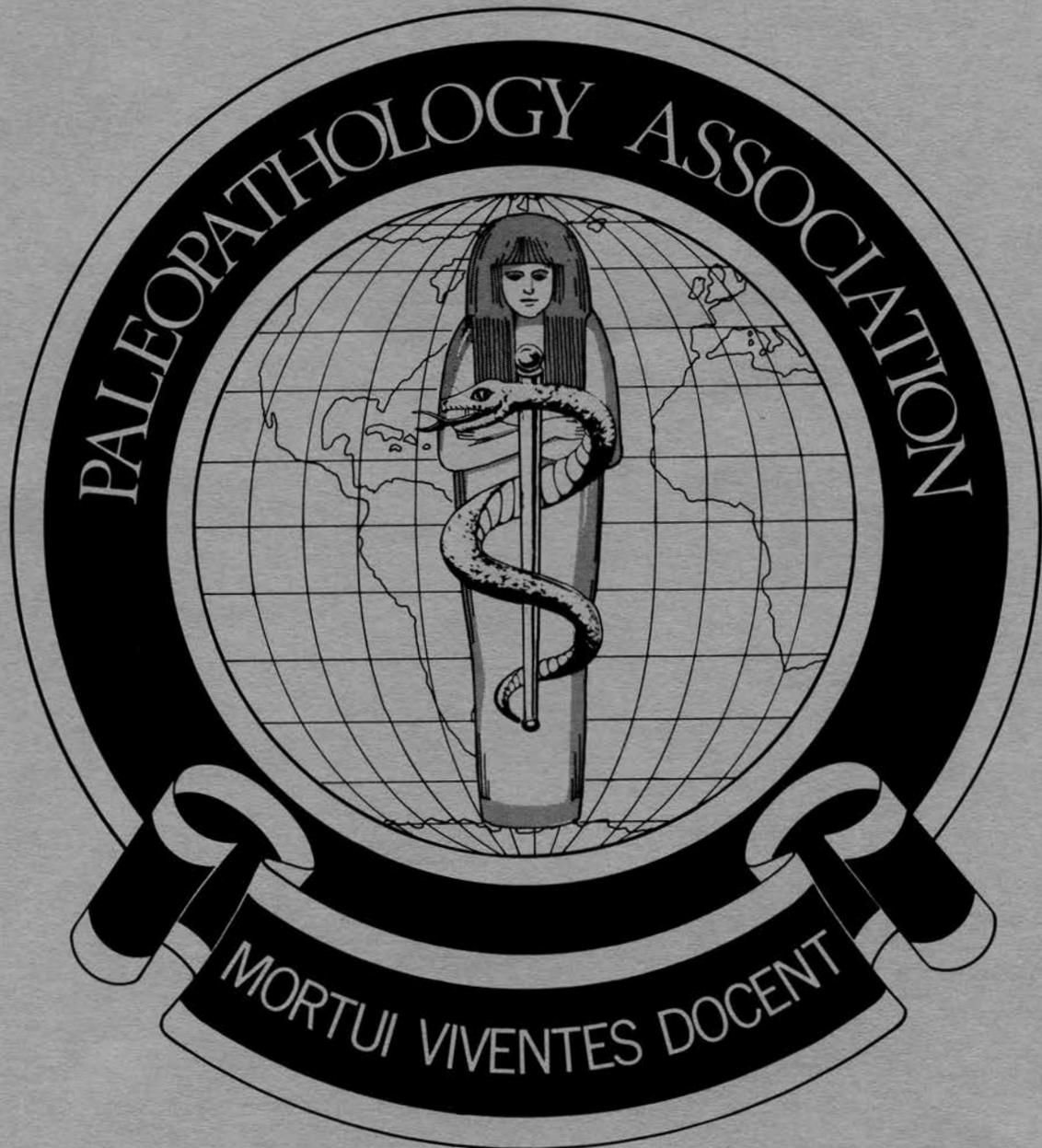


PAPERS ON PALEOPATHOLOGY

presented at the

Twenty Third Annual Meeting



9 and 10 April 1996

Durham, North Carolina

## SECTION 1: WORKSHOPS

### A. SKELETAL DISEASE WORKSHOP VIII: SEVERAL OF THE SEVEN BASIC CATEGORIES OF DISEASE

Bruce D. Ragsdale, Cunningham Pathology Associates and Elizabeth Miller, National Museum of Natural History, Smithsonian Institution

This year's dry bone diagnosis workshop afforded the usual opportunity for participants to test their skills in diagnosing specimens acquired by surgery or autopsy, and therefore having definite known diagnoses. These specimens included:

- 1) fracture of tibia and fibula six hours old;
- 2) gouty phalanges;
- 3) chronic draining osteomyelitis of 72 years duration in a 74 year old male;
- 4) sickle cell anemia with bone infarcts;
- 5) erosive femoral head arthritis from a patient with scleroderma;
- 6) Paget's disease of the distal humerus and spine, with coarse cortical fenestrations relating to a contiguous paraspinal hematopoietic tumor mass (extramedullary hematopoiesis due to extensive marrow fibrosis in polyostotic Paget's disease).

Specimens from the Smithsonian collection were presented through the courtesy of Donald Ortner and discussed by Elizabeth Miller. These were possible cases of:

- 1) fluorosis;
- 2) sporadic hypothyroidism;
- 3) tumor of nervus mandibularis or cartilage rest;
- 4) a controversial skull with bosselated surface nodularity particularly along suture lines and fascial attachments, shown at a previous workshop and now reentered with CT studies favoring a multifocal benign fibro-osseous process, possibly juvenile active ossifying fibroma (Ophthalmology 92: 150-159, 1985).

The invitation for the membership to enter cases in the workshop and discuss them was accepted by Donald Chrisman. He provided the opportunity to compare and contrast surgically derived tibial plateau specimens of osteoarthritis, rheumatoid arthritis and gout. Also, Michael Schultz presented histopathology and scanning electron microscopy correlations on three specimens from last year's workshop:

- 1) calvarial hyperostosis due to meningioma;
  - 2) ossifying fibroma of rib;
  - 3) osteosarcoma of mandible.
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## B. ANALYSIS OF THE OS PUBIS: SEX AND PARTURITION

Judy Myers Suchey, California State University, Fullerton and Department of Coroner, Los Angeles and Robert Tague, Louisiana State University, Baton Rouge

This workshop was designed to give the scientific community an opportunity to examine the well documented pubic bones from the Department of Coroner, County of Los Angeles for two reasons:

- 1) to test their skills in sex determination using the pubic bone
- 2) to examine dorsal changes in females with histories on the number and spacing of births.

There were 28 participants at this session.

