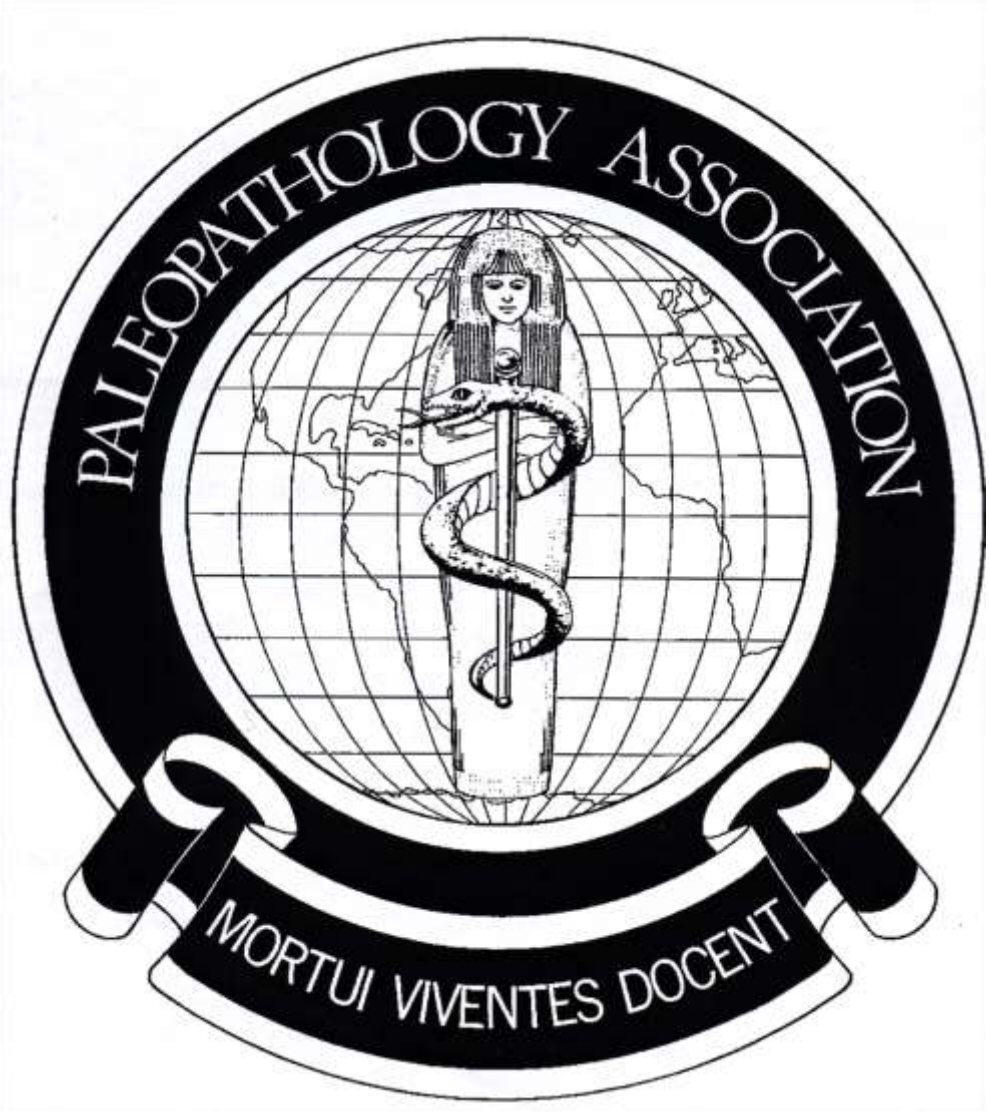

PALEOPATHOLOGY ASSOCIATION

SCIENTIFIC PROGRAM

44th Annual North American Meeting
Westin Hotel NEW ORLEANS
17-19 April, 2017

PALEOPATHOLOGY ASSOCIATION
44th Annual North American Meeting
WESTIN HOTEL, NEW ORLEANS
April 17-19, 2017

SCIENTIFIC PROGRAM

Monday, April 17
Pre-Meeting Excursion (9.30am – 5.00pm) *Meet at **Marriott Hotel (NOT Westin) Main Entrance***
Registration (6:00pm – 9:00pm) *3rd Floor Prefunction*

Tuesday, April 18
Registration (7:45am – 5:00pm) *3rd Floor Prefunction*

Student Action Committee Raffle (7:45am – 5:00pm)

Morning Session (8:30 – 11:30am):

Workshop I. *Azalea 1*

8:30 – 11:00 ***Epidemiology is a risky business: paleopathology & paleoepidemiology*** (hosted by Jesper Boldsen & George Milner)

Workshop II. *Azalea 2*

8:30 – 11:00 ***Body Modification: "Like a Hole in the Head?"*** (hosted by John Verano & David Hunt)

Lunch (11:30am - 1:30pm)

Afternoon Session (1:30 – 5:00pm)

Podium Presentations *Azalea Ballroom*
Part I (1:30 – 3:00pm) **Chair: Megan Perry**

1:30 How should we diagnose disease in palaeopathology? Some epistemological considerations. Simon Mays

1:45 Don't judge a bone by its cover: Investigating long-term consequences of extremity trauma in palaeopathology. Rebecca Gilmour, Tracy Prowse & Erik Jurriaans

2:00 General trends in the prevalence of DISH in English and Catalan populations from the Roman to the Post-Medieval time periods. Laura Castells Navarro & Jo Buckberry ***

2:15 Pathologies associated with Pellagra. Myra Miller ***

2:30 The Gout of Duke Federico of Montefeltro (1422 - 1482): combining historical sources and osteological evidence. Antonio Fornaciari, Valentina Giuffra, Frank J. Rühli, Francesco M. Galassi

2:45 Life behind the wall: a study of skeletal remains found in female cloisters from the 16th to the 20th century. Nataša Šarkić, Lucía Muñoz & Jesús Herrerín ***

3:00 – 3:30 Break

Part II (3:30 – 5:00pm) Chair: Ryan Harrod

3:30 'The scourge of the seas' Osteological evidence of scurvy in late 18th century British sailors. Ceridwen Boston & Catherine Sinnott +++

3:45 Examining the pathoecological role of dogs among the Loma San Gabriel through the analysis of coprolites from La Cueva de Los Muertos Chiquitos, Durango, Mexico. Johnica Morrow, E Grady & Karl Reinhard +++

4:00 Like Mother, Like Child: Investigating change and continuity in infant and maternal health stress in Medieval and Post-Medieval London. Claire Hodson & Rebecca Gowland ***

4:15 Differential diagnosis of possible treponemal and mycobacterial infections in a late-19th century semi-nomadic sample in Jordan. Alysha Lieurance, Mallory Provan & Megan Perry

4:30 Revisiting Avulsion Fractures: Bioarchaeological Methods and Interpretations. Jennifer Byrnes &Kevin Knowles+++

4.45 Interpreting Fracture Healing in the Archaeological Record: Socioeconomic Status and Fracture Treatment in Industrial-era London. Derek Boyd & Colleen Milligan ***

Student Action Committee Events (5:00 – 6:30pm) *Salon Room*

5:00 – 5:45 **Student Group Discussion Panel. Chair: Robin Quataert**

Non-destructive Research Methods: Toward a Future in Paleopathology

Panelists: Teresa Wilson (Louisiana State University)
Niels Lynnerup (University of Copenhagen)
Frank Rühli (University of Zürich)

5:45 – 6:30 **Student Group Meeting. Chair: Jessica Walker**

Association Business Meeting and Dinner (6:45 – 10:00pm) *River 127 & Terrace*

Cash bar, followed by dinner

Wednesday, April 19

Registration (8:00 – noon) *3rd Floor Prefunction*

Student Group Raffle (8:30am – 5:00pm)

Morning Session (8:30 – noon) *Azalea Ballroom*

SYMPOSIUM. *Vitamin D Deficiency: New Perspectives Under Past Light*

Organized by Megan Brickley.

Part I (8:30-9:50am) Chair: Jane Buikstra

8:30 Introduction. Megan Brickley.
8:35 The discovery and synthesis of the nutritional factor, Vitamin D. Glenville Jones
8:50 Vitamin D's role in health and disease: Does the present inform the past? Stephanie Atkinson
9:05 The pathology of vitamin D deficiency in animals: a comparative overview. Elizabeth Uhl
9:20 Vitamin D metabolism in feral and captive nonhuman primates as an evolutionary approach to understanding vitamin D in humans. Toni Ziegler
9:35 Discussion: How can current research in biomedicine and non-human species contribute to understanding and interpreting vitamin D deficiency in past communities?

9:50 – 11:00 Break & Poster Session I (Including POSTER SYMPOSIA) *Magnolia Ballroom*

9:50 – 11:00 Break & Poster Session I *Magnolia Ballroom*

Including POSTER SYMPOSIA:

Paleopathology of Andean South America: 20 Years of Advances and Future Prospects

(organized by J. Marla Toyne, Haagen D. Klaus & Melissa Murphy)

Health correlates of "The Little Ice Age" (A.D. 1300-1850): New questions, new insights

(organized by Maria Ostendorf Smith)

Vitamin D Deficiency: New Perspectives Under Past Light (posters)

Posters in place all day. In addition to the Andean Paleopathology, Little Ice Age and Vit D symposia posters, authors of ODD numbered posters from the Open Poster session will be present during this break.
Poster titles and authors listed at the end of the program.

Part II (11:00 – 12:45) Chair: Susan Pfeiffer

Symposium. Vitamin D Deficiency: New Perspectives Under Past Light (continued)

11:00 Documentary sources on the early history of vitamin D deficiency disease. Simon Mays

11:15 Vitamin D deficiency across the Western Roman Empire. Megan Brickley, Michele George, Simon Mays & Tracy Prowse

11:30 Gender-related risk of vitamin D deficiency development in a Dutch post-medieval farming community. Barbara Veselka, Lida van der Merwe, Menno Hoogland & Andrea Waters-Rist ***

11:45 Rare paleopathological insights into vitamin D deficiency rickets, co-occurring illnesses and documented cause of death in mid-19th century London. Rachel Ives

12:00 The biosocial context of osteomalacia in the Rima Rau cave site skeletal material from the Cook Islands. Hallie Buckley, Annie Snoddy & Sian Halcrow

12:15 Vitamin D deficiency: new perspectives under past light. Nina Jablonski

12:30 Discussion: How can we use archaeological human remains to learn more about the past?

12:45 – 1:55 Lunch – Let's Do Lunch

Student Group Silent Auction (2:00 – 5:00pm)

Afternoon Session I (2:00 – 5:15pm)

Podium Presentations *Azalea Ballroom*
(2:00 – 2:45) Chair: Niels Lynnerup

2:00 "Flipping" the immunopatholobiology of acquired syphilis to reconstruct host immunological status and estimate heterogeneity in frailty. Molly Zuckerman

2:15 Sur la Goutte du Roi: A Study of Charlemagne's (742/748 – 814) relics and cause of death. Frank Rühli, Francesco Galassi, Michael Habicht & Joachim Schleifring

2.30 Needles in haystacks: Bacterial profiling and pathogen detection in ancient remains. Kirsten Bos, Åshild Vågene, Tanvi Honap, Frank Maixner, Albert Zink, Jane Buikstra, Anne Stone, Daniel Huson, Alexander Herbig & Johannes Krause

2:45 Introduction to **3D and paleopathology poster symposium: image capture, scanning, visualization & printing** (organized by Niels Lynnerup & Chiara Villa)

2:50 – 4:00 Break & Poster Session II *Magnolia Ballroom*

Posters in place all day. In addition to the 3D symposium posters, authors of EVEN numbered posters from the Open Poster session will be present during this break.
Poster titles and authors listed at the end of the program.

Part II (4:00 – 5:30pm) *Azalea Ballroom* **Chair: Melissa Murphy**
Brief Discussions of Poster Symposia
Special Session: Local Bioarchaeology & Paleopathology

4:00 **3D and paleopathology: image capture, scanning, visualization & printing**

4:15 **Paleopathology of Andean South America**

4:30 **Health correlates of "The Little Ice Age" (A.D. 1300-1850)**

4:45 Ill at Ease in the Big Easy: Disease and Death in New Orleans. Prof Christi Sumich

5:15 Closing Remarks and Announcements, Award of Cockburn Student Prize and Early Career Prize, Announcement of SG Raffle and Silent Auction Winners. Piers Mitchell

Posters: Magnolia Ballroom

Vitamin D Deficiency: New Perspectives Under Past Light

(Posters associated with Podium Symposium, organized by Megan Brickley)

1. **Syndemics in palaeopathology? A Vitamin D case study.** Judith LITTLETON
2. **Radiographically recognizable? An investigation into the appearance of osteomalacic pseudofractures.** Emma JENNINGS, Jo BUCKBERRY & Megan BRICKLEY
3. **Vitamin D deficiency in St-Etienne de Toulouse, France: Investigations using Micro-CT.** Bonnie KAHLON, Benoit BERTRAND, Antony COLOMBO, Hélène COQUEUGNIOT, Chris KNÜSEL, Lori D'ORTENZIO & Megan BRICKLEY
4. **The Rachitic Tooth: The Use of Radiographs as a Screening Technique.** Lori D'ORTENZIO, Isabelle RIBOT, Benoit BERTRAND, Bonnie KAHLON, Emmy BOCAEGE, Emeline RAGUIN, Annabelle SCHATTMANN & Megan BRICKLEY
5. **Re-examination of the skeletal manifestations of rickets on immigrants from the historic population from St. Matthew, Quebec City (1771-1860).** Marie-Hélène B-HARDY, Zocha HOULE-WIERZBICKI, Jacinthe VIGEANT, Emeline RAGUIN & Isabelle RIBOT
6. **The relationship between vitamin D deficiency and leprosy in two English medieval populations.** Sofia-Anna PAPADOPOULOU & Jo BUCKBERRY
7. **The Shape of Things to Come: Growth in Children with Rickets.** Sarah STARK, Sonia ZAKRZEWSKI & Simon MAYS ***
8. **The Art of Diagnosing Rickets: a Test Against a Subadult Portuguese Sample in the Scheuer Collection.** Jennifer AUSTEN & Craig CUNNINGHAM

Paleopathology of Andean South America: 20 Years of Advances and Future Prospects

(Poster Symposium organized by J. Marla Toyne, Haagen D. Klaus & Melissa Murphy)

1. **Summer Has Lead Us Here: A Bibliographic Analysis of Recent Research Trends in South American Paleopathology.** J. Marla TOYNE, Melissa S. MURPHY & Haagen D. KLAUS
2. **From Looted Cemeteries to Modern Paleopathology: Reflections on the History of Studies of Disease in the South American Past.** Melissa S. MURPHY, J. Marla TOYNE & Haagen D. KLAUS
3. **Developmental Variations and the Andean Past: the Cultural and Demographic Implications of C2-C3 Block Vertebrae.** Anne R. TITELBAUM
4. **Building a Social Paleopathology: What Ancient Stress can tell us about Community.** Sara L. JUENGST & Steven WERNKE
5. **Addressing Activity Patterns through Statistical Methods: Generalized Estimating Equations Modelling of Multiple Data Points.** Sara K. BECKER
6. **Understanding Discrepancies in Juvenile Age Estimation: Paleopathological considerations for the study of Prehistoric Children from Southern Peru.** Kristie SANCHEZ, Maria Cecilia LOZADA & Rex C. HAYDON ***
7. **Perspectives on care and disability from the Rimac Valley, Peru.** Alejandra ORTIZ, Melissa S. MURPHY & Trisha BIERS
8. **Advancements in the Investigation of Tuberculosis in Pre-Columbian Peru.** Elizabeth A. NELSON, Jane E. BUIKSTRA, Tiffiny A. TUNG & Kirsten I. BOS ***
9. **Defining Spatial Paleopathology: Assessing Geographic Risk for Cribra Orbitalia in the Andes.** Beth K. SCAFFIDI
10. **Curated Corpses: new insights into the human remains from the Moche site of Dos Cabezas, Peru.** In Memoriam of Professor Alana Cordy-Collins. Trish BIERS, Charles MERBS, Rose A. TYSON & David HUNT
11. **Paleopathology of the Ventarrón Complex: Biological Stress, Diet, and Subsistence Economy at the Origins of Social Complexity in the Lambayeque Valley, Peru.** Hilarie K. HULEY, Haagen D. KLAUS & Ignacio ALVA MENESES ***
12. **Living and Dying with a Cleft Palate in Ancient Peru: Differential Diagnosis, Associated Pathological Conditions, and Burial Treatment of an Individual with Congenital Craniofacial Abnormalities.** Johanna E. YOUNG, Hilarie K. HULEY, Haagen D. KLAUS, Allison HAM & Ignacio ALVA MENESES
13. **Future Landscapes in Andean Paleopathology: Theory, Methods, and Questions for the next 20 years.** Haagen D. KLAUS, Melissa S. MURPHY, and J. Marla TOYNE

Health correlates of "The Little Ice Age" (AD 1300-1850): New questions, new insights

(Poster Symposium organized by Maria Ostendorf Smith)

1. **Health and diet under a dim light: paleoenvironmental anthropology of the LIA.** Olalla LOPEZ-COSTAS & Antonio MARTINEZ CORTIZAS +++
2. **Health and the Little Ice Age north of the Alps: Relationship between Stress, Nutritional Deficiencies, and Disease.** Leslie Lea WILLIAMS & Clark Spencer LARSEN +++
3. **Skeletal Environmental Markers (SEM): A new method for quantifying the effects of climate change on Romanian human skeletal populations from the Little Ice Age.** Annamaria DIANA +++
4. **Paleopathology in the Time of Climate Change: U.S. Southwest as a case-study.** Ryan P. HARROD & Debra L. MARTIN
5. **Selective Mortality from External Forces: Physiological Stress in the North American Great Plains during the Little Ice Age.** Jocelyn D. MINSKY-ROWLAND
6. **Feeling the Chill: An Examination of Skeletal Stress at the Onset of the Little Ice Age in the Black Friars Cemetery Population (13th – 17th centuries).** Amy SCOTT
7. **Pre-Columbian health status and climate change: AD 1300-1600 in southern Appalachia.** Maria Ostendorf SMITH, Lindsey HELMS-THORSEN, Dustin L. LLOYD
8. **The effects of the Little Ice Age on oral health and diet in populations from continental Croatia.** Mario NOVAK, Željka BEDIĆ, Vlasta VYROUBAL, Siniša KRZNAR, Ivor JANKOVIĆ, Emma LIGHTFOOT & Mario ŠLAUS
9. **The Abandonment of Greenland: The Viking Norse and the Little Ice Age.** Niels LYNNERUP
10. **A study of three skeletal markers of childhood health in an urban and a rural adult population from medieval Denmark as influenced by the Little Ice Age.** Charlotte PRIMEAU, Preben HOMØE & Niels LYNNERUP
11. **The "Little Ice Age" and the Protohistoric Monongahela Demise: A Review of Health and Activity Markers in the Ohio Valley.** Robyn WAKEFIELD-MURPHY ***

3D and Paleopathology: image capture, scanning, visualization & printing

(Poster Symposium organized by Niels Lynnerup & Chiara Villa)

1. **A comparison of 3D models generated from three laser scanners.** Chiara VILLA, Daniel GAUDIO, Cristina CATTANEO, Jo BUCKBERRY, Andrew WILSON & Niels LYNNERUP
2. **3D Visualisation in Palaeopathology.** Jo BUCKBERRY, Andy HOLLAND, Tom SPARROW, Chris GAFFNEY & Andrew S. WILSON
3. **3D in 2.5D: The use of RTI on pathological and taphonomic processes in skeletal remains.** Sarah Y. STARK & Sonia R. ZAKRZEWSKI ***
4. **What's Inside That Bone? Using X-ray and 3D Scanning Technology to Recreate Internal Aspects of Pathological Bone.** Mariana ZECHINI, Maddeline VOAS, Katy PATTERSON, Jane HOLMSTROM & Kristina KILLGROVE
5. **Through the looking glass: understanding the internal effects of carious lesions using micro-CT.** Christianne FERNEE, Katharine ROBSON-BROWN, Alex DICKINSON, Chris WOODS & Sonia R. ZAKRZEWSKI ***
6. **Gorm the Old - Denmark's First King: A new life in 3D.** Marie Louise S. JØRKOV, Chiara VILLA & Niels LYNNERUP +++
7. **Radiological findings in Egyptian canopic jars – comparing the three standard clinical imaging modalities (conventional X-ray, CT and MRI).** Patrick EPPENBERGER, Mislav CAVKA, Porin SCUKANEC & Frank RUEHLI
8. **The Consequences of a Hardened Lifestyle: Three-dimensional analyses of traumatic lesions from Middle Age Denmark.** Elizabeth N. STEVENS ***
9. **The use of computed tomography to reassess neoplasm diagnosis in prehistoric samples.** Savannah LEACH ***
10. **Differentiating pellagra in human skeletal remains: a pilot study using computed tomography.** Kristina ZARENKO ***
11. **Early diagnosis of genetic dwarfism can be assessed on perinates by µCT-scan analysis of trabecular bone microarchitecture.** Antony COLOMBO, Hélène COQUEUGNIOT, Menno HOOGLAND, Olivier DUTOUR & Andrea WATERS-RIST
12. **Use of 3D Topographic Reconstruction in the Analysis of Trauma Associated with Scalping: A Case Study.** Arysa GONZALEZ, Christa D. KELLY & Christopher W. SCHMIDT ***
13. ~~**Forensic re-evaluation of a cranium with ante- and peri-mortem gunshot wounds of documented interval using MicroCT.** Heather BONNEY & Rachel IVES~~ POSTER WITHDRAWN

Open Session Posters (chairs: Sarah Jolly & Deborah Neidich, University of Pittsburgh)

1. **A Tale of Two Cities: Health and Trauma in Medieval Denmark.** Larissa COLLIER & Charlotte PRIMEAU +++
2. **Changes in Body Mass and Indulgence-Related Disorders Among Medieval Danes.** Kaela PARKER ***
3. **Embodying Madness: Contextualizing Biological Stress Among 19th and 20th-Century Institutionalized Euro-American Women.** Madeline ATWELL ***
4. **Cortisol and bone health: Integrating stress into biocultural approaches in paleopathology.** Kaitlin EAST ***
5. **A Case Study of Possible Childhood Illness.** Hailie NORMAN, Anna OSTERHOLTZ, Andre GONCIAR & Zsolt NYARADI ***
6. **A Forager Child with Compromised Health and Mobility from the Late Archaic, Southwestern Ontario.** Susan PFEIFFER & Thivviya VAIRAMUTHU
7. **A Case of Severe Infection and Trauma: Possible disability in prehistoric Alabama.** Diana S. SIMPSON ***
8. **Life and Death in Tell Edfu, Egypt: The Troubled Lives (and Deaths) of Three Individuals in the Twenty-first Century B.C.** Roselyn CAMPBELL ***
9. **The Child in the Pit: Death and Disability in Late Antiquity.** Katherine M. POMPEANI ***
10. **Life Course Transitions and Dental Health at Roman Winchester (UK).** LC AVERY, Tracy L PROWSE & Megan B BRICKLEY
11. **Investigating the impact of air quality on the occurrence of respiratory disease in the Middle Nile Valley: Comparing Kerma and Medieval sites.** Anna BARRETT, Charlotte ROBERTS & Daniel ANTOINE ***
12. **Possible evidence for medical treatment in historic Iceland.** Joe W WALSER III, Tina JAKOB & Steinunn KRISTJÁNSDÓTTIR
13. **Out on a limb: changing body proportions and health during the Roman to Anglo-Saxon transition in England (3rd to 6th centuries AD).** Lauren J. WALTHER & Rebecca L. GOWLAND ***
14. **A Woman's World: Pathological and Morphological Risks During Childbirth.** Candace MCGOVERN ***
15. **The Cost of Modern Life in Yucatan. Trauma Patterns in a Documented Cemetery Series from the City of Mérida, Yucatan, Mexico.** Julio CHI, Allan ORTEGA & Vera TIESLER
16. **Crossing the Threshold of Modern Life. Comparing Disease Patterns Between two Documented Cemetery Series from the City of Mérida, Yucatan, Mexico.** Vera TIESLER, Julio CHI KEB & Allan ORTEGA

17. **Porotic Hyperostosis and Shifting Health Pattern among Yucatecan Coastal Settlers Before and After the Maya Collapse**. Raúl LÓPEZ, Allan ORTEGA, Julio CHI & Vera TIESLER
18. **Investigating Vitamin C Deficiency in the Colonial Maya.** Emmalea GOMBERG ***
19. **On these shoulders we carry our burden: scapular and humeral entheseal changes for Ancestral Puebloans (875-1150 AD).** Maryann CALLEJA, Elizabeth DUFFY, Cristina TICA & Debra MARTIN
20. **Markers of Hardship and Otherness: Trauma, pathology, and cranial modification in a possible captive from Central Illinois.** Allison FOLEY
21. **'Parity features' and social status at prehistoric sites in Austria.** D PANY-KUCERA, M SPANNAGL-STEINER & K REBAY-SALISBURY +++
22. **Cranial-caudal shift in the Morton Collection of Fulton County, IL.** Ryann SEIFERS & Della COLLINS COOK
23. **An Examination of Upper Respiratory Infection in Hunter-Fisher-Gatherers of the Middle Holocene Cis-Baikal, Russian Federation.** Samantha PURCHASE-MANCHESTER, Angela LIEVERSE & Vladimir Ivanovich BAZALIISKII
24. **Recording and interpreting signs of respiratory diseases from bones associated with the upper and lower respiratory tract, especially the skull and the ribs.** Susan KLINGNER & Michael SCHULTZ +++
25. **Considering evidence for hypertrophic pulmonary osteoarthropathy (HPO) as part of an integrative approach to chronic respiratory infection: Evidence from Isola Sacra in Roman period Italy.** Laura LOCKAU & Alessandra SPERDUTI ***
26. **The Langobards in Italy: A Bioarchaeological Analysis of the 7th Century AD Necropolis of Sovizzo in Vicenza, Italy.** Ashley MAXWELL & Rosanne BONGIOVANNI
27. **External auditory exostoses and maritime resource procurement in ancient Cyprus.** Kirsi O. LORENTZ
28. **Prevalence of Dental Caries as Correlate of Weaning Age.** Kristi CARNAHAN ***
29. **Linear Enamel Hypoplasia Frequency during the Roman Occupation of London.** Mark CLEMENTE ***
30. **Dental caries and mandible morphology: how the location and prevalence of dental caries may influence morphology of the mandible through altered masticatory patterns and performance.** Cara HIRST
31. **The Precarious Search for Caries: Oral Health at the Medieval site of La Granède, France.** Leslie QUADE & Stephan NAJI

32. **Dental Wear Trends in Late Archaic and Woodland Period Populations in Eastern US.** Heather PAXSON
33. **Non-Masticatory Tooth Wear in an Early Bronze Age Population from Southern Poland.** Mark TOUSSAINT & Piotr WŁODARCZAK
34. **Dental Caries and Periodontitis in Post-Medieval London Cemeteries.** Catherine G HUDSON & Chelsey JUAREZ ***
35. **A Case of a Dilacerated Molar: Differential diagnoses of abnormal dental development from a historic cemetery.** Kevin C KNOWLES +++
36. **Aberrant tooth number and its utility in the paleopathology of syndromes.** Lita SACKS ***
37. **Oroantral Fistulae at the Monastic Settlement of Ghazali, Sudan (ca. 670–1270 C.E.).** Robert J. STARK & Joanna CIESIELSKA
38. **Down in the mouth: distributions of dental and oral conditions in human skeletal remains from Philistine period Ashkelon, Israel.** Kathryn E. MARKLEIN, Rachel KALISHER & Sherry C. FOX
39. **Symphalangism among the Philistines at Ashkelon, Israel.** Sherry FOX, Kathryn MARKLEIN, Rachel KALISHER, Marina FAERMAN & Patricia SMITH
40. **Reassessing the misidentification of a Tripolye trepanation.** Trisha JENZ, Kayla KUBEHL & Jordan KARSTEN
41. **Implications for Pathology Associated with Femoral Neck Torsion at Woodland Ridge.** Jessica M. CHEVROLET, Brenda L. DETTY & Christopher W. SCHMIDT
42. **Bilateral Anomaly Affecting the Greater Trochanter: Exploring Etiologies through Differential Diagnosis.** Erik PORTER, Jordan TEMPLES & Lesley GREGORICKA
43. **Identifying Stone Axe Cranial Trauma in the U.S. Southwest: Experimental Paleopathology.** Ashley A HANNIGAN, Justin R ELMER & Ryan P HARROD
44. **Are Nonlethal Cranial Injuries Being Over-diagnosed in the Archaeological Record? An Interdisciplinary Literature Review of Diagnostic Criteria for Healing, Depressed Cranial Fractures.** A. Devon BOTHAM & Cynthia WILCZAK
45. ~~**The geographic, temporal, and demographic contexts of interpersonal violence in the later Holocene of southern Africa's Cape West Coast.** Elizabeth DOYLE & Rebecca GILMOUR~~ POSTER WITHDRAWN
46. **Situs Inversus: Viscera Transposition and Associated Skeletal Anomalies.** Kristen PEARLSTEIN & Brian SPATOLA
47. **Premature and trauma-induced sutural fusion in a protohistoric cranium.** Pina S SIMONE, Cortney M. CONNOR, Rebecca S. JABBOUR, & Gary D. RICHARDS ***
48. **A Quantitative Approach to Distinguishing Two Forms of Cranial Modification in Andahuaylas, Peru.** Davette N. GADISON ***

