Interpreting Skeletal Remains

Background

Whenever skeletal remains of unknown or suspicious origin are discovered, forensic scientists are called upon to help identify the bones or solve the mystery. Bones that are carefully collected and examined can reveal a surprising amount of information.

The first task of the forensic scientist is to determine whether the bones are human. Human bones are easy to recognize. The human skull, for example, has a much larger braincase for its size than the skull of any other animal. The bones of the human leg provide yet another clue. The ends of these bones, which form the knee joint, are especially wide. The widened knee joint enables a person's weight to be spread over a large area, which reduces stress on the knees.

If the bones are found to be human, then the forensic scientist and the police carefully dig up the site where the bones were discovered. They perform this work slowly to discover evidence such as any fibers, hair, and insects. Another reason for their slow pace is that old bones may be fragile and must be handled gently.

After bringing the bones to the laboratory, the forensic scientist tries to determine whose bones they were. This task depends on the slow, careful collection of many small clues such as the shape of the skull and the roughness of joint surfaces. A skeleton also can reveal the person's approximate age, sex, and muscular build, and much about how the person lived and died. Some of the small bones in the fingers, for example, fuse as a child develops. A forensic scientist can estimate a child's age from the condition of these bones.

The teeth and bones of the skull also provide many clues to an individual's age and sex. An adult has 32 teeth, unless some have been lost. The third molars, or "wisdom teeth" do not emerge from the jaws until the late teens. This fact can help determine the age of a teenager or young adult. Wear and tear on the tooth surfaces provides another clue to the age of remains. The more worn the tooth surfaces, the older the person is thought to be.

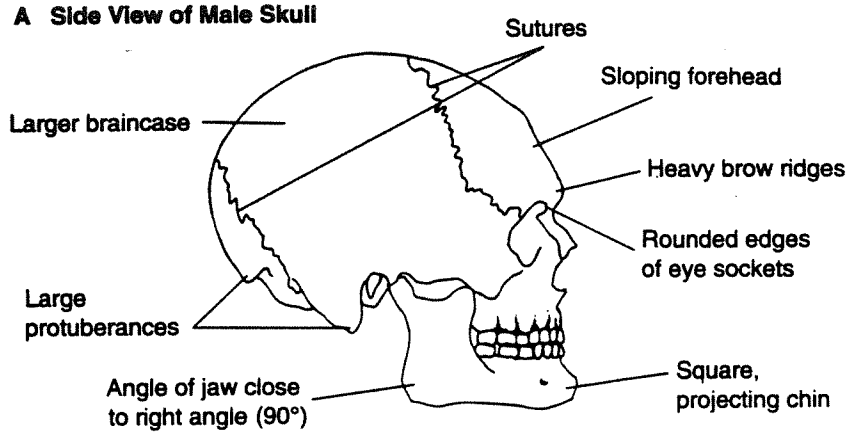
The bones of the skull are especially useful for estimating age. These bones are partly separate at birth. Their edges gradually fuse from birth to age 50. The fused edges of these bones are called sutures. Figure 1 on page 50 shows the locations of some of the sutures of the skull. A forensic scientist can estimate the age of a skeleton by examining these sutures. All three sutures labeled in Figure 1 begin to close at about age 21. The suture at the rear of the skull, shown in Figure 1C, begins to close more quickly after age 26, and is fused by age 30. Figure 1C also shows how the left and right sides of the skull form a suture on top of the skull. This suture closes by age 31 or 32. The last suture to close runs across the top of the skull from side to side just above the forehead, as seen in Figures 1A and B. This suture is not fused until about age 50.

Figure 1 also shows some of the differences between male and female skulls. Males tend to have large, square chins, whereas females have smaller, rounded chins. Females have a sharp border around the eye socket, and males have pronounced eyebrow ridges.