An introductory slide presentation by Suchey acknowledged the support of Dr Lakshmanan Sathyavagiswaran and other professionals from the Department of Coroner, as well as the participation of colleagues, nation wide, in the research. Suchey then described the process of pubic bone removal at autopsy and the slow maceration process by which the sample had been prepared. Case studies were shown to illustrate the importance of the pubic bone in the forensic identification process. Attention was also directed at prehistoric cases, including the AL 288 ("Lucy") fossil. In light of the current theoretical discussion regarding the sex of Lucy, the cast of Lucy's pubic bone was compared to a 35 year old modern female who bears striking morphological similarities to the 3 million year old hominid. Tague continued the slide presentation by comparing Lucy's pubic morphology with the sexual dimorphism seen in modern humans. He also discussed the relationship in modern human females between parity and changes to the dorsal aspect of the pubis ('pits of parturition'). He demonstrated that resorption of the pubis is not unique to humans, but is found in nonhuman primates and other mammals. Several theories on the etiology of pubic resorption were discussed, including birth trauma, hormones, and joint mobility.

Following the introductory slides, the participants studied the pubic bones. Many focused on correct identification of the precursor ventral arc and ventral arc. Some participants tested themselves on a large series in order to calculate their accuracy in pubic sex determination. Others focused on dorsal changes in the Os pubis, examining the following sets of bones:

- 1) females showing severe dorsal pitting but very different histories of childbirth;
- 2) females who had given birth to more than five children;
- 3) females who died soon after giving birth; and
- 4) females who died while pregnant or as an immediate result of childbirth.

Acknowledgments are due to Laura Watts, State University, Fullerton and Deborah Gray, Department of Coroner, County of Los Angeles for their participation in this workshop.

## SECTION 2: CONTRIBUTED PAPERS

### CLASSIFICATION OF BONE LESIONS

D. J. Ortner, National Museum of Natural History, Smithsonian Institution

One of the troublesome problems currently limiting some types of research in paleopathology is the difficulty in using data and observations obtained by multiple scientists. There are many reasons for this problem but a significant one is the failure, thus far, to develop a detailed descriptive terminology and a comprehensive classification system for skeletal abnormalities seen in human archeological remains. Terminology currently being used is both inadequate to deal with the complexity of bone tissue variation in pathological skeletal remains and confusing because of inconsistent and imprecise usage.

The abnormal conditions apparent in skeletal tissue are usually the result of: (1) abnormal bone loss and (2) abnormal bone formation. There are abnormalities in size and shape (e.g., dwarfism and rickets) that do not fit this generalization but these are rare. Problems arise when one tries to deal effectively with the variation in the expression of these conditions. This variation provides one of the major diagnostic tools for the paleopathologist and is thus of critical importance in research about ancient disease.

In this report, I discuss and illustrate some of the descriptive problems encountered when an observer attempts to describe abnormal bone tissue. For example, lesions characterized by abnormal, reactive fiber bone formation will sometimes have a hole in one or more locations within the lesion. An important question is whether the hole was formed as a destructive process after the fibrous lesion was formed, or whether it represents a defect in the formation of the fibrous lesion. The pathogenesis of the two options is different and this may affect the diagnostic options. This example illustrates the need for greater attention to issues of classification and terminology in paleopathology.

### TWO POSSIBLE CASES OF DIFFUSE IDIOPATHIC SKELETAL HYPEROSTOSIS FROM THE TEXAS STATE CEMETERY

Joan E. Baker and Helen Danzeiser Dockall, Texas A & M University

Two possible cases of diffuse idiopathic skeletal hyperostosis (DISH) were noted in elderly males excavated from the Texas State Cemetery. This sample was composed of 56 individuals of known age and sex. The affected individuals were 75 and 85 years of age. DISH is most readily identified by the presence of flowing ossification along the anterolateral borders of at least four contiguous vertebral

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bodies with preservation of the intervertebral space and absence of apophyseal fusion. In addition, ossification of the quadriceps tendon to the patella, projecting spines on the proximal surface of the tibiae, and sacroiliac fusion may also be indicative of DISH. One individual appears to have all the classic indicators of DISH. The second had a number of skeletal manifestations typical of DISH, and also three cervical vertebrae fused at the centra and the apophyseal joints. This apophyseal fusion has not previously been associated with DISH.

#### A CASE OF SURVIVED SCALPING FROM THE FISHER MOUNDS SITE, ILLINOIS

K. J. Carlson, Indiana University

An adult male cranium (WM28) exhibits aggression trauma consistent with scalping. Healing processes suggest the individual survived the scalping by many years. An osteoclastic ring encircles the top of the skull. The ring runs across the frontal and follows temporal lines on the left and right sides. Infection has affected much of the right side. Bone resorption has nearly detached the right coronoid process from the ascending ramus. The right zygomatic arch is missing, probably from bone resorption. The right parietal is missing completely. As the sutures are undamaged, the right parietal probably sloughed off. Langford excavated the site in the 1910s and 1920s, but did not record burial treatment or level of this individual. Big West Mound contains Late Woodland and Upper Mississippian components, but the component of WM28 is currently unknown.

#### PREHISTORIC DENTAL CALCULUS: AN SEM AND LIGHT MICROSCOPE INTERPRETATION

M. K. Marks, N. P. Herrmann and D. A. Gerard, University of Tennessee (MKM, NPH) and University of Tennessee Medical Center (MKM, DAG)

The burial of a Mississippian-period Native American from central Tennessee exhibits an extreme degree of dental calculus. The condition is asymmetrical, confined to and encircling the right side of the unworn mandibular dentition. The left post canine mandibular dentition is missing antemortem, and the anterior teeth display high, uneven attrition and periodical abscessing. The maxilla and maxillary antagonists are fragmented and incomplete. Some pathological oral soft tissue condition undoubtedly compromised normal long-term mastication. Using light microscopy, SEM and SEM - EDX, we characterized the mineral and elemental composition of the calculus, underlying alveolar bone and enamel- calculus interface. Calcium, phosphorus, and several trace elements were discovered, which helped us discern the local ecological setting. This analysis is telling about particular aspects of prehistoric lifeways in Middle Tennessee during the prehistoric Mississippian period, and also provides a protocol for more accurate assessment of pathological dental specimens whose analysis has been, for the most part, traditionally confined to macroscopic perspectives.

## WHAT DOES POROTIC HYPEROSTOSIS MEAN? RESULTS OF MICROSCOPIC INVESTIGATIONS IN PRE-COLUMBIAN SKULLS FROM THE NORTH AMERICAN SOUTHWEST

Michael Schultz, University of Göttingen and Charles F. Merbs, Arizona State University

Porotic hyperostosis of the cranial vault and the orbital roof is frequently seen in prehistoric infant skulls from the North American Southwest. Up to now, these morphological features have been thought to be caused by anemia. To check this hypothesis, infant skeletons from 15 pre-Columbian populations excavated in Arizona, New Mexico and Chihuahua (Mexico) were investigated by macroscopic, radiological, light microscopic (polarisation, microradiography), and scanning electron microscopic techniques. The results of the microscopic investigation, which is highly reliable for differential diagnosis, demonstrate that porotic hyperostosis of the skull vault as well as Cribra orbitalia can be caused by inflammatory processes or even other diseases. Sometimes scurvy and rickets produce morphological features similar to the lesions caused by anemia, particularly when more than one disease affects the bone at one time. The epidemiology of ancient diseases with respect to the frequency of anemia, scurvy, rickets, and inflammatory processes of the skull (e.g. osteomyelitis, periostitis) must therefore be reconsidered.