49. **Osteoarthritis Patterns at the Santa Clara Valley Medical Center Hospital Cemetery, 1871-1935.** Martha N. DIAZ & Eric J. BARTELINK ***
50. **Doomed to Die? An Examination of Demographics and Comorbidity During the 1918 Influenza Pandemic in Milwaukee**. Ashley L. BRENNAMAN
51. **Zoo-Odontology: Differential Diagnosis of Pathological and Animal-Related Lesions on Modern Forensic and Archaeological Skeletal Material.** Katherine BISHOP ***
52. **The effects of hydrochloric acid on fleshed porcine ribs.** Amaretta J. AZEVEDO
53. **Metagenomic analysis of ethanol-preserved museum wet tissue specimens** Giada FERRARI, Frank J. RÜHLI & Abigail S. BOUWMAN
54. **Revisiting Weeden Island human remains and signs of syphilis at Bayshore Homes, St. Petersburg, Florida.** Madeleine YEAKLE, John KRIGBAUM, Donna RUHL & Neill WALLIS
55. **An examination of two cases of erosive polyarthritis at the Early Iron Age site of Neiyangyuan, Shanxi Province, China.** Mauricio HERNANDEZ, Dong WEI & Hong ZHU
56. **The case of a Portuguese postman died from leprosy in 1931 and the paleopathological analysis of his skeleton.** Vítor MATOS, Giovanni MAGNO, Alexandra AMOROSO & Susana GARCIA +++
57. **Bones by the Bay: Paleopathological Analysis of a Late 19th Century Anatomical Skeletal Assemblage from Point San Jose (Fort Mason), San Francisco.** Kristen A. BROEHL, Colleen MILLIGAN, Eric BARTELINK, P. WILLEY & Peter GAVETTE ***
58. **An Examination of Endocranial Lesions on Juvenile Individuals from the Tennessee River Valley.** Jaimie IDE
59. **Early life experience and skeletal manifestation of tuberculosis infection in an early 20th century Portuguese sample.** Kelly Elaine BLEVINS, Ana Luísa SANTOS & Charlotte ROBERTS ***
60. **Biological compensation to ill health status and traumatic injury as evidenced through entheseal stress patterns in a historically documented population (Hamann-Todd Collection 1913-1935).** Anna ALIOTO & Michelle MACHICEK
61. **A Probable Case of Leprosy from Colonial Period St. Vincent and the Grenadines, Southeastern Caribbean.** Greg C. NELSON, Taylor N. DODRILL & Scott M. FITZPATRICK
62. **Do you kneed some assistance? Secondary osteoarthritis as a result of trauma to the quadriceps muscles.** Olof OLAFARDOTTIR
63. **The Poultice Recommended for Surgical Interventions on Head Wounds in the Hippocratic Corpus. Did it Work?** Anagnostis P. AGELARAKIS, Argiro AGELARAKIS & Benjamin WEEKS

64. **Secondary hypertrophic osteoarthropathy – a rare condition in a human skeleton from the early medieval settlement site at Lauchheim, Germany.** Stefan FLOHR, Isabelle JASCH, Antje LANGER, Martin RIESENBERG, Julia HAHN, Axel WISOTZKI, Horst KIERDORF, Uwe KIERDORF & Joachim WAHL
65. **Cortical bone mass in the second metacarpal and fragility fractures in two Portuguese reference collections.** Francisco CURATE, Catarina NOGUEIRA, Andreia PERINHA, Cláudia UMBELINO & Eugénia CUNHA
66. **Cranial Trauma at Woodland Ridge.** Jessica GREGORY, Jessica MUNOZ & Christopher SCHMIDT
67. **Reconstructing the manner of death from cranial trauma.** Caitlin HUMPHREY & Maciej HENNEBERG
68. **A probable case of metastatic carcinoma from post-Medieval Belgium.** Jessica L. A. PALMER, Kim QUINTELIER & Andrea L. WATERS
69. **A Rare Case of Osteosarcoma in the Ethmoid Bone with Possible Proptosis.** Khrystyne TSCHINKEL, Gabriel PRIETO & John VERANO ***
70. **Difficulties and Developments in Differential Diagnosis of Cancer in Archaeological Remains.** Jennifer WILLOUGHBY
71. ~~**Mercury levels may be misleading as indications of syphilis treatment.** Stella IOANNOU & Maciej HENNEBERG~~ POSTER WITHDRAWN
72. **Collective burial or Neolithic crime scene?** Sofija STEFANOVIC, Natasa SARKIC & Sasa ZIVANOVIC
73. **Myositis ossificans: heterotopic ossification.** Don LEWIS

The Poultice Recommended for Surgical Interventions on Head Wounds in the Hippocratic Corpus. Did it Work? Anagnostis P. AGELARAKIS, Argiro AGELARAKIS & Benjamin WEEKS

This presentation introduces results of an interdisciplinary endeavor focusing on paleopathology and experimental archaeometry, relative to the nature of the poultice recommended for cranial surgical procedures in the chapter "On Head Wounds" of the 3rd Book on Surgery of the Hippocratic corpus.

The aim of this project was to evaluate the proportionality and preparation stages of the recommended ingredient materials, the state of their composition with emphasis on matters of viscosity at the juncture of application, and its effectiveness potential as an inhibitor to infectious pathogenicity following trauma impact and surgical treatment. In conducting this investigation, a multitier approach was implemented during the past decade considering materials from the bioarchaeological record, ethnographic data collected through field participant observations in the domain of ethnomedicine, and bioarchaeometric experimentation by directly testing the poultice preparation on bacterial growth.

The bioarchaeological record comprised archaeologically retrieved cranial trauma cases and artifactual assemblages of surgical tools dating from the 7th century BC to the 3rd c. AD from Western Thrace in Greece. Ethnographic inquiries of extant ethnomedical relevant usages were conducted in island and mainland communities of Greece. Microbiological tests were conducted in Greece and at Adelphi University treating Escherichia coli and Staphylococcus aureus seeded agar plates with properly prepared poultice incubated at 37° C for a minimum of 24 hours compared to controls treated with improperly prepared compounds.

A synthesis of bioarchaeological, ethnobotanical and archaeometric/microbiological studies clearly indicated that the Hippocratic corpus cataplasm recommended for treatments of head wounds was both practical and effective.

Biological compensation to ill health status and traumatic injury as evidenced through entheseal stress patterns in a historically documented population (Hamann-Todd Collection 1913-1935). Anna ALIOTO & Michelle MACHICEK

Entheseal markers and joint disease distribution have been employed in studies that focus on reconstructing activity patterns and anatomical movement in ancient and recent populations (e.g. Kennedy, 1989; Lieverse et al., 2007). This study aims to identify the connections between disease and traumatic injury with entheseal patterns at select muscle and ligament attachment sites as related to biological compensation. Further, as this study was carried out on individuals of known age, sex and pathology, it can provide a basis for understanding these factors in past populations where this information is unknown.

This research was carried out on historically documented individuals from the Hamann-Todd collection. Selected individuals (n=54) were assessed for patterns of entheseal markings on the post-cranial skeleton at upper limb attachment sites (n=23) using standard methodology (Hawkey and Merbs, 1995). This methodology was incorporated with documented health status and cause of death (e.g. presence or absence of disease, malnutrition, and trauma).

The results show varying instances of biological compensation to pathology and trauma. Discrete individuals displayed instances of bilateral asymmetry, and reduced or increased robusticity at entheseal sites. Despite these examples, the group data indicates that disease processes may not always be a dominant factor when correlated with entheseal changes, as originally hypothesized.

As an additional measure, we compared our findings with an Early Iron Age (c. 500 BC-AD 100) sample (n=10). This component was added in reference to our long-term goal, which is to develop a more refined understanding of biological compensation to disease processes in the past.

Vitamin D's role in health and disease: Does the present inform the past? Stephanie ATKINSON & Laura LOCKAU

The acknowledged role of vitamin D in the support of growth and maintenance of bone is well understood. However, emerging ecological and observational evidence has unveiled the potential for vitamin D deficiency to be an etiological factor in cancers, immune disorders, cardiovascular diseases, abnormal glucose metabolism and neurodegenerative diseases. Investigating the association of vitamin D status in humans to these conditions will provide a framework for analyzing and understanding these relationships in archaeological skeletal samples. Not all conditions leave evidence in the skeleton and it is critical to consider all conditions that may have affected past peoples. Surveys of nutrition status of Canadians reveal that vitamin D status is significantly affected by ancestry, latitude, food source availability and dietary beliefs/practices, all of which are pertinent in consideration of vitamin D availability in the past populations. This paper will review recent developments in the understanding of health consequences of vitamin D and how this new knowledge can be applied for use by paleopathologists.

Embodying Madness: Contextualizing Biological Stress Among 19th and 20th-Century Institutionalized Euro-American Women. Madeline ATWELL

The late 19th and early 20th-centuries in the United States were periods in which white women of middle and low socio-economic status were admitted into insane asylums at a higher rate than men for the first time in recorded history. An existent body of literature helps us to comprehend the social and cultural climate in which the institutionalization of women was both acceptable and commonplace; yet few studies have paired this research with the information that can be revealed on the bones of those institutionalized. A sample of 54 female skeletons from the Robert J. Terry Anatomical Collection that were institutionalized in a Missouri state-supported asylum or sanitarium were analyzed for evidence of biological stress to understand how structural violence infringes upon the human body in ways that are embodied in both life and death. Individuals were macroscopically examined for skeletal trauma including cranial and post-cranial fractures and chronic trauma such as Schmorl's nodes. Osteoarthritis, enamel hypoplasia, and porotic hyperstosis were also recorded. Additionally, the individuals were examined for skeletal evidence of infectious diseases such as tuberculosis and treponematosis. Trauma was found in various manifestations across the sample suggesting that the structure of the institution for the mentally ill may have negatively contributed to the health of those institutionalized.

The Art of Diagnosing Rickets: a Test Against a Subadult Portuguese Sample in the Scheuer Collection. Jennifer AUSTEN & Craig CUNNINGHAM

Current assessment of vitamin D deficiency in the archaeological record has proved difficult at best. Although this is a more definitive diagnosis in adult material, the identification of rickets in subadults is often uncertain, particularly if limb bowing is absent. The use of large subadult osteological collections combats these difficulties in palaeopathology; the capacity for a large subadult sample size allows easy performance of health assessment in younger age groups. As such, the Scheuer Collection, a large juvenile osteology collection at the University of Dundee, offers a variety of both documented and undocumented subadult material. Utilizing gross macroscopic analysis in the examination of 19 undocumented archaeological subadults from the collection, this project assessed the practicality of this method in the assessment of health. The presence of rickets in relation to other pathological conditions was difficult to determine; as such, only three potential cases could be identified. This is a prime example of the problems facing palaeopathologists today, in part due to the production of nonspecific indicators and the lack of bowing in the limbs in early cases of rickets (Brickley and Ives 2008). These macroscopic, nonspecific indicators are often similarly expressed in other conditions such as scurvy and tuberculosis, and even normal growth (Lewis 2007). Based on information gathered from gross macroscopic analysis, this study reaffirmed the difficulty in diagnosing pathological conditions such as rickets with absolute

certainty, and confirms the need for more specific diagnostic criteria, should bowing of the limbs be absent.

Life Course Transitions and Dental Health at Roman Winchester (UK). LC AVERY, Tracy L PROWSE & Megan B BRICKLEY

With recognized links to diet, the analysis of dental health can expose sex and/or age-based dietary differences in a skeletal sample. Dental heath variables including antemortem tooth loss (AMTL), dental caries, and wear were scored in 176 adults from Roman Winchester, UK (c. 4-5th century CE). A life course perspective is used to explore dental health in relation to life trajectories for males and females, investigating: (1) how sex and age-based differences played out through the life cycle, and (2) if certain transitions were more dramatic than others in terms of dental health.

After grouping by sex, Mann-Whitney U tests were performed to explore differences between age categories. Significant differences ($p<0.05$) in AMTL, caries rates, and wear were present between adolescent and young adult females, and between young and middle adult females. Dental health differences were less pronounced among males with only young and middle adult males showing significant differences in AMTL, caries rates, and wear ($p<0.05$). Dramatically fewer significant differences in oral pathology were found between middle and old adult males and females.

Oral pathology normally accumulates with age, but these results indicate that levels of oral pathology increased more gradually between age groups for males, while the changes in oral health between age categories among females were more pronounced, speaking to different life course trajectories. The different dental health trajectories for males and females at Roman Winchester may relate to differences in age-related dietary patterns, life history variables (e.g., pregnancy), or changing social roles in gender-based groups.

The effects of hydrochloric acid on fleshed porcine ribs. Amaretta J. AZEVEDO

Over the years, anthropologists have been asked to assist with cases where the perpetrator(s) used corrosive chemicals in an attempt to dissolve a body and other evidence of a crime. Previous research has demonstrated that hydrochloric acid is by far one of the most destructive chemicals available to the general public capable of dissolving organic tissues.

The purpose of this study was to examine the effects of two concentrations of hydrochloric acid (14.50% and 31.45%) on fleshed porcine ribs and determine if environmental factors such as access to oxygen, agitation, availability of fresh acid, and ambient temperature affect the rate of dissolution. A total of 104 fleshed rib samples between 2-3 inches long were placed in 100 mL of acid. Observations were recorded throughout the experiment and the percentage of mass lost was calculated after six days. The results from this study demonstrate that agitating the samples and exposi ng them to increased temperatures accelerates the rate of dissolution, while refilling the container with fresh acid and limiting oxygen supply delays dissolution.

Since the presence of corrosive chemicals such as hydrochloric acid has the potential to impact nearly every aspect of the anthropological report, it is important to understand the skeletal changes associated with exposure to hydrochloric acid as a taphonomic agent versus other potential postmortem agents. In addition, studying the effects of different environmental factors is important for reconstructing postmortem events and may help investigators understand the amount of effort the perpetrator(s) invested in concealing their crime.

Investigating the impact of air quality on the occurrence of respiratory disease in the Middle Nile Valley: Comparing Kerma and Medieval sites. Anna BARRETT, Charlotte ROBERTS & Daniel ANTOINE

Periosteal reaction on the ribs and bony changes within the maxillary sinuses can provide unique insights into the prevalence of respiratory diseases in archaeological populations. These diseases can be exacerbated by a number of factors, including particulate pollution in the air, which is known to irritate and inflame the respiratory tract, increasing susceptibility to respiratory infections. The factors affecting prevalence rates are likely to have varied throughout human history. Adults from the 4th cataract sites of 4-L-2, 4-L-88, and 4-L-100, all dating to the Kerma Classique period (1750-1500 BC), and site 3-J-18, dating to the Medieval period (AD 550-1500), were analysed macroscopically for evidence of respiratory disease. Endoscopy was also employed to observe enclosed sinuses. The presence of bony changes within the maxillary sinuses, according to established diagnostic criteria, and periosteal reaction on the internal (visceral) surfaces of the ribs were recorded. This research compares the patterns and distributions of these changes between the Kerma and Medieval periods. Preliminary results suggest the prevalence of respiratory diseases from both periods is high and may, in part, be related to the increasingly arid, dusty environment. The results are further discussed in relation to variations in climate, occupation, and cultural-socio-economic practices, which may all contribute to differential exposure to particulate pollution and impact upon respiratory health. This should add to our understanding of the past inhabitants of the Middle Nile Valley and the history of the impact of particulate pollution on human health, a problem increasingly relevant in populations today.

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Addressing Activity Patterns through Statistical Methods: Generalized Estimating Equations Modelling of Multiple Data Points. Sara K. BECKER

Skeletal measures of activity, such as musculoskeletal stress markers and osteoarthritis, have been used to reconstruct workload levels, repetitive motions, and mobility in past human societies. However, working with multiple data points recorded from an individual's skeleton can come with potential scalar issues and reduction of information. For example, if one person has osteoarthritis on one surface of a joint and this is reduced to an overall present or absent count per individual or the individual's joint, the reduction in sample size may result in a loss of very specific pathology data and be insufficient to address research questions. However, if osteoarthritis is calculated on a per data point basis, one individual with multiple positive scores may skew statistical results when looking for patterns of activity, or could be a violation of the independence of data required for many statistical tests. Using examples from the Andean Tiwanaku culture (AD 500-1100) of Bolivia and Peru, this poster covers the generalized estimating equations (GEE) method to model the multiple recorded data points for skeletal activity indicators that keeps data linked with each individual specimen. This methodology also correlates well with archaeological artifactual data and other predictor variables (e.g. age, sex) that can contextualize actions performed in prehistory. In addition, GEE is flexible enough to accommodate variables that are not normally distributed, small sample sizes, and most importantly, randomly missing or unobservable variables – all of which are vital when studying skeletal samples that vary in preservation levels and skeletal elements recovered during excavation.

Curated Corpses: new insights into the human remains from the Moche site of Dos Cabezas, Peru. In Memoriam of Professor Alana Cordy-Collins. Trish BIERS, Charles MERBS, Rose A. TYSON & David HUNT

This poster presents the results for a sample of skeletal remains (N=12) recovered from the archaeological complex of Dos Cabezas in the north coast of Peru. Between AD 300 and 650, this site was the largest administrative centre in the Jequetepeque valley for the prehistoric Moche Norteño culture. Elite burial chambers have yielded the remains of four males whom shared a suite of accelerated

long bone growth, osteoporosis, abnormalities in epiphyseal closure, kyphosis, arachnodactylism, and parietal thinning. These conditions match with clinical and archaeological documentation of the effects of hormone-related changes on the skeletal system, however, a differential diagnosis is discussed here to consider a range of possibilities from cancer to endocrine disorders. Grave goods and burial treatment of the individuals suggest their membership into the highly-structured world of ritual battles and sacrifice. Who these individuals were in Moche society were evaluated through forensic iconography by Cordy-Collins and C. Merbs. Skeletal evidence at entheses demonstrates that these individuals likely held a particular pose, that of "Kneeling Warrior." However, as their skeletal structure was too brittle to withstand actual combat, it is hypothesized that the Dos Cabezas males served a religious role, perhaps a cult of the warrior, furthering a warrior-like tableau. Professor Alana Cordy-Collins, University of San Diego, spent part of the latter portion of her career investigating these individuals and had collaborated with the authors here. It is out hope to share and discuss her latest findings and to continue her contribution to Andean archaeology and paleopathology.

Zoo-Odontology: Differential Diagnosis of Pathological and Animal-Related Lesions on Modern Forensic and Archaeological Skeletal Material. Katherine BISHOP

Pathological and taphonomic lesions on recovered osteological material may be difficult to distinguish due to mechanical modification from internal or external sources (e.g. root etching, lytic lesions, and dental impressions). Actualistic analyses of various animal tooth modifications on bone can lead to an understanding of what to look for to distinguish the pathology (e.g. osteomyelitis) from the taphonomic process (e.g. carnivore gnawing). My lab-controlled pilot study used a novel approach to examine tooth impressions caused by carnivores and rodents. Lesions on bone were analyzed using this technical method, which afforded a more holistic understanding of the influence of varying dental morphology on bone. My current analysis applies the technical approach to two forensic cases at the Office of the Chief Medical Examiner in Edmonton, Alberta (Canada), as well as archaeological specimens recovered from investigations at the Kastro Kallithea Archaeological Project in Thessaly (Greece). In a forensic context, animal gnawing can impact the interpretation of individualizing characteristics, such as pathology, age, and sex estimations. A more specific understanding of puncture wear patterns and canine tooth indentations can provide clues to the circumstances of deposition or suggest where other remains are likely to be found. Alternatively, archaeological studies would greatly benefit from understanding scavenging marks on ancient bone to differentiate pathological lesions from pseudopathology. Zoo-odontology is a promising method to consider when analysing human remains as it aims to identify the source of bone modifications and aid pathological analyses in modern forensic and archaeological contexts.

Early life experience and skeletal manifestation of tuberculosis infection in an early 20th century Portuguese sample. Kelly Elaine BLEVINS, Ana Luísa SANTOS & Charlotte ROBERTS

Tuberculosis is of interest to paleopathologists because of its history with humans and the characteristic way it affects the skeleton. However, tuberculosis only manifests skeletally in approximately 3-5% of untreated individuals. Some studies have demonstrated an association between rib lesions and hypertrophic pulmonary osteoarthropathy (HOA) and tuberculosis infection when diagnostic lytic lesions are not present. This project seeks to understand the factors which influence the development of destructive and proliferative changes caused by the Mycobacterium tuberculosis complex (MTBC). Specifically, the aims of this research are to characterize the childhood experiences of individuals who died of tuberculosis with associated skeletal lesions and those who died without skeletal lesions to test the hypotheses that 1. Adverse early life events cumulatively affect and permanently impair the ability to cope with chronic infectious disease, and 2. Only events occurring at specific times permanently affect the ability to cope with chronic infectious disease. Linear enamel hypoplasia, cribra orbitalia, evidence of growth suppression in terminal stature and vertebral neural canals, vertebral lytic lesions, HOA, and new bone formation on the ribs were recorded in individuals with documented TB in the Coimbra Identified Skeletal Collection (n=125; 50 females and 75 males, ages 7-77). Results indicate that adverse early life experiences recorded in skeletal and dental tissues, regardless of timing, do not predict whether an individual will develop skeletal lesions related to tuberculosis infection, further complicating the implications of non-specific stress indicators.

Needles in haystacks: bacterial profiling and pathogen detection in ancient remains. Kirsten I. BOS, Åshild J. VÅGENE, Tanvi HONAP, Frank MAIXNER, Albert ZINK, Jane E. BUIKSTRA, Anne C. STONE, Daniel HUSON, Alexander HERBIG & Johannes KRAUSE

While methodological advancements in ancient DNA research have permitted the reconstruction of ancient bacterial genomes, pathogen detection is commonly accomplished via capture-based approaches that carry with them an assay-specific ascertainment bias. Such biases can be reduced when historical or archaeological contexts implicate a particular disease, but examples of this are rare in the archaeological record. Here, we present an approach for the analysis of non-enriched sequencing data that permits a fast and precise assignment of DNA reads to microbial taxa, with a focus on bacteria. Our method permits the characterization of ancient metagenomic profiles and circumvents biases common to capture-based screening techniques for the identification of pathogenic species. We illustrate the utility of our method through metagenomic profiling of tissues from the Tyrolean Iceman, and for pathogen screening with New World material that show skeletal evidence suggestive of tuberculosis infection.

'The scourge of the seas'- osteological evidence of scurvy in late 18th century British sailors. Ceridwen BOSTON & Catherine SINNOTT

Scurvy (Vitamin C deficiency) is a disease synonymous with sailors. With the increasing globalisation of trade, colonial expansion and warfare, 18th century seamen spent longer and longer at sea, increasingly relying on a sea diet deficient in fruit and vegetables. In the British Royal Navy (R.N.), scurvy was a major cause of morbidity and mortality, until the introduction of lemon juice rations in 1795 all but eradicated it. Naval physician James Lind famously undertook the first controlled experiment on cures for scurvy, but also dissected many corpses of scorbutic seamen at Haslar Hospital, near Portsmouth. A detailed account of his findings was published in his 'A Treatise on the Scurvy' in 1785.

A recent osteological study of over 300 seamen's skeletons from three R.N. hospitals in England (Royal Hospitals Haslar, Plymouth and Greenwich) revealed extraordinary rates of periostitis on multiple elements, as well as distinctive cranial changes (orbital new bone deposits, orange peel-like pitting and thickening of the ectocranium, and mandibular new bone). Although it may been argued that such changes are non-specific to scurvy, their distinctive patterning across the skeleton (posterior proximal femoral shaft, antero-lateral and posterior tibia, and dependent locations at the elbows and ankle joints) is consistent with Lind's description of bleeding and clot formation beneath the deep muscles of the lower limb and joints in scurvy. A pilot micro-CT study of the ectocranial changes has revealed a distinct layer overlaying the normal cranium, distinguishing it from ectocranial thinning and diplöe hypertrophy of porotic hyperostosis of anaemia.

Are Nonlethal Cranial Injuries Being Over-diagnosed in the Archaeological Record? An Interdisciplinary Literature Review of Diagnostic Criteria for Healing, Depressed Cranial Fractures. Devon BOTHAM & Cynthia WILCZAK

The work examines how antemortem cranial injury is diagnosed in the literature in order to determine whether nonlethal trauma is being over-diagnosed in archaeology. While the majority of publications cite criteria for perimortem cranial fractures, very few have adopted

a clear set of criteria for diagnosing antemortem depressed fractures. This study systematically reviewed the relevant bioarchaeological, forensic, and paleopathological literature and identified ten criteria commonly used in diagnosing healing, depressed cranial fractures (HDCF). Each criterion was then assigned a level of diagnostic certainty following the modified Istanbul protocol (Appleby et al. 2015). Bioarchaeological studies (n = 108) of trauma were evaluated for the criteria used to diagnose HDCF. Results indicate that studies recording HDCF rarely consider more than 2-3 criterion and an explicit set of criteria ranked by diagnostic certainty was almost never defined. The most commonly scored features, lesion shape (63%), size (63%) and location (91%), can only be considered consistent with HDCF. Features diagnostic of HDCF, retention of concentric or radiating fracture lines, were only mentioned in 4% and 14% of the studies. Another feature typical of HDCF, inner table involvement (convexity), was only scored in 25% of the studies. Even more problematic were contradictions in how criteria were applied across studies. For example, only single lesions were scored by18% of studies while 7% only scored multiple lesions as indicative of HDCL. The results indicate that the unclear, ambiguous, inconsistent or absent diagnostic criteria for HDCL is potentially causing an overestimation of nonlethal violence in the archaeological record.

Appleby, Jo, Richard Thomas, and Jane Buikstra. 2015. "Increasing Confidence in Paleopathological Diagnosis – Application of the Istanbul Terminological Framework." International Journal of Paleopathology 8: 19–21.

Interpreting Fracture Healing in the Archaeological Record: Socioeconomic Status and Fracture Treatment in Industrial-era London. Derek A. BOYD & Colleen F. MILLIGAN

Injury to the skeleton reflects the hazards of the physical and social environment. The human body responds with an intricate process of fracture healing that, depending on severity and the positioning of the fracture ends, may require treatment. Access to trauma care may not be available to all individuals within a community, due to a suite of possible biosocial variables, including socioeconomic status. Given high rates of injury-related mortality in the present, it is important to explore the factors that have influenced access to treatment in the past. The goal of this study was to examine patterns of fracture healing on 46 individuals from two socioeconomically disparate communities from Industrial-era London. Observations of appendicular fracture angulation, rotation, overlap, apposition, shortening, and non-union were recorded for each individual. These data were compared quantitatively between communities. The results of a series of chi-squared tests indicated that there was no statistically significant association between socioeconomic status and the quality of fracture healing present. These results suggest that London's medically plural environment provided access to fracture treatment for both high and low status individuals. This study demonstrates the importance of developing a rich historical background for situating patterns of fracture healing in any particular cultural context. It also draws attention to the problems inherent in making inferences about fracture treatment in the archaeological record.

