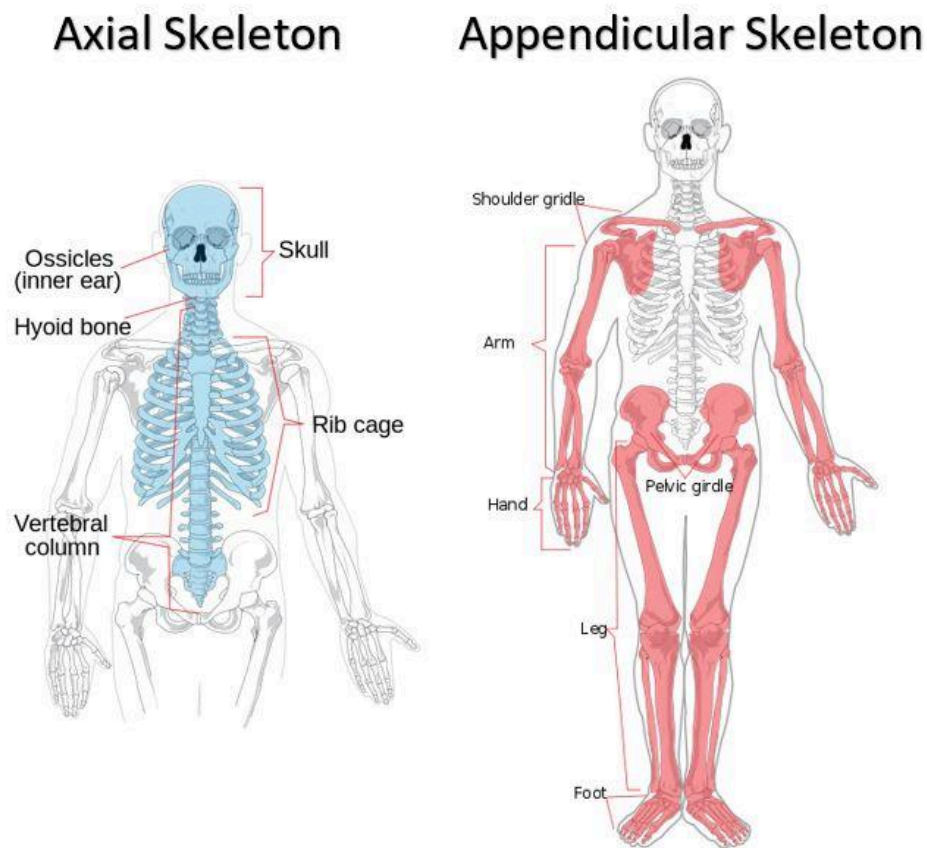
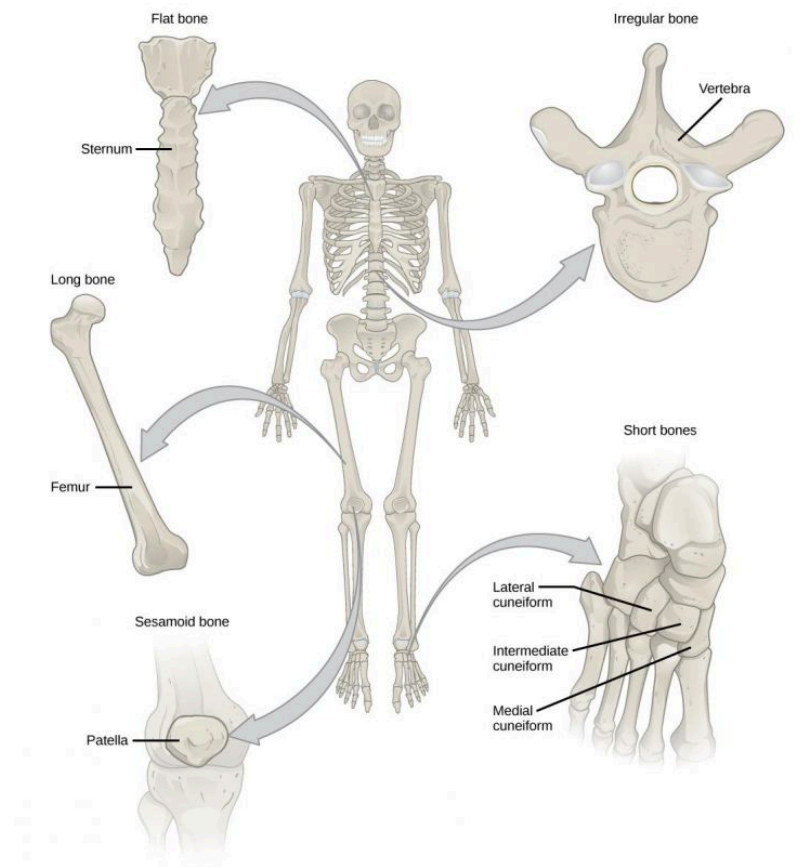