## PALEOPATHOLOGY AT THE TUTU SITE: THE BIOARCHAEOLOGICAL CONTEXT

M. K. Sandford, G. Bogdan, D. S. Weaver, and L. Sappelsa, University of North Carolina at Greensboro (MKS, GB) and Wake Forest University (GB, DSW)

In this paper, we discuss our analyses of paleopathology from the Tutu Archaeological Village (TAVI) site in the United States Virgin Islands in the light of the bioarchaeological and ecological contexts. The results of carbon 14 dates, suggesting that the site was occupied over a 1200 year period, are used to provide a temporal context for the interpretation of specific categories of lesions, including those of the inflammatory/immune variety. Lesions consistent with treponemal infections are present on individuals dating from both early (ca AD 800) and later (ca AD 1200-1400) occupations of the site. In addition, we use other data, including those generated from investigations of the settlement pattern, bone chemistry, and faunal and paleobotanical remains, to reconstruct a more complete picture of human adaptation and lifeways in the prehistoric Caribbean.

## ANEMIA AND THE ANCIENT MAYA: A VIEW FROM PLAN DE SANCHEZ

Lori E Wright, McMaster University, Hamilton

Since Hooton's identification of 'spongy' lesions on the crania from the Cenote at Chichen Itza, porotic hyperostosis has played a key role in the evaluation of

prehistoric nutritional adequacy. Among the Ancient Maya, anemia is often attributed to inadequate intake or absorption of iron from the maize-based diet. Problems with this diagnosis are brought into focus through comparison of paleopathological data with the prevalence of porotic hyperostosis in modern forensic skeletons from Plan de Sanchez, Baja Verapaz. Recently excavated by the Guatemalan Forensic Anthropology Team, the skeletons are those of rural agriculturalists, mostly of Achi Maya descent, massacred in 1982. The lifestyle and diet of this people are broadly analogous to those of the Ancient Maya, yet anemic lesions are very rare on the crania --- a sharp contrast to the paleopathological findings. Possible explanations for this discrepancy are discussed, including parasitism, infectious disease, and differential frailty.

### THE ICEWOMAN OF THE ANDES

Sonia F. Guillén, Centro Mallqui, Ilo, Peru

This is a preliminary report on the discovery of and subsequent research on the frozen mummy of a female child accidentally found in September 1995, by Dr. Johan Reinhard, a well known researcher of high mountain Inca religious shrines. A Peruvian and international research team has started to undertake cultural and biological studies of the remains found in Nevado Ampato in Arequipa, Peru, at heights above 20,000 feet. The initial study included a radiological evaluation from which an age of 12 years has been estimated; sex appears female from facial features of the sacrificed child. The x-rays clearly indicate that the body is frozen, although the skin of the face freeze dried when the body fell from the summit as the ice melted and loosened the 500 year old bundle. The conservation and research program was presented and discussed, as well as the early findings of the project.

### TRAUMA IN THE PRECERAMIC POPULATIONS OF NORTHERN CHILE: VIOLENCE OR OCCUPATIONAL HAZARDS?

Vivien Standen, Universidad de Tarapacá and Bernardo Arriaza, University of Nevada, Las Vegas and Universidad de Tarapacá

This study discusses the incidence of cranial trauma found in 33% of late Chinchorro individuals (N=70) from northern Chile, circa 2000 B.C. All the individuals with cranial trauma (N=23) were adult, older than 20 years of age. Males were affected three times as often as females (17 males versus 6 females). Most of the cranial trauma appears as depression fractures involving the external table. The diameter of the lesions vary between 10-20 mm to 50 mm, clustering on the left side of the cranium and face. In males, as well as in females, the left parietal was the bone most frequently involved, followed by the left side of the orbits and nasals. We hypothesize that these cranial and facial traumas were the result of interpersonal violence, rather than a consequence of occupational costal hazards (e.g. falling on slippery rocks).

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## HEALTH AND DIET OF TWO PREHISTORIC POPULATIONS FROM CHILE'S SEMIARID NORTH

Maria A. Rosado, Rowan College of New Jersey

This paper examines the relationship between health and diet in two prehistoric populations from Chile's semiarid north. Trace element analysis and a detailed paleopathological study were carried out. The skeletal remains are from the Archaic period (n = 99; 1830 BC) and the Diaguita period (n = 82; AD 1000-1500). Archaeological and historical evidence suggests the Diaguita had a subsistence combining cultivated and wild plants, pastoralism, and marine resources. By contrast, the subsistence of the Archaic population (archaeological evidence) was primarily based on marine resources. The mean log ratio concentration values of the elements barium and strontium (Archaic = -0.7985, n = 38; Diaguita -0.5475, n = 53) support the archaeological and historical evidence for subsistence modes of both populations. Based on the differences in diet, differences in health between the two populations are investigated. The hypothesis that a generally poorer health status and more nutritional problems are associated with the Diaguita population was tested. Paleopathological analysis revealed that both populations suffered from dental infections, anemia, and skeletal infections, but the frequencies of infections and anemia were not statistically significant between the two populations ( $p > .05$ ). These populations do not demonstrate, as many other studies of health and agriculture do, a general decline in health from the hunter-gatherer population.

## A STUDY OF PITUITARY ADENOMA FROM BARTON ON HUMBER

Becky Crossley, Andy Levy and Juliet Rogers, Palaeopathology Study Group, (BC, JR) and Bristol University Department of Medicine (AL)

Pituitary adenoma can affect as many as one in five of the population. Predisposing factors could be generic or environmental. A proportion of adenomas cause enlargement and/or erosion of the sella turcica in which the pituitary gland is situated in the skull. This study attempted to examine the change in prevalence of abnormal sellar volume over a period of approximately 1000 years by using archaeological material from Barton on Humber. Standard lateral and AP x-rays were made of 88 crania from Saxon, mediaeval and post-mediaeval periods. The sellar volume and sellar cranial index were calculated. The radiographs were examined for morphological changes associated with erosion by pituitary adenoma and seven of these skeletons were examined for other pathology indicative of pituitary disease. No significant change in prevalence of abnormal sellar volume was observed, although a trend towards a higher prevalence from Saxon, through mediaeval, to the post-mediaeval period was noted.

## A POSSIBLE CASE OF NEUROFIBROMATOSIS IN AN ARCHAEOLOGICAL SKELETON

C. J. Knüsel, University of Bradford and J. E. Bowman, United Medical and Dental Schools (Guy's Hospital) London

The skeletal remains described in this paper are those of a probable early sufferer from von Recklinghausen's neurofibromatosis, a tumour-forming disorder that occurs quite commonly today. This case is the earliest described from archaeological remains. As such, it provides confirmation for the problematical literary documentation of the presence of the disorder, and also allows direct appraisal of its skeletal manifestations.