Doomed to Die?: An Examination of Demographics and Comorbidity During the 1918 Influenza Pandemic in Milwaukee. Ashley L. BRENNAMAN

The 1918 influenza pandemic is estimated to have killed 20 to 50 million people worldwide, with over half a million of those deaths being American citizens. Despite the devastating effects, the 1918 outbreak of the Spanish Flu is often overlooked. This is possibly due to the United States victory in World War I, which ended shortly after the influenza pandemic began, or to a lack of adequate medical understanding of the disease, highlighting the elusive nature of the virus' transmission. Comparatively lower mortality rates in Wisconsin are a reflection of lower population densities throughout the state, as well as active government and civic prevention efforts. With an understanding of the incredible virulence of the 1918 influenza outbreak, I investigated comorbid tuberculosis (TB) as a cause of potency and the patterns of selective mortality within a Midwestern population. This project employs documentary data from Milwaukee County, Wisconsin, to assess the patterns of selection for age and sex, as well as investigate the selective force of TB during the 1918 influenza epidemic in Milwaukee. Results indicate a W-shaped mortality curve with the highest death rates occurring within the young and middle adult cohorts. A selective bias towards males is observed, providing evidence for TB-influenza interaction. Additionally, the confluence of influenza and TB was noted on individual death certificates. This comorbidity of TB and influenza may have important implications for understanding and treatment of future influenza outbreaks.

Vitamin D deficiency across the Western Roman Empire. Megan BRICKLEY, Michele GEORGE, Simon MAYS & Tracy PROWSE

The medical writings of Soranus of Ephesus and Galen (both 2nd century C.E.), describe pathological changes in children that are consistent with rickets, but the extent of vitamin D deficiency in the Roman Empire has not previously been systematically pursued. This study set out to investigate vitamin D deficiency using data gathered from 3530 individuals from 15 settlements located between 37°N - 53°N. Sites ranged from rural estates to major urban centers. As expected the highest prevalence was found in juveniles 5.3% (63/1199) with active and healed cases present at most sites, followed by adults with evidence of a childhood episode of deficiency 2% (50/2331), and lowest levels seen for active cases of deficiency in adults 0.6% (15/2331). If consideration is given to skeletal preservation, and individuals that lack the key elements required for a diagnosis are removed, rates of deficiency rise to 9.7%, 2.5% and 0.7% respectively. Data gathered demonstrate that vitamin D deficiency was far more widespread than anticipated being found across the Roman Empire. While latitude is clearly important; the highest levels found in the most northern site (Ancaster in the UK), settlement size and levels of social complexity also play a role. Relatively high levels of vitamin D deficiency were found at Isola Sacra (Italy), and Barcino (Spain), both mid-size port cities located closer to the equator. Through the integration of all forms of evidence available, this project offers new insights into biocultural interactions responsible for the presence of vitamin D deficiency.

Bones by the Bay: Paleopathological Analysis of a Late 19th Century Anatomical Skeletal Assemblage from Point San Jose (Fort Mason), San Francisco. Kristen A. BROEHL, Colleen MILLIGAN, Eric BARTELINK, P. WILLEY & Peter GAVETTE

The objective of this poster is to convey the preliminary results of pathological analyses on a late 19th century medical skeletal collection and discuss possible implications of the analysis for investigating the context of the skeletal assemblage. The Point San Jose Collection is a skeletal sample that was discovered and excavated by National Park Service archaeologists at Fort Mason (part of the Golden Gate National Recreation Area), in San Francisco, California. It is a Civil War-era medical assemblage found in a pit behind the post's historical hospital. As part of a Phase I osteological study on the remains, pathological observations were recorded based on type (shape or size change, bone loss or formation, trauma, infection, metabolic disease, joint disease, dental disease) and body region affected. Results were tabulated with the understanding that one observation could fall under multiple categories. Due to the commingled nature of the assemblage, individual skeletal elements were the unit of analysis instead of individuals. Only about 20% of all observable fragments displayed skeletal pathologies (447 of 2,231), with bony formation associated with joint disease the most common. Trauma, infection, metabolic disease, and dental disease were present at varying frequencies. The somewhat low prevalence of pathological changes provides evidence as to the possible context of the sample. Since the elements in this collection do not appear to show selectivity based on pathology, the study suggests that they represent medical waste associated with autopsy/dissection or disposal of specimens.

Osteomalacia in the protohistoric South Pacific? A biosocial context for pathology in human skeletal remains from Rima Rau Burial Cave, Cook islands, Polynesia. Hallie BUCKLEY, Anne Marie SNODDY, Nancy TAYLES, Angela CLARK & Sian HALCROW

The co-mingled skeletal remains of people interred in the Rima Rau burial cave on the island of Atiu, Cook Islands, Polynesia were investigated in 2012 at the request of the local community. A total of 612 skeletal elements with an MNI of 42 individuals were recorded for demographic and palaeopathological analyses. Skeletal evidence of diseases such as yaws was noted in some skeletal elements as well as possible scorbutic changes in infant and child cranial remains. Of note was a high level of traumatic injuries (9.3% of skeletal elements). Evidence of poorly mineralized fracture calluses with non-union in some bones, femoral neck fractures, bowing deformities and osteopenia are highly suggestive of osteomalacia in a number of elements. Although vitamin D deficiency is the most common clinical cause of osteomalacia, it is also associated with chronic dietary calcium, and/or phosphorous deficiency. A nutrient rich diet and exposure to sunlight are usually more than adequate on tropical Pacific islands. In this case it seems more likely that there is some form of prolonged nutrient deficiency leading to the pathological changes in this sample. There are a number of local oral histories surrounding the identity of the people that make up this skeletal sample, one of which is that they were the slaves of the chiefs. A tentative aetiology of starvation induced osteomalacia is proposed and will be discussed within the biosocial context of the wider Pacific Islands region.

Revisiting Avulsion Fractures: Bioarchaeological Methods and Interpretations. Jennifer BYRNES & Kevin KNOWLES

Bioarchaeological analyses have traditionally overloooked avulsion fractures. This situation may be related to three factors: 1. researchers may not see the value of recording them; 2. they may not always be recognized; or 3. they are reported as bone fractures. The majority of bioarchaeological publications that discuss avulsion fractures focus on case studies of unique individuals, or unusual avulsion fracture(s). A bioarchaeological sample from the mid-19th to early 20th century Erie County Poorhouse Cemetery (Buffalo, NY) is used to illustrate a method for recording avulsion fractures and to demonstrate their interpretative relevance.

The sample was limited to 218 individuals that were at least 50% complete and over 16 years of age at death. Avulsion fractures were characterized as either complete or incomplete, displaced/disrupted, and/or highly invasive into articular surfaces (e.g., lower pole fracture). Approximately 15% of individuals had observable bony changes consistent with avulsion fractures. There was no significant difference between the upper and lower limbs, although females tended to have more upper limb avulsion fractures than males. The majority of avulsion fractures (80%) were observed on bones of the hands and feet. Avulsion fractures, particularly of the hands and feet, provide insight into the daily lives of past people. The fractures inform the researcher about the possible causes of injuries, as well as the functional limitations that result from the antemortem fractures. These soft tissue injuries are informative, and should be recorded in osteological analyses.

On these shoulders we carry our burden: scapular and humeral entheseal changes for Ancestral Puebloans (875-1150 AD). Maryann CALLEJA, Elizabeth DUFFY, Cristina TICA & Debra MARTIN

The agriculturalists of the Pueblo II Period (AD 875-1150) faced harsh conditions in the American Southwest. Their primary mode of subsistence, maize agriculture, demanded long hours and heavy workloads due to the marginal environment. Health indicators for one group from the Kayenta region living at Black Mesa, AZ, demonstrated that porotic hyperostosis was ubiquitous across the population (n=194). With an interest in the sexual division of labor at Black Mesa, a study was designed to examine scapular and humeral entheses for all adults using the methodology of Mariotti and colleagues (2007). The sample size consisted of 18 males and 11 females, with equal representation of all age categories. The data collected for m. triceps brachii, pectoralis major, deltoideus, and brachioradialis demonstrated that both males and females utilized their upper bodies. No statistical significance was found for humerii or scapulae between age categories. A high degree of entheseal development was observed on the scapulae for both males and females; however, a greater proportion of females exhibited a high degree of scapular entheseal development compared to males. These results support the idea that males and females were involved in different forms of labor-intensive activity. In addition, the distribution of highly developed entheses suggests men and women were performing tasks similar to those depicted in the ethnographic record. Integrating this data within a biocultural framework allows for a more nuanced and detailed account of what daily life was like for these individuals.

Life and Death in Tell Edfu, Egypt: The Troubled Lives (and Deaths) of Three Individuals in the Twenty-first Century B.C. Roselyn CAMPBELL

In 2012, three human skeletons were discovered in a grain silo at the site of Tell Edfu in southern Egypt. Despite the importance of proper burial rites in ancient Egyptian society, these individuals lay sprawled in the silo with no evidence of proper mortuary treatment. A thick layer of fill was deposited over the skeletons, and ceramic analysis indicates that the bodies were almost certainly deposited around the middle of the twenty-first century B.C., a time of political fragmentation and decentralization.

Osteological analysis of the three skeletons suggests that all three were likely female, and at least two were adults, while the third had a somewhat younger age-at-death. All three individuals show evidence of disease, hard labor, and trauma, an indication that these people likely had difficult and perhaps painful lives. One individual show evidence of repeated trauma, suggestive of abuse, while another may have suffered from tuberculosis. The three individuals seem to have been deposited without wrapping of any kind, and the disarray of the bodies suggests that they were not carefully arranged in the pattern of most Egyptian burials, begging the question as to why they were denied a proper burial. The presence of numerous pathologies, as well as the unusual burial context, suggest that these individuals may have been viewed as outsiders or outcasts during life. This paper explores the identity of these individuals, and what their lives might have been like as members or outcasts in their community, not only in life, but even in death.

Prevalence of Dental Caries as Correlate of Weaning Age. Kristi CARNAHAN

Early childhood is a precarious time for children's health, and weaning is a pivotal period. Estimation of age of weaning in past populations can give important information regarding health status of the sub-adult population and a better understanding of early childhood cultural practices. This study explores the relationship between weaning age and rates of dental caries in the prehistoric, maize-dependent, colonial population of Tipu (AD 1541-1638) in Western Belize. Because of the maize-based diet, transition from breastmilk to solid food is likely to cause a statistically significant increase in the rate of dental caries. Previous isotopic rib analysis gave a weaning age estimation of 1-3 years for this population, while ethnohistoric data places weaning at 3-4 years. Juvenile dentition (n=60) was examined from individuals with a minimum age estimation of 1 to 5 years old, with at least one intact and erupted deciduous tooth. All age estimations are based on tooth development and eruption patterns. Data collected includes presence of caries by tooth class and total number of present teeth. Statistical analysis was completed with and without deciduous incisors to account for possible nursing caries. ANOVA testing for all models reveals a positive correlation between age and percentage carious lesions ($p=.05$ or less). T-test models show significant ($p=0.01$) increases from minimum age 3 to maximum age 5. These findings correlate with the upper limits of previous isotopic analysis and are in line with ethnohistoric accounts. Dental caries rates in this study confirm both previous isotopic analysis and ethnohistoric data.

General Trends of the Prevalence of DISH in English and Catalan Populations from the Roman to the Post-Medieval time periods. Laura CASTELLS NAVARRO & Jo BUCKBERRY

Clinical and palaeopathological diagnosis of Diffuse Idiopathic Skeletal Hyperostosis (DISH) requires at least 3 vertebrae to be ankylosed, and is commonly associated with males over 50 years of age (e.g. Julkunen et al 1971, Maat et al 1995). However, early lesions can be identified, allowing the pathogenesis of the disease to be assessed, which we term 'early DISH'. Although the aetiology of DISH is unknown, it appears to be closely related to health and lifestyle.

This presentation reports on the analysis of six English and six Catalan populations from the 3rd to the 18th century AD. The populations were paired to allow direct comparison between English and Catalonian populations, as well as a diachronic analysis of the prevalence of the condition in each region. All cemeteries contained urban lay populations. Male individuals have a higher prevalence of the condition in all populations. Females are also affected by DISH however they tend to show earlier stages of the disease, suggesting that age of the onset is later. Comparing the English and Catalan populations, the English have slightly higher prevalence rates of the condition and, in general, show more advanced stages of DISH than the Catalan populations. These differences could be related to a genetic predisposition to the disease or to variations in the dietary habits between the two regions.

Implications for Pathology Associated with Femoral Neck Torsion at Woodland Ridge. Jessica M. CHEVROLET, Brenda L. DETTY & Christopher W. SCHMIDT

Variations in femoral neck torsion are not necessarily pathological, but torsion has the potential to lead to multiple and compounding effects in the lower limbs. The current study seeks to understand lower limb morphology and pathology in a Late Woodland population from northern Indiana (Woodland Ridge, 12C335). We used a total of 12 individuals, of which 3 were subadults. The bones were seriated by maximum length, but sexes were pooled due to comingling. An interdisciplinary approach was taken for femora osteometrics, which included standard femoral measurements as well as angle measurements adapted from medical science. The latter were femur neck shaft angle and degree of femoral torsion, which were computed using photographs and ImageJ software. One adult had noticeably lower femoral angles (acquired coxa vera). Two people had marked femoral neck anteversion and one had marked retroversion. Pathological conditions such as degenerative joint disease and periosteal reactions were found in all adults, regardless of anteversion and retroversion. But one anteversion individual had extreme pitting at numerous lower limb insertion points. The individual with low femoral neck angles had incipient sacroiliac fusion and osteophytosis. This study indicates that femoral shape may indicate skeletal plasticity related to the persistence of a condition or behavior and has stimulated additional considerations for us as we endeavor to contextualize lower limb pathology among pre-contact humans from Indiana.

The Cost of Modern Life in Yucatan. Trauma Patterns in a Documented Cemetery Series from the City of Mérida, Yucatan, Mexico. Julio CHI, Allan ORTEGA & Vera TIESLER

Healed bone injuries are among the most frequently observed pathologies observed in the bone registry of both archaeological and forensic collections. These indicate a host of life events of an accidental or deliberate nature, spotlighting broader conditions related to age-at-death, sex, lifestyle, care, and contingency. With this premise, we score systematically types, frequencies and healing states of bone trauma in a modern skeletal series from the Xoclán Cemetery, Mérida, Yucatán (N=192). This collection is the first of its kind in the peninsula of Yucatan, a region short of two million mostly local Mexican residents and decedents of the ancient Maya. All individual records include basic life data, treated anonymously. For the evaluation and study of bone lesions, traditional methods and techniques of physical anthropology, x-rays, histomorphological methods applied to non-decalcified bone were used to observe the healing processes of the lesions. Our results show high frequencies of healed trauma, related to surgical intervention, geriatric accidents and automobile transit. We discuss the trauma types and frequencies with similarly constituted series from the Yucatan and conclude that the last decades have brought dramatic changes in lifestyle and specific health costs to the local population, materialized in their skeletal remains.

Linear Enamel Hypoplasia Frequency during the Roman Occupation of London. Mark CLEMENTE

Britain was occupied by the Roman Empire from 43-410 CE, during this occupation London was transformed from primarily rural into an urban environment with affects to the population. This research examines linear enamel hypoplasia (LEH) spanning the Roman occupation of London and possible implications for the early childhood health of individuals during this time. LEH, a non-specific stress marker, is exhibited by grooves on teeth that occurred during dental development and are evident throughout one's life. The data were downloaded from The Wellcome Osteological Research Database of the Museum of London and compiled in SPSS for further statistical analysis. These data included two cemeteries in the Greater London area dating to the period of Roman occupation to observe frequency rates of LEH between males and females. A total of 43 individuals from the Roman West and 16 individuals from the Roman South cemeteries were observed. Preliminary results show that 23 (53.4%) males in the Roman West cemetery exhibited at least one LEH, whereas 12 (27.9%) females displayed at least one LEH. Five (31.2 %) males in the Roman South cemetery presented at least one LEH and 7 (43.7%) females exhibited at least one LEH. These results show that there are possibly some childhood stress disparities between males and females among the two cemeteries assemblages.

A Tale of Two Cities: Health and Trauma in Medieval Denmark. Larissa COLLIER & Charlotte PRIMEAU

The potential relationship between childhood disease and trauma were explored in two Medieval Danish cemetery collections. The cemeteries of Tjærby and Randers are located in northern Jutland and span the medieval period in Denmark, AD 1050 to 1536. A total of 291 individuals from the cemetery at Tjærby were examined for disease and a subset of 237 were examined for trauma. For the cemetery at Randers, 170 skeletons were examined for disease and trauma. Chi-square analysis and Relative Risk assessments were run using SPSS version 22.

The relationship between having evidence of childhood disease and trauma was not significant. There was also no significant difference in presences of trauma between the rural and urban cemeteries or between males and females. However, there was a significant difference in location of trauma when Randers and Tjærby were compared. The cemetery group from Randers had a greater relative risk for trauma to the spine and ribs than the group from Tjærby. Conversely, the cemetery group from Tjærby had a higher relative risk of upper limb and cranial trauma than the group from Randers.

Economy in the rural Danish communities during the Medieval period was primarily agriculture although there was some cattle production in areas of Jutland. In the urban centers, trading and craft specializations such as carpentry, bakers, tanners, and butchers became the predominant form of economy. The division and variation in trauma will be explored through the shifts in both economy, population density, and wider cultural changes in the region.

Early diagnosis of genetic dwarfism can be assessed on perinates by µCT-scan analysis of trabecular bone microarchitecture. Antony COLOMBO, Hélène COQUEUGNIOT, Menno HOOGLAND, Olivier DUTOUR & Andrea WATERS-RIST

We studied skeletal remains of 3 perinates of known age-at-death (Middenbeemster, The Netherlands, 19th century), having the same mother who was known to be dwarf (a- or hypo-chondroplasia). These autosomal dominant disorders are caused by mutations on FGFR3 gene, impairing growth cartilage function. If one of the

parents has the trait, then the offspring presents 50% risk to be also a dwarf. However, none of the perinates showed any macro-morphological evidence of dwarfism. We hypothesized that microarchitectural analyse of bone may reveal early impairment of skeletal growth. In this perspective, we analysed trabecular bone microarchitecture (TBMA) of perinates using µCT scans (resolution: 7-18 µm). We selected proximal humerus because it shows high rate of growth; it is clearly affected by disease; it is less concerned by biomechanical constraints. We defined and analysed 4 Volumes of Interest (VOI) thanks to TIVMI© software program, using a semi-automatic protocol based upon scale criteria and metaphyseal border. To characterize TBMA in 3D, we selected 5 parameters (volume, number, thickness, length, connectivity) and compared their values to those of a sample of comparable age (n=4, [0-0.5] years old), from identified skeletal collections. Our results showed a completely different pattern of values from VOI1 (the closest of the metaphyseal surface) to VOI4 (the farthest) for two of the perinates, when compared to 'normal' sample. These results allowed us to diagnose this genetic dwarfism on these two perinates. To sum up, µCT appears to be a precious ally for evidencing bone disease at an early stage.

Cortical bone mass in the second metacarpal and fragility fractures in two Portuguese reference collections. Francisco CURATE, Catarina NOGUEIRA, Andreia PERINHA, Cláudia UMBELINO & Eugénia CUNHA

The purpose of this study is to interpret the overall patterns of sex-specific and age-related cortical bone loss in the second metacarpal as well as the skeletal fragility fractures in two Portuguese reference skeletal samples and subsequent sample comparison. Conventional radiogrammetry was used to assess cortical parameters (diaphysis total width [DTW], medullary width [MW] and cortical index [MCI]) at the second metacarpal midpoint in the modern (late 19th – early 20th centuries) Identified Skeletal Collection of Coimbra (CEI) {N=302, ♀= 154; ♂= 148} and the 21st Century Identified Skeletal Collection (CEI/XXI) {N=136, ♀= 68; ♂= 68}. Fragility fractures (vertebrae, hip, distal radius and proximal humerus) were also assessed. The results suggest that cortical bone mass decreases with age-at-death in both sexes, but especially in females. The values of MCI (CEI: ♀: $\bar{X}$= 47,21; S.D= 11,43 ; ♂: $\bar{X}$=51,97; S.D.=11,93 CEI/XXI: ♀: $\bar{X}$=36,36; S.D=11,60 ; ♂: $\bar{X}$=45,94; S.D.=10,99) and DTW (CEI: ♀: $\bar{X}$= 7,14; S.D.=0,62; ♂: $\bar{X}$=8,01; S.D.=0,75 CEI/XXI: ♀: $\bar{X}$=7,47; S.D.=0,67; ♂: $\bar{X}$=8,22; S.D.=0,81) are significantly different between sexes. The pattern of cortical bone loss is similar in both samples - after age standardization - but only in females. Age at death and sex are the factors that play a major role in cortical bone fragility, regardless of the sample. Fragility fractures are associated with aging and reduced cortical bone mass – but not with sex – and the prevalence is similar in both samples (CEI = 23.75% vs. CEI/XXI = 25.37%) after age standardization.

Skeletal Environmental Markers (SEM): A new method for quantifying the effects of climate change on Romanian human skeletal populations from the Little Ice Age. Annamaria DIANA

This poster aims to present the methodology used in a pilot study integrating human osteoarchaeological data with historical and climatological evidence from medieval Romania. Two unpublished late medieval skeletal assemblages unearthed in the historical centres of Bucharest and Braşov (located in southern and north-central Romania respectively) were chosen to investigate the impact of substantial climatic and environmental changes that took place worldwide between the 14th and the 18th century AD.

The two urban skeletal populations were analysed and their demographic and pathological profiles were reconstructed. Six elements defined 'Skeletal Environmental Markers' (SEM), which included physiological, pathological and behavioural indicators of stress, were chosen on the basis of the likelihood of their frequency and prevalence to be dependent on the deterioration of the climate and the biocultural environment, and with the aim to possibly observe chronological trends of distribution. Despite some limitations (i.e. incomplete chronological information for most of the burial contexts, minimal local historical sources, lack of funding for isotopic analyses, and time constraints), the results of the present study have offered a new perspective on the relationship between Romanian medieval populations and their living environment, and have shown the enormous potential of interdisciplinary bioarchaeological research.

It should be stressed that the presented method can be applied to any population as long as historical, archaeological and/or isotopic data can be integrated with osteological data. Statistical testing and the addition of more SEM categories will be developed in the future.

Osteoarthritis Patterns at the Santa Clara Valley Medical Center Hospital Cemetery, 1871-1935. Martha N DIAZ & Eric J BARTELIN

In 2014, California State University, Chico had the opportunity to acquire a large skeletal series from the Country Infirmary Cemetery located on the Santa Clara Valley Medical Center campus in San Jose, California. According to archival research and burial-associated artifacts, the Infirmary Cemetery was in use between 1871 and 1935. A minimum of 1,017 individuals were recovered from 2012-2015 by a California CRM firm and their subcontractor in charge of osteological services. During excavation, there was an onsite laboratory analysis of the human skeletal remains. This project is a pilot study that compared results of the in-field data analysis of osteoarthritis (OA) with the analysis conducted at CSU, Chico to determine whether differences in data recording methods resulted in different prevalence calculations. A chi-square test determined that there was no statistically significant difference in OA scores for the elbow and wrist joint complexes. However, for the remaining joints examined, statistical comparisons could not be made due to the low level of observability for joint complexes (i.e., not assessable joints). Discrepancies were noted in either OA scoring or in the criteria for inclusion in the sample for the shoulder, hip, knee, and ankle joint complexes. For instance, this study estimated 9 cases of OA in the previously mentioned joints, the CRM firm estimated 13. Additionally, the joints that were diagnosed with OA do not necessarily match with those diagnosed with OA in the CRM firms sample. This presentation highlights the importance of standardization in OA data recording methods.

The Rachitic Tooth: The Use of Radiographs as a Screening Technique. Lori D'ORTENZIO, Isabelle RIBOT, Benoit BERTRAND, Bonnie KAHLON, Emmy BOCAEGE, Emeline RAGUIN, Annabelle SCHATTMANN & Megan BRICKLEY

Dental literature suggests that vitamin D deficiency can alter the morphology of the pulp chamber in radiographically detectable ways. This study investigates if such changes can be seen in the permanent molars of archaeological individuals. Three modern individuals with medical and dental records established that changes in the pulp chamber could be observed in those with past deficiency (n=2/3). To test the utility of this technique, individuals with clear skeletal evidence of rickets from St. Matthews, Quebec (n=1) and St. Jacques, France (n=4), and those with slight skeletal indicators from Bastion des Ursulines, Quebec (n=6) were analysed. Results showed that 5/5 individuals with clear skeletal evidence of past deficiency and 5/6 with slight skeletal indicators of deficiency displayed constricted and/or misshapen pulp horns.

The exact mechanism for morphological changes in the pulp chamber are not fully understood, but are probably linked to severity of deficiency. To determine how many individuals would be missed by radiological examination, histological assessment was undertaken on individuals lacking both skeletal and radiological evidence of deficiency from Saint-Antoine (n=6) and Pointe-aux-Trembles (n=4), Quebec. Forty percent (4/10) showed histological evidence of slight deficiency, through the presence of interglobular dentin (IGD). Many individuals who have rickets do not show clear skeletal changes as adults and assessment of bowing deformity is difficult in such cases. Results from our investigation suggest that radiograph assessment of teeth could be used as a screening method to elucidate patterns of deficiency in past communities and potentially select individuals for histological or microCT assessment.

Cortisol and bone health: Integrating stress into biocultural approaches in paleopathology. Kaitlin EAST

Stress is a complex, biocultural phenomenon that is a significant, albeit unevenly distributed, aspect of past and present human experience and health. It can best be understood as a multifaceted process broadly characterized by exposure to a challenge, a state of disharmony, and response. Stressors may include physiological insults such as infection or psychosocial factors such as chronic stress. Responses to stressors, through the actions of cortisol, have direct, explicit, and cumulative effects on bone metabolism and immunocompetance. However, a lack of understanding of the biological impacts of cortisol, the difficulty of identifying direct effects of cortisol on the skeleton, the nature of skeletal assemblages, and conceptual challenges relating to traditional biomedical conceptions of disease and the body have resulted in limited explicit consideration of the effects of stress on bone in paleopathology. Clarifying the role of cortisol in bone health could strengthen many differential diagnoses, clarify the pathophysiology of conditions with skeletal consequences, and inform discussions on the effects of stress on pre-existing pathological conditions or risk for development of new disorders. Therefore, this poster will explore the effects of cortisol on bone metabolism and other biological systems which may indirectly impact bone health to suggest a model linking the experience of stress with patterns of morbidity in skeletal populations through the actions of cortisol within a biocultural context. Explicit consideration of the stress process is essential to understanding the uneven distribution of poor health outcomes in past populations and continuing to develop a biocultural approach in paleopathology.

Radiological findings in Egyptian canopic jars – comparing the three standard clinical imaging modalities (conventional X-ray, CT and MRI). Patrick EPPENBERGER, Mislav CAVKA, Porin SCUKANEC & Frank RUEHLI

Originating from an imitation of natural dehydration processes of prehistoric burials in the desert, the continuously refined mummification procedures in ancient Egypt involved the use of canopic jars, to store and preserve internal organs, previously removed from the body.

The aim of this study was to assess organ remains contained in canopic jars with the three standard clinical imaging modalities conventional X-ray, computed tomography (CT) and magnetic resonance imaging (MRI) with regard to the specific tissue alterations caused by embalming and postmortem dehydration processes. For this purpose three Horus-children-headed canopic jars from the Egyptian collection of the archaeological museum in Zagreb were imaged.

As expected, conventional X-ray and CT provided superior detail over MRI, mainly because of the higher spatial resolution. However, the high density of the travertine, of which the three examined canopic jars were made, limited the image quality of conventional X-ray images. CT scans, in contrast, showed very little artifacts and revealed structures of organ-specific morphology (intestine) of higher density (c. 400 HU), which are very clearly distinguishable from the surrounding embalming material of homogenous density (c. 250 HU). Furthermore, despite of the significantly lower spatial resolution, MRI images provided important additional information. Unexpected pronounced variations in signal intensity coincided well with the structures identified in the CT scans. These radiological findings, are thus highly compatible with the putatively contained organs in accordance to the inscriptions and dedicated deity of the examined canopic jars. A further histological and genetic analysis is expected to confirm our presented results.

