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AN ANALYSIS OF DEVELOPMENTAL DEFECTS FROM THREE LARGE NORTH AMERICAN INDIAN SKELETAL COLLECTIONS

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This paper reports on twenty developmental defects arising in the human skeleton. These defects were analyzed in the light of possible environmental influences and genetic factors. The environmental variables included diet, water hardness, mineral deficiencies and physical stress. In all, 1937 prehistoric and protohistoric American Indians from three diverse settings were examined. The sites were: 1) the Indian Knoll, Kentucky; 2) Mobridge, South Dakota; and 3) the Grasshopper Ruins, Arizona. The incidence of three defects was found to be worthy of closer inspection --- sacral spina bifida, spondylolysis, and spondylolisthesis. The Indian Knoll material displayed the highest frequency for sacral spina bifida and spondylolisthesis, and the Mobridge sample exhibited the highest frequency of spondylolysis.

Based on reconstructions of the physical and cultural environments for each group, it is suggested that physical activity coupled with a genetic predisposition accounts for the observed differences in neural arch defect frequencies between sites. It is further suggested that the occurrence of sacral spina bifida is predominantly under genetic control, but may be influenced to some extent by such variables as zinc deficiency and water hardness.

ANCIENT CONGENITAL ANOMALIES FROM THE DAKOTAS: OUR EXPERIENCES

J.B.Gregg, University of South Dakota and University of Tennessee-Knoxville, L.J.Zimmerman, University of South Dakota and P.S.Gregg, Sioux Falls

Why, despite over 18 years work and the evaluation of many ancient human burials, have there been almost no manifest but many occult congenital deformities found in skeletons from the Dakotas? Is it because there were none? Or did deforming anomalies for some reason not reach the community cemetery? Today, in the upper Midwest, craniofacial anomalies are commoner in the Native Americans than in the general population, yet facial clefting is not found in Dakota skeletons. In the Arikara culture, which gave the greatest number of human remains to South Dakota, incest was accepted. If faulty genes were present, should not this practice have catalyzed the appearance of anomalies?

Assimilation of the Atlas to the skull base is uncommon in skeletons from Illinois examined by Morse, but quite frequent in Dakota skeletons. This may represent a genetic difference. Craniovertebral anomalies have been

found quite frequently today in individuals who have congenital velopharyngeal problems. Manifest probable congenital anomalies from the upper Midwest have included hydrocephalus (5), hip dislocation (3), proximal radius-ulna fusion (3), microtia with external and middle ear deformity (1), hemimandibular dysostosis (1), and marked asymmetry of the mandibular condyle neck (1). Undoubtedly, all of these were not obvious at birth or were not considered life threatening by their contemporaries, and the individuals escaped infanticide. They were not severe enough to have been eliminated by natural selection. It is probable that in the ancient Dakotas those with disabling congenital anomalies were eliminated from the population actively or passively and their remains did not get into the community cemeteries.

Occult congenital anomalies that would have been hidden by soft tissue during life are common in Dakota skeletons. Their prevalence in data available as of now is very similar to patterns of today.

THE DEATH OF CHARLES FRANCIS HALL, ARCTIC EXPLORER

P. Horne, Banting Institute, Toronto

Charles Francis Hall, Cincinnati journalist turned explorer, died aboard his ship, the U.S.S. *Polaris*, on 8 November 1871. Hall had been commander of the "North Polar Expedition", and his ship was overwintering on the north-west coast of Greenland at the time of his death. There was a great deal of tension between officers and crew and in particular between Hall and the ship's surgeon, Dr Bessels. Hall suffered gastrointestinal and central nervous system symptoms for a period of two weeks before his death. During this time he accused at least two of his officers of poisoning him. In 1968, Hall's grave was opened and he was autopsied on site at Thank-God-Harbour, Greenland. Specimens of hair and fingernail were submitted to neutron activation analysis and showed: "An intake of considerable amounts of arsenic by C.F. Hall in the last two weeks of his life."

AN APPROACH TO DIAGNOSIS OF RHEUMATOLOGIC DISEASE IN PALEO-PATHOLOGICAL SKELETAL SPECIMENS

R.W.Ortel, West Virginia University

Identification of the less common rheumatologic diseases in paleopathologic material is unusual, possibly because of lack of familiarity with their characteristics by anthropologists. An approach to some of the common and uncommon rheumatologic diseases is presented, utilizing some cardinal features of each, based on current knowledge of conditions treated by modern rheumatologists. This approach attempts to distinguish the diseases in ancient skeletal and mummified materials by 1) anatomic distribution; 2) radiologic appearance; 3) pathologic changes; and 4) distinguishing or discriminating features. In general, the descriptions are limited to those that one might

reasonably expect to encounter in skeletal materials, although some changes in mummified specimens are mentioned. Lists of diseases to be considered on the basis of anatomic distribution or type of pathologic change are appended. A limited number of copies of the outline are available.

