The Skeletal System

The skeleton of the body is made up of bones and joints. A mature adult has 206 bones that work together with joints and muscles to move the various parts of the body.

The skeleton may be divided into two parts: the **axial** and **appendicular** skeletons. The axial skeleton includes the bones of the skull, chest, and spinal column. The appendicular skeleton comprises the arms and legs, along with the shoulder and pelvic bones.

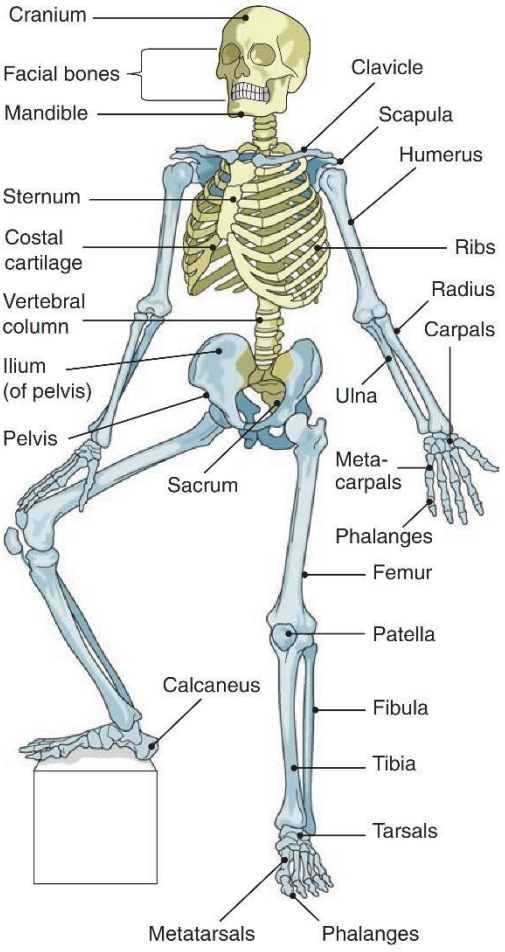

FIGURE 5-1 The skeleton. The skeleton is divided into two portions. The axial skeleton is shown here in yellow; the appendicular in blue.

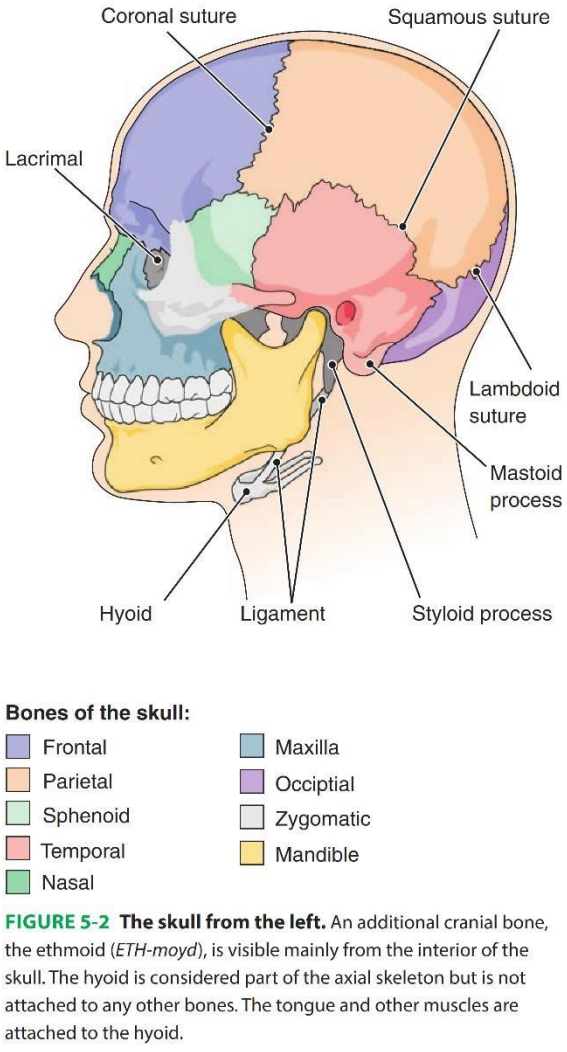

FIGURE 5-2 The skull from the left. An additional cranial bone, the ethmoid (*ETH-moyd*), is visible mainly from the interior of the skull. The hyoid is considered part of the axial skeleton but is not attached to any other bones. The tongue and other muscles are attached to the hyoid.

