WHY ANTHROPOLOGISTS STUDY HUMAN REMAINS

By Patricia M. Landau and D. Gentry Steele

Let me ask you this question. Why do you study them for? What do you get out of it? What's the purpose?

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One of the most controversial kinds of studies anthropologists undertake is that of the biological remains of Native Americans. The motivations of physical anthropologists to study human remains often seem unfathomable to some members of Native American communities, and our methods seem also to be misunderstood. We recognize the differences between the values and spiritual beliefs of Native Americans and those of other Americans, and we respect the right of all people to maintain their personal belief and ethical systems. We want to explain the reasons why some physical anthropologists value the study of human biology and history, and why we place so much importance on the study of human remains. We also want to explain what kinds of information can be gained from such studies, the methods used in them, and the impact of these on the remains being studied.

The Native American Graves Protection and Repatriation Act (NAGPRA, P.L. 101-601) calls for the repatriation of Native American remains whose cultural affiliation can be determined by a preponderance of evidence. Physical anthropologists are willing to comply with NAGPRA's terms, but the need remains for long-term study of some skeletal collections before repatriation.

I. Why do physical anthropologists study the biological remains of the deceased?

An innate need to know is universally characteristic of humans, even though the subjects of our inquiry may vary from culture to culture. Physical anthropologists have an interest in learning just who humans are—their

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origins and their heritage. Although no simple statement can explain all the reasons why some physical anthropologists study human remains, one very fundamental reason is that human remains offer direct, tangible evidence of our history, how we have become biologically suited to the many environments in which we live, and how we behave.

Other people have similar interests in origins and heritage, but the means used to answer these questions vary widely. How we come to know ourselves varies from individual to individual as well as from society to society. Some societies rely on personal revelation, on the advice of spiritual leaders, or on oral traditions. Physical anthropologists, like other scientists, adhere to methods that have their roots in the ancient societies of the Mediterranean and North Atlantic. Explanations or hypotheses are proposed to explain relationships between facts or conditions of the physical world. These explanations are then tested by observation of additional measurable facts or physical conditions; if an explanation is supported by these additional observations, it can be accepted as valid or true. The results of the tests of hypotheses or explanations must be repeatable: if an explanation is tested a second or third time the results must be the same as the results of the first test, and if the explanation is tested using the same method on other material, the results of that test must also be the same or very similar. Further, observers should be interchangeable; any trained individual performing the test must get the same or very similar results. If any of these conditions are not met, the explanation is speculative at best, or must be rejected.

This method of acquiring knowledge and understanding is based on a belief system that relies on empirical data gathered from the observation of the material world. Knowledge, for those who share this belief system, is gained through the accumulation of many interrelated insights about the issue being studied.

In examining our heritage, physical anthropologists seek to understand the biological history and origins of all humans in all geographical areas. Our focus is on all humankind. While each human society has its own history, all human societies can be linked by migration and intermarriage through time to be categorized as a single species, *Homo sapiens*, humankind. Each society's biological history is an integral part of the complete and continuing story of all humankind.

II. Why is the information we get from skeletal remains unique, and why can't it be acquired from living peoples?

There are three ways in which data is gathered about past populations: 1) by the study of the artifacts left behind, 2) by the study of the living, and 3) by the study of biological remains. Each of these ways of studying our past has advantages and disadvantages, but the study of the remains themselves has the unique advantage of providing direct information about our ancestors.

Consider questions regarding the health of our ancestors. Did they suffer from the same diseases as we do? Did their particular lifeways or habits subject them to specific diseases and hardships? Were they subjected to new diseases or biological disorders when their lifestyles changed or they came into contact with new peoples migrating into their area? A study of the plant and animal debris discarded in prehistoric living areas gives some evidence of what they ate, and certainly this provides valuable indirect evidence of their health. The study of coprolites, preserved human feces, may reveal more directly what they ate. Further, this line of evidence can give unique information about some of the parasites that may have affected their health. Even the examination of artifacts, such as figurines depicting people who lived in the community, or tools such as lice scratchers or bloodletters, can provide evidence of the health of past peoples. However, each of these lines of evidence is indirect.

A clear example of a health study that documents the singular contribution of studies of human remains is the question of the origin of treponemal disease. Treponemae, a type of spirochetal organism, causes syphilis, pinta, and yaws. Although these diseases are all caused by treponemae, their distribution and mode of transmission is different. Yaws thrives in hot, humid tropical environments worldwide, while pinta is found in the tropical New World. Endemic syphilis is found in subtropical North Africa and the Near East and temperate zones of Asia (Ortner and Putschar 1981). None of these conditions require sexual contact for transmission. In contrast, venereal syphilis has a worldwide distribution and is spread through sexual contact. It is unclear whether these diseases are all caused by different treponemal organisms. One hypothesis is that all treponemal organisms are descended from an early Old World organism that was not exclusively sexually transmitted (Cockburn 1961); another view suggests that yaws, pinta, endemic syphilis, and venereal syphilis are caused by the same organism and that the physical expression of the disease depends on climatic and social factors like urbanization, sanitation, and population density (Hudson 1963, 1965).