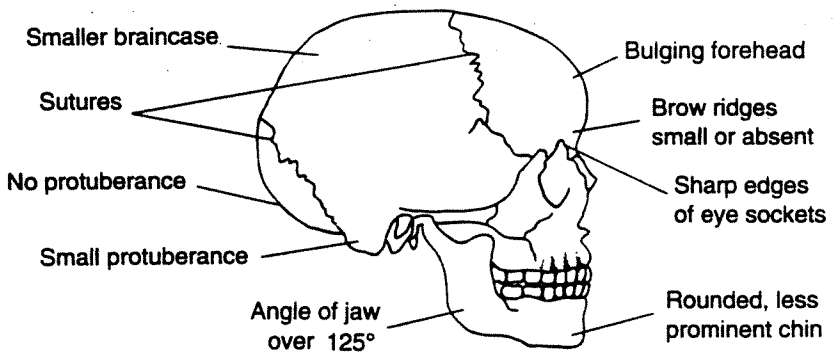
Changes in the pelvis, or hipbone, and other bones provide clues to the age of a skeleton. One such clue that indicates adulthood is the fusion of the parts of the pelvis into a single bone. As adults age, their bones lose calcium, causing pits and rough areas to form in the surfaces of smaller bones and the ends of long bones. At the same time, the smooth, distinct edges of young bones become irregular and shaggy.

Name_____ Class_____ Date _____

A Side View of Male Skull



B Side View of Female Skull



C Posterior (Rear) View of Skull

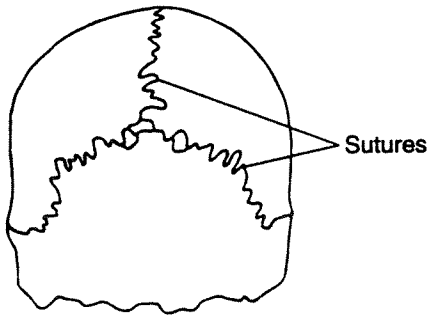


FIGURE 1

In addition to the fact that the skeleton of a male is usually larger and heavier than that of a female, the pelvis also can be used to determine a person's sex. In females the pelvis is thinner and less dense than it is in males. Notice in Figure 2 on page 51 that the male pelvis is deep and funnel-shaped, with a narrow angle in front (50°–80°). The female pelvis is shallow and broad, and forms a wider angle (90°–100°). The wider, more open female pelvis allows for the passage of a baby during childbirth.

The sacrum is the part of the spine that attaches to the pelvis. The sacrum is straight in females and slanted inward in males. The coccyx, or "tailbone," curves inward below the pelvis in males, but is nearly straight and vertical in females.

© Pearson Education, Inc. All rights reserved.

