osteological examinations of archaeological skeletons routinely estimate or assess age-at-death, sex, stature and any pathological conditions. Such data, when combined with a mortuary analysis can provide compelling narratives about both individuals and the societies in which they lived and died. Here we examine the graves of two elderly individuals from the Anglo-Saxon cemetery of Great Chesterford, Essex. Female Burial 112 and male Burial 140 each died after reaching 65 years of age, having suffered age-related conditions such as osteoarthritis and antemortem tooth loss. The skeletal remains of both individuals were incomplete and suffered from taphonomically induced damage. During their relatively long lives, in the context of differing yet similar cultural environments, they left different legacies which were reflected in their respective mortuary treatments. The female Burial 112 was tightly crouched in a tiny grave in what appears to be a low prestige part of the cemetery; she wore a bronze pin, the end of which had broken and was curled over, and the fragmented remains of a ring and key at her hip. The male Burial 140, on the other hand, was laid out in a very large grave, in the centre of a cluster of graves, many of them children or infants, with stones marking borders between two infant graves. His grave goods included a spearhead, tweezers, pursmount as well as the usual buckle, knife and other fragments. This paper explores their lives, as reflected in death, providing insights into their youth and the process of their ageing. We examine their final resting places, finding two elderly individuals, one infantilised and reduced, one set above his neighbours, but both ordinary members of their society.
Facial variability in the context of the other-race effect

Authors: Zarus Cenac¹, Richard Cook¹

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Worse recognition of individual faces from a race outside of ours, compared to within, is called the other-race effect. A racial difference in facial variability has largely been dismissed as a cause. A publication from 1979 found no such differences, but there are now stronger methods of comparison. Previous research has shown that average (mean) cranial variance diminishes as migratory distance from within Africa increases, yet such a reduction had not been explored regarding the skeletal face alone. The current analyses used morphological data of William W. Howells and the 1988 Anthropometric Survey of U.S. Army Personnel. Skeletal facial variability was quantified as mean variance and, after principal component analysis, standardised generalised variance. Each type of variance negatively correlated with migratory distance. Regarding mean variance, confidence interval trend lines demonstrated that pairs of groups, whether ethnicities or races, have unequal facial morphological variability when their difference in migratory distance reaches at least circa 20,000 and 25,000 km for males and females respectively. The variability of full faces, i.e. with tissues overlaying bone, was compared using an existing nonparametric bootstrap. Equal variability of 18- to 30-year-old Black, Caucasian, and Native Americans agreed with the distance thresholds, although comparisons did not include male Native Americans due to their small sample size. Numerically, determinant ratios indicated that the trend of declining variability is evident in the full face. Results signal that variability is likely to be a moderating factor in the other-race effect, and they lead to novel insights concerning perceptual expertise and police lineups.

More than Pott’s Spine: the Pre-Antibiotic Distribution of Skeletal Tuberculosis

Author: Rebecca Cessford¹·²

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Clinical literature reports that tuberculosis of the bones and joints occurs in 3–5% of individuals suffering from active disease. It is also noted that around half of all skeletal TB cases involve the spine, with the hip and the knee being the next most frequently involved sites. However, it has been suggested that in the pre-antibiotic period the prevalence of skeletal TB may have been higher and the distribution of disease may not have involved the spine as frequently, particularly amongst children. This hypothesis was explored using tuberculosis specific records (n=2719) from the recently digitised historic medical casefiles from Stannington Children’s Sanatorium dating from 1935-1953. Diagnoses from the files were recorded to identify the type of TB each patient was admitted with (skeletal, pulmonary and extra-pulmonary) and the skeletal element(s) involved in cases of bones and joints TB to evaluate the distribution of tuberculous infection. Analysis of the records indicates that the prevalence of skeletal TB amongst unique admissions was around 15%, a higher prevalence than has previously been reported. The distribution of affected skeletal elements also differed from clinical literature, fewer cases were reported to involve the spine (33%), although the pattern of spine, hip and knee as the most frequently affected areas was still evident though differing proportions to those previously recorded. This furthers epidemiological understanding of pre-antibiotic TB in children and provides insight into extra-spinal elements that may not have been previously associated with TB.

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Morphometric Analysis of Maxillary Cave Bear Dentition from Scladina Cave (Belgium) and Kents Cavern (UK)

Authors: Daniel Charters¹, Isabelle De Groote¹, Carlo Meloro¹, Grégory Abrams²

Affiliation(s): Liverpool John Moores University¹; Archéologie Andennaise ASBL²

Even though frequently discovered in archaeological sites, the life and death of the cave bear (Ursus spelaeus) is still an enigma. Scladina Cave (Belgium) is well-known for its Neanderthal presence, but has yielded cave bears throughout its stratigraphic sequence. In this study, we use linear measurements and geometric morphometric analysis on maxillary molars (M1 and M2) of Ursus spelaeus to further our understanding of temporal variation in morphology. We analysed dentitions from six different stratigraphic layers covering approx. 162,000 years: 1A (~38-40kya), 3 (~55-90kya), 4A (~75-130kya), 5 (~110-150kya), 12 and 13 (~120-200+kya). Additionally, we explored a subsample of Kents Cavern (UK).

Linear measurements show that cave bear 2nd molars became significantly larger over time. First molars fluctuate in size but shape ratios indicate that both M1 and M2 became more rectangular. Size analysis of Kents Cavern dentition show a clear differentiation from Scladina, supporting the hypothesis that these specimens belong to a separate species. Canonical Variates Analysis (CVA) on the M1 and M2 shape data demonstrates that the Kents Cavern sample can be distinguished from that of Scladina in relative buccolingual width and in the position of the paracone and metacone for M1. Within Scladina, CVA confirms shape differences between layers with M1 exhibiting higher discriminatory power. This result suggests possible shifts in the diet of the cave bears related to environmental change. The material from Kents Cavern possibly belongs to a more primitive form of cave bear: Ursus deningeri. This study demonstrates the usefulness of teeth from accurate stratigraphic sequences in gaining insight in mammalian palaeobiology.

A unique Roman fettered burial from Great Casterton: its implications and potential significance

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In 2015, an unusual Roman burial was uncovered during construction works in Great Casterton, Rutland. The partial skeleton of an adult male who had been buried with iron fetters fastened around his ankles, linked and secured with a padlock, being interred in a ditch. Radiocarbon date analysis has shown that the man died between the mid-3rd and early 5th centuries AD. A large cemetery, dated from the 3rd - 4th centuries, which served the Roman town at Great Casterton lay immediately adjacent to the site, and the shackled individual may have been buried in or close to the boundary of this cemetery. This poster explores the bioarchaeological evidence and the potential significance of this burial context, which is a unique example, so far, for Britain. In particular, recent research which has explored the ‘osteobiographies’ of enslaved individuals is considered in order to determine what, if anything, can be said about the individual’s life and social standing. Specialist analysis of the iron fetters and padlock are used to shed light on the circumstances and nature of the interment, and to determine whether they were a reflection on the person’s status as a prisoner or slave or were instead related to a more abstract funerary rite linked with other ‘deviant’ burial practices not uncommon during the later Roman period in Britain. It is concluded that the osteological evidence was not sufficient to determine whether the person was enslaved during life and that reasons for burial in this manner are likely to be wide-ranging and much more complex than first thought.

Funding: MOLA Research Dividend
Decapitation and Fragmentation Burial Practices in Western Roman Britain

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The Roman period in Britain (A.D. 43-410) is marked by progressive cultural change and increased population diversity in rural and urban settlements. Archaeological investigations of Romano-British burials have revealed differential burial treatments and attitudes toward the dead over time. Recent investigations into Late Roman period (3rd – 4th century A.D.) decapitation burials have shown these burials reflect diverse uses of the rite in regions throughout Britain. Traditional interpretations of these burials suggest motivations for sacrifice, execution, trophy taking, fear of the dead, or veneration, although recent investigations of decapitation burials in central and southern Britain have also revealed the possible continuation of the Late Iron Age (100 B.C. – A.D. 43) fragmentation rite of human and animal remains. This project will explore Late Roman period inhumation decapitation burials in Oxfordshire and Gloucestershire which have not been examined for potential fragmentation activity in order to test the hypothesis that decapitated burials may also contain evidence for the parallel fragmentation rites. If such evidence is present within these contexts, this may suggest that decapitation practices in western Britain were potentially part of a sub-class of mortuary treatment linked to cultural conceptions of the dead steeped in Late Iron Age and Roman attitudes toward the dead, such as veneration, ‘killed’ objects, or social ostracism. This project contributes to the growing cross-disciplinary literature on how ancient populations utilized the body conceptually and physically, and to the larger literature on the broader uses of the body in society.

Funding: University of Wisconsin-Milwaukee

Hinkley Point Anglo-Saxon Cemetery

Authors: Sharon Clough¹, Mandy Jay², Konstantina Drosou³, Terry Brown³

Affiliation(s): Cotswold Archaeology¹; University of Durham²; University of Manchester³

The development of a new nuclear power Station at Hinkley Point by EDF energy afforded a fantastic opportunity to investigate archaeologically a large area in North Somerset. Cotswold Archaeology discovered a large Anglo-Saxon cemetery in 2014 which produced over 300 burials. There was no known settlement within the immediate area so an extensive programme of post-exavation work was planned to answer the questions- who these people were, where did they come from and how long they were buried at this site? Presented are the initial results of the skeletal analysis and the pilot project of Radiocarbon dates, isotopic results and aDNA work. All the burials were laid roughly west-east with no grave goods, which was unusual for the period (radiocarbon dated to between the 5th-7th century AD). The burials clustered and were intercutting around a rectangular probable building and it is proposed that this cemetery represents a possible ‘cult’ site, or early Christian chapel. The results - There was a mixed age and sex population, as expected for an attritional cemetery. 207 articulated skeletons, 122 disarticulated skeletons and 73 deposits of charnel. Stature was very comparable with other regional contemporary sites. Pathological lesions of the expected type were present e.g. osteoarthritis, healed fracture, non-specific periostitis. In addition there was a bilateral amputation of hand and foot (Poster presented at BABAO 2016), sharp force trauma, pulmonary infection, possible leprosy, ankyloses and dislocation. The isotopic results and aDNA (mitochondrial) suggest that most of the individuals were local to the area and ate a similar diet, some of those in the multiple graves may have been related.

Funding: EDF Energy and Cotswold Archaeology
Using nutrient foramina to discern human from non-human long bone fragments in forensic anthropology

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Long bone shaft fragments can be found isolated in forensic contexts, such as fatal fires and mass disasters. When diagnostic anatomical landmarks are not visible, the assessment of a human or non-human origin of fragments may be challenging. However, the presence of nutrient foramina can make the assessment of the origin of the bone still possible. The long bones of human and non-human subjects of different ages and both sexes were employed for this study. The non-human species included in the study - chicken, duck, sheep, pig, and deer - were chosen because the shafts of their long bones can be mistaken for human if they are found in a fragmentary state. The primary nutrient foramina of the long bones were macroscopically evaluated to assess their location and appearance; their direction was assessed with a hypodermic needle. Micro-CT images were used to measure the angle of the nutrient canal at the level of the cortical bone and to determine the shape of the canal entrance. Location and direction of nutrient foramina were proven to be different between human and non-human bones; however, these two features might not be exploitable in case of very fragmented samples. The shape of the canal entrance and its angle at the cortical bone obtained from the micro-CT scannings were useful parameters, though the foramina appearance was the most reliable for the origin identification. For a correct identification of a fragment, it is advisable to use all the features considered in this study and combine the data, as one parameter on its own may not be enough. This research proves that nutrient foramina can be considered as a reliable bone feature for the distinction between human and non-human fragmented long bones.

Funding: Cranfield University

The Embalmed Baron. The case of The Baron Pasquale Revoltella (1795 – 1869) of Trieste.

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Baron Pasquale Revoltella died in Trieste on the 8th of September 1869. He was a commerce and maritime transports tycoon of the Austro-Hungarian empire. He financed also the project of the Suez Canal. Considered one of the biggest promoters of the development of the city of Trieste, at the time of his death he donate all his properties to the city. Fascinated by the ancient Egypt he requested to be, after his death, embalmed in the traditional "egyptian" way. After 142 years, in 2011, his remains were exhumed according to his own last will. A taphonomical, anthropological and paleonutritional profile was made. A CT was carried out on the whole body, in order to gather data about the embalming technique. The results obtained confirmed the historical information about the life and death of the Baron but revealed also various taphonomical anomalies due to the specific embalming methodology used to treat the corpse.
Coronal suture shape at bregma differentiates some primate clades

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Affiliation(s): University of Cambridge (University of Roehampton alumni)¹; University of Roehampton²

Skeletal features that diagnose clades (synapomorphies) of extant taxa are necessary for the determination of relationships of fossil forms, as no other information is available readily for extinct taxa. When such characteristics are hypothesized, it is imperative to test their applicability across the taxonomic group to which they pertain. It has been suggested that Hominoidea (apes, including people) is characterised by a derived change to the shape of the coronal suture, where hominoids display a frontal that is wide at bregma (the intersection of the coronal and sagittal sutures). This proposed ape synapomorphy is tested by analysis of a measurement of the angle described by the coronal suture at bregma across Primates. Means of the angles, derived from photographs in norma verticalis, are compared between higher-level taxonomic groups: Strepsirhini, Tarsioidea, Platyrhini, Cercopithecoidea and Hominoidea, the last of which is treated both as a complete group and divided into its constituent families Hominidae and Hylobatidae. The results show that two groups, Platyrhini and Hylobatidae, are significantly different from all other primate clades in having a narrower angle of the frontal at bregma – phylogenetic analysis suggests that these represent convergent synapomorphies of their respective groups from the “wide at bregma” primitive condition retained by all other primates. Thus, while some extant Hominoidea have a frontal that is wide at bregma, it does not represent a derived condition for the group. These results have implications for the recognition of platyrrhines and hylobatids in the fossil record.

Taken from the cradle: paleobiological analysis of the partially mummified remains of an Inca infant.

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The present work deals with the bioarchaeological analysis of the human remains from a sub-adult Inca individual displaying cranial modification. The partially mummified head and neck were integrated to a private collection in Brazil prior to 1973. The paleobiology of this individual was analyzed in terms of age at death estimates, physical anthropology and taphonomy. Age at death was assessed at 1.5-2.5 years old. based on the stage of dental calcification and eruption. Although the estimation of age at death based on the maturation of skull bones was attempted, it failed to produce results since those were severely altered by both the intentional modification and pathological processes. The cranial modification seriously affected the fusion of the skull bone probably causing premature closing the coronal suture and partial closing of the lambdoid one. Generalized pitting on the bone surface of the left parietal might suggest the presence of non-specific infection on that bone. The remaining mummified soft tissues are highly altered by lack of proper storing conditions over the last four decades and very little of the skin is preserved on the specimen. Finally, both soft tissues and bones are affected by fungi. The taphonomical analysis will help build a curatorial protocol as a suggestion for the institution which is housing this material.
Stable isotope dietary comparison between apparently healthy individuals and those affected by infectious pathologies from medieval Tomar, Portugal

Authors: Ana Curto¹, Teresa Fernandes², Anne-France Maurer³, Cristina Dias³, Geraldine E. Fahy¹

Affiliation(s): University of Kent¹; University of Évora²; HERCULES Laboratory; HERCULES Laboratory³

The synergy between health and nutrition is well known. If malnutrition is more prevalent, it can result in prolonged chronic infections with a higher probability to affect the skeleton. The presence of skeletal lesions can represent an adaptation to pathological conditions, suggesting that the individual survived the infection, while the absence of skeletal lesions is ambiguous. The aim of this study is to infer about dietary differences between apparently healthy individuals and individuals with obvious osteological infectious lesions buried in Tomar’s medieval cemetery (11th to 16th centuries). In this study, carbon and nitrogen stable isotope ratios from bone collagen were analysed. 27 skeletons with signs of infectious disease were sampled (from long bones without lesions). From these 8 had healed lesions, 9 had active lesions and 10 had a combination of healed and active lesions. Sex was not taken into account as no significant difference (p<0.05) was found between males and females. The isotope ratios of these individuals were then compared with 32 (17 male; 15 female) apparently healthy skeletons, without visible stress markers and with above average stature. This study helps shed light upon the relationship between diet and health by comparing healthy and unhealthy individuals.

A new method for recording and presenting the true prevalence of rib lesions related to respiratory disease

Authors: Anna M. Davies-Barrett¹², Charlotte A. Roberts¹, Daniel Antoine²

Affiliation(s): Durham University¹; The British Museum²

Examination of periosteal reaction on the visceral surface of the ribs has been demonstrated to give unique insight into the prevalence of respiratory disease from skeletal assemblages. However, in archaeological contexts, the rib shafts generally do not survive as well as their necks and angles and are commonly recovered in a fragmentary state. Prevalence rates of rib lesions presented based on the whole rib do not take into consideration that certain parts are often poorly preserved and unobservable. This has impacted on the ability to record and present true prevalence rates for pathological changes that affect the ribs and, thus, may skew results towards lower prevalence rates. Firstly, this study proposes a new method to record true prevalence rates for rib lesions on the visceral surface, focused on three separate regions of the rib: the neck, angle, and shaft. It also presents new diagnostic criteria for recording periosteal reaction on the ribs. The true prevalence rate for each rib region is presented, in further detail, by side and rib number. In less easily seriated examples, rates can be presented by approximate position in the ribcage: upper, upper-middle, lower-middle, and lower. Secondly, it has been suggested that the region of the rib cage affected by periosteal reaction may provide some insight as to the type of respiratory disease affecting the person. This new method allows for a more accurate analysis of rib lesion distribution throughout the rib cage. Presented alongside the percentage of individuals affected within a sample, this method can further our understanding of potential diseases leading to periosteal reaction and identify possible differences between population groups.

Funding: AHRC Collaborative Doctoral Award scheme
A Bioarchaeological Approach to the Excavations of La Grand Place de Sclayn, Meuse Valley, Belgium.

