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## NUTRITIONAL STRESS MEASURED BY SKULL BASE AND PELVIS: A NEW METHOD

L.M.Olney, National Geographic Society

Skull base differs significantly between two samples of Americans: one whose childhood centred on the period from 1880 to 1903 (Terry Collection), and the other whose childhood centred on the period from 1928 to 1944 (mostly from law enforcement agencies). Pelvic inlet index and stature of these samples differ similarly. Skull base height is measured with a sliding caliper held with two ends resting on auricular surfaces as the meati, and a depth gauge measuring the distance between basion and the upper edge of the caliper.

## SKULL BASE AND PELVIC CHANGE FROM PALEOLITHIC TO MODERN TIMES

J.L.Angel, Smithsonian Institution

Skull base and pelvic inlet, like stature (N=1500 - 2000), reduce height significantly from Paleolithic meat and herb to Early Neolithic cereal diet (with phytate?), 5,000 years later rise in Classic Hellenistic times in Greece (olives, grapes, better wheats, fish, eggs), fluctuate, then rise with modern varied diet (U.S.A.), fitting our hypothesis (Olney and Angel) that skull base height (porion-basion) and pelvic inlet depth index sensitively measure nutritional status, as does stature. Exceptions (Mesolithic and Anatolian E. Br. short stature but high skull base, royal Myceneans extra growth, etc.) show different growth timing for each, responding to different protein, vitamin, caloric, genetic and mechanical forces.

## BONE MINERALS, NUTRITION AND SOCIAL FACTORS IN THE ANCIENT EASTERN MEDITERRANEAN

S.C.Bisel, Smithsonian Institution

Data for three Hellenistic Period sites, Tel Michal, Dhema and Athens, were obtained by bone and soil mineral analyses (Ca, P, Sr, Zn, Mg, Cu). Dietary and social implications were inferred. All three sites consumed relatively large amounts of red meat (low site-corrected Sr levels). Athens and Dhema consumed leavened bread (normal Zn levels), and Tel Michal unleavened (low Zn levels). Immigration of adults probably did not occur at Tel Michal (uniform Mg levels), and may have occurred at the other two sites (variation in Mg levels).

## BONE STRONTIUM AND DIET IN MESOLITHIC EAST MEDITERRANEAN

A.Sillen, Smithsonian Institution

Dietary considerations are particularly important in explaining the transition from hunter/gatherer to food production that took place in the near east ten thousand years ago. Currently available techniques for inferring paleo-diets provide conflicting information on the proportion of meat/vegetables as late as Epi-Paleolithic hunter/gatherers. The contribution of strontium technique to this issue is assessed in a pilot study on one Natufian site (Hayonin Cave). The measurement of Sr/Ca ratios of faunal and human bones may provide relevant new information on the subsistence of this era.

## SKELETAL LEAD CONTENT AS A PREDICTOR OF SOCIAL VARIANCE IN A COLONIAL AMERICAN POPULATION

A.C.Aufderheide, University of Minnesota (Duluth)

Archaeological and historical evidence suggested that two social groups (owners and laborers) on an early colonial American plantation (1670 - 1730) had vastly different quantities of lifetime ingested lead; measurement of their skeletal lead content confirmed these expectations with a specificity sufficient to predict the social role of each studied individual more accurately than could age, race, or sex.

## HOMO ERECTUS AND HYPERVITAMINOSIS A: A TWO MILLION YEAR OLD CASE

M.R.Zimmerman, Hahnemann Medical College Hospital

A nearly complete Homo erectus skeleton found in Koobifora, Kenya showed a diffuse diaphyseal deposit of coarse woven bone, overlying an otherwise normal and well preserved cortex. A striking histologic feature, seen in thin ground sections, was enlargement of the osteocytic lacunae.

The gross morphology and histologic appearance of these lesions are similar to those seen in modern patients suffering from chronic hypervitaminosis A. The differential diagnosis includes hypervitaminosis D, abnormal parathyroid function, scurvy, syphilis, infantile cortical hyperostosis, Engelmann's disease, fluorosis, van Buchem's disease, and smallpox osteomyelitis, all of which differ in specific features from hypervitaminosis A.

A diet rich in liver could result in a vitamin A overload, and such a diet may have been the case for H. erectus, an early hominid in the beginning and somewhat experimental meat eating phase of human evolution.