Through the looking glass: understanding the internal effects of carious lesions using micro-CT. Christianne FERNEE, Katharine A ROBSON-BROWN, Alex DICKINSON, Chris WOODS & Sonia R ZAKRZEWSKI

Enamel, as the hardest tissue in the human body, is often unaffected by external taphonomic factors, but in life, organic acids produced by oral bacteria break down enamel and result in carious lesions. Caries is one of the oldest and widespread diseases in the world, and remains a major oral health problem in modern human societies. Although the study of caries has a lengthy academic history, used both bioarchaeologists and paleoanthropologists to evaluate dietary and demographic adaptations, focus has normally been placed upon external morphology. Consequently, there are best practice methods for recording caries. In contrast, the impact of carious lesions on internal tooth structure has been subject to little attention. Micro-Computed Tomography (micro-CT) is a modern technique that enables access to such internal structures non-invasively.

This paper illustrates how micro-CT can be used to study carious lesions in fine detail. Carious lesions are studied in a series of teeth from the Anglo-Saxon site of Great Chesterford with micro-CT enabling visualisation of the internal structure. Understanding how carious lesions affect the internal structure of a tooth enables us infer the effect that these lesions had on an individual, including on functional ability and the structural integrity of the tooth, as well as the pain response that may have been generated by the pathology.

Metagenomic analysis of ethanol-preserved museum wet tissue specimens. Giada FERRARI, Frank J. RÜHLI & Abigail S. BOUWMAN

Fixed wet tissues from museums and anatomical collections offer an extensive, often pathogen-specific and precisely dated, archive for retrospective molecular investigations. While the predominantly used fixative formalin has an inhibitory effect on DNA, thus making the conversion into sequencing libraries very difficult, ethanol-fixed tissues offer a much more promising source for the analysis of historic pathogen genomes.

Among the specimens of the Hunterian Museum collections at the Royal College of Surgeons in London (UK), are approximately 3'500 18th century preparations from the original collection of surgeon and anatomist John Hunter, along with other ethanol-preserved wet tissue preparations. We collected samples from thirteen specimens dated to between 1760 and 1886 that were diagnosed with several bacterial and viral infections.

We performed a tissue-specific shotgun metagenomic analysis and were able to confirm selected museum diagnoses by detecting significant amounts of poxviruses reads. Furthermore we investigated the taxonomic compositions of the metagenomes of all samples in order to identify potential secondary infections and co-infection patterns.

Secondary hypertrophic osteoarthropathy – a rare condition in a human skeleton from the early medieval settlement site at Lauchheim, Germany. Stefan FLOHR, Isabelle JASCH, Antje LANGER, Martin RIESENBERG, Julia HAHN, Axel WISOTZKI, Horst KIERDORF, Uwe KIERDORF & Joachim WAHL

Hypertrophic osteoarthropathy (HO) is a rare disorder with characteristic manifestations in soft and hard tissues. Hard tissue changes basically consist of extensive periosteal new bone formation. In archaeological skeletons, a careful differential diagnosis is mandatory to distinguish HO from other types of periosteal new bone formation.

A well-preserved skeleton of a middle adult man from the early medieval settlement site at Lauchheim, Germany, exhibit extensive periosteal new bone formation. The skeleton was investigated by macroscopic, radiologic, and microscopic methods.

Periosteal new bone formation was present in a symmetrical fashion on the long limb bones, the metatarsals, metacarpals, clavicles, and scapulae. Lesion severity was higher in the lower than in the upper limbs, and within the extremities increased from proximal to distal. While most of the periosteal new bone was of a rather compact nature, in places also more porous areas were present, suggesting active lesions. Joints and entheseal sites were free from diagnostically relevant changes. Radiologic and microscopic analyses revealed multi-layered shells of periosteal new bone that were attached to the original cortex by thin osseous stalks or, less frequently, in a broader fashion. Medullar cavities and compact bone of the affected elements showed no diagnostically relevant changes.

Distribution and morphology of the lesions are indicative of HO. Age-at-death of the individual and the presence of active periosteal lesions suggest a secondary rather than a primary HO. For the latter, an adolescent onset is more typical. Morphologically, no indications of the underlying disease causing secondary HO were found.

Markers of Hardship and Otherness: Trauma, pathology, and cranial modification in a possible captive from Central Illinois. Allison FOLEY

F°12-12, an older adult Mississippian female from the Morton site in the Central Illinois River Valley, exhibits a wide array of pathology and trauma suggesting a life of injury and mistreatment Her pathologies (Harris lines, extreme dental attrition, severe osteoarthritis, and musculoskeletal stress) indicate a lifetime of exertion and stress. In addition to these pathologies, F°12-12 also displays a range of cranial and postcranial trauma all showing variable degrees of healing.

F°12-12 is somewhat of an anomalous case within the Morton population which has a high rate of trauma (46% of adults), but not much violent trauma (7.7% of adults). F°12-12 is also an anomaly in her cranial deformation; this individual's skull has a sloped frontal cranial modification. The style of modification has been noted in the region (Neumann 1942) but it is neither widespread nor shared by other Mississippian individuals buried at Morton. That she was buried in a separate mound, away from other the majority of the other Mississippian burials, but was interred with a Mississippian child, further indicates a complicated social identity.

The pattern of craniofacial trauma and multiple incidents of postcranial traumatic recidivism, combined with considerable musculoskeletal stress, and a possible non-local origin, suggests that this individual may have been a captive. This case study will not only detail the pathologies and trauma exhibited in F12-12, but will also outline this individual's mortuary treatment and contextualize all of the above within the wider scope of the site.

The Gout of Duke Federico of Montefeltro (1422 - 1482): combining historical sources and osteological evidence. Antonio FORNACIARI, Valentina GIUFFRA, Frank J. RÜHLI & Francesco M. GALASSI

Federico of Montefeltro, Duke of Urbino, is still remembered as one of the greatest warlords and patron of the arts of the Italian Renaissance. He died in Ferrara on September 10 1482 after contracting an infectious disease during his last military campaign in Northern Italy. The medical aspects of his life amount to an extremely rich pathobiographical account. In the number of his pathologies, it appears from historical accounts, particularly Bernardino Baldi's biography of the Duke, that gout played a prominent role in Federico's life. It is known, however, that gout was a very broad nosological category in the past and encompassed several rheumatic afflictions of various etiologies. This led to the exhumation of the Duke in the year 2000 from the Church of St. Bernardino (Urbino) and to the recovery a few bony remains, most notably the first metatarsal bone of the right foot. This bone showing a deep erosion at the medial side, has recently undergone radiological analysis (conventional X-ray and CT scan) which clearly demonstrated a typical gouty lesion with a periarticular lytic lesion and reactive bone deposition and sclerosis around the margins. In addition, the Duke's handwritten correspondence to his physician Battiferro Battiferri da Mercatello has further clarified the gouty nature of his ailments: a perfect match between historical sources, first-hand documentation and osteological analysis allows an extremely highly accurate paleopathological reassessment. This work stresses once more the importance of combining historical and documental source-based palaeopathology with hard evidence derived from a traditional palaeopathological study.

Symphalangism among the Philistines at Ashkelon, Israel. Sherry FOX, Kathryn MARKLEIN, Rachel KALISHER, Marina FAERMAN & Patricia SMITH

Recent excavations by the Leon Levy Expedition to Ashkelon have uncovered minimally 227 individuals from a Philistine cemetery dating to the Iron Age IIA period in Israel. It is unknown where the Philistines originated, although congenital disease prevalence may provide some insight into this question. In this contextual study, paleopathological analyses have revealed a congenital disorder known as symphalangism at Ashkelon, whereby the intermediate and distal foot phalanges are fused together (synarthrosis of the interphalangeal joint). Aside from the great toe, there are normally three bones in each toe. In individuals with symphalangism there are only two in one or more of the toes. At Ashkelon, when noted, symphalangism was found only in the fifth ray. This ray usually possesses the highest prevalence. There are at least 8 individuals from the site possessing syphalangism from a sample of 18 intermediate foot phalanges for a prevalence of 44%. This prevalence is similar to that of Europeans at approximately 40%. There are 2 males, 3 females, and 2 individuals of indeterminate sex recovered with this congenital disorder of the middle and distal phalanges of the 5th ray of the foot. One individual is 6-9 months of age at the time of death and 7 individuals are of adult age. The authors will explore the prevalence of this trait in the region, providing one piece of the puzzle to help elucidate the origins of the Philistines at Ashkelon.

A Quantitative Approach to Distinguishing Two Forms of Cranial Modification in Andahuaylas, Peru. Davette N. GADISON

Artificial cranial modification is an irreversible and highly visible form of body alteration that has been employed throughout prehistory around the world to convey social information such as social status, ethnic and/or kin group affiliation. The practice of artificial cranial modification has been suggested to be the most ubiquitous biocultural practice that has been noted to occur on every inhabitable continent. For over a century, a number of studies have employed ambiguous classification schemes and typologies in attempt to categorize distinct styles of artificial cranial modification. The aim of this study is to elucidate whether two types of modified crania, annular and tabular, are correctly assigned to each category by using a quantitative method proposed by O'Brien and Stanley (2013). This approach entails the collection of craniometric data derived from four measurements that were then used to create indices in order to compute discriminant functions. These methods were applied to total of 50 individuals affiliated with two distinct polities that coalesced during the Late Intermediate Period (AD 1000 – AD 1400) in Andahuaylas, Peru. Preliminary data appear to support this method however further research is required.

Don't Judge A Bone by Its Cover: Investigating Long-Term Consequences of Extremity Trauma in Palaeopathology. Rebecca J. GILMOUR, Tracy PROWSE, Erik JURRIAANS & Megan B. BRICKLEY

Extremity fractures can result in nerve and soft tissue damage, prolonged immobilization, pain, and use-avoidance, all of which may lead to limb disuse and bone atrophy. This research used biomechanical methods to investigate the long-term repercussions of fractures. Fracture type, location, malunion, and secondary complications (e.g., osteoarthritis) were hypothesized to influence injury responses in the past.

Long bone fractures in Roman period adults from Ancaster, U.K. (n=100) and Vagnari, Italy (n=40) were radiographed, then the bone areas and asymmetries were calculated and compared to a representative sample of individuals without fractures. Extremity fractures were identified among individuals at Ancaster (n=39) and Vagnari (n=12), but only two Ancaster individuals had fractured limbs with evidence of possible disuse (i.e., with smaller, outlying bone areas and asymmetries). Fracture location, force types, amounts of malunion, osteoarthritis, and infection were not predictive of bone loss explainable by disuse.

Incorporating biomechanical methods in palaeopathological analyses of fractures contributes to an understanding of long-term trauma consequences by helping to recognize patterns in bone areas and asymmetries indicative of impairment and adaptation The results of this study make it clear that fracture types, locations, malunion, and secondary complications do not necessarily predict poor functional outcomes and impairment; fractures that look 'severe' may not result in disuse, and vice versa. Caution should be used when inferring the effect that fractures, and perhaps other pathological conditions, have on an individual's physical experience, as evidently not all morphologically remarkable lesions result in long-term functional consequences.

Investigating Vitamin C Deficiency in the Colonial Maya. Emmalea GOMBERG

Although residing in a tropical environment, the possibility of scurvy in the ancient Maya has been posited by a number of researchers in recent years, especially given new research on the condition which has emerged. The historic population of Tipu in western Belize dating to AD 1541-1638 is one of the largest and best preserved Maya series, and was therefore evaluated for possible presence of scurvy since the diet appears typical of the Peten. All individuals, both juveniles and adults, with at least 50% of the crania and mandible were examined, providing a final sample size of over 300 individuals. The temporal bones and greater wings of the sphenoid were analyzed for scorbutic activity. Porotic lesions were assigned one of the follow severity scores: 1- barely discernable, 2- mild, 3- moderate, 4- severe.

Overall, 30% of the sample showed indications of mild vitamin C deficiency. Adult males had the highest frequency at 38%, followed by juveniles at 30%, and females at 20%. Co-occurrence of scorbutic activity on the temporal bone and greater wing of the sphenoid were found in 92% of the sample, with bilateral symmetry in 80%. Some 58% of the sample showed a co-occurrence of vitamin C deficiency with Cribra Orbitalia, Porotic Hyperostosis, or both.

This data suggests adults at Tipu experienced a vitamin C deficiency, but the frequency was low and severity was relatively mild. It also shows that scurvy tends to co-occur with other nutrient deficiencies, and could be a result of Maya food processing practices.

Use of 3D Topographic Reconstruction in the Analysis of Trauma Associated with Scalping: A Case Study. Arysa GONZALEZ, Christa D. KELLY & Christopher W. SCHMIDT

White-light confocal profilometry provides 3D topographic surface reconstructions that are suitable for qualitative and quantitative study. Two-dimensional profiles and 3D surface areas, volumes, mean depths, and maximum depths are determined using surface analysis software. Three-dimensional topographic surface reconstructions of scalping cut marks, found among human remains from a Late Woodland site, Woodland Ridge (12C335), from northern Indiana, were made. Cut mark replicas from six commingled cranial and long bones were made with polyvinylsiloxane impression material and epoxy resin. Data collection commenced at 10X magnification in multiple profile mode. Analysis employed SolarMap® software. Cut mark morphology was compared to experimental cut mark data housed at the University of Indianapolis made with stone and steel tools. The results indicate the scalping cut marks were indeed ancient and likely made with large stone tools, perhaps ground stone celts. The approach used herein shows great promise for understanding cut mark formation in ancient bone.

Cranial Trauma at Woodland Ridge. Jessica GREGORY, Jessica MUNOZ & Christopher SCHMIDT

This project concerns trauma at the Woodland Ridge site (12C335), which is a late woodland mortuary from northern Indiana dating to around AD 1200. Blunt force trauma is non-penetrating damage to the skeleton, while sharp force trauma creates tissue separation. The damage documented here likely represents non-projectile implements capable of creating blunt force damage, but in this case penetrated the skull. An adult (male?) has a distinct lenticular perimortem fracture on the posterior left parietal that measures 30 x 13 mm. An adult male from the same burial cluster has a similar fracture on his left parietal. In both cases the force of impact was so great the cranial inner table broke away and the damage mimics that from projectiles. Additionally, a young adult (female?) has a healed depression on her left parietal near the sagittal suture. The nature of the depression is unclear but its placement indicates it is related to violence. From the two perimortem wounds, it appears the people were struck with sizable tools, like hafted celts. It is conceivable that such an implement could create blunt force and sharp force trauma. Interestingly, two scalped individuals buried nearby had no evidence of blunt force damage. All told, at least 5 individuals (nearly 30% of the population) have skeletal trauma, which indicates a level of violence that is well above that seen in preceding temporal periods in Indiana but which is similar to contemporary sites, like Norris Farms, in Illinois.

Identifying Stone Axe Cranial Trauma in the U.S. Southwest: Experimental Paleopathology. Ashley A HANNIGAN, Justin R ELMER & Ryan P HARROD

Human skeletal remains recovered from archaeological contexts with perimortem traumatic injuries can be difficult to identify for a number of reasons. Taphonomic changes, recovery practices, missing context, destructive analyses, and many other factors can hide defects on the bone, leading to the misidentification of perimortem trauma. While many of these factors are beyond the control of paleopathologists, we can improve our accuracy of identification by recreating the perimortem injury through experimental studies. For this project, we created a traditional stone axe, which has been the suggested implement responsible for blunt force trauma in the pre-contact U.S. Southwest. The tool was modeled after descriptions of artifacts recovered from Aztec Ruins (1125-1280 AD). Three pig cadavers were used. Each cranium was struck on the frontal bone (avoiding the sagittal crest). After defleshing the remains, we analyzed the fracture patterns focusing on the general size, morphology, and extent of breakage on the bone. This was compared to published literature on cranial trauma involving modern axes, hammers, machetes, and cleavers. The results indicate that it is possible through experimental methodology to identify the general fracture characteristics of prehistoric stone axes. While there are limitations to using a pig cranium as a proxy for a human cranium, the similarities in the bone biomechanics provide insights into the fracture patterns associated with this type of violence. The results of this project provide a visual reference that could be used during bioarchaeological examinations where stone axe trauma is suspected.

Re-examination of the skeletal manifestations of rickets on immigrants from the historic population from St. Matthew, Quebec City (1771-1860). Marie-Hélène B-HARDY, Zocha HOULE-WIERZBICKI, Jacinthe VIGEANT, Emeline RAGUIN & Isabelle RIBOT

The aim of this paper is to present two unique historic specimens from the protestant cemetery of St-Matthew (Quebec City), who developed vitamin D deficiency at different stages of their life and/or possibly in various places. In fact, according to historical sources as well as isotopic studies, St-Matthew's population (buried between 1771 and 1860) was mainly composed of first generation immigrants from the British Isles or Northern Europe. The growing Quebec City often attracted people seeking for better living conditions in the New Continent.

A full portrait including archaeological, osteological, palaeopathological and chemical data (i.e. burial place within cemetery, age, sex, dietary and mobility pattern) is presented for one child and a young adult. Biographical interpretations are discussed, in order to explore whether these individuals developed vitamin D deficiency onsite, or before arrival in the city in the case of first-generation migrants. Their health status might therefore reflect previous environment.

Paleopathology in the Time of Climate Change: U.S. Southwest as a case-study. Ryan P. HARROD & Debra L. MARTIN

The global climate events known as the Medieval Warm Period (MWP) and the Little Ice Age (LIA) dramatically changed local precipitation and temperature. Looking specifically at the U.S. Southwest, this research attempts to understand how this affected people's lives during Pueblo II and III periods (MWP) and the Pueblo IV and Historic periods (LIA). Using both original and published data collected from human skeletal remains from a number of different sites, we assessed the impact of climatic variability on people living in the region. The pathological alterations on bone included indicators of stress, activity-related changes, markers of disease, and exposure to traumatic injury. The Southwest is an ideal location for studying the relationship between climate shifts and paleopathology because of the extensive archaeological and environmental data available for this region. Human remains analyzed from sites associated with the Medieval Warm period include Aztec Ruins, Black Mesa, Chaco Canyon (Peñasco Blanco, Pueblo Bonito, and Pueblo Del Arroyo), Kin Bineola, La Plata, Mesa Verde, and Wingate. Human remains analyzed from sites associated with the Little Ice Age include Gran Quivira, Grasshopper Pueblo, Hawikku, Pecos, Point of Pines, San Cristobal, and Turkey Creek. The results of the analyses indicate that there is a range of human responses to climate change that include migration, cultural reorganization, increased networking, redistribution of resources, and in some cases an increase in raiding and low-level warfare.

An examination of two cases of erosive polyarthritis at the Early Iron Age site of Neiyangyuan, Shanxi Province, China. Mauricio HERNANDEZ, Dong WEI & Hong ZHU

Although advances in molecular biology have shed light on the underlying factors of chronic joint conditions in modern populations such as viral infections or genetic predisposition, little is known about their prevalence in the past. The Neiyangyuan cemetery is located in Shanxi Province, China, and dates to the Spring and Autumn period (771-476 BCE). Out of 48 individuals macroscopically examined for pathological lesions, a male and a female estimated to have been over 40 years old at death display bilateral erosive arthropathy affecting most appendicular joint segments but no axial joints. Additionally, whereas phalangeal joints display mild to moderate severity, larger joints such as the ankle, knee, and elbow show severe destructive changes, suggesting the condition is systemic and progresses from larger to smaller joints.

The nature of lesions indicates this disorder would have been inflammatory in life, since both individuals display similar bilateral severity across all affected joints, and no eburnation is discernible. Bilateral distribution across the appendicular skeleton rules out an infectious agent such as septic arthritis, which usually affects one joint, or spondyloarthropathy, which affects axial joints. It also rules out several non-infectious causes such as rheumatoid arthritis, since no phalangeal joint fusion is present, or ankylosing spondylitis and psoriatic arthritis, which affect the vertebral column. We conclude that both individuals were likely affected by an advanced form of an autoimmune disease with a genetic risk factor. Identifying and describing similar cases can help build a record of autoimmune conditions across East Asia for future comparative studies.

Dental caries and mandible morphology: how the location and prevalence of dental caries may influence morphology of the mandible through altered masticatory patterns and performance. Cara HIRST

Several studies have recorded changes occurring among human dentition and the masticatory apparatus over time, this includes an increase in the prevalence of dental caries and a decrease in masticatory efficiency. Variation in the morphology of the mandible has been demonstrated in numerous experimental animal and archaeological studies, to be influenced by masticatory patterns, performance and dietary consistency. It has also been demonstrated that the presence of certain pathological lesions on the dentition, including dental caries, may alter masticatory behaviour and food selection. For instance, a clinical study conducted by Decerle et al. (2013), determined that among individuals with multiple untreated caries, masticatory performance was reduced.

This study aims to investigate the relationship between dental caries and mandible morphology, in order to determine if the prevalence of dental caries may influence masticatory behaviour and subsequently bone remodelling of the mandible; through the alteration of masticatory patterns and performance. This study will analyse >500 human mandibles dated between the Bronze Age and Post-Medieval period in Britain. The location and prevalence of caries were recorded, and mandibles were 3D scanned, and 52 landmarks were used to conduct a geometric morphometric analysis. Results determined that there was no significant correlation between mandible morphology and the prevalence of dental caries. These results suggest that any pain or discomfort that was possibly experienced because of the presence of dental caries did not influence the masticatory pattern or performance to an extent that influences bone remodelling.

Like Mother, Like Child: Investigating change and continuity in infant and maternal health stress in Medieval and Post-Medieval London. Claire M. HODSON & Rebecca L. GOWLAND

Intrauterine life is unequivocally precarious and maternal stress can result in disruption to the growth and health of the developing fetus. This paper examines the skeletal evidence for intrauterine stress, and considers the effects of temporal trends in environmental adversity and social class on mothers and infants in Medieval and Post-Medieval London.

A total of 174 infants, aged between 30 gestational weeks and six postnatal months, from four Medieval and seven post-Medieval London populations were analysed.

Dental development and skeletal measurements were assessed to estimate age-at-death. Analysis focused on individuals with large disparities between dental and skeletal age, indicative of growth disruption. Individuals from the post-Medieval sites of Crossbones and St. Brides were found to show the largest discrepancies in age estimates (e.g. 23-week differences between dental/humeral age estimates).

Pathological new bone formation was recorded for each individual. Lesions on the endocranium, suggestive of intracranial haemorrhaging, were found to be most prevalent, with the frontal bone most commonly affected: infants from seven sites exhibited a true prevalence rate (TPR) of ~50%, while two post-Medieval samples had TPRs of 79% and 71%.

Findings support a narrative of poor infant and maternal health for both periods. However, infants from the post-Medieval period show higher levels of disease and poor growth, corresponding with increased health risks due to industrialisation. Correlations between poor growth and pathological lesion prevalence were identified in infants across all status groups during the post-Medieval period, suggesting that high-status cultural practices were not conducive to good maternal or infant well-being.

Dental Caries and Periodontitis in Post-Medieval London Cemeteries. Catherine G HUDSON & Chelsey JUAREZ

This study aims to understand the interaction between two dental pathologies (dental caries and periodontitis) with sex, age, and socioeconomic status in three post-medieval London cemetery populations. The data was obtained from the Wellcome Osteological Research Database. Adults with estimated sex and age from the Chelsea Old Church cemetery, a high socioeconomic status population (N = 149), St. Brides Lower cemetery, a low socioeconomic status population (N = 304), and St. Benet Sherehog, a mixture of the two socioeconomic statuses (N = 124), were chosen for this study. Adult individuals were grouped previously in the database into four age categories: 18-25, 26-35, 36-45, and >46. This data was entered into JMP for frequency distributions analysis. Analysis showed variation between each cemetery. The two way interaction between sex and each individual pathology for all cemeteries showed males having a higher frequency than females,

with Chelsea Old Church having the least difference. Chelsea Old Church's dissimilarity may be due to higher socioeconomic status females being more likely to obtain similar quantity and quality types of food or dental care as their male counterpart. Analysis also showed that the frequency of each individual pathology does not necessarily consistently increase with age. Of the three cemeteries, St. Brides Lower is the only one to have shown a relatively steady increase of frequency as compared to age. Further analysis also indicated that the cemeteries are not homogeneous and that sex, age, and socioeconomic status all are important variables with regards to dental caries and periodontitis.

Paleopathology of the Ventarrón Complex: Biological Stress, Diet, and Subsistence Economy at the Origins of Social Complexity in the Lambayeque Valley, Peru. Hilarie K. HULEY, Haagen D. KLAUS, Ignacio ALVA MENESES, Steven BALL, Gabriel M. BROWN, Allison HAM, Jaclyn THOMAS & Johanna E. YOUNG

Complex societies began to develop on the north coast of Peru around 2600 B.C., and much debate surrounds this process. Particularly, past work hypothesized that early Andean civilizations were based on maritime resources – rather than an agriculturally focused economy. However, it has been exceedingly difficult to provide a paleopathological test of this hypothesis, as Formative era skeletons are very rare in the archaeological record. Excavation since 2006 at the Ventarrón archaeological complex (Lambayeque Valley, north coast Peru) produced diachronic skeletal sample consisting of 171 individuals spanning the Formative era into the 10th century A.D. These individuals were scored for evidence of cribra orbitalia, porotic hyperostosis, scurvy, enamel hypoplasias, periostosis, dental caries, antemortem tooth loss, and calculus.

Initial crude prevalence results demonstrate that the Formative era individuals (~2600-1500 B.C.) demonstrated a near total lack of skeletal pathology and possessed excellent oral health. By the Cupisnique, Moche, and Sicán periods (~1500 B.C. -1100 A.D., intensive irrigation agriculture progressively emerged as the dominant mode of food production, and increasing prevalence of childhood anemia and a significant decline in oral health were observed. These observations, especially the oral health data contextualized within the broader diachronic sequence, generate a working hypothesis that early social complexity at Ventarrón was indeed associated with exploitation of marine resources or other nonstarchy foods. Moreover, these observations allow for a more holistic understanding of later shifts in subsistence economy and the interplay between Andean societies and their unique environments.
This work was funded by grants to HDK by the Wenner-Gren Foundation and George Mason University.

Reconstructing the manner of death from cranial trauma. Caitlin HUMPHREY & Maciej HENNEBERG

Determining the manner of death surrounding a gunshot wound to the cranium is not an easy task based purely on skeletal remains. Within the Cleveland Museum of Natural History's skeletal collection, there are forty-five cases of gunshot wound trauma. Of the forty-five cases, thirteen cases were to the cranium (8 documented as gunshot wound or unknown, 2 murder and 3 suicide). Osteological and anthropological analysis was conducted to determine the characteristics that may allow the manner of death to be established. Internal or external bevelling are distinct features of entrance and exit wounds, respectively. Bevelling equally distributed around the wound suggests the projectile was perpendicular to the bone when it entered, while unequal distribution may lead to identifying the internal projectile path and the direction from which the projectile was fired. The anatomical site of wound entrance, and exit if visible, can also aid in determining the projectile path. If the projectile path is identified, a reconstruction of the firing position and events surrounding the death can lead to identifying the manner of death. Reconstructing the manner of death from skeletonised remains is important not only for the conduct of forensic cases, but also for analyses of historical events.

An Examination of Endocranial Lesions on Juvenile Individuals from the Tennessee River Valley. Jaimie IDE

Within an archaeological population, the subadult component has the potential to yield the most valuable information about the community's overall health. However, assessing juvenile remains for pathological conditions can be complicated by growth and development, as well as the complex nature of infectious disease and malnutrition. Historically, the identification of endocranial lesions has proven difficult due to the lack of standardized scoring, types, and explicit examples, as well as the frustration of basing analyses on convoluted descriptions. Applying the methodology and criteria set forth by Lewis (2004), cranial material from juvenile individuals excavated from prehistoric sites in the Tennessee River Valley were analyzed in an attempt to correctly identify the type, and when possible, the etiology, of present intracranial lesions. Of the 3,299 total individuals within this sample, 30 juvenile individuals from nine sites presented pathological manifestations of meningitis, inflammation, and hemorrhagic activity on the interior cranial vault, some in conjunction with significant postcranial infection. These individuals represent three percent of the total juvenile component, which is significantly smaller than the results of Lewis' study, however site specific percentages for infected individuals are more comparable in rate and representation. With the application of this article to the analyses of prehistoric skeletal populations, a more accurate identification of endocranial lesions is possible, as well as a more thorough understanding of rates of juvenile infection and overall population health.

