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and
FIRST AIDAN COCKBURN MEMORIAL SYMPOSIUM

Mummies, Disease, and Ancient Cultures:
Retrospect and Prospect



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SECTION 1: RETROSPECT

MUMMIES: A WORLDWIDE PHENOMENON

Eve Cockburn, Paleopathology Association

Mummification is defined as the preservation of soft tissues, whether by accident or design. It may be produced by freezing, by drying (either in the sun, in a dry climate, or by smoke), or by chemical methods (various types of embalming, acid in peat bogs, etc.). It is found worldwide, extending all through the New World, from Alaska and the Aleutian Islands, through the United States, down to Peru and Chile; in the Old World, examples can be found in the Canary Islands, Denmark, Italy and Siberia; farther east, there are specimens in Japan, and also in the southern hemisphere, in Australia and Papua New Guinea. Though sometimes produced accidentally, as with the early preservation of bodies in Egypt and Peru, it is more likely to occur by design, as in later periods of Egyptian and Peruvian history. The time frame extends from mammoths up to such recent examples of embalming as Lenin, Eva Peron, and modern American funeral practices. The primary reason for deliberate embalming is religious, and is linked to the human desire to preserve the bodies of the dead for use in some future hereafter.

EARLY INVESTIGATION OF EGYPTIAN MUMMIES

William H. Peck, Detroit Institute of Arts

After a short discussion of the development of mummification in ancient Egypt, and some comments on the use of 'mummy' as a drug and as a pigment, the speaker examined some of the early investigations of mummified remains. Notable among the early researchers were Thomas Greenhill, who published The Art of Embalming in 1705, and Thomas Pettigrew, who produced his History of Egyptian Mummies in 1834. It was with Pettigrew that the study of Egyptian mummies first became truly scientific, and his observations, based on firsthand examination of a number of specimens, contain much information that is still valid today. The discovery of x-rays by Roentgen in 1895 added new techniques to the methods of examination, and the work of Ruffer, Lucas, Elliot Smith, Dawson, and Sandison has provided the basis on which further development of the science can build.

THE DETROIT EXPERIENCE: STYLES OF MUMMIFICATION

T. A. Reyman, Mount Carmel Mercy Hospital

Large numbers of mummified bodies have been found in Egypt as a result of ancient burial practices. The classical method utilized for royalty and the rich required costly materials and time consuming preparation. The mummy PUM-II demonstrated many features of the classical method. The mummies PUM-III and PUM-IV were eviscerated incompletely per ano, with final preparation and wrapping aimed at external aesthetics only. Mummy ROM-I was the ultimate in the lowered scale of mummifications, having been simply wrapped with no preparation at all.

These variations in mummification attest to the changes in cultural thinking over the millennia, striking a balance between religious beliefs and economic factors, as mummification became available to the lower social classes of people.

THE INTRODUCTION OF COMPUTERIZED AXIAL X-RAY TOMOGRAPHY TO MEDICAL ARCHEOLOGY

Peter Lewin, Hospital for Sick Children (Toronto)

Radiological examination has been revolutionized by computerized axial x-ray tomography, in which the object to be examined is exposed to a series of sequential x-ray exposures from different angles, and the varying relationships of the x-ray pictures on the internal structures are then compared to yield a representation of the structures in two dimensions. In 1976, with Dr. Harwood Nash, we pioneered the use of CAT scanning in medical archeology with the examination of the brain of Nakht, a 14 year old who died about 3,000 years ago. The computed tomographic images demonstrated the internal structures of the brain, including ventricles and an outline of the white and grey matter of the brain. In November 1977, we performed the first total body scan on the mummy of the priestess, Djema 'Etes' Ankh, dating back about 2,500 years, and still intact in its cartonnage. Superb detail was obtained of the mummy, which included noting various religious artifacts within the mummy's wrappings, and the remains of the uterus within the pelvis. We have been trying to introduce the three-dimensional x-ray examination of archeological material with the use of a dynamic spatial reconstructor at the Mayo Clinic Research Institute, but without results so far. This and other non-invasive techniques are invaluable in the examination of mummified remains and their internal structures, while keeping them intact for posterity.

