

15 April 1978

PAPERS AND EXHIBITS ON PALEOPATHOLOGY

presented at the

Annual Meeting

of the

Paleopathology Association

Academy of Medicine

Toronto, Canada

## THE ORIGIN AND ANTIQUITY OF TREPONEMATOSIS IN THE PRE-COLUMBIAN NEW WORLD

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Regarding the origin of treponemes in the New World, three hypotheses have been advanced: 1) that the disease was endemic both in the New and the Old World before European contact; 2) that the treponemes indigenous to American Indian natives were carried to Europe by the sailors of Columbus on their return; 3) that the place of origin was in Europe, and that the disease was brought to the New World by Europeans. In addition, there are two other problems: first, the documentation in dry bone of accurately diagnosed cases of the various types of treponemal infections, and second, the problem of establishing precise dating by which it can be known for sure that the skeletal remains are of the precontact period.

In reviewing the literature, there is no doubt in the author's mind that some form of treponemal infection(s), as evidenced in the human skeletal remains of American natives, did exist prior to European contact. Evidence of treponemal infections comes from various parts of the New World, including Peru, Mexico, the South and Southwest of the United States, the Ohio Valley and Puerto Rico. All reported cases are dated before 1500 A. D. That treponemal infection(s) could also have existed in Europe and other parts of the Old World is a strong possibility that cannot be ruled out. The lack of evidence in the bones recovered so far, however, indicates that a less virulent type of infection(s) may have been present in the Old World. There is also the absence of references in writings before the end of the fifteenth century to a disease like venereal syphilis as known at present, and statements that it was then a new disease.

## NATURAL VARIATION OF LESIONS IN SKELETAL TUBERCULOSIS

M. A. Kelley, Case Western Reserve University

Skeletal lesions caused by tubercle bacilli may be diverse in form and severity. Factors affecting their appearance are age, sex, host resistance and strain virulence. Many reports have stressed the importance of vertebral collapse for diagnosis of tuberculosis. While this practice is useful in some cases, there are several drawbacks: 1) approximately fifty per cent of the cases involve extra-vertebral regions; 2) not all tuberculous lesions settling in the spine lead to collapse; 3) more than

a dozen diseases produce collapse or lesions similar to spinal tuberculosis. Clearly, the paleopathologist must be well-versed in such variations as early stage manifestations of the tubercle bacilli in bones and joints and the patterns of multiple lesion cases. From the Todd collection housed at the Cleveland Natural History Museum, twenty-six documented cases of skeletal tuberculosis were examined for these criteria. Some early changes commonly encountered were decalcification of the involved bones (especially the anterior portion of vertebrae), and pitting of the articular cartilage in extra-vertebral joints. Bilateral joint involvement was rare and periostitis peripheral to extra-vertebral joints was common. Observations concerning the frequency of multiple lesions showed that: 1) nine out of ten cases involving the ribs also displayed vertebral lesions; 2) three out of seven weight-bearing joints were associated with spine involvement. While these figures may not be representative of past or present populations, they do support the application of multiple lesion patterns to diagnosis.

## AN EXPERIMENTAL BASE FOR PALEOPATHOLOGIC DIAGNOSIS

M. R. Zimmerman, University of Michigan

The difficulties of diagnosis of pathologic conditions are immensely magnified when the subject of a postmortem examination has been post-mortem for several hundreds to thousands of years. Artifacts of decomposition and bacterial and fungal invasion are compounded upon those of rehydration when mummified tissue is examined. As an approach to these problems, a study of the changes seen in experimentally mummified and rehydrated tissues was undertaken. Normal and pathologic tissues were studied in comparison to sections prepared from the fresh tissue.

The experimentally mummified tissues were generally similar to, but somewhat better preserved than, actual human mummies. There was organ and tissue specific variability in preservation, and different classes of pathology likewise showed differential preservation. Inflammatory reactions were not very well-preserved, although infecting micro-organisms were easily identified. Degenerative processes such as atherosclerosis and others featuring the accumulation of abnormal products were well preserved, while necrosis, as in acute myocardial infarction, was not. Malignancies were particularly well preserved. The implications of these findings for previous and future mummy studies will be discussed in terms of our understanding of the evolution of disease processes.