Rare Paleopathological Insights into Vitamin D Deficiency Rickets, Co-Occurring Illnesses and Documented Cause of Death in mid-19th Century London, UK. Rachel IVES

This is the first archaeological study to compare documented causes of illness and death with the skeletal manifestations of vitamin D deficiency rickets in order to better understand disease co-occurrence and frailty in the past.

Vitamin D deficiency rickets was recorded in a large series (n.1033) of low socio-economic status burials excavated from Bethnal Green, London, UK. The burials are tightly dated between AD 1840 and 1855, after the civil registration of births and deaths. Skeletal indicators of rickets were recorded using the criteria outlined in Ortner and Mays (1998), Mays et al. (2006) and Brickley and Ives (2008) and cases were classified by disease stage; active, healing, healed.

A high percentage of juveniles were found with skeletal manifestations of vitamin D deficiency rickets (21.4%, 138/642) and 26% of children with rickets had a documented cause of death. Deaths were frequently associated with respiratory infections and specific childhood illnesses, such as measles, as well as non-specific conditions including hydrocephalus and convulsions. No deaths were documented as due to rickets despite contemporary use of the term in the London Bills of Mortality.

The likely implications of the health associations and the manifestations of rickets are discussed and the integrated analysis of historical sources and paleopathological evidence is critically contextualized in this study. This combined analysis presents new insights into the lives of this socially disadvantaged group and demonstrates the high disease burden carried by children from poor urban families in the mid-19th century.

Vitamin D Deficiency: New Perspectives Under Past Light. Nina G. JABLONSKI

Vitamin D is essential for human health, but getting enough vitamin D has been a challenge for many people in prehistoric and historic times. Understanding the factors influencing vitamin D status contributes greatly to the understanding of past communities at both the individual and group level. In this paper, I will examine the challenge of vitamin D sufficiency in the evolution of anatomically modern humans, and explore how this challenge has been met through both biological and cultural mechanisms in the course of human dispersals. In this presentation, I will also explore the causes and consequences of vitamin D insufficiency resulting from rapid,

long-distance migrations and urbanization over, especially, the last 3,000 years. Drawing together information from the submitted papers, I will provide clear suggestions on how investigators interested in exploring the origins of health and disease in ancient populations can gain insight into the multiple roles played by vitamin D. I will also provide information on the determinants of healthy vitamin D status in people today, and identify the populations at highest risk of vitamin D deficiency as human lifestyles become increasingly different from those of the past.

Radiographically recognizable? An investigation into the appearance of osteomalacic pseudofractures. Emma JENNINGS, Jo BUCKBERRY & Megan BRICKLEY

Osteomalacia is a type of metabolic bone disease caused by vitamin D deficiency. A deficiency in vitamin D causes defects in the mineralization of osteoid, which overtime leads to weakened bone. In adults, pseudofractures, small, linear cracks in the cortex of the bone, surrounded by irregular, spiculated new bone, are a key feature of osteomalacia.

Radiography is frequently used to definitively diagnose pseudofractures, both clinically and in paleopathology, but little research has been done to determine whether pseudofractures appear similar to fractures caused by trauma, and in what ways they differ. A radiographic study of the characteristics of pseudofractures was performed on five individuals with clear skeletal features of osteomalacia from archaeological sites in Canada and the United Kingdom dating to the medieval period and the 19th century. The radiographic features of the pseudofractures were compared with healing trauma-related fractures. Preliminary results reveal key differences between pseudofractures and trauma-related fractures. Most surprising is the finding that pseudofractures may not always be visible radiographically, as the new bone formation is too poor a quality to appear radiographically dense like a true fracture callus.

This research has interesting implications for the diagnosis of pseudofractures, both paleopathologically and clinically. Pseudofractures cause ongoing discomfort, so accurate identification is critical for paleopathological work that aims to understand experiences of past individuals with vitamin D deficiency. Full recognition of pseudofractures are required to understand the demographics who were most vulnerable in the past, and the corresponding social and cultural reasons why this may have been so.

Reassessing the misidentification of a Tripolye trepanation. Trisha JENZ, Kayla KUBEHL & Jordan KARSTEN

Trepanation is defined as the scraping, cutting, or drilling of an opening (or openings) into the cranium for various motivations. This type of cranial surgery can be found worldwide and as far back as 5100BC. Misidentification of trepanation can occur, for example, in individuals that have cranial trauma or have been poorly preserved. In this study we examined a female Tripolye individual from the mortuary site of Verteba Cave outside of Bilche Zolote, Ukraine. This individual is a dated to 3,800-2,600BC based on 14C dating techniques and shows a piece of missing posterior-lateral parietal, oval in shape. The posterior cranium has evidence of a depressed fracture indicative of blunt force trauma to the squamous portion of the occipital bone and possible decapitation at the mastoid process. Following the publication of commentary suggesting this individual underwent trepanation, we conducted analyses to examine this possibility. We found this to be unlikely, especially when compared to the fracture patterns from the victims of the Khmer Rouge regime.

The Discovery and Synthesis of the Nutritional Factor, vitamin D. Glenville JONES

Although vitamin D deficiency, or rickets (osteomalacia in adults), was first recognized over 350 years ago, it was only about 100 years ago that vitamin D, the nutritional factor responsible, was discovered. This discovery was made more difficult by the fact that the substance could be synthesized in human skin through exposure to UV light and could also be present in the diet in animal-derived (D3) and plant-derived forms (D2). Prior to 1920, the frequency of vitamin D deficiency in the general population of industrialized cities was high and it was not unusual to see the bow-legged individuals. Women who experienced rickets in childhood showed pelvic deformities that made child-bearing difficult. The discovery of vitamin D led to the widespread fortification of foods such as dairy products in developed nations and the virtual eradication of rickets in those countries. Vitamin D3 was first chemically synthesized in the 1930s and its metabolism to the active form 1,25-dihydroxyvitamin D3 and its mode of action in calcium and phosphate homeostasis was elucidated in the latter half of the 20th century. The pharmaceutical industry has now synthesized multiple vitamin D analogs that mimic the effects of vitamin D on the body and are used therapeutically in diseases such as bone disease, chronic kidney disease and psoriasis. Accordingly, nutritionists, physicians, chemists and biochemists played critical roles in the rich history of vitamin D and these will be honored in this presentation.

Building a Social Paleopathology: What Ancient Stress can tell us about Community. Sara L. JUENGST & Steven WERNKE

Studies of paleopathology have often been relegated to appendices or footnotes in the discussion of social processes and identity. This is, however, changing; as paleopathologists and bioarchaeologists turn to social issues, ancient markers of stress and disease are used as significant indicators of hierarchy, identity, and community. Presence and distribution of pathological lesions can indicate an individual's and community's experience with disease; by using these data in innovative ways, we can reconstruct past hierarchy and community structure. This poster aims to demonstrate this by presenting data from two case studies, one from the Early Horizon Titicaca Basin (800 BC – AD 200) and one from colonial Southern Peru (AD 1573-1843), to discuss how pathological lesions can inform our understandings of community. We address how non-specific stress indicators (periosteal reaction, cribra orbitalia, porotic hyperostosis, linear enamel hypoplasia) reflect social differentiation and hierarchy in strikingly different sociopolitical Andean settings. In the first case study from the prehispanic Titicaca Basin, pathology is notably limited across several burial samples. When combined with mortuary evidence, we suggest this indicates relatively equal access to resources between different burial groups. In the case study from colonial Peru, nonspecific indicators of stress are common, suggesting that, unsurprisingly, the dietary stress and disease load associated with colonial environments was significant. In both cases, the distribution of lesions reflects the varying degrees of hierarchy people experienced during times of social change.

Gorm the Old - Denmark's First King: A New Life in 3D. Marie Louise S. JØRKOV, Chiara VILLA & Niels LYNNERUP

Gorm the Old was the first king of Denmark and reigned from Jelling in Jutland from c. 936 to his death c. 958. Human skeletal remains were found in the church of Jelling in 1978. The skeleton was relatively complete: cranial bones, most of the long bones, fragments of pelvic bones, vertebrae, scapulae and few bones from the right foot. However, the remains had suffered taphonomic damage and fragmentation. The initial anthropological analyses suggested that the skeleton was of a male, ca. 40-50 years of age with osteophytosis in the lumbar vertebrae and evidence of sharp force trauma on the distal femur. The remains were attributed to King Gorm the Old and reburied in the church in 2000.

Before reburial, the remains were CT scanned using a Siemens Somatom Plus using 120 KV, 340 mAs and slice thickness of 1 mm. Using the newest 3D modeling techniques, we are able to reconstruct and reexamine the remains as well as 3D print the bones of King Gorm the Old. This study shows the importance of performing CT scanning of skeletal remains, not only for permanent documentation that allows reexaminations of the remains, but also as basic tool for 3D printing and 3D reconstruction of fragmented remains.

Vitamin D deficiency in St-Etienne de Toulouse, France: Investigations using Micro-CT. Bonnie KAHLON, Benoit BERTRAND, Antony COLOMBO, Hélène COQUEUGNIOT, Chris KNUSEL, Lori D'ORTENZIO & Megan BRICKLEY

Vitamin D deficiency is a product of biophysical and biocultural factors; both are important in determining levels of vitamin D deficiency. Recent work on past communities suggests vitamin D deficiency was more widespread than previously thought; as in the current community urban living and cultural factors could lead to deficiency in those living at low latitudes.

This investigation used a newly developed x-ray screening technique (D'Ortenzio et al. 2017) to select individuals for micro-CT analysis. The individuals analysed lived in the southern French town of Toulouse (43°N) and died between the 9th and 12th centuries A.D. Nineteen individuals that had at least one permanent molar were selected and dental x-rays obtained. Five individuals showed radiological changes consistent with deficiency and these five and three individuals with no changes were selected for micro-CT analysis at 11µm.

Micro-CT analysis showed evidence of interglobular dentine (IGD) – mineralisation defects, in four of the five individuals with two having multiple episodes. Examination of the skeletons showed changes consistent with healed rickets in one of these individuals. Histological assessment of SQ15 who showed x-ray changes, but no evidence IGD using micro-CT, demonstrated that slight IGD was present. IGD was also identified in one of the individuals with no radiological evidence of deficiency. Toulouse was an important regional centre at the end of the 9thcentury, but conflict in the 10th century brought instability for inhabitants. Our results indicate that socio-cultural practices in Toulouse were such that even at this southerly location vitamin D deficiency was present.

D'Ortenzio L, Ribot I, Bertrand B, Kahlon B, Bocaege E, Raguin E, Schattmann A, Brickley M. 2017. The Rachitic Tooth: The Use of Radiolographs as a screening technique. Poster Presented at the PPA North American Meeting, New Orleans.

Future Landscapes in Andean Paleopathology: Theory, Methods, and Questions for the Next 20 Years. Haagen D. KLAUS, Melissa S. MURPHY & J. Marla TOYNE

In light of the expansive growth of Andean paleopathology over the last 20 years, this poster charts out some of the directions, themes, and issues representing near-term challenges and opportunities in the study of disease in the Andean past. First, Andean paleopathology has the opportunity to continue transcending its descriptive early days and more fully engage with social theory. Considering currently pioneering examples, it is clear that theoretical constructs involving embodiment, identity and ethnogenesis, the bioarchaeology of care, and paleopathology-mortuary analysis integration can enrich paleopathological interpretations in the Andes. Second, the range of questions that Andean paleopathology can address may also be expanded to better include issues of human-pathogen coevolution and the nature of culture-disease-ecology relationships in synchronic and diachronic perspectives. Pragmatic introspection regarding sampling design is intertwined with the goal of developing large, temporally diverse, and regional skeletal samples to address questions involving adaptive transitions, such as the shift from foraging to farming, urbanism, and both Andean and European colonialism. Third, development of new methods can drive conceptual and interpretive advances. South American paleopathology is an ideal setting to showcase powerful new techniques including NextGen aDNA sequencing, proteomics, microbiomics, epigenomics, 3D scanning, and advanced (digital) data collections protocols, and rigorous approaches to differential diagnosis that, in turn, will likely fuel advances in knowledge and anthropological science in ways that we currently may not anticipate.

Recording and interpreting signs of respiratory diseases from bones associated with the upper and lower respiratory tract, especially the skull and the ribs. Susan KLINGNER & Michael SCHULTZ

In the majority of paleopathological studies, only the maxillary sinus is examined in association with upper respiratory diseases and for the lower respiratory tract only the ribs in the search for the signs of tuberculosis. However, it is important to differentiate between unspecific and specific respiratory diseases, because the presence of unspecific respiratory diseases will allow conclusions about the general health and the living conditions. Even though the examination of the whole skeleton is necessary, here, only the traces found on the internal surface of the ribs and on the surfaces of skull structures will be presented.

For the study of traces of respiratory diseases left on bones, 112 adult individuals of an Early Neolithic (5500-4800 BC) burial ground from Wandersleben (Thuringia, Central Germany) were examined paleopathologically with macroscopic, radiological, endoscopic, low power microscopical, light microscopical, scanning electron microscopical and biochemical methods.

The origin of bony changes can be explained by only a limited number of processes. On the examined skull structures, seven different traces associated with upper respiratory diseases could be found and on the internal surface of the ribs, 14 different traces associated with lower respiratory diseases. These traces can be present in several combinations and allow conclusions about the activity of the process. This study can provide a general understanding of bony changes associated with respiratory diseases and the processes behind them. It can also be used as a guideline for a standardized examination and would, thereby, facilitate the comparability of results from different research projects.

Children's Health in Archaic Texas: A Paleopathological Analysis of Juvenile Remains. Lauren KOUTLIAS

While many dissertations, theses, and publications have repeatedly mentioned the relatively low number of juvenile burials at Texas mortuary sites, this thesis serves to reconsider the importance of juveniles in the archaeological record. The Archaic Period mortuary sites of Ernest Witte and Morhiss on the Western Gulf Coastal Plains of Texas provide an adequate number of juvenile skeletons on which to conduct osteological analyses. By studying the remains of these children from a paleopathological perspective, a connection can be made to diet overall community health (Hard and Katzenburg et al 2011). Results indicate that the higher rate of pathologies at Morhiss compared to Ernest Witte may be attributed to the earlier adoption of plants in the diet of the Morhiss population and later by the Ernest Witte population. Other results indicate that many children struggled during the weaning period. This study stresses that a consideration of juvenile presence and health in past societies is important to reconstructing and understanding the past.

Hard, Robert J., and M. Anne Katzenberg. 2011 Stable Isotope Study of Hunter-Gatherer-Fisher Diet, Mobility, And Intensification on the Texas Gulf Coastal Plain. American Antiquity 76.4: 709–751.

A Case of a Dilacerated Molar: Differential diagnoses of abnormal dental development from a historic cemetery. Kevin KNOWLES

Skeletal remains from the Erie County Poorhouse Cemetery (1851-1913) were recovered during construction on the South Campus of the University at Buffalo. Individuals exhumed were those that died at the poorhouse and associated hospital. During skeletal analysis, a female with an estimated age between 20 and 35 years old at time of death, was observed with abnormal development and eruption of the permanent dentition, including a dilacerated maxillary right molar crown.

Clinical dentistry suggests two differential diagnoses for the dilacerated tooth—mechanical trauma and non-specific stress that impacts development of the tooth (Jafarzadeh and Abbot, 2007). Although trauma is throught to be the most common cause, there is no evidence of remodeling of the right maxilla of this individual. Instead, some disturbance to the development of the tooth must be considered.

The nature of this disturbance can be difficult to ascertain. Other dental anomalies are present in this individual—an impacted left maxillary canine and evidence of linear enamel hypoplasia—that are commonly associated with dilacerated crowns caused by non-specific stresses. Due to the different timing of development and eruption for these two teeth—the molar tooth crown developed by 30-36 months, the maxillary canine erupted at 10-12 years—it is

likely that some defect to the tooth germ itself would have caused these issues. The possible sources of these defects—environmental or genetic—are discussed here.

Jafarzadeh, Hamid; Abbot, Paul Vincent. 2007. Dilaceration: Review of an Endodontic Challenge. Journal of Endodontics 33(9): 1025-30"

The use of computed tomography to reassess neoplasm diagnosis in prehistoric samples. Savannah LEACH

Despite being benign, osteomas impact surrounding anatomy and are pathologically important. Osteoma tissue origin and the effects on nearby structures are crucial to performing an accurate differential diagnosis and fully recreating the impairment an individual experienced in life. These factors cannot be determined through macroscopic inspection alone. This study uses computed tomography (CT) scans to reassess two skeletal neoplasms from prehistoric Illinois originally diagnosed as osteomas by visual inspection.

WM-107 from Fisher Mounds has an osteoma (2.3 cm superior to inferior and 1.3 cm at anterior to posterior) on the right ascending ramus near the coronoid process. This tumor likely altered the path of the pterygoid muscles and impinged the inferior alveolar nerve. CT scans demonstrated a radiopaque periphery and radiolucent center, suggesting an osteoid osteoma arising from osteoblasts. CT scans also characterized the tumor as pedunculated, a characteristic of peripheral osteomas arising from periosteum. Osteoid osteomas and osteoblastomas share many of the same characteristics, with osteoblastomas described as larger than 2 cm. Due to its large size, this growth may be an osteoblastoma, which is more locally aggressive and has greater growth potential than osteoid osteomas.

These CT scans were compared to another prehistoric case of an osteoma from Illinois. This osteoma was much smaller (1 cm by 0.7 cm) and had an even radiopacity beneath a smooth surface. This comparative case presents a striking morphological difference to that described above. Although impractical to CT scan all neoplastic growths, care should be taken when diagnosing neoplasms in skeletal remains.

Myositis ossificans: heterotopic ossification. Don LEWIS

Myositis ossificans, or MO, is a functionally benign process which mimics more aggressive disease. It is better termed heterotopic ossification (HO) usually within the larger muscles. The term myositis ossificans traumatica has been used when the condition is clearly related to trauma while myositis ossificans circumscripta is another synonym which will also be found in the literature. Some of these ossifications are completely extraosseous; others attached to the skeletal structure. It is important to note that this must be differentiated from myositis ossificans progressiva, more correctly termed fibrodysplasia ossificans progressiva, which is an inherited, autosomal dominant affliction which grows in a predictable pattern. This will not be addressed. The pathophysiology of MO is unclear, but it may be caused by an interaction of local factors including vascular stasis, tissue hypoxemia, available calcium reserve in adjacent skeletal tissue, mesenchymal cells having osteoblastic activity, and local soft tissue edema. There is then an inappropriate differentiation of fibroblast into osteoblasts. While MO is unusual in the head and neck, I will present a few documented cases. Also, with particular focus on our interest at this conference, I will show not only photographs but also bring a casting of a quite famous example of myositis ossificans in the earliest fossil discovered of *Homo erectus*.

Differential diagnosis of possible treponemal and mycobacterial infections in a late-19th century semi-nomadic sample in Jordan. Alysha LIEURANCE, Mallory PROVAN & Megan PERRY

Semi-nomadic and nomadic bedouin of the Late Ottoman period Levant have been characterized in travelers' accounts and ethnohistoric documentation as marginally nourished and prone to infectious diseases. Two conditions, bejel and tuberculosis, have been implicated as endemic conditions amongst these groups. Both conditions stem partially from unhygienic and/or crowded living conditions, not always expected within nomadic populations. The paleopathological analysis of a communal, commingled burial from Late Ottoman Hesban (MNI=45), located on Jordan's Madaba plateau, has discovered skeletal lesions possibly indicative of both conditions within the sample. Differential diagnosis of conditions leading to extensive remodeling of the nasal bones and nasal aperture and lytic lesions in the lumbro-sacral region suggest a late-stage treponemal infection and possible bovine tuberculosis as likely etiologies. These results, combined with comparative data from the region, have implications for the living conditions of 19th century Bedouin in western Jordan on the eve of industrialization in the region.

Syndemics in palaeopathology? A Vitamin D case study. Judith LITTLETON

One of Don Ortner's maxims was "a dog can have ticks and fleas". This was a reminder that individuals may have more than one pathological condition at a time. More than simple comorbidity, the concept of syndemics (developed in medical anthropology) points to synergistic relationships between pathological conditions occurring within particular social circumstances that can significantly alter the presentation of both conditions, may interact to create worse outcomes, or may be concentrated in particular subgroups. In contemporary populations multiple syndemics have been identified including TB, HIV/AIDS, malnutrition (Triple Trouble) or TB and diabetes. In each of these cases the result is the unequal distribution of disease.

Syndemic frameworks have not been used in palaeopathology yet they may help clarify differential diagnoses and may identify hidden heterogeneity when a subset of a population is at significantly higher risk of mortality because of co-existing conditions. However the restriction of data to non-survivors only complicates their analysis.

I explore these issues by reanalysing the pattern of rickets, cribra orbitalia, and periostitis (as reflective of childhood infection) among children from two sites in Bahrain (QAB n=12; DS3 mni=631). I hypothesise based on contemporary data from the Middle East that the synergistic relationship between rickets with protein-energy malnutrition and respiratory infection occurred in the past but that this synergism is restricted to a subgroup of very young children (less than three years) consistent with a syndemic interaction. The implications of this are explored particularly in consideration of hidden heterogeneity.

Considering evidence for hypertrophic pulmonary osteoarthropathy (HPO) as part of an integrative approach to chronic respiratory infection: Evidence from Isola Sacra in Roman period Italy. Laura LOCKAU & Alessandra SPERDUTI

Hypertrophic pulmonary osteoarthropathy (HPO) is a form of hypertrophic osteoarthropathy (HOA) caused by chronic pulmonary disease. While in clinical cases HPO is typically caused by neoplastic conditions, in the pre-antibiotic era respiratory infections were probably the predominant cause. HPO is associated with bilaterally symmetrical new bone formation in characteristic skeletal locations; a limited number of paleopathological cases of HOA have been identified based on skeletal lesions, in a few cases correlating with biomolecular evidence for tuberculosis. In paleopathology, evidence for HPO has typically been presented as case studies, or detailed discussions of the lesions present in one or two individuals from a skeletal sample. Despite general acknowledgement that respiratory infections are likely to have been the most important cause of this condition in the past, previous analyses have not considered HPO in the context of other skeletal evidence for chronic respiratory infection.

Skeletal lesions consistent with HPO were observed in three adult individuals from Isola Sacra, a Roman period (1st-3rd centuries AD, n=822) collection from Italy. Additionally, other skeletal lesions associated with chronic respiratory infections, including periosteal new bone formation on the visceral surfaces of the ribs and vertebral lesions, were observed in 12 juvenile and 10 adult individuals from this sample. Given close associations between each of these types of skeletal lesions and respiratory pathology, this paper suggests that integrating skeletal features previously considered separately in the

examination of respiratory infections can assist in the development of a more comprehensive picture of chronic respiratory infections within past populations.

Health and diet under a dim light: paleoenvironmental anthropology of the LIA. Olalla LOPEZ-COSTAS & Antonio MARTINEZ CORTIZAS

A small area at the edge of Europe (NW Spain) offers a unique opportunity to link climate changes and ancient health. This is due to the availability of detailed environmental (i.e. climate, vegetation, etc.) and human lifestyle (i.e. paleopathology, paleodiet, historical sources, etc.) reconstructions. Paleopathological and isotopic studies were performed in 6 skeletal collections covering the period of the Little Ice Age (LIA; AD1300-1850). Investigations based on peat records (pollen and geochemistry) revealed that the climate of the studied area was characterized by intense cooling (a decrease up to 5-5.5°C), abrupt changes in rainfall and higher frequency of storms during LIA. The isotopic study shows an increase of marine resources and C4 plants (millet and maize later) in diet, regarding previous centuries. This has been interpreted as a possible strategy to bioproductivity deterioration. Several cases with probable signs of tuberculosis and treponematosis were recorded. Historical sources also indicate different pandemia propagations. Specifically, the impact on demography of bubonic plague in 14th century is coeval with a recovery of forests in pollen records. Additionally, this is one of the few European regions where C4 plants were staple. The high maize consumption detected in one of the necropolis matches with skeletal signs (osteoporosis, cribra orbitalia, periostitic lesions, extreme alveolar bone loss) compatible with pellagra. Our study suggests that it is possible to find effects on human populations in response to abrupt climate changes. Considering paleoenvironment in paleopathology is clearly an advantage, but we believe that future knowledge depends on more detailed reconstructions.

External auditory exostoses and maritime resource procurement in ancient Cyprus. Kirsi O. LORENTZ

External auditory exostoses (EAEs) are considered proxies for aquatic activity, and modern clinical data exists as to their etiology, symptoms and signs. Understanding repetitive aquatic activity has a bearing on many key questions in archaeology, including the process of becoming Neolithic, preceded by the Broad-Spectrum Revolution (the BSR hypothesis), involving e.g. intensification of aquatic resource procurement. Emergence of specialists, and specialised sites (e.g. fishing/maritime resource procurement) is frequently tied to increasing socio-economic inequality, and increasing social complexity, respectively.

This poster explores the evidence for repetitive aquatic activity in Cyprus through time using paleopathological evidence, and external auditory exostoses (EAEs) in particular. Aquatic activity in ancient Cyprus is explored through a paleopathological study of EAEs discovered within the human ear canals recovered from the earliest Neolithic (Cypro-PPNB Kissonerga-Mylouthkia water wells - the world's oldest) to medieval times. 197 skeletons were examined, of which 140 were adult. Of these, 42% were estimated to be male or probable male, 39% female or probable female, and for 18% it was not possible to estimate sex due to poor preservation status. EAEs and their severity were recorded using a well-established scoring system allowing comparative research. Digital 3D data capture was conducted in order to allow comparative study of the size of the exostoses, not normally accessible through conventional osteometry. Coastal versus inland populations were compared for EAE prevalence and severity where possible. All auditory canals recovered from Cypro-PPNB Kissonerga-Mylouthkia display EAEs (Grade 1; adult males). Data from later periods shows variation in occurrence, prevalance and severity. The EAE evidence indicates maritime aquatic activity in these contexts given the lack of freshwater bodies. Ichthyological and malacological evidence points to dietary as well as other uses of maritime organisms.

Porotic Hyperostosis and Shifting Health Pattern among Yucatecan Coastal Settlers Before and After the Maya Collapse. Raúl LÓPEZ, Allan ORTEGA, Julio CHI & Vera TIESLER

Porotic hyperostosis has commonly been associated to physiological stress periods related to nutritional deficiencies during infancy. In this study, we test this assumption by comparing this condition in systematically scored cranial vaults of Prehispanic Maya settlers who were buried along the Yucatecan coastline. We pose that these individuals must have enjoyed a balanced diet given their ready access to marine resources. For this study, we scored the presence vs. absence, degree, state of healing, anatomic distribution, and morphological attributes according to age-at-death, sex, and time period in 576 well-preserved crania from18 Maya settlements dated to the Classic and Postclassic period (A.D. 250-1521). Macroscopic analyses were complemented with the scrutiny of histomorphological sections in 30 case studies in order to discern the etiology of the condition. Our combined results show that the main etiology of porotic hyperostosis is anemia and a synergistic action between chronic diarrhea, fever, and poor hygiene. Less common are the porosities caused by vitamin C deficiency, and hemorrhagic-inflammatory processes. Stable frequencies of spongy hyperostosis mark the millenium before the Maya collapse, whereas a sharp increase of this condition is materialized by the Postclassic skeletal populations under study. We discuss the latter trend in terms of shifts in subadult diets, changing weaning practices and the sociopolitical re-organization after the collapse of Classic-period hegemonies.

The Abandonment of Greenland: The Viking Norse and the Little Ice Age. Niels LYNNERUP

The remains of the Greenland Viking Norse provide a unique biological anthropological material for the investigation of human and environmental interaction. As a population, they were generally secluded from much of the contemporary European medieval society, and land suitable for their way of life was limited in Greenland. The archaeological and historical record is excellent, clearly establishing the 500-year period of colonisation ca. 1000-1500AD. In other words: the Greenland Norse represent a relatively isolated population, constrained in both space and time.

