SCIENTIFIC PROGRAM AND ABSTRACTS

(Edited after the meeting)

45th Annual North American Meeting

Hyatt Regency Hotel Austin (Texas)

9-11 April, 2018
45th Annual North American Meeting of Paleopathology Association
Austin (Texas), 9-11 April, 2018
Scientific Program

MONDAY, April 9
8:30am-5:00pm  Pre-meeting excursion to Gault Archaeological Site and Bullock Texas and State History Museum  Meet at Hyatt Lobby
6:00pm-9:00pm  Registration  Lobby

TUESDAY, April 10
7:45am-5:00pm  Registration  Texas Foyer
8:30am-5:00pm  Student Action Committee Raffle

8:30am-11:30am  Workshop I.  Texas 3
Neoplasm or not? Morphologic analysis of dry bone specimens
Hosted by Casey L. KIRKPATRICK, Bruce D. RAGSDALE, Roselyn A. CAMPBELL
8:30-9:00  Introduction to morphologic analysis
9:00-10:00  Independent study of skeletal and radiographic specimens
Coffee break 10:00-10:30
9:45-11:30  Re-assemble for group discussion of cases

8:30am-11:30am  Workshop II.  Texas 2
Parasitology in Paleopathology: New perspectives using large data bases.
Hosted by Dong H. SHIN, Morgana CAMACHO, Johnica MORROW, Karl REINHARD
8:30-8:45  Introduction
8:45-10:00  Creating large data sets from the published literature on ancient parasites to understand disease in past civilizations  Piers MITCHELL
Ancient DNA analysis of multiple parasite species’ eggs discovered in coprolites of mummies
Jong Ha HONG, Chang Seok OH, Min SEO, Dong Hoon SHIN
Dialogue between Paleoparasitology and History: The scientific data interpreted through studies of historical documents  Dong H. SHIN
The contribution of mummy studies to defining parasite patterns  Karl REINHARD
Coffee break 10:00-10:30
10:30-11:30 Microscopic observations

Lunch  11:30am-1:45pm
1:45am-3:00pm Podium Presentation - Part I Texas 2-3 Chair Christopher KNÜSEL

1:45 Evidence for parasitic infection in Roman period latrines from three towns in Asia Minor
Marissa LEDGER, Faith WILLIAMS, Theo ARNOLD-FOSTER, Hui-Yuan YEH, Jan BAETEN, Jeroen
POBLOME, Friederike STOCK, Helmut SCHWAIGER, Sabine LADSTÄTTER, Maria KNIPPING, Helmut
BRÜCKNER, Erica ROWAN, Nicholas CAHILL, Piers MITCHELL ***

2:00 The interplay between diet, lifestyle and parasitism in provoking parasitic disease: New Mexico
Ancestral Puebloans, 1141-1253 CE
Morgana CAMACHO, Karl REINHARD

2:15 Anatomy of tuberculosis in Late Prehistoric North America: Disease among the Monongahela of
Southwestern Pennsylvania
Robyn WAKEFIELD-MURPHY ++

2:30 Metagenomics of a 143 year old Swiss Raclette cheese reveals its diverse microbial content
Abigail BOUWMAN, Marco MEOLA, Judith NEUKAMM, Meral TURGAY, Petra LUEDIN, Noam SHANI

2:45 It’s all in the hips: An exploration of the skeletal changes of tuberculosis of the hip using historic
radiographs from Stannington Sanatorium
Rebecca CESSFORD ***

Coffee break 3:00pm-3:30pm Texas Foyer

3:30-5:00pm Podium Presentation - Part II Texas 2-3 Chair Tracy L. PROWSE

3:30 Skeletal evidence for active and healed vitamin D deficiency at two Roman period sites
Laura LOCKAU, Megan BRICKLEY ++

3:45 A woman’s world: Pathological and morphological changes associated with pregnancy and childbirth
in Roman Britain
Candace McGOVERN

4:00 Working women: Agricultural Intensification and subadult health status in Illinois Woodland and
Mississippian mortuary contexts
Paige DOBBINS ***

4:15 Compromised childhood health and incremental dentine analysis of St Gertrude Church cemetery
population (15th-17th centuries AD) from Riga, Latvia
Elina PETERSONE-GORDINA, Charlotte ROBERTS, Janet MONTGOMERY, Andrew MILLARD, Darren
GRÖCKE, Guntis GERHARDS ***

4:30 The ‘Disease of Kings’: An examination of the dietary and social factors that contributed to gout in
Medieval Cambridge
Jenna M. DITTMAR, Piers D. MITCHELL, Alice ROSE, Bram MULDER, Mary PRICE, Benjamin NEIL, Sarah
INSKIP, Ben HAINES, Tamsin O’CONNELL, Jay STOCK, Toomas KIVISILD, Craig CESSFORD, John ROBB

*** Entrant for the Cockburn Student Prize + Entron for the Early Career Prize
4:45  **Palaeopathology of stroke: Elucidation of an old medical conundrum by means of combination of ancient written sources and biomedical mummy research**  
Francesco M. GALASSI, Michael E. HABICHT, Mathura RAVISHANKAR, Stefano De CAROLIS, Enrico CAVAGNA, Verena SCHUENEMANN, Frank RÜHLI

5:00  **Diabetes in three North American historical Human Skeletal Collections**  
Charity F. UPSON-TABOAS

5:15pm-6:30pm  **Student Action Committee Events**  
**Texas 2-3**

5:15pm-5:45pm  **Student Group Discussion Panel**  
**Pitfalls and promise in rigorous differential diagnosis**  
Chair Kristi CARNAHAN  
Panelists: Jane BUIKSTRA, Della COOK, Simon MAYS, John VERANO

5:45pm-6:30pm  **Student Group Meeting**

6:45pm-10:00pm  Cash bar followed by Association Business Meeting and Dinner  
**Texas 1**

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**WEDNESDAY, APRIL 11**

8:00am-12:00am  **Registration**  
**Texas Foyer**

8:30am-5:00pm  **Student Action Committee Raffle**

8:30am-10:00am  **Podium Presentation - Part III**  
**Texas 2-3**  
Chair John VERANO

8:30  **Maintaining mobility after fracture: A biomechanical analysis of fracture consequences at the Roman sites of Ancaster (UK) and Vagnari (Italy)**  
Rebecca J. GILMOUR, Megan B. BRICKLEY, Erik JURRIAANS, Tracy L. PROWSE

8:45  **Symbolic replacement of severed body parts with objects in 3rd-7th century AD graves in England**  
Simon MAYS, Vicky CROSBY

9:00  **Prevalence and patterns of cranial trauma in the Migration period cemetery of Bitburg, Germany**  
Christian MEYER, Ferdinand HEIMERL, Kurt W. ALT

9:15  **Skeletal fracture patterns: Evidence for intentional violence in Medieval Nubia**  
Valerie A. LEAH

9:30  **Life and death on Mograt Island, Northern Sudan**  
Tina JAKOB, Claudia NÄSER, Jens WESCHENFELDER, Lilli JANOTTE

9:45  **Military reactive arthropathies: Identifying early modern occupational disease through paleoepidemiological methods**  
Meghan BANTON, Tony WALDRON

Coffee break **10:00am-11:00am**  
**Texas Foyer**

*** Entrant for the Cockburn Student Prize  
++ Entrant for the Early Career Prize
10:00-11:30am  Poster Session I  Texas 1
Posters in place all day. Authors of ODD numbered posters will be present during this break. Poster titles and authors listed, alphabetically, at the end of the program.

Let’s Do Lunch 11:30am-1:30pm

1:30pm-5:00pm  Student Group Silent Auction
1:30 pm-3:00pm  Podium Presentation - Part IV  Texas 2-3  Chair Tina JAKOB

1:30  Disability in the Konya Plain, Turkey: Two case studies from Roman Çatalhöyük
Michelle GAMBLE (Austrian Archaeological Institute), Sophie MOORE (Brown University)

1:45  Interpersonal violence at the Medieval Priory of Norton, Runcorn, Cheshire, U.K.
Carla L. BURRELL, Eleanor R. DOVE, Lynn SMITH, Silvia GONZALEZ, Matteo BORRINI, Joel D. IRISH

2:00  Marriage à-la-mode? Developmental conditions in high status Medieval burials at Stirling Castle
Jo BUCKBERRY, Chelsea LANDON, Turi KING

2:15  Fighting and dying at the edge of the empire: skeletal injuries caused by intentional violence from the 17th century CE mass burial in Osijek, eastern Croatia
Mario NOVAK, Slavica FILIPOVIC

2:30  Bone metastatic disease and the identification of the primary organ: how far is too far? Evidence from two Portuguese reference collections from the 19th-20th centuries
Carina MARQUES, Vítor MATOS, Albert ZINK, Eugénia CUNHA

2:45pm-4:00pm  Poster Session II  Texas 1
Posters in place all day. Authors of EVEN numbered posters will be present during this break. Poster titles and authors listed, alphabetically, at the end of the program.

Coffee break 3:00-4:00am  Texas Foyer

4:00pm-5:30pm  Podium Presentation - Part V  Texas 2-3  Chair Mary Lucas POWELL

4:00  11Pk5 Blue Creek Mound: A man who survived surgery, or another Hopewell pseudotrepanation?
Della Collins COOK

4:15  Pathological conditions and trauma in the Late Woodland Nanjemoy Ossuary III (Maryland)
Niovi DOLLAS, Margaret GARDNER, David R. HUNT

4:30  ‘Putting flesh on the bones’: A new resource for palaeopathologists
Michelle WILLIAMS-WARD, Jo BUCKBERRY, James NEILL, Alison CULLINGFORD, Sarah GEORGE

4:45  A paleopathology database for New Mexico bioarchaeology
Ann L.W. STODDER, Shamsi DANESHVARI BERRY

5:00  Educating the older generation through palaeopathology
Charlotte ROBERTS, Kirsty MCCARRISON

*** Entrant for the Cockburn Student Prize  ++ Entrant for the Early Career Prize
5:30 pm Closing Remarks and Announcements, Award of Cockburn Student Prize and Early Career Prize, Announcements of Student Group Raffle and Silent Auction

Niels LYNNERUP

Thursday, April 12  AAPA-PPA joint session (abstracts are in AAPA Meeting Program Abstracts)

Texas 1

2:30pm-6:00pm Going Beyond the 'Biocultural Synthesis': Bridging Theory and Practice in Bioarchaeology
Organized by Colleen M. CHEVERKO, Julia R. PRINCE-BUITENHUYS, Mark HUBBE

2:30  Corporeal affect: Human remains as subjects and objects in Cambodia
Julie M. FLEISCHMAN

2:45  Structural Violence and Disease: Epistemological Considerations for Bioarchaeology
Lisa N. BRIGHT, Joseph T. HEFNER

3:00  Extending the adaptive landscape metaphor into bioarchaeological theory and practice
Mark HUBBE, Colleen CHEVERKO

3:15  Embodying intimacy: Cranial vault modification as child rearing practice
Christina TORRES-ROUFF

3:30  A biocultural approach to reconstruct immune competence in past populations: Searching for a new dialogue between Immunology and Bioarchaeology
Fabian CRESPO

3:45  When biocultural isn't enough: The evolutionary becomings of skulls
Julia R. PRINCE-BUITENHUYS, Agustin FUENTES, Susan Guise SHERIDAN, Matthew J. RAVOSA

Coffee break 4:00pm

4:30  Contextualizing the biocultural approach with practice theory: Physical activity and inequality during the Andean Middle Horizon and Late Intermediate period
Sarah SCHRADER, Mark HUBBE, Christina TORRES-ROUFF

4:45  Bioarchaeology beyond structure: Discussing power and inequality through the lens of practice
Selin E. NUGENT, Kellen N. HOPE

5:00  Putting theory into practice: Biocultural reconstructions of gender and social identity relative to health and disease in past populations
Molly K. ZUCKERMAN

5:15  Making silenced voices speak: Restoring neglected and ignored identities in anatomical collections.
Carlina M. de LA COVA

5:30  Discussant Haagen KLAUS (George Mason University)

5:45  Discussant Agustin FUENTES (University of Notre Dame)

*** Entrant for the Cockburn Student Prize
++ Entrant for the Early Career Prize
Posters (in alphabetical order of 1st author)  

Texas 1

1. The development of a pathological teaching collection by and for students: Hands-on instruction to enhance learning of pathology  
Kathleen BLAKE

2. Determinants of intracemetery structure at Jucu de Sus necropolis, Transylvania (700-1100 AD)  
Kelly BLEVINS, Kori Lea FILIPEK, Katie TUCKER, Jordan SNYDER, Liam LANIGAN, Katie HUNT, Kayla CROWDER, Megan OLIVIERSON, Khrystyne TSCHINKEL

3. Stratigraphic probes and large-scale discovery of emergence and control of infection: 1700 – 1850 CE, New England, USA  
Sebastien BOTERO, Ariadne Barbosa GONÇALVES, Ruth GRADY, Brianna HABERYAN, Chase HORN, Karl REINHARD

4. Interpersonal violence in skeletal assemblages dating from the Roman occupation to the Post-Medieval period in London  
Mark CLEMENTE, Lauren BAILEY

5. The rachitic tooth: Refining the use of interglobular dentin in association with vitamin D deficiency from Belleville, Canada (1824-1875)  
Lori D'ORTENZIO, Bonnie KAHLON, Megan BRICKLEY

6. Violence and pathology: A re-examination of a Late Archaic trophy taking victim  
Erin EDWARDS, Megan HOFFMAN

7. The visible and the invisible: Identification of mycobacterial and Yersinia pestis co-infection in Medieval Denmark through palaeopathology and biomolecular approaches  
Julia GAMBLE, Katherine EATON, Jesper BOLDSEN, Hendrik POINAR

8. Assessing the abundance of arthropathies and inflammatory reactive bone in the Late Woodland Nanjemoy ossuary III (Maryland)  
Margaret GARDNER, Niovi DOLLAS, David R. HUNT

9. Rotator cuff disease prevalence, demography and anatomical distribution in a skeletal assemblage from the Litten Site, Chichester, West Sussex (1550-1850 CE)  
Aaron A. GASPARIK

10. Spina bifida and lower limb abnormalities in a modern Hispanic migrant  
Timothy GOCHA, Chloe MCDANIELD, Courtney SIEGERT, Michelle HAMILTON, Kate SPRADLEY

11. A possible case of smallpox? Description and differential diagnosis of suspicious humeral lesions, postcontact Mórrope, North Coast of Peru  
Kelly GROTH, Mikayla MATTHEWS, Haagen Klaus

12. A case of multiple epiphyseal dysplasia in a Proto-Historic period skeleton from the northern interior of British Columbia  
Evan HARDY, Terra LEKACH

*** Entrant for the Cockburn Student Prize  
++ Entrant for the Early Career Prize
13. **A case of hypertrophic osteoarthropathy in an adult Macaque from an anthropological skeletal collection**
   Cara HIRST, Tony WALDRON

14. **A case study comparing clinical observations and skeletal lesions to assess a diagnosis of gout**
   Hannah KRUSE, Kathleen BLAKE

15. **A possible case of lambdoid craniosynostosis from the Roman cemetery of Vagnari, Italy (1st–4th c. AD)**
   Marissa L. LEDGER, Liana J. BRENT, Tracy L. PROWSE

16. **The health impact of civilization on society: disease patterns of citizens during the Late Zhou Dynasty in China (877 BC - 771 BC)**
   Mocen LI, Charlotte ROBERTS, Peter ROWLEY-CONWY, Liang CHEN, Dongyue ZHAO