MUMMIES FROM THE UNITED STATES

Arthur C. Aufderheide, University of Minnesota (Duluth) and Mahmoud Y. El-Najjar, New Mexico State University

Less than 100 mummies have been recovered from the southern and southwestern United States. Most of these came from the cliff shelters in the 'four corners' of Arizona, New Mexico, Utah and Colorado, and the remainder were found in such scattered areas as caves in Kentucky and Tennessee. Most of them are now housed in the Arizona State Museum in Tucson (about 40) and the American Museum of Natural History (about 10). All are mummified by natural dehydration, usually stored in stone-lined cists, in a flexed position, and wrapped in fur or cloth robes. Except for studies of ABO antigens and hair ectoparasites, few studies have been carried out on North American mummies. Results of recent autopsy dissections by the authors on six of these from Arizona demonstrated such conditions as pneumoconiosis, vesical calculi, abdominal stab wounds with evisceration, and atelectasis.

A REVIEW OF ALEUT AND ALASKAN MUMMIES, PLUS A REPORT ON THE HARVARD AUTOPSIES

M. R. Zimmerman, Hahnemann Medical College Hospital

Examination of three mummies from Alaska, two Aleuts and an Eskimo, revealed the common features of atherosclerosis and anthracosis. One Aleut, a male, had died of pneumonia, and the other Aleut, a female, showed evidence of healed pneumonia, healed renal acute tubular necrosis, middle ear disease, and pediculosis (lice). The Eskimo, a female, has been frozen since 400 A.D., and was found to have been the victim of trauma, with a skull fracture and death by asphyxiation. The other mummy reported on was that of a young Peruvian man, who was also a victim of trauma. He had multiple skull fractures, and died shortly after a trephination. The Aleut and Peruvian mummies had been in long term museum storage, and the Alaskan mummy was examined as a forensic case, at the request of the coroner in Fairbanks.

THE ANTHROPOLOGICAL APPROACH

F. P. Saul, Medical College of Ohio

The anthropological approach is defined (in this context) as the recording and interpretation of human biocultural variability in time and space. Anthropologists have given special consideration to the skeleton, including teeth, because it records certain aspects of the individual's life history (age, sex, 'race', activity 'scars', disease 'scars'). It is also more likely to be preserved from the past and is more directly comparable to living populations than are other body tissues. Specific examples of life history variation, sometimes in cultural context, are presented, using the techniques of Angel, Kerley, Ortner, Stewart, et al., and the speaker's specimens.

HISTOLOGY, SEROLOGY, AND BIOCHEMISTRY OF MUMMIES

T. A. Reyman, Mount Carmel Mercy Hospital

Extensive research on mummified tissue has enabled scientists in many disciplines to analyze these specimens by a variety of test methods. The dried tissue can be rehydrated and processed like fresh surgical or autopsy material. This histological examination has resulted in the detection of many diseases in these bodies. Serological and biochemical studies have utilized routine and more sophisticated methods such as HLA tissue typing, blood group typing, heavy metal, protein, lipid, and other chemical analyses. The data generated have provided invaluable insights into not only the health of the population, but also the materials and methods used in mummification as practiced during these times.

THE TEMPORAL BONE

Jaime T. Benitez, William Beaumont Hospital

Undecalcified sections from the left temporal bone of Egyptian mummy PUM-II allow identification of active osteoid seams. There was no evidence of metabolic bone disease. The increased radiographic density in this specimen was due to excessive resin infiltration. A modified histological method was used for decalcified sections from the right temporal bone. There was no tissue disintegration in the tympanic membrane by this procedure. Scar tissue was identified around the perforation of the tympanic membrane, indicating that at one time it was larger in size. Serial sections with connective tissue stains reveal no evidence of abrupt rupture in the margins of the perforation, but rather reparative tissue, ruling out an artifact. This perforation represents sequelae of middle ear infection.