Authors: Isabelle De Groote, Stephanie Johnson, Elizabeth Parrott, Meike Wanjek, Grégory Abrams, Patrick Hoffsummer

Affiliation(s): Liverpool John Moores University; Teesside University; Department of Prehistory, Scladina Cave Archaeological Centre; University of Liège

This paper presents the findings of the human skeletal analyses conducted on the burials of the Grand Place de Sclayn. Initially the site was excavated in the early to mid-1980s and yielded 37 burials, of which a number of these were stored for subsequent analyses. During this excavation period a number of time periods were also identified, indicating the multiple times when the site was in use. The positioning of the site alongside the Meuse Valley can be considered as a key location and may contribute to the repeated usage of the site over many time periods. Archaeological analyses identified two burial periods in the human skeletal assemblage; A Ninth Century Carolingian phase and a much more recent cemetery postdating the twelfth Century. The aim was to carry out a detailed bioarchaeological analysis of the human skeletal remains in storage from the initial excavation, by conducting both sex and age at death determination as well as stature estimation and the recording of any skeletal and dental pathologies. To provide information on both the demography of the site as well as the health status of those buried there, it was hoped the bioarchaeological analyses would aid in the interpretation of the Carolingian building. Although the sample size is small, the bioarchaeology has brought an important insight into the site which was previously uninterpretable from the archaeology alone. Results show the Carolingian individuals were in excellent health and must have been of high status. The presence of both males and females suggests the building may have been an aristocratic funerary chapel that saw its use quickly changed to a village church. This is supported by the low number of burials associated with the chapel.

Hard tissue, soft tissue: an examination of the associations between body composition and pelvic dimensions in girls and women living in London.

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The associations of body composition with pelvic dimensions in women are unclear, particularly with regards to pelvic obstetric capacity. Studies have demonstrated that maternal height can predict obstructed labour, whilst others have found differential variance between limb proportions, pelvic canal and non-canal dimensions. This study examines the interaction between growth of hard and soft tissues during puberty that could impact pelvic dimensions as girls grow into women. Body composition data and pelvic dimensions were collected from dual energy x-ray absorptiometry (DEXA) scans from 273 girls and women living in London today between the ages of 4 and 22 years. Potential predictors of pelvic dimensions included four component model lean mass, fat mass, height and weight. Outcome pelvic dimensions collected from DEXA scans were bi-iliac breadth, mediolateral inlet breadth and biacetabular breadth. Variables were converted to age-adjusted z-scores to enable accurate body composition comparison between adults and growing children. Pelvic dimension change was compared among 53 individuals who were re-measured at least 3 times at 2 year intervals. Multiple regression analyses demonstrate that biacetabular breadth and mediolateral inlet breadth were associated significantly with all body composition measures apart from weight, whilst only height and lean mass were associated significantly with bi-iliac breadth. In conclusion, fat and lean mass are associated with bony pelvic dimensions, suggesting that women with larger pelvises, lean mass and fat mass could support more offspring growth throughout pregnancy and lactation.

Funding: Parkes Foundation
Dying in the Neolithic: isotope analysis of the Late Neolithic mass grave of La Sagrera, Barcelona

Authors: Frank DiRenno¹, Jacqueline Towers², Geoff Nowell³, Miquel Molist⁴, Janet Montgomery⁵, Eva Fernández-Domínguez⁵

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The recent excavation of the Late Neolithic mass burial of La Sagrera (Barcelona) raised questions regarding the reason for the mass inhumation and the relationship of this group with coeval populations in the area. Isotope analysis of thirteen individuals has shed light on the provenance and diet of those buried there. Strontium isotope analysis revealed a largely local group, with the majority of individuals falling within expected local biosphere values, and some individuals with elevated values probably reflecting migration from regions north and east of the site. The δ18ODW values of this group are significantly lower than expected for coastal Barcelona, almost 3‰ below local modern rainfall estimates. In an attempt to understand the diets of the individuals, bulk and incremental dentine collagen analysis were conducted, revealing two isotopic groups distinguished by age at death. Individuals that died during childhood had elevated δ15N and δ13C compared to those that died in adulthood. The elevated values may be the result of stress prior to death and/or increased marine consumption in response to food shortage such as crop failure, as proposed for the Neolithic population in the Shetland Islands (Montgomery et al. 2013). In contrast, the low and flat δ15N and δ13C profiles observed in the adults point at a diet dominated by agriculture, as expected from a Late Neolithic population. These results in connection with the absence of skeletal evidence indicative of violence, suggests the burial may have served the largely local population following an epidemiological or famine event.

Funding: LaSagrera Archaeological Project, Funded by the Archaeology Section of the City Council of Barcelona

An investigation into childhood stresses between an urban and rural sample dating from the 12th to 17th centuries

Authors: Eleanor R Dove¹, Joel. D Irish ¹, Constantine Eliopoulos ¹, Isabelle De Groote ¹

Affiliation(s): Liverpool John Moores University¹

Harris lines (HL), linear enamel hypoplasia (LEH), and porotic indicators (PI) have historically been used as indicators of ‘stress’ during childhood. Stress in this context is used to describe conditions adverse to normal growth. Although the reliability of HL has been questioned in recent years, this study attempts to circumnavigate some of the methodology issues associated with using HL. Here a new population-specific method of calculating HL age of formation is implemented - using population-specific growth data and a new estimated centre of ossification. This method has been applied to two contemporary collections, rural Poulton (n=337) and urban Gloucester (n=202). The results of the HL formation ages have been compared with the formation ages of LEH, and presence of PI. There is a significant correlation between LEH and HL within the Poulton sample, in particular for males ($\varphi = 0.632$, p=0.002). There is no correlation between HL and LEH in the Gloucester sample. However, there is a high incidence of HL that formed during the ages of 2 to 4, and the factors that caused skeletal cessation of growth did not affect enamel development. The most common age of HL formation was between the ages 9 to 9.5 for Poulton and 7.5 to 8 for Gloucester. Between Poulton and Gloucester, there was a significant difference (p=0.02) in the number of HL, with more disturbances occurring in the Gloucester sample. Similarly, there was a significant difference in the prevalence of PI ($\chi^2 = 11.36$, 1 df, p= 0.0007), with a higher prevalence in the Gloucester sample. The results of this study suggest that the aetiologies of HL and LEH are multifactorial and that the people of Gloucester experienced more adverse conditions during childhood.
**Tunnel vision: analysis of a disarticulated assemblage recovered from a natural rock fissure as an example of an understudied form of funerary practice**

Authors: Mairead Downey¹, Martin Smith¹

Affiliation(s): Bournemouth University¹

The deposition of human remains in caves and rock fissures is a neglected form of burial ritual, despite its occurrence over long periods during the past. To date there have been relatively few detailed taphonomic studies of skeletal material recovered from caves in Holocene contexts, whilst opinions on the date of such depositions have often been based on conjecture rather than scientific dating. The current study focuses on such a previously undated assemblage from the island of Portland, Dorset. This material is comprised of skeletal remains from multiple individuals, with diverse parts of the skeleton represented and displaying unusual qualities of preservation. The excavation of this assemblage from a natural rock fissure was conducted by the famous women’s rights activist and birth control campaigner Marie Stopes in 1952, whilst pursuing her less well known interest as an amateur archaeologist. In addition to conducting fieldwork on Portland, Marie Stopes also set up the island’s museum where these remains continue to be curated. The current project has analysed the Portland assemblage from a compositional and taphonomic point of view in order to inquire as to what mode of (possibly complex) burial practice was involved, with AMS dates obtained in order to place the material in a temporal context. The results demonstrate the extent to which useful information can be obtained from otherwise unprovenanced material by taking a structured, holistic approach to assemblage composition and taphonomic interpretation.

**Funding:** Bournemouth University

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**Hard Life or Hard Times? Individuals from Tukthuset, the Oslo House of Correction**

Authors: Rose Drew¹, Gwyn Madden²

Affiliation(s): Research Fellow, University of Winchester UK¹; Grand Valley State University, MI USA²

In 1989, burials from Tukthuset workhouse (1750-1938), Oslo, Norway, were excavated during roadway construction. The collection is comprised of almost 200 archive boxes that are a mix of fairly complete individuals and commingled remains. Osteological analysis suggests 309 minimum number of individuals. University of Oslo was allowed use of 20 burials yearly from Tukthuset for anatomical study. Twenty-five skeletal elements represent a minimum of seven individuals buried in a single box, displaying sawing and hesitation marks. Based on inclusion of one or two unmatched skeletal elements in other, primary burials, it appears bones used for anatomical study were deposited in more complete burials. One hypothesis surmised a mix of social classes would be observed among individuals buried at Tukthuset: those of higher status when young later falling on hard times, and those that may have been poor throughout life. Linear enamel hypoplasias formed during enamel formation were used to observe health between foetal and 15 years of age. LEH in 15% of those at Tukthuset suggests most were healthy or higher status in youth. Rachitic deformities in 8% of individuals also suggest poor diet and/or indoor activity when young. A second hypothesis was that those buried at Tukthuset would be in poor health around the time of death. Only 12% show bony reaction consistent with infectious processes, although it is understood many die before bony change occurs. Healed fractures in 15% of the population suggest that the people were cared for long enough for advanced skeletal repair to occur.
The fragmentation analysis of cremated human remains from the Biala site 2, Zgierz, Poland

Author: Monika Dzierlińska

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The presentation shows the results of the fragmentation analysis of cremations from the collective grave of the Trzciniec Culture discovered in the Biala site 2, Zgierz, Poland, which are characterized by surprisingly good degree of preservation. The examined remains came from an un-urned burial dating to the Bronze Age. Bones from the entire burial weighed 42 kg. The minimum number of individuals was 62. Despite the white calcination, substantial amount of the materials contains fragments exceeding half the length of the limb bones. The analysis procedure was based on the method developed by McKinley (1994). The bones were passed through a stack of three sieves of 10, 5 and 2 mm mesh size and next each of the fractions were weighed. The degree of fragmentation was determined by the ratio between the fractions. The length of the largest fragment was also measured. More than 90% of all remains were fragments belonging to the largest fraction which maximum length exceeds 10 cm. The largest fragment was 21.6 cm and belonged to the tibia. The extremely low degree of fragmentation in this case led to questions: why are these bones so well preserved? What factors, and how, affected the lack of damage bones in this case? During the cremation process bones are undergoing physical transformations, which make them fragile. However cremated remains affected by lower cremation intensity often show poorer preservation than do white calcined fragments. The researchers pointed to various reasons for the fragmentation, but the problem itself has not been investigated so far. The appearance of the bones from Biala forces me to ask whether the condition of burned bones does not hide more information than we have assumed.

Sex Determination vs Sex Estimation: what’s your take?

Author: Constantine Eliopoulos

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The assessment of sex is an integral part of any anthropological examination, as it is a major contribution to the construction of the biological profile. In recent years there has been an informal terminology debate, where some use the term “sex determination”, while others prefer the term “sex estimation”. There are supportive arguments for both terms and in some occasions this has led to frustrated authors debating with reviewers during manuscript revision. Here we present both opinions and invite the conference participants to vote for their preferred option. It is hoped that this initiative will start a discussion and it will ultimately lead to a consensus on the terminology to be used. In every discipline, there needs to be uniformity in the terms that are used, especially in the forensic context. It is only through dialogue that we can move forward and eliminate any ambiguity.
Dis/ability stories from the skeletons: a fictive narrative from the Romano-British cemetery at Alington Avenue, Dorset

Author: Stephanie Evelyn-Wright

Affiliation(s): University of Southampton

My research explores the themes of impairment and dis/ability through the examination of data from later Roman period cemetery contexts from southern Britain (3rd-4th century AD). This study utilises an integrated osteobiography approach to explore how dis/abled identity was experienced and was manifested in the skeletal and mortuary archaeological records. A pivotal part of this approach requires the integration of different data types into one larger biography of a particular individual within a specific social setting. This, in particular, has proven to be a challenging process. The following paper is inspired by the work of Alexis Boutin, who uses fictive narrative to present osteobiography case studies. This paper details data collected from the Romano-British cemetery site of Alington Avenue and presents the insight gleaned concerning dis/ability at the site in the form of a fictive narrative. The aim of this narrative style, not only allows the author to better integrate the data, but also presents the findings of the study in an accessible format. This paper will act as a mechanism to kickstart debate as to the nature of dis/ability and the mechanisms by which we present such data. I hope that conference delegates will provide feedback as to the impact that such a narrative approach had on their understanding of the site of Alington Avenue, the time period and the local experience of the individuals in my story.

Funding: South, West and Wales Doctoral Training Partnership

It’s all in your head? Cranial morphological variation in modern human populations

Authors: Christianne Fernée, Sarah Stark, Sonia Zakrzewski

Affiliation(s): University of Southampton

Cranial phenotypic variation is the result of genetic, ontogenetic and environmental factors. The cranium, therefore, can potentially signal a wide range of factors. Variation in specific cranial regions have been associated with particular variables; the face has been linked to the environment and the temporal bone to phylogenetic relationships. Environmental factors include diet and climate. Dietary related cranial variation has been documented world-wide. Climatic influences have consequences on body form, including the cranium, as morphological variation is linked to thermoregulatory principles. Sexual dimorphism can also be reflected in cranial morphology, the skull often used to estimate the sex of a skeleton. Geometric morphometrics (GM) provides tools to quantify shape differences. Previous cranial studies often rely solely on landmark-based analysis. Advances in the field of GM, however, have seen the introduction of semi-landmarks. Semi-landmarks enable the analysis of shape in greater detail, including specific curved features and surfaces. Semi-landmarks are an ideal tool for the study of cranial morphological variation as they enable the analysis of overall cranial morphology and specific feature variation. In this paper a sample of crania from 3 different geographical locations, climatic regions and chronological periods are studied. Geographically, the samples originate from Oceania, Alaska and North America. The samples from Oceania and Alaska are archaeological. Conversely, the North American sample is a cadaver-based collection from the United States of known age, sex and ethnicity. These samples differ in climatic conditions, diet and activity patterns.

Funding: AHRC-SWWDTP
Challenging Brothwell – a study of the differential rates of wear in the maxillary and mandibular molar dentition

Author: Sammy Field1,2

Affiliation(s): University of Southampton1; Historic England2

Current methods that use dental wear to estimate age at death assume that both upper and lower molars have the same rate of wear. Whilst previous work has found that left and right molars generally have a symmetrical pattern of wear, there has been no thorough investigation regarding the maxillary and mandibular molars. It has therefore been assumed that a single dental wear chart for estimating age at death (such as those produced by Brothwell and Miles) can be applied to all sets of molars with the same results. This is a vital assumption to test as archaeological skeletal remains are often fragmentary and any individual may only have one associated set of molars. We must be sure that if a single dental wear chart is to be used it is suitable for both the upper and lower molars. This paper compares the rates of wear for both the upper and lower molars using a juvenile sample. Due to the accuracy of juvenile age estimates obtained from the developing dentition, a relatively precise window of time can be used to assess wear. To gain a better understanding of the effects of dental wear over the whole tooth two different measurements are taken. The first uses an ordinal scale to observe the tissue lost on the occlusal surface, as utilised by Brothwell. The second measures the crown height to see the vertical loss in molar height. A comparison of these measurements allows consideration for the implication of using a single dental wear chart to estimate age at death for both the maxillary and mandibular molars.

Funding: AHRC, Historic England

Beyond the cutting edge: high-resolution digital analysis of potential lacerations from the Jucu de Sus Necropolis (Transylvania).

Authors: Kori Lea Filipek1,2, Dave Errickson2, Matthew Crowther2,3, Katie Tucker2,4, Ioan Stanciu5, Kelly Elaine Blevins,2,6, Jordan Snyder1,2; Liam Lanigan2,7

Affiliation(s): Durham University1; Transylvania Bioarchaeology2; Teesside University3; German Archaeological Institute (Berlin)4; Romanian Institute of Archaeology and Art History (Cluj-Napoca)5; Arizona State University6; Centre for Geogenetics, Copenhagen7

The Jucu de Sus necropolis is a multi-phased cemetery (8th to 12th centuries AD) located in the Transylvania region of Romania. Previous investigations in 2007 reported a large number of burials (n=80), and the bioarchaeological training excavation carried out by Transylvania Bioarchaeology is currently investigating these individuals, and others presently being excavated. This case study examines a young adult male from the 11th-12th century, with subperiosteal new bone formation on the anteromedial portion of the proximal diaphysis of the left femur. In addition, there are a number of perpendicular incision-like marks on this surface. The individual was selected for further investigation to determine whether these marks were a consequence of palliative care (e.g. lacerating an ulcer), or a by-product of abnormal taphonomy. The individual was fully documented in three-dimensions using a PicoScan structured light scanner (4DDynamics, Belgium). In addition, the linear marks were microscopically analysed using a Hitachi TM3000 Tabletop SEM. The results highlight the benefits of using high-resolution digitization for the documentation of skeletal pathologies to make more meaningful and accurate interpretations. Furthermore, the study supported the notion that further investigations using microscopic imaging are beneficial for analysing traumatic lesions.
Grangegorman Lower Cholera Cemetery, Dublin

Authors: Dawn Gooney¹, Carmelita Troy¹

Affiliation(s): Rubicon Heritage Services Ltd.¹

Between October 2015 and February 2016 archaeological excavation was undertaken at the Cholera Graveyard at Grangegorman Lower, Dublin in advance of the Luas Cross City (LCC) light rail system. These works were undertaken by Rubicon Heritage Services Ltd for SISK Steconfer Joint Venture Ltd (SSJV) on behalf of Transport Infrastructure Ireland (TII). A total of 30 articulated coffined inhumations were recovered from an enclosed walled area of the Richmond Penitentiary garden. Historical sources state that the adjoining penitentiary garden was set aside as a graveyard for the exclusive use of cholera victims in 1832. The construction of a wall in the 1870s by the Midland Great Western Railway enclosed a narrow rectangular area of land. This phase of activity also saw the excavation of two parallel charnel trenches used to re-inter human remains (minimum number of 1,543 individuals). Contemporary records of the MGWR’s activities do note that burials were disturbed during the works and then reburied. In addition to a cholera graveyard, the disturbed and pit burials in the penitentiary garden may have been associated with a number of different functions of the prison. The close location of the garden to the North Dublin Union House of Industry 1773 (subsequently the North Dublin Union Workhouse 1839) may indicate that the institution utilised the area for their deceased throughout the 19th century, which includes the period of the Great Famine 1845-52. Though the disarticulated nature of the majority of the human remains may have limited some diagnoses, analysis has shown a range of pathologies and traumas not uncommon for a 19th century urban population.