17. **Tumultuous tumuli: Demography and pathological analysis of the Bronze Age Gusića Gomila II site, Croatia**
   Andrea LOPEZ, Julianne PAIGE, Anna OSTERHOLTZ, Helena TOMAS

18. **Maxillary sinusitis of odontogenic origin from Amarna, Egypt: differential diagnosis of two adult cases from the New Kingdom**
   Erika MOREY

19. **Vitamin D deficiency and interglobular dentin (IGD) in a Roman (1st-3rd c. AD) population from Aventicum, Switzerland**
   Taylor PEACOCK, Chryssa BOURBOU, Bonnie KAHLON, Megan BRICKLEY

20. **The James L. Shupe Veterinary Fluorosis Collection: A study of skeletal fluorosis**
    Kristen PEARLSTEIN

21. **Time doesn’t heal all wounds: Examining spinal pathology patterns among different temporal sites in west-central Illinois**
    Abigail PEEPLES

22. **Possible case of echinococcosis in ancient Uzbekistan (9th-12th centuries CE)**
    Megann PHILLIPS, Sean Y. GREER, Elissa BULLION

23. **The impact of mobility on the transmission of tuberculosis in Roman Britain: a bioarchaeological study**
    Charlotte ROBERTS, Kendra QUINN, Andrew MILLARD, Janet MONTGOMERY, Jane EVANS, Angela LAMB

24. **Molecular identification of parasites in an intestinal coprolite from a mummified priest from the Piraino Mother Church Crypt, Sicily**
    Amanda ROLLINS, Frederika KAESTLE, Georgia MILLWARD, Dario PIOMBINO-MASCALI, Karl REINHARD

25. **Malocclusion at Amarna, Egypt (1347-1332 BCE)**
    Jerry ROSE, Anna N. FAULKNER, Ashely E. SHIDNER

26. **Migration and vitamin D deficiency: A case-study using interglobular dentin, skeletal lesions, and oxygen isotope analysis from the Late Roman (4th century AD) necropolis of Michelet, France**
    Hana SALAHUDDIN, Tracy PROWSE, Cécile Chapelain De SERÉVILLE-NIEL, Julia PACORY, Bonnie KAHLON, Megan BRICKLEY

*** Entrant for the Cockburn Student Prize  
++ Entrant for the Early Career Prize
27. **Age-related bone loss in a Nubian population from Tombos (1400-660 BC)**
   Kaitlyn SANDERS

28. **Degenerative joint diseases in the appendicular skeleton in Portuguese people from early 20th century**
   Ana Luisa SANTOS, Mario ARRIETA

29. **Vitamin D deficiency: A teaching skeleton from Wheatland Wyoming High School**
   Ryann SEIFERS, Alex GARCIA-PUTNAM, Jessica DROKE

30. **Patterns of interobserver replicability in identification of surface morphology feature boundaries using 3D Scans**
   Kristrina A. SHULER, Marie Elaine DANFORTH, Kyle MCLAUGHLIN

31. **A circular depression at the spinoglenoid notch of a Prehistoric Andean scapula: plausible evidence of suprascapular nerve entrapment by a paralabral cyst**
   Anne R. TITELBAUM, Bebel IBARRA, Bronwyn E. MCNEIL

32. **Probable metastatic cancer in a woman from the Salinar period (ca. 200 BC-AD 200) in Huanchaco, Peru**
   Khrystyne TSCHINKEL, Kathryn HUNT, Gabriel PRIETO, John VERANO

33. **Treating sickness: A pathological review of adolescent health in two post-Medieval English hospitals**
   Sascha VALME

34. **The Victorian match boy: evidence of mandibular phosphorus necrosis from Gloucester (UK)**
   Satu VALORIANI, Constantine ELIOPOULOS, Joel D. IRISH, Matteo BORRINI

35. **A test of the Modified Rapid Manual Method on Sus scrofa teeth**
   Karey WALL, Chelsey JUAREZ

36. **Skeletal dysplasia in New Kingdom Tombos (c. 1400-1050 BC)**
   Katie M. WHITMORE, Michele R. BUZON

37. **Non-destructive methods for using modern cases of myositis ossificans traumatica to diagnose and interpret trauma in the past**
   Emily F. WIEGERS, Teresa V. WILSON

38. **Elucidating fluctuating asymmetry in dental and cranial remains from Tepe Hasanlu, Iran**
   Amanda WISSLER

39. **Mulberry molars as a symptom: evaluating diagnoses of cases with mulberry molars in the literature**
   Paige V. WOJCIK

40. **A documented case of Wernicke-Korsakoff Syndrome in an adult female from the Terry Collection**
   Kristina M. ZARENKO, Colleen M. CHEVERKO, David HUNT

41. **Humeral morphology related to sex and labor in rural and urban Medieval Danish populations**
   Qun ZHANG, Charlotte PRIMEAU, Marie Louise JØRKOV, Chiara VILLA, Niels LYNNERUP

*** Entrant for the Cockburn Student Prize

++ Entrant for the Early Career Prize
WORKSHOP I

Neoplasm or not? Morphologic analysis of dry bone specimens.
Organized by Casey L. KIRKPATRICK, Bruce D. RAGSDALE, Roselyn A. CAMPBELL
With the growing public and academic interest in paleo-oncology, it is important that paleopathologists become unified in their methods for the differential diagnosis of possible neoplastic disease. This workshop will instruct attendees in the differential diagnosis of possible neoplasms using the most accessible diagnostic methods for paleopathologists; namely, macroscopic and radiologic analyses. The importance of both of these methods to the differential diagnosis of dry bone specimens will be emphasized, and attendees will learn about differentiating characteristics in both media. This will include discussion of: lesion distribution (solitary vs. multifocal), character of margins, details of periosteal reactions, and remnants of mineralized matrix. These characteristics should point to the mechanism(s) producing the bony changes, allowing for selection of a likely category of disease (e.g. neoplastic), within which a differential diagnosis can be elaborated and from which a favored specific diagnosis can be chosen.

Following a lecture on this topic, attendees will be invited to examine and discuss bones, and radiographs of bones, that have been diagnosed with neoplastic disease or mistaken for neoplastic disease.


WORKSHOP II

Parasitology in Paleopathology: New perspectives using large data bases.
Organized by Dong H. SHIN, Morgana CAMACHO, Johnica MORROW, Karl REINHARD
The goal of this workshop is the demonstration of insights that can be gained from analysis of large data sets. These data sets, ranging from 100 to 1,000 samples, can provide epidemiological insights into transmission and pathology. Large data sets also provide insights into zoonotic transmission. Most importantly, focused studies can connect parasitological infections with bone pathology. We propose a combination of posters and presentations. The core presentations are listed below. The organizers will solicit additional papers in the coming months.

Creating large data sets from the published literature on ancient parasites to understand disease in past civilizations. Piers D MITCHELL
Large data bases can be created by undertaking new research with many sources of data, or by bringing together existing research in the published literature. This second approach enables us to optimise the information we can gain from work undertaken already, and often allows us to obtain a clearer perspective than might have been available to those originally studying each site. The aim of this part of the workshop is to show how published research on ancient parasites can be used to create large databases that improve our understanding of infectious diseases in past populations. After discussing the challenges associated with this approach, we will consider some ways in which this has been used in recent years. A database of prehistoric sites helps us to determine which species appear to have infected humans throughout our evolution, and which were acquired from wild animals as we migrated around the planet. A database of sites from the Roman World highlights how parasites spread by faeces were the most common species to infect humans, despite their sophisticated sanitation measures. A database of sites in ancient China shows that some parasites such as roundworm and whipworm remained common over the last 2,000 years until the 1980s, while other species such as Chinese liver fluke changed from being common to extremely rare over the same time period. Once we identify such changes, we can propose hypotheses to explain them, such as changes in diet, cooking practices, hygiene, lifestyle, pollution, technology and industry. This approach of creating, analysing and interpreting databases of parasite evidence in past civilizations helps us to detect long term trends that only become clear when we step back and look at the bigger picture.
Ancient DNA analysis of multiple parasite species' eggs discovered in coprolites of mummies. Jong Ha HONG, Chang Seok OH, Min SEO, Dong Hoon SHIN
To reveal parasitic infection patterns among ancient people, archaeoparasitology applies a variety of scientific techniques to archeological samples. Over the years, we found various species of parasite in the feces or precipitates of Joseon Dynasty (15th to 18th century) mummies of Korea by microscopic examination. In this presentation, we will show how multiple genes of Ascaris lumbricoides, Trichuris trichiura, Metagonimus yokogawai, Paragonimus westermani and Clonorchis sinensis ancient DNA (aDNA) could be extracted from feces or precipitates of Korean mummies. After we were successful in amplification of ancient parasite aDNA, consensus sequences were then determined by the alignment of the sequences of cloned PCR products. We tried to do the phylogenetic analysis of obtained sequences with the others already reported in GenBank. Our future analysis on more aDNA sequences obtained from the regions of much wider geo-historical scope will achieve the goal of revealing the pattern of parasitism in each ancient human society, thus finally reconstructing the history of parasitic infections from global perspectives.

This work was supported by the National Research Foundation of Korea (NRF) grant funded by the Korea government (MSIP) (no. NRF-2016R1A2B4015669).

Dialogue between Paleoparasitology and History: The scientific data interpreted through studies of historical documents. Dong Hoon SHIN
The purpose of paleoparasitology is to investigate the ancient people’s remains obtained from archaeological sites by established techniques of parasitology, further analyzing the data from the viewpoint of socio-cultural perspective. For several decades after the initial development, notable achievements have been reported by the pioneers in this field, which has provided important information about parasite infection pattern in history across the globe. However, paleoparasitology deals with a relatively limited number of degraded samples compared to parasitological studies on modern human specimens. As a result, though the research result itself is interesting, there are many cases where the interpretation is insufficient and indefinite. In order to overcome these problems, our laboratory recently tried to get more concrete information useful for the interpretation of paleoparasitological results by active dialogue with professional historians and archaeologists. In this attempt, we could get a specific context about ancient parasitic infection, which must be difficult to obtain in a simple paleoparasitological study. In this workshop we will introduce our experience to share with related scholars in this field.

The contribution of mummy studies to defining parasite patterns. Karl REINHARD
Parasitology is most relevant to paleopathology when infection can be linked to disease. Making this linkage requires quantitative analysis of parasite eggs, juveniles, and/or adults, depending on the species under study. The quantitative study of parasitism begins with the definition of prevalence and intensity of infection in a host population. Prevalence is the proportion of infected hosts among all the hosts examined. Mean intensity is the mean number of parasites found in the infected hosts, excluding the zeros of uninfected hosts. These two measures can be achieved in mummy populations. Older studies focused primarily on prevalence. Prevalence data can be used to identify populations at more or less risk of infection than other populations. As such, they provide no definitive estimate of the potential of disease since most infections provoke no symptoms or minor complaints. In contrast, intensity of infection measures the number of parasites per host. In a population of mummies, intensity can show which populations experienced symptoms. This presentation focuses on these measures in mummy series from Peru and Chile to show how quantified analysis reveals individuals and populations who were most likely to experience infection-related distress.
ABSTRACTS

Military reactive arthropathies: Identifying an early modern occupational disease through paleoepidemiological methods. Meghan BANTON, Tony WALDRON
The military lifestyle is associated with increased exposure and susceptibility to pathogenic bacteria. Many of these bacteria can also trigger the development of reactive arthropathies - arthritic conditions caused by microbial infections. A paleoepidemiological study was designed to determine if an affinity between reactive arthropathies and military service can be quantitatively demonstrated. A comparative study of Early Modern (1450 to 1815) British military (N = 182) and non-military (N = 124) skeletal assemblages was conducted; sites: Towton, Greenwich Naval Hospital, Stonehouse Naval Hospital, All Saint’s Church – Fishergate, Chelsea Old Church, and St. Brides Lower. Common pathology and patterns of disease expression associated with reactive arthropathies (spondyloarthropathies were of primary interest) were used to define criteria for identification and categorization of cases. Prevalence, odds ratios, and Mantel-Haenszel X 2 tests were used to determine if the occurrence of reactive pathology differed in a manner suggestive of a military affinity. The prevalence of reactive pathology in military assemblages was 8.2% (95% CI 5.1, 13.2) and 1.6% (95% CI 0.4, 5.7) for control assemblages. The nested case control study produced an odds ratio of 5.25 (95% CI 1.08 – 25.42), p=0.039; the Mantel-Haenszel X 2 was 4.86, p=0.028.

There is a higher prevalence of reactive pathology in military skeletal assemblages and the odds of encountering reactive pathology are significantly greater in military assemblages. These findings indicate reactive arthropathies were an occupational disease of historical military combatants. This information provides historical insight into the consequences of military infectious diseases.

The development of a pathological teaching collection by and for students: Hands-on instruction to enhance learning of pathology. Kathleen BLAKE
Access to pathological skeletal specimens for undergraduate students in research and classroom settings is limited. My goal with this project was to develop a skeletal teaching collection for undergraduate students containing varying types of pathology and trauma, with accompanying modern clinical data, to allow for analysis of bony reaction to disease, both past and present. Pathologies such as osteoporosis, potential gout, arthritis, generalized infection, and fractures were present. Students examined these as part of research projects as well as for comparison with existing skeletal materials within the department. In addition to the skeletal material, students benefited from exposure to specimens with soft tissue, in removing soft tissue, and by connecting an individual’s known health to observed pathology. Therefore, students were integral to the process from soft tissue examination and removal, assessment of medical and pharmacological history, and preservation and stabilization of skeletal material. Eleven specimens exhibiting fractures, pathology, and joint replacements were obtained from the Anatomy Gifts Registry, a nonprofit human tissue donation organization that provides screened materials for educational purposes. All specimens contained some soft tissue, and several joint replacements were present, including hip and knee. Students removed soft tissue, stabilized the remains, and evaluated and assessed pathologies for both in-class and independent research projects. To date, eight specimens have been processed and assessed.

Determinants of intracemetery structure at Jucu de Sus necropolis, Transylvania (700-1100 AD). Kelly BLEVINS, Kori Lea FILIPEK, Katie TUCKER, Jordan SYNDER, Liam LANIGAN, Katie HUNT, Kayla CROWDER, Megan OLIVERSON, Khrysytne TSCHINKEL
The Jucu de Sus necropolis is associated with multi-period settlements extending from the late Roman (2nd-3rd centuries AD) to the Medieval (11th-12th centuries AD) period. The site is located on a floodplain in the Transylvania region of Romania, west of the Someșul Mic River. Previous excavations in 2007 produced a significant number of burials (n=80). Since 2014 Transylvania Bioarchaeology (TBA), in association with the Institute of Archaeology and Art History in Cluj Napcoa, has continued the excavation of the cemetery as part of a field school and exhumed 34 individuals. The aim of this study is to explore how lived experience shaped Jucu de Sus intracemetery structure. Lived experience was inferred from presence of metabolic disease, infectious disease, and trauma in skeletal
remains that were at least 75% complete (n=38). Gower’s similarity measure was calculated using these attributes, and a clustering analysis was performed. The clusters were plotted on their spatial locations to determine how similarities in life experience affected burial organization. The results suggest that males experienced the highest risk of injury and were buried separately from juveniles and females, who were buried together. Not only is this high degree of structure critical information for understanding the burial practices at Jucu de Sus, but also it suggests the individuals used in this analysis were contemporaneous. This is an important conclusion, as thus far it is unclear whether this is a multi-period cemetery. Overall, the hypothesis that lived experience shaped burial organization at Jucu de Sus is accepted.