Bone is made up of **osseous tissue**, which consists of special mature bone cells called **osteocytes**. The bones of the skeleton are of different shapes and sizes. They may be essentially **flat**, such as those found in the cranium and ribs. They also may be **short**, such as those in the wrist and ankles, or **long**, such as those found in the arms, legs, hands, and feet.

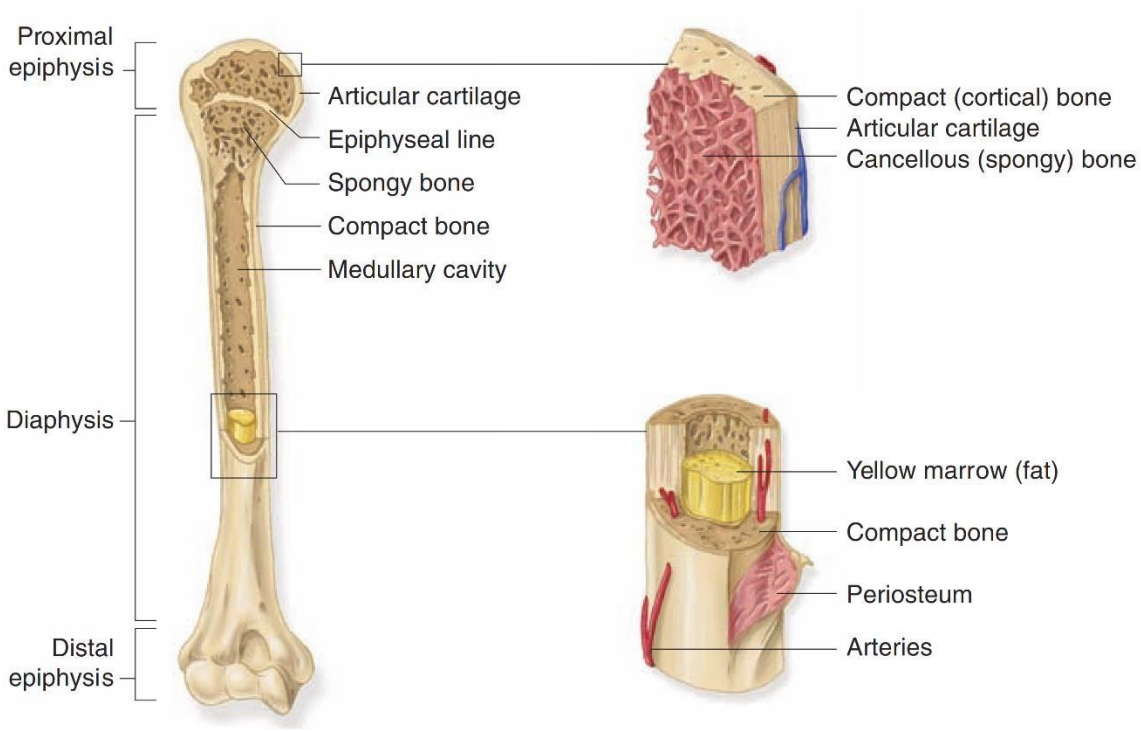

Figure 6.3 Features found in a long bone.

Long bones have subparts that are named. The term **diaphysis** [a Greek word (growing between)] is the shaft of a long bone, and the term **epiphysis** [epi- (upon); -physis (growth)] is the name given to each end of a long bone. The term for the inside of the diaphysis is **medullary cavity**. Because it's a cavity, it is hollow, of course, and medullary means that the cavity contains marrow. The Latin word medius, meaning "middle," is also the basis for the word medulla (marrow).

Most bones are covered with a membrane called the **periosteum** [peri-

(around); oste/o (bone)]. The inner surface of the medullary cavity is lined with a thin layer of cells called the **endosteum** [endo- (inside); oste/o (Greek word for bone)].