Studies of living populations in which the disease is present and of historical records of the spread of the disease could not determine its origin or how it reacted when encountering new populations. In Europe, a particularly virulent epidemic seemed to spread shortly after the discovery of the Americas. In the New World, syphilis spread rapidly and tragically among Native American populations as they came into contact with Europeans. The examination of prehistoric skeletal remains in the New World, however, has documented the presence of the disease in the Americas before the arrival of Columbus (Bullen 1972; Elting and Sterna 1984; Powell 1988; Reichs 1986). Ample evidence also exists for the presence of syphilis or other treponemal diseases in Europe prior to Columbus' return to the New World (Brothwell

1961; Madrid 1986; Steinbock 1976; Stewart and Spoehr 1967). Knowing this, it has become evident that the disease, probably in the form of a new and virulent strain, reinfected historic Native American populations with tragic results (Baker and Armelagos 1988). The study of syphilis, with the use of prehistoric human remains as evidence, has provided humankind with one of the best documented records of the complex origin, spread, and reinfestation of a population by a contagious and deadly disease. Our understanding of our relationship to all contagious diseases has been dramatically improved by our unraveling of the history of treponemal diseases.

A brief examination of the history of cranial modification in the Americas provides another example of how the study of the biological remains of past peoples furnishes unique and valuable evidence. The basic shape of the human head is roughly globular, but this shape can be modified by placing uneven pressures on the head of a growing child. This uneven pressure can be brought about unintentionally by placing a baby in the same resting position time after time, such as in a cradle board or crib. Intentional alteration of cranial shape also has been practiced on a worldwide basis. Although intentional cranial modification is usually not practiced in North America today, many early Native American groups deliberately altered skull shapes by compressing the heads of infants with bands or flat surfaces. Ninety-two percent of all individuals in a prehistoric Adena population displayed evidence of the intentional modification of cranial shape (Webb and Snow 1974), and an early study of an Ohio population revealed that 77 percent of all crania exhibited evidence of intentional modification (Hooten 1920). By historic times, however, these societies had changed and cranial shape alteration became much less widely practiced. Without the information provided by the study of biological prehistoric remains, the widespread nature of this practice in the Mississippi valley would not be known.

A recent study of the biological remains of a Mimbres population in the American Southwest by Holliday (1993) has added an interesting twist to the story of cranial shape modification in the Americas. Her work has documented that, not uncommonly, infections developed in the bone at the point of contact at which pressure was applied. In some cases this infection was serious enough to endanger the life of the child by directly exposing the underlying brain to infection. Again, the analysis of human remains has provided singular evidence of common health threats in past populations.

Many aspects of prehistoric life would be unknown without the analysis of human remains, and these aspects are not restricted to health, daily activities, and other behaviors. Crow Creek Village, a large fourteenth century settlement encompassing nearly eighteen acres, was the home to at least 800 people. The analysis of skeletal remains excavated from this site reveals that a minimum of 486 men, women, and children were killed in a massive siege of the village. Roughly 90 percent of the dead showed evidence of scalping, and indications of decapitation were seen in about 25 percent of the victims.

Equally important, the presence of healed and healing wounds suggestive of scalping in some individuals indicates that this form of violence was not a unique happening (Willey 1990). The occurrence of this prehistoric massacre would not have been known without the recovery of data from human remains.

The study of human remains also provides useful corroboration of ethnographic accounts of historical events. The analysis of skeletal material from the King site, a Georgia site occupied between A.D. 1535-1570, may support accounts of atrocities perpetrated by the Spanish during the early years after European contact (Blakely and Mathews 1990). This study indicates that King site residents enjoyed uncharacteristically good health with relatively low levels of nutritional and environmental stress. Paradoxically, an unusually high death rate was documented. More than 20 percent of the individuals who died displayed cuts and punctures on their bones. The form, angle, and position of the wounds indicated the victims were struck from above with a metal blade at least 60 cm long while facing their assailants. A significant number of these individuals were interred in common graves rather than the single interments seen in the majority of the burials at this site, a burial pattern characteristic of mass disasters in small communities. The victims were predominantly young adult females and people of both genders over 40. Ethnographic and historical data indicate that Native American groups in this time period and area customarily killed young adult males while taking females captive. Thus, if these people were victims of a conflict with another Native American group, we would expect to find mostly young adult males in the common graves and very few females. Therefore, because young adult males appear to have been selectively excluded from the conflict, it appears that these individuals do not represent victims of conflict between Native American groups. Historical and ethnographic sources record that the de Soto expedition sometimes captured older individuals and young females for slave labor and forced prostitution (Hudson, et al. 1988). The type of wounds, the demographic identities of the wounded, and ethnographic and historical data indicate that these individuals represent casualties of a Native American/Spanish conflict, most probably an attack by the Spanish on a carefully selected portion of a Native American community, perhaps as part of an attempt to capture slaves.

One of the most amazing aspects of humanity's biological heritage that has been elucidated by the study of human biological remains is cannibalism. Ethnographic and archaeological evidence supporting the rare occurrence of cannibalism in modern humans and our ancestral species of *Homo* is a matter of some debate (Arens 1979; Binford 1981), but direct evidence from the study of human remains clearly indicates that cannibalism, a practice recorded in many other parts of the world (Bowden 1984; Forsyth 1985; Sahlins 1983; Sanday 1986; Villa, et al. 1986), occurred under rare circumstances in the American Southwest as well (Turner 1993, 1989, 1983;

Turner and Turner 1992; White 1992).

These examples illustrate that information gathered during the analysis of human remains is unique because it provides direct data that can come from no other source. Other anthropological disciplines and ethnographic data can supplement, but not replace, information gathered during the study of human remains. The information gathered from the study of human remains is valuable to physical anthropologists and other scientists because it provides unique direct data and because it allows us to answer questions about prehistoric human life in great depth from many different perspectives.

