Anthro Notes

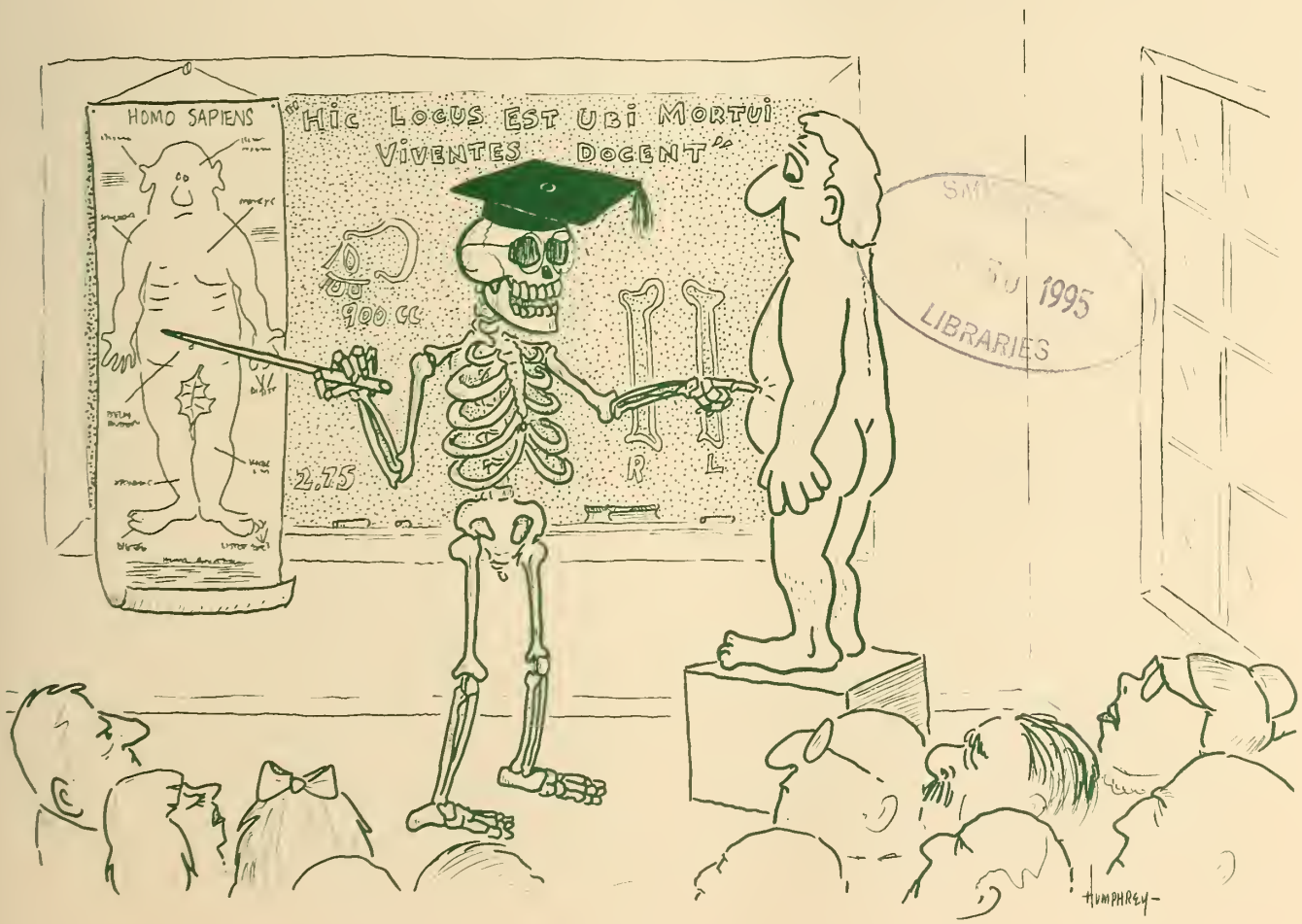
National Museum of Natural History Newsletter for Teachers

Vol. 11 No. 2 Spring 1989

WHAT BONES TEACH US

Collecting and studying human skeletons in museums and scientific laboratories is presently a complex, controversial subject. The purpose of this article is to explore the kinds of information scientists obtain by studying human skeletons, and how that information is used.

A physical anthropologist is trained to determine many facts about an individual from bones alone. For instance, sex identification often can be determined by the differences in the pelvis and skull. Even bone fragments may be sexed; some chemical components of bone differ between men and women. Age at the time of death can be estimated very closely by



10TH ANNIVERSARY ISSUE

looking at the teeth and at the fusion between different parts of the same bone, especially for children and young adults. For older people, the estimates are less exact and rely more on changes in joint surfaces, fusion between skull bones, and microscopic details of internal bone structure. Height is estimated by the length of the long bones, especially the thigh. Race can often be determined by looking at characteristics of the facial skeleton. Statistical studies of tooth, skull and face shape can even distinguish closely related groups within the same major race.

