Focus on Four Fields

Biological Anthropology: Bioarchaeology and the Analysis of Human Remains

What Secrets Do Our Skeletons Hold?

The study of human remains can be traced back to the development of anthropology as an academic discipline in the nineteenth century. Today, this study typically falls under the umbrella of biological anthropology, a major component of which is **bioarchaeology**. However, the lines that separate different anthropological specialties are often flexible, and paleoanthropologists, archaeologists, and other types of scientists are also often involved in the analysis of human remains. In this section, we will focus on the methods and techniques typically used by bioarchaeologists.

Bioarchaeology can be thought of as the archaeology of human death, since it relies on the remains left behind by individuals long after they have died. Death is a fact of life and an unavoidable topic for anthropologists who study humans both past and present (Rubertone 2007). The topic intersects with questions about social issues and population dynamics, such as inequalities in wealth, health status, and the occurrence of disease. The analysis and interpretation of mortuary remains reminds us that humans are biocultural organisms. After all, this analysis can reveal a great deal about not only an individual's physical characteristics (e.g., height, weight, sex) but also the cultural practices of the society in which she or he lived (e.g., religious or spiritual practices and the structure of rituals) (ibid., 256).

The excavation and analysis of human remains often involves a systematic set of procedures that begins with surveying, both on foot and with non-invasive techniques like ground-penetrating radar, to locate graves. Once a grave has been located and prior to any excavation, researchers must apply for permission from local governments and request the consent of any known relatives who are still living. In Canada, this latter requirement often involves cooperating with local Indigenous groups. The highly sensitive nature of burials requires bioarchaeologists to be extremely respectful of those who are buried as well as their living relatives. Each country has different requirements for obtaining permission to excavate and study human remains. In the United States, these requirements are established by federal laws; in Canada, they are generally set out by the province or territory within which the remains are located. (For more on this topic, see Chapter 8, p. 170.)

If and when permission has been granted, the excavation can begin. In most cases, excavation involves retrieving biological remains as well as cultural artifacts associated with the graves. Numerous cultural practices and beliefs influence how humans are buried, where they are buried, and what objects are included in their burials. Bioarchaeologists document evidence of these practices by recording as much as they can about what they uncover. What is the position of the body? Is it on its side, back, or front? Is it "flexed" (i.e., curled up in a fetal position) or laid out flat? Does the site contain the remains of only one individual, or is it a group burial site? Are the graves oriented along an east–west or a north–south axis? Are the remains in any type of container (e.g., jars or coffins)? What types of artifacts are included in the graves? Is there any jewellery? Are there any weapons or tools? The combined interpretation of these multiple sources of data can provide an abundance of information about the individual and her or his society.

bioarchaeology The study of human remains from prehistory to provide information about the human past.

Excavating Burial Sites

What sorts of conflicts might arise before, during, or after the excavation of a grave? Why and in what circumstances might living relatives require a researcher to observe religious or spiritual rituals when examining the remains? When might ownership of the remains become an issue? If artifacts have been uncovered, to whom do they belong?

Analysis of Skeletal Remains

Bioarchaeologists often use skeletal remains to look at patterns of age and sex, genetic markers, health status, evidence of disease, and even the types of food the individual consumed while he or she was alive. But where do they begin?

The first step is to look at the skeletal remains and any other biological indicators that are present in the grave. The individual's age at death is usually one of the first characteristics that a researcher identifies. Skeletal size is typically a reliable indicator of age at death for youths up to approximately 12 years of age. For older individuals, analysis of the long bones of the skeleton can provide useful clues. All long bones are composed of a diaphysis (i.e., a shaft) and two epiphyses (i.e., ends). In children and adolescents, the area between the diaphysis and the epiphyses consists of a layer of cartilage known as a "growth plate" or an epiphyseal plate. The epiphyseal plates of different long bones fuse to their diaphysis at different ages. In females, the epiphyseal plates begin to fuse from 12 to 17 years of age; in males, they begin to fuse from 15 to 21 years of age (Bass 1995, 17). As a general guide, the stages of fusion can be used to determine the approximate age of adolescents. If all epiphyses are fused, the individual is likely an adult. Because the aging process beyond early adulthood causes the internal structures of bones to thin and become brittle, researchers can use bone density to estimate the age at death for adults.