Theorical and methodological problems to interpret gender in funerary context from Monte Albán Tombs

Authors: Geraldine G. Granados¹, Lourdes Marquez¹

Affiliation(s): Escuela Nacional de Antropología e Historia¹

The tombs of Monte Albn are related to the socioeconomic level of the household and with the people who conform the domestic group (González, 2011). Most of the researchers interpreted that the Zapotecs deposited only the men adults in this funerary context. The logic in that way is tombs mean prestige and status, then if there are more men than women, it is possible to assume that men had more power in this society. Facing this problem, this research presents the osteological evidence in contrast to another point of views, based on the following questions: Were there more men than women buried in tombs?, Could this evidence allow us to build a gender model for Monte Alban tombs? This is the reason why the scope of this work discusses the evidence that we have about gender. Thus, we used the osteological and statistics methodology, in addition to bibliographic revision, but at the same time. We analyzed almost all the Osteological Collections from Monte Albn, with a total sample of 581 individuals, from different contexts for comparing burials and tombs. The preliminary results, that we obtained, confirm that there is not a significant difference between men and women inside the tombs, also we found that they are some different patterns for tombs composition. These results reflect on the methodological problems that we must discuss for understanding the gender in Zapotec society, most of them come from the methodological approach and the misunderstanding of the difference between sex and gender. This paper contributes to observe the mistakes and general problems to research gender in Mesoamerica based on an osteological and bioarchaeological approach and to think that women were also empowered within the society.

Funding: Instituto Nacional de Antropología e Historia, Consejo Nacional de Ciencia y Tecnología
Comparison and evaluation of 3D capture methods and sharing platforms for the recording and analysis of forensic taphonomic traces on skeletal remains

Authors: Stephen Haines, Patrick S. Randolph-Quinney

Affiliation(s): The School of Forensic and Applied Sciences, The University of Central Lancashire, Preston

Methods of 3D shape capture are routinely applied in forensic anthropology. However, little work has been done in recording and analysing taphonomic traces in 3D, and no consensus on whether taphonomic digital models are valid or verifiable. This research evaluates criteria for effective 3D scanning in relation to recording taphonomic damage whilst factoring real-life applicability such as cost and user friendliness, of both hardware and software. We systematically compare 3D output from different products in current usage, including relatively inexpensive desktop laser scanners costing a few thousand dollars, up to 6-degree of freedom armature laser scanners, costing several tens of thousands. Visualisation software was also evaluated, with differing packages (from open-source, to commercial licence software) being evaluated for ease of visualisation, analytical quality, and cost-effectiveness. A series of actualistic experimental taphonomic cases were produced, covering common trace types – this includes burning, sub-aerial weathering, blunt force trauma, ballistic trauma, and cut marks. Scanning methods included non-contact laser, photogrammetry, and combinatory approaches. Specimens were scanned at minimum, maximum and optimal imaging qualities, and evaluated statistically for retention of taphonomic trace evidence. Engineering tolerance modelling was applied using GeoMagic Control to facilitate and visualise differences between resulting surface models. This paper discusses the results of the study both in terms of scanning optimality, but also with regards to the relative cost effectiveness of differing equipment packages, and post-processing software.

Experimental archaeological approach to understanding how the pilaster of femur was developed during Kofun Period in Japan

Author: Hiroko Hashimoto

Affiliation(s): The Congenital Anomaly Research Center, Kyoto University

During Kofun Period in Japan, some people of social eminence who were buried in a Kofun burial mountain often had femurs with well-developed pilaster. Several morphologists pointed that this character was likely to relate with horse-riding posture with specific harness. Horses and harness were introduced from the continent by Chinese and Korean who settled in Japan in Middle Kofun Period (fifth century). I have evaluated which muscles were mainly used during horse-riding with Kofun style harness in this study. I got permission to do this experiment from an owner and trainer of a riding club. Subjects were six people who had plenty of horse-riding experiences at least 45 years career (four males and two females, age 65 to 74). The subjects rode a horse with Kofun style harness for approximately two hours with some rests for one trial. One subject took five trials with at least four months intervals. After horse-riding I have palpated the subject’s femur, and interviewed the subjects. All of the subjects always felt muscle pain only on the adductors. The subjects did not very often use adductors on the femurs in ordinary life. The terminations of adductor brevis, longus and magnus are the medial lip of linea aspera. The Kofun people of social eminence who were buried in a Kofun burial mound often had well-developed pilaster on femurs, characteristically. If the horse-riding was an everyday activity for the Kofun people of social eminence, adductors must be well-developed. As a result of that, the medial lip of linea aspera of femur, which is the termination of adductors, was developed well and formed pilaster.

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Multidimensional scaling for determining the effect of occupation on entheseal changes

Author: Charlotte Henderson

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It has been shown that age is an important factor in entheseal change (EC) presence, but this is for each independent feature. A random forest model has previously found a weak correlation between predicted and real age. The aim of this study was to use a multidimensional scaling model to determine the effect of occupation while controlling for age. Entheses were recorded using the new Coimbra method in all males from the identified skeletal collection in Coimbra. Entheses chosen were the: supraspinatus insertion, infraspinatus insertion, subscapularis insertion, common extensor and flexor origins, biceps brachii and triceps brachii insertion. Occupations were categorised into heavy manual, manual, nonmanual and soldiers based on previous studies. The R package “randomForest” was used to partition the data into subsets of individuals in the same occupation category based on their overall EC expression, thus using all features. Several approaches were taken, but when clusters, based on these models were created, age was an important factor. Residuals from a regression model and later fitted values from the model were used to remove the effect of age. Age remained an important factor, but most importantly occupational categories did not cluster together well. Despite previous studies showing that each feature of EC expression was not strongly affected by age, this study shows that age remains a more important than occupation as defined by these categories (but also when using the professions as documented in the collection). Other effects may be at play, particularly the difficulty of classifying occupations by biomechanical loading and non-occupational biomechanical loading, e.g. gardening or changes in occupation over life course.

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Reconstructing Missing Landmarks: investigating how accuracy varies among methods and samples

Author: Cara Hirst

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3D Geometric Morphometrics (GMM) is a rapidly growing field in anthropological and archaeological research, providing numerous benefits to researchers. 3D GMM analysis requires the consistent placement of homologous landmarks present among all specimens. The poor preservation of archaeological material however means that methods such as GMM, which require complete specimen greatly reduces the available sample size. To increase sample sizes in archaeological research, there are several methods available which can reconstruct or estimate missing landmark data. Previous studies have determined that the accuracy of such methods for reconstructing 3D landmarks can vary between studies and specimens and samples. Before reconstruction methods are employed by researchers it is necessary to understand the factors which influence accuracy of these methods. This study aims to investigate the variables which influence the accuracy of five methods for estimating missing 3D landmarks on the human mandible, to determine if these landmarks can be accurately estimated. Reconstruction methods tested included thin plate splines, multivariate regression, mirroring across an empirical midplane and a manual mirroring method. Results from this study demonstrated that the accuracy of reconstruction methods varied significantly between methods, and by the number and location of the landmarks which were being reconstructed. This study demonstrates that methods for reconstructing missing landmarks data is not a ‘one fits all’ method, and extensive testing should be conducted before using these methods, to ensure the most accurate method is being employed, and that reconstruction error is known and clearly stated.
In Sickness and In Health: a bioarchaeological and historical analysis of the medieval hospital of St James, Thornton Abbey, England.

Author: Emma Hook

Affiliation(s): University of Sheffield

In 2012 the hospital of St James at Thornton Abbey was discovered by a team of archaeologists from the University of Sheffield. The archaeological remains from Thornton provide the opportunity to investigate a later-medieval hospital and its cemetery population. This poster will introduce a new doctoral project during which the combined analysis of bioarchaeology, archaeological context and historical frameworks will produce a comprehensive and nuanced understanding of the hospital of St James and its population. Preliminary analysis of the Thornton Abbey population will be presented, illustrating how this data can be used to gain a broader picture of health care and burial practices in the later-medieval hospital. The techniques employed in this investigation include palaeodemographic and palaeopathological analyses, which will be outlined here. In addition, this poster will demonstrate how 3D modelling has been utilised to document burial conditions and forms. It will also explain how the application of DNA analysis to establish or dismiss the hypothesis of familial relations within the practice of coterminous burial.

Funding: White Rose College of Arts and Humanities

Understanding the presence of children in late medieval hospitals in England, AD. 1050 - 1600.

Author: Esme Hookway

Affiliation(s): Staffordshire University

It is estimated that over 1000 hospitals were founded in England during the medieval period (AD. 1050-1600). Initially created as sites of hospitalia for pilgrims, many evolved into places of care for the poor, sick and infirm. Some sites specialized in the care of specific population groups. At hospitals for women and children, orphans could be raised until the age of seven years. Archaeological information on the inhabitants of medieval hospitals is expanding due to excavations at hospital cemetery sites. It is estimated that 37.5% of the medieval population would have been under 15 years of age however children are often underrepresented in cemetery contexts. This poster presentation will display initial findings of research into the presence of children at English medieval hospitals. This research was prompted by the results of an excavation at the Hospital of St. John the Baptist, Staffordshire (c.1135-1600AD), which will be discussed as a case study. An unexpectedly high proportion of juveniles (20%) were recovered from the hospital cemetery. A similar spike in the number of adolescents was observed in human remains recovered from the hospital cemetery of St. Mary, Spital, London. The osteological report from St. John identified evidence of trauma and disease, such as maxillary sinusitis, cribra orbitalia and osteochondritis dissecans from which it is possible to make some inferences about the social and environmental conditions in which these individuals lived. It is hoped that this research will shed new light on our understanding of the importance of hospital sites for the welfare of children in the medieval period and on the lives and deaths of children that were buried at such sites.
Paleopathology of the Ventarrón Complex: biological stress, diet, and subsistence economy at the origins of social complexity in the Lambayeque Valley

Authors: Hilarie K1, Haagen Klaus1, Ignacio Alva Meneses2, Steven Ball1, Gabriel Brown1, Allison Ham1, Jaclyn Thomas1, Johanna E. Young1

Affiliated with; George Mason University1; Director, Ventarrón Archaeological Project2

Complex societies began to develop on the north coast of Peru around 2600 B.C., and much debate surrounds this process. Particularly, past work hypothesized that early Andean civilizations were based on maritime resources – rather than an agriculturally focused economy. However, it has been exceedingly difficult to provide a paleopathological test of this hypothesis, as Formative era skeletons are very rare in the archaeological record. Excavation since 2006 at the Ventarrón archaeological complex (Lambayeque Valley, north coast Peru) produced diachronic skeletal sample consisting of 214 individuals spanning the Formative era into the 10th century A.D. These individuals were scored for evidence of cribra orbitalia, porotic hyperostosis, scurvy, enamel hypoplasias, periostosis, dental caries, antemortem tooth loss, and calculus. Crude prevalence and multivariate statistics demonstrate that the Formative era individuals (~2600~1500 B.C.) demonstrated a near total lack of skeletal pathology and possessed excellent oral health. By the Cupisnique, Moche, and Sicán periods (~1500 B.C. ~1100 A.D.), intensive irrigation agriculture progressively emerged as the dominant mode of food production, and increasing prevalence of childhood anemia and a significant decline in oral health were observed. These observations, especially the oral health data contextualized within the broader diachronic sequence, generate a working hypothesis that early social complexity at Ventarrón was indeed associated with exploitation of marine resources or other nonstarchy foods. Moreover, they allow for a more holistic understanding of later shifts in subsistence economy and the interplay between Andean societies and their unique environments.

Funding: Wenner-Gren Foundation and George Mason University

A “two-step” case of dismemberment in Karst Plateau (Trieste, Italy): a multidisciplinary approach.

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In spring 2005 some human remains in advanced state of decomposition were found in the Karst Plateau of Trieste. The remains, belonging to the same individual and consisting in the torso and part of inferior arms, were abandoned in different locations and showed clear signs of post-mortem mutilation. At the time of the findings, the anthropological and anatomo-pathological studies allowed the remains to be attributed to a young female subject. However, the personal identification could not be performed. In 2013, other skeletal remains partially buried, belonging to the same subject, were discovered 30 km further from the afore-mentioned findings. This discovery allowed the previously discussed case to be reopened using new investigatory techniques. By means of radiology, electron microscopy, facial traits approximation and cranio-facial superimposition the generic and personal identification of the victim was achieved, together with fundamental information on the modalities of the mutilation. In addition, a forensic archaeological intervention on the site of the discovery has been able to clarify some aspects of the concealment of the remains. However the personal identification of the victim is still unknown. The multidisciplinary protocol used by our group for personal identification in this kind of forensic cases will be discussed.
Bioarchaeological Research on Mograt Island, Sudan

Authors: Tina Jakob¹, Joe W. Walser III²,³

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This contribution presents the first bioarchaeological results from the recent excavations on Mograt Island, Sudan. We analysed a total of 43 individuals spanning the late Neolithic (ca. 3000 BCE), the Kerma period, New Kingdom and Napatan to the Meroitic period (1st century BCE) with the aim to evaluate whether health deteriorated over time. The skeletal remains were analysed macroscopically using standard osteological and palaeopathological methods. We found a high number of non-adults in the Neolithic cemetery and evidence for non-specific stress indicators (enamel hypoplasia, cribra orbitalia and periosteal new bone formation). However, respiratory health (maxillary sinusitis and new bone formation on the visceral aspect of ribs) was worse in the later periods, probably caused by the increase in aridity and subsequent dusty environment. Trauma in the form of fractures was restricted to accidental trauma in the earlier periods, but one individual from the Napatan period showed evidence for multiple fractures including blunt force cranial trauma. Although the sample size was relatively small we concluded that environmental conditions contributed to a decrease in population health and likely led to social tensions over diminishing resources.

Funding: Qatar-Sudan Archaeological Project (QSAP)

A novel analytical approach to burial position measurement from an early medieval cemetery

Authors: Vail Johnson¹, Karl Harrison¹, Joanna Caruth²

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Currently, analysis of skeletons within traditional burial archaeology will only focus on three aspects: cardinal direction of the skeleton, if the skeleton is lying face up/down or on its side (supine/prone) and the position of limb joints (crouched/flexed/extended). This, along with grave good analysis, is enough detail for archaeologists to write a report to assist the post-excavation osteological report. On the other hand, there is a relatively recent analytical method – archaeothanatology. Originating from France, Henri Duday has developed this very fine and intricate method to analyse individual skeletons. Finding a middle ground between burial archaeology and archaeothanatology would provide additional data that will assist in analysis of cemeteries as well as anthropological findings. This project will use digitised skeletal drawings provided by Suffolk Archaeology from excavations at Eriswell, Suffolk. The cemetery site is an Early Medieval cemetery from fifth to seventh century, with over 400 burials identified from three excavation seasons. The method aims to provide a novel quantitative technique to measuring the skeleton within its grave. The conclusions from the study hope to add weighting to the current anthropological and grave good analysis in the estimation of biological profiles of certain individuals.
Harlyn Bay: a case study in the analysis of a curatorially commingled skeletal collection from iron age Cornwall

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Curatorially commingled human remains are subject to forms and degrees of commingling, the extent of which is not seen in excavation or laboratory contexts. This case study focuses on the analysis of remains recovered from the site of Harlyn Bay, a British Iron Age (c 100 B.C. to 100 A.D.) cemetery excavated between 1900-1905 and housed at the Royal Cornwall Museum. Early use of the collection by antiquarians led to the commingling of human remains from multiple contexts within Harlyn Bay. A preliminary assessment of the collection also revealed that a subset of the remains had been commingled with other skeletal collections housed at the museum. Consequently, prior to conducting commingled skeletal analyses to individuate the remains, additional museological and skeletal methods were employed to identify which remains could be confidently associated with Harlyn Bay. These included 1) identification and review of all available archival documentation, including notations written on/within storage containers and the remains; 2) visual assessment of the remains for notable disparities in their physical condition suggesting discrepancy in origin or history; 3) querying of museum staff and databases for additional information on the cultural identity and physical attributes of the other associated commingled collections. Through the application of these methods, the majority of the Harlyn Bay collection has been disentangled. This case study highlights the need for the development and application of additional methods to determine the form and extent of curatorial commingling prior to the individuation of remains and offers preliminary steps to achieve this goal.

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Serious chronic disease of the cervical spine and trauma in young female of Middle Ages (Czech Republic)

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The skeletal remains of the young female (20 - 24 years) from the Southern bailey of the Pohansko near Břeclav (Early Middle Ages, second half of the 9th century-beginning of the 10th century) display several pathologies. The first one is deformation of the mandible, that was the most probably caused by fracture of the ramus in combination with subcondylar fracture. The spine of this young woman exhibits the most likely trauma of the cervical spine in combination with slowly growing structure situated inside of the spinal canal, that caused deformation especially of the C7. Cervical and thoracic spine together with internal surfaces of several ribs exhibits infectious changes of advanced stage, in all likelihood of tuberculous origin but osteomyelitis could not be excluded. In the proximal end of the right tibia was identified Brodie’s abscess. The histological analysis of the new bone formation in the ribs confirmed infectious origin and tuberculosis could be considered. Micro CT of the vertebrae (C5 and C6) suggests also infectious origin of the new bone formation on the ventral surface of vertebrae. Even though it was done by two different departments with different methods (PCR amplification 123 bp long section from IS6110 and shot-gun allogeneic sequencing), an attempt to isolate DNA of Mycobacterium tuberculosis from the first rib was not successful.Interesting is that, despite of the serious injuries and advanced stage of chronic infectious the female survived quite a long time without medical care. In the international paleopathological literature was not find any similar case.