## SUBADULT OSSUARY IN A CHULTUN AT CHICHÉN ITZÁ, YUCATÁN

L.M. de González, Instituto Nacional de Antropología e Historia, Yucatán,  
and R. Harrington, University of Arizona

A subadult ossuary found in the archaeological zone of Chichén Itzá was studied from a paleopathological point of view to determine the general conditions of life, and in particular the health of a Maya late Classic subadult population. The investigation consisted of an inventory of bones to determine the minimal number of individuals represented in the collection, their distribution by age group, the relative incidence of diseases identified in the remains, and a radiological analysis of the incidence of lines and bands of increased density in the long bones in order to obtain the morbidity index. The results of the analysis can be interpreted in two ways, one with socio-cultural implications (a collective child sacrifice) and the other in epidemiological terms.

## THE ANTIQUITY OF PAGET'S DISEASE IN THE MAYA AREA

F.P.Saul, A.J.Christoforidis and J.M. Saul, Medical College of Ohio,  
D.C.Cook, Indiana University and J.T.Benitez, William Beaumont Hospital

Ancient cases of this well known but little understood disorder are very rare, perhaps because few ancient individuals reached the required late age of onset seen in modern cases. This individual, probably a middle-aged male, was originally listed as non-human (owing to the deformed nature of his bones) when he was found by a Harvard University expedition to Barton Ramie, Belize. He has been dated to ca 800-1,000 A.D. The remains include his neurocranium, mandible, both humeri and clavicae and miscellaneous fragments. It is the late or 'burned-out' stage of the disease that seems to be represented here, rather than the better known 'wooly' or light and porous early stage, inasmuch as the bones, although thickened (2 cm thick in the vicinity of Bregman), are also well mineralized and sclerotic. Preliminary histologic studies of bone from the skull (by DCC) and gross studies of an incus (by JBB) support the strong possibility that this may be the only good example of this disorder in ancient Meso-America and perhaps in the entire New World.

## THE NATIONAL ACADEMY OF MEDICINE (MEXICO) HISTORY OF MEDICINE PROJECT

L.A.Vargas, Instituto de Investigaciones Antropologicas, U.N.A.M.

*This project is a major interdisciplinary undertaking that has brought together anthropologists, medical specialists, and others in order to prepare a definitive history of medicine in Mexico. Activities to date have ranged*

from the reprinting of out-of-print sources, on through the collecting of oral histories obtained from tradition practitioners, as well as modern medical authorities. The first of a series of volumes will soon be published, and it contains several chapters of interest to paleopathologists.

## TREPONEMATOSIS IN COLONIAL MEXICO

T.A.Cockburn, Paleopathology Association and L.M.de González, Instituto Nacional de Antropología e Historia, Yucatán

In order to rebuild foundations (and without the knowledge of physical anthropologists), six tons of Colonial period burials spanning three centuries were bulldozed from beneath the National Cathedral of Mexico City. This heap of mixed and broken skeletal material was then handed over to the Department of Physical Anthropology in Mexico City. After considerable sorting and counting of long bones (minimum number of adults 2397), LMdeG settled on the large sample of pathologic long bones for her thesis project. Pathology found includes fractures, osteoarthritis, congenital malformations, Paget's disease, ossified sub-periosteal hemorrhages, and a surprisingly large quantity of treponematosi. Information gained from research into the cultural context of these bones, combined with their pathology, provides an interesting picture of Colonial sexual mores of the elite persons who were buried in the National Cathedral.

In view of the success of demonstrating malaria antigens in mummy ROM I , using the indirect fluorescent antibody test, attempts will be made to do the same for treponemal antigens in the syphilitic bones. A positive result would encourage the use of this test for many infections.

## MAYA PALEOPATHOLOGY 1981 (Display)

F.P.Saul, A.J.Christoforidis and J.M.Saul, Medical College of Ohio

This is an updated version of the display presented at last year's meeting. The basic categories of trauma, treponematosi, Paget's, scurvy, weanling disease and anemia have been retained, but expanded and new sections on cultural influences, pseudopathology, dental disease and variations, and tuberculosis have been added. New material ranges from unique engravings on teeth (ca 100-250 A.D.), on through saber shin tibiae (ca 450 B.C. - 250 A.D.), and lumbar vertebrae suggestive of tuberculosis (ca 1250 - 1350 A.D.). Photographs are accompanied by x-rays as appropriate.

The work was supported in part by the National Science Foundation, the National Geographic Society, and the National Institutes of Health.

## HISTOLOGY OF SIBERIAN MAMMOTH TISSUES\*

T.A.Reyman, Mount Carmel Mercy Hospital and M. Goodman, Wayne State University School of Medicine

Since 1977, three woolly mammoths have been discovered in northern Siberia: these are referred to as Magadan (Dima), Taimir (Khatanga), and Yuribei. Carbon dating has established the geologic ages of these animals as 40,000, 53,000, and 10,000 years old, respectively. Histologic studies revealed tissue preservation inversely proportional to the geologic age, the oldest being poorly preserved, and the youngest being quite well preserved. Most of the tissue was skeletal muscle and subcutaneous tissue. In the better preserved specimens, intact muscle fibers were noted with rare cross striations but no nuclei. In the poorly preserved tissues, even connective tissue was not well preserved, and stained irregularly. Most specimens had modest numbers of bacterial and fungal contaminants, with one specimen from the Yuribei mammoth revealing active growth of a phycomyces-like fungus in Ruffer's solution. This latter organism seems to be a modern contaminant, but the presence of these and other microorganisms dictates caution in the interpretation of other tests performed on these specimens.