III. What can we learn about our ancestral origins from the study of human remains?

The colonization of the Americas is one of the largest and most recent events in the spread of humanity throughout the world, which is why it is of such enormous interest to physical anthropologists. Many lines of evidence have been presented to explain the peopling of the Americas, including the study of human biological remains. Christy G. Turner, relying on the study of teeth, has substantiated the other lines of evidence that have indicated that the ancestors of Native Americans came from northern Asia near the end of the Pleistocene. Using the evidence gathered from examination of early Native American teeth, Turner has proposed that the peopling of the Americas occurred in three migrations. The first, representing the ancestors of most Native Americans, arrived near the end of the Pleistocene, passing through an ice-free corridor in Canada, and rapidly spreading throughout North and South America. Peoples of the second migration were the Na-Dene, ancestors of the Athabascan-speaking peoples, most of whom settled along the Northwest Coast of North America. Some of these peoples, however, penetrated into the American Southwest within the last few thousand years. The final migration Turner proposes was the spread of the Eskimo-Aleut peoples, a population that came to inhabit the northern fringes of North America.

While Turner's explanation for the peopling of the Americas is well-documented, there are other studies that provide modifications of his explanation. Brace and Tracer (1993) have proposed that, instead of a single migration before that of the Athabascan-speaking peoples, there were at least two populations present in the Americas prior to the Athabascans. Steele and Powell (1992, 1993, 1994) have provided information that early North American populations differed in appearance from living Native Americans and northern Asians by having a relatively longer and narrower braincase and a narrower face. These studies, and those of Brace and Tracer, suggest that the earliest northern Asian peoples in the New World arrived before the broader features of living northern Asians and Native Americans had developed.

IV. What information about the behavior of past peoples can be acquired from the study of human remains?

The examination of human remains also yields information about an area that is frequently difficult or impossible to explore, the mundane daily activities of peoples of the past. A proven relationship exists between the shape of an individual's body and the activities in which the individual engaged; habitual or prolonged activities often cause skeletal and dental tissues to assume unusual shapes and forms (Kennedy 1989). Therefore, we often can infer some activities of past populations from irregularities in altered skeletal and dental morphology. Many indications of activity patterns are related to the consumption of particularly abrasive foods or grinding the teeth in an abnormal pattern, as evidenced by the abnormal anterior tooth loss seen in some prehistoric Sadlermiut females who softened skins with their teeth (Merbs 1983). Evidence of the use of teeth as a tool also is seen in unusual grooves related to cordage production on the anterior dentition of Native Americans at the Stone Lake site in California (Schultz 1977).

Other signature indications of daily activities found on human skeletal material include enlarged, roughened attachment sites for massive muscles and signs of stress in the related joints. An example of this is seen in the overdeveloped attachment site of the muscle in the lower arm and arthritis in the elbow joint that is related to spear throwing (Angel 1966) and slinging and pitching (Kennedy 1989). Further examples of indications of daily activities are seen in the changes in articular surfaces of bones of the leg and ankle (Barnett 1954; Das 1959; Kostick 1963; Singh 1959; Ubelaker 1979) detected in people who spend a good deal of time in squatting positions. Some habitual activities may cause stress fractures like those seen in the vertebrae of individuals who carry heavy loads on the tops of their heads (Scher 1978); other types of more generalized stress may be indicated by bone degeneration and bone spurs in the lower portion of the vertebral column associated with generalized stress and lateral bending and flexion (Kelley 1982).

Although daily activities like these might be inferred to occur in past populations, skeletal and dental markers offer direct, empirical proof of their common occurrence. These reconstructions of mundane daily behaviors of past peoples are important because they provide indications of everyday activities that were important, and in some cases necessary in the lives of our ancestors.

V. How do anthropologists gather information from human remains?

Physical anthropologists have used many methods to gather information from human remains. Early anthropologists relied on observation of anatomical characteristics, and this remains a mainstay of physical anthropology. Observation of macroscopic anatomical characteristics, or traits large enough to be seen without magnification or any other type of technological assistance, is suitable for the study of traits that vary in their form, some observations pertinent to health and nutrition, and most methods of age and sex determination. One of the chief advantages of macroscopic examination of bones is that it requires little or no permanent alteration of the remains, and most commonly no preparation of the remains besides gentle cleaning. Another advantage is that it requires little or no special equipment other than good light; this means that these methods can be used almost anywhere. However, an important disadvantage of reliance on macroscopic characteristics is that the material must be complete or almost complete, and in a relatively good state of preservation.

Microscopic techniques, on the other hand, may require alteration of the material that is sometimes permanent and perhaps destructive, although the amount of material needed for these techniques is usually very small, often less than a thimbleful. These methods allow us to extract information from even fragmentary and poorly preserved material. Significant drawbacks to microscopic analyses are that they require specialized tools and equipment that usually are costly and not easily transported to the field, and they may result in the destruction of some of the material.

Osteometric analysis relies on measurement of remains with standardized tools that include tape measures, calipers, and different types of calibrated boards. Osteometric analysis is useful in answering questions such as ancestral/descendant relationships, health and nutrition, sexual dimorphism, estimated stature, and sex assessment. This type of analysis has many of the same benefits and drawbacks as the observation of macroscopic characteristics. Although it is non-invasive, non-destructive, and requires little preparation of the remains, it usually requires relatively complete remains in a relatively good state of preservation. However, unlike macroscopic observations, osteometric studies require specialized tools that often are expensive, although the equipment is usually small and easily carried to the field.