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Assessing the effect of biomechanical stress on hand entheseal morphology: a histological approach

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In anthropological sciences, entheses - the bone areas where muscles attach - are frequently utilized as occupational stress markers. This approach is based on the concept that entheseal morphology is substantially affected by accumulated biomechanical stress, which is stimulated by lifelong muscle activity. Consequently, highly developed fibrocartilaginous entheses are typically described as steep tubercles or ridges. However, the association between biomechanical stress and manual entheseal morphology is not yet fully demonstrated. Previous histological research on human entheses has interpreted the distribution of calcified fibrocartilage in entheseal areas as a reaction to increased compressive stress. On this basis, if entheseal surface height increases due to biomechanical stress, a greater concentration of calcified fibrocartilage is expected at the most developed (elevated) parts of entheseal surface areas. To test this hypothesis for hand entheses, a histological analysis was conducted on the three entheses of the four thenar muscles in four cadaveric hands obtained from the Department of Anatomy (University of Athens). The donors had approved the use of their bodies for scientific purposes. These thumb entheses were selected because previous research has recently found statistical evidence that they reflect habitual manual activity. Based on a systematic observation of high resolution microscopic images, there was a visibly higher proportion of calcified fibrocartilage at the most superficial parts of the hand entheses. It is concluded that high surface elevation in hand entheseal areas is associated with increased biomechanical stress, which is reflected by high concentrations of calcified fibrocartilage.

Sex assessment of the sacrum – a morphological approach

Authors: Jacinth Kilmartin¹, Jo Buckberry¹

Affiliation(s): University of Bradford¹

Sex assessment of the pelvis in the postcranial skeleton plays a key role in multiple disciplines including osteology and forensic anthropology. Yet, literature investigating the sacrum’s sexually dimorphic features remains sparse. The present study investigated variation within the sacrum’s sexually dimorphic traits in four, five and six segment sacra utilising 223 skeletons from St. Bride’s Church collection, London, England and the Spitalfriedhof St. Johann collection, Basel, Switzerland. Following modern morphological methodology utilizing observations from the pubic bone, cranium, and mandible, a series of illustrations and descriptions were adapted for six sacral traits and placed onto a five-point ordinal scale: auricular surface length, anterior ala shape, anterior curvature, ala proportion to the sacral base, posterior ala shape and sacrum shape. Blindly scored by ten observers of varying skill levels, the inter-observer error was low for four of the six traits with moderate to substantial levels of agreement. The four replicable traits were then applied on the known-sex sample indicating bimodal distribution excepting anterior curvature. No traits were found to be sexually dimorphic for the four or six segment sacra. Logistic regression was used to analyse the scores for the five segment sacra, providing a predicted accuracy range of 83.9% - 87.4% and a range of 90%- 95% on a validation study of 20 further individuals from both collections, the higher accuracies in each case provided by a combination of three traits. These preliminary results offer the potential for a new fast, reliable methodology for sex determination utilising the morphology of the sacrum robust enough to be applied to multiple populations.
The Biomechanical Properties of Archaeological Bone: a novel approach to diagenesis

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The biomechanical properties of bone are influenced by the amount of the mineral and collagen components, their packing and interaction. As a result, the various structural units in bone (e.g. osteonal vs interstitial lamellae) exhibit different biomechanical characteristics (e.g. elasticity and hardness) that may play a key role in bone preservation post-mortem. This study presents, for the very first time, the data on the relationship between the biomechanical properties of archaeological bone and its preservation state. 19 human and animal bone sections from long bones and petrous pyramids have been examined using nanoindentation. Different regions (e.g. periosteal/subperiosteal, mesosteal, endosteal/subendosteal, as well as canal tissue in petrous specimens) have been indented in each section and the properties of different microstructural features (e.g. osteonal, interstitial and circumferential lamellae, preserved bone adjacent to microbially attacked tissues) have been assessed. Our results provide valuable information on the biomechanical properties of archaeological bone. Young’s modulus and Vicker’s hardness are compared to histological (Oxford Histological Index and Birefringence Index), collagen (% collagen, C/N, Amide/Phosphate) and hydroxyapatite (Infrared Splitting Factor, Carbonate/Phosphate) preservation. This combined data set gives a new insight into the preservation of archaeological bone, especially in the case of the petrous pyramid.

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Changes in appearance and desire across the ovulatory cycle in single and partnered women

Authors: Nicola Koyama¹, Matthew Kirtley², Sonia Tucci²

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Recent research has shown that women experience nonconscious shifts in mate preferences and behaviour across the monthly ovulatory cycle. Only two studies have investigated a shift in appearance, using ratings of photographs of women at low and high fertility. We conducted a study to assess changes in appearance and desire (attraction to opposite sex and sexual thoughts), self-reported mate value in single and partnered women, and additionally mate retention behaviour and partner’s mate value in partnered women, across the ovulatory cycle. We tested the hypothesis that women’s sexual advertisement should increase during the high fertility phase. Rather than ratings, we took measurements of appearance (clothing: sheerness, tightness, colour and skin exposure; and ornamentation: use of make-up and jewellery) from photographs of 43 women from one day during low and one day during high fertility. We found that partnered women wore more revealing clothes at high, than low, fertility phase. Attraction to the opposite sex did not differ between groups at both phases but for partnered women, desire (sexual thoughts) was higher at high fertility than low fertility. There were no differences in mate retention, mate value or relationship satisfaction scores between low and high fertility. The findings support the theory that female clothing may be used as a sexual signal and that the display of skin plays a vital role in mate choice.

Funding: Liverpool John Moores University
A challenging task - Recognizing Down's syndrome in human skeletal remains

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Detecting congenital abnormalities within the skeleton depends on many factors, including the completeness and condition of the remains as well as their expression and level of severity. Down syndrome, also known as trisomy 21, is a genetic disorder, which is characterized by an additional chromosome 21. It is related to developmental defects seen in both soft tissues and the skeleton, but seems to be rather difficult to identify due to a potential obscure manifestation within the skeletal framework. So far there have been three cases of Down’s syndrome reported from Southern Germany dating back to the pre-Roman Iron Age and Early Medieval. For the first time ancient DNA (aDNA) analysis was considered to confirm the morphological diagnosis of this specific genetic abnormality. Samples for a DNA testing were carried out for two of the specimens using 0,05-0,1 g of teeth or bone material. The results did not reveal any chromosomal changes in chromosome 21, therefore they do not support the anthropological statement. Irrespective of the skeletal identification of this congenital condition there are several other factors that need to be addressed and included when looking for individuals with Down’s syndrome. However, it is suggested that suspicious cases should be subject to a DNA analysis to confirm the findings.

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Experimental mummification in an outside cellar during wintertime in Northern Finland

Authors: Anniina Kuha¹, Nora Nurminen¹, Salla Marjakangas¹

Affiliation(s): University of Oulu¹

Mummified human remains are found in several Churches of Northern Finland. Exact information about their mummification is not available. In this study we were experimenting the effects of humidity, temperature and air circulation on the mummification process. Does mummification occur in cool temperature even when air circulation is limited? This study is based on previous mummy research and data collection at Finnish churches. The aim was to experimentally test out potential circumstances for natural mummification. To conduct this study piglets were put in the cellar during Finnish wintertime (outside temperature from 0°C to -25°C). Our cellar consisted of three “crypts”: the outer, middle and inner one. All of them provided slightly different temperature/humidity conditions. We placed piglets in all “crypts”, some of the piglets were wrapped in clothing replicating burial garment. Humidity in the crypts varied between 89% and 100%. Temperature was alternating in the outer and the middle crypts, varying on both sides of 0°C, but in the inner crypt it was stable. As a main result we discovered that our cellar conditions were not favoring mummification. After 77 days we could detect molds covering the bodies and no signs of actual mummification. The study was finished. This study may provide some noticeable information on preservation of bodies/natural mummification during wintertime in northern Finland. According to this study it seems that the body does not mummify if air circulation is limited. Molds can start to grow inside and outside the body even if the temperature gets close 0°C. Also, high humidity led the bodies’ skin to decompose as well as other decomposition processes started inside the bodies.
Testing and verification of the accuracy of 3D printing virtual anthropological specimens.

Authors: Michael Lane¹, Alessio Veneziano¹, Isabelle De Groote¹

Affiliation(s): Liverpool John Moores University¹

Increasingly anthropologists share virtual models of archaeological specimens which could be printed for study. Research into the accuracy of 3D printing is lacking but necessary. This study investigated whether it is possible to accurately create virtual 3D skeletal models and 3D print them in high quality for scientific research. The viscerocranium of a human skull was selected due to its smooth and sharp features. Photogrammetry using Agisoft Photoscan was applied to create the 3D model. An Ultimaker 2+ Extended was used to print the model in low, normal, and high resolution, using the 0.4, 0.6, and 0.8mm nozzles. 3D landmarks were analysed using Procrustes ANOVA in R to test for the effect of resolution and nozzle size and their combination on the size and shape of landmark configurations. Results show no significant differences in shape or size between the real skull, the 3D model, and prints. When resolution was accounted for, no significant differences were discovered between the prints. A statistical difference was found in the interaction with nozzle size within the prints but eliminated when using the 0.4 and 0.6mm nozzle prints only, suggesting smaller nozzles give better results. Overall, the results suggest it is possible to accurately print the viscerocranium of a human skull with no statistical differences in shape or size between the real specimen, 3D model, and the 3D print. These results apply only to the landmark configurations collected here so small differences in edge printing would not have been identified. Nevertheless, results suggest that 3D models can accurately represent original specimens and can be used in scientific research.

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Aetiology and Social Implications of Forearm Fractures in a Modern Cypriot Population

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Within a forensic context, it is vital to interpret the cause of trauma. It provides insight to the nature of interpersonal relationships and a population’s interaction with the environment. They may be used for identifying the deceased, determining cause and manner of death, and provide clues on cultural practices, lifestyle and violence. Forearm fractures were analysed from well-preserved skeletal remains of a modern population (lived 1900-2008) of known elderly, but non-osteoporotic individuals (n=150; 75 male, 75 female) from the Cyprus Reference Research Collection, under the curatorship of Odyssey Fieldschool, Cyprus. It was hypothesised that there would be age and gender-related differences in upper limb fracture distribution, and that side differences and extent of healing may allow interpretation of the fractures’ aetiology. Fracture data were compared to forensic literature to understand the aetiology and social implications of the trauma. Association of types of fractures and their prevalence with sex, known age-at-death, side, timing of injury and degree of healing are discussed. Of 150 individuals, 28 exhibited 46 injuries. Of these, 17 (61%) exhibited only one injury whereas 11 (39%) had multiple trauma. Healed antemortem fractures had the highest frequency (74%), while by partially healed (20%) and open (9%) fractures. No definite peri-mortem injuries observed, despite excellent preservation. Colles’ fractures were found to be most prevalent, and were 5 times more common in women than in men. Barton fractures were more equally gender-distributed. Surprisingly, limb dominance did not affect the left-right distribution of trauma. Most fractures exhibited are thought to be accidental than violent in origin.
**Isotopes, Statistics and the Anglo-Saxons – Thinking Big and Thinking Straight**

Author: Samantha Leggett

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This paper details the use of regression and Bayesian analyses to explore a dataset of over 1000 carbon and nitrogen stable isotope samples from Anglo-Saxon England from c. 400 – 1100 A.D. Traditional statistics used for smaller datasets are inappropriate for such large quantities of data, which are geographically and temporally diverse, with inherent dependencies. Therefore a different approach has been taken here with regression analyses and Bayesian modelling. The aim of the project is to track diet and burial practices in Anglo-Saxon England from the seventh century onwards as Christianisation sweeps through the island. This has resulted in the collation and generation of a large number of stable isotope values for the time period. The research questions include – does Christianisation affect both diet and burial practice in England during the seventh century? Are there regional patterns? Do we see change over time? Are there observable differences between religious and lay communities? It is hypothesised that there will be change over time leading up to the fish horizon as described by Barrett, which may correlate with increasing Christianisation as well as Scandinavian impact. However it is also hypothesised from previous studies that there will be no immediate change in diet during the seventh century, despite changes in burial practice, but that this shifts more gradually over time, and that if there is earlier increased fish consumption due to Christianity, then this may be fresh water fish and not visible isotopically. What will be demonstrated are novel approaches to large, multi-scalar questions about isotopic data, using middle to late Saxon England as a case study, and their suitability to this work.

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**Inside and Out: using X-ray to confirm macroscopic diagnosis of metastatic cancer**

Authors: Maria M Leroi, Amy Perez, Elżbieta Juskulska, Xenia Paula Kyriakou

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The diagnosis of cancer and cancerous metastasis is challenging in human skeletal remains, especially those of archaeological origin that might be poorly preserved. Bone metastasis is often associated with cancer that begins in one organ and then spreads to bone. The primary issue for the diagnosis of metastatic cancer is the presentation and distribution of the metastatic lesions which are not predictable or consistent to the cancer’s primary onset site. The Cyprus Reference Research Collection (CRRC) is a contemporary skeletal collection of known sex and age-at-death. Contemporary skeletal collections are a useful tool for the bioarchaeologist as these could offer an excellent platform for the comparison of skeletal cases of pathology with ancient bone. The skeletons of several individuals that exhibited evidence of probable metastatic cancer have been examined macroscopically, followed by a process of differential diagnosis and additional tests using digital technology to firmly establish the etiology of these lesions. Lytic and proliferative changes are discussed within a clinical and palaeopathological framework. Although it is thought that the cases are presenting metastatic lesions from the same type of primary cancer the variation between the cases has the potential for different diagnoses to be achieved.

**Funding:** Funding from Odyssey Fieldschool, Cyprus for the digital imagery
Enamel thickness variation within mandibular incisors in modern humans, Neanderthals and the Atapuerca-Sima de los Huesos population.

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Dental tissue proportions offer insight into phylogenetic relationships. Previous incisor research has revealed that Homo sapiens and Homo neanderthalensis diverge concerning incisor measurements, with Neanderthals having absolutely and relatively thinner enamel thickness. Here we contribute by assessing the variability in enamel thickness of Neanderthal (N=7) and modern human (N=35) using micro CT. In addition we include the hominin population at Sima de los Huesos (SH) (Sierra de Atapuerca, Burgos, Spain) (13). Analysis of the SH material has significant implications concerning the origin of Neanderthals and provides the opportunity to study hominin variation in a population constrained geographically and temporally. Standard methods were employed for 3D analysis and a labiolingual plane was analysed to extract 2D data. This data set includes average enamel thickness (AET), relative enamel thickness (RET), and relative dentine area (RDA). Our results reveal that the SH population possesses an intermediate position between Neanderthals and modern humans. There is a level of sexual dimorphism within dental tissue proportions similar to modern humans within the SH sample. Analysis of the SH sample also revealed variation within the tooth class between central and lateral incisors. We will discuss the implications of these results in relation to the phylogenetic position of the SH population. This work contributes to the extremely limited data set of incisors and for Middle Pleistocene hominins, and is the first data set reporting the SH sample. We aim for this data set to assist in the clarification of the phylogenetic position of SH, and encourage further investigation into incisors dental tissue proportions.

Cultural cranial modification within the first sedentary communities in Near East

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This paper explores bioarchaeological evidence for cultural cranial modification (also known as headshaping) in early Neolithic Near East, and at Tepe Abdul Hosein (Iran) in particular. The hypothesis that permanent body modifications, instigated in infancy, proliferate at the time of first sedentary communities, will be explored. Crania or cranial fragments of eleven individuals (n=11) recovered from the site of Tepe Abdul Hosein, located in present day Iran, were analysed macroscopically and through anthropometric methods for evidence of intentional cultural cranial modification (CCM). This data was compared to data from a number of contemporary, earlier and later sites from the region. Tepe Abdul Hosein is dated to the first half of the seventh millennium BC. Eight of the eleven individuals are adult, and all adult individuals are sufficiently preserved for macroscopic assessment of cultural cranial modification. All males present within the sample display circumferential type cultural cranial modification. Antero-posterior type cultural cranial modification occurs only on female individuals at Tepe Abdul Hosein, though half of the females do not display any modification. The discovery of different types of headshaping at Tepe Abdul Hosein, analysed in the context of other regional sites of contemporaneous, earlier, and later dates, has a bearing on the understanding of the first sedentary Neolithic communities in southwest Asia, and the elaboration of bodily difference and identity in the context of gendered socio-cultural practices.

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Borgo Cerreto Project: paleopathological study and facial reconstruction of a mummified individual of XVII century

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The individual is one of the twenty-three natural mummies of Borgo Cerreto, Perugia, central Italy. The style of the garment is typical of a member of the upper class of the Umbrian rural population of the XVII century. The mummy is well preserved. The anthropological study revealed that the subject was an adult mature male with a stature of 1.69 cm. The macroscopic study had not evidenced any skin lesions or pathological alterations. Tooth examination evidenced an osteolytic lesion of the first upper left molar compatible with a cyst. CT examination revealed calcified lamina tectoria and neo articulation with clivus. The spine showed diffuse spondylosis and osteophytosis with intersomatic bridge. Light lumbar arthrosis, irregularities and sclerosis of pubic symphysis and bilateral gonarthrosis are observable too. CT examination revealed the fracture of 4th right and 10th left ribs, probably as a result of post-mortem effects. A comparison between the cranial structure of the subject and a portrait of Baronio Vincenti (XVII century), Physicus et Medicus, the commissioner of the funerary chapel, was performed. Amira System, Programme Face Gen (Singular Inversion) and Photoshop with form 3 D were applied. The results of the anthropological and paleopathological study suggest that the individual was a mature male, as confirmed by the generalized osteoarthritis framework. The good condition of the dental apparatus, in relation to the age of the subject, suggests that he was a member of the upper class. The results of the facial reconstruction and the cranial superimposition on the portrait make the identification of the subject with Baronio Vincenzi very likely.