**Stratigraphic probes and large-scale discovery of emergence and control of infection: 1700 – 1850 CE, New England, USA.** Sebastian BOTERO, Ariadne Barbosa GONÇALVES, Ruth GRADY, Brianna HABERYAN, Chase HORN, Karl REINHARD

Analyses of 115 shaft features from New England revealed the emergence and control of fecal-borne parasitism over a 350-year period. The published data include only strata that were identified as fecal in origin. They do not include the stratigraphic probe analyses employed to find fecal layers. The amount of work and number of samples in the published work does not comment on the methods used to isolate helminth egg-rich levels. We illustrate these methods through the stratigraphic analysis of 24 samples from three 18th century features from Newport, Rhode Island. This analysis shows that the levels containing parasite eggs are compressed into a 20 cm level. Only four of 24 samples contained eggs and dietary remains. We also show that the association of dietary macroscopic remains, such as seeds, is vertically offset from egg levels. From this experience, we present a rubric to assess the validity of parasitological research strategies.

**Metagenomics of a 143 year old Swiss Raclette cheese reveals its diverse microbial content.** Abigail BOUWMAN, Marco MEOLA, Judith NEUKAMM, Meral TURGAY, Petra LUEDIN, Noam SHANI

The transmission of diseases from animals to humans via consumption of animal products is a long known health hazard. By the beginning of the 20th century drinking of infected milk was known to cause tuberculosis and pasteurization was practiced in many countries.

In order to assess the bacterial profile of cheese in Switzerland from before the period of pasteurization and antibiotic use, we undertook a metagenomic analysis of a 143-year-old semi-Raclette hard cheese from the Valais canton of Switzerland. Shotgun metagenomics using Illumina High-Throughput sequencing of the cheese revealed that the main bacteria used in dairying today were also present historically (namely *Lactobacillus* sp., *Lactococcus* sp., and *Streptococcus* sp.).

The shotgun approach allowed us to identify not only prokaryote, but also eukaryote DNA. Unexpectedly, the cheese appeared to be a mixture of cow and sheep milk, whereas today the Raclette cheese in the same region is almost exclusively produced from cow milk.

More importantly, we were able to retrieve DNA from nematodes (roundworms) of the order Spiruidea, which are known to be pathogenic to humans today. Here we shall present the initial data and discuss the implications of the presence of these microorganisms in historic cheese to human health.

**Marriage a-la-mode? Developmental conditions in high status Medieval Burials at Stirling Castle.** Jo BUCKBERRY, Chelsea LANDON, Turi KING

Stirling Castle was one of the key garrisons of the Scottish Wars of Independence, 1296-1328 and 1332-1357AD. In 1997, excavations at Stirling Castle revealed a lost royal chapel and nine burials radiocarbon dated to the 14th and early 15th centuries, including 1 infant, 2 older adolescents and 6 adults (5 males, 1 female). The abundance of peri-mortem trauma within this group has been reported on previously.

A wide range of developmental conditions were present within this small population. These include thoracolumbar, lumbo-sacral and sacro-coccygeal vertebral shifts, cleft neural arch of C1 and scoliosis. In addition, one individual displayed an absent styloid process of the left ulna and a bipartite left scaphoid. Both of these abnormalities in the wrist could represent healed non-union fractures; however the lack of any evidence of
callus formation on either bone and the smooth nature of the pseudarthrosis make a diagnosis of developmental variants of the wrist more likely. In total, five individuals (55.5%) had at least one developmental variant. Once levels of preservation and completeness are considered, true prevalence rates (TPRs) for each condition ranged from 25-100%. These are considerably higher than TPRs for other medieval populations, but it is hard to assess if this is statistically significant, due to the small sample size at Stirling. The high prevalence of developmental variants suggests the population excavated at Stirling may have had a small gene pool and is, perhaps, indicative of marriage patterns in medieval elite populations. Ongoing aDNA analysis will allow further evidence of the relationships between these individuals to be investigated.

**Interpersonal violence at the Medieval Priory of Norton, Runcorn, Cheshire, U.K.** Carla L. BURRELL, Eleanor R. DOVE, Lynn SMITH, Silvia GONZALEZ, Matteo BORRINI, Joel D. IRISH

This paper discusses sharp and blunt force trauma identified in six adult skeletons (5 males and 1 female) from the medieval Norton Priory Collection (n=130). Previously, the assessment of SK22 identified a perimortem vertebral blade wound (T1 to T8). Yet, recent analysis has identified a prominent antemortem blade wound in the mandible of the same individual. The blade has penetrated the bone horizontally along the buccal surface. The extent of this wound and the lack of infection illustrates that this individual has survived this weapon related injury. In addition to SK22, the remains of SK47 revealed a perimortem vertebral blade injury (C4 to C7). This lesion demonstrates a clean sharp edge with uniform coloration and no evidence of bone remodeling. It is speculated that this wound is more extensive but, due to postmortem damage of the thoracic vertebrarum, it is difficult to be conclusive. The remains of SK59 exhibits antemortem trauma to a left rib. Here, a distinct sharp notch is noted on the caudal edge. There is evidence of bone remodeling, suggesting that this is likely a healed stab wound. Finally, three individuals display healed blunt force trauma to their crania (SK11, SK101 and SK124a). These results were obtained through macroscopic, Scanning Electron Microscope and radiological analysis. Overall, these individuals display evidence of both ante- and perimortem trauma. Battle related trauma is considered and together with evidence of healed injuries indicates the ability of medieval people to survive such major traumas. This information contributes to the understanding of interpersonal violence in medieval Britain and the subsequent treatment.

**The interplay between diet, lifestyle and parasitism in provoking parasitic disease: New Mexico Ancestral Pueblos, 1141-1253 CE.** Morgana CAMACHO, Karl REINHARD

Porotic hyperostosis has been documented in Ancestral Pueblo skeletal series for decades. We are assessing causation of this pathology with coprolite research following published hypotheses (Walker et al., 2009). Our current study has a regional and cultural focus on Chaco Canyon culture. We analyzed 110 samples from two Chaco Great House sites; Aztec Ruins and Salmon Ruins. Three latrines were analyzed dating from 1141 CE to 1253 CE. Our coprolite analysis was designed to collect data relating to parasitism, anthelminthic treatments, dietary sufficiency and commonness of diarrhea. The data reveal a prevalence of pinworm infection ranging from 33% to 68%. These data exceed any previously documented prevalence in the region. It is noteworthy that the latrine with the highest prevalence has botanical evidence of anthelminthic treatment in the form of squash seeds and bean trichomes.

The dietary analysis reveals a food preparation technology that maximized nutrient extraction from maize. Diarrhea was a common aspect of life. Therefore diet appeared to be good, but the population experienced significant infection and intestinal pathology. We explored the archaeological reconstructions of life for Great Houses and conclude that architectural innovations, communal life, and infant care strategies would have aggravated pinworm infection in these communities.

It's all in the hips: An exploration of the skeletal changes of tuberculosis of the hip using historic radiographs from Stannington Sanatorium. Rebecca CESSFORD

The presence of an angular kyphosis in the spine is a strong macroscopic indicator for tuberculosis in a skeleton. The spine is, however, only affected in approximately 50% of cases of musculoskeletal TB, and any bone or joint is susceptible though many of the manifestations are regarded as non-specific. This study uses historical radiographs of children with diagnosed tuberculosis, both pre- and post-dating the introduction of effective anti-tubercular drugs, to explore manifestations in the proximal femur and acetabulum relating to tuberculosis of the hip.

For this clinical radiographs and medical files for patients with tuberculosis of the hip (n=97) admitted to Stannington Children’s Tuberculosis Sanatorium during the period 1935-1953 were used. These demonstrated a range of disease stages from early infection to advanced disease. Of these cases only four demonstrated synovial infection with no osseous changes. Both the femur and acetabulum become involved in 81.4% (79/97) of cases and radiolucent foci were identified in over two thirds (67/97) of cases; these were particularly prevalent adjacent to the acetabular roof (33/97). The high number of cases demonstrating radiolucent foci, reflective of internal lesions, highlight the need for radiography in conjunction with macroscopic analysis of skeletal remains in cases were tuberculosis of the hip is a possible differential diagnosis. Given the difficulties associated with macroscopic identification of extra-skeletal tuberculosis in palaeopathology, pre-antibiotic clinical radiographs offer a means of exploring the disease manifestations and offer a potential new source for developing new diagnostic criteria.

Interpersonal violence in skeletal assemblages dating from the Roman occupation to the Post-Medieval period in London. Mark CLEMENTE, Lauren BAILEY

Historical and archaeological evidence shows that violence was present during the Roman, Medieval, and Post-Medieval periods in London. Beginning with the Roman period, population density in London increased, continuing into the Medieval and Post-Medieval periods. Here, we use previously recorded data derived from the Wellcome Osteological Research Database (WORD), Museum of London (MoL), Centre for Human Bioarchaeology (CHB) representing skeletal assemblages from the Roman (n=183), Medieval (n=2,120), and Post-Medieval (n=1,487) periods in London to assess whether and how skeletal evidence of violence changed over time. Using evidence identified as interpersonal violence previously recorded in the WORD, such as blunt force trauma, sharp force trauma, and projectile injuries, we investigated associations between frequencies of these traumatic lesions, estimated age-at-death, and estimated sex across the time periods. We detected no significant associations between time period and evidence of interpersonal violence (X²=2.824; p-value<0.243655; significance at p<0.05), but we did find a significant association between sex and evidence of interpersonal violence (X²=36.576; p-value<0.000024; significance at p<0.05).

The first finding suggests that increasing population density may not have been associated with increased interpersonal violence, at least as evident in the skeletal record, while the second reveals that evidence of interpersonal violence was more common in males (2.8% affected) than females (1.1%). Results of this research show no diachronic changes in interpersonal violence from the Roman to the Post-Medieval, but these findings contradict scholarly hypotheses that an increase in population density equates to higher frequencies of interpersonal violence.

11Pk5 Blue Creek Mound: A man who survived surgery, or another Hopewell pseudotrepanation? Della Collins COOK

In last year’s PPA workshop, John Verano and David Hunt complicated the differential diagnosis of openings in the cranial vault that appear healed. In 1951 archaeologists John McGregor and Walter Wadlow described healed trepanation at bregma in an adult male from Pike County, Illinois. Their brief article is one of the rare examples of paleopathology in American Anthropologist. The skull has been discussed in secondary sources, but the diagnosis has never been challenged in print. Trepanation, or surgery of any kind was rare in Native America north of Mexico, but Hopewell (ca. 2500-1500 B.P.) preceded this ethnohistoric evidence by 2000 years. The exceptional technology that characterized Hopewell might suggest...
sophisticated surgical skills that were lost in later peoples.
Radiography, craniometry, and detailed examination of the margins of the opening and the endocast show that Blue Creek is yet another mistaken diagnosis of trepanation. Trauma, meningocoele, and dermoid cyst are unlikely. McGregor and Wadlow misidentified weathering on the external surface of the vault as evidence for healing. The texture and color of the margins of the opening suggest that there was a large bregmatic bone occupying the opening and protecting the margins. Features suggesting acrocallosal syndrome, a rare association of large bregmatic ossicles, are absent. 11Pk5 thus joins a long list of debunked identifications of Pre-columbian skull surgery in North America. Classic case studies such as this one should be revisited before they are lost to science.

The ‘Disease of Kings’: An examination of the dietary and social factors that contributed to gout in Medieval Cambridge. Jenna M DITTMAR, Piers D MITCHELL, Alice ROSE, Bram MULDER, Mary PRICE, Benjamin NEIL, Sarah INSKIP, Ben HAINES, Tamsin O’CONNELL, Jay STOCK, Toomas KIVISILD, Craig CESSFORD, John ROBB

The aim of this research is to explore the social factors that contributed to gout in the unusual urban landscape of medieval Cambridge by examining skeletal remains from a cross-section of society. Gout is an inflammatory arthritis characterized by the deposition of monosodium urate crystals in joints, especially the first metatarsophalangeal joint.

The first MTPJs of 176 adult individuals from four burial grounds located in and around Cambridge were analyzed: the urban parish cemetery of All Saints by the Castle (n=50), the Augustinian Friary (n=22), the Hospital of St. John the Evangelist (n=67) and the rural parish cemetery in Cherry Hinton (n=37). Lytic lesions were imaged using a microCT scanner. Gout was identified in 19.4% (n=27/139) of the individuals buried within Cambridge, which is the highest known prevalence for a Medieval town in the UK. Gout was not found in any of the rural individuals. The highest prevalence rate was identified at the Augustinian Friary (23%), followed by All Saints parish cemetery (20%) and St. John’s hospital (18%). Isotopic analysis of individuals buried at St John’s Hospital reveals $\delta^{13}C$ and $\delta^{15}N$ values of those with gout were around or above the skeletal assemblage mean ($\delta^{13}C=-19.0‰$, mean $\delta^{15}N=12.3‰$, n=154), suggesting that these individuals were consuming protein-rich diets. The surprisingly high prevalence of gout within Cambridge compared with other Medieval burial grounds suggests that the urban environment, comprising numerous religious institutions and the university, may have contributed to the enrichment of the diets of even the poorest members of urban society.

Working women: Agricultural intensification and subadult health status in Illinois Woodland and Mississippian mortuary contexts. Paige DOBBINS

The goal of this research was to examine temporal variation in female labor associated with subsistence modifications in the Midwestern US and its potential relationship to changes in weaning practices, diet, and overall health status of subadults.

This study was performed on a sample of 173 burials constituting 98 subadults and 75 adult females from sequential Illinois mortuary contexts (Albany (11WT1), Kuhlman (11A163), Schroeder (11HE177), and Dickson (11F10) Mounds) that represent the transition from Middle Woodland hunter gatherers to Mississippian agriculturalists within the region. This research was accomplished by (1) scoring pattern and degree of dental attrition and dental caries in subadults, (2) identification of porotic hyperostosis and cribra orbitalia as evidence of iron-deficient and megaloblastic anemia within the subadult sample, and (3) analysis of frequency and severity of osteoarthritis (OA) on the joint surfaces of the humerus, radius, and ulna in multiple age cohorts of adult females.

Subadults of Schroeder (CE 900-1150) and Dickson Mounds (CE 800-~1250) shared patterns of increased frequencies of dental caries, porotic hyperostosis, and cribra orbitalia when compared to the Albany (BCE ~200-CE 300) and Kuhlman Mounds (CE 600-1050) samples. These findings co-associate with increased frequencies of OA in females and existing demographic profiles which show subadult mortality increased in the Late Woodland and Mississippian periods. This facilitates identification of possible modifications in childcare and diet resulting from the intensification of food procurement and processing and gives further insight into the relationship between intensive female labor and subadult health status in Illinois.
Pathological conditions and trauma in the Late Woodland Nanjemoy Ossuary III (Maryland). Novi DOLLAS, Margaret GARDNER, David R. HUNT

Nanjemoy Ossuary III is an eastern Maryland site dated to the late-Woodland period (1100-1500 AD), excavated by T.D. Stewart and D.H. Ubelaker in 1979/1980. It is a commingled ossuary with a minimum number of individuals estimated at 74 adults and 37 subadults. In processing this skeletal series to be added to the Anthropology collections at the Smithsonian, certain recurrent pathological conditions were observed and recorded for accessioning.