#### **PATTERNS OF PERIOSTEAL REACTION IN ENGLAND FROM ROMAN THROUGH ELIZABETHAN EPOCHS**

Bruce N. Rothschild and Christine Rothschild, Arthritis Center of Northeast Ohio and Northeastern Ohio Universities College of Medicine

Four British sites (three pre-Columbian and one post-Columbian) were chosen to assess the character of periosteal reaction. The only periosteal reaction observed among 320 individuals in either the Poundbury or Cannington sites was three isolated tibial bumps. Twenty-four percent of individuals from the Winchester site had predominantly poly-ostotic periostitis. Those with sabre shin deformity had prominent surface periosteal reaction. Tibial involvement was invariably bilateral, with hand and foot involvement common. Nine percent of individuals from Spitalfields had predominantly pauci-ostotic periostitis reactions. Hands and feet were spared, while tibial involvement was unilateral in 29%. Present sabre shin deformity was associated with total surface remodeling. The time course of population health between 5th-10th century (Poundbury-Cannington) and 11th-14th century (Winchester) sites clearly reflects the appearance of a new disease. Subsequent replacement by a different periosteal disorder is clearly demonstrated. Syphilis appears to be that post-Columbian event.

#### **PALEOPATHOLOGY AND ITS CONTRIBUTIONS TO THE DECIPHERMENT OF THE HUMAN CONDITION IN ANTIQUITY: THE CASE OF TWO POPULATIONS FROM MALLOURA IN CYPRUS**

Anagnosti Agelarakis, Adelphi University

This paper juxtaposes paleopathological and epidemiological manifestations preserved in the dry skeletal record of two distinct cultural components from Cyprus. The osseous samples represent populations of the Hellenistic (300 B.C.), and the Venetian (16th c. A.D.) archaeological sites of Malloura at Athienou. Through archaeological forensic reconstructions of the osseous record, and the careful diagnostic criteria and procedures provided by the field of palaeopathology, it was possible to provide a nexus with the human condition in antiquity. This paper, representing the objectives of a larger interdisciplinary research project, aims to offer unique opportunities for study of the human condition, specifically as it reflects on aspects of the differential pathogenicity and mortality between sex and age subgroups across the demographic profiles of the two populations. These data, in conjunction with the rest of the archaeological and paleoenvironmental record, will allow us to draw better conclusions for the archaeo-anthropological record of this Eastern Mediterranean region.

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## **TUBERCULOSIS AND THE JEWISH PEOPLE: A BIOCULTURAL ANALYSIS**

Joe Zias, Israel Antiquities Authority

The genetic factor in resistance to tuberculosis has been suspected since the 1890s, when epidemiological data on the disease were first being collected following discovery of the bacillus in 1882. Subsequent studies confirmed these findings, and today the individual immune response to the mycobacterium is regarded as an important factor in understanding the disease process. When studying tuberculosis response among various populations under similar environmental conditions, one is struck by the wide divergence in rates of morbidity and mortality. Studies have generally failed to take these differences into account, stressing the social environment as the overriding epidemiological factor in the disease process. Data from the Near East contradict some of the basic principles regarding transmission of the disease; we have therefore attempted to study one of these ethnic groups, the Jews, as they have exhibited one of the lowest rates. Using a biocultural approach, our research attempts to provide a broader understanding of the disease in the Ancient Near East, and a possible explanation of its evolution.

## **DISABLING CONDITIONS IN THE SKELETAL RECORD: IS IT POSSIBLE TO ASSESS THE PRESENCE OF DISABILITY, AND WHAT MAY BE OUR ASSUMPTIONS?**

Charlotte Roberts, University of Bradford

Disability has many definitions in modern developing and developed societies, and also in ancient ones. These definitions inevitably incorporate assumptions and ideas about what disability is, how it is manifest, and how it may affect or enhance a person's position in society. This paper explores these issues and considers some of the potential evidence for disability in the skeletal record, how some particular conditions may affect a person's lifestyle, whether these conditions may have been seen to be disabling, and whether they may have affected survival. Problems with interpretation of the evidence are also highlighted.

## **THE MYTH OF NON-SPECIFIC PERIOSTEAL REACTION**

Christine Rothschild and Bruce N. Rothschild, Arthritis Center of Northeast Ohio and Northeastern Ohio Universities College of Medicine

If periosteal reaction were indeed non-specific, one would anticipate little population variation in its expression. Most non-treponemal disease processes that can produce periosteal reaction occur with such low population frequency (less than 1%, and usually less than 0.1%) as not to influence population studies. Periosteal reaction in 80 skeletal populations was therefore examined to determine geographic

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variation in frequency, character and reproducibility of patterns discerned. Examination of geographically and climatically disparate pre-Magna Carta populations (e.g., Mali, Mauritania, central Germany, and England) revealed no periosteal reaction, other than occurrence of isolated bumps in fewer than 2%. Periosteal reaction patterns in the other populations were rigorously preserved, without variation or overlap. Patterns manifested contiguous geographic/chronologic uniformity, but were independent of climate. It would therefore seem that periosteal reaction is not non-specific, but that it is amenable (as a population phenomenon) to specific diagnosis.

## THE NATURAL HISTORY OF UNTREATED SKELETAL LESIONS

Bruce D. Ragsdale, Cunningham Pathology Associates, Birmingham AL

Modern textbooks of pathology are illustrated by surgical specimens intercepted at some point short of their full natural history. Autopsy specimens are more likely to represent advanced expressions of disease, but the morphologic expression has generally been modified by therapeutic manipulations including surgery and medical treatment. The practice of pathology affords rare instances where, for one reason or another, no treatment was given or treatment was delayed, yet radiographs were taken that document the evolution of a process with skeletal manifestations. This presentation shares such cases in all seven of the basic categories of disease, collected by the author during a 25-year period. Beyond being better standards for the diseases represented, these cases teach much about the mechanisms, tempo and morbidity of specific disease states.

## DIAGENESIS AND DECOMPOSITION IN ARCHAEOLOGICAL BONES (Workshop Preview for the 1997 Annual Meeting)

Michael Schultz, University of Göttingen

Archaeological bone is known to be affected under the earth by various factors (e.g., roots of plants, fungi, algae, bacteria, insects and their larvae, worms, protozoa, and mechanical agents such as water and crystals). Unfortunately, even today, little is known about the physiology of the fauna and flora of cadavers preserved over many centuries in the ground. All these post mortem factors produce damage that may be falsely diagnosed by paleopathologists as lesions caused *intra vitam* by disease (pseudopathology). As a rule, many changes cannot be differentiated by macroscopic or radiological analysis, but are easily diagnosed by microscopic techniques. Furthermore, it should be kept in mind that these post mortem factors are able to affect the results of immunohistochemical and molecular investigations as well as the examination of trace elements. Therefore, microscopic investigation is indispensable before examination of archaeological remains by chemical and physical techniques can be carried out.