The skeleton reveals information about lifestyle as well. Well-developed muscles leave their mark on bone and tell of heavy physical activity during life. Habits (such as pipe-smoking) and handedness may leave traces on teeth or in asymmetric bone and muscle development. Health, injuries, and many diseases, such as syphilis, tuberculosis, arthritis, and leprosy, may leave traces on bone. A subfield of physical anthropology, paleopathology, is devoted to the study and diagnosis of diseases in ancient human remains.

From these studies, paleopathologists are often able to provide medical insights on the history and ecology of modern human diseases. For instance, childhood illness or malnutrition can be detected by abnormalities in tooth enamel and bone mineralization. By noting the position of these abnormalities, physical anthropologists, with their knowledge of normal growth patterns of bones and teeth, can often pinpoint at exactly what age the illness or growth disturbances occurred. From this can be determined whether a child's health problems were caused by a sick or poorly nourished mother, by early weaning, or by later periods of food shortage.

Victim Identification

Because of their skill at piecing together an individual's life history from skeletal clues, physical anthropologists are constantly in demand to help identify humans who have been the victims of accidents or foul play. The forensic anthropologist can tell authorities if bones are human, and if disarticulated, whether or not they all come from the same individual. Today, physical anthropologists are helping Argentinean authorities locate and identify skeletons of people kidnaped and murdered by political extremists during Argentina's period of upheaval in the past decade. Recently, anthropologists helped confirm the identification of a skeleton attributed to Nazi war criminal Josef Mengele. Other scientists use information learned from studying museum skeletons to help provide facial reconstructions of what missing children might look like several years after their disappearance.

Burial Remains

Why do scientists collect and study more than one skeleton from the same site or cemetery? Isn't one enough? The answer depends on what questions the scientist wants to answer. Although a single skeleton can tell us much about an individual, that person is known only in isolation, and people don't live in isolation. To the anthropologist, much more important information about whole social groups, their history and relationships with neighboring and past cultures, their diet and health, and also their social customs and relationships can be obtained only by studying large numbers of skeletons from the same culture or living site. Such population-wide studies require many specialized analytic techniques that depend on having large numbers of observations in order to be valid.

The Case of the Ainu

Many of these population studies have provided information about past human migrations, declines, and relationships that were unrecorded even in traditional stories and myths. For instance, research by anthropologists on the Ainu of Japan has resolved some long-standing questions about their origins. The Ainu are considered by most Japanese to be a low status ethnic minority whose physical features are somewhat different from the majority population. Although Japanese tradition holds that modern Japanese are descended from the prehistoric Jomon culture found throughout Japan, two studies now show that the Ainu are the true descendants of

the Jomon people. According to studies of minute variations in teeth and skulls of the modern inhabitants of Japan, and of various prehistoric cultures from Japan and other parts of Asia, the modern Japanese are most likely the descendants of invaders from northern China called the Yayoi, who conquered the islands a little over 2,000 years ago. An interesting twist to the story is that many of the medieval Japanese warrior class, the samurai, show physical features that suggest that they were descendants of Jomon mercenary armies recruited by the Yayoi during their military conquest. As the samurai gained power and status, they eventually intermarried with the Yayoi ruling classes and passed on some of their typically "Ainu" facial traits into the modern upper classes of Japan. Today's Ainu are the descendants of unabsorbed Jomon populations who were pushed into increasingly marginal areas by the Yayoi-Japanese and their Jomon-derived samurai.

Similar kinds of studies have been used to provide answers to questions as diverse as how many waves of prehistoric immigrants populated Australia, how much white admixture there is in various Amerindian groups, and how much intermarrying there was between Pueblo groups in the Southwest and Europeans during the contact period. Other researchers using the same techniques have been able to chart the progressive distinctiveness of Amerindian groups from other Asians and Pacific island populations to estimate when Amerindian migrants first entered the Western Hemisphere and when the various tribes became separate.

Mohenjodaro Revisited

Scientists utilizing new techniques have even been helpful in resolving questions about classical civilizations. The city of Mohenjodaro, the center of Harappan civilization in the Indus Valley, was thought to have been sacked by Aryan warriors invading in 1500 BC. After studying the human remains from Mohenjodaro, anthropologists have now concluded that no massacre ever occurred because they found no battle injuries on the bones. They also found no evidence of genetic differences between populations before, during, and after the decline of Mohenjodaro, which makes an invasion of foreigners very unlikely. However, the skeletons did show high levels of disease and parasites, which might have been a more important cause of the Harappan decline than any invasion or conquest.