\*Tissue samples received by Dr. M. Goodman from Drs. N. Vereshchagin, V. Mikhelson and Y. Ovchinnikov, U.S.S.R. Academy of Sciences.

## ISOLATION AND CHARACTERIZATION OF DEOXYRIBONUCLEIC ACID FROM THE TISSUE OF A WOOLLY MAMMOTH

P.H.Johnson, C.B.Olson and M.Goodman, Wayne State University School of Medicine

DNA has been isolated from airdried samples of tissue from the Yuribei and Hatanga mammoths, and from frozen tissue of the Magadan mammoth. The isolation procedure involved homogenization of tissue by high speed blending in low ionic strength buffers followed by repeated cycles of reaction with proteinase k in 0.5% sodium dodecyl sulfate (SDS), phenol extraction, and alcohol precipitation. A number of physical and biochemical techniques were used to characterize the resulting putative nucleic acid fractions:

- 1) Agarose gel electrophoresis and ethidium bromide staining demonstrated the presence of deoxyribonuclease sensitive material. DNA isolated from Yuribei mammoth tissue migrated as a heterogeneous population of fragments having a mean size of approximately 1,000 base pairs as determined by electrophoretic mobility relative to molecular weight standards.
- 2) Fluorescence spectroscopy showed that the mammoth DNA preparations produced emission and excitation spectra in the presence of the intercalating dye ethidium bromide indistinguishable from purified calf thymus DNA. Estimation of mammoth DNA concentration from absorption at 260 nm and

from ethidium bromide fluorescence enhancement were in good agreement.

3) Ultraviolet spectroscopy showed that the mammoth DNAs possessed anomalous UV spectra, each characterized by a local maximum at 260 nm, but unusually high relative absorption at 230 nm, 280 nm and visible wavelengths, compared to purified calf thymus or modern elephant DNAs. However, a fraction of the mammoth DNAs isolated by hydroxyapatite chromatography (see below) showed a normal UV spectrum.

4) Hydroxyapatite (HAP) chromatography at 60° in 0.12M phosphate buffer (PB) resulted in separation of two distinct fractions of mammoth DNA. Approximately 70% of the DNA did not bind HAP under these conditions, and was characterized by an anomalous UV spectrum. The 30% fraction that did bind HAP was eluted by 0.5 M PB and had a normal DNA UV spectrum.

5) All mammoth DNA preparations were found to be substrates for E. coli DNA polymerase I in an in vitro nick translation (DNA synthesis) reaction, and resulted in the incorporation of radioactive nucleotides to give labeled DNAs of high specific activity.

Thermal melting analysis of YUR DNA showed a cooperative profile characteristic of the helix to coil transition of double standard DNA. From the midpoint of the melting transition (T<sub>m</sub>) relative to viral DNA of known base composition, the base composition of modern elephant DNA (Elephas maximus) was calculated to be approximately 37% GC. DNA isolated from Yuribeī tissue had a T<sub>m</sub> one degree centigrade higher, corresponding to a base composition of approximately 39.4% GC.

6) Competition hybridization analysis is currently in progress to determine the nucleotide sequence relatedness between the DNA of modern elephant and that of DNA isolated from mammoth tissue.

## THE SPINE AND ISCHEMIC NECROSIS IN MODERN AND ANCIENT SKELETAL REMAINS

M.A.Kelley, University of Rhode Island

Skeletal collections are often useful for determining the frequency and distribution of lesions that otherwise go unnoticed in the living. This paper examines a rather common and usually asymptomatic spinal lesion, for which there is little medical literature available. In such cases, the anterior aspect of the lower thoracic and lumbar vertebrae display crescentic lesions suggestive of a form of ischemic necrosis known as intervertebral osteochondrosis. A total of 2196 skeletons from three early American Indian sites and one 20th century medical school cadaver population were examined for this lesion. Variables such as age, sex, weight, race, activity patterns and other biocultural information are considered in relation to the frequency of this lesion. In the American Indian samples, individuals in the third and fourth decades of life were most often affected, and modern whites and blacks were not affected until older ages. It is suggested that physical stress and degenerative changes are primarily responsible for these lesions.