Mummification in cold climate

Authors: Salla Marjakangas¹, Anniina Kuha¹, Nora Nurminen¹

Affiliation(s): Oulu University¹

Research Question The role of burial depth and dry sandy soil on the mummifying process of Finnish church mummies? In Finland mummies are found mainly under old churches where the specific conditions of temperature, ventilation of cool air and sandy soil have lead to mummification of the bodies. We have collected temperature and humidity information of three churches to study their effect on mummification process. All studied churches had mummified remains but interestingly temperature/humidity information varied significantly between churches. We thus explored alternative factors that could result in mummification. In this experiment we wanted to clarify the role of grave depth and dry sandy soil on mummification process. Five naturally died piglets were placed to a hall with sandy soil. Four of the piglets were placed in the wooden caskets. Two of the chests were buried in sand (A1 & A3) and other two placed on top of the sand (A2 & A4). One of the piglets was buried without any chest in between of the two buried chests (A5). Temperature data was collected from two of the coffins, one buried in the sand, one on top of the sand (A1 & A2). The piglets were weight and pictured before the experiment, and post mortem exam will be done after the piglets have been removed from their graves. The experiment started on February 2017 and final results will be received in June 2017 when piglets will be taken to further post mortem research and the success of the study will be revealed. According to premilinary results, the weight of the piglets decreased except for A5. The weight loss of the A1 was 152g, A2 142g, A3 160g and A4 around 400g. Sand was stuck to skin of A5 which led to weight gain by 272 grams.
Gloucester Infirmary burial ground: evidence of autopsy in the 18th and 19th centuries

Authors: Sharon E Martin¹, Constantine Eliopoulos¹, Isabelle De Groote¹, Joel Irish¹

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Excavation carried out in 1983 uncovered approximately 45 individuals from Gloucester Infirmary burial ground in Southgate Street. Gloucester Infirmary was established in 1755 with the burial ground being consecrated in 1781. This was an important landmark in the treatment of disease in Gloucester as the care was provided for free via subscription and attracted large numbers of medical professionals to the area. These charitable hospitals were frequently established in the late 18th and early 19th century Britain and were commonly associated with anatomy schools which carried out public dissection. A high number (77.8%) of individuals from Gloucester Infirmary burial ground had evidence of skeletal pathologies. Pathological conditions which were identified included dental disease, joint disease, trauma, metabolic disease and a high representation of infectious conditions, including periostitis. In this skeletal collection, we also discovered two individuals with craniotomies who had similar biological profiles as they were both males and in their twenties. This poster will present these two autopsy case studies which can provide an insight into the sociocultural context surrounding 18th and 19th century hospital burials. There is no evidence that these skeletal remains were used for dissection or anatomical collection, but only that they were subject to cranial autopsy. Periostitis was found on the endocranium of one individual, indicating inflammation of the surrounding tissues such as the brain and the meninges. This may have been related to the cause of death and would have been identified during autopsy.

Testing new methods to solve old problems? Identifying salmon and trout vertebrae using geometric morphometrics.

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Pacific salmon and trout (Oncorhynchus spp.) were a key resource for prehistoric human cultures of coastal NW North America and their exploitation has been critical to the development of hunter-gatherer societies in the region. Oncorhynchus spp. remains are commonly recovered in large numbers from archaeological sites from the NE Pacific and Bering Sea coasts, with vertebrae being by far the most frequent element represented. Although these remains have the potential to address a range of questions, not only for archaeology but also for fisheries science and ecology, the difficulty in identifying them to species remains a fundamental obstacle. This "identification problem" has led researchers to explore different techniques applied to Oncorhynchus vertebrae, including radiography, biometrics and DNA. Though aDNA is currently the most reliable method, it is expensive to conduct on a large-scale and is destructive. Traditional biometrical approaches, are cheaper to apply to large-scale projects and, are also non-destructive. However, their accuracy has been questioned by comparative DNA studies on the same specimens. In this project we take the biometric method further by testing the potential of geometric morphometrics (GMM) to identify archaeological Oncorhynchus vertebrae to species, using modern wild specimens of known species as reference. The initial results, verified by aDNA, demonstrate that GMM can be effective for identifying certain species of Oncorhynchus and, when successful, it did so with a high level of confidence. These results indicate that GMM show greater promise than traditional linear measurement approaches and could provide valuable insights into past fishing activities.

Funding: BABAO, Association for Environmental Archaeology
A Woman’s World: exploring the morphological and pathological conditions associated with obstetric dilemmas in an urban Romano-British population

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Evolutionary morphological changes required to accommodate bipedal movement and a larger brain size, alongside various pathologies, make humans prone to an obstructed labour. This occurs when the fetus is unable to navigate through the pelvis during a vaginal delivery and can result in death for both the mother and neonate. Within archaeological populations the high frequency of reproductive age females is often attributed to childbirth related complications. To establish the likelihood of a contracted pelvis the transverse and cognate measurements at the pelvic inlet, mid-plane, or outlet was collected from 136 Romano-British females between 10-45 years at death. The metric data was compared with pre-WW2 clinical literature based on the minimum size of a viable foetus. Within the sample, 14.7% (n=20) had at least one pelvic inlet measurement which would place the mother at risk for pelvic disproportion (CPD). Pathological and morphological changes such as sacroiliac osteophytes and sacralisation were noted and the youngest individual who could be expected to successfully undergo a vaginal birth was 14.08 years of age at death. Overall, this can provide a better understanding of the birthing process among archaeological populations and childbirth hazards.

Lesser Known Londoners of the Past: making the most of the miscellany of museum collections through digitisation

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Many museums hold collections of human remains that are lacking documentation, which are consequentially under-utilised in relevant scientific studies. The Natural History Museum holds over 25,000 sets of human remains, many of which have gone decades, or even centuries without being thoroughly researched. The aim of this project was to show how the digitisation of human remains can highlight areas of potential research and improve access to under-utilised collections. Osteological analysis, archival research and high quality photography were undertaken for over 740 individuals, dating from prehistory through the post medieval period. These remains were excavated over the last 200 years from nearly 100 sites across London and range in number from hundreds to a single individual per site. By looking at these remains as a cohesive collection, under the greater context of ‘Londoners’, we have been able to include sites with sample size or preservation issues that meant they were overlooked in previous research. The immediate result of digitising these remains has been the development of multiple post graduate projects utilising this data. In the long term the detailed collection records and digital images can be used to develop more research projects, to better fulfil researcher’s sample requirements and to decrease unnecessary handling of remains. Skeletal inventories and site information will be made available to researchers via the Museum Data Portal, with more in depth information for both the public and scientists available on the Museum website collections pages.

Funding: Charles Wolfson Charitable Trust
The Mass Grave of Halberstadt, Germany: a new facet of mass violence in the early neolithic of central Europe

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The Early Neolithic in Central Europe is the time of the Linearbandkeramik (LBK; ca. 5600-4900 cal BC), the first full farming culture in this area. Many deceased members of the LBK were carefully buried in dedicated cemeteries. Additionally, several enigmatic sites are known, where skeletal remains are found in more unusual settings which suggest a variety of postmortem ritual practises that exceed “simple” burial. A few further burial features are characterised by a seemingly total lack of care: the rare mass graves of the LBK, most of which are interpreted as results of violent massacres. In 2013 another LBK mass grave was discovered and excavated at Halberstadt, very near a contemporary settlement and cemetery. The mass grave contained the skeletal remains of 9 individuals, 8 of them diagnosed as male (89%). Several postcranial bones show signs of perimortem carnivore activity; others display perimortem fractures. All crania show traces of perimortem blunt force trauma which adds the Halberstadt mass grave to the short list of Early Neolithic mass violence sites. But in contrast to the sites already known, the injuries at Halberstadt cluster almost exclusively at the back of the head, indicating another violence-related context than the massacres encountered so far. This view is supported by the results of Sr and C/N isotope analyses, which set the mass grave assemblage clearly apart from the population buried in the local cemetery. Combining all available evidence, an execution-style killing of a non-local group of mostly male individuals seems most likely, which extends the known scope of violent behaviour of Early Neolithic groups in Central Europe.

High-spatial resolution intra-tooth Sr-isotope analysis of a modern migrant - how does a rapid relocation manifest in human tooth enamel?

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Strontium isotope analysis (87Sr/86Sr) of archaeological humans is widely used to investigate geographic origins. Whilst recent work suggests the petrous or any calcined bone can retain biogenic ratios, Sr-isotopes have typically been obtained from tooth enamel. The c. one year duration of human enamel maturation, the period of crown mineralisation, body residence time of Sr and bulk sampling of enamel all contribute to a ratio that is a weighted average of a multiplicity of inputs over possibly several years. By measuring sequentially mineralising teeth diachronic information about childhood residence may be obtained but higher resolution intra-tooth sampling by laser ablation has been attempted in the hope that decreasing the sample size will increase the temporal resolution of the data. However, whilst this technique may discriminate between samples in old and highly variable geological regions such as Africa, the low precision of the data can mask biogenic variation in regions of low Sr-isotope variability, such as southern Britain. Here we present Sr-isotope data of a deciduous molar from a modern child who migrated on a known day between two different Sr-isotope regions whilst the enamel was mineralising. The tooth was sampled by micro-drilling and the Sr-isotope ratios measured by TIMS. This combination of techniques produces data of equivalent spatial resolution to laser-ablation sampling but far higher accuracy and precision. The results show that an abrupt relocation does not manifest as a step change in enamel and erroneous conclusions regarding residence and relocation may be reached if the data are interpreted without an understanding of the patterning and duration of tooth enamel mineralisation.

Funding: NERC standard grant 'Timelines in Teeth' (PI Montgomery)
An unusual prehistoric mass burial from Jagodnjak, eastern Croatia – a bioarchaeological approach
Authors: Mario Novak¹, Ivor Jankovic¹, Dinko Tresic Pavicic²
Affiliation(s): Institute for Anthropological Research, Zagreb, Croatia¹; Kaducej Ltd., Split, Croatia²

Here we present the results of bioarchaeological analysis of the human skeletal remains from a recently discovered prehistoric mass burial located in Jagodnjak, eastern Croatia. The pit containing multiple skeletons was situated within the perimeter of the Middle Bronze Age cemetery. However, based on the preserved pottery fragments and the presence of three Neolithic pit-dwellings in the immediate vicinity the mass burial can be dated to the Neolithic period (radiocarbon dating pending). The human remains were mostly articulated but the individual skeletons became partially commingled due to the haphazard placement of the bodies at interment as well as post-depositional processes. In total, ten male skeletons aged between 20 and 45 years were recovered. All skeletons show various pathological changes such as caries, AMTL, ectocranial porosity, cribra orbitalia, and ante-mortem fractures. Furthermore, one individual exhibits several cranial peri-mortem injuries (cuts and blunt-force trauma). A non-standard burial practice (multiple human remains haphazardly interred in one grave) as well as unusual demographic distribution (ten adult, relatively young males) might suggest an episode of intentional violence in which males were killed and quickly disposed of. This hypothesis is supported by the presence of multiple cranial peri-mortem trauma in one individual. It seems that the mass burial from Jagodnjak might be compared to the well-known LBK massacres such as Asparn/Schletz, Talheim and Schöneck-Kilianstädten. The main question – were the victims the locals or the intruders – is still unresolved, but hopefully ancient DNA and stable isotopes analyses that are in progress will provide more insight into this issue.

Funding: Croatian Science Foundation grant (IP-2016-06-1450).

Experimental mummification: replicating the Natural mummification process of church mummies of Northern Finland.
Authors: Nora Nurminen¹, Anniina Kuha¹, Salla Marjakangas¹
Affiliation(s): Oulu University¹

The experimental mummification was based on the information that has been collected from a church in Keminmaa, which has one of the best preserved mummies in Finland, the mummified remains of Vicar Rungius. The temperature and the humidity in the area of the church were recorded and those results were used as a base for the experiment. By using piglets we are mimicking the conditions that resulted in mummification. Three piglets have been placed inside an incubator chamber, with set temperature and humidity. These piglets will be monitored weekly, weight and visual inspection and also CT-scanned every three months. The temperature is set in 0, 6 degree, which is based on the temperature data collected, and also the humidity is set in 80%. One piglet will be placed in a freezer to mimic the winter months (-22 degrees of Celsius) From the Ct-scans the Hounsfield scales was taken from bone, soft tissue in the abdomen (liver) and from the brain (the size of the brain was measured). From the changes of measurements, we can see how the cold temperatures and mummification affect the remains from the inside. The piglets have been in the incubator chamber for a year, and some drying of the tissue/mummification is clearly visible. More evidence of mummification can be seen in the CT-scans, for example the loss of fluids in the bone, soft tissue and brain. The conditions favoring mummification when the remains will mummify is when it is highly humid, the temperature stays low but not under zero and the air flow is constant. Also possible barriers in the air flow, such as clothing, coffin etc, will affect the outcome.
From the Cradle to the Grave: bioarchaeological perspectives on an Ychsma Period monumental multiple burial from Pachacamac, Peruvian Central Coast

Author: Lawrence S. Owens

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Ychsma Late Intermediate Period (AD 1000-1470) burials are comparatively poorly understood in relation to the funerary traditions of other Andean groups. The Ychsma Project aimed to expand the corpus of burials, and to better appreciate the significance of the extensive intra- and inter-site interment variability within the polity. The recent discovery of a monumental burial structure at the site of Pachacamac (Pyramid 13, Unit 100) has permitted the testing of extant theories and the development of new hypotheses concerning Ychsma burial traditions and biosocial identities. All 121 individuals were mapped, aged, sexed, and scored for pathological conditions, trauma, and non-metric traits. Their spatial distribution and temporal spread was also assessed. Age, sex and genetic affinity were determining factors in the nature of burial distribution, as was position within the bicameral structure. C14 dates indicate that the tomb was reused over a considerable period of time, child burials still being left there when the structure had collapsed. We suggest that adults (especially males) assumed greater social status with increasing age, and that the subadults with whom they were interred were essentially grave goods. Subadults, by contrast, cease being buried as addenda by the age of around 7 years, at which time they were interred as individuals in their own right. At least some of the interments in the two chambers were related to one another, raising the possibility of familial/dynastic structures.

Constant change: evidence for socioeconomic stability in post-medieval Aalst

Author: Jessica L. A. Palmer, Andrea L. Waters-Rist

Affiliation(s): Leiden University

Post-medieval Aalst (Belgium) was a thriving centre of commerce and specialized craft, embedded in a countryside which provided much of the necessary base materials. Situated on the river Dender along the trade route between Bruges and Cologne, Aalst was renowned for its craftsmen, most notably blue-dyers. Twenty percent of the active population consisted of craftsmen, organized in trade guilds. These guilds greatly favored city-born entrants, who lived out their lives in this career and city. Many socio-economic changes occurred in the Low Countries from the late medieval period to the Industrial Revolution, however, historic sources from Aalst attest to marked socio-economic stability in this timeframe. The current research combines skeletons from two excavations in the city center to study whether this purported stability is supported by osteoarchaeological evidence of physical activity. Adult skeletons from an earlier (1450-1650, n=103) and a slightly later (1650-1792, n=118) middle class cemetery are compared. These collections contain many specialized craftsmen from the town. To evaluate whether activity patterns remained constant, entheseal changes (EC) are evaluated at 29 muscle attachment sites of the upper and lower limb, in combination with osteoarthritis prevalence in all joints. EC and osteoarthritis results are highly concurrent between both sites, supporting the historical characterization of minimal change in economic activities during this period. This research thus provides an excellent example of how combining history and osteology can solidify reconstructions of past societies.
Spatial variation in skeletal biomechanics among late Neolithic and Copper Age populations in the central Mediterranean.

Author: Eóin W. Parkinson

Affiliation(s): University of Cambridge

Long bone cross-sectional geometric (CSG) properties can act as indicators of habitual behaviour in past populations. This study compares variation in CSG properties of the femur and tibia in contemporary populations from the Maltese Islands and Italian peninsula during the late IV-III millennium BC. The central Mediterranean was a mosaic of cultural and environmental diversity during the IV-III millenniums BC, characterised by social change, technological innovation and economic diversification. These processes have largely been explored through indirect archaeological evidence, which has been intensely provincial in focus. Solid CSG properties were derived from 3D laser surface scans. The application of innovative methods, in particular 3D superimposition and digital reconstruction, are also used here to acquire metric data from fragmented human remains. The results show no statistical difference in lower limb CSG properties between contemporary central Italian and Maltese populations, whilst populations from Alpine Italy show adaptions to high levels of habitual activity around rugged terrain. The findings suggest that both Maltese and central Italian populations engaged in low levels of terrestrial mobility, which in the case of Malta can be attributed to a small island context. The results from central Italy contradict traditional archaeological interpretations that central Italian Copper Age groups were highly mobile pastoral agriculturalists. In Alpine Italy, the data supports archaeological evidence for upland settlement and a subsistence based on pastoralism. This research demonstrates how the application of modern methods in bioarchaeology can challenge long standing traditional archaeological narratives.

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Dexterity vs Thermoregulation: trade-offs in upper limb proportions of Himalayan populations

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High altitude stress has been associated with a reduction in relative zeugopod (forearm/lower leg) length. This pattern supports the ‘thrifty phenotype’ hypothesis, whereby, under environmental stress, autopod segments (hand/foot) are protected from growth deficits at the expense of the zeugopod. This pattern has been observed in Andean populations, and in the lower limbs of Himalayan populations, but has yet to be confirmed in the upper limbs of Himalayan populations. In the Himalayas, other environmental influences may dictate limb proportions; the significantly lower minimum temperatures compared to other high altitude regions may be a significant stressor to induce cold-adapted limb proportions (shorter and broader distal limb segments) as per Allen’s rule. This cold-adapted pattern has been noted in the hand morphology of cold-habiting populations, but not in their foot morphology. This study set out to determine whether upper limb length of Himalayan populations indicated cold-adapted proportions, or followed patterns of the ‘thrifty phenotype’, as seen in their lower limbs. We compared the relative upper limb segments lengths of highland and lowland adults aged 18 to 59 (n=254: F=90, M=164) of shared genetic ancestry residing in the Himalayas. Relative to height, ulna length was found to be significantly shorter in the highland population in both males and females, whilst relative humerus, hand length and hand width were not significantly different. While zeugopod dimensions may be susceptible to cold, these findings suggest that the ‘thrifty phenotype’ model explains the maintenance of hand dimensions in Himalayan populations.