## OCHRONOSIS CHEMICALLY PROVED IN AN EGYPTIAN MUMMY

F. A. Stenn, Northwestern University Medical School

Ochronosis is a rare inborn error of metabolism occurring in the degradation of tyrosine and phenyl alanine. The specific genetic defect is the absence of the enzyme homogentisic acid oxidase. It is the accumulation of homogentisic acid that causes the dark pigment in the connective tissues and the arthritis. Alkaptonuria is a term applied to the dark urine that occurs in these patients. Some six hundred cases have been reported.

X-rays of the intervertebral discs of an Egyptian mummy dating from 1500 B. C. revealed linear calcification and narrowing of the hip and knee joints. Biopsy cores from the right hip showed black cartilage at the articular surfaces. The black pigment was extracted, analysed, and compared to an air-oxidized homogentisic acid polymer. The two substances were identical. The chemical evidence thus confirms the x-ray diagnosis of ochronosis.

## PALEOPATHOLOGICAL EVIDENCE FOR THE EVOLUTION OF RHEUMATOID ARTHRITIS

L. Klepinger, University of Illinois

One of two Hellenistic period (330-210 B. C.) skeletons from the Sicilian archaeological site of Morgantina exhibits a pattern of articular disease atypical of any described in the modern clinical or paleopathological literature. The pathological pattern is quite bewildering, but can be interpreted in light of Short's hypothesis on the recent appearance of rheumatoid arthritis. Short argues that rheumatoid arthritis probably developed out of the more ancient disease, ankylosing spondylitis. One explanation of the Hellenistic skeleton is that it represents a stage in the evolution of rheumatoid arthritis out of the parent disease, ankylosing spondylitis.

## LIGHT AND ELECTRON MICROSCOPIC STUDIES ON TISSUE FROM ELMER MCCURDY

T.A. Reyman, Mount Carmel Mercy Hospital, Detroit  
and P. Horne, Banting Institute, Toronto

Elmer McCurdy was a train robber who died from a gunshot wound to the chest inflicted by a sheriff's posse in 1911. His body was embalmed in a solution of arsenic, and finally became mummified through the years (PPA Newsletter, No. 19, September 1977). When finally discovered in a sideshow near Los Angeles, California, in the spring of 1977, the body was claimed by Dr. Thomas Noguchi, Medical Examiner, County of Los Angeles, who provided us with the tissue specimens. Dr. Clyde Snow (Forensic Anthropologist, Civil Aeronautics Board, Oklahoma City) succeeded, through extensive investigative efforts and records research, in identifying the body as that of Elmer McCurdy.

The tissue from various sites was analysed by Dr. Ralph Smith (Ann Arbor, Mich.) and was found to contain very high levels of arsenic. The tissue showed very good histological detail, which included recognizable intact red and white blood cells, tissue cell nuclei, neurons in the brain, cross striations and nuclei in cardiac and skeletal muscle, fat, bone, nerves, and other tissue components. The lungs showed hemorrhage and alveolar collapse consistent with a gunshot wound to the chest. Skeletal muscle from the leg showed encysted Trichinella spiralis (Trichinosis). Focal arteriosclerosis was noted in one artery. The electron microscopic studies not only corroborated these findings, but revealed the presence of intact, recognizable subcellular organelles such as mitochondria, endoplasmic reticulum, tonofilaments, desmosomes, pigment, and nucleoli in the preserved nuclei.