Chemical analysis of remains is similar to microscopic analysis in some ways: it can extract valuable, detailed information from fragmentary and poorly preserved remains, but it requires sensitive and specialized equipment that is not easily transported. Moreover, chemical analysis techniques are invasive, require preparation of material, and usually require the destruction of small amounts of bone. The value of chemical analyses lies not only in their ability to obtain data that can be gotten in no other way, but also in their utility as a vehicle for testing, revision, and confirmation of hypotheses formulated using data gathered from other sources. Chemical analyses are particularly useful in reconstructing diets (Keegan 1989), establishing genetic affinities, assessing metabolic abnormalities and other questions of health, making behavioral correlations, and establishing dates (Aufderhiede 1989).

VI. Why do we restudy human remains?

The foundation for scientific research methods is that explanations, or hypotheses, are formulated, tested, and refined before they can be accepted. Each explanation in turn generates new ideas, new interpretations, and new questions. Physical anthropology, like all sciences, is accretionary; each new discovery is the foundation for subsequent research that addresses fresh topics or deals with earlier topics from a different perspective. This testing, retesting, and expanding of interpretations is dependent on the restudy of the biological remains recovered from sites.

Science, like life, is not static. Technology, like methods, hypotheses, and perspectives, changes through time. A survey of articles published between 1950 and 1980 describing results of studies of skeletal remains indicates that 26 percent of the studies used techniques unavailable at the time the material was recovered (Buikstra and Gordon 1981). Stable isotope analysis, chemical analysis, and the extraction of DNA from prehistoric bone are only some of the relatively recent innovations. Methodological advances are only part of the story. Equipment is improved or made more affordable. Computer use originally was restricted to the very well-funded because of the cost of the equipment; it has been made affordable for individuals only relatively recently. Similar statements can be made about photographic equipment, x-ray imaging, and even four-wheel drive transportation.

The perspective from which we address topics also changes over time, and often is changed by technological advances like those mentioned above. Questions of biological affinity, for example, have long been prominent research topics. The development of computer technology has given impetus to large-scale studies of many traits considered simultaneously, which in turn has spurred the development of new areas of investigation.

Technological advances, the development of new methods that include more sophisticated research design, and accompanying shifts in perspective are reasons for the restudy of remains (Ubelaker and Grant 1989). Each of these also influences the development of new areas of interest. An examination of physical anthropology research published in a fifty-year span is illustration of this principle (Lovejoy, et al. 1982). Studies of human remains published between 1930 and 1950 reveal that works of the 1930s were overwhelmingly descriptive in character, with studies of single metric and discrete traits being the major means of data analysis through the 1940s and 1950s. Descriptive reports of the incidence of metric and nonmetric traits also dominated the 1940s, but a slight rise in methods of identification of age, sex, and race also was evident. The 1950s saw continued emphasis on descriptive reports. This era is also notable for an increase in studies of growth, development, maturation, and aging. The 1960s brought a shift away from purely descriptive studies to analytical approaches that used multivariate statistical techniques. Paleodemography, growth, stature, and health status also became important research topics during the 1960s, with organized symposia on paleodemography, paleopathology, and skeletal population studies fueling research. The 1970s saw an amplification of the trend toward the use of multivariate statistical techniques; researchers found fresh applications for these techniques in age and sex determination. As technology was developed and new interests were followed, previously studied skeletal assemblages were the basis of new studies as well.

Within the framework of global and national research trends, regional shifts also can be identified. In anthropological studies in south Texas, Steele and Olive (1988) identified a drift away from studies attempting to identify biological affinity towards studies concerned with prehistoric health status. These local inclinations reflected an increased national interest in prehistoric human adaptation and paleoecology. Such theoretical shifts are to be expected in any science. In fact, they are desirable and even necessary because they provide a framework for new research questions. It easily is seen, however, that it is impossible to design a single study that will anticipate all future research trends.

These reasons explain the need for the restudy of human remains, but the significance of re-evaluation of old hypotheses cannot be overemphasized. Re-examination of previous studies is critical for physical anthropology, as it is for any science, because it allows us to discard erroneous conclusions and outdated ideas and to identify ineffective methods and practices. Buikstra and Gordon (1981) found that close to 74 percent of studies applying new techniques to previously explored questions reached new conclusions. We restudy remains to re-evaluate conclusions as well as to test new hypotheses and methods, to move forward in our understanding of past Native American populations and, by extension, all humans past and present.

VII. Why do we study so many individuals?

The study of the remains of a single person can provide information that allows us to characterize that individual. In contrast, the study of the remains of many individuals from a population provides data that can be used to generalize about other people of the society in which they lived. Skeletal analyses may embrace all of the individuals whose remains were recovered from a site, as in Patrick's (1988) osteometric and demographic analysis of remains from the NAN Ranch Ruin site; target a particular group within the population, as in Marek's (1990) study of growth patterns in children whose remains were recovered from the same site; or use an individual study to address specific questions with implications for a community, as in the study of an individual from the NAN Ranch site presented by Shafer, et al. (1989).

Additional studies use pooled samples comprised of remains from several sites. Workers may choose to combine samples from a restricted geographic area, as seen in Gregg and Gregg's (1987) evaluation of South Dakotan remains dating from 3800 B.P. until historic times addressing questions about health status, trauma, and mortality. Researchers also may combine samples from a wide geographic range, as illustrated by Newman's (1953) evaluation of the effects of nutrition and the environment on body size in aboriginal peoples of the New World. Questions about particular groups during a specific time period may require the examination of samples from a geographically restricted area. These examples constitute only a few of the many ways in which data gathered from several discrete samples may be pooled to address research questions.