Arthritic activity was commonly present in this population, a reflection of a heavily active lifestyle - though there are also a few possible cases of rheumatoid-like lytic bone destruction in the hand and foot joints. There are cases of traumatic events, such as an instance of a severe, healed trauma to a femur, as well as healed trauma in the long bones and hand/foot elements in other instances. There is a marked percentage of elements exhibiting periosteal inflammation, the highest frequency occurring on tibiae (85% occurrence), and the least on radii (8%). Many long bones (particularly the tibia) also include lytic lesions in conjunction with periosteal activity. One articulated vertebral column shows lytic lesions, vertebral body collapse, and fused elements. Differential diagnoses of the appendicular skeleton for chronic, recurrent inflammatory events or long-term infection from treponematosis-like diseases cannot be achieved due to the commingled nature of the remains and low number of cranial elements, whose overview identified few diagnostic lesions.

It is apparent this population suffered from stressors of normal to severe arthritis and probable high mortality due to infectious and/or inflammatory disease.

The rachitic tooth: Refining the use of interglobular dentin in association with Vitamin D Deficiency from Belleville, Canada (1824-1875). Lori D’ORTENZIO, Bonnie KAHLON, Megan BRICKLEY

Vitamin D plays a central role in calcium and phosphorus homeostasis essential for mineralisation of hard tissues. A deficiency in vitamin D is associated with incremental interglobular dentin (IIGD), observed as clear bands of bubble-like spaces following incremental lines within dentin. This study evaluated tooth dentin to grade IIGD severity, to characterise different types of interglobular dentin, and to clarify identification of IIGD. Histological examination was conducted on permanent canines (n=172) of individuals from Belleville, Canada (1824-1875). Permanent molars from a St. Matthews, Quebec (1771-1860) individual, with skeletal and dental evidence of deficiency were used for comparison. Results showed that 54 Belleville individuals displayed IIGD, with severity scores ranging from Grade 1 to Grade 3, indicative of mild to severe vitamin D deficiency. Four Belleville individuals initially assessed as having <Grade 1 severity had developmental interglobular dentin (DIGD). DIGD is not associated with vitamin D deficiency; it is imperfectly calcified dentin that does not follow the incremental lines. DIGD is localized in areas where dentin tubules are only half as dense as those under the enamel. Our data showed that caution is required when evaluating IIGD that is < Grade 1, as it may be misidentified as DIGD. Other naturally occurring structures in dentin that may be misidentified as IIGD include Tomes’ granular layer and marbling within the dentin matrix.

This knowledge aids in enhancing the role of IIGD to act as a biological marker for conditions that are associated with vitamin D deficiency, particularly in less severe cases.

Violence and pathology: A re-examination of a Late Archaic trophy taking victim. Erin EDWARDS, Megan HOFFMAN

Firehouse Site (12D563), in southeastern Indiana, is a roughly 3000-year-old Late Archaic habitation site with an adjacent small cemetery. It was excavated in 2003 and yielded five individuals, three males, one female, and one unknown ranging from young adult to old adult. One individual that is of particular interest is Burial 3, a young adult male found in a partially flexed position with six, chert projectile points, one of which damaged a lumbar vertebra. Moreover, Burial 3 has cut marks and evidence of decapitation and limb removal. The cut marks are present on the distal end of the right humerus and on the third through fifth cervical vertebra. His head, first and second cervical vertebrae, and right forearm were missing. The cut marks only appear on bones that articulated with those that were removed, indicating the mutilations were perimortem. The objective of this study was to determine if Burial 3...
had pathological conditions that may have weakened him before his death. The lumbar point damage consisted of a perforated spinous process and fractured transverse process. Those injuries were clearly antemortem because they were healed. Additionally, we found that Burial 3 had evidence for disc herniation between the lumbar vertebrae 3 through 5, which is unusual for a young adult. This condition would have been painful and potentially hindered normal movement. Thus, the pathology indicates that Burial 3’s spinal condition and projectile point damage put him in a vulnerable state, and it is plausible he was targeted for trophy taking.

Palaeopathology of stroke: elucidation of an old medical conundrum by means of combination of ancient written sources and biomedical mummy research. Francesco M. GALASSI, Michael E. HABICHT, Mathura RAVISHANKAR, Stefano De CAROLIS, Enrico CAVAGNA, Verena SCHUENEMANN, Frank RÜHLI

Stroke represents the second leading cause of mortality in patients aged over 60 globally and a leading cause of disability. A topic of capital importance for contemporary medicine, its history and palaeopathological record has long been elusive and fragmentary. This study uses a bimodal and multidisciplinary approach. The first objective of this work is to focus on the holistic collection of the historical record available for this important disease from the days of Ancient Egypt to the revolutionary discoveries on its physiopathology by Johann J. Webpfer (1620–1695) and Rudolph Virchow (1821–1902), using literary sources and artistic evidence. The second objective is to investigate the antiquity of stroke through the description of the first case of stroke in paleopathology in the natural mummy of the Italian priest Giovanni Arcangeli (1677/78–1751) in which a combination of archival sources and hard biological evidence demonstrates stroke as the cause of the priest’s old age disability and likely cause of death. The morphological data consists of the priest’s upper limb paralysis matched by CT-scan demonstration of the calcification of right carotid artery.

Latin-written documentation from the Rimini Diocesan Archives unequivocally indicate morbus apoplecticus (stroke) both as the patient’s major disease and the cause of his leaving the parish of San Lorenzo a Monte.

Furthermore, while more lab data are provided, this talk emphasizes the importance of multidisciplinary approaches to palaeopathology, in particular the emerging role of ancient source analysis to better describe the palaeophenotype of diseases, with a special focus on palaeo-semiotics.

The visible and the invisible: Identification of mycobacterial and Yersinia pestis co-infection in medieval Denmark through palaeopathology and biomolecular approaches. Julia GAMBLE, Katherine EATON, Jesper BOLDSEN, Hendrik POINAR

Human evolution has been shaped by a range of infectious diseases, some visible and some invisible to the macroscopic examination of human skeletal remains. Only a few diseases (such as leprosy and tuberculosis) leave a relatively clear osteological signal, and thus these have tended to dominate the palaeopathological literature. More often, however, diseases manifest on acute scales invisible to most macro level investigations. Until recently, these have only been detectable through the analysis of demographic patterns in cemetery contexts (i.e. through epidemic mortality profiles), but aDNA advances allow the specific detection of these diseases. This study presents the results of combined bioarchaeological and molecular analyses on medieval Danish populations, focusing on the case study of a female (aged 21 – 26 years) from the medieval rural site of Tirup who has nonpathognomic osteological indicators consistent with leprosy and tuberculosis, and from whom both Yersinia pestis (the causative agent of plague) and Mycobacterium sp. have been identified through quantitative PCR, shotgun sequencing, and targeted genome enrichment. Specifically, changes to the hard palate, fibula, and 5th metatarsal consistent with leprosy and changes in the pelvis and vertebrae consistent with tuberculosis are visible. While not independently pathognomnic, these indicators provide insight into patterns of disease co-infection when integrated with the aDNA evidence. These results will therefore be considered in relation to the early mortality of this individual and the positive DNA identification of bacterial co-infection to tease apart interpretive frameworks surrounding frailty within the context of the osteological paradox.
Disability in the Konya Plain, Turkey: Two case studies from Roman Çatalhöyük. Michelle GAMBLE, Sophie MOORE
Between the 1st – 4th centuries AD, a Roman population used the two prehistoric mounds of Çatalhöyük, in the Konya Plain, Turkey, as a cemetery. Eighty graves from the Roman period have been excavated and analysed as part of a wider study of the ‘Post-Chalcolithic’ cemeteries covering the site of Çatalhöyük. Of the 80 Roman skeletons examined, two individuals in particular stand out for presenting extreme pathological changes, including limb atrophy, osteopenia, and ossification of entheses, which would have significantly impacted their mobility and physical abilities. This paper will present the evidence for the differential diagnoses and the implications for the two individuals: a female aged between 20-35 years at death and a male aged 35-45 years at death, using an osteobiographical approach. Further, we can begin to examine the nature of the community that would have had to provide care for these individuals based on the framework previously established by Tilley and Schrenk (2017). Both of these individuals lived into adulthood despite their disabilities, and were thus clearly cared for, and were buried in a similar fashion to the other burials of the same period, in one case including grave goods. The Roman population at Çatalhöyük remains a bit of a mystery to-date, as the evidence of the settlement is sparse. Therefore, understanding the nature of the community is primarily available through the skeletal material and burial architecture and grave goods; thus the presence of individuals with severe disabilities from a relatively small population provides an important clue to understanding the nature of the Roman community at Çatalhöyük.


Assessing the abundance of arthropathies and inflammatory reactive bone in the Late Woodland Nanjemoy Ossuary III (Maryland). Margaret GARDNER, Niovi DOLLAS, David R. HUNT
In the recent overview for permanent curation for the Department of Anthropology at the National Museum of Natural History, Nanjemoy (Ossuary III) revealed intriguing patterns of pathological conditions. The Nanjemoy site is Late Woodland period (1100-1500 AD), affiliated with two previous excavations on the Juhle family’s farm in Maryland. The Juhle sites (Ossuaries I and II) were excavated in the early 1970’s by T.D. Stewart and D.H. Ubelaker, who excavated the third ossuary on the farm in 1979/1980. An initial report of the Nanjemoy excavation was published by Ubelaker, reporting the MNI for the Nanjemoy ossuary is an estimated 74 adults (by the right temporal) and 37 subadults (by the right femur).

In the present work, we observed interesting series of pathological conditions including typical signs of arthritic change in the appendicular skeleton due to high activity lifestyle, as well as numerous examples of inflammatory diseases with periosteal involvement and lytic activity. The frequency of pathological conditions of inflammatory and/or infectious periosteal reactive bone observed is remarkable, particularly when the amount of bones assessed is considered. Based on mostly intact postcranial elements, periosteal involvement is present in 49% of humeri, 36% ulnae, 34% vertebrae, 53% of femora, 89% tibiae, 33% fibulae. The range and severity of these conditions is illustrated by images in this presentation. It is apparent that this population suffered from stressors of normal to severe arthritis and probable high mortality due to infectious and/or inflammatory disease.

Rotator cuff disease prevalence, demography and anatomical distribution in a skeletal assemblage from the Litten Site, Chichester, West Sussex (1550-1850 CE). Aaron A. GASPARIK
Rotator cuff disease is a common musculoskeletal condition associated with age-related tendon degeneration, acute trauma or overuse of the shoulder during activity. This multifactorial aetiology means a range of pathological changes can appear throughout the shoulder, with degeneration in one area often affecting – and being affected by – pathological changes elsewhere in the joint. Though rotator cuff disease is frequently observed clinically, few palaeopathological studies have analyzed it in detail, limiting our understanding of this condition in archaeological contexts. The present study sought to rectify these methodological discrepancies by applying a revised version of the clinically-validated Waldron method for the palaeopathological diagnosis of rotator cuff disease.
to a sample of 120 post-medieval, adult skeletons from Chichester, West Sussex. Disease prevalence and distribution were determined and pathological changes at specific tendon insertions were examined to explore how different areas of the shoulder were affected. The disease was noted in 20/53 females (37.7%) and 40/67 males (59.7%). Though not statistically significant, these findings differed from clinical studies, which present a roughly even male-female distribution. This study suggested extrinsic factors may have played a larger role in sex-related patterns of rotator cuff disease in this sample compared to modern samples. A greater proportion of older adults were affected, which reflected age-related distribution trends observed clinically. The subscapularis was most frequently altered, corresponding to recent clinical discussions regarding the multifactorial aetiology of rotator cuff disease. This study proposed further research investigating additional sites and time periods to better understand the pathogenesis of this disease.

Maintaining mobility after fracture: A biomechanical analysis of fracture consequences at the Roman sites of Ancaster (UK) and Vagnari (Italy). Rebecca J. GILMOUR, Megan B. BRICKLEY, Erik JURRIAANS, Tracy L. PROWSE
This study uses biomechanical data from the tibia to investigate functional consequences of fractures to the legs (femora, tibiae, and fibulae) in adults from Roman Ancaster, UK and Vagnari, Italy (1st to 4th centuries AD). We hypothesized that some leg bone fractures would cause altered mobility, evident as tibial cortical bone loss and asymmetry, thus providing insight into injury experiences and possible impairment among Roman period individuals at these sites. Biplanar radiographs were taken of fractured long bones and compared to those of individuals without fractures (Ancaster n=20:57; Vagnari n=6:19). Tibial cortical bone areas and asymmetries were calculated radiographically and corrected for body size. Evidence for altered mobility was identified when tibial cortical bone exhibited larger or smaller outlying areas and levels of asymmetry; outliers were defined as measures greater or less than 1.5 times the interquartile ranges (1.5IQR). Asymmetry and area 1.5IQRs were divided by site; area 1.5IQRs were also calculated by sex. In both samples, individuals without fractures had relatively symmetric tibial cortical bone on average, with 1.5IQRs ranging from -22.1 to 19.1% (Ancaster) and -21.2 to 22.2% (Vagnari). None of the individuals with leg fractures had areas or asymmetries that were larger or smaller than these calculated ranges. These findings suggest that both Ancaster and Vagnari individuals tended to resume mobility after a fracture had healed. The absence of biomechanical evidence for impairment addresses issues concerning injury recovery and suggests that resilient behaviors and continuation of mobility may have been valued or required in these communities.

Spina bifida and lower limb abnormalities in a modern Hispanic migrant. Timothy GOCHA, Chloe MCDANELD, Courtney SIEGERT, Michelle HAMILTON, Kate SPRADLEY
In 2014, the unidentified remains of a presumed migrant who perished after crossing the U.S./Mexico border were exhumed and transferred to Texas State University for analysis under the “Operation Identification” project, which facilitates identification and repatriation of deceased individuals found in proximity to the Texas-Mexico border. Skeletal analysis revealed the remains were those of a Hispanic female between 20-40 years, who stood 4’9” – 5’0”, and presented with significant skeletal abnormalities in the spine and lower limbs. This presentation will discuss impacts these anomalies had on the individual’s locomotion, and situate them in the broader sociopolitical context of the humanitarian crisis occurring along the southern U.S. border. The suite of pathologies included a sixth lumbar vertebra, congenital fusion of the posterior centra of L5 and L6, partial sacralization of L6, and complete lack of neural arch with an open dorsal bord of S5-S2 and S4, consistent with spina bifida. The open neural arch is compensated for by fusion of the spinous processes and lamina of L3/L4. Anomalies in the lower limbs include asymmetry in femoral length, mediolaterally broadened patellae, hypoplastic metatarsals, lack of bilateral midfoot arch, and an unusual presentation of os trigonum in the left talus. The constellation of abnormalities indicates this individual had a significantly altered gait that limited mobility, and yet despite these disabilities she still attempted to make the crossing. As such, this case is testament to the suffering people will undergo to risk their lives in order to escape violence and economic hardship in their homeland.
A possible case of smallpox? Description and differential diagnosis of suspicious humeral lesions, postcontact Mórope, North Coast of Peru. Kelly GROTH, Mikayla MATTHEWS, Haagen KLAUS
Smallpox is one of the most devastating diseases ever endured by the human species, and it is one of the rare viral pathogens that can elicit skeletal changes. Smallpox (Variola major) can produce a necrotic non-suppurative osteomyelitis that has a particular predilection for the elbow joint. In this poster, we evaluate a case of abnormal bone destruction and formation in the distal left humerus of an adult male from Mórope in the Peru’s northern Valley Lambayeque Complex. This person died during the Late Colonial occupation of the town between ca. A.D. 1640-1750 and when the region experienced periodic waves of multiple high-mortality Old World diseases.
In this case, the individual’s left anterior humerus featured a destructive, irregular necrotic focus that perforated the olecranon fossa. Florid abnormal new bone formation indicative of significant periosteal inflammation was present on the anterior metaphysis and distal diaphysis. The surfaces of the trochlea and capitulum were spared. Significant postmortem damage to the posterior aspect of the bone prevented clear observation, but minor new bone formation was noted as well. The right humerus and the rest of the skeleton was normal. We evaluate multiple differential diagnoses from pseudopathology to bacterial processes, mycoses, hypertrophic (pulmonary) osteoarthropathy, and smallpox. Though an idiopathic, localized case of pyogenic osteomyelitis cannot be completely ruled out, we argue these lesions appear more consistent with a mild, unilateral case of Variola osteomyelitis, and adds to the small number of potential paleopathological cases of New World smallpox following European contact.