Disease, Diet, and Demography

Studies of cemeteries show scientists how human groups interact with their environment, and how they in turn are affected by changes in the physical world they occupy. Reconstructions of demography, diet, and growth and disease patterns help physical anthropologists understand the ecology of prehistoric groups and make some surprising discoveries about human adaptations, such as the health costs of agriculture, and the origins of some modern human diseases.

Many diseases can be diagnosed from skeletons, and it is sometimes possible to recover fossilized bacteria, and occasionally, amino acids for blood typing directly from bone. One extensive study of Grecian cemeteries from ancient to modern times traced the increase in malaria-resistant anemia (thalassemia, similar to sickle-cell anemia in Africa) in Grecian populations, and showed the effects of changes in ecology and social and economic patterns on the health and lifespan of ancient and recent Greeks. By looking at groupings of skeletons in cemeteries, the scientist was also able to reconstruct families or clans, and to show that anemic groups were more fertile than others.

Studies of skeletons can also tell what people ate, even without having any cultural information. Some techniques measure certain chemical isotopes and trace elements in ground bone. These amounts will differ, depending on the proportion of meat to vegetables in the diet, and on the type of plant foods eaten. Results have shown that in some prehistoric groups men and women had different diets, with men sometimes consuming more meat and women eating more plant foods. Other studies have shown that different diets leave different microscopic scratch patterns on tooth

surfaces, and several kinds of prehistoric diets can be distinguished in this way.

Changes in diet often cause changes in health, which can be seen in the skeleton. The shift to maize in the prehistoric Southwest coincided with an increase in porous bone in skeletons, a sign of iron deficiency anemia. In maize farmers from Dickson Mounds, Illinois, defects in tooth enamel, which are caused by stress during childhood, are more numerous. Infant mortality was also higher, and adult age at death lower than in pre-agricultural groups. Similar studies of Hopewell mounds concluded that the agricultural Hopewell had more chronic health problems, dietary deficiencies, and tuberculosis than pre-agricultural groups. Agriculture is usually thought to bring an improvement in quality of life, but the surprising conclusion that prehistoric agriculture marked a decline in general health in the New World has been confirmed by many other studies.

Recent Population Studies

Studies of human skeletons can be useful even for recent populations, when written records are limited or have been lost. Several studies have reconstructed the living conditions of African-Americans both during and after the end of slavery. Skeletons recovered from an 18th century New Orleans cemetery showed many differences in nutrition and physical stress between urban and rural slaves. Skeletons from a late 19th-early 20th century cemetery in Arkansas open a window on this period, which is not well documented by other historical sources. Researchers concluded that men commonly left the community (there were few male burials), and that some of the community intermarried with the local Indian population. On the whole, the population was poorly nourished and had low resistance to disease. Many infants died at birth of widespread bacterial infections. Childrens' skeletons show dietary deficiencies and chronic infections, with many dying at 18 months, the weaning age. Iron deficiency anemias were common, probably due to corn-based diets; high levels of arthritis indicate heavy physical labor; and many signs of injuries on male skeletons may be evidence of high levels of interpersonal violence. Even without written records, the skeletons in this Post-Reconstruction community tell us of continual malnutrition, poor health, and levels of physical stress, which even exceeded those found in some communities during slavery.

Ancient Diseases in Contemporary Populations

Physical anthropologists find many contemporary diseases in earlier human populations. Some show peculiar distributions in the United States today, which can sometimes be tied to disease prevalence in the past. One of these is osteoporosis, a weakening of bone due to a calcium-poor diet and low bone mass resulting from low exercise levels during life. This condition afflicts primarily elderly white females, leading to spontaneous fractures and spinal deformities. Surprisingly, anthropologists have discovered that osteoporosis is common in living and prehistoric Eskimos of both sexes, and appears at an earlier age when compared to American whites. However, fractures and spinal problems have not been common in Eskimo populations. In spite of the traditional calcium-poor Eskimo diet, vigorous exercise results in heavier bones that protect the individual in old age. Now however, increased lifespan and alterations in lifestyle may contribute to a rise in osteoporotic bone disorders in Arctic populations in the future.