Physical anthropologists can reach conclusions by examining relatively small samples, but to ensure that their conclusions are valid they require large samples. Without the examination of many individuals, physical anthropologists cannot be sure that data gathered during skeletal analysis are representative of the society and not idiosyncratic of the few individuals studied. If a condition is identified in one individual, its subsequent identification in other individuals is corroboration that its presence in the community might be noteworthy.

Physical anthropologists also need to examine remains from large numbers of individuals to determine the range of variation within a population. Averaging the occurrence of traits tells us one thing, but the range of variability within a population tells us another. Large sample sizes are necessary to provide evidence of rare skeletal variations in a population. These traits are noteworthy because their presence may be used to identify ancestor-descendant relationships among prehistoric groups and between historic and prehistoric groups. As an example, Ossenberg (1974) concluded that Illinois Hopewell groups and later Plains tribes that included Dakota, Assiniboin, Blackfoot, and Cheyenne populations were not closely related after an examination of the remains of 942 individuals for the incidence of 26 skeletal traits of the cranium. Most of these traits occurred in less than 20 percent of the individuals. Similarly, most of the discrete traits upon which dental studies are based occur in less than 10 percent to 20 percent of the individuals examined.

Given the value of large samples, other questions present themselves. How large must the sample be? How many individual remains are enough? There is no clear answer to these questions. In cases where rare cranial, dental, and other traits are being studied, many individuals must be examined before important traits even can be identified, and the same traits must be observed in many individuals before their significance can be assessed. The same can be said of the analysis of skeletal indications of habitual activities. Such traits may be interpreted as indications of idiosyncratic behavior when seen in one individual, but the same trait takes on new significance when seen in a relatively small but significant segment of the population. We cannot be sure that any anomaly we observe is unimportant unless we can determine with certainty that it does not occur with a significant frequency in a single population or across several separate populations; in other words, its absence in an individual is as important in some ways as its presence. Therefore, all individuals are important; the examination of each is critical. This is a simple but important reason why many physical anthropologists advocate the detailed examination of many human remains.

VII. Why do analyses take such a long time?

A skeletal analysis is more than just looking at bones. The study of human remains is an analysis, in the true sense of the word, requiring the meticulous examination and assessment of human remains in all their component parts from many perspectives. Analyses may include the evaluation of ancestral/descendant relationships, health, nutrition, human adaptation, growth, and development. Each topic is integrated into a synthetic interpretation of the lives of past peoples. A skeletal analysis is a demanding and time-consuming undertaking; it must be done thoroughly.

As a practical matter, collections of skeletal material can never be analyzed completely because of time and financial constraints. In spite of this, physical anthropologists strive to achieve as complete an analysis as possible, because they know that it is not possible to attain reliable, valid conclusions from a partial analysis; a hurried analysis can result in overlooking critical details that may be of importance at some point later in the study, or that may be crucial in subsequent studies.

Basic information about the minimum number of individuals represented by the material, including age and gender, are determined during the initial analysis. Identification of skeletal indicators of trauma, disease, or other disorders, nutritional status, gross morphological characteristics, and other concerns are more complex undertakings, as are the application of chemical analysis, dating techniques, and microscopic evaluation. Gathering osteometric data, which sometimes requires the reconstruction of broken or fragmentary elements, and compiling data on the incidence of non-metric traits are quite exacting and time-consuming. As lengthy as they are, these processes do not consume the bulk of time spent on analysis.

Early studies of human remains from archaeological contexts were chiefly descriptive, but current trends in studies of prehistoric skeletal biology are problem-oriented and directed at answering specific questions. Problem-oriented studies often require the formulation of new techniques, and workers require time to design and refine new methods. Even the smallest sample requires a great time investment for planning the data gathering and contemplating and statistically processing the data. Large amounts of time also are spent in library research on related archaeological sites from the same area or time period. Often unusual characteristics of the skeletal material require comparison with other skeletal collections, and this restudy requires longer periods of access to skeletal remains. Suitable comparative samples may not be readily available, or may be housed at distant facilities. Similarly, if other physical anthropologists need to be consulted, they may not be immediately available. While some consultations may occur via telephone, most often the material itself must be examined for a definitive opinion, so travel time is also a consideration.

Early studies of human remains were primarily grounded in anthropological theory. The current trend in research, though, rests on multidisciplinary studies, those that employ workers and techniques from other scientific disciplines. Their utility for the resolution of specific problems is inestimable because such studies address the unique characteristics of each sample from more than one theoretical framework and technological approach. Interdisciplinary research allows the amassing of data that could not be collected by anthropological techniques alone. However, the time spent in the planning stages of problem-oriented research represents a significant portion of the total time spent on the analysis, and this is particularly true for multidisciplinary research. These studies require more time because they require the participation of teams of scholars rather than a single analyst. It is often difficult to assemble a team that can labor on one study or issue simultaneously in the face of all other commitments of the participants. This is especially true for scientists outside the anthropological disciplines, for whom anthropological studies may represent a tangential study away from the majority of their work. Because most scholars are working on several projects simultaneously, the need for coordination with other workers represents a logistical problem that is usually not quickly or easily resolved. Added to this is the dilemma of the limited number of specialists in some areas.

Among the additional factors that contribute to the need for long-term study of remains is the reality of North American physical anthropology: Many researchers work as staff, students, or faculty in universities where research is only one facet. An additional factor is the overwhelming abundance of important questions about past populations that need to be addressed: Most physical anthropologists work on several projects at once.