RADIOLOGY IN EGYPT

James E. Harris, University of Michigan

The royal mummies of Egypt found at the turn of the century in the Valley of the Kings are now housed at the Egyptian Museum. Since 1967, they have been completely surveyed by full body x-rays and cephalograms. These mummies, representing the XVII dynasty through the XXII, reveal radiographically considerable variability of the face and skull, reflecting admixture with many other royal houses during this 'Empire' period. Further, the x-ray approach has revealed periodontal (gum) disease, attrition (wear of teeth), arthritis, ankylosing spondylitis, poliomyelitis, healed fractures, and smallpox.

ELECTRON MICROSCOPY: REVIEW, PLUS NEW DISCOVERIES FROM PERU

Jeanne M. Riddle, Henry Ford Hospital

A variety of specimens from Egyptian and Peruvian mummies were examined, using both the scanning and transmission electron microscopes. Surface features and the internal structure of ancient peripheral blood elements (erythrocytes, leucocytes, platelets and fibrin strands) were identical to their modern counterparts. Fibers of Egyptian wrappings were flax, denoting linen fabric; the basic fiber of Peruvian burial blankets studied was cotton. Scanning electron micrographs of insects were used to identify seven distinct genera of the orders Diptera and Coleoptera that were collected during the dissection of three pre-Hispanic mummy bundles, representing distinct cultural complexes (86 to 1240 A.D.).

SECTION 2: PROSPECT (Panel discussion)

Panelists

John B. Gregg: Ear, nose and throat surgeon in Sioux Falls, who is also on the faculty of the Department of Anthropology at the University of Tennessee-Knoxville. He has specialized in the paleopathology of the Upper Missouri River Basin, and has lately been working on the discoveries at the Crow Creek massacre site.

Peter K. Lewin: Assistant Professor of Pediatrics at the University of Toronto. He is a staff pediatrician at the Hospital for Sick Children, an experimental pathologist, and has pioneered in the use of electron microscopy and CAT scanning in medical archeology.

Donald J. Ortner: Curator of anthropology at the Smithsonian Institution since 1970. He is a specialist in human skeletal biology and paleopathology, and is the author of Identification of Pathological Conditions in Human Skeletal Remains.

R. Ted Steinbock: Now a radiologist at Massachusetts General Hospital. He became interested in paleopathology while still an undergraduate at Harvard, and turned his thesis into the book Paleopathological Diagnosis and Interpretation. His next position, in Albuquerque, will combine his interests in radiology and anthropology.

Michael R. Zimmerman: In his present position in Philadelphia, he combines his skills in both anthropology and pathology. With an M.D. (he is a surgical pathologist) and a Ph.D., he is uniquely qualified to speak for both disciplines.

Moderator

Theodore A. Reyman: Chief of Pathology and Director of Laboratories at Mount Carmel Mercy Hospital in Detroit. He has worked on all the mummy autopsies conducted by the Paleopathology Association, and has developed the use of modern pathology techniques in the examination of ancient material.

T.A.R. opened the discussion by requesting a short statement from each of the panelists, to emphasize future directions in paleopathological research, but with reference to possible problems and potential remedies.

R.T.S. stressed the importance of the multidisciplinary approach, with examination not just of skeletal evidence, but also of soft tissue study and information from art forms. He felt that we should be looking at the distribution of disease in time and space, and its influence on cultural patterns. Two areas that he would like to see receiving more development would be nutritional deficiencies and infectious diseases, both of which would have influenced the evolution of human culture. We need to determine how prevalent any disease was in past eras, and have to get away from the modern clinical approach in looking at

the way populations existed without therapeutics. He reminded us of the radiology adage: 'You don't see what you don't look for' -- and urged us to keep an open mind in future research.

D.J.O. talked about the difference between the paleopathological record and what the clinician sees today. Paleopathologists and anthropologists frequently see conditions that do not come to the attention of the modern radiologist or clinician, and it is important to sort out these 'sub-clinical' conditions, so that researchers will have solid backing for their diagnoses.