Dentition is another key indicator of age at death. The presence of baby (or "milk") teeth indicates a young child, generally under the age of 6 or 7. As a general rule, the first permanent molars erupt at age 6, the second at age 12, and the third (better known as "wisdom teeth") between the ages of 18 and 21. Estimations of older individuals are generally based on the loss of and wear patterns on teeth, and on evidence of dental disease. Different rates of dental disease typically appear in different age groups, with the oldest members of a population generally being most affected by dental disease (such as cavities and abscess) and tooth loss. Teeth can also be used to identify family and relations. For example, the absence of teeth (e.g., no wisdom teeth) or the presence of more teeth than is typical is often associated with genetic markers.

In addition to discovering an individual's age at death, bioarchaeologists also try to determine the sex of the skeleton. Although it is almost impossible to determine the sex of pre-adolescent skeletons based on their physical characteristics, the sex of adult skeletons is generally apparent by looking at the shape of the pelvis (Figure F1.1). Females tend to have larger and more *U*-shaped hips, which facilitates childbirth, while males' hips tend to be narrower.

The structure of the skull also differs between males and females (Figure F1.2). Most notably, eye sockets tend to be more squared in males and more rounded in females. In addition, the chin is more *U*-shaped in males and more *V*-shaped in females. Finally, the occipital condyle (the bump at the rear base of the skull) is much more pronounced in males than in females.

Bioarchaeologists also often look at the skeleton for evidence of health and disease. Children who have been subject to times of stress, like severe fever or malnutrition, often have linear features on their bones indicating that the bones stopped growing. These are known as Harris lines. Children who lack sufficient vitamin D can develop a bone disease known as rickets, which causes

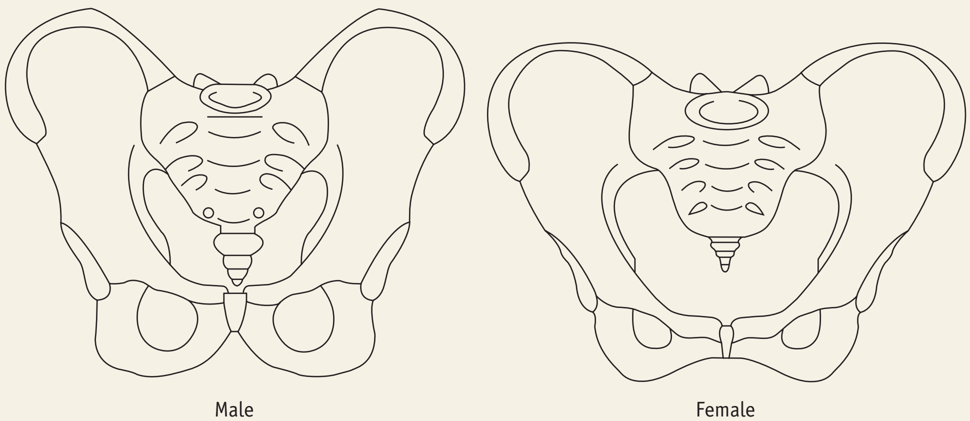

FIGURE F1.1 | Typical male and female pelvises.

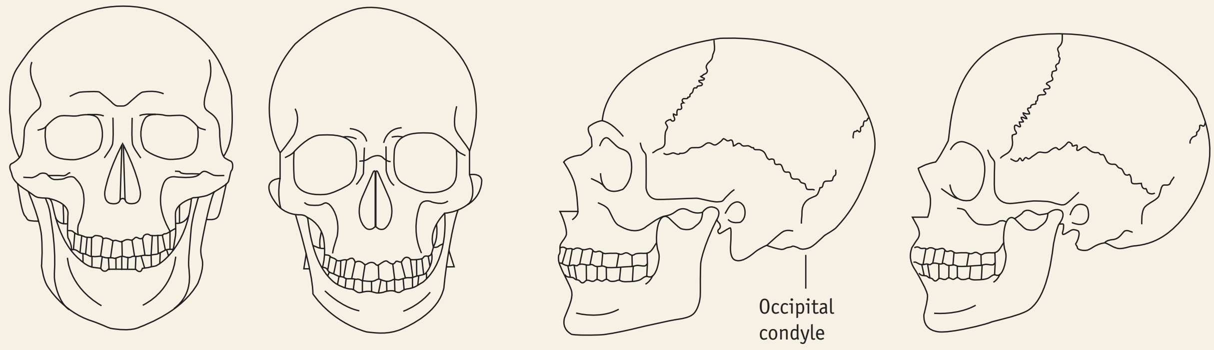

FIGURE F1.2 | Typical male and female skulls.