Funding: BABAO research grant, the National Geographic Society, Sigma Xi, Trinity Hall
Looking for rural immigrants in St Gertrude Church cemetery (15th-17th centuries AD) in Riga, Latvia: an isotopic analysis

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Affiliation(s): Durham University¹; Institute of Latvian History, University of Latvia²

This paper aims to identify immigrants from rural Vidzeme region who were buried in two mass graves in St Gertrude Church cemetery. It compares dietary carbon and nitrogen isotope values from bone and incremental dentine, and strontium isotope ratios, in people who were buried in the mass graves and the general cemetery. Seven hundred and twenty-one individuals were recovered during the archaeological excavation. Carbon (δ¹³C) and nitrogen (δ¹⁵N) dietary isotope analysis was applied to 96 adult individuals. Teeth from 19 children were selected for incremental dentine and strontium (87Sr/86Sr) isotope analysis. Five faunal samples from rural Vidzeme and Riga were used to estimate the local strontium isotope biosphere range. No statistically significant differences emerged between people from the mass graves and the general cemetery with regard to dietary isotope values. Similar incremental dentine δ¹³C profiles were observed in children from both mass graves, but not between those buried in the mass graves and the general cemetery. Children from one mass grave showed evidence for nutritional stress shortly before death, consistent with a historically documented famine in the region. The lack of significant differences in 87Sr/86Sr ratios between the contexts suggested that most individuals derived from Riga and/or its vicinity, but one child may have come from rural Vidzeme. Overall, the results suggest that population groups of different childhood origins are represented in the mass graves, including people from Riga and its vicinity, and rural Vidzeme, resulting in a lack of statistically significant differences in dietary isotope values and 87Sr/86Sr ratios between the contexts.

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Figs are important, but not fallback foods for chimpanzees in the Issa Valley, Tanzania

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At many sites, chimpanzees respond to periods of low fruit availability by shifting their diets to include more lower-quality "fallback foods", usually more readily available throughout the year. Fallback food consumption can influence ape population density, as well as overall ecology and evolution. Numerous studies have discussed the importance of figs (Ficus sp.) as a fallback food for wild chimpanzees, but not necessarily for all populations, as some communities consume figs year-round. We investigated the role of figs in the diet of the Issa Valley chimpanzees, a community that lives in a miombo woodland mosaic habitat of western Tanzania. We macroscopically analysed 810 chimpanzee feces samples over four years and found that figs were the most frequent plant consumed in that period. Consumption was not associated with fruit availability, although figs were significantly more consumed in the dry season. Fig consumption was negatively associated with party size. We compare Ficus species diversity and distribution at Issa as well as our chimpanzee diet results to the role of figs in forest-dwelling chimpanzees and the implications for savanna living and broadly, adaptations to a dry habitat.

Funding: National Science Foundation; LSB Leakey Foundation; Wenner Green Foundation; CARTA
Biorhythm correlates with human molar enamel thickness

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Recent studies have hypothesised that the periodicity of an incremental marking preserved in tooth enamel, Retzius lines, may reflect an underlying biorhythm that has a role in regulating body mass and stature. This hypothesis, termed the Havers-Halberg Oscillation (HHO), holds great potential for accessing aspects of a fossil species biology from a single tooth. Here, we explored the HHO in n=76 human permanent first molars to determine if the hypothesised biorhythm correlates with final enamel thickness. Using histological methods, we calculated Retzius line periodicity (RP) and average enamel thickness for each tooth. Analyses reveal that log-transformed RP and average enamel thickness are significantly and positively correlated (p= 0.006). Our findings provide further evidence that the underlying biorhythm may regulate the growth of multiple hard tissues, not just bone. Furthermore, we propose that, RP, in addition to a circadian rhythm, may have a role in regulating human enamel growth.

Funding: Dora Harvey Memorial Research Scholarship

The Ancestral Shape Hypothesis: 3D vertebral morphology, locomotion, and human spinal health

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Humans are afflicted by back problems more frequently than other primates. Consequently, researchers have suggested that the bipedalism may be one factor contributing to our back problems. Recently, we found evidence that vertebral shape may play an important role in the development of a common spinal lesion, the Schmorl’s node. Using 2D shape analyses, we found that the shape of the vertebral body and pedicles of humans with Schmorl’s nodes were statically indistinguishable from those of chimpanzee vertebrae. We hypothesized that some individuals have an ancestral vertebral shape that may be inadequately adapted for the strain placed on the spine during bipedalism, and thus increases their susceptibility to developing Schmorl’s nodes. Considering these findings, we initiated a more extensive investigation of vertebral shape, locomotion, and spinal health by analysing the 3D shape of the first lumbar vertebrae of humans, chimpanzees, and orangutans. Three-dimensional landmarks were digitized on each vertebra and the landmarks coordinates were analysed using geometric morphometrics. The data were regressed on log centroid size to minimize the influence of allometry and the regression residuals were subjected to principal components analysis, canonical variates analysis, and MANOVAs. Between-group Procrustes distances indicate that human vertebrae with Schmorl’s nodes were closer in shape to chimpanzee vertebrae than were human vertebrae without Schmorl’s nodes. These findings support the hypothesis that back pain may, in part, be due to individuals having a plesiomorphic vertebral shape which is relatively poorly suited to bipedal posture and gait.

Funding: Wenner-Gren Foundation, MITACS, Simon Fraser University, and the University of Liverpool.
Relationship between lean mass, fat mass, and limb bone cross-sectional geometry: implications for estimating body mass and physique from the skeleton

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Cross-sectional geometry (CSG) of the lower limb bones relates to body mass, presumably as bone adapts to in vivo loading. It is less clear how body mass components (fat and skeletal muscle mass) relate to bone properties, but theoretical relationships have been proposed and if these are correct, past trends in adaptation and health could be studied by estimating relative muscularity and adiposity from archaeological skeletons. Data on female athletes (n = 75 - distance runners, footballers, rowers) and controls (n = 31) were used to investigate relationships between body mass, its components, and lower limb bone CSG. Mean age was 24.0 ± 5.0 years and BMI (weight/height²) ranged from 15 to 33 kg/m². CSG of the femoral and tibial midshafts was measured by peripheral Quantitative Computed Tomography, skeletal muscle and fat mass were estimated by bioimpedance analysis, and body mass and stature were recorded. Relationships between total body, skeletal muscle and fat masses, and CSG of the femur and tibia midshafts were assessed by correlation and multiple regression. The results show that lower limb bone CSG is most strongly related to skeletal muscle mass (highest r = 0.72, for femoral total cross-sectional area, TA), followed by body mass (highest r = 0.64, for tibial minimum second moment of area, Imín), but relationships with fat mass are weak (highest r = 0.31). Our findings support theoretical links of bone geometry with skeletal muscle, but not fat mass, and indicate that lower limb bone CSG can be used to study past trends in skeletal muscle mass.

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Syphilis among the soldiers buried at the Queen’s Chapel of the Savoy, London

Authors: Paola Ponce¹, Lucy Sibun¹, Nathalie Gonzalez¹

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In 2011, Archaeology South-East (UCL) was commissioned to undertake an archaeological excavation at the Queen’s Chapel of the Savoy, City of Westminster, London. The excavations recovered 609 skeletons dating between 1552 and 1853. These were found in the chapel yard associated with the military hospital, later barracks and prison. The objective of this paper is to report on 6 possible cases of treponemal disease found in the skeletal population. The condition affected 0.9% (6/609) of the total population; three males aged 30-45 [153], [1077], and [1135], one adult male of unknown age [939], one possible female over 45 years of age [1767], and [819] a 13-19 years old individual of unknown sex. Pathognomonic signs of syphilis were represented by ‘crater-like’ lesions in the skull along with post-cranial periosteal manifestations in bone closer to the skin such as the tibia or the nasal cavity following diagnostic criteria outlined by Ortner (2003). Although syphilis is not mentioned in the burial registers historical records do suggest that sexually transmitted diseases were all too common amongst the Savoy soldiers. Other historical documents record that prostitution was the main source of employment for young women during the 18th century in London and that the Savoy was located at the heart of the busiest area. In line with the results obtained for sailors buried at the Royal Hospital Greenwich, London, the lifestyle of seamen and marines made them particularly vulnerable to contracting sexually transmitted diseases like syphilis. These historical facts offer a possible explanation for the slightly higher prevalence of syphilis amongst the Savoy population compared with other contemporary sites from London.
The Bioarchaeology of Diversity: a case study in the Roman Empire

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This poster presents a new project to explore migration—the geographic movement of people—and diversity—the intersection of different types of people—in imperial Rome. In the field of bioanthropology migration is often perceived in overly simplified terms. Researchers seek to determine if an individual or group migrated, and when in their lifetime this might have occurred. Furthermore, many scholars treat diversity in equally simplified terms. Traditionally, individuals are assigned to an ancestral population of “best fit,” despite claims that this practice is mostly inaccurate. Migration and diversity are complex, intertwined elements of the human experience. Therefore, it is essential that they be approached in tandem using multidisciplinary methods. This poster outlines the many methods available to examine migration in the past and identifies ways to incorporate them with evidence of cultural diversity. These include scientific approaches, such as biodistance, mtDNA, and isotope analyses, in addition to cultural approaches, such as the study of material goods, foreign dress, and funerary accounts of ethnicity, and finally, literary approaches, which document the opinions of native Romans and migrants. This project formulates a novel approach to interpreting migration and diversity, which will be tested on imperial Rome. In the future, these methods will be applied to case studies from across the Roman Empire, which was characterized by its diverse communities as a result of frequent conquest and large-scale population movements. The outcome will establish if this integrated approach allows for greater insight into the natural of population movement alongside the experiences of migrating and host communities.

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Evaluation of infectious middle ear disease from CT images of archeological crania

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Infectious middle ear disease (IMED) constitutes today a major health problem worldwide in both developed and developing countries and palaeopathological evidence has shown that humans have suffered globally from IMED for thousands of years. Evidence of IMED in archaeological populations has predominantly been macroscopically examined using the auditory ossicles, microscopically, or using X-ray imaging. Few studies have examined IMED using CT images. This study uses CT images to examine for evidence of IMED in archaeological skeletal material using two adult populations (n=91 and n= 59) from the Danish medieval period (1050 AD to 1536 AD). In total, fifty individuals (n= 24 and n=26) show osteological signs of IMED during childhood. The criteria for examining IMED is explained and illustrated in this poster together with a short discussion of issues with soil residues possibly mimicking sclerotisation from earth burials. In conclusion, the advantage of CT images is the 3D visualisation and this method being applicable to all adult skeletons with even fragmented crania, rather than using only individuals where the small and often missing auditory ossicles are found. This method could be further developed with a grading system of severity and with clarification of the borderline cases where IMED is expressed very slightly.

Funding: The Velux Foundation
The origins of neoplastic disease in the human fossil record: new evidence from Swartkrans, Malapa and Rising Star Caves

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Until recently, the reported incidence of neoplasia in the extinct human lineage was rare, and it was generally assumed that pre-modern incidence was rare and limited to benign conditions - new fossil evidence suggests otherwise. Hominin fossils from the South African sites of Swartkrans, Malapa and Rising Star have yielded primary osteogenic pathologies, including the earliest case of malignant neoplasia in the human record, with a case of osteosarcoma, dated to 1.7 Mya from Swartkrans. Diagnoses have been made possible only by advances in 3D imaging methods, in particular the use of high-resolution tomography. The expression of malignant osteosarcoma in the Swartkrans specimen indicates that there is no reason to suspect that primary bone tumours would have been any less frequent in ancient specimens. Such tumours are not related to lifestyle and often occur in younger individuals. As such, neoplasia (malignant or benign) has a considerable antiquity in the fossil record. This paper addresses the diagnostic methodologies employed, particularly the evaluation of palaeopathological and osteological criteria from tomographic volumes, and how this can be used to define pattern and process in pathological bone. We also discuss the growing body of evidence that neoplasias occur in almost all complex animals in the fossil record, suggesting that the mechanisms behind the disease have a very old evolutionary history. Malignancy and tumorigenesis is ancient and may be implicitly linked to the evolution of both bone and cartilage – and may thus be unavoidable consequences of development and skeletonisation in complex organisms.

Funding: NRF South Africa, University of Central Lancashire, UK

Health and the environment in Medieval London and Scotland

Author: Indigo Reeve

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It has been established in studies in both clinical and archaeological contexts, that variations in the physical and social environment have an impact on the health of populations. The aim of this project is to assess how large these differences in health impact are and how well they can be seen in archaeological populations. Samples of Scottish populations from three different medieval Scottish sites will be analysed. In addition the data from three medieval London sites in the Wellcome Osteological Research Database will be selected. Data on the demography, stature, and pathology of each population will be collected and compared. The Scottish sites are varied in that they are in different landscapes and have different exposure to external populations through trade links. Whitefriars is in Perth, a rural town. The Hirsel is a village on one of the major crossings of the River Tweed in the Borders. Constitution Street is in the port town of Leith. Now part of Edinburgh at the time it was the port that served the capital. The London sites are all populations from an urban centre larger than any contemporary settlement in Scotland. Research will be undertaken into the history and environments of the sites and the differences between them. The data will then be compared to discover to what extent the hypothesis is correct. The expectation is that the differences in the physical and socioeconomic environments of the sites will have impacted the health of the population and that this will be visible in the skeletal remains. Comparative studies such as this provide a way to examine hypotheses about population variation and health that can reveal information case studies cannot and give time depth to modern clinical concerns.
Osteobiography and history: finding the unknown poor, and what they tell us about history

Authors: Alice Rose, Sarah Inskip, Craig Cessford, Jenna Dittmar, Ben Haines, Toomas Kivisild; Piers Mitchell, J. Robb, Christiana Scheib, Jay Stock, W. Wohns, Mary Price, Chris Rynn

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Osteobiographies provide a humanistic window into the past, but are not used as a bioarchaeological research tool. This paper explores how reconstructing the life of a 13th century man can unlock larger histories. Bioarchaeology is revealing about factors of life unaccounted for in historic sources, especially for the population majority: the working class and poor. This includes diet, disease, health, and activity. However, research is often monotypic and/or data is pooled to create population averages, ultimately obscuring sample heterogeneity. Taking an osteobiographical approach permits assessment of relationships between data allowing analysis of contingency, providing greater depth to reconstructions and improving our understanding of the past. We explore this via examination of ‘Feature 958’, a man buried in Cambridge in the 13th century. He was over 40 years when he died and was interred in the cemetery of St. John’s Hospital, a charitable institution for destitute people. He had typical and atypical skeletal traits, which combined were particularly revealing about his life. Most notable was the conflict between burial at a poor institution and isotope values indicative of a diet rich in animal protein. Combined this suggests a more affluent life than his burial location hints. Based on this several possible lives were reconstructed for the man, all of which underline the role of contingency in medieval life. As close-up history, these reconstructions give insight into the vicissitudes of life among the silent poor; they give us “a past with faces”, motivations and goals, not a homogeneous, passive mass, and they help us understand why medieval society may have reacted to historical events in the way they did.

Funding: Wellcome Trust

Ethics and archaeological human remains: let’s take a step back

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There is no doubt about the contribution bioarchaeology has made to understanding the lives and deaths of our ancestors, and to archaeology as a subject. Over the last 30 years in the UK alone there has been a meteoric rise in the number of people working in bioarchaeology, and this has gone alongside rapid developments in available analytical methods, and dissemination of data via social media. We are now able to say much more about the skeletons we study than we ever could and this is mainly due to biomolecular analyses. However, some of these analyses require the partial or total destruction of skeletal elements. That said, and the benefits of such techniques understood, it is perhaps time to step back and reflect on this kind of research, whether it has become “too routine” and “automatic” (and a quick pathway to a Nature paper?) without more consideration being paid to the ethics of such research, and if some open debate and discussion is needed within and without our community. This paper will focus on the benefits and costs of destructive analyses, the ethics and extant guidance available for such work, curatorial responsibilities for human remains in museums and other institutions, and some suggestions for taking a more ethical stance.
Osteitis Pubis...Contributions to Bioarchaeology and Forensic Anthropology

Authors: Emma Louise Saunders¹, Dr Nicholas Márquez-Grant¹

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Osteitis pubis (also known as pubic bone stress injury) can be defined as an overuse stress injury found in athletes. It is known to cause osseous changes to the pubic bones, particularly at the pubic symphysis. Originally described following pelvic surgery and parturition, this condition is now commonly associated with physical activity. It is believed that the mechanism of injury is repetitive microtrauma caused by an imbalance between the effects of the adductor and abdominal muscles at the pubic bones. This research looks to form set recording criteria to allow a consistent approach in the identification of osteitis pubis on skeletal remains and to increase awareness of this condition within the disciplines of bioarchaeology and forensic anthropology. In order to achieve these aims the recording criteria were determined using pelvic imaging from a living population, to assist in the identification of this condition on bone. Increased knowledge of this condition could assist in understanding its effect on the formation of age estimations and help to form interpretations on the lifestyle of past populations. In addition to this further understanding of how this condition affects the bone could assist in forensic investigation for age estimations and provide an additional unique identifying feature.

Syphilis in the Netherlands. Dating and provenance of three syphilitic individuals from Kampen

Authors: Rachel Schats¹, Lisette M. Schats², Menno L.P. Hoogland¹

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The origin of venereal syphilis is heavily debated subject for many years. The hypothesis that Columbus introduced this disease to Europe is supported by many pre-Columbian cases in the New World. The evidence for cases of syphilis predating AD 1493 in Europe is much more scarce. Recently, however, osteological analysis of skeletal remains from an infirmary (AD 1300-1600) in Kampen, the Netherlands revealed three individuals with lesions pathognomonic for syphilis. To gain a better understanding of syphilis in The Netherlands and to contribute to ongoing debates on the origin and spread of the disease, this research aimed to securely date and estimate provenance for the three individuals using AMS dating and strontium and oxygen isotope analysis. Results of the 14C demonstrate that two individuals likely predate 1493, although a later date cannot be ruled out completely. One individual does clearly predate Columbus’ return (AD 1304-1423). Isotopic data support a local origin for one individual, but a non-local, although possibly still Dutch, origin for the others. This pioneering research on the dating and provenance of syphilitic individuals contributes to the ongoing debates on the origin of syphilis and is a starting point for future work into the introduction, spread, and impact of the disease in the Netherlands.