M.R.Z. agreed with this assessment. He felt that good diagnostic criteria must be established. A start has been made during the past ten years, but it is most important to realize that the conditions we see in skeletal and mummified material may not look the same as they do in modern material. He has experimentally mummified material, then, after rehydration, has examined it for soft tissue lesions that he knew were present. This is necessary in order to be able to recognize conditions that clinical colleagues may not be familiar with. His views for the future are that we should continue the examination of mummified material in order to build up a population basis for understanding disease: paleoepidemiology ('a numbers game'). He also referred briefly to his increasing difficulties in getting tissue specimens out of Egypt, which is hampering his research.

P.K.L.'s interest lies in applying the latest scientific techniques to medical archeology. He has been looking into a three-dimensional attack, where dynamic spatial reconstructions by computer will avoid the sacrifice of precious material. CAT scanning may soon be so far developed that it will permit histological analysis of the cells, and with neutron activation analysis, it will be possible to compare specimens from ancient and modern peoples using very tiny samples, yet producing a wide range of information about nutrition and health in ancient times.

J.B.G. reminded everyone of the dangers to the future of research in this country that lie in the increased activism of North American Indians on the reburial issue. Demands are now being made that all Indian remains should go back in the ground, which might effectively bring paleopathological research to a halt. He quoted the Angel-Suchey resolution, adopted at the last meeting of the American Academy of Forensic Science (*Ed. note: A similar resolution was carried at the March meeting of the American Association of Physical Anthropologists). There is enormous need for public support, for which it is essential to avoid simplistic distortions in the media (he gave an example in which the use of the term 'treponematosis' was reported as 'syphilis'). He mentioned various possible solutions (e.g. reburial of Sioux skeletons at Bear Butte, a hallowed space), but with particular emphasis on education and negotiation.

D.J.O. commented on this from the point of view of a museum curator, who has under his care one of the largest skeletal collections in the world. He also stressed the need for scientists to support each other, and the importance of making members of minority groups realize that it is their own biological history that is being reconstructed, just as archeological research helps to reconstruct cultural history. An area of confrontation has developed in certain parts of this country, but we must make people

understand that we are not just desecrating graves. If this explanation is made effectively, we should be able to de-fuse opposition. He also looked to the future in his role of curator: What is human biological history going to want to know in fifty years time? It is his responsibility to protect the invaluable material in his care -- and he worries that his own colleagues do not always treat these specimens with respect due to irreplaceable sources of data.

P.K.L. agreed that communication must be used, not confrontation. He had experienced a situation among the Inuit, where the chiefs agreed to research on ancient bodies of their ancestors because it would tell them more about their own history. He felt that in recent years the number of investigative expeditions had proliferated to such an extent that local people reacted by banning any study, as happened in Egypt. He felt that the numbers of studies should be controlled.

J.B.G. mentioned that the Peruvian Government had lent a mummy for autopsy to the Knoxville World's Fair, leading to comments from all participants on the danger of this kind of circus approach ('it becomes a red flag in the minds of sensitive people').

With reference to the preservation of important material, M.R.Z. recalled that he had at one time refused to carry out an autopsy on a very fine mummy. D.J.O. commented that any procedure inevitably destroys some data, but it should be possible to find an appropriate balance between possible destruction of data and the expected research results. T.A.R. drew attention to the value obtained from the Harvard mummy research, where the specimens were in such poor condition that the results obtained were far more worthwhile than the preservation of the material. R.T.S. drew a comparison with the use of needle biopsies in modern radiology in order to avoid surgical procedures with their attendant dangers. T.A.R. stressed the need to compare needle biopsy reports with what is then found in a full autopsy, as this will be a previously uninterpreted procedure.

M.R.Z. pointed out the significant difference between modern and ancient pathological specimens, which is that present day pathologists are concerned with cellular pathology, whereas in ancient specimens the cells do not exist. In some research at least, he feels that needle biopsies would be not just difficult, but impossible.