Another important issue warranting the long-term study of human remains is that the rarity of some samples may make it difficult to acquire an adequate sample to represent the population. The small sample of Paleoindian remains is the classic example of this problem. The earliest Native Americans, like later hunter/gatherer groups, appear to have existed in small nomadic bands that seldom stayed in one place long enough to create large cemeteries. This situation is compounded by the poor preservation and fragmentary nature of ancient remains. The paucity of remains of Paleoindians and later hunter/gatherer groups presents a profound impediment to meaningful research. This problem can be addressed by pooling several small samples to obtain a larger sample. The remains of a scant twenty-one individuals from sixteen sites can be securely dated at 8500 B.P. or older (Steele and Powell 1992); while the remains of each of these individuals are scientifically important when considered separately, their collective significance when pooled into one group is increased (Steele and Powell 1992).

VII. How does the study of human remains, particularly the study of Native American remains, benefit living people?

The study of treponemal disease in past populations and its ancient distribution has provided valuable information on how epidemics spread among populations. Other studies of medical disorders affecting past populations have had measurable impact on modern health and treatment of disease as well.

The study of rheumatoid diseases like arthritis is such an example. Human remains offer unique opportunities for the study of rheumatoid diseases because an entire bony joint can be examined three-dimensionally, an option not available in the study of living individuals. This is important because diagnosis by visual assessment of bony changes has proven to be much more sensitive than assessment by x-ray of the impaired joint. In a recent study, rheumatoid anomalies were readily detected by visual examination in sixteen of twenty-four skeletal specimens, while the analysis of x-rays of the same material revealed abnormalities in only two of the same twenty-four individuals (Rogers, et al. 1990). It is possible to gather detailed information about changes in bony joints during the early stages of rheumatoid disorders using visual inspection that might escape detection (Rogers and Dieppe 1990). Therefore, the study of prehistoric and historic skeletal samples has aided in our understanding of the patterns of early development of this disorder and this knowledge in turn may be used eventually in the early diagnosis and treatment of living peoples suffering from rheumatoid arthritis.

Information gathered from the reconstruction of ancient diets, accomplished in part through the chemical analysis of human remains, is helpful in tackling modern health problems. The causes of chronic kidney failure, or end-stage renal disease, in children are not fully understood, but information gathered from the study of the diets of past populations is giving new insight into its causes and, most importantly, its treatment. Data indicates that prolonged hyperfiltration, excessive filtering of liquid in the kidneys, plays an important role in the development of this condition. Hyperfiltration occurs in healthy kidneys as a response to a sudden rise in the amount of urea, a substance produced during protein digestion, and other waste products that must be flushed from the body. Ethnographic evidence indicates hunter/gatherer populations had an intermittent, feast-or-famine dietary pattern that may have resulted in the evolution of many physiological mechanisms to accommodate fluctuations in nutrient intake. Analyses of human skeletal remains can provide corroborative evidence for feast-or-famine patterns among early peoples through the identification of indications of periodic episodes of dietary stress. Because feast-or-famine patterns were characteristic of early human groups, hyperfiltration may have developed as an appropriate response to the sudden rise of digestive waste products, especially those from protein digestion. As humans began to consume relatively less animal protein, this physiological response became less critical for survival but lingered on in our genetic makeup (Kallen 1991). The traditional medical approach to chronic kidney disease associated with hyperfiltration included an elevated protein intake. Recent studies, though, suggest that dietary protein restrictions are beneficial (Acchiardo, et al. 1986; Ihle, et al. 1989; White 1989; Zeller, et al. 1991).

Studies of human remains also corroborate ethnographic accounts of our history. Ethnographic accounts are important evidence, especially when they offer information about the early days of European contact and colonization of North America. Ethnographic accounts do not necessarily require corroboration by other data, but they are strengthened when they are confirmed by physical evidence. As an example, physical evidence of European atrocities committed during the exploration and colonization of the New World may be provided by study of remains from sites like the King Site in Georgia (Blakely and Mathews 1991).

And how can knowledge of the prehistoric Crow Creek massacre or the practice of scalping be viewed as helpful to people of today? The answer can only be that our total history is who we are. The good and the violent. The noble and the ignoble. That is all of our history. Certainly, violence and scalping (Iscan and Kennedy 1989, Reece 1940, Ortner and Putchar 1981) were not behaviors found only in the New World. They are part of human history in the Old World as well. We can only hope that by acknowledging that history can we keep it from being a part of our future.

SUMMARY

In this presentation, we have explained why we want to study the past, why we want to study human skeletal remains, and why these studies are important. Many of these views have been expressed by other physical anthropologists (Buikstra 1983; Owsley 1984; Ubelaker and Grant 1989). We recognize that our beliefs may not be appreciated or accepted by all, but we believe our views are as valuable and supportable as are alternative, Native American views. Just as Native Americans experience a heart-felt sense of responsibility toward the skeletal remains of ancestral peoples, physical anthropologists feel an equally profound, personal sense of responsibility toward the remains of peoples of the past. Like Native Americans, we believe that ancestry is not always limited to the closest of kin; in a broad sense, all ancient peoples are the ancestors of modern peoples. We revere all ancestors by preserving their memories and by unraveling mysteries, mundane and extraordinary, about their lives. We wish to recover lost information about ancient peoples; to accomplish this, we gather tiny threads of information from whatever source we can, constantly revising our picture of the past.

Balancing these beliefs against other spiritual and emotional needs is a difficult task, but it is a goal worth pursuing, and effective communication of ideas will help us to attain it.