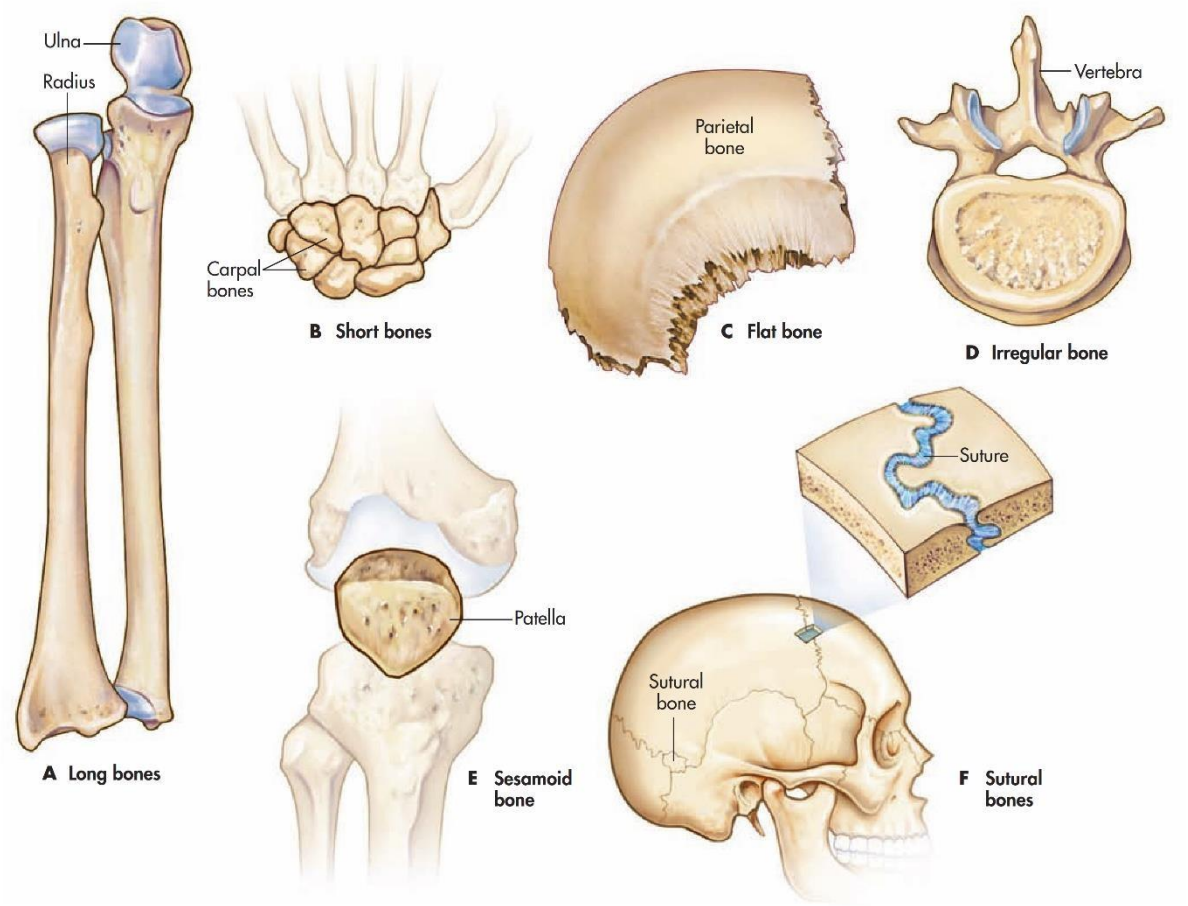

Figure 6.2 Classification of bones by shape.

The Axial Skeleton

The **axial skeleton** is composed of the **cranial, facial, thoracic,** and **spinal bones**. The six main cranial bones are the **frontal** bone; two **parietal** bones, one on each side; two **temporal** bones, on the sides of the head; and the **occipital** bone. The cranial bones are joined by **sutures** [from the Latin word sutura (seam)], which are fibrous membranes that join them. Cranial bones enclose and protect the brain.