Estimating Height

Archaeologists can use the long bones of the leg to estimate the living height or stature of an individual. To see how, try the following exercise on yourself:

1. Estimate your height using one of the two formulas below (note that your femur is the long bone that connects your hip to your knee):

   For genetic males: 2.32 x length of femur in cm + 65.53 = _______ (± 3.94 cm)

   For genetic females: 2.47 x length of femur in cm + 54.10 = _______ (± 3.72 cm)

2. Measure your height using a tape measure.

Was your original estimate accurate? What factors might have influenced your results? Are your legs shorter or longer, relative to your overall height, than the formula projects?

long bones, generally in the legs, to soften and become bow shaped (Figure F1.3). Some chronic diseases, like tuberculosis, leprosy, and syphilis, tend to erode or create holes in bones (Figure F1.4). However, most infectious diseases do not affect bones.

Study of the teeth is useful in showing changes in health and diet. Dental analysis involves recording the physical appearance of each tooth in the mouth as well as tooth loss. Abnormally thin enamel can suggest the individual experienced a period of illness or poor nutrition. Tooth loss can indicate prolonged periods of illness or inadequate nutrition. High rates of cavities (also known as "caries") can point to a diet rich in carbohydrates, as the bacteria that cause cavities feed on the sugars in carbohydrates. In addition, excessive wear on teeth can suggest a diet full of tough, fibrous foods.

Stresses of everyday life are also sometimes apparent on skeletal remains. For example, the size and density of the long bones—large and robust, or small and gracile—can suggest the types of activities in which an individual was involved. According to **Wolff's law**, bones that have been under greater stress or have had to carry greater loads will be larger and denser than bones under less stress or subject to less of a load. Thus, if we spend a lot of time walking or running, or if we regularly carry heavy objects or engage in challenging manual labour, our bones will become denser; however, if we live highly sedentary lives or spend a great amount of time in water or on boats, or if we do little carrying or manual labour, our bones will become less dense. This law is supported, for example, by Stock and Pfeiffer's (2001) discovery of a higher lower-limb robusticity in African terrestrial foragers than in marine foragers of the Andaman Islands. Wear patterns are also apparent in joints and other bones. Repetitive work will wear down joints and often contribute to degenerative diseases like osteoarthritis.

Bioarchaeologists also look at other, more specific musculoskeletal markers (MSMs) to provide evidence of various day-to-day activities. For example, a study of the

Wolff's law The principle that a living person's bones adapt to the stress or load to which they are subjected, such that greater stress or load will lead to denser bones and less stress or load will lead to less dense bones.

Biophoto Associates/Science Source

FIGURE F1.3 | Long bones of the legs affected by rickets.

skeletal remains of nineteenth-century Canadian fur traders revealed evidence of excessive use of and strain on these traders' shoulders and back regions that would have been associated with paddling, rowing, lifting, and carrying heavy items (Lovell and Dublenko 1999). Also, there were arthritic lesions (scars) on the ends of their right leg bones that may have been caused by the habitual "kicking" of the leg while driving dog sleds (ibid., 254). Skeletal remains from the Arctic regions

Courtesy of the Museums at the Royal College of Surgeons of England

FIGURE F1.4 | Syphilis lesions on the skull.

of Canada reveal strong evidence of teeth being used as tools. More specifically, it was common for women to soften hides by chewing on them, which resulted in extremely worn front teeth and MSMs on the joint of their jaw. These examples reveal how our skeletons can provide evidence of our life history, including our work habits, our health, and our relations.

Thinking like a Bioarchaeologist

Imagine that a bioarchaeologist finds your remains 500 years in the future. What assumptions might she or he make about your life? What might the jewellery you are wearing or the items in your possession say about you? What would your bones and teeth reveal about the types of activities you regularly engage in, your past health, or your diet? Do you have any injuries or dental work that would allow a bioarchaeologist to understand your day-to-day life? What aspects of your life would a bioarchaeologist not be able to interpret based on this evidence?

Key Terms

bioarchaeology

Wolff's law

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