## THE DIAGNOSIS OF 'SYPHILIS' IN AMERINDIAN BONES: METHODOLOGICAL AND HISTORICAL COMMENTS

C. N. Cassidy, Smithsonian Institution

Paleopathology aims to discover and analyse pathological entities of past populations, and to put these into historical perspective. The latter activity means to consider the evolutionary history of diseases; too often it has been interpreted to mean that past diseases must be identified with some extant disease. This is doubly troubling: it ignores the possibility of evolutionary change and it encourages concentration on diagnosis

instead of on descriptive analysis. Especially where argument (as about origin or spread) exists, this bias can result in incomplete analysis and precipitate diagnosis. Accumulating evidence suggests this methodological error explains a considerable proportion of diagnoses of 'syphilis' in Amerindian bones.

Componential analysis of 42 articles describing observations of disseminated periosteal reactions (DPR: author's term) in the bones of ostensibly pre-Columbian Amerindians (1878-1978) indicated 25 (60%) of authors labelled DPR 'syphilis'. Early authors were cautious; writers of the 1930s emphatic. Since 1950 more authors have selected non-syphilis diagnoses (9/16). With the partial exceptions of several studies written after 1957, there have been no thorough analyses of DPR as an entity unto itself. Current information suggests numerous points where DPR and syphilis (sensu strictu) are not similar enough to permit mutual identification.

The methodological moral is that diagnosis should be a late endeavor in paleoanalysis. It should be preceded by thorough analysis of the prehistoric syndrome (so entitled until good evidence permits the label disease), including descriptions of its morphology, topography and epidemiology.

## PROBLEMS IN DIAGNOSIS: A SLIDE REVIEW

J. L. Angel, Smithsonian Institution and F. G. Gilkey, Denver

Dr. Angel: Lytic pits of early tuberculosis in vertebral bodies of 19-20 year olds have reactive rims: is kyphotic fused collapse of T2-11 in an Early Iron Age Greek girl of 16-19 more likely tuberculosis or a fungal infection (blastomycosis)? Is spindling atrophy of all distal metatarsals in an Early Bronze male probably leprosy? Is reactive periostitic wavy thickening of cortex (skull, tibia) in prehistoric Florida or Ecuador what divides treponemal from other bacterial cause? Gallstones persist in the ground as well as bone does (example from Mycenae). In Kentucky and Peru, metastatic carcinoma begins before 2,000 B.C. In long-bone swelling in a 3 year old Classic Macedonian, is cortical thickening from renal rickets, Barlow's disease or (as locally claimed) thalassemia? How do we distinguish four arthritides (infectious, rheumatoid, hypertrophic and inflammatory)? Slides are shown to illustrate the points at issue.

Dr. Gilkey: Slides include a variety of lytic lesions of various bones.

Clinically diagnosed blastomycosis caused predominantly lytic lesions with mild to moderate subperiosteal reactive bone, except for a longitudinally streaked patch on one tibia that strongly resembles syphilis. A series of skulls with naso-palatal-pharyngeal destruction were contrasted. The diagnoses included: probable syphilis ('bored-out' nose in a middle-aged woman who died of aortic insufficiency), probable nasal malignancy (differential diagnosis: nasopharyngeal carcinoma, ethmoid sinus carcinoma, esthesioneuroblastoma, lymphoma, and Wegener's granulomatosis--lethal midline granuloma), cleft palate, and a case with features of all of these. Marked destruction of the posterior surface of the manubrium pointed strongly to syphilis in another individual who died of aortic insufficiency and who had long bone subperiosteal reaction consistent with syphilis.

## POST MORTEM FOR AN EMPIRE

F. P. Saul, Medical College of Ohio

The great Maya empire of Mexico and Central America collapsed at least 500 years before the arrival of Columbus in the New World. In an effort to determine the 'cause of death', I have studied most of the human skeletal remains recovered from the Maya area by Harvard and Cambridge University expeditions and others. In particular, I have searched for indications of trauma that might be due to invasions. I have found few such indications, and have strong indications of genetic continuity. A great variety of disorders is present, including much dental decay, as well as examples of congenital dysraphism, sinusitis, ankylosed sacroiliac joints, deformed nasal septa, osteomyelitis, etc. The most interesting for historians and medicine are those lesions (cranial 'caries sicca'?, 'saber shin' tibia) that potentially relate to treponemal infections, inasmuch as the remains are definitely pre-Columbian in date (ca 600 B.C. to 930 A.D.).