D.J.O. remembered an attempt he had made at antibody research, where enzymatic changes occurred within a few hours, completely changing the results obtained. P.K.L. reminded everyone of the damage done by the French in the massive radiation of Ramses II -- a warning to everyone who deals with priceless specimens. T.A.R. stressed again the importance of keeping an open mind, giving as an example the tetracycline-labelling of Nubian bones, a case in which a single, rather odd observation led to a striking discovery.

The feelings of the panel were probably best summed up by J.B.G., when he quoted: 'Honor the dead by learning from them: they have much to tell us of their lives and our own.'

SECTION 3: CONTRIBUTED PAPERS

PALEOPATHOLOGY OF THE PEOPLE OF CASAS GRANDES, MEXICO

Mahmoud Y. El-Najjar, New Mexico State University

(Read by title)

A POSSIBLE CASE OF HUMAN BONE DYSPLASIA FROM A LATE WOODLAND OSSUARY IN MARYLAND, U.S.A.

Donald J. Ortner, Smithsonian Institution

The case consists primarily of the fragmentary, major, long bones of a child probably 13 - 15 years of age. The bones are long and abnormally slender, suggesting near normal endochondral growth but deficient intramembraneous bone formation. The specimen (NMNH 374120) is from Ossuary 1 at the Nanjemoy Creek Site in Maryland, U.S.A., which was excavated by T. Dale Stewart between 1953 and 1955. It is dated to the Late Woodland period. No European trade artifacts were found, suggesting a pre-contact date (ca. 1500 - 1600 A.D.). Stature estimated from the fragmentary long bones is about 146 cm (4 feet 9 inches). The greatly diminished diameter of the shafts could be caused by several diseases and combinations of diseases, including: 1) paralysis; 2) hypogonadism; 3) hypopituitarism; 4) malnutrition; 5) osteogenesis imperfecta tarda. Although osteogenesis imperfecta tarda seems the best diagnosis, this is by no means certain. Problems in this diagnosis include the fact that, although some bowing is present in some of the major long bones, there is no evidence of fracture, and osteon remodeling is more evident than is typical in this disease. Forthcoming amino acid analysis of the tissue may provide further clarification of this case.

THE CROW CREEK MASSACRE EXPLAINED: FAMINE IN FOURTEENTH CENTURY SOUTH DAKOTA

Larry J. Zimmerman and John B. Gregg, University of South Dakota

Analysis of the mutilated remains of over 500 people who perished in a massacre at a 14th century fortified Crow Creek village on the bluff of the Missouri River in central South Dakota showed much evidence of active and previous malnutrition. Transverse lines in long bones, evidence of iron and protein deficiency, osteoporosis, and indications

of scurvy are present. These findings confirm that famine and its sequelae were major contributory factors to the massacre.

APPLICATION OF NEW METHODS IN THE ANALYSIS OF COPROLITES: MASS SPECTOMETRY AND GAS CHROMATOGRAPHY

John G. Moore, V.A. Medical Center (Salt Lake City)

Coprolites are found in abundance at sites of prehistoric habitation in the Mountain West and other arid regions of the world. Content analysis of coprolites yields direct information on dietary constituents and parasitic infestation. A distinct feature of coprolites is the return of color and odor after rehydration, even after several thousand years of dormancy. The color of the coprolite is darker and the odor distinctly more fecal when compared to animal stool similarly reconstituted; these features are useful in ascertaining human origin. In the current investigation, pyrolytic mass spectrometry and 'head space' gas chromatographic analysis was applied to modern and ancient human fecal samples, and to samples of bear, cougar, deer and bison scats in an attempt to isolate a species-specific compound and/or fingerprint pattern, and further simplify the identification of human coprolites. The identification of such a compound(s) would be of general biologic, forensic and paleopathologic interest. It is intended to present some preliminary information regarding these investigations.

RAMSES V: SMALLPOX VICTIM?