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A Review and Comparison of Paleoepidemiological Studies on Neoplastic Disease

Author: Thomas Siek

Affiliation(s): University College London

The majority of paleopathological neoplastic research has been centered on individual case reports. As a result, paleo-oncological research regarding past trends and frequency has been hindered by the lack of large-scale paleoepidemiological studies. In past decades there have been a small number of published reports and they differ in their methodological approach and form of analysis. As a result, these past studies remain separate entities in paleoepidemiological scholarship. This presentation aims to review and compare these studies in order to help develop a clearer consideration of neoplastic prevalence in the past. Previously published studies were gathered from noted anthropological, archaeological, and paleopathological academic journals, and their methods and results were collated and compared. Few report on age-specific prevalence and they limit themselves by excluding benign neoplasms, children, and partial skeletal remains. Some only look at the amount of previously published case reports in the paleopathological literature and many do not discuss the number of expected cases compared to the number of those observed. Most importantly, each study reported only the crude prevalence rather than employing a confidence interval to determine an upper and lower range of true prevalence. Using available data from these studies, a confidence interval was calculated for each study to allow for a more in-depth comparison of statistically significant differences. Paleoepidemiological research on neoplastic disease requires further standardization of methods and analysis to allow for a richer interpretation and the benefit of future paleo-oncological research.

Forensic Anthropology in Zimbabwe contexts, Exhumation of mine shafts

Author: Keith k Silika

Affiliation(s): Staffordshire University

Zimbabwe is a former British colony that achieved its independence from Great Britain in 1980. Since 1966 four different democides have occurred; Liberation war (1966-79), election violence (1980- ), Matabeleland pogroms (1982-87), and blood diamond deaths (2008- ). These conflicts have resulted in the death of over 50,000 people some of whom are buried in mass graves, dip tanks, curves, pit latrines, individual graves, and disused mine shafts. Using a case study of the William Mine exhumation, were over 600 human remains were disinterred in Mt Darwin, Mashonaland Central in 2011, this poster is going to provide a forensic anthropological overview of the difficulties associated with mineshaft exhumation within a Zimbabwean context. This mine shaft has been left open since the 1980s and there has been dispute with regards the perpetrators and victims, influenced partly by political actors and lack of forensic expertise. During the exhumation, the government claimed that the remains belonged to victims of the liberation era whilst the opposition claimed the remains belonged to their members from the 2008 election violence. Thirdly, the Zimbabwe Peoples Liberation Army (ZIPRA), one of the guerrilla armies who fought the war of liberation, claimed the remains belonged to their members. This was later supported by court action to stop the exhumation which was however ignored. To add to the confusion, the persons carrying out the exhumation did not have the relevant skills and training. According to Amnesty International, some remains still had body fluids and contemporary football regalia. This research aims to highlight the problems surrounding exhumation without consideration to taphonomic indicators.
Moments of inertia and cross sectional properties: an integrated method in the evaluation of bone functional adaptation

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The concept of bone functional adaptation (BFA) implies that bones are highly reactive during their lifetime, adjusting their architecture according to mechanical environment. Bone morphology reflects mechanical loadings occurred in vivo. This important relationship between bone geometry and strains has been widely used by anthropologists and bioarchaeologists to study behaviour patterns of past populations, through the analysis of the properties of the cross sectional geometry (CSGP) of long bones. The aim of this study is to investigate a new kind of properties, the moments of inertia (MOI), in differentiating populations according to their level of BFA. Their sensitivity was compared with CSGP. MOI quantify the rotational inertia of one object along the three space axes. Modern and historical populations samples from Friuli (North-East of Italy) and Slovenia were compared which activity patterns were already known based on previous researches. The study focused on both lower and upper limbs: on one side right midshaft femurs were considered, on the other both right and left proximal humeri. The bones were scanned using multi-detector-computed-tomography. 5 cm-high bone cylindroids were obtained through a process of image segmentation. The outcomes revealed that MOI were more sensitive than CSGP in differentiating samples according to their level of use of the limbs. This was highlighted for both femurs and humeri. Moreover, the two types of properties did not show high degree of correlation. MOI might represent a new technique in the evaluation of BFA: they could sustain CSGP, providing additional data and leading to a new integrated method in the analysis of bone (re)modelling.

Assessing the effect of bone storage on DNA preservation

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The progression of the use of aDNA analysis for the expansion of archaeological knowledge is limited to a certain extent by the lack of understanding of good practice and methods in storing bone after excavation. Using powdered samples from modern chicken bones, three temperatures were tested (19C, 25C and 37C) alongside with humidity in a four-month experiment. Four replicates per sample were collected every 30 days. Untreated control samples were kept in the freezer at -20°C for the duration of the experiment. DNA was extracted with an Omega Bio Tek E.Z.N.A Tissue DNA kit and DNA concentration measured with a ThermoScientific NanoDrop Lite Spectrophotometer. The results of the experiment were analysed with SPSS. The study concludes that the presence of humidity accelerates the degradation of DNA and that storage at all temperature conditions cause significant degradation in the initial two months of exposure when compared with storage at -20°C. Significantly, there appears to be no statistically significant degradation of DNA after the initial two-month period for the following two months of the experiment. These results demonstrate that there is a need for the careful treatment of bones following their excavation or beginning of storage with regard to DNA preservation. The results of this research also warrant more research into more specific optimum storage conditions for bones for the preservation of DNA, especially concerning humidity, and recommend a revised look at the current guidelines and procedures for storing bone material.
Dealing with Data: an investigation of current guidelines & perspectives on the ownership and use of 3D digitisations of human remains

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Handling human remains requires high standards of ethical and professional conduct. The rapidly increasing use of 3D digitisations raises additional concerns over the ownership, use, and ethics of different data formats. Despite this, there are still no standard data collection protocols for digitising human remains. Research agreements that are employed by archaeological and anthropological collections often fail to consider 3D data. An online questionnaire queried current perspectives on different data formats, experiences with the 3D digitisations, and current protocols employed. It targeted curators and collection managers, and researchers using human remains and/or 3D data. The aim of this research is to assess how views concerning the ownership, use, and ethics of 3D data may affect its application. Additionally, this data will help understand how to maintain the highest ethical treatment of human remains. This project will conclude in the development a standard 3D research protocol guideline. The preliminary results identify three key areas of concern in 3D data collection. Firstly, research agreements. The results confirm the current lack of standard protocols, as well as significant disparity between current practices for data collection. Secondly, establishing clear ownership. The ‘owner’ of archaeological human remains continues to be an issue of some contention. However, digitisations also need to consider the ‘collector’ of that data, in a similar vein to photographs. And finally, data use. The results showed that permitted usage did not match the considered ownership of the data. This is further evidence of the discrepancies in current practices, and subsequent need for standardisation.

Preliminary isotopic studies from pre-Columbian hunter-gatherer individuals of northeastern Brazil during late holocene.

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The excavation of Pedra do Cachorro archaeological site, located in the interior of Pernambuco state, northeastern Brazil, revealed -until now- skeletal remains of two male adults that presented radiocarbon dates 760 +/- 30 BP and 3560 +/- 30 BP, and a child, around 3 years old, dated in 1470 +/- 30 BP. To elucidate aspects of the diet practices of these pre-Columbian hunter-gatherer populations from northeastern Brazil, with few information about, this preliminary study presents carbon and nitrogen stable isotope analysis of bone collagen of these three individuals. Collagen extraction and isotopic analysis were done at Geochron Laboratory of Universidade de Brasilia, Brazil and Beta Analytic, USA. C:N was monitored for collagen preservation. Using isotopic studies from other pre-Columbian inland Brazilian groups as a baseline for carbon and nitrogen pattern, the adults from Pedra do Cachorro presented results compatible with a significant consumption of terrestrial local fauna such as Mazama and Pecari. The child presented a higher δ15N that could be associated with breastfeed practices and are probably not related with a marine diet. Although other diet related analysis with fauna are still being processed, isotopic results of these individuals that lived in the region during different periods, suggest a long-term maintenance of diet practices, probably related with hunting practices of small and medium size mammals.

Funding: FUMDHAM / INCT-INAPAS / UFPE / CAPES-PNPD
The estimation of human living stature from foot measurements in the British population

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Identification of an individual is an important task in the medico-legal environment, especially in cases where mutilated remains are present. Researchers have developed methods of estimating stature from skeletal measurements; however, there are not many reliable methods of estimating living stature. This study aims to develop a method of accurately estimating human living stature from various foot measurements: These measurements are foot length (FL), toe width (TW) and heel width (HW). 30 participants between the ages of 19 and 71 were recruited from Cambridge, UK, and their living stature was measured along with the foot measurements (FL, TW, and HW) from both left and right feet. No significant difference was found between age groups (18-25, 26-40, & 41-60) for both stature and foot measurements in males and females. The measurements male left foot length (MLFL), male left foot heel width (MLFHW), male right foot length (MRFL), female left foot length (FLFL), and female right foot length (FRFL) were found to show a significant correlation with living stature. Equations were developed with varying degrees of success: Individual regression equations for the estimation of living stature from foot measurements had prediction errors of ±4.91cm to 6.13cm in males and ±3.09cm to 3.33cm in females. Multiple regression equations had error ranging from ±4.78cm to 5.05cm in males, and an error of ±3.21cm in females. Generalised equations were also developed with errors ranging from ±5.54cm to 5.67cm: Prediction rates from all equations ranged from 40% to 80%. The study provides regression equations for the estimation of living stature from foot measurements; however these can be greatly improved upon due to the high errors.

An investigation of fractures and polio infection: a case study from a modern Cretan collection

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During the Edinburgh Unit for Forensic Anthropology (EUFA) 2017 field school season, students assessed a skeletal collection from the St. Konstantinos and Pateles cemeteries of Crete dating to the 20th Century. The burial collection has known age and sex demographics. Analysis of these burials revealed that a male, 75 years of age, demonstrated several severe skeletal defects. This presentation provides an assessment of these defects. The left humerus displayed a complete fracture of the anatomical neck. As a result, the humeral head detached from the shaft and became dislocated from the shoulder forming a false joint. The false joint is located several centimetres from the original joint position and involves the humeral head, glenoid fossa, and humeral shaft. The left femur also exhibited a fracture of the femoral neck and a fracture of the left greater trochanter. This resulted in an unusual reunion of the femoral neck to the shaft and of the greater trochanter to the femoral shaft. There is no evidence of medical intervention for any fractures. These fractures appear to have resulted from a single impact event. Active infection is present bilaterally at the medial clavicle and in several cervical, thoracic and lumbar vertebrae. In addition to the trauma, the individual displayed considerable lower leg bowing of both the tibiae and fibulae. The distal antero-lateral surface of the tibiae and the lateral fibulae are significantly flattened. We suggest that the bowing of the lower leg bones is the result of a polio infection. This diagnosis is supported by the presence of the flattening of the distal fibular ends that is consistent with prolonged use of metal leg braces.
The Differential Diagnosis of Hallux Valgus and Gout in Skeletal Remains

Authors: Heather Marie Tamminen¹, Elizabeth Craig-Atkins¹

Affiliation(s): Department of Archaeology, University of Sheffield¹

The skeletal effects of two or more different pathological processes can initially appear identical. This situation necessitates research to characterise distinguishing features that will enable accurate differential diagnosis. Hallux valgus (HV) and gout present very similar skeletal manifestations yet have distinct aetiologies. HV is afforded little attention in osteological literature and therefore may be incorrectly identified as gout. This project aimed to identify a reliable means of differentiating the two. Operational definitions were generated by consulting multiple osteological and palaeopathological resources. A collection of over 100 late mediaeval adult skeletons from Warwick was examined for this project. Although the location of gout and HV lesions on the medial head of the first metatarsal is the same, the edges and floor of the lesions in each case have subtle differences. There are additional pathognomonic features that aid in diagnosis. Gout can present with lesions at other joints in the body whereas additional lesions are uncommon in HV and when they do occur, they appear on the lateral head of the fifth metatarsal. HV can also present with alterations that look similar to osteoarthritis with eburnation of the plantar surface of the first metatarsal head as well as possible morphological changes to the joint surface. Due to the differences in aetiology of these two pathologies, distinguishing them is vital to understanding lifeways of both individuals and their wider communities.

A re-analysis of the middle Pleistocene hominin-like footprints from Vértesszőlős, Hungary

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Affiliation(s): Liverpool John Moores University¹; Kobe University²; Research Fellow of the Japan Society for the Promotion of Science³; Hungarian National Museum⁴

The Vértesszőlős quarry is located in North West Hungary, where the Paleolithic ‘Samu’ hominin fossil remains (Homo heidelbergensis) were found. The site is dated between the Early and Middle Pleistocene (ca. 500-350ka). In 1967, a surface of calcareous mud was excavated a short distance from where the ‘Samu’ hominin remains were found, exposing numerous fossil tracks made by a range of mammals and birds. Of particular interest here are three elongate impressions, two successive and one isolated. These tracks have previously been referred to in the literature as both hominin in origin, and as being produced by a small bear. Since bear pes prints can resemble human footprints, we attempted to discern the 3D morphology of the traces quantitatively, using digital photogrammetry. Our analysis shows that one of the prints is most likely the product of two superimposed hoof prints from an ungulate. However, the two successive prints are more problematic. The highly weathered surface has made interpretation especially difficult. Both impressions seem to possess a narrow, rounded end similar to the heel of a human footprint. The impressions are broader on the opposite end, and bounded by smaller impressions that could be interpreted as toe marks. However, the imprints vary considerably in their length/width ratios, and are too widely spaced to form part of a single biped trackway. It is conceivable that one or both of these impressions are highly weathered hominin tracks. However, given the highly weathered nature of the exposed surface, and the lack of clarity in the prints, we cannot at this time confidently attribute the prints to any specific track maker based on our digital models of the prints.

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A Palaeopathological Approach to Commingled Human Remains: case studies from the Xagħra Circle Hypogeum, Gozo

Authors: Jess E. Thompson¹, Ronika K. Power², Bernardette Mercieca-Spiter³, Jay T. Stock⁴, Rowan McLaughlin⁵, John E. Robb⁶; Simon Stoddart⁷; Caroline Malone⁸

Affiliation(s): University of Cambridge¹; Macquarie University²; Superintendence of Cultural Heritage, Malta³; Queen’s University Belfast⁴

Among the various methods to identify individuals from commingled remains, the utility of pathological conditions is under-discussed in the bioarchaeological literature. While of obvious importance for victim identification in forensic cases, the analysis of pathological lesions in large assemblages of archaeological human remains is often undertaken primarily to characterise population health. However, possible additional benefits include the opportunity to unite the remains of disarticulated individuals through the identification of pathological lesions of similar pathogenesis. This is demonstrated through two cases of possible individual identification from the Xagħra Circle hypogeum on Gozo. The underground burial complex was in use from 3700-2300 cal BC and contained the remains of an estimated 750-900 individuals, most of whom were disarticulated in a long cycle of post-depositional mortuary rites. In one context, the partial remains of at least two individuals exhibiting extensive periosteal new bone formation—one adult and one child—were deposited in discrete areas of commingled bone. A total of 6 adult long bones and 6 juvenile cranial and post-cranial remains present periosteal reactive bone. Most of the elements are fragmented, although re-fits are observed, and they are of fair-good cortical preservation. Healing and active lesions are observed on most elements, suggesting chronic illness. It is hoped that CT-scanning will shed light on both the number of individuals represented and the differential diagnosis. Combined with taphonomic analysis of the human remains and a programme of radiocarbon dating, we hope to contribute to the ongoing discussion of analytical methods to approach commingled assemblages.

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Dental pathology, wear, and developmental defects in fossil hominins and extant primates

Authors: Ian Towle¹, Joel D. Irish¹, Isabelle De Groote¹

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Studying different types of dental pathology, wear and developmental defects can allow insight into diet and behaviour in a variety of ways. In this study data on these different variables are collected for South African hominins and extant primates. The species studied include Paranthropus robustus, Australopithecus africanus, A. sediba, early Homo, Homo naledi, baboons, chimpanzees and gorillas. Macroscopic examination of each specimen was performed, with a 10X hand lens used to verify certain pathologies. Variables recorded include chipping, occlusal wear, caries, tertiary dentine, periodontal disease, and enamel hypoplasia. Clear differences in frequencies are found between different South African hominin species. The most noteworthy of these include the high levels of pitting enamel hypoplasia in P. robustus molars compared to other species, likely due to a species-specific enamel formation property or developmental disturbance. The low rates of chipping in P. robustus does not fit with this species being a hard food specialist. Instead, the wear best supports a diet of low-quality tough vegetation. Homo naledi displays high rates of chipping, especially small fractures above molar wear facets, likely reflecting a diet containing high levels of contaminants. Australopithecus africanus likely had a broad diet, with angled molar wear, lack of caries, and high chipping frequencies supporting this conclusion. Seven new carious lesions are described, two from H. naledi and five P. robustus. Other, rarer, pathologies are also highlighted, including abscesses in an early Homo individual, root grooves caused by erosive wear in A. africanus and a case of amelogenesis imperfecta in a female chimpanzee.

Funding: Liverpool John Moores University
The Hand of Medieval Justice: an archaeological example of a Leibzeichen from Petrikirche, Berlin

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Between 2008 and 2015, excavations within the cemetery of Petrikirche, the earliest church in Berlin, uncovered the remains of almost 4000 individuals within single and multiple graves. One of these graves, Burial 4211, was highly unusual in its structure and contents. It was a small shallow pit containing the remains of a single articulated hand with small fragments of the distal radius and ulna. Skeletal analysis determined that the hand was from the right side of an adult of indeterminate sex and had been severed by two chopping blows, directed from the anterior and posterior, to the distal part of the distal upper limb. There was also a third chop to the palmar surface of the hand that had possibly been made with a different implement. A number of different interpretations for the presence of this isolated hand in a medieval cemetery were suggested, including punitive or medical amputation, or interpersonal violence. However, the pattern of trauma and the burial context would argue against these. Another possibility was that the remains represent a phenomenon known as “Leibzeichen”, which is the preservation, by pickling, drying or smoking, of part of a murder victim to act as a corpus delicti in court proceedings. There are a number of surviving German examples of presumed Leibzeichen and comparison between these and the hand from Petrikirche suggests that the latter does indeed belong to the same category. If this is indeed the case, it is an extremely rare finding as it would be only the second example from a secure archaeological context. Further work to compare the radiocarbon and stratigraphic dating and chemical analyses that might indicate deliberate preservation are also proposed.