However, I believe that the most significant findings are those lesions that pertain to anemia (spongy/porotic hyperostosis crania), childhood growth arrests at the time of weaning (linear dental enamel hypoplasia), and even scurvy (ossified subperiosteal hemorrhages in conjunction with periodontoclasia), suggesting that the basic ecological and cultural setting, as well as food supply problems due to increasing construction of ceremonial centers, set the scene for the eventual collapse of the Maya civilization. Continuity in regard to present day health problems (especially involving disease) and a secular decrease in Maya body size from 5,000 to 3,000 B.C. to the present are demonstrated.

## THE AUTOPSY OF JOHN PAUL JONES

P. Horne, Banting Institute, Toronto

One of the most fascinating manhunts in history was the search for the body of American admiral John Paul Jones. Discovered at long last in 1906 by General Horace Porter, U.S. Ambassador to France, the mummified body had lain for over a century in an unknown and unmarked grave in Paris. General Porter spent five years searching for the body, and even after the correct cemetery was identified, three coffins had to be opened before the right one was found. 'The body was marvelously well preserved, all the flesh remaining intact but slightly shrunken and of a grayish-brown or tan color... The face presented a natural appearance... broad forehead, high cheekbones, prominently arched eye orbits and other points of resemblance.'

The body was taken to the Paris École de Médecine for thorough scientific examination by the top anthropologists and pathologists of France. An opening was made in the back to explore the thoracic cavity and viscera inside: a quantity of alcohol ran out. 'The left lung showed a spot which was clearly the result of an attack of pneumonia. It had healed, but remained surrounded by fibrous tissue.' This relates to what we know of his condition before death from contemporary medical records. In addition, just before his death he grew yellow and showed symptoms of jaundice: during the autopsy, it was recorded that in the kidneys 'the vessels at several points had their walls thickened and invaded by sclerosis. A number of glomeruli were completely transformed into fibrous tissue... microscopic proof that Jones died of chronic renal affection.'

## WHOLE BODY SCAN OF AN EGYPTIAN MUMMY USING X-RAY COMPUTED AXIAL TOMOGRAPHY

P.K. Lewin, Hospital for Sick Children, Toronto

Computerized tomography (CT scan) has revolutionized contemporary radiological examinations. In this radiological technique, the object to be examined is exposed to a series of sequential x-ray exposures from different angles, the x-ray source rotating around the object in a clockwise direction. The varying relationships of the x-ray pictures on the internal structures are then resolved in a computer to yield a representation of the structures in two dimensions.



The application of this technique to medical archeology was pioneered by Lewin and Harwood-Nash in 1977 (Paleopathology Newsletter No. 17, March 1977). In November 1977, through the courtesy of Dr. N. Millet, Curator of the Egyptian Department of the Royal Ontario Museum, the beautiful mummy of the priestess, Djema 'Etes' Ankh, dating from about the ninth century B.C. and still intact in its cartonnage, was fully examined by CT scan. The examination was performed by Dr. Harwood-Nash at the Hospital for Sick Children. Superb detail was obtained of the mummy within its cartonnage.

Tomographic sections of the head showed prothetic artificial eyes set in the eye sockets. The cranial cavity was stuffed with linen wadding and bandages, the brain having been removed through the right nostril and cribriform plate of the skull, which was fractured. Sections through the pelvis showed normal hip joints, and within the pelvic cavity remains of the uterus could be observed. Various religious artifacts were enclosed in the mummy wrapping, as was a gold plate on the left flank of the abdomen.

This is the first report of a mummy exposed to total body scan by computerized tomography. This technique is invaluable in the examination of mummies and their internal structures without destroying them.