The thoracic bones, which include the **sternum** [from a Greek word sternon (chest)]**, ribs,** and associated **cartilage**, are known collectively as the thoracic cage. The adjective thoracic is formed from the word thorax, which is Latin for "breastplate" (chest armor). The two major organs inside the thoracic cage are the heart and lungs. The lower end of the sternum is a bony daggerlike projection called the **xiphoid process**. This term comes from the Greek word, xiphos, which means "sword."

The Appendicular Skeleton

As mentioned previously, the appendicular skeleton consists of the body's appendages (arms and legs) and the areas to which these appendages are attached: the shoulder and pelvic girdles. Shoulder bones, although associated with the chest, are part of the appendicular skeleton. The main bones of the shoulder girdle are the **clavicle** (collarbone) and the **scapula** (shoulder blade).

Joints

A joint is the place where bones come together. Some joints, such as the knee and elbow joints, are highly movable, and some are capable of little or no movement. A joint with no movement is called a **synarthrosis** [syn- (together); arthr/o (joint); -osis (condition)].

A joint with little movement is called an **amphiarthrosis** [amphi- (both sides); arthr/o (joint); -osis (abnormal condition)]. Any of the

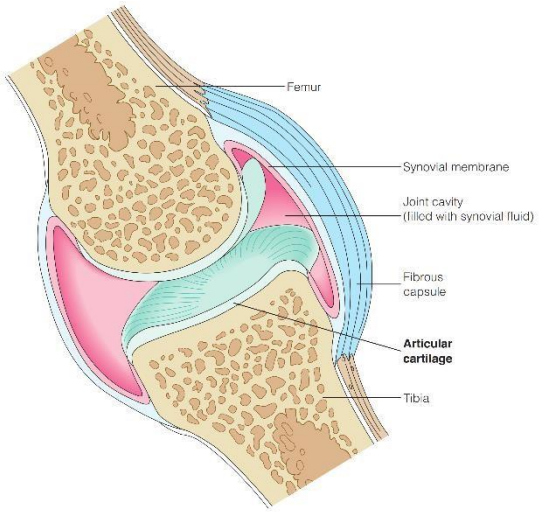

Figure 7-4 A joint cavity.

suture joints in the cranium would be a good example of a synarthrosis, and the vertebral bodies within the spinal column are examples of amphiarthroses. A joint that has free movement is called a **diarthrosis** [a Greek word (articulation)] or a synovial joint.

The spaces within each synovial joint are filled with a viscous liquid called **synovial fluid**. **Cartilage**, a precursor of bone tissue, is classified as connective tissue, but it is mentioned here because cartilage enables movement in the synovial joints. **Bursae** (singular: bursa) are found wherever tendons or ligaments impinge on other tissues. Bursae are spaces within connective tissue filled with synovial fluid.

Disorders and Treatments

A **sprain** is a tear in a ligament or the fibrous tissue that connects bones. A **fracture** is a broken bone. However, all fractures are not the same. Some are simple breaks, and some are not. If the fracture is a closed fracture, there is no wound or open skin. If the broken bone protrudes through the skin, it is called an open or compound fracture.

Treatment of a fracture consists of **reduction** (realignment) of the broken bone. In some cases, **traction** (using elastics or pulley and weights to maintain alignment) may