A case of multiple epiphyseal dysplasia in a Proto-Historic period skeleton from the northern interior of British Columbia. Evan HARDY, Terra LEKACH
Multiple epiphyseal dysplasia (MED) is a rare genetic condition that can manifest in a number of skeletal abnormalities dependant on the causative mutations, however the condition is generally characterised by delayed or non-occurent epiphyseal union. The remains of a young adult female (20-30 years based on third molar eruption, dental wear, and auricular surface morphology) were excavated from a proto-historic period (1806-1900 CE) cemetery in British Columbia, Canada’s Northern Interior in the summer of 2017. The cemetery was unmarked and contained grave goods consistent with the proto-historic period, with both pre- and post-contact materials being represented in the assemblage. The individual’s skeleton features multiple skeletal abnormalities in the limbs, extremities, cranium, and vertebral column. These abnormalities include sagittal craniosynostosis resulting in an asymmetrical cranial morphology, severe thoraco-lumbar kyphoscoliosis, irregular morphology of the acetabulum, and delayed and non-occurrent epiphyseal union of the tubular bones including all limbs, and the metacarpals, metatarsals, and phalanges. Based on stature estimation (157.47 ± 2.62 cm) the individual is within the range of average female stature within the population (157.09 ± 2.62 cm) (not accounting for kyphoscoliosis). The condition has been diagnosed as MED. MED is the only condition that accounts for lack of union in almost all epiphyses in an individual that is of average stature. Kyphoscoliosis and the abnormal shape of the acetabulum are also consistent with an individual suffering from MED. This individual is possibly the first currently known case of MED found in an archaeological population outside of Egypt.

A case of hypertrophic osteoarthropathy in an adult Macaque from an anthropological skeletal collection. Cara HIRST, Tony WALDRON
Within archaeological and anthropological institutions, a lack of resources has led to pathological cases of academic interest being overlooked. One such collection, at UCL was recently re-analysed. This has led to several pathological cases being identified, including an adult macaque of unidentified species and sex, which was found to have widespread, solid, thin periosteal reaction, primarily affecting the limbs. The lesions were found to be bilateral and highly symmetrical, and the cortex of the bone was unaltered. It was determined that the morphology and distribution of skeletal lesions were consistent with a diagnosis of hypertrophic osteoarthropathy (HOA), based on descriptions of HOA among in the archaeological literature and veterinary studies.
HOA typically occurs secondary to pulmonary, cardiac, intestinal or hepatic diseases, and most commonly is considered a paraneoplastic syndrome which occurs secondary to pulmonary and plural tumors. The most common symptoms include painful inflammation of the bones and joints, clubbing of the fingers and toes, and widespread symmetrical periostitis. While osteoarthropathy has been recorded among humans and other animals, there have only been three previous cases on HOA among non-human primates published, and these cases focused on radiographic and soft tissue examination during necropsy. As such there has been a lack of discussion concerning the paleopathological lesions of HOA on dry bone among non-human primates. This paper describes the appearance and distribution of skeletal lesions, and compares this to previous cases of HOA among human and non-human primates. Demonstrating the importance of the re-examination of skeletal collections, to increase palaeopathological literature.

**Life and death on Mograt Island, Northern Sudan.** Tina JAKOB, Claudia NÄSER, Jens WESCHENFELDER, Lilli JANOTTE

This study provides insights into the health of cemetery populations buried on Mograt Island, situated between the 4th and 5th Nile cataracts. Fifty-seven, mostly complete and well-preserved individuals were macroscopically analyzed, using standard bioarchaeological methods. The importance of these remains lies in their chronological continuity spanning 3000 years, with the earliest cemetery dating to the Neolithic (ca. 3000 BCE; 14 non-adults, 3 females, 4 males and one individual of undetermined sex), the Kerma period (5 males and 1 female), to the New Kingdom-Napatan and early Meroitic period (8 non-adults, 6 females and 7 males) with the youngest burials dating to the 1st century BCE.

High infant mortality was found, especially in the small Neolithic population, where 60% of the individuals (14/22) did not reach adult age (over 18 years). In addition, high frequencies of non-specific stress indicators (cribra orbitalia; 8/46), enamel hypoplasia; 16/33, peristeal new bone; 23/57) were present during all archaeological periods, and an increase in non-specific respiratory problems was found. Healed fractures were common (5/57), likely due to the rocky landscape and interaction with animals. Dental health was generally good with only one caries lesion (in 554 teeth). However, periapical lesions were frequent and can be correlated with advanced dental wear caused by inclusions of sand in the diet. Congenital conditions were observed in all chronological groups, in particular in the vertebrae (e.g., transitional vertebrae) and might indicate a closely related community.

This study contributes to our understanding of archaeological populations from a little known area of Sudan.

A case study comparing clinical observations and skeletal lesions to assess a diagnosis of gout. Hannah KRUSE, Kathleen BLAKE

In developing a pathological skeletal collection at SUNY Oswego, donor samples were macerated, and stabilized for use as teaching aids. Each donor sample was accompanied with relevant medical history. One elderly individual presented pathology to the first metatarsal-phalangeal joint, marked by excess growth and joint fusion, rendering it immobile. No injury to the first metatarsal phalangeal joint was mentioned in the medical history. To determine the etiology to the individual’s foot, the skeletal lesions were examined and compared the provided pharmacological data. Pathology was restricted to the first metatarsal-phalangeal joint, with small amounts of lipping on the phalanges and metatarsals, indicating this was not likely arthritis. Osteomyelitis was also discounted as a diagnosis because the three features were not observed. Based on the localization and characteristics of the trauma, gout was decided to be the most likely source.

A review of the pharmacological records indicated that the donor was not being treated with gout medication; however, this individual was being treated for diabetes mellitus, a condition that may cause diabetic neuropathy. Diabetic neuropathy results in reduced sensitivity which may explain the lack of treatment or complaint about the pain in the foot.

While this case could be viewed in a modern context, analysis reflected the process of assessment in historical cases. Crystals may be used to confirm the presence of gout, these were not present due to the processing of the remains for analysis. Gout was not the initial
proposed diagnosis, preservation of soft tissue was not conducted. While medical records were provided, they were not complete so inferences were made based on the pharmacological evidence possessed. Therefore, it was necessary to rely on the skeletal lesions to assess the presence of potential gout.

Skeletal fracture patterns: Evidence for intentional violence in Medieval Nubia. Valerie A. LEAH
The interpretation of skeletal fractures is a difficult endeavor that requires multiple lines of osteological evidence to accurately accomplish. One tool at the anthropologist’s disposal is fracture pattern analysis, whereby fracture margins, morphologies, and locations are compared to forensic/clinical correlates and experimental models to better interpret timing and mechanism of injury. This technique considers and compares multiple characteristics of one or more lesions, allowing reasonable deductions of injury etiology to be made. Thus, this research combined forensic anthropological and bioarchaeological methods to examine well-preserved adult human remains (106 females; 100 males) from the medieval Nubian site of Mero Island (cemeteries 3-J-10 and 3-J-11). Macro- and microscopic methods (Leah, forthcoming) were used to evaluate each individual for evidence of ante- and perimortem skeletal fractures. Overall, 129 individuals exhibited sharp and blunt force ante- and perimortem injuries consistent with both accidental and violent trauma. Two case studies have been chosen to illustrate the importance of fracture pattern analysis in the determination of possible interpersonal violence (e.g., multiple antemortem cranial depressed fractures; perimortem sharp force penetrating lesions on the ribs and cranium) versus accidental injury. While it is certainly unwise to state the exact manner of death in most cases, these skeletal fracture patterns contribute compelling evidence for probable intentional violence at the Fourth Cataract. Importantly, these results refute previously proposed notions that the Fourth Cataract in the medieval Christian period was an inherently peaceful region. Further, this research demonstrates the merits of using a forensic approach to the analysis of archaeological remains.

A possible case of lambdoid craniosynostosis from the Roman cemetery of Vagnari, Italy (1st–4th c. AD). Marissa L LEDGER, Liana J BRENT, Tracy L PROWSE
Ongoing excavations of a Roman cemetery at the site of Vagnari, south Italy, have recovered over 140 skeletons representing a rural, working-class population on an Imperial state (1st – 4th c. AD). Excavations in 2017 revealed one subadult individual with an unusually large and asymmetrical cranium. Age estimation using dental development indicated that this individual was 8–12 years old at the time of death. Macroscopic analysis of the cranium revealed premature fusion of the right lambdoid suture with a resulting ipsilateral occipitomastoid bulge and contralateral frontal/parietal bossing. The cranial bones also showed thinning of the right occipital bone as well as deeper and extensive vascular impressions on the endocranial surface of the frontal and parietal bones. This paper presents a differential diagnosis of this condition, and considers non-syndromic unilateral lambdoid craniosynostosis, syndromic craniosynostoses, and posterior plagiocephaly as potential explanations. Poor preservation of the facial bones and postcranial remains (especially the hands and feet) preclude differentiation of non-syndromic versus genetic syndromic craniosynostosis. Regardless, we propose that this individual represents a rare case of lambdoid synostosis in the archaeological record.

In spite of this visible deformity, and possible behavioural implications, this child was buried in a typical fashion within the community cemetery (e.g., in a cappuccina burial with standard grave goods), indicating long term care of the child as part of this community at Roman Vagnari.

Evidence for parasitic infection in Roman period latrines from three towns in Asia Minor. Marissa LEDGER, Faith WILLIAMS, Theo ARNOLD-FOSTER, Hui-Yuan YEH, Jan BAETEN, Jeroen POBLOME, Friederike STOCK, Helmut SCHWAIGER, Sabine LADSTÄTTER, Maria KNIPPING, Helmut BRÜCKNER, Erica ROWAN, Nicholas CAHILL, Piers MITCHELL
There is good bioarchaeological and historical evidence for infectious disease in people during the Roman period, both from skeletal remains and latrines. However, studies of parasite infection have been mainly focused on sites in northern Europe. The aim of this
The health impact of civilization on society: disease patterns of citizens during the Late Zhou Dynasty in China (877 BC - 771 BC). Mocen LI, Charlotte ROBERTS, Peter ROWLEY-CONWY, Liang CHEN, Dongyue ZHAO

In bioarchaeology, the rise of civilization has been linked to a deterioration in human health when compared to previous less “developed” societies. However, research has so far been insufficient to corroborate this view in China.

To test such a hypothesis, disease patterns were macroscopically observed in 33 skeletons from an urban context (16 females, 16 males, and one subadult). All individuals are dated to the Late Zhou Dynasty (877 BC - 771 BC) and identified as citizens from Rui State, which was an administrative center of the ruling Zhou Dynasty in Shaanxi, China. The results showed that Rui citizens experienced high rates of inflammatory diseases, with evidence on long bones (52.4%; 11/21), in maxillary sinuses (15%; 3/20), and on ribs (7.7%; 2/26). In addition, 92.6% (25/27) of individuals manifested enamel hypoplasia, 15.4% (4/26) of individuals showed cribra orbitalia, and 30.4% (7/23) had porotic hyperostosis. A comparative study between these state citizens and two prehistoric populations from the same region showed that inflammatory disease increased for Rui citizens, but cribra orbitalia and porotic hyperostosis declined. Considering the archaeological context, this increase in inflammatory disease could have resulted from a crowded and urban lifestyle, a situation that developed with the shift towards centralized population centers. In conclusion, the rise of civilization brought both costs and benefits for human health, with the development of inflammatory diseases being the primary health challenge for this urban population.

Skeletal evidence for active and healed vitamin D deficiency at two Roman period sites. Laura LOCKAU, Megan BRICKLEY

Beyond its role in skeletal mineralization, recent clinical evidence has established the importance of vitamin D in a range of biological roles, particularly in the immune system, that broaden the implications of deficiency for overall health and mortality. Considering the distribution of skeletal lesions associated with this condition, differentiating active and healed deficiency, and evaluating how evidence for deficiency relates to age-at-death can provide valuable information for paleopathologists, particularly given the potential for vitamin D deficiency to contribute to the development of other pathological conditions and to affect survival. Gross, radiographic, and microscopic skeletal changes associated with vitamin D deficiency were examined in juvenile and adult human skeletal remains from the Roman period sites of Ancaster, UK (n = 276) and Isola Sacra, Italy (n = 823), and evidence for active (Ancaster juveniles 8.4%, adults 1.1%; Isola Sacra juveniles 1.6%, adults 1.3%) and healed deficiency (Ancaster juveniles 8.4%, adults 4.9%; Isola Sacra juveniles 5.9%, adults 4.3%) was present throughout the life course in individuals from both sites. At Ancaster, a higher prevalence of skeletal evidence for vitamin D deficiency (9.4% vs. 6.5% Isola Sacra) is associated with differences in age-at-death distribution and the presence of a significant relationship between skeletal lesions and survival (Mantel-Cox p 0.03). Differences between the sites likely reflect variation in the occurrence of vitamin D deficiency due to biocultural factors, and potentially the overall health and mortality of these individuals.
Tumultuous tumuli: Demography and pathological analysis of the Bronze Age Gusića Gomila II site, Croatia. Andrea LOPEZ, Julianne PAIGE, Anna OSTERHOLTZ, Helena TOMAS

Gusića Gomila II, a site associated with the Cetina culture of 2200-2000 BCE, was uncovered near the town of Trilj. Human remains were excavated from a stone tumulus which contained 3 intact graves in situ, designated as Cist I (MNI=2: 1 adult male, 1 non-adult), II (MNI=4: 1 adult male, 1 adult indeterminate, 2 non-adults), and III (MNI=3: 1 adult male, 1 adult indeterminate, 1 non-adult). Commingled and fragmentary remains present challenges for analysis and interpretation. These assemblages can provide data on past lived experience that might otherwise be lost. The methodology used concentrates on elements rather than individuals. Pathological conditions cannot be traced between elements of a specific individual, but the presence of pathological changes indicate the population as a whole was exposed to disease vectors and/or experienced stresses as part of daily life. The study of the long bone fragments showed periosteal deposition in both adults and non-adults. Linear enamel hypoplasia (LEH) was found on 5 of 23 teeth (22%). The teeth with LEH (2 of 5 or 40%) exhibited multiple LEHs, indicating recovery incidences of stress during dental development. The scope of analysis is limited by the nature and preservation of the assemblage, but we show the population from Gusića Gomila II was exposed to both childhood and adult stress. The limited skeletal material from this time period and location, demographic and pathological analysis of this assemblage begins to build an understanding of lived experience in Bronze Age Croatia.