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### SECTION 3: SYMPOSIUM ON BEHAVIORAL IMPLICATIONS DERIVED FROM THE SKELETON

#### INTRODUCTION

Elizabeth Miller, National Museum of Natural History, Smithsonian Institution

This symposium began as a way for students of Charles Merbs, both former and present, to thank him for his support and encouragement, and to wish him luck with his continuing (hopefully for a long, long time) research. The symposium very quickly grew beyond that point, however, to incorporate individuals who had not been directly influenced by him. The symposium organizers soon discovered that behavioral interpretation from the skeleton was a hot topic that many people wished to discuss. As we learn more about paleopathology, we begin to question our dearly held beliefs about interpretation. This symposium was designed to introduce the concept of behavioral interpretation, to discuss it, and to critique the perhaps over-wide usage and misapplication of such interpretation in paleopathology today. It was also designed to incorporate carefully framed studies of behavior, in order to show that behavioral interpretation is not a dying field, and that meticulously designed behavioral studies are still very much applicable in the field of paleopathology. It is to be hoped that, through such considerations of the subject as this symposium, we shall continue to refine and re-define our concept of behavior and its interpretation from the human skeleton.

#### INFERRING BEHAVIOR FROM HUMAN OSTEOLOGICAL DATA: IS IT GOOD SCIENCE?

Robert Jurmain, San Jose State University

For several generations, especially in the United States, osteologists have sought not only to link behavior to specific osseous manifestations, but also in the retelling of human prehistory, to explain how these behaviors became distributed within and among various populations. In particular, the 'stress hypothesis' as enumerated by this author and others has been applied to the explanation of population patterns of osteoarthritis, and is rarely discussed as a *hypothesis*; it is commonly taken as an established fact, from which more specific relationships can then be drawn. The assumed association of osteoarthritis with mechanical ('occupational') stress has thus become widely accepted, but at such a general level the hypothesis is not testable in osteological samples and, even more disturbing, contemporary epidemiological data throw such a broad-hued assumption into considerable doubt. Attempts to link lesions expressed in a particular joint area to specific behaviors are theoretically more amenable to scientific testing, but given the limitations of most osteological samples, such more restricted hypotheses can only rarely be tested rigorously in a manner compatible with most definitions of 'scientific method.'

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## THE UTILITY OF OSTEOARTHRITIS IN BEHAVIORAL RECONSTRUCTION

Bethel Nagy, Arizona State University.

Osteoarthritic changes in skeletal material have long been used to infer behavior. In recent years, however, the use of osteoarthritis as a behavioral indicator has received a great deal of criticism. Although much of this is well-founded, it should not be construed to mean that osteoarthritis data offer nothing to studies of activity patterns. The proximate cause of osteoarthritic changes is biomechanical, and therefore, the patterning of osteoarthritis within and between joints should reflect joint use. Merbs's (1983) analysis of Sadlermiut skeletal material was one of the first studies to note variability in the placement of osteoarthritic changes on joint surfaces. Subsequent research designed specifically to 'map' osteoarthritic changes on joint surfaces has not only confirmed that osteoarthritic patterning is variable, but also indicates that types of variability differ among populations. These patterns can in turn provide information on habitual joint movement.

## VIOLENCE AT NUNIVAK ISLAND, ALASKA: THE INTERPRETATION OF BEHAVIOR FROM CRANIAL TRAUMA

Elizabeth Miller, National Museum of Natural History, Smithsonian Institution

The remains of approximately 150 individuals were recovered during survey and excavation at Nunivak Island, Alaska, in the late 1920s and early 1930s. These remains are currently undergoing documentation at the National Museum of Natural History, as part of the repatriation process initiated by the National Museum of the American Indian Act of 1989. During preliminary assessment, it was noted that many of the crania demonstrated sharp and/or blunt trauma with no healing. This paper discusses the use of trauma in the interpretation of behavior, with particular emphasis on the cranial trauma found at Nunivak Island. When combined with archaeological and other biological information, the relatively high incidence of lethal cranial trauma at Nunivak Island can be placed in the behavioral context of a changing social and physical environment.

## UNSPOKEN STORIES OF THE ELDERS: LIVES WRIT IN BONE

Christine L. Hanson, Department of Anthropology, University of Alaska Anchorage

The remains of eleven individuals were recovered from salvage excavations in Point Hope and in Kotzebue, Alaska. The National Park Service, at the request of the appropriate village Elders, and with their permission, recovered the skeletal material and supported anthropological analyses. These analyses included standard metric and nonmetric data and any anomalies that might be considered the result of behavior. 'Parity pits,' linear enamel hypoplasias, dental attrition, enthesopathic

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roughening at the insertion of the costoclavicular ligament, Harris lines, severe 'hip' degeneration, and a projectile point embedded in the spine between L1/L2 were interpreted as indications of culture and behavior.

### **MEDIEVAL BEHAVIOR RELATED PATHOLOGY FROM FRANKISH CORINTH, GREECE**

Ethne Barnes, Wichita State University

Recent skeletal analysis of human remains from 13th century Frankish Corinth has revealed a number of functional stress markers on bones in men, women, and some children. The pattern of functional stress for each individual was analyzed within the medieval cultural context to determine possible habitual behaviors. Reconstructions of behavior from related pathology include combat, blacksmithing, horseback riding, and daily chores. Functional stress patterns were determined by the presence of enthesitis, bone hypertrophy, fatigue fractures, disunion of growing bones, and osteoarthritis, caused by overuse or repetitive force on musculotendinous units and joints of the skeleton. Predisposing factors to functional stress resulting from anatomical deviations caused by previous injuries, musculoskeletal asymmetry or developmental defects, particularly in the vertebral column, were also identified along with compensatory changes. Malaligned joints and musculotendinous units are prone to overuse injury and should be considered when reconstructing behavior from human skeletal remains.

### **COMPARATIVE DEGENERATIVE JOINT DISEASE OF THE VERTEBRAL COLUMN IN THE MEDIEVAL MONASTIC CEMETERY OF THE GILBERTINE PRIORY OF ST ANDREW, FISHERGATE, YORK, ENGLAND**

C.J. Knüsel, S. Göggel and D. Lucy, University of Bradford

The pattern of degenerative joint disease (DJD) of the intervertebral and apophyseal joints of the vertebral column of 81 skeletons from the 13th-14th century medieval priory cemetery of St. Andrew, Fishergate, York, England was recorded in the eastern and southern cemeteries, and within the priory buildings. The pattern of DJD did not vary between sub-populations of people with different social status, but rather between intervertebral and apophyseal joints of individuals. It is argued that this difference was a response to erect posture during bipedal locomotion, reflecting vertebral curvatures rather than differing occupational stresses. Nevertheless, when the data were analysed, it was found that the southern cemetery showed a different distribution from both the eastern and the priory cemeteries, but the eastern and the priory showed similar distributions. This observation provides complementary data to support the archaeological interpretation that the three areas served different social groups. The results were not of statistical significance, and it is argued that the vertebral column may not be an ideal structure to study markers of occupational stress due to biological constraints on its function.