#### THE AUTOPSY OF AN EGYPTIAN MUMMY (Film)

Produced by the Academy of Medicine, Toronto.  
Directed by G.B.Hart. Written and narrated by J. Senior. Photography by F.Hall and I.Wahn

This film, which runs 25 minutes, is a detailed account of the autopsy and its results. It begins with scenes that show the mummy in its case, discuss the provenance, the writing on the coffin and its accession to the Royal Ontario Museum. It then goes on to show pre-autopsy procedures, the actual autopsy (conducted by a joint Canadian - U.S. team, with most of the members drawn from the Paleopathology Association), and the work that followed in various laboratories. The finds depicted include a tapeworm, Taenia, Schistosoma haematobium, and a cyst of Trichinella spiralis. The film is basically a handbook of an autopsy, and may provide useful guidelines for future attempts at examining ancient bodies.

## ELECTRON MICROSCOPY APPLIED TO ANCIENT SPECIMENS (Display)

J. M. Riddle, Ford Hospital, Detroit

The objective of this exhibit is to demonstrate the range of information that can be obtained when ancient specimens are viewed with the transmission electron microscope and the scanning electron microscope. Peripheral blood elements from PUM III, a female Egyptian mummy, were studied, using methodology that was specifically designed to permit light microscopy and both types of electron microscopy to be performed on the same tissue section. The surface features and interior morphologies of the ancient blood cells were identical to their modern counterparts. Insects from several mummies were surveyed, using scanning electron microscopy. A dermestid larva, a blowfly larva and a beetle were viewed and classified by using the morphologic features displayed in the third dimension.

Finally, the weaving patterns and fibers from the wrappings of Egyptian mummies, as well as several Peruvian funeral blankets, were studied three-dimensionally. Individual fibers of flax and cotton were identified as the basic material from which these wrappings were constructed. Electron microscopy was demonstrated to be a useful avenue for investigation, capable of adding another dimension to our understanding of a variety of ancient specimens.

## OSTEITIS OR BONE INFLAMMATION AND THE QUESTION OF PRE-COLUMBIAN SYPHILIS (AND/OR YAWS) AMONG THE MAYA (Display)

F. P. Saul, Medical College of Ohio

Cranial lesions vary from the isolated marked stellate pits or craters (shown in the external frontal bones of an adult male from the Altar de Sacrificios, 600 - 300 B. C.) to the more continuous pitting and cratering (caries sicca?) that cover the frontal and parietal bones of an adult female from the same area (754 A. D.). Unfortunately, the latter case is complicated by the possibility of postmortem damage by insects and/or roots. Post-cranial lesions found in various bones (ulna, radius, femur, fibula) involve varying degrees of enlargement or thickening of the cortical or dense outer layer of the diaphysis or shaft, together with varying degrees of distortion. The most distinctive combination of enlargement and distortion occurs in the tibia, and involves an anterior thickening of the cortex that, together with an anterior-posterior bowing, results in a

deformity that has been called 'saber shin' tibia (specimens from the Altar de Sacrificios and Seibal, dated between 550 and 950 A.D.).

Inflammation is a general category involving enlargement and deformation of bone in response to various external stimuli, including both infectious disease and trauma or injury, sometimes in conjunction, as well as various internal disorders. Most authorities distinguish between periostitis or inflammation of the periosteum or outer bone, and osteomyelitis or involvement of the marrow and other deeper tissues. The majority of the Maya specimens seem to emphasize periostitis.

Thus it can be said that several Maya, definitely pre-Columbian in date, present osteitic lesions on their crania and long bones that are very reminiscent of syphilis or yaws as seen today.

#### MASTOIDITIS IN PRE-COLUMBIAN AMERICA (Display)

R. A. Tyson, San Diego Museum of Man

Three x-rays were shown to illustrate a unique specimen from the San Diego Museum of Man, which has been discussed in previous issues of the Paleopathology Newsletter (No. 20, Dec. 1977, p.4 and No. 21, March 1978, p.2). The bone (No. 44 from the Hrdlička Collection) is a prehistoric skull fragment from Lomas, Peru; it is from a male, and shows an abscess that perforates outward as well as inward. This is one of the very rare examples of ear disease in pre-Columbian America.