Bone metastatic disease and the identification of the primary organ: How far is too far? Evidence from two Portuguese reference collections from the 19th-20th centuries. Carina MARQUES, Vitor MATOS, Albert ZINK, Eugénia CUNHA

The study of the cancer in past human societies is a crucial line of investigation in paleopathology. Nonetheless, the appraisal of cancer landscape in the past is hindered by diagnostic difficulties. The present work aims to discuss the paleopathological identification of the neoplasm primary site (organ) based on the pattern of metastatic bone disease. The spectrum of metastatic bone disease was assessed in 131 skeletons (53 males and 78 females; age at death interval: 15-93 years), from the Coimbra Identified Skeletal Collection, Coimbra, and Museu Bocage Identified Skeletal Collection, Lisbon, and dated between 1904 and 1969. Most of the individuals had gastric (n=32), uterine (n=21), intestinal/colorectal (n=18), prostatic (n=9), or breast (n=6) cancers recorded in the cause of death. Metastatic bone disease occurred predominately in individuals with breast cancer (83.3% [5/6]), contrasting with a low coefficient obtained in individuals with gastric neoplasms (18.8% [6/32]). This disparity supports the well-known difference in osteotropism between these primary cancers; however the same does not hold true for other primary sites. Individuals with prostate (33.3% [3/9]), uterine (38.1% [8/21]), intestinal/colorectal (39.9% [7/18]), or liver (33.3% [2/6]) cancers reached similar coefficients despite the considerable difference in osteotropism. The anatomic distribution and the typology of lesions did not markedly diverge among the afore-mentioned groups (except for a higher likelihood of thoracic cage lesions in individuals with breast neoplasms). The osseous lesion typology and anatomic distribution were poorly discriminant variables to identify the neoplasm primary organ. The heterogeneity of the patterns of metastatic bone disease limits our diagnostic ability. Providing a broader diagnosis is more useful than incur in misdiagnosis.

Symbolic replacement of severed body parts with objects in 3rd–7th century AD graves in England. Simon MAYS, Vicky CROSBY

Normative inhumation in 3rd – 7th century AD Britain was extended supine burial, but deviant burials are sometimes found, including decapitation or other bodily mutilations. Occasionally, the severed head or other missing body parts are replaced in the grave by objects placed at the appropriate anatomical locations. This paper reviews this practice and describes three new examples from Stanwick, England. The 3rd –5th century AD Stanwick cemetery contains 35 inhumations; five were decapitated (two males aged 30-50yrs, a female 18-30yrs, a female 50+ yrs, and a child ca. 4yrs). In two of these, the severed head was placed in the lower part
A woman's world: Pathological and morphological changes associated with pregnancy and childbirth in Roman Britain. Candace MCGOVERN

Pathological and related morphological changes to the pelvis and lumbar spine can result in an increased risk of complications during pregnancy and childbirth. Previously published works frequently approach this topic from an evolutionary perspective, examining obstetric hazards due to adaptations related to bipedal movement or attempt to isolate morphological changes to the female pelvis related to childbirth. Within the field of paleopathology, studies have remained limited focusing on complications stemming from contracted pelves, an unstable pelvic brim or pelvic fractures. The aim of this study is to establish the frequency of pathological and related morphological changes to the female skeleton including developmental, metabolic, and spinal causes, in addition to other diseases or deficiencies which can result in a contracted pelvis, dislocation, instability or atrophy of lower limbs. To accomplish this, the skeletal remains of 402 Romano-British females between the ages of 13 and 45 years were examined. Within the group 37.6% (n=151) displayed changes that could result complications during pregnancy or childbirth. These included changes such as sacroiliac osteophytes (6.5%, n=26), sacralisation (1.2%, n=5), pubic symphysis dysplasia (0.8%, n=3) and premature fusion of the coccyx (3.7%, n=15) which have been previously neglected in past populations studies. Widening the potential pathology associated with pregnancy and childbirth will provide a better understanding of the process in past populations without access to modern birthing methods such as caesarean sections.

Prevalence and patterns of cranial trauma in the Migration period cemetery of Bitburg, Germany. Christian MEYER, Ferdinand HEIMERL, Kurt W. ALT

In 2007 a Late Roman to Early Medieval cemetery (4th to 6th century AD) was excavated in Bitburg, a town located ca. 30km north of the major Roman capital of Trier (Augusta Treverorum). The cemetery was situated just outside the western walls and ditches of the Late Roman fortress. Thirty-five individuals (15 male, 7 female, 2 indeterminate, 11 non-adults) could still be documented, many more graves had already been destroyed by Medieval and modern building activity. To determine the health status of this population, dating to a time of major upheaval in Central Europe, macroscopic analysis and CT scans were utilized and pathological lesions were recorded systematically using a self-developed zonation method. The most significant result of this study is a very high prevalence of mostly peri-mortem cranial trauma, which far exceeds the levels of violence usually encountered in the Early Medieval cemeteries of the same general region, as 56% (5/9) of preserved male and 67% (2/3) of female skulls at Bitburg show evidence of major traumatic injuries, both healed and unhealed. The affected individuals are scattered throughout the preserved areas of the burial site and do not form a cluster. This indicates that the population under study was at constant risk to suffer potentially lethal trauma during the use of this cemetery, a time of severe social unrest. The results are discussed in light of the specific historical context of the region and are compared to other sites where trauma was recorded with the same methodology.

Maxillary sinusitis of odontogenic origin from Amarna, Egypt: Differential diagnosis of two adult cases from the New Kingdom. Erika MOREY

Maxillary sinusitis of odontogenic origin is often noted in clinical literature for its persistence through conventional sinusitis therapies and resolution only
The well contained the remains of at least 28 individuals and radiocarbon dating places it in the Early Modern Period. Based on the recovered artefacts, a large number of skeletal injuries associated with intentional violence in adult males were discovered. The population for the current study (n=237) includes individuals with maxillary bone and dentition from the Roman (1st-3rd c. AD) cemetery of En Chaplix, Aventicum, Switzerland. Three teeth from each individual with undetermined sex and three subadults (an older child and two adolescents). Beside the pathological changes frequently found in archaeological contexts such as dento-alveolar lesions, Schmorl’s nodes, and cribra orbitalia this assemblage contained a large number of skeletal injuries associated with intentional violence in adult males. These included ante-mortem injuries such as nasal fractures, but also a whole range of peri-mortem trauma caused by sharp-bladed weapons, most probably sabers and/or knives.

The morphology and distribution of peri-mortem injuries in this case suggest a combination of a face-to-face combat (e.g. cuts on the anterior part of the cranium and on forearm bones) and execution (decapitation). Based on the available historic sources, the comprehensive archaeological context as well as the bioarchaeological characteristics of the studied sample will be presented. The remains found in the Early Modern period well from Osijek belong to members of the Ottoman armed forces who were killed and unceremoniously disposed of during the unsuccessful Turkish siege of Osijek in 1690.

**Vitamin D deficiency and interglobular dentin (IGD) in a Roman (1st-3rd c. AD) population from Aventicum, Switzerland.** Taylor PEACOCK, Chryssa BOURBOU, Bonnie KAHLON, Megan BRICKLEY

The assessment of residual rickets in paleopathology is difficult, relying on often subtle indicators such as long bone bending deformities, the identification of which is hindered by poor preservation. Interglobular dentin (IGD) in teeth has emerged as a feature associated with vitamin D deficiency, offering promising results. This study sought to determine whether IGD was present in permanent teeth from fragmentary individuals (n=3; two males and one female all 25-35) who exhibited non-diagnostic skeletal changes associated with vitamin D deficiency, such as subtle long bone bowing. All individuals came from the Roman (1st-3rd c. AD) cemetery of En Chaplix, Aventicum, Switzerland. Three teeth from each individual with dentin formation spanning birth to 19 years were histologically analyzed. The number, severity, and age of occurrence of IGD were investigated following D’Ortenzio et al. (2016). The study found that all individuals, and seven of nine teeth (77.8%) exhibited...
IGD. The most severe levels of IGD (Grade 2.5 and above) were found in the two least preserved individuals, with IGD corresponding to the period of rapid skeletal growth. Low levels of IGD that would have corresponded with the adolescent growth spurt were also present in the third molars of these individuals. Lower levels of IGD (Grade 1.5) were associated with the better-preserved skeleton which exhibited a clearer case of residual rickets.


**The James L. Shupe Veterinary Fluorosis Collection: A study of skeletal fluorosis.** Kristen PEARLSTEIN

The James L. Shupe Veterinary Fluorosis Collection, housed at the National Museum of Health and Medicine, is comprised of bone specimens and archival records that document fluoride ingestion in large mammals. Skeletal fluorosis is a metabolic condition characterized by periosteal hyperostosis and increased bone density. Skeletal fluorosis may be observed in conjunction with dental fluorosis, exhibited as hypomineralization of the tooth enamel. This study introduces the Shupe Fluorosis Collection and discusses the skeletal changes observed in cases of documented fluoride ingestion and toxicosis. The remains available for research are comprised of veterinary fluorosis specimens, poisonous plant-induced congenital malformation specimens, and comparative veterinary and human hereditary multiple exostoses specimens. The veterinary specimens consist of single bone elements or partial skeletons from large domestic animals, primarily bovine, equine, and ovine specimens. A range of documentation is available for each case, including experimental and observational data spanning several decades, necropsy and field reports, X-rays and microradiographs, photographs, cross-sectional segments of bone, and microscope slides. Additionally, the collection is supported by an extensive library of reprints, texts, and reports on fluorosis, fluoride treatment, and related fluoride research.

Promoting the study of the Shupe Collection improves our understanding of the cause and effects of skeletal fluorosis, and supports military and civilian veterinary research by making the Shupe Collection and associated documentation an available resource.

Skeletal fluorosis is still endemic in many countries and should be considered as part of a differential diagnosis during documentation of human and non-human skeletal remains.

**Time doesn’t heal all wounds: Examining spinal pathology patterns among different temporal sites in west-central Illinois.** Abigail PEEPLES

This research sought to examine a co-association among three spinal arthroses to distinguish differences within three different sites acting as proxies for three temporally distinguished pre-Columbian subsistence strategies. Schmorl’s nodes, vertebral osteoarthritis, and vertebral osteophytosis were examined in the spines of 124 adults representing the Middle Woodland (200 BCE – CE 300), Late Woodland (CE 900-1100), and Mississippian (CE 800-1250) periods of Illinois, to assess if subsistence strategies affected presence and severity of these pathologies. From Albany Mounds, representing a hunter-gatherer society, 19 males, 9 females, and 1 unsexed adult was examined for pathologies. Kuhlman Mounds, a Late Woodland site representing a subsistence strategy of grass cultivation and hunting-gathering techniques, had 22 males, 19 females, and 2 unsexed adults examined from the skeletal sample. Twenty-nine males and 23 females were observed from the Mississippian site of Dickson Mounds representing intensive agriculture of maize. Vertebral joints were examined and scored for presence and severity of each arthrosis, and an increase in severity of osteoarthritis and osteophytosis in the Dickson Mounds population. The population sample from Albany Mounds showed higher frequencies (12%) of osteoarthritis in the cervical joints, while the Dickson Mounds sample showed a higher frequency (8%) in the lower thoracic joints. The remaining data revealed correlations among age groups and sex based on temporality and arthrosis presence. The differences in frequency patterns support a difference in not only activities between the population samples, but also a difference in workload.
Compromised childhood health and incremental dentine analysis of St Gertrude Church cemetery population (15th-17th centuries AD) from Riga, Latvia.

Elina PETERSONE-GORDINA, Charlotte ROBERTS, Janet MONTGOMERY, Andrew MILLARD, Darren GRÖCKE, Guntis GERHARDS

This study compares evidence for compromised childhood health, as expressed in linear enamel hypoplasia and cribra orbitalia, and dietary carbon and nitrogen isotope values from non-adult incremental dentine, in people who were buried in the mass graves and the general cemetery of St Gertrude’s graveyard.

The aims were to explore if and how compromised childhood health increased frailty of adults and children in the cemetery, and to study isotopic evidence for possible nutritional or physical stress in children from the mass graves and the general cemetery.

Seven hundred and twenty-one individuals were recovered during the archaeological excavation. Three hundred and ninety-one adults and 160 children could be observed for cribra orbitalia, and the dentitions of 225 adults and 161 children could be examined for linear enamel hypoplasia.

Teeth from 19 children were selected for carbon (δ¹³C) and nitrogen (δ¹⁵N) incremental dentine analysis.

While no significant differences were observed in the prevalence of cribra orbitalia between any adult or non-adult groups, the prevalence of linear enamel hypoplasia was more varied, particularly in children.

With regard to incremental dentine analysis, children from one mass grave showed evidence for nutritional stress shortly before death, consistent with a historically documented famine in the region, and possible in-utero stress was observed in five children from the mass graves and two from the general cemetery.

Altogether, the results indicate a higher frailty for children in the mass graves, especially those who had suffered from previous episodes of compromised health, compared to children in the general cemetery.

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Possible case of echinococcosis in ancient Uzbekistan (9th-12th centuries CE). Megann PHILLIPS, Sean Y. GREER, Elissa BULLION

Echinococcosis is among the most common parasitic infections identifiable in skeletal remains. This is due to the preservation of calcified shells of fertile cysts inhabited by tapeworm larvae that form in soft tissue, adjacent to bones or within bones. It is frequently found in pastoral populations in close contact with domestic dogs, and this work describes a possible example of echinococcosis at the early Islamic site of Tashbulak (9th-12th centuries CE) in Uzbekistan.

The individual described in this study was a middle-aged adult male whose remains contained an apparent mineralized semispherical encasement for an internal organ or other biologic feature in the upper right quadrant of the abdomen in decubitus position. The semisphere was slightly larger than a golf ball, with a maximum diameter of approximately 34.2mm and a vertical height of approximately 11.6mm from the base to the dome-like apex of the structure. Here we evaluate multiple competing differential diagnoses. Macroscopically, the most likely diagnosis is that of a hydatid cyst produced by *Echinococcus granulosus* infection. The appearance of the shell was consistent with observed archaeological and clinical cases of presumed *E. granulosus*, showing a rough internal surface that would have accommodated tapeworm scolice attachment. The structure as a whole had a perforated appearance consistent with incomplete chitin formation around a cyst. Ecogeographic and contextual data are also consistent with this finding, as a portion of the Tashbulak population likely engaged in pastoralism. This work sheds further diagnostic and paleopathological light on a rarely observed but impactful parasitic disease.

Educating the older generation through palaeopathology. Charlotte ROBERTS, Kirsty MCCARRISON

There is a focus generally on engaging and supporting the younger generation in the UK, but the older generation is increasing. In 2016 there were nearly 12 million people in the UK aged 65 years or over (18% of the population of 65,648,054 - ONS 2017). There are also an estimated 10,722 nursing and residential homes in the UK (Age UK 2017). However, the care profession
outside the hospital environment is facing a challenge to provide appropriate care to older people, alongside engaging activities. Having successfully delivered insights on human health to the younger generation (McCarrison and Roberts 2014), this presentation gives the results of a pilot study in a care home where “Skeleton Science” educational workshops were provided. The objective is to show the impact of palaeopathological research on older people’s perspectives on their own health and well-being. Funded by Durham University, the study involved short introductory talks to residents on archaeology, and the study of archaeological human remains, handling sessions, consideration of, and group discussion on, health in more recent time periods in the north-east of England (post-medieval, i.e. 16th century to 20th century), visits to museums and an excavation, and the production of a resource (Roberts and McCarrison 2016) and website (https://skeletonscience.weebly.com/).

Residents were particularly interested in the health and well-being sessions (casts of archaeological human bones with evidence of diseases common in the past, e.g. osteoarthritis) but also diseases making a return, such as tuberculosis and rickets.