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## **ACTIVITY-INDUCED OSTEOLOGICAL CHANGES IN CANADIAN ABORIGINAL SKELETAL REMAINS**

Robin M. Lillie, Office of the State Archaeologist, The University of Iowa

Aboriginal Canadian skeletal remains from the collections of the University of Iowa Museum of Natural History presented osteological evidence for historically documented patterns of cultural behavior. Dental attrition, antemortem dental enamel chipping and tooth loss, dental malocclusion, and maleruption suggest use of the teeth as a tool. Of particular note were osteophytic and bony development at the point of muscle and ligament insertions as well as degenerative changes associated with osteoarthritis. These conditions strongly suggest patterns of repeated behavior resulting in osteological changes; the activities include rowing or kayaking and sewing. It is argued that there is also osteological evidence for lateral knee stress resulting from dog sledding.

## **THE PEOPLE BEHIND THE POTS: CONTEXT, DIET, AND BEHAVIOR OF ANCIENT ANDEANS**

Jane E. Buikstra, Maria Cecilia Lozada Cerna, Gordon Rakita and Paula Tomczak, University of New Mexico (JEB, GR, PT) and University of Chicago (MCL)

Defined by a distinctive ceramic style, the Chiribaya culture of the south-central Andes has recently been the subject of contextualized bioarchaeological study. A refined ceramic chronology, developed through a systematic program of radiocarbon dates, coupled with analyses of grave assemblages and chemical evidence for dietary variation, provides new insights concerning coastal Andean political economy. Our behavioral interpretations of Chiribaya peoples is thus strengthened by the integration of archaeological and biological data.

## **EXTERNAL AUDITORY EXOSTOSES IN PREHISTORIC CHILEAN POPULATIONS: A TEST OF CHRONOLOGY AND GEOGRAPHIC DISTRIBUTION**

Vivien Standen, Universidad de Tarapacá and Bernardo Arriaza, University of Nevada, Las Vegas and Universidad de Tarapacá

Over one thousand prehistoric crania (N = 1149) from northern Chile were analyzed to test the hypothesis that the external auditory exostoses (EAE) found in some of these specimens were a consequence of continuous diving for fish and shell fishing in the cold water of the Pacific Ocean. The crania came from 43 sites, including the coast, lowland valleys (100-2,000 meters above sea level) and the highlands (2,000 to 4,000 masl), with a time frame of 7000 B.C to the colonial era (1400 A.D.). As expected, there was a clear association with elevation and sex. The coastal inhabitants have the highest incidence of EAE, with 31.3% (105/336),

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followed by 2.3% (6/264) for the valley people and 0% (0/549) for highlanders. Coastal and valley men were significantly more affected than their female counterparts, but there was no significant association with economy or chronology. In the Arica area, the early Chinchorro fishers without agriculture have 29.4% (28/95) EAE, the subsequent agropastoralists 43% (29/68), and the late Arican agropastoral fishers 40% (n = 22/55). It seems that with the advent of agriculture the coastal Arica populations increased ocean harvests, rather than decreasing them, to gain a surplus for trade with nonmaritime groups.

## DISCUSSION

Charles F. Merbs, Arizona State University

The data collected and analyzed by participants in this symposium covered a broad range, including the development and sometimes pathological nature of tendinous and ligamentous attachments (but what shall we call them?), degenerative changes (particularly involving joints), alterations and extensions of articular surfaces, and evidence of trauma (unhealed as well as healed). The subject thus presented is extremely broad, obviously including things 'done to' as well as 'done by' an individual. The skeletons examined also ranged broadly, from Arctic Inuit and native Andeans to Frankish Corinthians and medieval English monks. The only major category absent was modern forensic cases. This omission was unfortunate because it is in the forensic context that anthropologists are particularly encouraged to explore this field, to include 'occupation' in order to achieve an 'identification.' If they are lucky enough to get an identification, it becomes possible to check their activity speculations and the methods used to develop them against activities actually known to have been engaged in by the deceased.

The symposium affirms that the field of reconstructing activity from the skeleton is alive and thriving. As in almost any developing area of enquiry, the early studies, including my own, now appear overly simplistic, failing to take account of the perplexing complexities and pitfalls now known to exist. The overall lesson to be learned, however, is not to avoid this area of enquiry entirely, but to proceed with great caution, dealing aggressively with the complexities, and avoiding the over simplifications of the past. Be familiar with the classical literature, but do not be entirely dependent on it. Those familiar with this literature must recognize its shortcomings as well as its strengths. Develop testable models and search for internal patterning in your collections that can be demonstrated statistically, and for pattern differences between segments of your series or between series geographically and temporally. Test alternative hypotheses. When applying the approach to individuals or skeletal series generally, use the entire arsenal of traits available. Look at the total picture and how the various elements interrelate; do not cripple your efforts by limiting yourself to just one category of traits. My final advice is: do let yourself be seduced. Go forth boldly, but do so well armed, and proceed with great caution.

[Ed. note: Dr Merbs gracefully credited earlier generations of anthropologists who had influenced him: 'Bill Laughlin, Jim Anderson, their sources of inspiration --- Ernest Hooton, Aleš Hrdlička, anatomist J. C. B. Grant --- and on into the past.']

#### SECTION 4: POSTER PRESENTATIONS

##### A POSSIBLE CASE OF AMPUTATION OF THE FEET, WITH EVIDENCE OF HEALING, IN A MOCHE BURIAL FROM THE NORTH COAST OF PERU

Laurel S. Anderson and John W. Verano, Tulane University

During excavations in 1994 of a group of Moche tombs at the ceremonial center of El Brujo on the north coast of Peru, the skeleton of an adult male with missing feet was encountered. Examination of the skeletal remains reveals evidence of extensive bony reaction on the distal articular surfaces of the tibiae and fibulae, with sclerotic bone formation and nonfunctional joint surfaces. The knee and hip joints are normal in appearance, and there is no evidence of cortical bone loss in the diaphyses of the tibiae or fibulae that might suggest disuse atrophy. The normal robusticity and morphology of the leg bones argues against congenital absence of the feet, and the bilateral nature of bone reaction is not consistent with septic arthritis. A possible diagnosis is amputation of the feet. A number of artistic representations of individuals with missing feet are known from Moche art, and two cases of probable perimortem amputation of the feet have recently been reported from the site of Sipán, located approximately 100 km north of El Brujo.