16th century Salmonella enterica genomes from Teposcolula-Yucundaa - an early contact era epidemic cemetery in Mexico

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Indigenous American populations experienced high mortality rates during the early contact era as a consequence of infectious diseases, likely introduced by Europeans. Most of the pathogenic agents that caused these outbreaks remain unknown and are highly debated, which is additionally complicated by the fact that few infectious diseases cause idiopathic lesions to form in the skeleton, and historical evidence often lacks precision in implicating specific pathogens. Here we have applied a new fast and sensitive metagenomic tool called MALT to search for traces of ancient pathogen DNA in individuals buried in an early contact era epidemic cemetery at Teposcolula-Yucundaa, Oaxaca in southern Mexico. This site is linked to the 1545-1550 CE “cocoliztli” epidemic, which affected large parts of Mexico. Using MALT we were able to identify Salmonella enterica DNA in three individuals. We present two complete high-coverage ancient genomes for Salmonella enterica serovar Paratyphi C, a bacterial cause of enteric fever. We analyzed our ancient genomes in the context of modern S. enterica strain variation to assess phylogenetic relationships, as well as the presence and absence of virulence factors. We propose that S. Paratyphi C contributed to the decline in population size sustained during the 1545 “cocoliztli” epidemic at Teposcolula-Yucundaa. This study represents a first step towards a molecular understanding of disease exchange in early contact era Mexico.

Funding: The Max Planck Society, the European Research Council (ERC)
Puberty and Adolescent health in Post Medieval England

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This project aims to assess the health of post medieval adolescents through the use of osteological, archaeological, and historical sources. Individuals from the ages of 10 to 25 years were chosen to fully encompass the entire duration of puberty from initiation to completion. For this project the post medieval period covers the years from AD1550 to AD1850 due to the significant demographic changes in mobility, urbanization, and industrialization and their impacts on health. While there has been recent research on health and diet during the post medieval period, puberty, and the growth of early adolescents (Mant and Roberts, 2015; Lewis et al. 2015; Newman and Gowland 2016), there is relatively little research on adolescents during the post medieval period outside the city of London. This project attempts to address this gap in scholarship through the physical analysis and evaluation of adolescent human remains throughout England to document the stages of puberty and identify trends and differences in health among the population. In order to trace adolescent health, this project reviews the markers for non-specific stress and examines historically prevalent metabolic and infectious disease for the effects that they would have on the overall health and pubertal development of adolescents. This project has also collected an amalgamation of secondary skeletal sources from throughout the country in order to form a comparative database and further our understanding of the overall state of health of adolescents despite the lack of pubertal information.

Intra- and inter-population variation among the Medieval English: a preliminary craniometric study

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Craniometric characteristics can be used to reconstruct within- and among-group variation, potential migration routes and ancestral origins. This pilot study analyses a set of cranial measurements collected from 91 individuals from the English Medieval collections curated at Liverpool John Moores University (UK). The sites were selected according to their chronological affinity but contrasting cultural backgrounds: Poulton (Cheshire) was a rural community, while Linenhall (Cheshire) and Gloucester (Gloucestershire) were from an urban context. Principal Component Analysis (PCA) was performed on a set of 16 cranial measurements to understand the variation among the three English samples. From this, a comparison was then made between the Medieval English sample (n=91) and three European samples from WW Howells’ databank: Norse (Medieval Oslo), Berg (Carinthia region, Austria) and Zalavar (Western Hungary, 9th-11th Century) (n=309). The first step of the study demonstrated that there is no substantial variation between the three British samples, because the samples overlap. This affinity was likely due to the spatial proximity of the sites. Results of the comparison between the English and the other European samples created a similar outcome, as the British sample overlays the European samples.
Deviant burial in Roman Tongeren, Belgium

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Recent excavations in Tongeren (Belgium), resulted in the unexpected discovery of human bones among Roman settlement remains and in the 4th century moat. The scattered remains of minimum three perinates were recorded in nine features, alongside house foundations, in a pit, a cess pit and layers. Radiocarbon dating placed two contexts in the 1st to early 3rd century AD. The discovery indicates the separate treatment of new-borns and infants in Roman society who, contrary to older individuals, could be buried within settlements. The discovery of the remains of minimum three adults in four contexts is unusual however, based on the location and manner of deposition. A primary deposition of a prone male was recorded at the bottom of the 4th century moat and dated to the late 4th-first half of the 6th century AD. Two depositions, in the moat and in a demolished hypocaustum, consisted only of cranial remains, both male. The cranium in the moat showed a possible peri-mortem penetration fracture and was dated to the second half of the 3rd-late 4th century AD. The other cranium could be late Roman or early medieval and was found within the settlement. Disturbed post-cranial remains were discovered in a ditch in the settlement. They may represent a disturbed or secondary deposit and were dated to the second half of the 4th-first half of the 6th century AD. The location of the adult remains outside regular burial grounds indicates a deviant background or circumstances of death. Based on their environment and manner of deposition, the remains may be associated with outsiders or individuals with a liminal status, accidents, clandestine or ritual depositions, while the possible peri-mortem trauma indicates violence.

Osteoporosis - a Modern Lifestyle Disease? An Interdisciplinary Study in Past Northern Europe

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In recent years the prevalence of osteoporosis-related fractures and its disease burden have increased significantly. Research into its pathogenesis indicates that osteoporosis is a complex disease, caused by a combination of environmental factors and genetic predisposition. Paleopathological studies into osteoporosis suggest that osteoporosis rates in the past varied between different cultures and time periods. However, most of these studies have focussed solely on lifestyle or life history events as the main etiological factor, providing valuable but limited insights. This recently started project aims to study prevalence rates of osteoporosis in three skeletal collections dating from the late Neolithic to the Medieval period in Scandinavia, and to characterize the interaction between lifestyle and genotype in the development of osteoporosis. The skeletal collections will be scanned using a pQCT scanner in order to assess differences in bone mineral density and to identify diagenetic processes. Osteological analysis, focussing on pathology, stable isotope data, as well as archaeological contextual information will provide both individual and population specific information on lifestyle. In addition, a selection of single nucleotide polymorphisms associated with bone mineral density will be targeted to assess whether there are differences between past and modern populations in the genetic predisposition for osteoporosis. Studying these variables in populations from periods ranging from prehistory to the Medieval period, will facilitate a more complete and unique understanding of the development of this disease from the past to the present, and will help answer the question: is osteoporosis a modern lifestyle disease?

Funding: The EU Framework Programme for Research and Innovation Horizon 2020 under Grant Agreement No 676154
One Last Drop? Assessing evidence that an individual from post-medieval Manchester suffered from Alcohol Use Disorder

Author: Rebecca Venn

Affiliation(s): Durham University

This project aimed to identify the skeletal indicators of Alcohol Use Disorder (AUD) and determine the likelihood that a post-medieval individual suffered from AUD. Excavations of an 18th-19th century former chapel in Hazel Grove, Manchester identified an individual named Margaret, who died aged 88, with pathological changes possibly resulting from alcoholism. This project summarised clinical literature, identifying the effects of alcohol on bone cell processes and hormones as well as the resultant pathological changes as identifiable macroscopically. These pathological changes were compared to those identified on Margaret’s remains. Additionally, a range of contextual evidence including songs, government legislation and prints were summarised. The main direct pathological consequences of AUD with severe drinking are osteoporosis, fractures with delayed healing, infection, and osteonecrosis of the femoral head. Margaret potentially had osteoporosis, had extensive fractures and had periosteal reactions and osteitis/osteomyelitis present. There are no pathognomonic changes for AUD with heavy drinking, making identification reliant upon a suite of pathologies, in conjunction with contextual data. Several the pathologies associated with AUD are identifiable on Margaret’s remains. Furthermore, heavy alcohol use was widespread in the 18th-19th centuries, particularly for low to middle status individuals such as Margaret. Hazel Grove was known for a high frequency of ale-houses and taverns and it is thus plausible that Margaret suffered from AUD with heavy alcohol consumption. Differential diagnoses, include osteomalacia, elder abuse and a combination of these with AUD.

Friend or Foe: bioarchaeological analysis of individuals from a Spanish War (1568 – 1648 AD) mass grave from Boksum, the Netherlands

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During construction activities near Boksum in the province of Friesland, the Netherlands, a mass grave was discovered. The pit contained at least seven individuals, who were buried on top of each other without a specific burial position or grave goods. Historical sources report a 1586 AD battle near Boksum between the Spanish Royal Army and the Dutch Rebel Army, that comprised mostly of Frisians and included a large number of local volunteers. In the Battle of Boksum, about 1000 rebels were slain of which most human remains were never found. The aim of this research is to determine if these individuals indeed were victims of the Battle of Boksum and to establish whether the remains belong to the Dutch or the Spanish side. Radiocarbon dates confirm the human remains to be from CalAD 1520 – 1640 Cal AD (68,2% probability). Osteoarchaeological analysis showed the remains to be from young individuals with ages-at-death ranging from 12 years to 20 years and the sex of the adults (n = 2) was male. One of the individuals displayed ballistic trauma to the cranium and one other individual presented with sharp force trauma to the skull. The lack of other skeletal trauma and the relative young age-at-death of the individuals suggest them to be part of rather the local resistance than of the Spanish Army. Strontium and stable oxygen isotope analyses of enamel suggest that these two individuals are of Dutch origin, although it is not possible to exclude all regions of Spain. This paper demonstrates that the use of osteoarchaeological and stable isotope analysis can contribute to our understanding of historical events such as the Battle of Boksum.
Prehispanic population dynamics in the Central Coast of Peru: evidence from dental morphology

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Archaeological evidence from Prehispanic Peru has been used to support multiple migrations throughout the region. These occurred for various reasons, from military conquest to religious pilgrimage (i.e. the oracular site of Pachacámac in the Central Coast). This study tests whether migration can be supported, as the cultural evidence is necessarily ambiguous given the possibility of trade networks and patterns of influence. The use of dental morphology could provide a comparatively neutral perspective, and permit us to determine whether it was people – or just goods – that were moving. A total of 173 permanent dentitions from 4 different groups were analysed, using 20 dental non-metric traits as defined by the ASUDAS (Arizona State University Dental Anthropology System). The sample spans 1600 years: a Pre-Lima group (Tablada de Lurín, n=25), a Lima group (Huaca Pucllana n=10; Huaca 20 n= 50), an Ychsma group (Pachacámac, n=51) and an Inca group (Pueblo Viejo-Pucará, n=37). The data obtained was processed using descriptive (frequencies) and multivariate statistics (Principal Components Analysis, Multidimensional Scaling and cluster analysis). All multivariate methods indicate a distant Inca group, with the Ychsma group being equidistant from Pre-Lima and Lima groups, and a quite notable distance between the Pre-Lima and Lima groups. This suggests that there was biological continuity between the Pre-Lima, Lima and Ychsma, and a discontinuity between these three and the Inca group. This is the first time that population movements during the late Inca period have been demonstrated biologically, as well as the significance of local trajectories.

Early Neolithic life, death, and burial in the Central Zagros region of Iraq

Author: Sam Walsh

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Ongoing excavations at the Early Neolithic (10,000-7500 BC) site of Bestansur, Iraqi Kurdistan, have revealed numerous human skeletal remains and complex mortuary practices. In addition, there is extensive evidence for buildings, domesticated animals, and transported materials including carnelian, obsidian, and sea-shells, establishing this site as one of the most important Neolithic settlements in Iraq. At least 65 individuals have been found in Building 5, in various states of disarticulation, with few complete flexed burials. Contextual and taphonomic evidence indicates that the human remains were manipulated and managed as part of extensive mortuary practices where the living interacted with the dead. Over half the assemblage is made up of juvenile individuals, the majority of which are infants, this in tandem with the pathological evidence may relate to wider patterns in health, environment, and diet. As part of this project standard osteological methods and non-destructive microscopic and imaging techniques will be used to answer questions on: -the curation and deposition of the remains-health and diet in social groups These questions will be related to the wider context of the Neolithic transition of the eastern Fertile Crescent.

Funding: The Wainwright Fund, the National Geographic Society, the British Institute for the Study of Iraq
Osteoarchaeological and taphonomic analysis of Neolithic and Bronze Age human skeletal remains from Heaning Wood Bone Cave, Great Urswick, Cumbria

Authors: Keziah Warburton, Patrick S. Randolph-Quinney, Clare Bedford, Jennifer C. Randolph-Quinney, Martin Stables, Rick Peterson

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Heaning Wood Bone Cave is a vertical shaft into a complex karstic fissure system. Infilling events are multidirectional with a depositional talus forming under the vertical fissure, as well as secondary infilling at the base of the cave. First excavated in 1958 by Holland, it yielded remains of three adults and a juvenile, together with an extensive fauna including Bos, Sus and Canis. Artefacts included lithics, a fragment of cremation urn, and a bone pin. 14C places these within the Early Bronze Age. Recent work initiated by Stables has expanded the skeletal assemblage and a detailed analysis is ongoing. The cave is now the subject of detailed recovery of sedimentological, spatial, and bioarchaeological data using the same digital recovery and recording protocols applied at Rising Star Cave, South Africa. 3D modelling of karst structures, coupled with spatial analyses of bone clasts is being undertaken as excavations continue. We report on the results of osteological and taphonomic analyses of recently recovered human remains from the talus cone, together with a broad overview of the faunal components of the assemblage, including microfauna and invertebrates. Human remains comprise adult, juvenile and foetal material, with traces indicative of a complex taphonomic history. In particular, high relative abundance of manual and pedal elements, together with a lack of evidence for transport of material within the cave system, suggests bodies were deposited whole into the fissure. Based on the taphonomic analyses we compare behavioural and site formational markers within the assemblage with deposits of coeval date elsewhere in the North and Northwest of England.

Funding: School of Forensic and Applied Sciences, University of Central Lancashire

A Multidisciplinary Osteobiography of Human Remains from Rushen Abbey, Isle of Man

Authors: Marie Weale, J Buckberry, A Fox

Affiliation(s): University of Bradford; Manx National Heritage

Skeleton C was excavated from Rushen Abbey in 1926 by the Isle of Man Natural History and Antiquarian Society. This skeleton is of specific interest as it is thought that at least three of the Vikings Kings were killed at buried at Rushen Abbey. King Olaf II who ruled the Kingdom of Mann and the Isles between AD1226-1237, King Reginald who ruled for May of AD1249 and King Magnus who ruled between AD1254-1265. This skeleton has been commonly thought to be King Olaf II as it has been told that he died from an attack at Peel Castle (Chronicle of Mann and the Isles, pg 40). This research aims to establish if the skeleton is consistent with King Olaf II or one of the other Viking Kings. The burial has been dated to the 12th century based on the archaeology of the site. We have submitted a radiocarbon date (results in July 2017). The skeleton is very well preserved and an osteological analysis found the skeleton to be a young adult male aged between the age of 30-50 years. Significantly, the skeleton shows perimortem sharp force trauma on the left of the thoracic vertebra (T3-T8). It has been identified by the clean cut, smooth bone with blunt characteristics from contact with a heavy weapon. This poster will present our research in skeleton C and his burial context, including analysis of his grave goods. The remains will be compared with other well-known Viking burials from the island, shedding light on the shift from Paganism to Christianity in the Viking age of Mann.

Funding: Isle of Man Natural History and Antiquarian Society, Culture Vannin
The Face of Robert the Bruce

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There is no doubt as to the significance and importance of King Robert II to Scotland. Robert the Bruce was voted the third most important Scot in the 2006 public poll, with 12% of the vote. However, despite his immense reputation, there are no recorded descriptions of the appearance of Robert the Bruce by people who met him during his life. In addition, there were no representations of him created during his lifetime and he was dead for more than 300 years by the time the earliest portrait was painted. The centrality of the human face as symbolic of personality permeates the fabric of human experience, and it is therefore not surprising that we desire to see the faces of historical figures and idols from the past and make judgements on their personality, attractiveness and character. It is well-established that the face is key to the perception of attractiveness and cognitive bias towards attractive people is a well-established human response. Attractiveness has been shown to be related to higher social status and we make rapid, unreflective judgments on competence, aggression and leadership qualities based on facial appearance. Therefore, the facial appearance of a King may be, perhaps more than for any other person, crucial to power, status, resilience and reputation. This paper analyses the Hunterian Museum skull cast of Robert the Bruce and presents a 3D digital depiction of his facial appearance, primarily based on skeletal morphology and osteological interpretation, but also considering the historical context relating to his status and reputation to inform this interpretation.

Funding: University of Glasgow

A 2D geometric morphometric approach to analysing the functional morphology of the hominin foot from the Pliocene to the Holocene.

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Fossilised footprints are the most direct, unequivocal evidence of locomotor behaviour and can be a source for inferring kinematic and other biological data. Environmental conditions and other risks of immediate damage to these fragile fossils necessitate rapid recording, often resulting in poor resolution 3D data capture. This was particularly evident in the cases of Happisburgh, Norfolk and Formby, Merseyside. Upon inspection of rapidly captured 3D models, point cloud density may be poor, resulting in reduced depth dimensionality accuracy and loss of topographical features. In this study we developed an approach to circumvent the problems in analysing poor-resolution 3D data by adopting a 2D geometric morphometric (GM) approach to investigate changes in functional morphology of the hominin foot identifiable from footprints from seven localities: Site G (n=17) and site S (n=10) at Laetoli, Tanzania (Pliocene); Ileret, Kenya (n=12); Happisburgh, England (n=14); Terra Amata, France (n=1) (Pleistocene); Formby, England (n=71); Walvis Bay, Namibia (n=146) (Holocene). Results have highlighted three major changes in foot morphology from the Pliocene to the Holocene: a posterior displacement of the medial longitudinal arch, a shortening of the hallux and toe extremities, and a trend for the hallux becoming more adducted. These changes likely affected the lever mechanics of the foot, promoting locomotor efficiency from the early Pleistocene. We demonstrate that certain aspects of functional morphology can be inferred using 2D GM data. Our analyses reveal evolutionary trends in footprint shape from the earliest footprint discoveries dating from ~3.66Ma to the Holocene. We plan to extend this work to other fossil footprint sets.

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