The impact of mobility on the transmission of tuberculosis in Roman Britain: A bioarchaeological study. Charlotte ROBERTS, Kendra QUINN, Andrew MILLARD, Janet MONTGOMERY, Jane EVANS, Angela LAMB

Tuberculosis (TB) is an infectious disease mainly transmitted to humans by the inhalation of infected droplets. It is caused by bacteria within the Mycobacterium tuberculosis complex. In the early 1990s, the World Health Organisation (WHO) declared TB a global emergency; this continues to be the case today. The increase in global travel, including migration, is thought to be exacerbating its spread.

This research tests the hypothesis that 21 people who experienced TB, confirmed by osteological and aDNA diagnosis, had been mobile at some point in their lives (6F, 7M, 8 subadults, 4-45 year+, buried at seven sites in modern Hertfordshire, Yorkshire, Gloucestershire, Dorset and Hampshire). Isotope analysis (C, N, Sr and O) was applied to establish if their childhoods, and the last 10-15 years of life, were spent locally or non-locally to their burial locations. Carbon and nitrogen isotope analysis on bone collagen suggests that all but three of these people ate a diet based on C3 terrestrial ecosystems with limited aquatic food intake, and they ate similarly to people buried in the same or other contemporary cemeteries. Strontium and oxygen isotope analysis on their teeth identified seven people as not having been brought up in the area where they were buried. The remaining 14 people were possibly raised locally. It was concluded that linking mobility with transmission of infectious disease is very challenging, particularly because there is no way of knowing how long people have been infected with the disease before or after they were mobile.

Molecular identification of parasites in an intestinal coprolite from a mummified priest from the Piraino Mother Church Crypt, Sicily. Amanda ROLLINS, Frederika KAESTLE, Georgia MILLWARD, Dario PIOMBINO-MASCALI, Karl REINHARD

Intestinal contents were sampled from a spontaneous enhanced mummy from the Sepulcher of the Priests crypt of the Piraino Mother Church in the Province of Messina, Sicily. This adult male mummy is an unidentified religious dignitary dating from the late-18th to mid-19th centuries. Ancient DNA techniques were used to compliment the microscopic detection of parasitic remains from the intestinal coprolite sample based on egg morphology. Coprolite DNA was extracted in the Ancient DNA Laboratory of Molecular Anthropology at the Indiana Molecular Biology Institute. Species specific primers were used to detect molecular signatures of common and clinically significant parasites. These molecular diagnostic techniques confirmed the morphological diagnosis of Trichuris trichiura (whipworm). A previously undetected Enterobius vermicularis (pinworm) infection was also identified genetically. This data shows that the Piraino1 mummy was simultaneously infected with multiple intestinal parasites indicative of poor hygiene. This also emphasizes the importance of utilizing multiple diagnostic techniques to detect parasites from archaeological contexts.
Malocclusion at Amarna, Egypt (1347-1332 BCE). Jerry ROSE, Anna N. FAULKNER, Ashely E. SHIDNER.
Fifty-two percent of the 164 complete mandibles from the South Tombs Cemetery, Amarna, Egypt (1347-1332 BCE) display two or more misaligned and/or rotated incisors and canines despite normal maxillary alignments. Extensive research demonstrates that chewing forces generated during mastication of coarse preindustrial foods promotes sufficient growth of the jaws to ensure good occlusion. Examination of the archeological, botanical, and skeletal evidence did not identify any difference in food preparation or physical consistency from other Nile Valley groups. The individuals ranging in age from 1.5 to more than 50 years were grouped as having fewer or more than two rotated and/or displaced anterior teeth and the skeletal data was examined for any differences between the two groups. There was no association with misalignment and canine-canine breadths and lengths, molar-molar breadths and lengths, enamel hypoplasias and other indicators of childhood stress. Only reduced adult stature was significantly associated with male and female malalignment groups.

Analysis of growth rates (96 individuals between 4.5 months and 14.5 years) showed that growth was normal until 7.5 months when it uniformly dropped. From 1.5 to 6.5 years of age there was great variation from well below to well above. This growth delay would have coincided with supplementation of breast milk with foods that we hypothesize were low in protein and other nutrients and would explain the constricted V shaped mandibles associated with the misaligned teeth. The large variation in growth rates between 1.5 and 6.5 years explains the even split between the misaligned and aligned groups.

Migration and vitamin D deficiency: A case-study using interglobular dentin, skeletal lesions, and oxygen isotope analysis from the Late Roman (4th century AD) necropolis of Michelet, France. Hana SALAHUDDIN, Tracy PROWSE, Cécile Chapelain De SERÉVILLE-NIEL, Julia PACORY, Bonnie KAHLON, Megan BRICKLEY
In modern communities, immigrants are frequently found to have high levels of vitamin D deficiency. We set out to explore the lived experience of vitamin D deficiency in an individual identified as an immigrant from the necropolis of Michelet (4th century AD), associated with the Roman city of Noviomagus Lexoviorum. The individual investigated was an adult male, aged 25-35 years. Skeletal remains were analysed for lesions indicative of vitamin D deficiency. No skeletal evidence of childhood or adolescent deficiency was identified, but clear evidence of osteomalacia was found, indicated by multiple rib pseudofractures. Histological examination of a second molar was employed to inspect mineralization defects in dentin, known as interglobular dentin (IGD). Presence of IGD indicated childhood vitamin D deficiency (grade 1+) from 4 - 10 years of age. IGD, however, was not observed in the later stages of dentin development, specifically in secondary dentin, likely due to the rate of deposition. Stable isotope analysis of oxygen (δ¹⁸O) in enamel from the M2 revealed that this individual was living along the southern coast of Spain, or in North Africa, when his tooth crown was forming (ca. 2.5 – 8 years of age).
Our integrated analysis demonstrates that this person likely experienced mild vitamin D deficiency during childhood. Further, when he migrated to France at some point after childhood, he experienced severe vitamin D deficiency based on the presence of osteomalacia. This is the first integrated isotopic and paleopathological analysis of vitamin D deficiency in a migrant from the Michelet necropolis.

Age-related bone loss in a Nubian population from Tombos (1400-660 BC). Kaitlyn SANDERS
Osteoporosis is a growing concern within the medical community, as it can lead to skeletal fracture and contribute to fragility and morbidity. Though osteoporosis is commonly association with post-menopausal women, the causes of osteoporosis are still not fully understood and examination of osteoporosis in the past can shed light on the disease and its ties to sex, age, reproduction, and other biocultural factors. For this study, bone loss was examined using digital radiogrammetry of the 2nd metacarpal in 26 females and 18 males from an Ancient Nubian burial site at Tombos, Sudan dating to 1400-660 BC. The ages of the individuals ranged from young (18-29), to middle (30-49) to old (50+) adults.
The following measurements/indices for each metacarpal were recorded: length, total width, medullary width, cortical thickness, cortical index, cortical thickness index, and medullary width index. A two-way ANOVA was performed to examine differences between age groups and sexes and a one-way ANOVA was conducted within each age group to explore differences between sexes. While the males had a decreased cortical index in the old age group, the differences were not statistically significant. Within the female cohort there was also a decrease in cortical index with age—the older age group was significantly different from both younger groups, indicating significant bone loss after 50 years. Rates of bone loss between males and females were not significantly different for any age category. The patterns found at Tombos highlight the biocultural factors that affect bone loss.

Degenerative joint diseases in the appendicular skeleton in Portuguese people from early 20th century. Ana Luisa SANTOS, Mario ARRIETA

Degenerative joint changes are one of the most common lesions recorded in bioarchaeological analyses. While its etiology is not fully understood, age is considered one of the factors that most influences its expression. However, studies in young adults are scarce. This work aims to explore prevalence of degenerative joint disease in individuals between 25 and 54 years old, with known sex and occupation. From the Identified Skeletal Collection of Coimbra (Portugal), 78 males and 76 females, with age-at-death grouped in decades (25-34, 35-44, 45-54), were selected. Marginal lipping (marginal osteophytes), porosity, surface osteophytes and eburnation were recorded from the articular surfaces of the bones involved in appendicular joints. The results obtained were grouped as ‘absent’, ‘barely discernible’ (grades 0-1), ‘obvious’ (grades 2-3) (adapted from Zampetti et al., 2016). In both sexes, the joints mostly affected were hand, hip, knee, and foot. A statistically significant increase in the frequency of marginal lipping and surface osteophytes with age (p<0.05) was observed in several joints, both in males and females. There are significant differences between sexes on marginal lipping in the wrist among the 25-34 age group, in the shoulder among the 35-44 range, the ankle in the 45-54 age group; and in surface osteophytes of the elbow and hip in the 45-54 age group. Prevalence is always higher in males. Exploratory analyzes seem to show association between occupations and degenerative joint changes, mainly in the males aged 45-54. In this sample, the pathological changes in the joints began to manifest in the first decades of adulthood.


Vitamin D deficiency: A teaching skeleton from wheatland Wyoming High School. Ryann SEIFERS, Alex GARCIA-PUTNAM, Jessica DROKE

Most high school anatomy classes have a reference skeleton that is professionally processed and without pathology. Wheatland High School, in Wheatland, Wyoming, has a reference skeleton with healed, but pronounced, rickets. There is no record of how the elderly individual came to Wheatland High School, but we aim to investigate where and when this individual originates utilizing: pathological analyses of the femora and other abnormal skeletal elements, light stable isotope analysis of 18O, 13C, and 15N, coupled with a discussion of the tooth filling in the upper, left, second molar. Since the tooth filling does not appear to be of the same material we use today, we hope to glean information about when, and potentially where, the tooth was filled from historical dentistry sources. These results inform our discussion of the socioeconomic conditions surrounding rickets and what equipment could have aided this individual’s mobility during life. Vitamin D deficiencies, such as rickets, that occur during development can inhibit normal long bone growth as the bones bend in response to loading stress. Rickets is a childhood disease, but evidence of long bone curvature can persist into adulthood. Both femora in this individual are curved, but asymmetrically. The left bending medio-laterally and the right anterior-posteriorly. We also explore conditions, other than rickets, that can cause curved femora such as we see in this individual.
Patterns of interobserver replicability in identification of surface morphology feature boundaries using 3D Scans. Kristrina A. SHULER, Marie Elaine DANFORTH, Kyle MCLAUGHLIN

Three-dimensional scanning offers the ability to measure the surface area of features with variable relief and irregular boundaries on skeletal elements. Presumably this method offers a high degree of accuracy, but levels of interobserver error have not been extensively addressed. This project investigated this issue using upper body entheses as a proxy for a variety of potential features, including pathological lesions. Six entheseseal sites on 11 skeletal elements (humerus, radius, and ulna) were evaluated from a colonial Maya sample from Tipu, Belize. Two researchers separately outlined entheses in chalk and then scanned them using different NextEngine® scanners. Scanners were set to 360°, 8 divisions, neutral, macro, and one machine at 40k and the other at HD268k/in², providing a total of 40 scans. Features were trimmed, and surface areas measured (in² converted to cm²) using ScanStudio®. Lowest average percent differences for attachment sites were seen in deltoideus (r=.12) and biceps brachii (r=.21), as expected, due to their well-defined boundaries whereas pectoralis major (r=.44) and brachialis (r=.41) offered the lowest reliability, due to more amorphous borders. Supinator (r=.37) and teres major (r=.36) had moderate levels of interobserver difference. Factors affecting replicability appear to include small sample size, level of background lighting, presence of preservative on the bones, trimming method (brush versus polygon), and scanner resolution. These results demonstrate the necessity of clearly defining and reporting all methodological parameters when using scanning technology. This is an initial but important step to reliably identifying the nature of bony features.

A paleopathology database for New Mexico bioarchaeology. Ann L.W. STODDER; Shamsi DANESHVARI BERRY

This presentation describes the paleopathology portion of the New Mexico Bioarchaeology Database, a newly initiated project aimed at collating 150 years of observations on human remains from archaeological sites in New Mexico. In contrast to the well-known, 1800+ individual assemblage from Pecos Pueblo, excavations here typically yield far smaller numbers of burials (rarely approaching 100), analyses of which are reported in hundreds of limited-distribution technical reports. Bringing these dispersed data together will enable new research on the health histories of people who lived here before and after European presence. The Access database accommodates several levels of reporting: a pathology checklist, element group overviews, and element-specific lesion descriptions. Because many of the assemblages are fragmentary and taphonomically modified, the observability of major categories of bony changes (bone loss, bone formation, size and shape alteration) is recorded for every element, allowing more accurate prevalence statements than those based on completeness characterizations in inventories. Lesion classification follows the Osteoware pathology module, with additional prompts for observing specific lesions associated with scurvy, treponematosis, and tuberculosis. Individual records are linked to archaeological site forms that include cultural and temporal affiliation, excavation history, and bibliographic references. Data sets can be created for age and sex groups, and for cultural, temporal, or location-specific assemblages. This approach captures a huge amount of legacy data and promotes comprehensive paleopathology analysis in our ongoing projects. The database can be expanded with additional analytic modules, and the cultural and temporal systematics could easily be modified for use in other regions.

A circular depression at the spinoglenoid notch of a Prehistoric Andean scapula: Plausible evidence of suprascapular nerve entrapment by a paralabral cyst. Anne R. TITELBAUM, Bebel IBARRA, Bronwyn E. MCNEIL

While intraosseous cysts are described in paleopathological literature, it’s rare to find reports concerning effects of soft tissue cysts, even though they’re relatively common in clinical contexts. Cysts in soft tissue may compress neurovasculature and cause pressure erosion of adjacent bone. Here we document plausible evidence of a paralabral cyst of the posterior shoulder, and discuss its effects on the underlying anatomical structures. An isolated, partial left scapula with a smooth sided, concave depression (18x5mm) at the spinoglenoid notch
was recovered from a commingled Late Intermediate period tomb, in Ancash, Peru. Based on size, robusticity, epiphyseal fusion, and lack of degenerative changes, the scapula was likely from a young adult male. The depression was notable for its regular appearance, with no bone deposition or destruction. Rather than reflect an intraosseous pathology, the defect appeared to have resulted from pressure erosion from a mass occupying the space. A narrow strip of flattened bone connected the depression to the posterior-superior aspect of the glenoid. The location and morphology of the depression and its connection with the glenoid are consistent with a paralabral cyst. Paralabral cysts arise secondary to a tear of the glenoid labrum, which acts as a one-way valve permitting fluid to flow along a path of least resistance, often to the spinoglenoid notch. A thin stalk connecting the cyst to the labral tear is often visible with MR imaging. A cyst at the spinoglenoid notch would have compressed the suprascapular nerve, causing weakened function of the muscle infraspinatus, and eventual atrophy.

Probable metastatic cancer in a woman from the Salinar period (ca. 200 BC-AD 200) in Huanchaco, Peru.
Khrystyne TSCHINKEL, Kathryn HUNT, Gabriel PRIETO, John VERANO

Recent excavations on a hillside above the town of Huanchaco (Trujillo, La Libertad) have encountered multicomponent cemeteries with graves dating from c. 200 BC to the early colonial period. One burial (IG-246) contained the remains of a female estimated to be 45+ years old, associated with the Salinar period (ca. 200 BC-AD 200). The skeleton displays diffuse areas of bone destruction and new bone formation on the frontal bone, clavicles, scapulae, vertebrae, ribs, manubrium, proximal femora, ossa coxae, and sacrum. The appearance of both types of lesions in a single individual is rare (ca. 10%) in modern clinical oncological cases and are highly consistent with a malignant neoplasm. Macroscopic, microscopic, and radiographic analyses all suggest a probable diagnosis of metastatic cancer secondary to an unknown soft tissue neoplasm. Due to the advanced nature and multifocal distribution of lesions in the manubrium, ribs, thoracic and lumbar vertebrae and right ilium, as well as the presence of both new bone formation and destruction, the primary tumor likely had origin in the lung, breast, cervix, or ovary. In this poster we illustrate and describe the nature of the lesions visible in the skeleton and provide a differential diagnosis within the context of the antiquity of cancer in the paleopathological record. In particular adding to the understanding of how bone reacts to neoplastic disease in its natural progression without modern medical intervention. This is one of the oldest individuals with a malignant neoplasm recorded in Peru, to date.