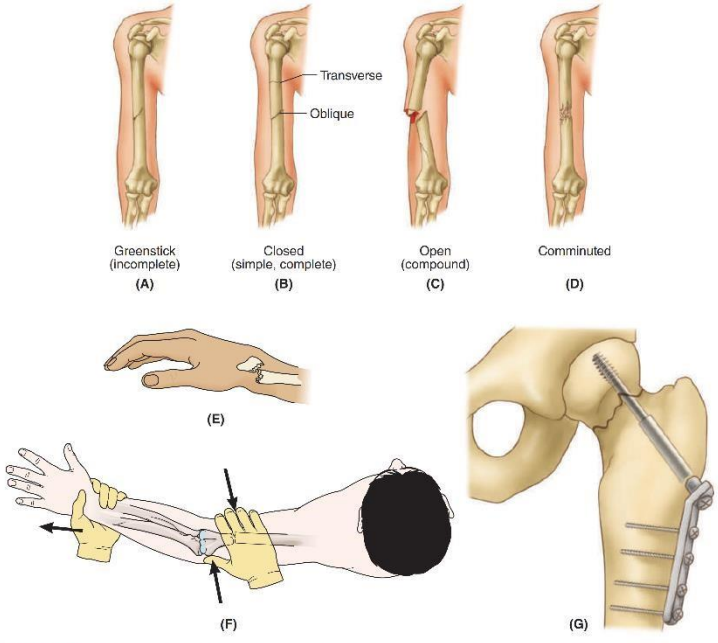

Figure 7-9 Fractures: A. Greenstick (incomplete). B. Closed (simple, complete). C. Open (compound). D. Comminuted. E. Colles. F. Closed reduction. G. Open reduction internal fixation.

be needed. Casts and splints are used to immobilize a broken bone during the healing process.

Bone disorders arising from disease include conditions such as **osteomyelitis** [oste/o (bone); myel/o (marrow); -itis (inflammation)], an inflammation caused by bacteria.

Osteoporosis [oste/o (bone); por/o (porous); -sis (condition)] is a bone disorder characterized by a decrease in bone density and mass. Two other bone disorders are **rickets** and **osteomalacia** [oste/o (bone); -malacia (softening)]. These two conditions result from vitamin deficiency and lack of calcium absorption. Neoplasms or tumors of the bone may be primary or secondary (from other sites in the body). **Osteosarcoma** [oste/o (bone); sarc/o (flesh-like); -oma (tumor)] is a tumor of the bone. **Chondrosarcoma** [chondr/o (cartilage); sarc/o (flesh); oma (tumor)] is a tumor that arises in cartilage.

arthralgia [arthr/o (joint); -algia (pain)] pain in a joint. Joint disorders include **arthritis** [arthr/o (joint); -itis (inflammation)], a general term used to denote joint inflammation. General wear and tear on joints results in **osteoarthritis** [oste/o (bone); arthr/o (joint); -itis (inflammation)]. Treatment may include medication for pain and inflammation and/or physical therapy. **Arthrocentesis** *[arthr/o: joint; -centesis: surgical puncture for aspiration]* may be used to drain the fluid and relieve the pressure in the joint.

Rheumatoid arthritis [from the Greek word rheuma (flux); -oid (resemblance of)] is attributed to an immunologic abnormality that causes an inflammatory response with subsequent tissue destruction.

A disc that protrudes into the spinal canal and puts pressure on the spinal nerve is called a **herniated disc** [from Latin word hernia (rupture); disc/o (disk)]. It can be discovered in a number of ways, including by means of a **myelogram** [myel/o (bone marrow); -gram (record or picture)] or **arthroscopy** [arthr/o joint; -scopy use of instrument for viewing] examination of the interior of a joint.

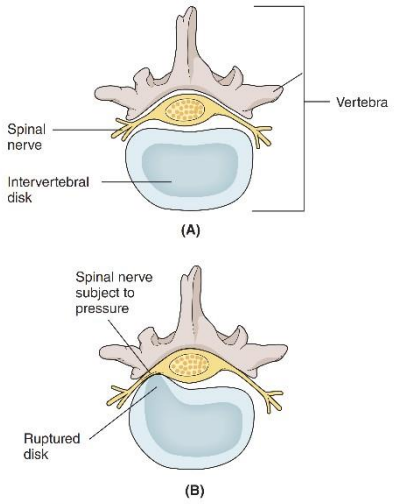

Figure 7-10 A. Normal intervertebral disc. B. Herniated intervertebral disc places pressure on spinal cord.

Compression fractures of the vertebrae may produce **kyphosis** [kyph/o (humped); -sis (condition)] (humpback) and loss of height. **Lordosis** [from the Greek word lordosis (a bending backwards)] (swayback) involves the lumbar region. **Scoliosis** is a sideways curvature of the spine that may occur in any region of the spine.