Skeletal System

Big Picture

The skeletal system is made up of all the bones in an organism's body. The human body, for example, has 206 bones. The skeleton serves many important and diverse purposes. Not only does the skeleton determine the shape of and provide support for the body, but it's also involved in maintaining mineral homeostasis, storing minerals, anchoring muscles, facilitating movement, producing blood cells, and protecting important organs, such as the heart and the lungs. Despite its importance and apparent rigidity, bones, like all organs in the body, are susceptible to disease and injury, including fractures, osteoarthritis, and rickets.

Key Terms

Skeletal System: The organ system that consists of the bones, cartilage, and ligaments.

Cartilage: Flexible connective tissue.

Ligament: Fibrous connective tissue.

Joint: Where two bones meet.

Bone Matrix: Framework of bones, made up of protein fibers, such as collagen, and minerals, such as calcium.

Collagen: A protein found commonly in connective tissue.

Bone tissues:

Compact Bone: Dense and hard outer shell of most bone. Gives bone the stiff quality that allows it to protect the body's organs and generally support the body.

Spongy Bone : Porous and relatively soft inner layer of bone.

Bone Marrow: Tissue in the inner pores of spongy bone that produces new blood cells.

Periosteum: A membrane covering the outside of bone.

Specialized bone cells:

Osteoblast: Specialized bone cell that gives rise to new bone cells, playing a key role in bone growth. Osteoblasts also secrete the collagen found in the bone matrix and contribute to mineral uptake.

Osteoclast: Specialized bone cell responsible for the release of minerals into the blood.

Osteocyte: Specialized bone cell involved in regulating mineral uptake and release.

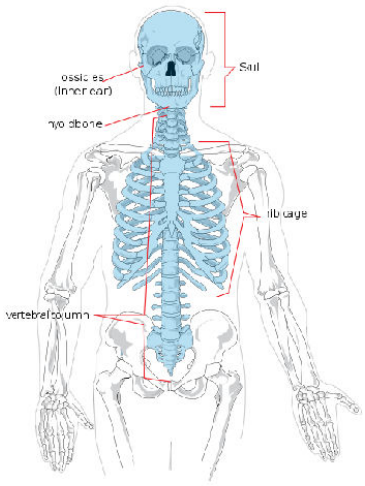
Ossification: The process by which connective tissue, including cartilage, turns into bone.

The Skeleton

The **skeletal system** can be divided into the axial skeleton and the appendicular skeleton.

- Axial skeleton:
  The bones located around the central axis of the skeleton. These include the skull, rib cage, and vertebral column.
- Appendicular skeleton:
  The bones connected to those of the axial skeleton. The appendicular skeleton includes the bones of the arms, legs, and feet and is responsible for locomotion (ability to move).

Axial Skeleton



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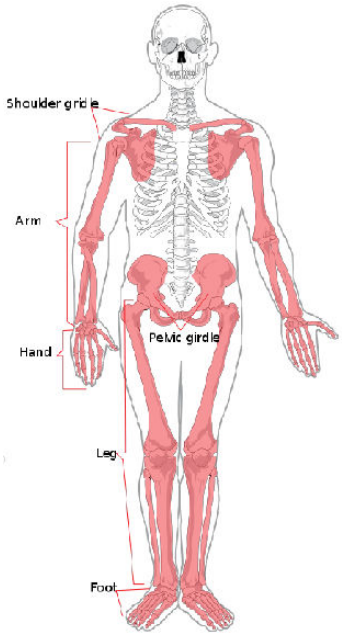
Appendicular Skeleton



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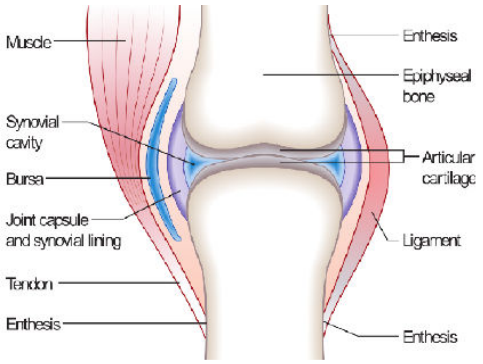
Skeletal System cont.

The Skeleton (cont.)

Joints

The **joint** is one region where we can find cartilage and ligament. The cartilage provides a smooth surface for the bones to move, and the ligament connects bones together. Joints can be categorized by function and the degree of movement they permit

- Immovable joint: Prohibits movement due to dense connective tissue between the bones.
- Partly movable joint: Allows a slight degree of movement.
- Movable joint: Allows the greatest degree of movement. Movable joints are held together by ligaments. Also called a synovial joint due to the presence of synovial fluid.
- Synovial fluid: A viscous fluid that fills the space between the bones in a movable joint and lubricates the cartilage between the bones.



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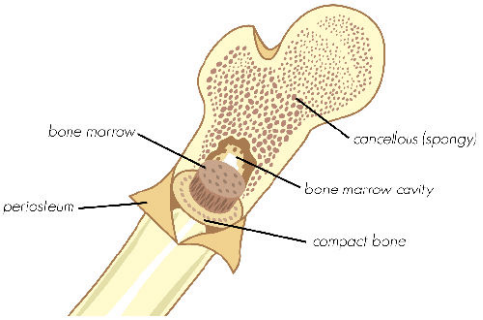
Bones

Although bones appear to be unchanging, bones are actually living tissues that are constantly being reshaped.

Structure

The **bone matrix** forms the rigid framework of bones.
Contains:

- **Compact bone**
- **Spongy bone**
- Tough protein fibers (mainly **collagen**)
- Blood vessels and nerves
- Specialized bone cells



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Bone Tissues

Bones are made up of different types of tissues. In addition to compact bone and spongy bone, bone also contains **bone marrow** and **periosteum.**

Bone Cells

The three types of specialized bone cells are **osteoblasts**, **osteocytes**, and **osteoclasts.** They are responsible for bone growth and mineral homeostasis.

- Mineral homeostasis is very important because just the right levels of calcium and other minerals are needed in the blood for the body to function normally. When the mineral level in the blood is too high, these specialized bone cells are able to absorb excess minerals and store them in the bones. If the mineral level is too low, the bone cells are able to release minerals back into the blood.
- These specialized bone cells are continuously building up and breaking down bone.

Growth and Development

The skeleton of a human fetus is made entirely of cartilage. The soft cartilage turns into the hard bone that we are familiar with through **ossification.** The mineral deposits stored in the bone replace the cartilage. When we are young, ossification occurs at the center of the bone and continues toward the two ends of the bone. This allows the bone to continue to grow longer. When all the cartilage has been replaced, the bone can no longer grow longer and growth stops.

Skeletal Injury & Disease

Bones, like any organ in the body, are susceptible to damage and disease. Three common problems that plague bones are below:

- Fracture: A break in a bone. Fractures can be caused by extensive stress or forceful impact. They can also result from small incidents when bones are weakened by diseases, such as osteoporosis.
- Osteoarthritis: Degenerative joint disease. Results in the loss of cartilage between joints, causing decreased movement due to stiffness and pain.
- Rickets: The softening of bones in children as a result of a vitamin D or calcium deficiency. Rickets can lead to bone deformities, including bowed legs.