Living in an environment with very little buffering capacities, ecological changes, probably the result of the Little Ice Age, had immediate and clear repercussions. We have been able to show a direct climatic impact on the humans as well as changing dietary subsistence patterns. Our demographic modelling indicates that emigration may account for the final abandonment of the settlements. A changing ecology thus seems to have pushed the Greenland Norse out of Greenland, because their sedentary way of life, relying as it did on animal husbandry, and probably with a strong cultural sense of identity focused on having farmsteads and domesticates, became unsustainable.

Down in the mouth: distributions of dental and oral conditions in human skeletal remains from Philistine period Ashkelon, Israel. Kathryn E. MARKLEIN, Rachel KALISHER & Sherry C. FOX

Human skeletal remains from the ancient site of Ashkelon, Israel provide evidence about the population associated with the first Philistine cemetery. Preliminary observations of dentition from the adult skeletons enhance understanding of the ecological and social conditions during this period. Employing dental proxies for child growth perturbations (linear enamel hypoplasia, LEH), diet (carious lesions and calculus), and possible infection (abscesses; periodontal disease, PD; and antemortem tooth loss, AMTL), we compare the prevalence of lesions and conditions between adult males (N=26) and females (N=29). Despite the higher prevalence of females (58.6%) with LEH than males (34.6%), this difference was not significant. With regard to conditions associated with possible dietary disparities, carious lesion (38.5%) and calculus (46.2%) prevalences among males were lower than female caries (48.3%) and calculus (55.2%) percentages. Infectious lesions, such as periapical abscesses, were infrequently observed in the sample within both sexes (female=0.0%; male=3.8%). Periodontal disease and

antemortem tooth loss, conditions often correlated with one another and age, appeared at higher frequency among males (PD=11.5%; AMTL=36.0%) than females. Regardless of the intersexual differences observed among these conditions, no differences were found to be significant between sexes. These results suggest that the sociopolitical, economic, and cultural environment in which this population lived did not promote disparities between sexes, specifically disparities which manifest on the teeth or within the oral cavity. Further investigation of postcranial and skeletal remains will enhance these oral data and establish a clearer and more nuanced perspective of males and females living and interacting in Philistine Ashkelon.

The case of a Portuguese postman who died from leprosy in 1931 and the paleopathological analysis of his skeleton. Vítor MATOS, Giovanni MAGNO, Alexandra AMOROSO & Susana GARCIA

Before antibiotics leprosy patients often died due to comorbidities related to the natural clinical progression of this chronic infection. Therefore, leprosy per se is a very rare cause of death in human identified skeletal collections. This research aims to present the paleopathological study, including radiological analysis, of the only individual having leprosy as the cause of death belonging to the Luís Lopes Collection, housed at the National Museum of Natural History and Science, Lisbon, Portugal. Biographical data available reveals that MB-35 skeleton belonged to a 47 years old postman who died in Lisbon in 1931. Additional clinical and occupational information were collected respectively in the historical archives of the Directorate-General of Health and the Portuguese Communications Foundation. The MB-35 skeleton was very well preserved and presented anatomical variations in the rib cage. Leprosy related changes were confined to hand phalanges and lower limbs, namely tibiae, fibulae and foot bones. The pattern of skeletal involvement, including the absence of rhinomaxillary lesions, is highly suggestive of a probable case of tuberculoid leprosy – a type of leprosy rarely reported in paleopathological literature. This diagnosis is further discussed under the light of medical and paleopathological knowledge regarding tuberculoid leprosy and also taking into consideration the life history of this individual.
Funding: Portuguese Science Foundation (VM funded by the FCT investigator program - IF/00186/2014 - and by the Research Centre for Anthropology and Health - UID/ANT/00283/2013).

The Langobards in Italy: A Bioarchaeological Analysis of the 7th Century AD Necropolis of Sovizzo in Vicenza, Italy. Ashley MAXWELL & Rosanne BONGIOVANNI

Langobard remains from the 7th century AD site of Sovizzo, Vicenza, were analyzed for hematopoietic diseases and dental pathologies to assess health and diet during the early medieval period in the Veneto (Northeastern Italy). The Langobards are a Germanic tribal group that migrated to the Veneto in AD 567, with occupations lasting until the 8th century AD; however, Langobard diet and health are largely unknown during this period of transition and subsequent occupation. Well-preserved Langobard remains from a 1985 excavated necropolis are extremely rare, increasing the importance of the case study at Sovizzo.

This study examines the frequencies of cribra orbitalia, dental attrition, carious lesions, abscesses, dental calculus, and linear enamel hypoplasias (LEH) in 24 adult individuals using standard methods to determine nutritional quality and the composition of dietary foods of this population. Dental attrition (92% scored 5 or above), carious lesions (95.8% had at least 1), and dental calculus (75%) were recorded in the sample, suggesting a diet high in carbohydrates with hard fibrous foods. Only 10 individuals could be scored for cribra orbitalia, with 90% exhibiting the orbital lesions.

This study demonstrates that the Langobards experienced pathological conditions related to a high carbohydrate diet. This correlates with archaeological and historical accounts of wheat and millet agricultural production, which were common in the Veneto during the early medieval period. Other regional studies show dental pathologies increased from the Roman to the medieval periods in northern Italy, possibly due to poorer living conditions due to repeated invasions.

How should we diagnose disease in palaeopathology? Some epistemological considerations. SIMON MAYS

In palaeopathology, diagnosis of disease is of pivotal importance. However as a discipline, we have devoted relatively little attention toward the higher level conceptual frameworks that underpin this process. The classical approach is essentially comparative. It uses lesions in a reference group or groups to help us identify disease in a target individual or population. The target group is archaeological remains showing pathological lesions. The reference groups comprise skeletal remains or imaging data from individuals with diseases that were diagnosed in life. Reference / target group approaches are a widely used conceptual framework in biological anthropology for developing methodologies (e.g. in estimation of age or stature). Although this type of approach has considerable strengths it also has significant and inherent weaknesses. Using analogies with studies in the methodology of skeletal age estimation, some of the chief weaknesses in the reference / target population model for palaeopathological diagnosis are discussed. Ways in which their impact upon diagnosis might be assessed, and to some exent mitigated, are considered. Despite its shortcomings, the reference / target population model will remain fundamental to palaeopathology, just as it is in other areas of biological anthropology. However, the case will be made for the value of supplementing it with alternative approaches, especially those that emphasise detailed understanding of the anatomical and pathophysiological basis of bone lesions; that would enrich our understanding of the lesions we see in skeletal remains and would help ensure that our interpretations of them are more thoroughly grounded in biology.

Documentary sources on the early history of vitamin D deficiency disease. Simon MAYS

The presentation will focus on the contribution that historic sources can make to our understanding of vitamin D deficiency disease (rickets, osteomalacia) in the past. Evidence dating from the 2nd – 19th century AD will be considered, but the prime focus will be on 17th-19th centuries AD. Sources will be evaluated critically for the light they can shed on aspects such as the epidemiological patterning in vitamin D deficiency, the health impacts of rickets /osteomalacia, and earlier ideas as to the causes of rickets / osteomalacia. Consideration will also be given to the interface between historic sources and palaeopathology, in particular the extent to which historic sources may be used to generate hypotheses amenable to testing using palaeopathological evidence.

A Woman's World: Pathological and Morphological Risks During Childbirth. Candace MCGOVERN

Morphological changes required to accommodate bipedal movement and larger foetal brain size in conjunction with poor health including nutritional deficiencies can make a vaginal birth extremely hazardous for women. Previous palaeopathological studies have limited their examination to individual female remains buried with neonates and to obvious complications stemming from a contracted pelvis, an unstable pelvic brim or pelvic fractures. This has resulted in a gap in the literature for a study on past populations which incorporates lesser known morphological or pathological issues including developmental, metabolic, and spinal causes, together with premature fusion of the coccyx, arthritis and other diseases or deficiencies which can result in the dislocation or atrophy of lower limbs.

The aim of this study is to establish the frequency of pathological or morphological changes in female skeletal remains during their reproductive period that do not stem from an obstetric dilemma but may result in an increased risk during childbirth. To accomplish this, 133 females between 16 and 45 years at death from three separate urban Romano-British sites were examined for evidence of pathological or morphological changes which can create

complications during a vaginal birth. Within the sample group 17% (n=23) displayed such changes, including 7 individuals with prematurely fused coccyges. Although fusion of the coccyx to the sacrum increases with age, in women of a reproductive age this can result in contracted pelvic outlet. The results also confirm previous studies as there was no evidence of major developmentally related pathology which could result in maternal deaths.

Pathologies Associated with Pellagra. Myra MILLER

Pellagra, a niacin/tryptophan deficiency caused by maize dependent/low protein diets, was endemic in the United States from the early 1900s to the 1940s. Tens of thousands were killed because of this nutritional deficiency and it affected even more. Despite the high prevalence of the deficiency, increased attention towards historical sites, and previous studies to establish a model, no standard exists for the identification of pellagra in human remains.

This study applies a model proposed by Paine & Brenton (2006) to seven newly-identified individuals that died from pellagra, housed in the Hamann-Todd Collection in Cleveland, Ohio. Pathologies considered are periostitis of the tibia, porotic hyperostosis/cribra orbitalia, caries, alveolar bone absorption, and osteoporosis. In addition to these, pathologies of the clavicle and sternum are also evaluated. Osteoporosis was determined radiographically due to the limit to nondestructive methods.

Rates of these pathologies in the pellagra sample are compared to rates in a randomly selected sample from the Hamann-Todd as well as the rates reported by Paine & Brenton (2006). In the sample, most individuals did display higher rates of periostitis and caries. However, they had lower rates of alveolar bone absorption than that seen in the control samples of those who died of non-pellagra causes. This suggests that diagnosis of pellagra can be done in historical collections, but that it will always likely occur as part of a suite of nutritional deficiencies.

Selective Mortality from External Forces: Physiological Stress in the North American Great Plains during the Little Ice Age. Jocelyn D. MINSKY-ROWLAND

The Little Ice Age (LIA) in the northern Great Plains was a time of temperature and moisture fluctuations, affecting human population shifts and available resources. This latter phenomenon has been suggested as the cause of health and growth deficiencies across several groups of people, including the Arikara Native Americans of South Dakota (AD 1600-1832). Environmental stressors may have affected childhood growth processes affecting later adult stature. It is hypothesized that adult individuals with short stature (a proxy for malnutrition), at the end of the LIA, will exhibit differential survivorship when compared to adult individuals at the beginning of the LIA. One-hundred and eighty-three adult individuals, from 3 post-Contact and 1 pre-Contact archaeological sites were analyzed for survivorship differences relative to stature. Survivorship was investigated using Kaplan-Meier estimates with log-rank tests in SPSS version 22. The associated Kaplan-Meier survivorship curves indicate that pre-Contact individuals with short-for-average stature lived longer when compared to post-Contact individuals with short-for-average stature. This result was statistically significant. It is suggested that short individuals at the earliest site had not yet experienced the full effects of the LIA in terms of a dearth of nutritional resources, whereas individuals at the later sites did. Although the health status of pre- and post-Contact samples are complex, it is clear that stress factors other than European Contact can explain temporal differences in adult Arikara health status. Future analyses will incorporate pre-LIA populations to compare the health consequences of pre-LIA populations with post-LIA populations.

Examining the pathoecological role of dogs among the Loma San Gabriel through the analysis of coprolites from La Cueva de Los Muertos Chiquitos, Durango, Mexico. Johnica J. MORROW, E.R. GRADY & Karl J. REINHARD

The role that dogs have played in the zoonotic transfer of parasites to humans has been widely studied in a modern context. The pathoecological role that dogs played in prehistoric populations often goes unrecognized. In the present study, 100 coprolites from La Cueva de los Muertos Chiquitos (CMC) were examined for parasite eggs and macrofossil contents using standard coprolite analysis procedures. Each coprolite was categorized as being likely deposited by a human or likely deposited by a canine based on macrofossil and parasite egg composition. Additionally, 90 coprolites suitable for immunodiagnostic testing were examined for the presence of 3 species of diarrhea-inducing protozoan parasite antigens (Entamoeba histolytica, Giardia duodenalis, and Cryptosporidium parvum) using enzyme-linked immunosorbent assays. The results of these tests were compared with the results from the microscopic analyses to better understand which parasites were exclusively found within dog coprolites, which were found within exclusively human coprolites, and which were found within coprolites that could not be distinguished as being either dog or human. From these data, the pathoecological role of dogs at CMC was reconstructed from an epidemiological perspective. These examinations of the pathoecology at CMC provide a model for reconstructing the pathoecological roles of dogs at other archaeological sites. Future studies of prehistoric human-dog interactions could further elucidate the nature of zoonoses at other sites and among specific groups of prehistoric human populations.

From Looted Cemeteries to Modern Paleopathology: Reflections on the History of Studies of Disease in the South American Past. Melissa S. MURPHY, J. Marla TOYNE & Haagen D. KLAUS

South America possesses a unique combination of a considerable time depth to human occupation, dramatic geographic and environmental variability, long-term in situ development of numerous complex societies, and a variegated history of European conquest and invasion. Skeletal remains and mummies from South America were integral to the origins of the field of paleopathology during the late nineteenth and early twentieth century. Indeed, the intellectual trajectory of paleopathology in South America follows the intellectual history of the field in general. Much of these early investigations focused on isolated specimens or trepanation, e.g. work by Peruvian scholars Muñiz and McGee (1897) or Tello (1913), and was based on material derived from the selective and a-contextual collection of pathological specimens from the looted cemeteries, the curiosity of physicians, and work by early anthropologists. Human skeletons were long neglected, and while burials were excavated, it was for their grave goods in support of a dominant art history approach. Paleopathological studies in the latter half of the twentieth century (until 1997) took multiple queues from processual-ecological thinking, and shifted focus towards paleoepidemiology, human adaptation, the effects social complexity on health, and the effects of European conquest and invasion on the health of indigenous peoples. This poster provides an overview of this history, from the origins of paleopathology in South America to the end of the twentieth century and we detail some of the important early case reports and specimens, highlighting the work by Aleš Hrdlička, T. Dale Stewart, and early groundbreaking population-based investigations.

Advancements in the Investigation of Tuberculosis in Pre-Columbian Peru. Elizabeth A. NELSON, Jane E. BUIKSTRA, Tiffiny A. TUNG & Kirsten I. BOS

The presence of Tuberculosis (TB) in the precontact New World has been a prominent topic of research in the archaeological sciences. It was initially doubted, but skeletal evidence and subsequent molecular identification of Mycobacterium tuberculosis in New World archaeological populations confirms its prehispanic presence. Paleopathological evidence of TB has been reported as early as 200AD in both Chile and Peru and 525AD in Columbia. Bioarchaeologists are incorporating clinical and epidemiological

data to fully understand the multiple social, ecological, and biological factors that promote this disease.

This poster provides an overview of paleopathological research of TB in pre-Columbian populations. We discuss the significant contributions of paleopathology, archaeology, and molecular studies in understanding the emergence and spread of this disease. We highlight the identification of a pinniped strain of M. tuberculosis complex in 1,000 year-old archaeological remains from coastal Peru. We also discuss preliminary results and novel methods of detection based on non-enriched DNA analysis of skeletal remains from Huari, Peru (1019-1400AD). Those analyses provide insights into population health after the collapse of the Wari empire and during a period of climate stress (drought). Furthermore, it affords us the opportunity to gain information on the temporal and demographic range of TB in pre-Columbian Peru and help better understand the ecology of this pathogen, possibly supporting whether or not it had become adapted for human transmission.

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A Probable Case of Leprosy from Colonial Period St. Vincent and the Grenadines, Southeastern Caribbean. Greg C. NELSON, Taylor N. DODRILL & Scott M. FITZPATRICK

Leprosy (Mycobacterium leprae) traveled to the Western Hemisphere with the earliest European and African migrants, so its time depth in this area is quite shallow compared to the rest of the world. Historical records indicate that the disease occurred throughout the Caribbean, afflicting all segments of society. However, these records also show that leprosy was ill-defined and little understood so its true prevalence, particularly prior to the mid-19th Century, is not well established. Here, we report on a case of probable lepromatous leprosy dating to the late eighteenth century from the Grenadines island chain in the Lesser Antilles. Although no post-cranial elements are available for examination, the skull of this individual (female, 25+ years) clearly exhibits skeletal changes associated with the rhinomaxillary syndrome that have become diagnostic of leprosy. These include, but are not limited to, rounding of the pyriform aperture, resorption of the nasal spine and anterior alveolar process, and pitting and remodeling along the midline and anterior portion of the palate. Dating to approximately 1798 this may be the earliest known skeletal representation of leprosy in the New World.

A Case Study of Possible Childhood Illness. Hailie NORMAN, Anna OSTERHOLTZ, Andre GONCIAR & Zsolt NYARADI

Városfalva is a cemetery site situated within the Carpathian basin (Romania), and used during the 17th and 19th centuries. Thus far, the site has only been partially excavated, and very few of the 42 individuals from the cemetery have had osteological analysis. Due to the coins, headbands, buttons, leather, a clay vassal, coffin wood, and coffin nails recovered during excavation, it is likely that Városfalva was once a cemetery for the wealthy. Despite these other finds, burial 31 was not strongly associated with any grave goods or coffin materials, which differentiated the burial from the general population. The research presented here details the biological profile and paleopathological analysis of burial 31. This burial consists of a child whose age at death was between 8-10 years. The individual showed evidence of significant childhood stress in the form linear enamel hypoplasias (LEH), that began around age 2. The first stress event may be associated with weaning, while the rest may have been due to nutritional deficiencies or disease. Burial 31 also showed evidence of porotic lesions on the mandible and on the greater wing of the sphenoid, cribra orbitalia, caries, and periosteal reactions in the postcranial skeleton, all consistent with vitamin C deficiency (scurvy). Other nutritional deficiencies are also possible, including: rickets, a comorbidity of scurvy and rickets, anemia, or another form of metabolic stress. This may suggest that even the wealthy in the Carpathian basin region of medieval Romania were not always able to gain enough nutrition to remain healthy.

The effects of the Little Ice Age on oral health and diet in populations from continental Croatia. Mario NOVAK, Željka BEDIĆ, Vlasta VYROUBAL, Siniša KRZNAR, Ivor JANKOVIĆ, Emma LIGHTFOOT & Mario ŠLAUS

This study aims to investigate possible differences in oral health and dietary habits caused by climatic changes brought by the Little Ice Age in late medieval and early modern inhabitants of continental Croatia. The analyzed osteological material consists of two composite samples: the first (end 13th – beginning 16th century CE) is comprised of 260 adult individuals from five sites while the second (beginning 16th – beginning 19th century CE) is comprised of 400 skeletons from six sites. In order to assess the previously mentioned changes three dento-alveolar pathologies were analyzed: caries, ante-mortem tooth loss, and alveolar abscesses. The dietary profile was additionally assessed by analyzing carbon and nitrogen stable isotope analysis from bulk collagen.

The preliminary results suggest that there are no significant differences in oral health patterns and subsistence strategies in continental Croatia before and during the Little Ice Age. Additionally, it seems that the observed differences cannot be solely associated with the occurrence of the Little Ice Age in Europe, but could be also connected to political and social processes related to the endemic warfare that was present in Croatia between the 16th and 18th centuries due to constant Ottoman intrusions.

Do you kneed some assistance? Secondary osteoarthritis as a result of trauma to the quadriceps muscles. Olof OLAFARDOTTIR

Secondary osteoarthritis is a type of osteoarthritis that is caused by another disease or condition, such as congenital abnormalities, trauma, gout, and rheumatoid arthritis. In paleopathology, secondary osteoarthritis is often difficult to diagnose due to the lack of information collected from a single skeleton. A Middle Woodland (ca. 150 B.C – A.D 400) male from Pete Klunk Mounds in the Lower Illinois River Valley was found to have severe osteoarthritis of the right knee. The severe osteoarthritis was unilateral and appeared to be associated with a small (13mm x 11mm) ovoid depression (healed wound), present on his anterior distal femur. The wound was located where the articularis genus muscles originates and the blunt object would have had to pass through the free part of the vastus muscle and the bursa under it. This type of trauma would have caused limited mobility and extensive tear in the muscle tissue, eventually leading to the bony changes seen on the distal right femur and proximal tibia. It is also possible that the medial meniscus was affected, leading to further arthritic changes in the knee. This is supported by the presence of eburnation on the medial plateau of the right tibia and the medial condyle of the right femur. The severity of osteoarthritis in the right knee suggests that the injury occurred years before the man's death so this case can add on to the bioarchaeological record of individual adaptation to impaired mobility, disability, and care.

Perspectives on care and disability from the Rimac Valley, Peru. Alejandra ORTIZ, Melissa S. MURPHY & Trisha BIERS

Recent work in the bioarchaeology of care, the bioarchaeology of personhood, and the bioarchaeology of identity has started to attend to the investigation of disability and impairment in prehistory and these developments have important implications for the field of

paleopathology. Here we examine several cases of hip abnormalities (hip dysplasia, hip subluxation, and hip dislocation) on human remains from the Rimac Valley of Peru (N=7) from the cemeteries of 57AS03 and Huaquerones from the archaeological site of Puruchuco-Huaquerones and from Corpus II, a site within the Huacas Pando complex. These remains date from the Middle Horizon through the early Colonial Period (AD 600- ~1540). We describe the etiology, epidemiology, and clinical manifestations of these conditions and then we diagnose each of the individuals within the spectrum of hip disorders. We analyze and compare this prehistoric prevalence, approximately 7.2 per 1000, with modern prevalence data from Lima, Peru (1.07 per 1000) and explore whether or not cradleboarding contributed to the higher prevalence of these abnormalities in the past. According to the chroniclers, disabled or impaired individuals, including those "cojos" who walked with a limp and "tullidos" who lost movement in one or all of their limbs, had roles and were incorporated into Inca society and in some cases, revered. Coupled with the paleopathological data, we report on what the mortuary treatments can say about the identities of these individuals in life, how their communities perceived them after death, and how Andean peoples responded to disease.

A probable case of metastatic carcinoma from post-Medieval Belgium. Jessica L. A. PALMER, Kim QUINTELIER & Andrea L. WATERS

Knowledge of the impact and prevalence of cancer in past societies is currently quite limited. Soft-tissue cancers are hard to detect osteoarchaeologically, and taphonomy is a major hindrance in a pathology largely characterized by lytic lesions. This has led to a persistent belief that cancer was less common in the past. Although this is possible, an increasing number of paleopathological cases are being reported. This study presents a case of probable metastatic carcinoma in a middle-aged (35-50 years) upper class woman from post-medieval Aalst (Belgium). The skeleton shows extensive osteoclastic activity on the skull, vertebrae, ribs, sacrum, os coxa, scapulae, humerii, clavicle, hyoid and femur. The lytic lesions vary in size from 2mm to 56mm. A total of 222 lesions was recorded, with irregular sharp edges and clear evidence of trabecular lytic foci with secondary cortical resorption, visible macroscopically and through x-rays. Only a few lesions show smoothened edges, and osteoblastic activity is seen in just three lesions. The most remarkable lesion is situated on the occipital at the foramen magnum; the left occipital condyle and the basilar part are resorbed leading to a greatly enlarged opening for the spinal cord. Smoothing of the lesion edge and minimal porous new bone formation on what remains of the condylar fossa show the individual lived with this lesion for some time. This case study adds new data on bony involvement in metastatic carcinoma, thereby furthering the knowledge of the historical relevance, as well as clinical manifestation, of cancer.

'Parity features' and social status at prehistoric sites in Austria. Doris PANY-KUCERA, M SPANNAGL-STEINER & K REBAY-SALISBURY

Within the framework of the ERC-project "The value of mothers to society" (VAMOS), we are investigating motherhood in prehistory, from both anthropological and archaeological points of view. This study develops a methodology to systematically relate women's life histories, inferred through osteological observations, to their social position in prehistoric societies (c. 3000-15 BC, Late Neolithic to Late Iron Age). Anthropological results are contextualised with archaeological data. The social status of the buried individuals will be inferred through archaeological observations; the spatial dimensions of body placement within settlements and cemeteries, grave depth and details of grave construction, and number and value of co-buried objects are taken into consideration.

Pregnancy and childbirth are stress events that may leave physiological traces on female skeletons and thus give insights into women's obstetric histories. Systematic morphological data acquisition at the pelvic bones can reveal the presence, absence and severity of these "parity features". These data will be used to model the probability of whether or not a woman has given birth. Further, aDNA analyses will help to clarify kinship relations, particularly between individuals who were buried together in double, triple and multiple burials. First statistical results from the Bronze Age pilot study show associations between sex, body height and parity features at the skeletons.

Changes in Body Mass and Indulgence-Related Disorders Among Medieval Danes. Kaela PARKER

In many parts of Europe historical and osteoarchaeological evidence suggests that the medieval period signals a transition in diet and health with a move to greater reliance on wheat, ale, and meat (Dyer, 1983). This transition is often paralleled by an increase in body mass and associated chronic ailments. During the medieval period (AD 1000 – 1536) Denmark was a population undergoing significant socioeconomic transition. Between the 12th and 13th centuries Danes were moving en masse from rural communities into urban centres. Two medieval Danish cemetery samples, the rural cemetery of Tirup (ca. AD 1150–1350) (n=139) and the urban cemetery of Black Friars (ca. AD 1300–1660) (n=393), were assessed. Femoral head diameter was measured to estimate changes in body mass and individuals were inventoried for skeletal lesions associated with increased indulgence (including DISH, gout, and osteoarthritis of the hips, knees, and lumbar region of the spine). A statistically significant increase in body mass was documented for individuals, both male and female, buried before ca. 1250 AD compared with those buried later. In females, a parallel increase in the prevalence of gout, osteoarthritis of the hip, and vertebral osteophytosis in the lumbar region was also documented. In males, an increase in lumbar and knee osteoarthritis was seen. The most drastic increase in 'indulgence-related' disorders, however, was noted between males buried before and after ca. 1350 AD. This data suggests that the 'urbanization revolution' in Denmark led to a increase in ill health possibly related to diet and increasing body mass.

Dental Wear Trends in Late Archaic and Woodland Period Populations in Eastern US. Heather PAXSON

Dental wear studies are used to draw inferences about lifestyles of past populations. Among groups living in the eastern US during the Late Archaic Period, high levels of dental wear are attributed to heavy consumption of shellfish. Recent research conducted by Nealis and Seeman, however, suggests that hot rock food preparation techniques were the main contributing factor to dental wear. The introduction of pottery in food preparation during the Early Woodland Period may have contributed more to decreasing dental wear than dietary changes. Therefore, decreasing rates of dental wear should be seen throughout the Woodland Period before the rise of large-scale maize agriculture.

To test this model, five sample populations were selected: the Late Archaic sites of Indian Knoll, Eva, and Oak View Landing; the Late Archaic/Early Woodland site of Ledbetter Landing; and the Late Woodland site of Hiwassee Island. Data for the study consists of calculated area of dentine exposure of adult maxillary second molars' occlusal surfaces, using Scott's 1979 method.

Comparisons among samples were conducted using the Mann-Whitney U test. Results showed no significant difference in rates of wear amongst the Late Archaic sample populations or between the Early Woodland sample populations when analyzed by age group. However, significantly decreased rates of wear in the Late Woodland sample population were seen compared to the Late Archaic in the young adult and middle-aged age groups. This seems to suggest that the introduction of pottery during the Early Woodland period did not immediately correspond with decreased dental wear.