Peter Lewin, Hospital for Sick Children (Toronto)

The speaker and Dr. Donald Hopkins of the Center for Disease Control in Atlanta recently examined one of the numerous scabs covering the mummy of Ramses V, looking for smallpox virus. They found two particles that looked like smallpox virus, and the scab extract had a vague cross-immunological precipitation with smallpox antibody. However, they could not confirm the diagnosis because the sensitive radio-immune assay test for smallpox was negative.

POSTMORTEM CONTAMINATION OF INTERRED BONES BY LEAD FROM SOIL

Arthur C. Aufderheide, University of Minnesota (Duluth)

Unphysiologically high (4,000 to 16,000 ppm Pb) concentrations of lead found in the tibial cortex samples of several 5th century B.C. lead miners from near Lavrion, Greece, seemed to be the result of bone contamination from lead in the soil, which was found to have a similar concentration of

lead. Review of the few previous publications expressing concern for the problem of postmortem contamination of bone from soil lead, revealed the need for further study of the conditions, extent and identification of lead, and perhaps other trace metals, exchange between bone and soil.

METASTATIC TUMOR IN AN ANCIENT NUBIAN SKELETON

Guy Marrocco, Cooley-Dickinson Hospital (Northampton)

Current thinking on the evolution of disease suggests that cancer is a disease of modern society. Historical evidence and the examination of mummies and skeletal remains underlines the paucity of evidence for the existence of cancer in its present magnitude. The literature is reviewed and a case of carcinoma, metastatic to bones recovered from a Meroitic and X-group cemetery in Nubia (B.C. 350 to A.D. 550), is presented. Epidemiologic and environmental factors in its evolution are considered.

EXPERIMENTAL STUDY OF IMMEDIATE POSTMORTEM CHANGE: APPLICATION OF HISTOLOGICAL AND MICROBIOLOGICAL TECHNIQUES TO TAPHONOMY

Marc S. Micozzi, University of Pennsylvania and Pennsylvania Hospital

A knowledge of the processes of postmortem change is important to paleopathology, as well as to paleontology and bioarchaeology, in understanding differential survival of organic remains and organic lesions, detecting pseudo-pathology, and distinguishing antemortem from post-mortem changes. Postmortem change may be viewed essentially as a competition between decay (putrefaction) and desiccation (mummification), with external factors of temperature and humidity largely determining the outcome of the contest. Even where decay occurs, patterns of disarticulation will ultimately determine the final deposition of the remains through taphonomic transformation, and in cold climates there is freezing and partial preservation of soft tissues.

A pilot study on postmortem change in laboratory animals was conducted using histological and microbiologic techniques in order to determine the effects of freezing and thawing on patterns of decay, as well as typical disarticulation sequences, microbiological and arthropod succession patterns, and other parameters under controlled conditions. Discrete patterns of postmortem change are discernible with time, and distinguishable between frozen and non-frozen tissue. The application of histology and microbiology measurably improves the characterization of postmortem change. Earlier experiments by other workers using previously-frozen, casually handled, and incompletely examined tissues should be repeated under controlled circumstances in order to further determine baseline data for intrinsic processes of postmortem change.

A COMPARISON OF SKELETAL TRAUMA SEEN IN THE OLD AND NEW WORLDS

Robert Sundick, Western Michigan University

An examination of significant numbers of aboriginal Indian skeletons from various parts of the United States, dating from Archaic time periods through early historic periods, reveals that the type of skeletal trauma found in the New World is very different from that observed in European and Middle Eastern skeletons of the same time periods. This can be attributed to different levels of technological development in the Old and New Worlds. In the Old World, where metal weapons were employed, severe skeletal trauma is seen more often than in the New World, where weapons of warfare generally consisted of small stone projectile points, which were less likely to leave evidence of skeletal trauma. Examples are presented of Middle Ages European skeletons from the site of Altenerding in West Germany, where skulls and long bones exhibit evidence of severe trauma caused by sword blows. The blows to the skull resulted in the death of the individual, and blows to the postcranial skeleton resulted in deformities, pseudo-arthroses and numerous parry fractures of the left ulna and radius.