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REFERENCES

Angel, J. L.
1966 "Early skeletons from Tranquility, California." *Smithsonian Contributions to Anthropology* 2(1).

Arcchiardo, S. R., L. W. Moore, and S. Cockrell.
1986 "Does low protein diet halt the progression of renal insufficiency?" *Clinical Nephrology* 25: 289-294.

Arens, W.
1979 *The Man-eating Myth: Anthropology and Anthropophagy*. Oxford: Oxford University Press.

Aufderheide, A. C.
1989 "Chemical analysis of skeletal remains." In M. Y. Iscan and K. A. R. Kennedy (eds.): *Reconstruction of Life from the Skeleton*. New York: Alan R. Liss, Inc.

Baker, B. J. and G. J. Armelagos.
1988 "The origin and antiquity of syphilis: a paleopathological diagnosis and interpretation." *Current Anthropology* 29: 702-720.

Barnett, C. H.
1954 "Squatting facets on the European talus." *Journal of Anatomy* 88: 509-513.

Binford, L. R.
1981 *Ancient Men and Modern Myths*. New York: Academic Press.

Blakely, R. L. and D. S. Mathews.
1990 "Bioarchaeological evidence for a Spanish-Native American conflict in the sixteenth-century southeast." *American Antiquity* 55(4): 718-744.

Brace, C. L. and D. P. Tracer.
1993 "Craniofacial continuity and change: a comparison of late Pleistocene and recent Europe and Asia." In T. Akazawa, K. Aoki, and T. Kimura (eds.), *Evolution and Dispersal of Modern Humans in Asia*. Hokusen-Sha.

Brothwell, D. A.
1961 "Paleopathology of early British man: an essay on the problems of diagnosis and analysis." *Journal of the Royal Anthropological Institute* 91: 318-344.

Buikstra, J. E. and C. C. Gordon.
1981 "The study and restudy of human skeletal series. The importance of long-term curation." In A. Cantwell, J. B. Griffin, and N. A. Rothschild (eds.), *The Research Potential of Anthropological Museum Collections. Annals of the New York Academy of Sciences* 376: 449-465.

Buikstra, J. E.
1983 "Reburial: how we all lose." *Society for California Newsletter* 17(1) 2-5.

Bullen, A. K.
1972 "Paleoepidemiology and distribution of prehistoric treponemiasis (syphilis) in Florida." *Florida Anthropologist* 25: 133-74.

Cockburn, T. A.
1961 "The origin of the Treponematoses." *Bulletin of the World Health Organization* 24: 221-228.

Das, A. C.
1959 "Squatting facets on the talus in U.P. (Uttar Pradesh) subjects." *Journal of the Anatomical Society of India* 8(2):90-92.

Elting, J. S. and W. J. Sterna.
1984 "A possible case of pre-Columbian treponematosis from New York State." *American Journal of Physical Anthropology* 65: 267-273.

Gregg, J. B. and P. S. Gregg.
1987 *Dry Bones: Dakota Territory Reflected. An Illustrated Descriptive Analysis of the Health and Well Being of Previous People and Cultures as is Mirrored in Their Remnants.* Sioux Falls, South Dakota: Sioux Printing, Inc.

Holliday, D. H. Y.
1993 "Occipital lesions: a possible cost of cradleboarding." *American Journal of Physical Anthropology* 90: 283-290.

Hooten, S. A.
1920 "Indian Village site and cemetery near Madisonville, Ohio." *Peabody Museum Papers* 8(1). Cambridge: Peabody Museum.

Hudson, C., C. DePratter, and M. T. Smith.
1988 "The victims of the King Site Massacre: a historical detectives' report." In R. L. Blakely (ed.), *The King Site: Continuity and Contact in Sixteenth Century Georgia.* Athens, University of Georgia Press.

Hudson, E. H.
1965 "Trepanematosis and man's social evolution." *American Anthropologist* 67: 885-901.

Hudson, E. H.
1963 "Trepanematosis and anthropology." *Annals of Internal Medicine* 58: 1037-1049.

Ihle, B. U., G. I. Becker, J. A. Whitworth, R. A. Charlwood, and P. S. Kincaid-Smith.
1989 "The effect of protein restriction on the progression of renal insuffieciency." *New England Journal of Medicine* 321: 1773-1777.

Kallen, R. J.
1991 "Paleonephrology and reflux nephropathy: from the 'big bang' to end-stage renal disease." *American Journal of the Diseases of Childhood.* 145: 860-864.

Keegan, W. F.
1989 "Stable isotope analysis of prehistoric diet." In M. Y. Iscan and K. A. R. Kennedy (eds.), *Reconstruction of Life from the Skeleton*. New York: Alan R. Liss, Inc.

Kelley, M. A.
1982 "Intervertebral osteochondrosis in ancient and modern populations." *American Journal of Physical Anthropology* 59(3): 271-279.

Kennedy, K. A. R.
1989 "Skeletal markers of occupational stress." In M. Y. Iscan and K. A. R. Kennedy (eds.), *Reconstruction of Life from the Skeleton*. New York: Alan R. Liss, Inc.

Kostick, E. L.
1963 "Facets and imprints on the upper and lower extremities of femora from a western Nigerian population." *Journal of Anatomy* 97: 393-402.

Lovejoy, C. O., R. P. Mensforth, and G. J. Armelagos.
1982 "Five decades of skeletal biology as reflected in the *American Journal of Physical Anthropology*." In F Spencer (ed.), *A History of American Physical Anthropology 1930-1980*. New York: Academic Press.