##### DIFFICULT BIRTHS AND BRIEF LIVES AT CASTLEDYKE, BARTON-UPON-HUMBER

Anthea Boylston, Rebecca Wiggins, Martin Foreman and Charlotte Roberts, University of Bradford (AB, CR), Rheumatology Unit, Bristol University (RW), and Humberside Archaeology Unit, Hull (MF)

Excavations of a cemetery dated late 5th to early 8th centuries AD by the Humberside Archaeology Unit took place at Barton-upon-Humber during three seasons in 1982, 1989 and 1990. There was a total of 196 grave cuts, from which 199 inhumation burials were recovered, in addition to fragmentary remains of a further 28 individuals. A single cremation burial was also recorded. Forty-six interments (22% of the population) were those of children and adolescents, including an almost full-term foetus found in the abdominal region of one female. Death occurred most commonly in children either in infancy or in adolescence. Grave goods included one of the earliest examples of 'bottle-feeding' in this country, which is paralleled by a recent find at Buckland in Kent.

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## AVULSION FRACTURE OF THE ANTERIOR PROCESS OF THE CALCANEUS?

Wolf Bueschgen, University of South Carolina

Excavations of the Vosberg valley in central Arizona led to the recovery of a large Hohokam-Anasazi skeletal sample. From this sample, one male aged 35-45 displayed a circular defect in the cortical bone of the non-articular anterior left calcaneus, with evidence of remodeling around the edges. Although a review of the paleopathological literature produced no reported cases of this particular lesion, the medical literature supports a diagnosis of an avulsion fracture of the anterior process of the calcaneus involving the bifurcate ligament (Chopart's ligament). This injury was most probably the result of traumatic inversion of the foot. Differential diagnosis is presented with the exclusion of conditions such as osteochondritis dissecans and avulsion of the attachment for the extensor digitorum brevis as the most likely alternate diagnoses.

## DEVELOPMENTAL CANALIZATION AND STRESS IN FIVE SPECIES OF PRIMATES

Mia Carr, Hampshire College

The purpose of this project is to compare the frequency and distribution of an enamel developmental defect, dental enamel hypoplasia, in a cross taxa survey. The samples of 72 gorillas, 56 chimpanzees, 8 orangutans, 26 baboons, and 20 gibbons were collected at the Cleveland Museum of Natural History. In addition to examining the difference across taxa, there is an evaluation of the issue of differential susceptibility to defects on different teeth: the maxillary canines, lateral incisors, and central incisors. The study also observes the frequency of distribution of hypoplasia concerning sex and age. Hypoplastic grooves have been observed in a variety of fossil hominids. Used as an age marker, observable hypoplastic activity has the potential for disclosing growth rates in early hominids when compared to the rates of hypoplasia in modern primates and humans.

## AN OBSTETRIC FATALITY FROM NORTHERN GREECE

Andrew Chamberlain and Sevi Triantaphyllou, University of Sheffield

During the summer of 1995, a rescue excavation of the Ancient Pydna Classical cemetery in northern Greece revealed an unusual skeleton. The grave contained a 4th century BC burial of a woman in her late twenties with the skeletal remains of a full term fetus being found in situ in the region of the lower abdomen/pelvis. Additionally, a well healed fracture of the right tibia and fibula of the mother was associated with a shortening of the affected limb and a possible distortion of the vertebral column. It is suggested that post traumatic deformity contributed to obstetric difficulties that were evidently fatal for both the fetus and its mother.

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## ROTATOR CUFF ENTHESOPATHY IN ARCHAEOLOGICAL SKELETONS: A POSSIBLE INDICATOR OF OCCUPATIONAL STRESS

B. Connell and C. J. Knüsel, University of Bradford

Pathological lesions thought to be due to rotator cuff tear were studied in two series of medieval skeletons from Gloucester and Chichester, England. These changes were quite common, particularly in females. The data demonstrate significant variation in the elements of the cuff involved and the side affected, and an association with bony acromial morphology. These patterns are considered to be the result of occupational activity due to the high prevalence of cuff enthesopathy in younger age groups. Modern clinical evidence suggests an occupational or overuse factor in the pathogenesis of this defect. This study attempts to assess how useful enthesopathies are as indicators of occupational stress, and focuses on the rotator cuff mechanism (and related structures) as this area is susceptible to repeated occupational and traumatic stresses. It is also suggested that the non-metric trait acromial articular facet is an enthesopathy in the coracoacromial ligament and not a genetically controlled variant.

## BILATERAL POSTAXIAL POLYDACTYLY OF THE FOOT IN A SALADO INFANT

Rebecca J. Hill and D. Troy Case, Arizona State University

Remains of an infant exhibiting supernumerary toes in the form of Y-shaped fifth metatarsals were recovered from an AD 1300-1450 Salado cemetery (AZ:U:3:49 [ASU]). The presence of supernumerary digits on the hands or feet is called polydactyly, and is among the most common congenital malformations in modern populations, occurring in Native Americans at a frequency of approximately 0.25%. Bilateral postaxial polydactyly of the foot can occur as an isolated anomaly, but is also a component of many syndromes. These syndromes are frequently associated with congenital heart disease, which may explain the death of this infant. Infanticide seems unlikely, as the body was formally interred with grave goods, an uncommon practice with infanticide cross-culturally. Postaxial polydactyly is known from four other prehistoric sites in the Southwest. The authors believe this case to be the first polydactylous infant and the first bilateral example of Y-form postaxial polydactyly reported from an archaeological sample.

## ANALYSIS OF THE DENTAL HEALTH OF A NINETEENTH CENTURY POORHOUSE SAMPLE FROM ROME, NEW YORK

Joan D. Merriman, SUNY Binghamton

Analysis of dental health in a skeletal population can be a good indicator of general health, diet, socioeconomic status, and level of health care. The Oneida County

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Poorhouse skeletal collection provides information on all these fronts, presenting a high number of caries, a great deal of antemortem tooth loss, substantial evidence of infection and alveolar resorption, and little evidence of dental care. Information on all these indicators are presented, as well as a discussion of evidence of changes in the temporomandibular joint commensurate with poor dental health and antemortem tooth loss. The population is compared with other nineteenth century skeletal populations, including other poorhouse residents, civil war soldiers, and wealthy landowners. The skeletons are placed in context with a description of postcranial pathology indicating a high level of health stress for this very marginal population.

#### AN EXPERIMENTAL ANALYSIS OF A REPORTED TREPHINATION FROM THE MIDDLE WOODLAND PERIOD IN SOUTHERN ILLINOIS

Elizabeth Pennefather-O'Brien, Indiana University

This study will reevaluate a reported case of trephination from a southern Illinois Hopewell site. In 1952, Neumann and Fowler reported a unique case of trephination on the calotte of individual Wh<sup>o</sup>7-9, an adult male from the Ethel R. Wilson Site in White County. This lesion occurs on the anterior portion of the left parietal, immediately superior to the squamosal suture. Initially, Wh<sup>o</sup>7-9 will be thoroughly cleaned to eliminate all adhering residue. The cut edges from Wh<sup>o</sup>7-9 will be both macro- and microscopically compared to cut edges produced through controlled experiments on cadavers and archaeological material of unknown provenance. Edges from both Wh<sup>o</sup>7-9 and the experimental pieces will be examined under SEM. Initial examination of cut edges on Wh<sup>o</sup>7-9 does not support Neumann and Fowler's trephination hypothesis. The placement of the trephination under the temporalis muscle is also inconsistent with other trephination examples (*cf* Peru).

