

TALES BONES TELL

In cases of homicide, mass disaster, missing persons, and death from undetermined or suspicious causes, law enforcement personnel often turn to scientists. Scientists in diverse fields (physical anthropology, botany, entomology, biochemistry, and sociocultural specialties such as costume design and analysis) apply their expertise to examining the human skeleton and related artifacts to illuminate the identification of remains or the circumstances surrounding a death. Physical or forensic anthropologists have participated in some of the most publicized cases of the century, including the identification of victims of serial killers such as Ted Bundy, the Green River Killer, Henry Lee Lucas, and Jeffrey Dahmer; of soldiers killed in Korea, Vietnam or Operation Desert Storm; and the solution of mysteries surrounding such figures as the Texas gunfighter William P. Longley and the kidnapped Lindbergh baby.

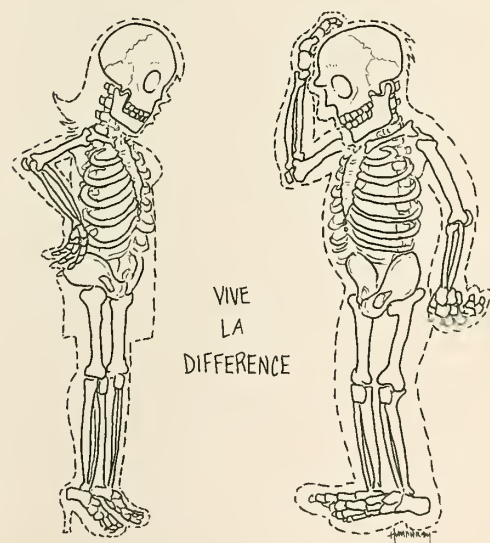
The forensic anthropologist can usually determine age at death, race, sex, and stature; detect any indications of trauma, disease, and occupational or habitual activities; and estimate elapsed time since death. The best sources--often the only sources--of such information are the skeleton and teeth.

When a complete skeleton or even a single bone is found, the first question is whether it is human, nonhuman animal, or other (e.g., burned gourd resembling a human skull). As human and animal bones differ in texture, density, shape, and size, visual examination quickly provides an answer. Should human and animal bones be present, they are separated, and the number of individuals represented by the human bones determined. Next the bones are examined for evidence of stabbing, bullet wounds, or butchering (i.e., disarticulation).

Forensic anthropologists examine human skeletal material using a variety of techniques to obtain many kinds of data. Determination of sex, race, age, stature, date and cause of death, and occupational or habitual activities all help in the quest for positive personal identification.

Determination of Sex

The most reliable osteological (bony) indications of sex are the pelvis, skull, and mandible, and the size of the long bones and joints. The female pelvic girdle consists of two hip bones and a sacrum that have a number of bony features differing from those of a male. For example, when the two hip bones of an adult female are put together with the sacrum and viewed from above, the birth opening is circular and large; female hip bones have a more outward flare than those of males; and the female pelvis has a broader notch for the sciatic nerve and a wider angle where the two pubic bones, which are long and rectangular, come together. These structural traits facilitate the process of giving birth. In contrast, the male pelvis is usually larger and more muscle marked than the female. The cavity viewed from above is heart-



shaped rather than circular and the pubic bones are short and triangular.

Like the pelvis, the male skull is typically larger and more muscle marked than that of the female. In addition, males exhibit larger mastoid processes (behind the ears), a sloping forehead with more developed browridges, blunt upper margins of the eye orbits, in contrast to the sharp orbital rims of females, and a larger lower jaw with a more squared chin.

Racial Affiliation

Racial affiliation is difficult to determine even in the living. Human populations, or even human families who are closely related genetically, are extremely variable. In addition, humans have always been quite mobile, and interbreeding among different populations is common throughout the world. Many of the characteristics used by the public to determine "race", such as a particular skin color or nose shape, actually occur throughout the world in unrelated populations. The concepts "Black," "White," "Asian," or "Native American," commonly used in the US, are social constructs, whose boundaries are arbitrary and bear little relationship to biological affinities. In examining skeletal material, the forensic anthropologist faces a further dilemma. Skeletal attributes more common in particular populations may not correspond at all to the surface characteristics such as skin color or hair form that are used to suggest ancestry among the living.

In the order of most to least reliable, the skeletal indicators of racial affiliation--people of African descent, people of European descent, and East Asians, which include Native Americans, Eskimos, Chinese, Japanese, and other Asians--are most apparent in facial structure, skull, teeth, and thigh bone. Anthropologists assess these attributes on a scale ranging from mild to prominent. For example, many people of African descent have short, wide nasal openings and grooves at the base of the bony portion of the nose in contrast to many people of European descent, who have narrow, long nasal openings and a ridge at the base of the nose. When viewed

from the front, the faces of "Europeans" tend to be narrow and long, and those of "Africans" tend to be wider and shorter; and those of "Asians" may range from flat to concave.