SKELETAL ANALYSIS FOR LEAD FROM MULTIPLE SITES: THE FEASIBILITY OF PREDICTING TOTAL SKELETAL LEAD BURDEN FROM SINGLE BONE SAMPLES

L.E.Wittmers, A.C.Aufderheide, A.A.Alich and J.A.Wallgren, University of Minnesota, Duluth

Lead is known to be distributed irregularly through the human skeleton. The study was designed to evaluate the possibility of predicting the total skeletal lead burden (TSLB) from a single bone sample. Samples were obtained from eight standardized osseous sites in each of 65 hospital autopsies. Bone lead concentrations were measured by graphite furnace atomic absorption spectroscopy. Regression analysis permitted the correlation of individual bone lead concentrations with TSLB. From this data correction factors were developed, which permit prediction of TSLB from individual bone samples with a highly useful degree of accuracy. Skull lead levels required no correction, and this, therefore, is the site of choice for lead measurements.

THE EFFECTS OF BOTANICAL PRODUCTS ON REHYDRATED MUMMIFIED TISSUE AND ON EXPERIMENTALLY MUMMIFIED TISSUE

E.A.Coughlin, Harvard University

Rehydration of tissue from HUM I, a Peruvian male mummy preserved by desiccation, and from HUM II, an Aleutian female mummy preserved by air drying, was accomplished by placing sections of pleura, liver, intestine and muscle in two milliliters of Ruffer's solution for 24 hours. Tissue mummified with experimental natron was obtained from two specimens of macac fascicularis monkeys. Sections of meninges, spinal cord, pleura, liver, stomach, intestine, muscle, and a whole eye were separately packed in natron for 14 days. Segments of these two tissue types were placed in a series of botanical oils for 60 hours. Specimens were removed from the oils and subjected to a testing procedure utilizing colloidal gold. Specimens of the oils themselves were also tested as controls. After three hours the amount of precipitated gold was measured directly in millimeters and an additional spectrophotometric measurement at 33 nanometers was recorded. Tissue associated with the botanical products of the genera Juniperus showed consistent electromagnetic activity in both test measurements and in both tissue types and over the entire range of specimens selected. Juniperus, as previously reported, is the main constituent of the PUM II Egyptian mummy fluid.

MOLECULAR STUDIES ON THE MAGADAN MAMMOTH

M. Goodman, M.I. Barnhart, J. Shoshani and A.E. Romero-Herrera, Wayne State University

Electron microscopy analysis of psoas major tissue from a 40,000 year old Siberian woolly mammoth (Mammuthus primigenius) showed the presence of almost perfectly shaped red and white blood cells inside blood vessels, collagen fibers with their native periodicity, and skeletal muscle Z lines delimiting sarcomers containing vestiges of A and I bands. The biochemical finding of both native and fragmented collagen molecules and the demonstration of immunological cross reaction between proteins of Mammuthus and modern elephants, Elephas maximus and Loxodonta africana, indicate that amino acid sequencing of polypeptide chains can help to elucidate the woolly mammoth's evolution.

SOFT TISSUE ANATOMIC FINDINGS IN THREE BASKETMAKER MUMMIES

A.C. Aufderheide, University of Minnesota, Duluth

Soft tissue pathology of three southwestern U.S. mummies from the Basketmaker culture was presented. A young adult male died of an abdominal wound with secondary intestinal protrusion through the wound (prehistoric homicide?). A child apparently aspirated a deciduous second molar tooth into the right main bronchus with consequent atelectasis and may have suffocated when the tooth subsequently lodged in the larynx. A middle-aged male revealed large quantities of black soil in the lungs --- possibly aspirated during dust storms; a calcium oxalate calculus was also present in his anatomically normal bladder.

