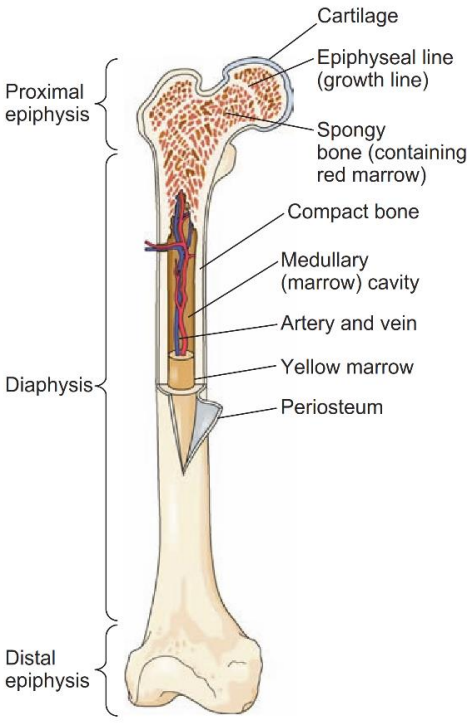
The Skeletal System

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.

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.

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)].

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 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 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.

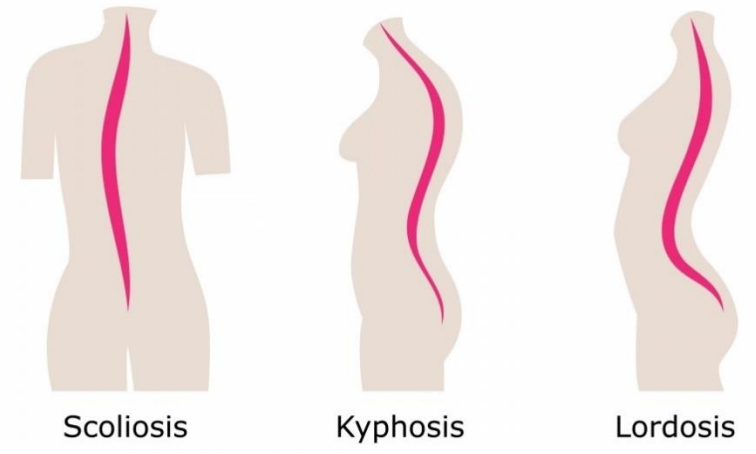
Osteoporosis [oste/o (bone); por/o (porous); -sis (condition)] is a bone disorder characterized by a decrease in bone density and mass. Two other bone disorders are **rickets** and **osteomalacia** [oste/o (bone); -malacia (softening)]. These two conditions result from vitamin deficiency and lack of 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.

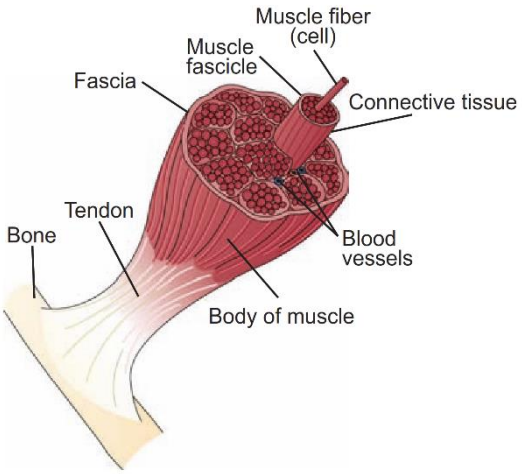
Compression fractures of the vertebrae may produce **kyphosis** [kyph/o (humped); -sis (condition)] (humpback) and loss of height. **Lordosis** [from the Greek word lordosis (a bending backwards)] (swayback) involves the lumbar region. **Scoliosis** is a sideways curvature of the spine that may occur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



Muscular System

Muscles can be characterized by their location, control action (voluntary or involuntary), and cell appearance (striated or nonstriated). There are three types of muscles: skeletal, smooth, and cardiac.

Skeletal Muscle



Of the three types, skeletal muscle is the largest group, comprising more than 600 separate muscles. These muscles are made up of fibers enclosed in a fibrous sheath of **fascia** [the Latin word for band] attached to bones by **tendons** [from the Latin verb tendo (stretch)] made up of connective tissue. **Ligaments**

[from the Latin noun ligamen (string)] connect bones to bones and offer support to muscles.

Smooth Muscle

Smooth muscle, which acts involuntarily, is located in the blood vessels, respiratory passageways, digestive tract, and walls of hollow internal organs. The functions of smooth muscle are to control and move substances through passageways with wavelike motions and to regulate the diameter of the openings of vessels and hollow organs.

Cardiac Muscle

Cardiac muscle, also known as the heart or myocardial muscle, forms the wall of the heart. It acts involuntarily and has a lightly striated appearance. The contraction and relaxation of the cardiac muscle is responsible for the heart's pumping action.

Disorders and Treatments

Muscular dystrophy [muscular (common English word); dys- (difficult); -trophy (from the Greek word trophé meaning "nourishment")] causes weakness without affecting the nervous system.

Myasthenia gravis [my/o (muscle); asthenia (from the Greek word astheneia meaning "weakness")] is an immunologic disorder characterized by fluctuating weakness, especially of the facial and external eye muscles.

Fibromyalgia [fibr/o (fiber); my/o (muscle); -algia (pain)] is a disorder characterized by widespread aching and stiffness of muscles and soft tissues, fatigue, tenderness, and sleep disorders. The cause of fibromyalgia is unknown, and it may coexist with other chronic diseases.

Cumulative Trauma and Sports Injuries

Carpal tunnel syndrome [carpal (a wrist bone); tunnel (common English word); syndrome (a Greek word meaning "running together")]: Due to pressure on the median nerve as it passes through the carpal (wrist) bone causes numbness and weakness in the areas of the hand supplied by the nerve.

Rotator cuff injury, which affects the shoulder, occurs to people who perform repeated activities such as swimming or throwing. The rotator cuff is formed by four muscles that may become inflamed and swollen when overused.

Epicondylitis [epi- (around); condyl (rounded end surface of a bone); -itis (inflammation)], also commonly called tennis elbow, is an inflammation of the medial and lateral epicondyles, bony projections of the distal portion of the humerus.

Plantar fasciitis [plantar (sole of the foot); fasci- (from fascia, Latin for band); -itis (inflammation)] is an inflammation of the plantar fascia (connective tissue in the arch of the foot) that can cause intense pain when walking or running. It may be caused by long periods of weight bearing, sudden changes in activity, or obesity.

Paralysis

Paralysis is the loss of sensation and voluntary muscle movement caused by injury or disease. The following terms name kinds of paralysis:

- **Hemiparesis** [hemi- (half); -paresis (paralysis)]: slight paralysis of one side of the body.
- **Myoparesis** [my/o (muscle); -paresis (paralysis)]: weakness or partial paralysis of a muscle.

- **Paraplegia** [para- (not normal); -plegia (paralysis)]: paralysis of both legs and the lower part of the body.
- **Quadriplegia** [quadri (four); -plegia (paralysis)]: paralysis of all four extremities.
- **Hemiplegia** [hemi- (half); -plegia (paralysis)]: total paralysis of one side of the body.