#### AN ISOLATED EXAMPLE OF 'CLUB FOOT' DEFORMITY FROM A ROMANO-BRITISH CEMETERY AT GLOUCESTER, ENGLAND AND THE CURRENT EVIDENCE FOR TALIPES IN PALEOPATHOLOGY

Charlotte Roberts, University of Bradford

Club foot is a deformity where the foot is permanently twisted at the ankle joint, resulting in the sole no longer resting on the ground when standing. The foot may be twisted in four directions, and the deformity can be present at birth or develop later in life. An example of club foot is presented in a young adult female from a Roman-British (4th century AD) site in Gloucester, England. The burial, one of fifty in the cemetery, displayed abnormalities in the left leg including the tibia, fibula, talus, calcaneum, and metatarsals. This skeleton is presented and evidence for the condition reviewed.

**A FUSED FEMUR AND TIBIA FROM WYALUSING  
MOUNDS, WISCONSIN**

Shirley J. Schermer, The University of Iowa

A fused femur and tibia were among remains collected by Captain Hall in 1880 from mounds along the Mississippi River. The morphology of the tibia was intact, although somewhat small in size. Epiphyses were fused. The femur was shortened in length and the distal two-thirds had lost its morphological character. A lytic lesion was present in the bridged area between the two bones. Bone fracture with healed osteomyelitis or septic arthritis are suggested causes.

**VARIATION OF THE ARTICULAR SURFACES OF THE THIRD  
METATARSAL AND THE LATERAL CUNEIFORM IN A PREHISTORIC  
SKELETAL POPULATION: PATHOLOGY OR DISCRETE GENETIC  
TRAIT?**

Alicia Wilbur, Indiana University

The third tarsometatarsal joint is found to exhibit a minor variation in a significant number of individuals in a prehistoric skeletal population from the Illinois Valley. The variation affects the lower portion of the articular surfaces of the third metatarsal and the lateral cuneiform, and may indicate ossification of the third plantar tarsometatarsal ligament, or perhaps an anomalous interarticular ligament with concomitant resorption pitting and exostosis of the inferior margins. Manifestation of this trait appears to be independent of size, age and sex, and has also been noted in a biologically related but temporally distant skeletal population. It is hypothesized that a unique pathological variation or a discrete genetic trait is represented in the third tarsometatarsal joint of this population.

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ADDRESSES OF SPEAKERS

- Agelarakis, A, Dept of Anthropology, Adelphi University, Garden City, NY 11530  
Anderson, LS, Dept of Anthropology, Tulane University, New Orleans, LA 70118  
§Arriaza, B, Dept of Anthropology, Univ of Nevada Las Vegas, Las Vegas, NV 89154-5012  
Baker, JE, Dept of Anthropology, Texas A & M University, College Station, TX 77843-4352  
Barnes, E, 320 North Parkwood, Wichita, KS 67208  
Boylston, A, Dept of Archaeological Sciences, Univ of Bradford, Bradford, West Yorks BD7 1DP, UK  
Bueschgen, W, Dept of Anthropology, University of South Carolina, Columbia, SC 29208  
Buikstra, JE, Dept of Anthropology, University of New Mexico, Albuquerque, NM 87131  
Carlson, KJ, Dept of Anthropology, Indiana University, Bloomington, IN 47405  
Carr, M, Hampshire College, Box 250, Amherst, MA 01002  
\*Chamberlain, AT, Dept of Archaeology & Prehistory, Univ of Sheffield, Sheffield S1 4ET  
¶Connell, B, Dept of Archaeological Sciences, Univ of Bradford, Bradford, West Yorks BD7 1DP, UK  
¶Crossley, B, Palaeopathology Study Group, Bristol Royal Infirmary, Bristol BS2 8HW, UK  
Guillén, S, Centro Mallqui, Ilo, Peru  
Hanson, CL, Dept of Anthropology, University of Alaska Anchorage, Anchorage, AK 99508  
Hill, RJ, Dept of Anthropology, Arizona State University, Tempe, AZ 85287-2402  
Jurmain, R, Dept of Anthropology, San Jose State University, San Jose, CA 95192  
Knüsel, CJ, Dept of Archaeological Sciences, Univ of Bradford, Bradford, West Yorks BD7 1DP, UK  
Lillie, RM, Office of the State Archeologist, Univ of Iowa, 14 Eastlawn Bldg, Iowa City, IA 52242  
Marks, MK, Dept of Anthropology, University of Tennessee, Knoxville, TN 37996-0720  
Merbs, CF, Dept of Anthropology, Arizona State University, Tempe, AZ 85287-2402  
Merriman, JD, Dept of Anthropology, SUNY Binghamton, Vestal, NY  
Miller, E, Office of Repatriation, MRC 138, Smithsonian Institution, Washington DC 20560  
Nagy, B, Dept of Anthropology, Arizona State University, Tempe, AZ 85287-2402  
Ortner, DJ, National Museum of Natural History, Smithsonian Institution, Washington DC 20560  
Pennefather-O'Brien, E, Dept of Anthropology, Indiana University, Bloomington IN 47405  
Ragsdale, BD, Cunningham Pathology Associates, 1801 1st Ave South, Birmingham, AL 35233-1935  
Roberts, C, Dept of Archaeological Sciences, Univ of Bradford, Bradford, West Yorks BD7 1DP, UK  
Rosado, MA, Rowan College of New Jersey, 201 Mullica Hall Rd, Glassboro, NJ 08028-1701  
Rothschild, BM, Arthritis Center of Northeast Ohio, 5701 Market, Youngstown, OH 44512  
Sandford, MK, Dept of Anthropology, Univ of NC at Greensboro, Greensboro, NC 27412  
Schermer, SJ, Office of the State Archeologist, Univ of Iowa, 14 Eastlawn Bldg, Iowa City, IA 52242  
Schultz, M, Zentrum Anatomie, Univ of Göttingen, Kreuzberggring 36, D-37075 Göttingen, Germany  
Standen, V, Museo San Miguel de Azapa, Universidad de Tarapacá, Arica, Chile  
Suchey, JM, 2200 Braeburn Ave, Fullerton CA 92631  
Weaver, DS, Dept of Anthropology, Wake Forest University, PO Box 7807, Winston-Salem, NC 27109  
Wilbur, A, Dept of Anthropology, Indiana University, Bloomington IN 47405  
Wright, L, Dept of Geology, McMaster Univ, 1280 Main St W, Hamilton, Ontario L8S 4M1, Canada  
Zias, J, Israel Antiquities Authority, POB 586, Jerusalem, Israel.

¶ Not at meeting, paper or poster presented by co-author

\* Not at meeting, poster presented by non-author

§ Second author, presenting paper

Committee for the 23rd Annual Meeting

Bernardo Arriaza  
Elizabeth Miller  
Bruce Ragsdale  
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Eve Cockburn

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