RECENT ADVANCES IN THE PALEOPATHOLOGY OF THE MAYA

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

Since our last presentation to the PPA (Toronto 1978) we have expanded our research on the health of the ancient Maya of Mexico and Central America. Seibal has yielded additional examples of presumed treponemal infections (osteitis), anemia (spongy parotic hyperostosis) and weanling disease (linear enamel hypoplasia). Furthermore, examination of the Cozumel mass burial (67 individuals, probably associated with a 1524 smallpox epidemic) indicates that these diseases were still present at the time of European contact. Cozumel has also produced an individual of definite pre-Columbian date, whose lumbar vertebrae bear tuberculosis-like lesions. Paget's disease (another disorder not previously noted in the Maya area) has been found in an individual from Belize. Several examples of unilateral internal thickening of the maxillary sinus (fibrous

dysplasia or sinusitis?) have been found (Seibal, El Posito). Our inventory of Maya cultural 'pathology' now contains engraving on lower incisors (Colha) and mushroom-shaped jadeite and hematite inserts (Copan) that are larger than the upper incisors they occupy. Finally, the problematic lesions that T.D.Stewart and ourselves believe to be the sequelae of intentional head shaping may include not only supra-inion (occipital) lesions, but also similar indentations of the posterior parietal (Cozumel).

BRONZE AGE PATHOLOGIES FROM JORDAN

M.Finnegan, Kansas State University

Since 1975 three expeditions to the Early Bronze Age cemetery at Bab edh-Dhra, Jordan, have produced skeletal materials from shaft tomb chambers and charnel house interments. Ortner (1979) has provided us with an overview of pathologies from the shaft tomb chambers representing EB-I interments. The present paper reports the preliminary analysis of frequencies of pathologies in the EB-II/III charnel house interments dated from 3000 - 2350 B.C. Basic demographic data of this population are presented, along with unique anomalies and various classes of pathological lesions and traumatic injuries to the skeletal material. It is of particular interest that there are few traumatic insults suggesting warfare conditions. A number of ribs displaying pathologies with uncertain causes are presented to the PPA for suggestions as to the etiologies.

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EARLY BRONZE AGE KARATASH PATHOLOGY

J.L.Angel, Smithsonian Institution

390 adults of this third millennium B.C. comfortable town in a fertile mountain valley have lifespans of 34 (male) and 30 (female) years: healthy enough for 4.1 births per female and only 2 juvenile deaths, and producing a population increase checked by malaria and warfare (parry fractures and head wounds from axes almost up to modern frequencies). But enamel growth arrests are uncommon, and pelvic depth index at 84 (U.S. middle class index is 92) shows fairly good nutrition. Osteoarthritis is little more than ours. There are several minor congenital anomalies, especially in early tombs -- spina bifida, cervical rib, elbow supercondyloid process, notched manubrium -- showing family continuity and mixture.

ELECTRON MICROSCOPY OF ANCIENT TISSUES (Display)
IROQUOIAN PALEOPATHOLOGY (Display)

J.E.Senior, Academy of Medicine, Toronto

The two exhibits prepared by the curator of the Museum of the History of Medicine focused on the electron microscopic work of P. Horne (Banting Institute, Toronto) and studies by J. Melbye (Univ. of Toronto). The former included photographs of abnormalities depicted in a diverse group of ancient and not so ancient tissues, ranging from Taenia eggs in a 3,200 year old Egyptian mummy named Nakht to a head louse in an Aleutian Island mummy and a Trichinella cyst in a turn of the century bandit named Elmer McCurdy. The latter showed some of the more interesting pathologies and abnormalities uncovered during the excavation of the 17th century ossuary at Kleinberg, Ontario. These included a healed trepanation in an adult male skull, congenital fusions of lower lumbar vertebrae, and of the ulna and humerus, and evidence of violence in the form of an arrow fragment embedded in a skull with ensuing healing.

MAYA PALEOPATHOLOGY (Display)

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

The cause of the decline of the Maya Empire long before the arrival of the Europeans is an intriguing question. A variety of explanations have been offered for this pre-Columbian collapse, ranging from disease and crop failure on through revolt and invasion. Primarily cultural or ecological data have been used to support these explanations. To shed more light on this, we have studied the poorly preserved and mostly previously ignored skeletal remains from archeological sites in Mexico, Guatemala and Belize. We have found few violent injuries -- two healed fractures and a healed massive hacking injury of the skull (and in the process we have downgraded a previously noted 'old, healed and depressed circular fracture' to a congenital dysraphism-encephalocele). We have, however, found a great variety of disorders ranging from the prosaic (dental decay) on through lesions of interest to historians of medicine (possible pre-Columbian syphilis or yaws, tuberculosis, Paget's disease) as well as a series of lesions relating to malnutrition that may help explain the decline of the Maya while also providing new time depth for present day health problems in the area (spongy or porotic hyperostosis cranii -- iron deficiency anemia?, ossified subperiosteal hemorrhages plus periodontoclasia -- vitamin C deficiency?, linear enamel hypoplasia -- weanling disease?). Specimens are shown in color or black and white photographs, and, wherever possible, in x-rays.