Evidence of a disease in prehistory is sometimes useful in understanding its cause. Osteoarthritis is often found in prehistoric skeletons. Changes in the locations and numbers of joints affected, and in the proportions of men and women afflicted, have suggested that systemic factors affecting only one sex may be involved in the severity of modern arthritis, an insight that may help focus further research efforts. Studies of prehistoric skeletons have shown that high levels of tooth decay are typical only of agricultural populations. This has led to the observation that sticky carbohydrates common to most agricultural diets have something to do with the epidemic of tooth decay modern populations are experiencing. But mineral deficiencies

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may also be involved, as some high levels of cavities and periodontal disease have been found in non-agricultural prehistoric Illinois Indians. Since the mineral content of ground water would affect the disease resistance of tooth enamel, such studies pointed to mineral supplementation of drinking water as a means of combating tooth decay. Tuberculosis has been found in skeletons as early as 5000 yrs B.P. in the Old World and by at least A.D. 1000 in the New World. It is associated with keeping livestock and living in sedentary or urban centers. Cemetery studies in Europe have shown a curious relationship between tuberculosis and leprosy, also a very ancient disease. Skeletons rarely show signs of both diseases, and as tuberculosis became more common in Europe in the late Middle Ages, signs of leprosy in European skeletons declined. Medical researchers now speculate that exposure to tuberculosis provides individuals with some immunity to leprosy.

Some health problems are more common in Native Americans than in the general population. One of these is rheumatoid arthritis, which had been thought to be a recent disease possibly caused by an infection. The discovery of rheumatoid-like lesions in prehistoric American Indians has changed the focus of medical research on this disease. Another condition more common than expected in some Native American tribes is the cleft palate/cleft lip complex of congenital bone defects. Clefting of the face has been found in prehistoric skeletons from the same region, though it is not as common as in the modern population. It is not known whether this shows a real increase in the problem, or if burials of prehistoric babies who died from their condition are simply not recovered as often as adults. Some researchers speculate that the increase, if real, might be the result of more inbreeding in tribal populations than would have occurred in the past, after groups were confined on reservations, and traditional migration and marriage patterns were disrupted.

Patterns of Social Organization

It might seem surprising that we can learn much about the patterns of political and social organization of past cultures from a study of bones, but in fact physical anthropologists and archaeologists can discover a great deal about social customs in prehistory through studies of cemeteries. This is only possible, however, with data about age and sex of each burial.

Evidence of status and marriage patterns are often visible in cemetery populations. Anthropologists studying skeletons from the prehistoric North American site of Moundville, Alabama, reconstructed three different status groups in Moundville society. These included individuals whose remains were either used as trophies, or were possibly sacrifices sanctifying the mound-building process, an intermediate group containing both men and women, and a high-status group composed entirely of adult men. By analyzing genetic differences among men and women in the same cemetery, it is often possible to reconstruct marriage and residence patterns. For instance in one study of prehistoric and historic Pueblo cemeteries, women in each cemetery had very similar genetic markers, while the men in each group were quite variable for those same traits. This indicates that women lived and were buried with their kin groups, while men lived and were buried with unrelated groups. The ancient Pueblo people were matrilocal, just as the modern tribes are today. Some studies have revealed a relationship between an individual's status during life, and his or her physical characteristics, such as height. Taller people tend to have higher status markers in their graves in several prehistoric cultures. This is more often true for men, but in some groups taller women also had higher status. By studying skeletons for indications of growth disturbances and disease, scientists can sometimes tell whether the greater height of high status people was due to better diet and more resources, or whether they were just genetically predisposed to be taller.

Conclusion

The above examples show how anthropologists can learn about many facets of the lives of individuals and communities of past cultures by studying the skeletal materials. The study of modern, historic, and prehistoric skeletons has made it possible for anthropologists to contribute an enormous and diverse array of information about human behavior and morphology past and present. None of these studies could have been accomplished without thorough study of human skeletons. To obtain this information, scientists commonly use techniques that were unheard of and unanticipated even a generation ago. It is certain that many more new approaches to reconstructing past lives from bones will be discovered in the future. Many collections may be studied and restudied, in the quest for new answers to old questions, or for answers to new questions altogether.

Prehistoric populations left us little of their history and experience from which to learn. By careful study of their skeletons, we gain an understanding of ancient humans that would not otherwise be possible. The late J. Lawrence Angel, a noted Smithsonian physical anthropologist and forensic expert, always kept a sign in his laboratory: "Hic locus est ubi mortui viventes docent." In this place, the dead teach the living. They teach us about the past, and if we listen carefully, about the future as well.

Recommended Reading:

Brothwell, D. R. Digging Up Bones. 3rd ed. Ithaca, NY: Cornell University Press, 1981.

Ubelaker, D. H. Human Skeletal Remains. 2nd ed. Washington, DC.: Taraxacum, 1989.

Wells, Calvin Bones, Bodies, and Disease. New York: Praeger, 1964.

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