PRE-CORTEZ OSTEOPATHOLOGY AND RADIOLOGY

G. Garcia Sanchez

(Read by title)

MEANING OF BONES IN PRE-COLUMBIAN MESOAMERICAN ART

Harold B. Haley, V.A. Medical Center (Houston)

Problems of interpretation and meaning of bones represented in pre-Columbian Mesoamerican art are discussed. Stucco art at Palenque pictures congenital disease (club foot, hand and foot polydactyly, split toes) in a father and son who ruled this area in the eighth century. They asserted lineage legitimacy by descent from the deformed Mayan God K. A specific interpretation problem is the four toes seen in Zapotec pottery. Does this have meaning comparable to Palenque, i.e., was there a Zapotec ruler/god with four toes that became of symbolic importance? Skull and crossbones are seen in classic Maya (\pm 8th century) sculpture and in 15th century picture-writing. The significance is not clear.

PATTERNS OF TUBERCULOSIS IN THE SACRUM AND ILIUM

Marc A. Kelley, University of Rhode Island and Marc S. Micozzi, University of Pennsylvania and Pennsylvania Hospital

An analysis of inflammatory lesions in and around the sacroiliac joint was undertaken, using documented and probable cases of tuberculosis. Heavy reliance has traditionally been placed on the vertebrae in the diagnosis of skeletal tuberculosis. Because at least 17 different diseases are capable of producing spinal lesions resembling tuberculosis, it is proposed that closer inspection of other sites might improve the process of diagnosis in dry bone remains. Furthermore, the sacrum and ilium often prove to be more resistant to breakage and disintegration than are individual vertebrae in archeological material.

A total of 10 cases (5 twentieth century and 5 archeologically-derived individuals) were located and examined. All 5 documented cases of sacroiliac tuberculosis displayed concomitant involvement of the spine. A review of the medical literature indicates that only 7 diseases need be seriously considered for differentiation from tuberculosis in the sacroiliac region: ankylosing spondylitis, blastomycosis, Crohn's disease, echinococcosis, malignant tumors, pyogenic osteomyelitis, and rheumatoid arthritis. These 7 are either characterized by lesions that are easily distinguishable from tuberculosis in dry bone remains, or quite rarely affect the sacroiliac region. It is concluded that tuberculosis occurs far more frequently in the sacroiliac region than the above diseases. When found in conjunction with spinal lesions, the diagnosis is considerably more sound than with use of the spine alone.

THE LIVING NUBIANS IN PALEOPATHOLOGIC CONTEXT

James L. Souers, University of Michigan

The Egyptian Nubian people now living near Kom Ombo Temple, north of Aswan, are unique, for they are one of the oldest known populations in the world. With the building of the Aswan High Dam in the early 1960s, their ancient homeland along the Nile was flooded between the First and Second Cataract, and they moved north to newly cultivated and irrigated farmlands, which were formerly an ancient dry lake bed. Their relocation permitted the examination of all pre-Islamic cemeteries dating between 200 and 1700 A.D., and in 1965 a team from the University of Michigan x-rayed nearly one thousand of these skeletons. In addition, over the past fifteen years, the modern Nubian people have been examined through a long term longitudinal project, sponsored by the National Institutes of Health, to discover, among other things, the evolution of health and disease in ancient and modern Nubia. X-ray studies of modern Nubians reveal that they are most similar to their ancestors in exhibiting congenitally missing teeth (including third molars), impacted teeth, dental crowding, and periodontal loss. Where the modern Nubian is most different from his ancestors is that he now has dental caries (decay), resulting in extractions at an early age, especially observed in first

molars. Kom Ombo is the center of sugar cane production for Egypt, which obviously contributes to early decay. Also, in modern Nubia, there is far less wear (attrition), resulting in greater crowding and dental malocclusion than in old Nubia. This study illustrates the importance of understanding the interaction of the environment with the genetic potential of a population. In old Nubia, where there was a tough coarse diet, the resulting wear produced healthier, better aligned teeth. In modern times, a soft diet with refined sugars has produced dental decay and enhanced crowding, much as is observed in America today. It would appear therefore that man can expect to have teeth which are increasingly more crowded (crooked), while at the same time exhibiting an increasing number of missing third molars, lateral incisors, and bicuspids.