Madrid, A.
1986 "Work in historical osteology at the National Museum of Antiquities in Sweden." *Museum* 38(3): 155-157.

Marek, M.
1990 "Long Bone Growth of Mimbres subadults from the NAN Ranch (LA 15049), New Mexico." MA Thesis, Texas A&M University.

Merbs, C. F.
1983 "Patterns of activity-induced pathology in a Canadian Inuit population." *National Museum of Man Mercury Series, Archaeological Survey of Canada* No. 119.

Newman, M. T.
1953 "Ecological rules and racial anthropology." *American Anthropologist* 55: 311-327.

Ortner, D. J. and W. G. J. Putschar.
1981 "Identification of pathological conditions in human skeletal remains." *Smithsonian Contributions to Anthropology*, No. 28. Washington, D.C.: Smithsonian Institution.

Ossenburg, N. S.
1974 "Origins and relationships of Woodland peoples: the evidence of cranial morphology." In E. Johnson (ed.), *Aspects of Upper Great Lakes Anthropology: Papers in Honor of Lloyd A. Wilford*. St.Paul: Minnesota Historical Society.

Owsely, D. W.
1986 "Human bones from archaeological contexts." *Museum Anthropology* 8: 2-8.

Patrick, S. S.
1988 "A Description and Demographic Analysis of a Mimbres Mogollon Population from LA 15049 (NAN Ruin)." MA Thesis. College Station: Texas A&M University.

Powell, M. L.
1988 *Status and Health in Prehistory: A Case Study of the Moundville Chiefdom*. Washington: Smithsonian Institution Press.

Reichs, K. J.
1986 "Trepanematosis: a possible case from the late prehistoric of North Carolina." *American Journal of Physical Anthropology* 79: 289-303.

Rogers, J. and P. Dieppe.
1990 "Skeletal paleopathology and the rheumatic diseases: where are we now?" *Annals of the Rheumatic Diseases* 49: 887-888.

Rogers, J., I. Watt, and P. Dieppe.
1990 "Comparison of visual and radiographic changes at the knee joint." *British Medical Journal* 300: 367-368.

Scher A. T.
1978 "Injuries to the cervical spine sustained while carrying loads on the head." *Paraplegia* 16:94-101.

Schultz, P. D.
1977 "Task activity and anterior tooth grooving in prehistoric California Indians." *American Journal of Physical Anthropology* 46(1):87-92.

Shafer, H. F., M. Marek, and K. J. Reinhard.
1989 "A Mimbres burial with associated colon remains from the NAN Ranch Ruin, New Mexico." *Journal of Field Archaeology* 16(1): 17-30.

Singh, I.
1959 "Squatting facets on the tibia and talus in Indians." *Journal of Anatomy* 93: 540-550.

Steele, D. G. and B. W. Olive
1988 "Bioarchaeological research in central and southern Texas: documentation of the value of curated collections of prehistoric human skeletal remains." Paper presented at the Annual Meeting of the Society of American Archaeologists, April 29, 1988.

Steele D. G. and J. F. Powell.
1994 "Paleobiological evidence of the peopleing of the Americas: a morphometric view." In R. Bonnichsen and D.G. Steele (eds.) *Method and Theory for Investigating the Peopleing of the Americas*. Corvalis, Oregon: People of the Americas Publications, Center for the Student of the First Americans, Department of Anthropology, Oregon State University.
1994b "Paleobiology of the First Americans," *Evolutionary Anthropology*. 2(4): 138-146.
1993 "Peopling of the Americas: paleobiological evidence." *Human Biology* 64(3): 303-336.

Steinbock, R. T.
1976 *Paleopathological Diagnosis and Interpretation*. Springfield: Thomas.

Stewart, T. D. and A. S. Spoehr.
1967 "Evidence on the paleopathology of yaws." In D. Brothwell and A. T. Sandison (eds.), *Diseases in Antiquity*. Springfield: Thomas.

Turner, C. G. II
1989 "Teeth and prehistory in Asia." *Scientific American* Feb: 88-96.
1983 "Taphonomic reconstructions of human violence and cannibalism based on mass burials in the American Southwest." In G. M. LeMoine and A. S. MacEachern (eds.), *A Question of Bone Technology*. Calgary: University of Calgary Archaeological Association.

Turner, C. G. II and J. A. Turner.
1992 "The first claim for cannibalism in the Southwest; Walter Hough's 1901 discovery at Canyon Butte Ruin #3 in northeast Arizona." *American Antiquity* 57: 661-682.

Ubelaker D. H.
1979 "Skeletal evidence for kneeling in Prehistoric Ecuador." *American Journal of Physical Anthropol ogy* 51: 679-685.

Ubelaker, D. H. and L. G. Grant.
1989 "Human skeletal remains: preservation or reburial?" *Yearbook of Physical Anthropology* 32: 249-287.

Webb, W. S. and C. E. Snow.
1945 "The Adena people." *Reports in Anthropology and Archaeology* 6. Lexington, KY: University of Kentucky.

White, R. H. R.
1989 "Vesicouretieric reflux and renal scarring." *Archives of the Diseases of Childhood* 64: 407-412.

Willey, P.
1990 *Prehistoric Warfare on the Great Plains: Skeletal Analysis of the Crow Creek Massacre Victims.* New York: Garland Publishing, Inc.

Zeller K., E. Whittaker, L. Sullivan, P. Raskin, and H. Jacobson.
1991 "Effect of restricting dietary protein on the progression of renal failure in patients with insulin-dependant diabetes mellitus." *New England Journal of Medicine* 324: 78-84.