Situs Inversus: Viscera Transposition and Associated Skeletal Anomalies. Kristen PEARLSTEIN & Brian SPATOLA

Situs inversus is a congenital condition defined by transposition of one or more of the internal organs of the body. The condition is associated with a number of congenital and developmental abnormalities, including anomalies of the vertebral column. This

study discusses a diagnosed case of situs inversus totalis in a 55 year old male, with mirror-image transposition of the heart, liver, spleen, stomach, and appendix. Observed skeletal abnormalities associated with this individual include a bifurcated C1 neural arch, caudal shifting of the thoracolumbar border, twenty-five individually defined vertebrae, and 13 pairs of ribs. Additionally, positioning of the thoracic and abdominal aorta along the right side of the spine is observed in conjunction with transposition of the anterior longitudinal ligament along the left side of the spine. Ossification of the anterior longitudinal ligament results in DISH-like bony structures observed on the anatomical left side of the vertebral column, as opposed to the characteristic presence of bony structures along the right side. In archaeological settings, a soft tissue diagnosis of situs inversus is difficult to confirm. However, understanding the possible skeletal anomalies associated with this condition allows researchers to consider situs inversus as part of a differential diagnosis during documentation of skeletal remains.

A Forager Child with Compromised Health and Mobility from the Late Archaic, Southwestern Ontario. Susan PFEIFFER & Thivviya VAIRAMUTHU

Well-preserved skeletal remains of a forager child (skeletal age 14.5 to 16.5 years) from the SW Ontario Late Archaic Hind Site (AdHk-1; ca. 3000 BP) document prolonged survival with a debilitating condition: a unique case of chronic physical impairment in a mobile, foraging group. Pervasive gracility, characterized by a diffuse reduction in osseous density involving both the axial and appendicular skeletons, suggests a chronic systemic condition. Assessment of motor function of the child's limbs reveals a very low likelihood of normal ambulation as well as limited upper body activity. Skull and limb measurements show substantial wasting and modest stunting. Alveolar resorption, extensive antemortem tooth loss, and less tooth wear than expected suggest reliance on a diet very different from that of other group members. Differential diagnosis focused on lifelong conditions that greatly reduce osseous density throughout the skeleton, with osteogenesis imperfecta (Types I, IV or VI) seeming most probable. The care needed to support a non-ambulatory child in a mobile hunter-gatherer society is explored and considered in the greater context of the Hind population as a transient community. The implications of surviving with compromised mobility and masticatory function in a seasonally mobile hunter-gatherer context include lifelong dependency on aid for transportation, as well as the necessity of special preparation of foods. The long-term survival of this child is evidence of a community that placed value on every member. We argue that this reflects an adaptive strategy for small forager communities.

The Child in the Pit: Death and Disability in Late Antiquity. Katherine M. POMPEANI

Archaeological excavations at the 5th-6th century AD fortified settlement of Golemo Gradište, Konjuh, Republic of Macedonia, provide evidence for social and political instability in Late Antiquity. Daily life was fraught with physical risks from the rugged landscape, violence, and occupational hazards from mining and animal husbandry. The remains of an adolescent (11-13 years-at-death) excavated in 2016 provide direct evidence for complications associated with multiple healed trauma. Notably, trauma to the neck and cranial base, and posterolateral fractures to right ribs 10 and 11. Although association of these injuries is unclear, both were well-healed at time of death. Deformation of the right occipital condyle and posterior foramen indicates that the injury occurred prior to fusion of the partes lateralis and basilaris (ca. 5-7 years). Complications included partial displacement of the ossiculum terminale epiphysis, lateral displacement of the right occipital condyle, torticollis, and possible upper arm paresthesia. The unusual burial context suggests that although the child was cared for, it may have died under unusual circumstances or been seen as a social outcast. Instead of a proper stone-lined cist grave, the body was placed on a layer of leveled fill in a disused storage pit in an abandoned structure. In contrast to other burials at Golemo Gradište, the latter shows a degree of expediency in burial, with minimal investment. Together, the osteological and archaeological contexts provide evidence for a diminished quality of life associated with childhood trauma in Late Antiquity.

Bilateral Anomaly Affecting the Greater Trochanter: Exploring Etiologies through Differential Diagnosis. Erik PORTER, Jordan TEMPLES & Lesley GREGORICKA

Observation of an articulated, 19th century adult female skeleton housed at the Mobile Medical Museum (Mobile, Alabama, USA) led to the identification of a bilateral anomaly of unknown etiology involving the greater trochanter of the right and left femora. The greater trochanter exhibited a rough, mottled, dripping candlewax-like appearance not well described in paleopathological literature. This study sought to develop a differential diagnosis to determine the most likely etiology of this condition, as well as to explore the potential functional consequences of living with this disorder. Diagnostic criteria were based on a detailed understanding of regional anatomy, macroscopic observation, radiographic imaging, paleopathological and clinical literature, and consultations with orthopedic practitioners and bioarchaeologists.

While the symmetry of this anomaly was initially suggestive of epiphyseal malunion, further investigation of atypical bone deposition in this region pointed instead to a traumatic origin or to repetitive occupational stress. Correspondingly, this anomaly was best diagnosed as trochanteric bursitis or as enthesopathy associated with increased stress at the insertion of the gluteus medius and minimus muscles on the greater trochanter. Consultations revealed this condition to be a frequent incidental radiographic finding of uncertain clinical significance among modern patients, generally lacking in behavioral relevance.

A study of three skeletal markers of childhood health in an urban and a rural adult population from medieval Denmark as influenced by the Little Ice Age. Charlotte PRIMEAU, Preben HOMØE & Niels LYNNERUP

This study presents the evidence of three skeletal markers relating to childhood health that leave permanent observable osseous changes in the adult skeleton. Two are well known to paleopathology, namely Harris Lines (HL) and Linear Enamel Hypoplasia (LEH). The third skeletal marker is less commonly used; the permanent changes in the temporal bones, induced by chronic or recurrent Infectious Middle Ear Disease (IMED) in childhood. A total of 291 adult skeletons from an urban (n=109) and a rural (n=182) cemetery, from the Danish medieval period (1050-1536 AD) were included. The frequencies of the three markers were examined by time period as divided by arm position for the Early, Middle and Late Medieval Period. The figures for the Late Medieval Period are based on very few numbers. A pattern for the Early to Middle medieval period is seen, in that LEH increases for both the rural and the urban populations, while there is a reverse trend for HL, with a decrease in frequencies for both the rural and the urban populations from the early to the middle period. There is no clear trend for IMED, which appears fairly constant for the urban population, while frequencies rise for the rural population. Only the decrease in HL in the rural population, and the increase in LEH for the urban population, was statistically significant.

An Examination of Upper Respiratory Infection in Hunter-Fisher-Gatherers of the Middle Holocene Cis-Baikal, Russian Federation. Samantha PURCHASE-MANCHESTER, Angela LIEVERSE & Vladimir Ivanovich BAZALIISKII

This research investigates infection—specifically sinusitis, otitis, and mastoiditis—to better understand physiological stress and lifeways among middle Holocene hunter-fisher-gatherers from Siberia's Cis-Baikal. 250 individuals from three cemeteries are examined, together representing two distinct biocultural periods (Early Neolithic [EN], 8000–7000/6800 BP, and Late Neolithic–Early Bronze Age [LN–EBA], 6000/5800–3400 BP) and two micro-regions (South Baikal and the Angara River Valley). An endoscope was used to document sinusitis and otitis, and a hand-held digital X-ray system was used for mastoiditis. Sinusitis was present in over two-thirds of observed

individuals (70.6%), while otitis and mastoiditis (considered together) were found to be nearly ubiquitous (99.4%). The frequency of sinusitis decreased significantly from the EN to the LN–EBA, being consistent with the results of previous research on physiological stress, but did not vary by occupational phases (for the cemetery of Shamanka II, only) and age at death. A difference in EN males and females may suggest that women were spending more time in poorly-ventilated dwellings than were men, while the consistently high rate of otitis may suggest that both populations engaged in activities not considered previously (e.g., swimming). In general, these results expand our perceptions of life in the middle Holocene Cis-Baikal.

The Precarious Search for Caries: Oral Health at the Medieval site of La Granède, France. Leslie QUADE & Stephan NAJI

Dental health is commonly considered as an indicator of dietary status and overall well-being. This study examines dental health in a Medieval population from southern France, and considers whether rural populations experienced more consistent dietary and cultural patterns than their urban counterparts.

Dentitions of 121 individuals from the rural cemetery of La Granède (4th-12th century), were examined for presence and location of several dental pathologies. In total 1804 teeth/alveoli (permanent and deciduous), were examined for carious and periapical lesions, calculus, ante-mortem loss, and enamel hypoplastic defects. Additionally, 42 individuals were radiocarbon dated, permitting their division into two temporal phases. This has enabled an intra-population, diachronic comparison of dental pathologies. Furthermore, results were statistically compared with published datasets from several, urban and rural, contemporaneous skeletal collections. Through analysis and comparison of this data, the factors impacting dental health, and their development over time, are examined.

Analysis revealed statistically significant differences in dental pathologies between both differing living environments and temporal phases. In particular, higher prevalence rates of deciduous carious lesions were found in the Granède non-adults than in contemporaneous urban sites. Additionally, temporal comparison between Granède individuals showed that those from the later phase displayed higher frequencies of calculus, carious and periapical lesions. Thus, these results illustrate diachronic variability within the Granède population, and support evidence of a rural/urban dichotomy. Importantly, these results highlight that the impact of cultural and dietary factors on dental health may not be as consistent in rural populations as previously thought. "

Sur la Goutte du Roi: A Study of Charlemagne's (742/748 – 814) Relics and Cause of Death. Frank J RÜHLI, Francesco M GALASSI, Michael E HABICHT & Joachim SCHLEIFRING

The Frankish king and emperor Charlemagne is still remembered as one of the greatest military leaders of all time, capable of bringing political unity back to what had once been the Western Roman Empire. The exact cause of his death as well as the destiny of his mortal remains have never been properly determined. In recent years only two studies addressing his biology have determined that he was 1.84 m tall on average, 15 cm taller than the average for a contemporary male (1.69 cm) and that his hair colour was mostly dark brown. For the first time a multidisplinary study allows to contemplate the same subject from a higher research platform. A thorough philologico-clinical reassessment of the primary sources describing Charlemagne and his demise is matched by an osteological report of the mortal remains of the Frankish king, a still unpublished survey of the bones of the Emperor in the Cathedral of Aachen performed in the 1988 by Joachim Schleifring. By examining the original sources it appears clear how the king experienced a health decline caused by a meat consumption-related rheumatic affliction, most suggestive of gout. The 1988 report also records calcifications on the bones which point in the same direction. Moreover, it has been speculated that Charlemagne's body might have been mummified : photographic evidence of mummified muscular tissue from 1988 confirms the story. The ongoing study on these materials aims to shed a much clearer picture on the great king's pathobiography.

Aberrant tooth number and its utility in the paleopathology of syndromes. Lita SACKS

Syndromes are rarely diagnosed in bioarchaeology due to the subtle nature of skeletal defects and the medicodental focus on soft tissue pathology and patient care. One clinically-relevant feature that preserves archaeologically is aberrant tooth number. This study examines the place of supernumerary teeth and dental agenesis in bioarchaeology through systematic literature review and illustrates their utility in identifying syndromic individuals.

Searches in American Journal of Physical Anthropology, International Journal of Osteoarchaeology, and International Journal of Paleopathology from first issue through 10/2016 yielded 50 research articles reporting aberrant tooth number in ancient humans. Of those, five do so for methodological purposes, 28 as unanalyzed incidental findings, and 17 as analyzed findings or the primary subject. Seven publications associate them with developmental disorders – three generally and four with specific syndromes (Cleft Lip Sequence, Klippel-Feil, Down, Fetal Alcohol, and Ehlers-Danlos).

Numerical aberration in permanent teeth was assessed at Koster Mounds, a skeletal series from prehistoric Illinois. Adults with observable dental or alveolar material (N=134) were examined. Six individuals with aberrant tooth number were identified. Four exhibited common patterns of aberrant tooth number (supernumerary/absent incisors, absent third molars) within normal variation. The remaining two had unusual patterns of aberrant tooth number and skeletal defects indicative of genetic syndromes. Differential diagnosis included Down, Hallerman-Streiff, Tricho-Rhino-Phalangeal, Coffin-Lowry, and Van der Woude Syndromes.

Ultimately, this study emphasizes the need for a paradigm shift in the perceived importance of skeletodental anomalies in paleopathology. It illustrates the visibility of genetic syndromes in prehistory when such anomalies are carefully noted.

Understanding Discrepancies in Juvenile Age Estimation: Paleopathological considerations for the study of Prehistoric Children from Southern Peru. Kristie SANCHEZ, Maria Cecilia LOZADA & Rex C. HAYDON

In regions like South America, where preservation is often exemplary, bioarchaeological methods have become an important tool in understanding the life and roles of children in past societies. The accurate characterization of these roles depends on the bioarchaeologist's capacity to understand juvenile mortality patterns and estimate age at death. To estimate the age of juvenile remains, bioarchaeologists employ standard methods involving analysis of long bones and timing of dental eruption. However, when these methods were employed on nine pre-historic juveniles recovered from a Nasca influenced cemetery dated to 550 A.D., there were large discrepancies in the results of dental and long bone age estimation methods, but only for juveniles in certain stages of development. Specifically, juveniles whose dentition suggested an age between 38-40 weeks also had diaphyseal lengths corresponding to the same age range; juveniles with older dental eruption patterns yielded long bone age estimations inconsistent with their dental age. Traditionally, such discrepancies are attributed to exposure of the child to environmental stressors such as disease or malnutrition that could stunt skeletal development. However, we found that these patterns held true regardless of presence of skeletal pathology, suggesting that use of standard age estimation methods may be inappropriate with individuals from this area. Overall, our findings suggest a closer look needs to be taken into the applicability of standard age estimation methods, and that the integration of medical knowledge from modern, local populations may help bioarchaeologists more accurately estimate the age of their infant and juvenile samples.

Life behind the wall: a study of skeletal remains found in female cloisters from the 16th till the 20th century. Nataša ŠARKIĆ, Lucía MUÑOZ & Jesús HERRERÍN

Spain is one of the countries with the highest number of female monasteries. Nuns in cloisters, who spend their whole lives hidden behind thick walls, have always aroused curiosity. Many books and historical studies have been written about their lives, but up to now, there has been no attempt at a general bioarchaeological and paleopathological study of these communities in Spain.

The ancient fortress of Infante Don Juan Manuel (Belmonte, Spain) was converted to the Dominican convent of Santa Catalina de Siena in the 16th century and was in use till 1960. Two necropolises were found there: one dating from the 16th to the 17th century, with 86 individuals (74 females, 1 was male and 11 indeterminate), and the other from the 19th to the early 20th century, with 27 individuals (20 females and 7 indeterminate).

Detailed anthropological and paleopathological analyses of the remains from both necropolises were performed in order to obtain more information on everyday life, health and diseases for these individuals. Even though the Dominican order is famous for its strict rules, hard work and fasting habits that did not change through time, there were notable changes in terms of both the types of pathologies that were present and the treatments that were used to cure them.

These remains represent an important source of information, not only for better understanding of the lives of these nuns, but also of how the transition to industrialism affected the Spanish society, even the most hidden parts of it.

Defining Spatial Paleopathology: Assessing Geographic Risk for Cribra Orbitalia in the Andes. Beth K. SCAFFIDI

Geographic information systems (GIS) methods have been increasingly used in the fields of spatial epidemiology and geomedicine to understand the geography of disease distribution. Only recently have bioarchaeologists begun to consider how these approaches can shed light on prehistoric disease patterns; for example, Gowland and Western (2012) found that high cribra orbitalia rates in Roman Britain overlapped spatially with the historical and modern ranges of the Anopheles mosquito, the vector for malaria which contributed to cribra orbitalia, porosities in the eye orbit which result from anemia.

This project defines spatial paleopathology as the application of geospatial methods to understanding ancient disease distributions. This research extends Blom et al's 2005 pan-Andean meta-analysis of cranial hyperostosis rates, using spatial methods to plot cribra orbitalia (CO) rates from published studies relative to landscape characteristics. Multiple regression is used to determine which landscape characteristics explain the variability in ancient adult and subadult CO rates. If CO is related to population density more than warm and wet-weather geohelminth infection, then larger sites should show the highest CO rates and there should be no correlation between warm wet climates and high CO rates. As expected, the highest CO rates were found in coastal zones. Preliminary analysis of precipitation, temperature, and elevation showed that none of those variables explained high CO among the initial sample (N=32 sites). This study tests additional variables such as soil moisture and composition, elevation, and proximity to water, while integrating newly published CO data into the model.

Feeling the Chill: An Examination of Skeletal Stress at the Onset of the Little Ice Age in the Black Friars Cemetery Population (13th – 17th centuries). Amy SCOTT

In studies of health and stress the influence of external factors on physiological processes drive much of osteological inquiry. While many factors may account for macroscopic skeletal change, the undeniable influence of climate is a necessity in these interpretations. The Little Ice Age, beginning in Europe in the 14th century, saw a period of climatic cooling and increased precipitation. Through this climatic upset, food sources dwindled and famine became rampant, particularly in urban city centers. This study focuses on the Black Friars Cemetery Population (13th-17th centuries) to explore changes in health in Denmark at the onset of the Little Ice Age. Using lesion-based and growth-based indicators of stress, this study explores three distinct temporal timeframes: 1) the period before AD 1300; 2) the period between AD 1300 to 1350 and 3) the period after AD 1350. A total of 88 adult individuals were assessed for evidence of cribra orbitalia, porotic hyperostosis, enamel hypoplastic lesions and Harris lines. Additionally, body size indicator measurements were collected to assess growth fluctuations throughout the maturation period. Results showed less evidence of stress lesions in the period before AD 1300 with increasing severity, identified through the presence of multiple lesions types, into the first half of the 14th century. Disruptions in growth however, were more evident in period after AD 1350. Representing distinct processes within the stress response system, this comparison of both lesion-based and growth-based indicators provides subtle detail into the health shifts occurring at the onset of this significant climatic event.

Cranial-caudal shift in the Morton Collection of Fulton County, IL. Ryann SEIFERS & Della Collins COOK

The Morton collection, which resides at Indiana University, was excavated by Fay-Cooper Cole from 1930-1932. It is Mississippian, Late Woodland and Red Ochre in affiliation. The senior author has previously reported on sacral closure and spondylolysis. In 239 individuals there were 54 useful sacra; these individuals were complete enough to count sacral vertebrae and had reached adolescence. Forty-three had five sacral vertebrae and 12 had six sacral vertebrae. Females and young adults predominate. Here we report the relationship of the number of sacral vertebrae to age, sex, and presacral vertebral number variation. This collection provides weak support for the homeotic model of vertebral variation developed by ten Broek and colleagues (2012).

Premature and trauma-induced sutural fusion in a protohistoric cranium. Pina S SIMONE, Cortney M CONNER, Rebecca S JABBOUR, & Gary D RICHARDS

This study examines a cranium from protohistoric California with shape changes driven by premature lambdoidal-sagittal fusion and trauma-induced partial coronal suture fusion. Among premature sutural fusions, lambdoidal-sagittal fusions are particularly rare. We assess cranial shape and blood flow patterns, their impact on brain development, and possible neurocognitive impacts.

This individual (male, ≈25-30 y) derives from California site CA-Lak-203 (≥1500 CE). Normal crania from prehistoric California (n=10) and modern crania with lambdoidal-sagittal and multisutural fusions (n=5) were employed for comparisons. Individuals were CT scanned (0.3-mm isotropic voxels). Bone surfaces were visualized and the endocranial surface reconstructed with Amira.

Given the extent of deformation, the lambdoidal and sagittal sutures were obliterated during early postnatal development. A trauma-induced depression on the coronal suture is associated with remodeled fractures. The trauma resulted in a partial coronal suture fusion during late infancy-early childhood. Remaining sutures are patent. Craniofacial shape differs from that in premature lambdoidal-sagittal or multisutural fusions. Partial coronal suture fusion contributes to a large supraglabellar depression, a convex midface, anterolaterally placed zygomatics, and an anteroinferior elongation of the face. Increased intracranial pressure and restricted venous outflow, with shunting to emissary veins, likely induced neurological damage during growth, resulting in mild-to-severe neurophysiological defects. Further, a shallow posterior cranial fossa suggests a Chiari I malformation, which could lead to central sleep apnea and syringomyelia. Difficulties faced by families caring for individuals with such extreme morphologies and neurophysiological deficits must have been magnified in prehistoric-protohistoric contexts and may relate to their rarity in the archaeological record.

The male cranium described derives from a California protohistoric site (CA-Lak-203, ≥1500 CE). Normal crania from prehistoric sites in California (n=10) were employed for comparisons, as were modern crania with lambdoidal-sagittal and multisutural fusions (n=5). Individuals were imaged on a GE LightScribe VCT scanner

(0.3-mm isotropic voxels). Visualization of external (isosurfaces) and internal (orthoslices) bone surfaces, segmentation and reconstruction of the endocranial surface was carried out in Amira 6.1.

The lambdoidal and sagittal sutures are obliterated. The coronal suture is partially fused, being patent along its inferolateral aspects. The sphenofrontal, squamosal, parietomastoid, and occipitomastoid sutures are patent. A large (37x22 mm) depression straddles the coronal suture near bregma. Endocranially, remodeled fragments of bone and fracture lines are visible. The frontoparietal trauma is associated with a thick layer (>5 mm) of healed reactive bone. Partial patency of the coronal suture results in a nearly round vault and an anteroinferiorly positioned, concave facial complex. This is a unique craniofacial shape relative to either lambdoidal-sagittal or multisutural fusions.

A Case of Severe Infection and Trauma: Possible disability in prehistoric Alabama. Diana S. SIMPSON

The Mulberry Creek Site (1Ct27) is a Native American shell mound site located in the Tennessee River Valley of Northern Alabama. Within the Late Archaic temporal component of this site, there are numerous examples of severe pathology and trauma in the human skeletal population. This case study focuses on a male individual of at least 40 years of age at time of death. This individual lived for an extended period of time with severe, wide-spread infection prior to suffering perimortem blunt and sharp force trauma to the skull. Based on antemortem fracture patterns, it appears that this individual suffered a major fall during life resulting in numerous fractures, including severe bilateral compression damage to both calcanei. In addition to, and possibly as a result of the antemortem trauma, this individual also suffered severe widespread infection, visible as both lytic and proliferative activity throughout the skeleton. Possible etiologies and differential diagnoses for this infection are explored, considering secondary septic infection as well as possible Treponematosis. The bioarchaeology of care model is then applied to this case to consider the relationship between disease, violence, and mortuary treatment for this individual. This holistic approach to analysis reveals a complex interaction between biological and social factors in the construction of this individual's disability and identity during life and in death, lending new insight into group identity in prehistoric Alabama.

Pre-Columbian health status and climate change: AD 1300-1600 in southern Appalachia. Maria Ostendorf SMITH, Lindsey HELMS-THORSEN & Dustin L. LLOYD

The Dallas phase (circa AD 1300-1407) and Mouse Creek phase (circa AD 1400-1600) in the Tennessee River Valley of Lower East Tennessee straddle the erratic world climate episode labeled 'the Little Ice Age' (LIA) (circa AD 1300 – 1850). Dendrochronological data and climate proxy studies suggest the post-AD 1400 climate in the American Southeast was generally colder and wetter with considerable interannual variability. Historic records (e.g., the Spanish Entradas, pioneer and colonial periods) reported harsh winters, including the regular freeze-over of the upper Tennessee River, a phenomenon that has not been observed since 1940. The apparently abrupt climatic events which characterize the LIA may have impacted the ecology of the subtropical southern Appalachian Mountains, the biodiversity of which reputedly rivals the Amazonian Basin. This may have affected the productivity of the maize-based subsistence economy of both the Dallas and Mouse Creek phase peoples of East Tennessee. There are archaeologically visible settlement and mortuary pattern changes that suggest an abrupt shift circa AD 1400 from a hierarchical (Dallas phase) to a heterarchical (Mouse Creek phase) social organization. Previous research documented a marked improvement in community health in the Mouse Creek phase. The present study affirms this, except for a significant increase in the prevalence of scurvy. In light of the still sketchy climatic history of East Tennessee, erratic unseasonable weather could have negatively impacted the aboriginal sources of scorbutic acid (i.e., berries) and may have positively impacted crop yield by, among other things, reducing the numbers of freeze-intolerant ectothermic insects.

Oroantral Fistulae at the Monastic Settlement of Ghazali, Sudan (ca. 670–1270 C.E.). Robert J. STARK & Joanna CIESIELSKA

The medieval monastic site of Ghazali (ca. 670–1270 C.E.) is located in northern Sudan at the entrance to the Wadi Abu Dom ~20 km southwest of the modern city of Karima. Three cemeteries have been identified at Ghazali, one associated with the monastic individuals (Cemetery 2), one associated with the nearby settlement (Cemetery 3), and one believed to be for adherents of the Christian faith from surrounding regions who wished to be buried ad sanctos (Cemetery 1).

During the fall 2015 field season 40 adult male individuals were excavated from 39 graves in Cemetery 2. The skeletal remains of these individuals were overall healthful, with osteoarthritis being the most common pathological condition. One exception is the highly variable dental health of these individuals, ranging from pristine dentition to full edentulism, with heavy wear, root abscess, and carious lesions being common. This presentation focusses on three cases (3/40, 7.5%) of oroantral fistulae. Individuals Ghz-2-004.2 and Ghz-2-031 exhibit marked osteolytic resorption along the alveolar aspect of the maxilla, to the extent that a significant portion of the facial surface on the left side of the maxilla of Ghz-2-031 has been osteolytically eroded. In Ghz-2-004.2 a large osteolytic ovoid oroantral perforation is present. A similar process appears to have been developing in Ghz-2-034 where osteolytic perforation of the RM2 socket resulted in communication between the maxillary sinus and oral cavity. Such oroantral fistulae were likely highly deleterious to the overall health and survival of these three individuals.

3D in 2.5D: The use of RTI on pathological and taphonomic processes in skeletal remains. Sarah Y STARK & Sonia R ZAKRZEWSKI

Three-dimensional visualization has advanced paleopathological methods by analyzing adaptive responses of bones. A more portable and affordable method, however, that is often overlooked is RTI (Reflectance-Transformation-Imaging) which uses 2.5-dimensions for high surface detail analysis. RTI is a computational photographic method that performs a mathematical enhancement of the subject's surface shape through an interactive re-lighting of the subject from any direction. This enhancement of surface information captures features that are often lost under direct examination with the unaided eye. The use of RTI has been used in archaeological analyses from cave paintings, graffiti, manuscripts, and use-wear analysis, however the application of RTI has only recently been used in osteological analyses. This paper examines the use of RTI for recording pathological versus taphonomic processes in bone.

The pathological lesions recorded include: cribra orbitalia, periostitis, trauma, and osteoarthritis from Roman Huntsmans Quarry, medieval Southampton Castle, and Anglo-Saxon Great Chesterford. The preservation from these sites range from poor to excellent with root-etchings causing the most significant surface change. RTI could clearly differentiate the differences between pathology and taphonomy, specifically when both processes occurred at the same location. Interestingly, some cases of periostitis highlight specific loci of trauma (slight bone depressions within the periosteal new bone formation) that was overlooked with the unaided eye. Although three-dimensional models capture high surface detail, the interactive light-enchantment of RTI provides a unique advantage to osteological analyses by differentiating between two very different and complicated processes of taphonomy and pathology.

The Shape of Things to Come: Growth in Children with Rickets. Sarah Y STARK, Sonia R ZAKRZEWSKI & Simon MAYS

Normal juvenile development requires adequate nutrient intake, but there is limited understanding of how such deficiencies affect growth trajectories. Growth is commonly studied using linear long bone measurements, but these lack shape information. In the current study, size is studied through linear measurements and shape is examined using geometric morphometrics, thereby enabling an integrated study of bone growth and morphology. A dataset of femora (n=25), tibiae (n=31), and humeri (n=36), from 47 juveniles

ranging from infancy to twelve years old, was collected from medieval Wharram Percy. Three-dimensional models were created using structured-light-scanning. Morphometric analysis revealed differences in the long bone growth patterns between children suffering from rickets and those without apparent skeletal markers of disease. This trend was most pronounced in the tibia and may reflect changes in functional loading to this bone.