THE PALEOEPIDEMIOLOGY OF RENAL AND BLADDER STONE DISEASE

R. Ted Steinbock, Massachusetts General Hospital

Renal stones (upper tract) and urinary bladder stones have distinct differences in etiology, chemical composition, and epidemiologic features, and should therefore be considered two separate diseases. Historical evidence has shown a striking increase in the incidence of renal stone disease in more developed countries over the past 200 years. There has been a simultaneous decrease in bladder stone incidence, demonstrating an inverse relationship between the two disorders. Dietary factors, particularly increased consumption of animal protein and refined sugar, and decreased amounts of grain and fiber, are implicated in renal stone formation (so-called 'idiopathic' upper tract calculi). By contrast, low animal protein during the first two years of life may be a major factor in bladder stone formation. The paleopathological record concurs with the historical, epidemiological, and biochemical evidence. The recovery of bladder stones from ancient burials may therefore have important dietary implications.

SECTION 4: EXHIBITS

SCANNING ELECTRON MICROSCOPY STUDY OF A COPROLITE FROM CANCUN, MEXICO: A PILOT STUDY

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

The Mexican Government recently asked us to study coprolites (ancient feces) recovered during archeological excavations near Cancun (Yucatan). Callen, Fry, Moore et al. have shown that coprolites can provide direct information about diet (remnants of food) and health (intestinal parasites). Our preliminary scanning electron microscopic examination begins with the surface at 300x, and then examines specific locations at magnifications up to 11,500x, revealing, for instance, filaments suggestive of Candida albicans. Our x-ray microanalysis shows spectra with large peaks of iron and calcium, with strontium and sodium in smaller quantities. SEM has previously been used to study coprolites (Bryant and Williams-Dean), but this may represent the first such use of x-ray microanalysis.

(Supported by National Science Foundation Grant No. BNS-8101759)

POSSIBLE OLDEST PRESERVED CANADIAN INDIAN HEAD, DATED ABOUT 500 B.C.

Peter Lewin, Hospital for Sick Children (Toronto)

This possibly decapitated head was wrapped in a wicker basket. It had been preserved naturally by oxidized copper from a copper ornament attached to the right ear. It was found in a pre-Micmac Indian cemetery at Augustine Site, near Fredericton, New Brunswick. Date approximately 500 B.C. (Found by Moira Wright)

ELECTRON MICROSCOPY APPLIED TO ANCIENT SPECIMENS

Jeanne M. Riddle, Henry Ford Hospital (Detroit)

This exhibit illustrated unique information obtained when specimens from mummies were studied with both the scanning and transmission electron microscopes. Basic operating principles of each instrument were reviewed briefly. Detailed procedures for the preparation of each type of specimen examined were included. Both the surface features and ultrastructural details of the oldest human blood cells found to date in a blood clot (female Egyptian mummy, PUM-III, 835 B.C. \pm 70 years) were shown.

Various insect larva were surveyed, photographed, and definitively identified. The weaving pattern and fiber composition of several mummy wrappings were also shown by scanning electron microscopy.

MAYA PALEOPATHOLOGY 1982

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

This was essentially the same display presented at last year's annual meeting, with discussions and examples of trauma, treponematosi s, tuberculosis, dental diseases and variations, Paget's, scurvy, weanling disease and anemia, as well as cultural influences and pseudopathology. However, actual bone and radiographic specimens from the laboratory were added to the display. (Supported in part by the National Science Foundation, the National Geographic Society, and the National Institutes of Health)

Additional displays for which no summary was received:

THE AUTOPSY OF PUM-II: Eve Cockburn

X-RAYING THE PHARAOHS: James E. Harris

THE ASSOCIATION FOR GRAVESTONE STUDIES: C. Perkins

DISPLAY FROM THE MUTTER MUSEUM IN PHILADELPHIA: Gretchen Worden