Diabetes in three North American historical Human Skeletal Collections. Charity F. UPSON-TABOAS
This research examines the prevalence of musculoskeletal disorders (MSDs) with diabetes mellitus in three historical human skeletal collections from North America. I examined known diabetic skeletal material and matched controls from the Hamann-Todd collection (1912-1938), Robert J. Terry collection (1898-1967), and William M. Bass collection (1981-present) for comorbid MSDs, which were scored for presence/absence and severity. The Hamann-Todd and Terry data were combined for analysis due to the similarity of the collections and low sample sizes (Hamann-Todd diabetic n=11, control n=12, age range 30-80; Terry diabetic n=18, control n=18, age range 21-74). The Bass collection (diabetic n=34, control n=31, age range 36-79) was considered a different population because BMI at death was significantly higher (29.5 vs 18.5, p<0.001) than the combined Hamann-Todd and Terry collections (total diabetic n=29, control n=30). Spearman’s rank correlations were determined for each MSDs’ relationship to age, diabetes, sex, and each other. Multinomial logistic regressions were then used to determine which disorders were most predictive of diabetes. Preliminary data show the best predictors of diabetes for the Hamann-Todd/Terry collections were peripheral neuropathy (found in 31% of diabetic individuals, 9/29), healed/healing fractures (66%, 19/29), and diffuse idiopathic skeletal hyperostosis (21%, 6/29). However, for the Bass collection, the predictors were peripheral neuropathy (68%, 23/34), osteoarthritis (100%, 34/34), and carpal tunnel syndrome (24%, 8/34). This may suggest differences in how diabetes affects the skeleton, possibly due to medical treatments available during the different time periods. Other possible factors may include socioeconomic status and the type of diabetes.
Treating sickness: A pathological review of adolescent health in two post-medieval English hospitals. Sascha VALME
Through the use of the use of osteological, archaeological, and historical sources the assessment my PhD project titled Puberty and adolescent health in post-medieval England collected a primary sample of 462 individuals from the ages of 10 to 25 years were examined for age, sex, pubertal stage, stress, and pathology. All individuals were divided into a classification system of Urban, Semi-Urban, and Infirmary with the latter being presented as an insight into the state of adolescent health from a hospital setting and examples of post-medieval medical intervention. In addition, a database of 424 previously recorded individuals were compiled into a secondary source group to compare, age, sex, and pathology in order to establish a better framework of post-medieval adolescent health. The two infirmaries collected in the primary sample consist of the Plymouth Naval Hospital and Radcliffe infirmary, Oxford. The 172 (36.6% of the total population) adolescents from the two infirmaries suffered from a range of various metabolic and infectious disease as well as significant developmental stress. The presence of stress indicators in the adolescent’s life were identified through the presence of enamel hypoplasias, vertebral neural canal size, vertebral body height, and stature/growth profiles. Between the two infirmaries of the observed 172 adolescents, 149 (86.6%) were identified with some form of pathology with 60 (40%) of the population having some form of new bone growth either healed or active. Overall there were differences in the proportion of expected metabolic disease and overall environmental infectious disease indicating that they would be vulnerable to distinct pathologies.

The Victorian match boy: Evidence of mandibular phosphorus necrosis from Gloucester (U.K.). Satu VALDRIANI, Constantine ELIOPOULOS, Joel D. IRISH, Matteo BORRINI
In the 19th century, Gloucester was one of the most important centers for match manufacture. Inside the factories laborers worked for more than 12 hours a day in deplorable conditions. The members of the poorest class were often tasked with dipping the splints of wood in melted sulphur or paraffin by hand; they also had to submerge matches into the lighting composition that contained white or yellow phosphorus. Those directly exposed to phosphorus fumes developed the “phossy jaw” condition.
In this study the remains of a young male (16-20 years old), recovered from Victorian Gloucester, were examined and macroscopic evidence of osteonecrosis was found on the left mandibular ramus. This condition is suggestive of occupationally-related osteomyelitis from industrial exposure to phosphorus. Additional evidence of this phosphoric necrosis has also been detected in the mandibular fossae. A differential diagnosis was conducted that excluded taphonomic factors, neoplastic disease, metastatic forms of neoplasms and actinomycosis. In fact, caries increased the chances to develop this condition by facilitating contact between the phosphorus, pulp cavity and alveolar bone. The necrosis often first manifested as a toothache before spreading to the mandible and face, often with disfiguring complications. Related respiratory problems and chest pain often occurred as well. The case studied here presents only an early onset stage of the disease. However, the work-related pathology that has been diagnosed allows a revision of the occupational environment where the analyzed individual lived and died in what was likely poor conditions.

Anatomy of tuberculosis in Late Prehistoric North America: Disease among the Monongahela of Southwestern Pennsylvania. Robyn WAKEFIELD-MURPHY
The Monongahela were a Late Prehistoric/Protohistoric (1150-1635 AD) archaeological tradition associated with maize agriculture and nucleated settlements located on hill bluffs in the Ohio Valley region of North America. Skeletons (n=167) were analyzed for age, sex, stature, and evidence of skeletal and dental pathology, with seven individuals showing lesions associated with skeletal tuberculosis as observed from macroscopic examination. Differential diagnoses for these cases are explored: brucellosis, extrapulmonary tuberculosis, and septic arthritis. FC#2051 was an old adult female with Pott’s disease, pathognomonic for tuberculosis, involving T10-T12 with a 90-degree angular kyphosis.
Skeletal dysplasia in New Kingdom Tombos (c. 1400-1050 BC). Katie M WHITMORE, Michele R BUZON

The site of Tombos is located at the Third Cataract of the Nile River in modern-day northern Sudan. During the colonial New Kingdom period (c. 1400-1050 BC), Tombos marked an important literal and figurative boundary between Egyptian and Nubian interaction. Immigrant Egyptian and Egyptianized Nubian individuals are buried at Tombos. However, within the cemetery Egyptian mortuary practices, including monumental pyramid complexes and artifacts such as funerary cones, ushabti figurines, and canopic jar heads are predominately used. In one such elite pyramid structure, two individuals, an older adult female found in the western burial chamber and an approximately four-year-old child found in the pyramid shaft, were excavated during the 2016 and 2017 field seasons. The pyramid structure is part of a larger chapel complex in an area where juvenile individuals appear to be concentrated in the cemetery. Both individuals displayed abnormal bone size and shape, which was most evident in the abnormally short limb bones. This poster presents a differential diagnosis of the possible pathological condition(s) that resulted in the observed skeletal dysplasias, with a most likely diagnosis of achondroplasia. Evidence of individuals in ancient Egypt with skeletal dysplasia is plentiful and comes from multiple sources, including skeletal remains, textual documentation, and artistic depictions. Individuals with skeletal dysplasia were incorporated into all levels of Egyptian society from the very elite to the common people, and their physical differences might not have been considered a disability by ancient Egyptians.
Non-destructive methods for using modern cases of myositis ossificans traumatica to diagnose and interpret trauma in the past. Emily F. WIEGERS, Teresa V. WILSON

Myositis ossificans traumatica (MOT) is ossification within an area of muscle tissue in response to previous traumatic injury. MOT can mimic several pathological conditions including osteosarcoma, soft tissue sarcomas, osteomyelitis, and the other manifestations of myositis ossificans. A set of diagnostic features is needed to properly diagnose in the absence of documented medical histories and histological analyses. Diagnostic features were developed through examination of two adult male modern skeletons from the LSU FACES Laboratory skeletal collection that exhibit MOT to assist in the diagnosis of a third adult male modern skeleton. Two of these individuals (Individuals A and B) have medical histories that support the diagnosis of multi-element MOT resulting from traumatic injury. The third individual (Individual C) has an unknown medical history and possible MOT on the right femur. This research uses Individual C as a case study to assess the traits of MOT as a diagnostic tool. Defect placement, surface texture, and internal structure of the defects were discerned by using visual and radiographic techniques. With support from the clinical literature, these skeletal observations showed that MOT is usually found in areas with prior injury and are seen as extraosseous bone with projecting spurs and distinctive segregation from the associated bone. Although Individual C has characteristic traits of MOT, features of osteomyelitis are also observed (e.g., cloaca and cortical bone destruction) and a dual diagnosis was appropriate. Proper diagnosis of non-neoplastic bone formations, like MOT, can give a glimpse into severe and repeated trauma within past populations.

‘Putting flesh on the bones’: A new resource for palaeopathologists. Michelle WILLIAMS-WARD, Jo BUCKBERRY, James NEILL, Alison CULLINGFORD, Sarah GEORGE

British palaeopathology owes many of its early advances to Dr Calvin Wells. Dr Wells’ extensive archive was donated to the University of Bradford in 1984. The project ‘Putting Flesh on the Bones’ is a collaboration between the Biological Anthropology Research Centre (BARC) and Special Collections at the University of Bradford, funded by the Wellcome Trust, to fully catalogue and digitise aspects of the archive. The Calvin Wells archive consists of books, slides, photographs, radiographs, correspondence, osteological reports and skeletal material covering the spectrum of disease types and pathological alterations to the skeleton, from across the world and from multiple time periods, many pre long-term curation of human remains. These include some of the first major reports on leprosy and Paget’s disease and a pioneering study of cremated remains in the UK. Despite Wells having more than 130 publications, the archive also includes many un-published reports. This work will highlight the contents of the archive and present what work has been completed to date. The archive will act as a resource for palaeopathologists, anthropologists, archaeologists and medical and health historians.

To quote Calvin Wells, “The intricate relationship between a people’s way of life and the diseases they endure is the chief reason for the study of palaeopathology” (Wells 1964:18). It is through Calvin’s lifetime of work that the Putting Flesh on the Bones project will provide a resource for future researchers to continue to examine that relationship and create a lasting legacy to Calvin Wells.


Elucidating fluctuating asymmetry in dental and cranial remains from Tepe Hasanlu, Iran. Amanda WISSLER

This pilot study examines fluctuating asymmetry in tooth dimensions by investigating the relationship between greater fluctuating asymmetry and increased mortality and whether increased asymmetry in tooth dimensions is associated with asymmetry in cranial and dental non-metric traits. Cervical tooth dimensions as well as a suite of cranial and dental non-metric traits were collected for 42 individuals (male, female, juvenile and adult) from the Hasanlu skeletal collection at the University of Pennsylvania Museum of Anthropology. Asymmetry was assessed using several established equations for both continuous and discontinuous traits (Palmer and Strobeck, 2003). Gower coefficients were also calculated between the right and left sides in order to combine multiple data types. Results demonstrated no significant relationship between age-at-death and asymmetry, or
between increased dental and cranial asymmetry. This was likely due to small sample sizes and missing data. A difference between skeletal and dental asymmetry was found to be statistically significant (paired t-test, p-value=0.012919, α=0.05). Despite mostly non-significant results, this study supports the assertion that the skeleton may be more sensitive to developmental disturbances while teeth are less influenced and their size more highly canalized. Additional research with larger samples size is needed to further clarify the effect of fluctuating asymmetry on mortality and cranial and dental non-metric traits.


Mulberry molars as a symptom: Evaluating diagnoses of cases with mulberry molars in the literature. Paige V. WOJCIK
Mulberry molars are frequently found among a suite of dental pathologies characteristic of congenital syphilis. Although mulberry molars are not considered pathognomonic of congenital syphilis, several recent paleopathology case studies have found mulberry molars in conjunction with other dental stigmata of syphilis. This poster explores both paleopathological diagnoses of cases with mulberry molars as well as modern clinical cases presenting with mulberry molars. The paleopathological literature focuses on differential diagnoses including tuberculosis, rickets, amelogenesis imperfecta, and fluorosis, but clinical cases have demonstrated the occurrence of mulberry molars in individuals with genetic syndromes (including Nance-Horan syndrome) and other genetic mutations that cause dental anomalies. Mulberry molars have also been found in patients treated with mercury. Paleopathological case studies without the presence of dental abnormalities diagnostic of congenital syphilis should include other genetic syndromes, genetic mutations, and possible treatments that could affect the development of the enamel in their differential diagnoses.

This project was funded by the Mellon Graduate Dissertation Fellowship.

A documented case of Wernicke-Korsakoff Syndrome in an adult female from the Terry Collection. Kristina M. ZARENKO, Colleen M. CHEVERKO, David HUNT
A key advantage to using documented skeletal collections is having background information to describe pathological skeletal lesions using contexts obtained from known causes of death of individuals. We present a differential diagnosis of a 66-year-old Euro-American female in the Robert J. Terry Skeletal Collection who presents with widespread lytic, porous lesions throughout her axial skeleton, concentrated mainly in areas of red blood cell production. This individual, who died in 1950, has a documented cause of death of myocarditis, but her death certificate also indicates she suffered from Wernicke-Korsakoff Syndrome (WKS), a disorder caused by thiamine deficiency that is primarily found in individuals with nutritional deficiencies, alcoholics, AIDS patients, and bone marrow recipients, among others (Isenberg-Grzeda et al. 2012). In clinical settings, WKS is diagnosed when an individual presents with a combination of memory impairment or confusion, malnutrition, and changes to the cerebellum and eyesight (Isenberg-Grzeda et al. 2012).

While these clinical symptoms do not indicate skeletal involvement and clinical literature does not discuss skeletal signs to diagnose WKS, thiamine is an important vitamin for osseous tissue, so the lytic lesions of fine, coalescing porosity with irregular margins observed on this individual could be related to a thiamine deficiency that manifested clinically as WKS. Following a differential diagnosis, this poster will highlight how documented skeletal collections are an important tool for studying skeletal pathologies while also emphasizing the inherent difficulties in making a differential diagnosis of conditions related to thiamin deficiency when documented medical records are not available for analysis.

Humeral morphology related to sex and labor in rural and urban medieval Danish populations. Qun ZHANG, Charlotte PRIMEAU, Marie Louise JØRKOV, Chiara VILLA, Niels LYNNERUP

This study presents a morphological analysis of the humerus in two contemporary medieval Danish populations, which represent rural (Tjaerby) and urban (Randers) populations. The purpose of this study was to investigate the degree of sexual dimorphism in the humerus, and identify whether morphological differences exist due to different labor patterns between the two populations. Twelve measurements, covering the humeral head, shaft and distal end, were taken using sliding calipers and tape ruler on a total of 250 humeri from adult individuals, 135 from Tjærbø (51 from female and 84 from male) and 115 from Randers (63 from female and 52 from male). The Robusticity Index was also calculated. The results showed that the two populations had different male humeral morphologies. Generally, we found larger humeral dimensions in males at the rural site of Tjærbø, with shaft circumference ($p<0.001$), head circumference ($p=0.021$), trochlea ($p=0.017$) and the Robusticity Index ($p<0.001$) in particular being significantly higher than at the urban site of Randers. There were no clear differences between females from the two sites. There was thus also a significantly larger sexual dimorphism in the rural versus the urban population.

An explanation for the differences may be that the rural population at Tjærbø probably was involved in heavier manual, agrarian activities than the urban Randers population, where the cemetery probably reflects traders and craftsmen.
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