In regard to teeth, "Africans" often have complicated or "wrinkled" molar cusp patterns. Two dental traits common to many "Asians" are an edge-to-edge bite and shovel-shaped incisors. Nearly all Native Americans who lived before about AD 1900, and many extant Asian groups, have severely worn teeth.

Determination of Age

The age of a person less than 18 years old can be determined most accurately by the stage of dental development, as the teeth develop in a predictable sequence making possible an age estimate generally accurate to within six months.

The size and stage of development of the long bones in the legs and arms also provide information for estimating the age of a subadult to within about 16 months. The maximum length of a single bone can be obtained and compared to bone lengths based on clinical growth standards; the resulting age estimate is accurate to within a few months.

Whereas age estimates of children are based on the stage of development of the skeleton and teeth, those of adults are derived from advanced growth and degenerative changes. Thus indicators of adult age include the stages of sutural closure in the skull's cranial vault and palate and structural changes of the pelvis. Equally important indicators are degenerative changes, such as arthritis of the spine and joints, and a general decrease in bone mass, a condition known as osteoporosis.

Determination of Stature

Stature or height can be determined for a child or an adult if there is at least one complete or nearly complete long bone of the arm (humerus, radius, or ulna) or leg

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(femur, tibia, or fibula). The measurements can then be compared with tables giving ranges in relation to sex, age, and so on.

Elapsed Time Since Death

To estimate the postmortem interval from death to discovery in weeks, months, or years is perhaps the most difficult aspect of forensic anthropology. During the first 24 hours after death, the human body goes through rigor mortis. Within a few days the

body begins to decompose, and the facial features become unrecognizable. Maggots are responsible for most of the process of reducing the body to a skeleton. When the body is not fully skeletonized, forensic anthropologists or entomologists can determine time since death by identifying the species of insects feeding on the body and determining its stage of development (maggots metamorphose from egg to the adult). If the remains are skeletonized, then the forensic anthropologist considers the color, cracking, and dryness of the bones and the absence of odor.

Trauma and Disease

Blunt and sharp force trauma in bone results from the impact of a brick, gunshot, or stabbing or slashing weapon. If the individual was fatally injured and died before the affected bone began to heal, the injury is designated perimortem, meaning that it occurred at or near the time of death. Examination of perimortem trauma can suggest the type of implement used and, often, the cause of death. Certain diseases such as cancer, syphilis, tuberculosis, and leprosy can also be identified in a skeleton because the disease alters the bone.

Evidence of Occupational or Habitual Activities

Bone responds to mechanical activity and exercise through growth. Conversely, insufficient activity and immobility lead to a decrease in bone mass. In persons who engage in repetitive activities for long periods of time, bones display adaptations to such activities. Overdevelopment can be seen, for example, in baseball pitchers (humerus), archers (scapula), blacksmiths (humerus), and dancers (feet). Other examples include dental grooves from holding nails between teeth (carpenters), chipped front teeth from opening bobby pins or safety pins, and stress fractures of toes in persons engaged in martial arts.

Positive Personal Identification

Frequently, the ultimate goal of a forensic investigation is to establish a positive identification. The police or medical authorities search files of missing persons for individuals who fit the physical description supplied by the anthropologist (for example, a white female, 25-30 years of age, who has been missing for one year). Facial photographs and dental and medical records, including radiographs (x-rays), of suspected victims are then requested from family, doctors, dentists, and hospitals. In the absence of fingerprints, a positive identification can be made from comparison of features revealed in x-ray pictures taken before and after death.

Forensic anthropologists seek unique and individualizing features in the skeleton, such as a healed broken bone or evidence of a particular bone disease, and in the teeth, such as the number and shapes of dental fillings. Most identifications are achieved through comparing dental x-rays of a missing person with those of the victim. Unusual dental traits such as chipped front teeth visible on photographs also provide evidence leading to a positive identification. When all else fails, a facial reproduction, either in clay or a sketch by an artist, can be produced and the presumed likeness distributed to police agencies or news media in an effort to find someone who recognizes the victim.

Forensic anthropologists, with their specialized knowledge of comparative anatomy and skeletal variability, have become integral members of homicide and mass disaster teams that travel worldwide. Their expertise in the identification of decomposed and skeletonized human remains has led to the identification of many individuals for whom conventional means have not been successful.

Further References

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