Collective burial or Neolithic crime scene? Sofija STEFANOVIC, Natasa SARKIC & Sasa ZIVANOVIC

During the archaeological research in Vinča (Serbia) in 1931, a grave that belonged to the Neolithic Starčevo culture was discovered. The grave of ten adults and one sub-adult, mostly males, was characterised as ""a tomb with dromos"". Researchers who have subsequently worked with the material, although possessing different views on architectural features of the tomb, have not questioned that this is a grave with collective burial. However, a recent analysis of the original photo documentation, carried out by the BioSense Institute, provided a completely different interpretation of the findings. The three individuals are determined to be buried on their chest, face to the ground, which does not fit with usual burial practice in this culture. In another three cases the head was completely separated from the body and in the case of one individual both femurs were bent in position, which could be only possible if his back was broken.

Very little skeletal material was preserved from this necropolis. However, by combining the analysis of the existing material and photographs, it was determined that at least eight of the individuals had ante-mortem traumas on the cranial and postcranial skeleton and there were at least three cases of decapitation. Radiocarbon dating confirmed that the burials of these individuals were not simultaneous (5700-5500 BC).

The goal of the current work is to illustrate how a forensic approach, even through photographic documentation, can provide a wealth of new information and even enable the discovery of a prehistoric crime scene.

Crossing the Threshold of Modern Life. Comparing Disease Patterns Between two Documented Cemetery Series from the City of Mérida, Yucatan, Mexico. Vera TIESLER, Julio CHI KEB & Allan ORTEGA

This study compares two cemetery series together with their civil records from the city of Yucatan, which spotlight changes in lifestyle, life expectancy and health during the 20th century. To this end, we scored health indications in a skeletal series from the Central Cemetery of Mérida, Yucatán (N=104; collected during the beginning of last century), and a recent cemetery population from the Xoclán Cemetery of Mérida, collected between 2003 and 2016 (N=194). The latter materializes living conditions towards and during the turn of the 21st century. The records under study include basic life and socioeconomic information, obtained from the civil records, along with skeletal data of age-at death, sex, benign tumors, non-specific stress markers, arthritis and osteopenia. Our results, once age-corrected, indicate a rise in almost all analyzed indications towards the turn of the present century, which we will discuss in terms of farmaceutical advances, public sanitation and longevity, changes in lifestyle and nutrition. We conclude that the documented shifts went along with health costs specifically for the local fringe populations of urban Yuatecans.

Developmental Variations and the Andean Past: the Cultural and Demographic Implications of C2-C3 Block Vertebrae. Anne R. TITELBAUM

Since the publication of Verano's "Advances in the Paleopathology of Andean South America," Andean paleopathology has continued to flourish as a dynamic and multidisciplinary field. One area of inquiry that has lagged behind however, concerns developmental variations of the skeleton. While variations are frequently observed among prehistoric Andean remains, relatively few studies have focused on them. And when variants are described, they tend to either be presented as an anomalous case study or briefly mentioned as an incidental finding. This dichotomy in presentation is understandable since it is challenging to understand the relevance of the anomaly itself. For example, what caused the variation? Does it represent the normal range of anatomical variation, is it an isolated anomaly, or is it part of a syndrome or systemic disorder? Did it affect the quality of life of the individual, or was it silent in its manifestation? In spite of the challenges, developmental anomalies are interesting in their own right, and they hold potential for understanding cultural and demographic factors. Not only do they offer insight into prehistoric behavior, data on variations may provide another avenue for understanding population trends, such as migration and gene flow. This presentation will explore the potential of investigating developmental anomalies in the Andes, by focusing on congenital block vertebrae. Most commonly occurring in the cervical spine, block vertebrae frequently involve the C2-C3 vertebrae. A comparison between regions and time periods will be drawn.

Non-Masticatory Tooth Wear in an Early Bronze Age Population from Southern Poland. Mark TOUSSAINT & Piotr WŁODARCZAK

Żerniki Górne is a multi-period site in southeastern Poland, which includes both Neolithic and Bronze Age burials from different cultural paradigms. Among these burials are 39 individuals from the Early Bronze Age "Mierzanowice Culture." Out of 17 individuals thus far investigated, four show clear signs of non-masticatory tooth wear. This includes wear in the form of grooves on canines, premolars, and one molar. The individuals are representative of both males (n =3) and a female, but all are estimated to be young adults. Non-masticatory tooth wear, as an indicator of an embodied set of labor practices, can be informative about the activities and gender roles of a society. For this reason, it is important to establish whether there are demographic patterns as to the presence and location of such wear. This study represents a preliminary assessment of non-masticatory wear at Żerniki Górne. For comparison, two individuals with unusual occlusal wear from another Mierzanowice Culture site (Szarbia, Gmina Koniusza), roughly contemporaneous, will be included.

Summer Has Lead Us Here: A Bibliographic Analysis of Recent Research Trends in South American Paleopathology. J. Marla TOYNE, Melissa S. MURPHY & Haagen D. KLAUS

Over just the past two decades, research involving an increasing number of well-preserved human skeletal collections from South American archaeological sites has greatly advanced paleopathological knowledge and practice. This poster examines recent research trends in South American paleopathology since 1997 through a quantitative evaluation of content in a wide array of sources including journals, books, and chapters. Data show primary sources are bioanthropological (top venues including The American Journal of Physical Anthropology, The International Journal of Paleopathology, and The International Journal of Osteoarchaeology), but there are increasingly publications in more archaeological sources (Journal of Archaeological Sciences and Latin American Antiquity) demonstrating the broader impact of the bioarchaeological approach to reconstructions of health and disease in past populations. The few reports in biomedical venues focus especially on mummified remains. There is a continued trend for case studies of individuals and documentation of unique pathological conditions as well as an increase in population-based, multi-method, and multi-site analyses, but more synthetic treatments remain limited. Topics such as bone chemistry (nutrition and mobility) and molecular anthropology (identifying infectious diseases) have significantly increased, while more traditional paleopathological topics (oral pathology, non-specific skeletal indicators of stress) remain consistent. While paleopathology remains strongly descriptive, the influence of bioarchaeology has encouraged a more theoretically rich interpretation of conditions. It is timely that we evaluate current trends using these survey data to highlight significant advances as well as identify areas for continued exploration.

A Rare Case of Osteosarcoma in the Ethmoid Bone with Possible Proptosis. Khrystyne TSCHINKEL, Gabriel PRIETO & John VERANO

Recent excavations conducted by Gabriel Prieto on a hillside above the town of Huanchaco (Trujillo, La Libertad) have encountered a multicomponent cemetery with graves dating from c. 200 BC to the early colonial period. One burial (IG-131) contained the remains of a female estimated to be 60+ years old, associated with the Chimu/Inka time period (ca. AD 1470-1530). A neoplasm on the ethmoid bone and/or ethmoid sinus was identified, visible in her right nasal passage, and is cauliflower textured. Radiographs will be needed to see where the neoplasm extends. Based on the location, size, texture, and bony formation, osteosarcoma of the ethmoid bone or sinus is the most likely diagnosis. Osteosarcomas in the craniofacial bones are rare, compromising fewer than 10% of all osteosarcoma cases (Gonzalex et al. 2016). The majority of osteosarcomas in this region occur in the maxilla or mandible, to date there have only been 14 reported clinical cases of ethmoidal osteosarcoma, in English and Japanese literature (Gonzalez et al. 2016; Park et al. 2004). Clinical symptoms have been reported as sudden vision loss in one or both eyes (when the tumor compresses the optic nerves), proptosis, dark discharge from the eye, obstruction of sinuses, and headaches. Differential diagnoses include an osteoma, osteoid osteoma, osteoblastoma, or osteochondroma. The purpose of this project is to disseminate information and acquire knowledge on possible diagnoses in order to create a better understanding of neoplasms in the archaeological record.

The Pathology of Vitamin D Deficiency in Animals: A Comparative Overview. Elizabeth W. UHL

Vitamin D is critical to calcium and phosphate homeostasis and is thus crucial for both the formation of bone and bone remodeling in a wide variety of species. Vitamin D deficiency diseases impact amphibians, reptiles, birds and mammals, however there is variation between species in both the ability to make vitamin D and susceptibility to dietary deficiency. For example, while most herbivores are able to produce vitamin D3 in response to sunlight, exposure to UV light does not increase dermal vitamin D3 concentrations in dogs and cats, which in the wild met their requirements through a carnivorous diet. Nutritional deficiencies can induce rickets in cattle, sheep and goats, but the disease is rare, especially in modern times. Pigs are more susceptible to nutritional vitamin D deficiency as they grow rapidly and are weaned early. Horses are less susceptible as they naturally have higher serum calcium concentrations as well as vitamin D levels that are lower than those associated with rickets in other animals. Environments also shaped susceptibility, as llamas and alpacas out of their natural high altitude intense solar radiation environments are highly susceptible to vitamin D deficiency. While susceptibility varies, the pathology of rickets and osteomalacia is similar across species, although fibrous osteodystrophy may also be present. Studies in animals, including lion cubs in the London zoo in 1889, have been critical to understanding the pathogenesis of vitamin D deficiency diseases in both animals and humans.

The impact of sociocultural habits on childhood vitamin D deficiency visible as residual rickets in five post-Medieval populations from the Netherlands. Barbara VESELKA, Menno L.P. HOOGLAND & Andrea L. WATERS-RIST

Vitamin D is obtained from sunlight and diet, and attaining sufficient amounts is affected by several factors that vary within and between populations. Inadequate levels in childhood can be evident in adults, called residual rickets, via remnant bending deformities of the lower limb. Limited research has explored the impact of sociocultural factors, such as division in activities, on vitamin D levels, especially in rural and small urban Dutch populations. For this paper, five post-Medieval skeletal collections from different parts of the Netherlands with varying population sizes are analysed: Gouda (n = 46), Roosendaal (n = 45), Silvolde (n = 20), Hattem (n = 30), and Beemster (n = 200). Residual rickets prevalence ranges from 8.7% in Gouda to 14.7% in Beemster and there is a different distribution of affected individuals among the samples. Since none of these populations were highly industrialised communities, typical factors, such as narrow architecture, overcrowding, and air pollution, are unlikely to have been at play in the development of vitamin D deficiency. Rather sociocultural habits are postulated to have contributed to childhood vitamin D deficiency. This is seen in (a) Gouda, where the majority of a high status family showed residual rickets and (b) Beemster, a rural population where women were at a higher risk of developing vitamin D deficiency most likely due to a gender related division in activities.This paper emphasises the need to research small urban and rural populations to enhance our understanding of the sociocultural factors that affect vitamin D levels.

A comparison of 3D models generated from three laser scanners. Chiara VILLA, Daniel GAUDIO, Cristina CATTANEO, Jo BUCKBERRY, Andrew WILSON & Niels LYNNERUP

Recent studies have shown the benefits of 3D surface scanner models and quantitative methods in addressing fundamental issues in biological anthropology and paleopathology. However, no tests have been carried out to evaluate the repeatability between laser scanners. This study presents the results of a comparison of 3D models generated from three different laser scanners. 24 Suchey-Brooks pubic bone casts and 19 archaeological auricular surfaces of the "recording kit" of Buckberry-Chamberlain method have been scanned using three laser scanners: 1) Faro Quantum Arm; 2) Minolta VI-910; 3) customized David laser scanner. 3D models were compared investigating the surface area difference and the distance between co-registered meshes. The repeatability of quantitative methods among instruments was examined using the curvature algorithm described in Villa et al. (2015). The results show that the overall anatomical shape of the bone surfaces can be represented independently from the laser scanners: close results were found for surface areas (differences between 0.3% and 2.4%) and for distance deviations (average < 20 μm, SD < 200 μm). Curvature values show similar trends but each laser scanner introduced a specific amount of random error in the position of each measured point that biased the results of curvature quantification. This study focused on the aging changes of the pelvic joint surfaces, but the results have also significant implication for the recoding of subtle changes associated with paleopathology. The precision and the repeatability among different instruments are essential for an accurate documentation of the bones but particularly for the reliability of quantitative methods.

Villa C., Gaudio D., Cattaneo C., Buckberry J., Wilson AS., Lynnerup N. 2015. Surface curvature of pelvic joints from three laser scanners: separating anatomy from measurement error. Journal of Forensic Sciences Vol. 60, No. 2, 2015, p. 374–381.

The "Little Ice Age" and the Protohistoric Monongahela Demise: A Review of Health and Activity Markers in the Ohio Valley. Robyn WAKEFIELD-MURPHY

Archaeological inquiry into the demise of the Monongahela cultural tradition (1050-1635AD) in the Ohio Valley Region of North America has previously attributed this phenomenon, in part, to climate change brought about by the ""Little Ice Age"" following 1300AD (Richardson et al. 2002). This study aimed to elucidate changes in health and activity following this event in the terminal Late Monongahela (1580-1635AD) period via an analysis of demography, infectious disease, dental disease, stress, osteoarthritis, and musculoskeletal stress markers (MSMs) in comparison with the Early (1050-1250AD) and Middle Monongahela (1250-1580AD) periods. Demographic profiles were not significantly different between the Late Monongahela and the Early and Middle periods. Rates of dental disease, stress and osteoarthritis increased during the Middle and Late Monongahela periods, and MSM robusticity was significantly higher in multiple muscle groups in the Late Monongahela sample. The difficulties and increased labor intensity of agricultural subsistence caused by periods of intense drought during the Little Ice Age likely influenced these patterns in health and activity, coupled with decrease in territory and resource competition other with encroaching indigenous groups (Richardson et al. 2002).

Richardson JB, Richardson DA, and Cook ER. 2002. "The disappearance of the Monongahela: solved?" Archaeology of Eastern North America 30: 81-96.

Possible evidence for medical treatment in historic Iceland. Joe W WALSER III, Tina JAKOB & Steinunn KRISTJÁNSDÓTTIR

Direct evidence for medical treatment is rarely visible on human skeletal remains, but can take the form of trepanations, amputations and setting of fractured bones. However, alternative interpretations, other than therapeutic measures have to be considered in such examples, since amputations might indicate juridical intervention or accidental loss of limbs are also possible. To provide better insights into possible treatment methods this contribution aims to use chemical analysis of heavy metals (mercury, lead, cadmium and arsenic) from Skriðuklaustur (eastern Iceland), an Augustinian monastery with an associated hospital in use AD 1493-1554. Mercury in form of ointments and solutions has been administered as to treat infectious diseases such as venereal syphilis throughout medieval Europe and nine of the excavated 271 skeletons from Skriðuklaustur showed skeletal evidence consistent with tertiary syphilis, with a range of other diseases such as tuberculosis also present. In total 50 rib samples were obtained from this site and a comparative non-monastic site in southern Iceland (Skeljastaðir) and analysed using inductively coupled plasma mass spectrometry (ICP-MS). Results showed raised mercury levels, which were unlikely due to diagenetic processes. Mercury containing ores (cinnabar or calomel) are not local to Iceland and we have to assume that mercury was imported, although contamination from volcanic eruptions and geothermal emissions has to be discussed in this context. There are a number of ways the analyzed individuals may have attained elevated mercury concentrations during life. For example, the skeletons exhibiting high mercury levels could represent either patients or individuals delivering mercurial treatments.

Out on a limb: changing body proportions and health during the Roman to Anglo-Saxon transition in England (3rd to 6th centuries AD). Lauren J. WALTHER & Rebecca L. GOWLAND

The Romanization of Britain in the first century AD had a negative impact on the health and well-being of the population. This is evidenced by the increase in prevalence of cribra orbitalia and dental enamel hypoplasia, coupled with a decrease in stature for both males and females when compared to the preceding period. The aim of this study was to examine skeletal evidence for a subsequent improvement in health from the Roman to the early Anglo-Saxon period (3rd to 6th centuries AD), with a particular focus on body proportions.

A total of 579 individuals were analysed from five Romano-British and 15 early Anglo-Saxon sites. Standard skeletal indicators of stress were recorded in conjunction with estimated stature and measurements of body proportions, including a variety of indices (brachial, crural, humerofemoral, brachiocrural, and intermembral), torso length, and the relative proportions of upper and lower limb lengths.

Results showed that the prevalence of stress indicators is lower in the later period while stature is higher, suggesting improved health. Anglo-Saxon females and males also display a higher crural index and longer limb lengths, with males demonstrating greater overall lower limb length, specifically due to the elongation of the tibia. Studies of living populations have shown that the distal limb segments are more sensitive to environmental adversity and that males are more likely to be affected than females. The combined results of this study support this and highlight the utility of body proportions when investigating nutritional and/or environmental resources in past populations.

Health and the Little Ice Age north of the Alps: Relationship between Stress, Nutritional Deficiencies, and Disease. Leslie Lea WILLIAMS & Clark Spencer LARSEN

The Little Ice Age (LIA) has well-documented effects on populations living in the marginal environments of Europe and the North Atlantic, but its consequences for populations in more fertile environments are less understood. To elucidate whether cold temperatures in the peak-LIA (16th–19th centuries) affected the stress, nutrition, and disease levels of central European populations, four skeletal series from Austria and Germany were examined for the prevalence and severity of several indicators: maximum femur length, linear enamel hypoplasia (LEH), cribra orbitalia, and osteoperiostitis. We hypothesize an increase in indicator prevalence and severity from the pre-peak to the peak-LIA concomitant with the later period's environmental pressures.

Data were collected from 170 individuals (peak-LIA, n=112; pre-peak LIA, n=58) using Global History of Health Project and Buikstra and Ubelaker (1994) Standards, though not all conditions could be observed in all individuals. Average maximum femur length increases by less than 2cm into the peak-LIA for both males and females. Overall LEH prevalence also increases in the peak-LIA, as does the frequency of individuals having more than two linear disruptions per tooth. However, this result is mitigated by the greater visible crown surface (crown height) in this period. Healed and unhealed cribra orbitalia frequency decreases in the peak-LIA, while lower limb osteoperiostitis prevalence and severity increase.

These results suggest a multifaceted relationship between stress, nutritional deficiencies, disease, and the peak-LIA. They also highlight the complexity of regional responses to climate change, particularly the ability of local communities to buffer against climate change in non-marginal environments.

Difficulties and Developments in Differential Diagnosis of Cancer in Archaeological Remains. Jennifer WILLOUGHBY

Paleo-oncological diagnosis is complicated by factors of preservation, myriad diseases that fall under the category of cancer and affect the body in diverse ways, and the comparative rarity of these diseases affecting the skeleton. Despite these factors, over 230 cases of cancer and neoplastic disease have been identified in archaeological human remains. Most of these cases are recorded in skeletal remains, and many include incomplete differential diagnoses. As new technologies and their applications become more widely available for paleopathological analysis, more accurate diagnoses can be reached. This paper will outline the difficulties of differential diagnosis in paleo-oncology, and explore some solutions, including the use of a new checklist to standardize radiological analysis and recording of neoplastic disease in mummified human remains.

Computed tomography (CT) provides a non-invasive method for the comprehensive analysis of remains that may reveal evidence of neoplastic disease not otherwise observable. As part of a radiological project surveying the presence of cancer in mummified human remains, a checklist was developed to ensure thorough examination of remains and accurate and standardized recording of anomalies. Checklists such as this are important for identifying potential cases of cancer as well as for ensuring accurate differential diagnosis. As more archaeological cases of neoplastic disease are discovered, the standardization of recording anomalies and the inclusion of full differential diagnoses in publications are essential for comparative examples and more secure diagnoses."

Revisiting Weeden Island human remains and signs of syphilis at Bayshore Homes, St. Petersburg, Florida. Madeleine YEAKLE, John KRIGBAUM, Donna RUHL & Neill WALLIS

Bayshore Homes is located in St. Petersburg, Florida (Pinellas County). In the mid-late 1950s, William Sears (1960) excavated Mound B revealing a complex middle-late Woodland burial assemblage. Renewed investigation by Robert Austin and Jeffrey Mitchem (2014) has markedly improved the context for this important mortuary assemblage. We are engaged in research focused on the remains interred in Mound B, specifically those associated with late Weeden Island (~AD 700-800) contexts as distinguished (if distinguishable?) from later (~AD 950-1210) Safety Harbor contexts at the site. In total, Sears recovered 118 individuals from Mound B and invited Charles Snow at University of Kentucky to analyze the skeletal assemblage, curated at the Florida Museum of Natural History. Snow (1962) noted distinct pathology suggestive of syphilis, and subsequent work by Adelaide Bullen (1972) and Dale Hutchinson and colleagues (2005) has documented and contextualized the pre-Columbian evidence for treponematosis in Florida, including a discussion of Bayshore Homes. Of note were

individuals with distinctive pathognomonic treponemal lesions on several postcrania fragments associated with individuals. Our current work is a re-assessment of the extant assemblage at FLMNH and preserved documentation, noting inconsistencies between previously published reports and the extant FLMNH assemblage. Our re-assessment includes review of the evidence for pathologies on long bone shafts consistent with syphilis (broadly defined). In addition to differential diagnosis, we assess whether these burials are late Weeden Island or early Safety Harbor in cultural affiliation, which would affect interpretations of syphilis-like conditions and population contact affecting the likelihood transmission of the disease.

Living and Dying with a Cleft Palate in Ancient Peru: Differential Diagnosis, Associated Pathological Conditions, and Burial Treatment of an Individual with Congenital Craniofacial Abnormalities. Johanna E. YOUNG, Hilarie K. HULEY, Haagen D. KLAUS, Allison HAM & Ignacio ALVA MENESES

Huaca Collud was a monumental adobe brick platform mound constructed during the Formative Period (1500-500 B.C.) on the north coast of Peru but continued to be reused as a mortuary site by subsequent cultures. One of the intrusive late pre-Hispanic burials (ca. 1000 A.D.) was Entierro 8, a ~45 year old probable male in an excellent state of preservation. Visual observation indicated absence of the left maxillary incisors associated with missing bone along the anterioposterior axis of the left hard palate allowing for extensive communication between the nasal and oral cavities.

Differential diagnosis considered pseudopathology, traumatic injury, and non-odontogenic cyst, but the abnormality is virtually pathognomonic for a left unilateral cleft palate/lip defect. Despite resultant difficulty in feeding, this individual survived into their fifth decade of life, though they were clearly affected by childhood metabolic stress reflected in the presence of cribra orbitalia, porotic hyperostosis, and enamel hypoplasias. This person also suffered a spondylolysis fracture of the L5 vertebra neural arch at or around the time of death. Their burial was relatively ornate and materially complex, suggesting that this defect did not negatively affect treatment in death, and in fact, accords well with a variety of Andean ethnohistoric sources depicting people with congenital defects were considered as spiritually 'special' or otherwise sanctified. This represents the first archaeologically documented case of a cleft palate/lip defect in the Andes and joins a handful of other cases in better characterizing the paleopathology of congenital defects in pre-Hispanic South America.

Differentiating pellagra in human skeletal remains: a pilot study using computed tomography. Kristina ZARENKO

This presentation reports the preliminary results of a pilot study to identify pellagra in skeletal remains from the Robert J. Terry Skeletal Collection. The aim of this research is to test a method put forth by Brenton and Paine (2007) to distinguish pellagra from other nutritional deficiencies based on cortical bone loss in ribs. Forty-six pairs of sixth ribs were measured at the midshaft scan site with calipers then CT scanned in 2mm slices with a field of view at 50mm. The sample was selected based on information available in the death certificates for the Terry Collection as well as macroscopic evaluations of skeletal remains. This sample includes eight known pellagrins, thirteen individuals with malnutrition as a cause of death, and nine individuals who likely had vitamin D deficiency osteomalacia. A comparative sample of twelve individuals of varying age without documentation of nutritional deficiency disease at time of death was also scanned. ImageJ software was utilized to calculate cortical bone thickness. Preliminary results indicate that differences in cortical bone thickness, and therefore cortical bone loss, exist across these pathologies. Skeletal identification of pellagra is important because this disease existed both at endemic and epidemic levels across much of the southern United States through the 19th and 20th centuries. The ability to differentiate this condition would allow paleopathologists to conduct a more complete analysis of historic human skeletal remains within in the U.S.

What's Inside That Bone? Using X-ray and 3D Scanning Technology to Recreate Internal Aspects of Pathological Bone. Mariana ZECHINI, Maddeline VOAS, Katy PATTERSON, Jane HOLMSTROM & Kristina KILLGROVE

Understanding pathology and trauma on human remains is an important aspect of understanding past peoples, yet many universities lack access to representative skeletal materials. At the University of West Florida (UWF), we have 11 teaching skeletons, many of which exhibit various pathologies and trauma, and we have created both digital and tangible representations of bone pathologies from this collection. This includes 3D printed models with external and internal representations of pathologies that allow viewers to understand pathological patterning both superficial and deep.

The goal of this project was to digitally recreate internal aspects of bone pathologies through a combination of 3D scanning and x-ray technology for use in Human Osteology courses at UWF and to share with others. The models were digitally bisected using ScanStudio HD software then printed using a MakerBot Replicator 2. The internal view of the pathologies was recreated with Dremel tools, using the x-rays as a reference. The digital and re-scanned plastic models were shared on Sketchfab, where we added them to our open-access online paleopathological comparative collection.

While pathologies and trauma on bone have been digitized before, this concept marries two methods - cost-efficient 3D scanning and x-ray technology - to create models that show internal and external patterns of paleopathology and trauma. These digital models allow viewers to "open up" the pathology to see the patterning below the surface of bone. Our project employs innovative ways to view how diseases and trauma affect the inside of bone, which is unprecedented in anthropology.

Vitamin D metabolism in feral and captive nonhuman primates as an evolutionary approach to understanding vitamin D in humans. Toni ZIEGLER, Amita KAPOOR, Neil BINKLEY, Jane PHILLIPS-CONROY, Clifford JOLLY & Jeffrey ROGERS

Evolutionary approaches to understanding human vitamin D requirements and disease states have a basis in nonhuman primate vitamin D states. A newly developed LC/MS/MS (liquid chromatography / mass spectrometry) vitamin D panel measures vitamin D and its metabolites, 25(OH)D3 & D2, and 24,25 dihydroxyvitamin D3 & D2 is used to compare captive and feral baboon species with present day humans who have high level exposure to the sun. Savannah baboons, as with early hominids, are covered with hair and skin color varies between species. Levels of traditional living East African tribesmen have levels of 25(OH)D3 that are higher than humans living in North America and Europe (28-68 ng/ml in tribesmen; 20 – 40 ng/ml in North America; Luxwolda et al., 2012). Baboons from several species that live in the sun-drenched savannahs of East Africa show 25(OH)D3 levels higher than humans (mean 90 □ 5.07 ng/ml) and are similar to levels found in captive baboons (Papio Anubis, 88.11 □ 4.86). Baboon species show different levels of vitamin D in the wild ($P<0.001$) with P. anubis showing significantly lower levels than P. hamadryas and P. cynocephalis. The P. anubis species has the darkest skin color of the three species indicating that as in humans, baboons have evolved different coloration dependent upon sun exposure and environment.
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"Flipping" the immunopatholobiology of acquired syphilis to reconstruct host immunological status and estimate heterogeneity in frailty. Molly K. ZUCKERMAN

Researchers have investigated how Treponema pallidum causes syphilis's tortuous course and diverse manifestations for several centuries with little progress. However, recent work on the immunopathobiology of syphilis has elucidated these dynamics, suggesting that syphilis's manifestations depend on infection duration, lesion site, and host immune status and response. Specifically, a strong host cell-mediated immune response, or delayed type hypersensitivity (DTH), to secondary stage bacteremia causes bacterial clearance; weak DTH causes incomplete clearance and persistent tertiary disease. Importantly, DTH is highly

responsive to pathogen burden, macronutrient deficiencies, and psychosocial and physical stress, especially paired with low socioeconomic status (SES), over the life course. Wedding these dynamics, analysis of low SES, post-medieval English individuals (N=24) with suggestive and specific treponemal lesions suggests potential synergy between early life health experiences, adult health outcomes, tertiary syphilis, and localized and systemic inflammation; this is indicated by significant associations between frequencies of linear enamel hypoplasia ($p=.03$; $p<.05$), periodontitis ($p=.04$; $p<.05$), and gummata. These findings show that it may be possible to "flip" the immunopathobiology of syphilis, creating hypotheses that can be tested with skeletal data and producing results that refine estimations of past health relative to syphilis, specifically immune status and response and heterogeneity in frailty. One hypothesis is that individuals manifesting tertiary treponemal lesions previously experienced weak DTH, associated with prior or contemporary stress and/or malnutrition. This could be tested, particularly employing clinically diagnosed anatomical collections, using a life history approach and indicators of early life and adult stress, systemic and local inflammation, and malnutrition.