Name_____ Class_____ Date_____

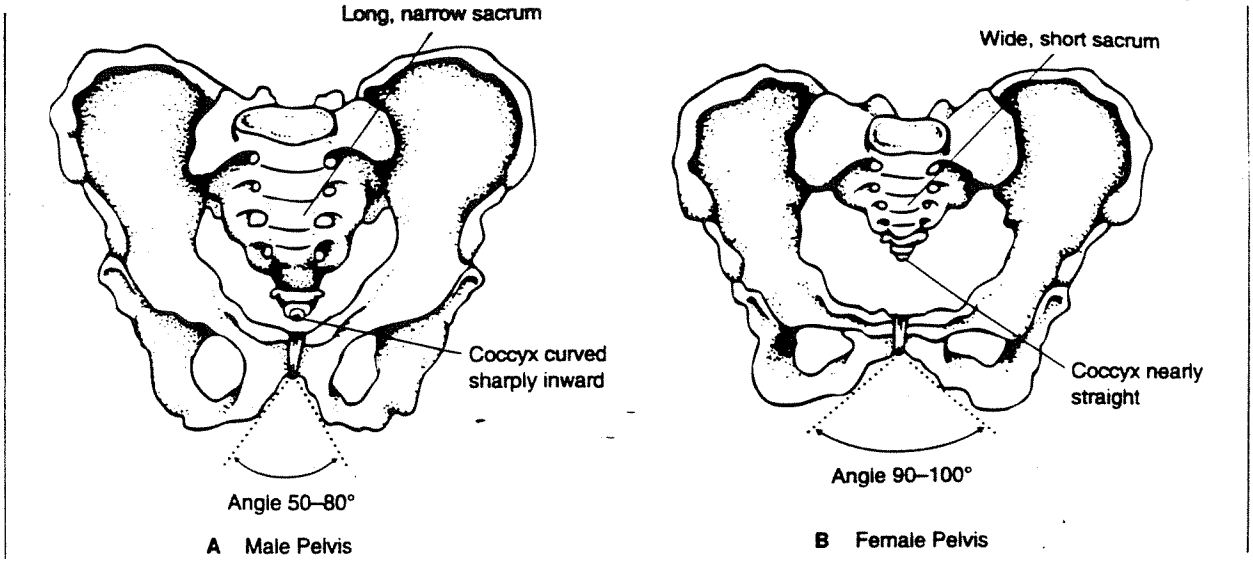


FIGURE 2

If a femur, or thighbone, is the only bone that a forensic scientist has to examine, it is possible to determine the individual's height and muscular build. Forensic scientists use a simple equation to estimate the person's height from the length of the femur. Forensic scientists also know that stouter bones are necessary to support heavier frames. Thus, a femur that is thick compared to its length indicates that the person was relatively heavy. Because exercise strengthens the point where the muscle is attached to the bone, a large mark where the muscle was attached is a sign that the person was muscular. Larger muscle-attachment scars on the bones of one arm as compared to the other indicate whether the person was right- or left-handed. Frequent, repeated stress on a joint can wear down the cartilage of the joint, causing the joint surface to appear smooth and shiny. If this kind of wear is found in the right shoulder joint, for example, the person may have spent a lot of time carrying heavy objects on the right side, as a postal worker or plumber might do.

Teeth and bones can also provide clues to a person's medical history. For example, a prolonged fever in childhood can temporarily stop tooth development, leaving a telltale ring on the teeth. Spaces between teeth, crowns, fillings, or other dental work make each person's teeth unique. Once the identity of the skeleton has been narrowed to a small number of possibilities, the teeth can be compared to dental records to settle the question. Bones can provide other medical information. They may be weakened by osteoporosis, a common disease of older adults in which the loss of calcium makes the bones fragile. A scar on a bone is a sign of a healed fracture.

The skeleton can even reveal a person's personal habits and diet. A flattening of the surfaces of the molars, for example, may mean that the person tended to grind his or her back teeth. Eating certain foods on a regular basis, such as hard candies or high fiber plant materials, can wear down the surfaces of specific teeth.

Interpreting Skeletal Remains

Investigation

CASE SUMMARY

While digging a foundation for a new building, construction workers found some buried bones that appeared to be human. Thinking they were being helpful, the construction workers placed the bones into a box and took them to the nearest police station. The police identified the bones as human and have asked you to examine the bones and to provide as much information as possible about them.

QUESTION FOR FORENSIC ANALYSIS

What can you determine about the person whose bones were found by examining the bones?

MATERIALS (*per group*)

preserved or plastic skeleton or individual bones
anatomical charts of the human skeleton
metric ruler
protractor
calculator (optional)

PROCEDURE

1. Using anatomical charts, identify each bone. Examine the bones carefully and note any damage, scars, or other special characteristics of the bones and teeth. On the lines below, record whether the skeleton is complete and note any special characteristics that you observe. If the skeleton is not complete, list the name of each bone examined.

Name _____ Class _____ Date _____

2. Examine the sutures of the skull to see how much fusion has taken place. Count the teeth to determine whether a full set of 32 adult teeth is present. Note any signs of damage to the teeth. Observe whether the surfaces of the bones, the ends of the long bones, and the edges of the pelvis are smooth or rough. Record your observations on the lines below.

3. Using Figures 1 and 2 as a guide, examine the skull and pelvis for male and female characteristics. Use a protractor to measure the angle of the pelvis, which is labeled in Figure 2. Note the shape of the sacrum and whether the coccyx curves inward. Record your observations on the lines below.

4. If a femur is present, measure the length of this bone in centimeters. Record this measurement on the line provided.

   Femur length: _____ cm

   Then, use the following equation to estimate the individual's approximate height.

   $$\text{Height (cm)} = (2.26 \times \text{femur length}) + 66.38$$

   (This equation is accurate to within 3.4 cm.)

   Record the person's estimated height below.

   Extimated height: _____ cm

5. On a separate sheet of paper, construct a Data Table to organize the observations you made in steps 1 to 4. Record all your observations in your data table.

ANALYSIS AND CONCLUSIONS

1. **Inferring** How might the construction workers have been more helpful to you as a forensic scientist?

Name_____ Class_____ Date _____

2. **Analyzing Data** Which bones were most useful in identifying the remains?

3. **Communicating Results** Write a report describing the person whose bones you examined. Include as much information as possible.

4. **Evaluating** Which of your conclusions about the person whose bones you examined were simple and clear-cut? Which conclusions were more difficult to make?

5. **Drawing Conclusions** How does your answer to question 4 help explain why courts are sometimes skeptical about this kind of forensic evidence?