Bone Classification and Anatomy



Axial and Appendicular Skeleton. Author: LadyofHats Mariana Ruiz Villarreal License: Public Domain via Wikimedia Commons; File: https://commons.wikimedia.org/wiki/File%3AAxial_skeleton_diagram.svg; and https://commons.wikimedia.org/wiki/File%3AAppendicular_skeleton_diagram.svg

The bones of the human skeleton can be categorized into two major groups; the **axial skeleton** and the **appendicular skeleton**. The axial skeleton includes bones of the skull, vertebral column and rib cage while the appendicular skeleton includes the bones of the upper and lower limbs plus the shoulder and hip bones which attach them to the torso.

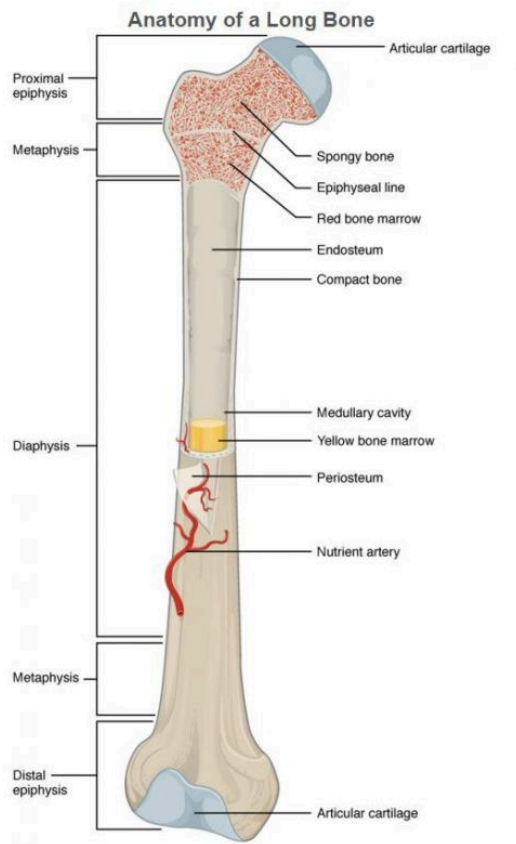


Bone Classification: Long, Short, Flat, Irregular and Sesamoid. Title: *Bone Structure*; Author: OpenStax; Site: <http://cnx.org/contents/FPtK1zmfh@7.25:kwbeYj9S@4/Bone-Structure>; License: licensed under a Creative Commons Attribution 4.0 License.

Based on their shapes, bone can be classified into one of 5 types of bone, **long bones**, **short bones**, **flat bones**, **sesamoid bones** and **irregular bones**. As the name implies, long bones tend to be much longer than they are wide. Classic examples of long bones are the femur and humerus. Short bones are about as wide as they are long. The carpals and tarsals of the hands and feet are good examples of short bones. Flat bones are flat and are represented by the frontal and parietal bones of the skull. Sesamoid bones are small round bones embedded in tendons that protect the tendon from stress or wear, such as the patella or others found in the hands and feet. Bones that do not fit any of the first three classifications are the irregular bones, think of the vertebra.

Anatomy of Bone

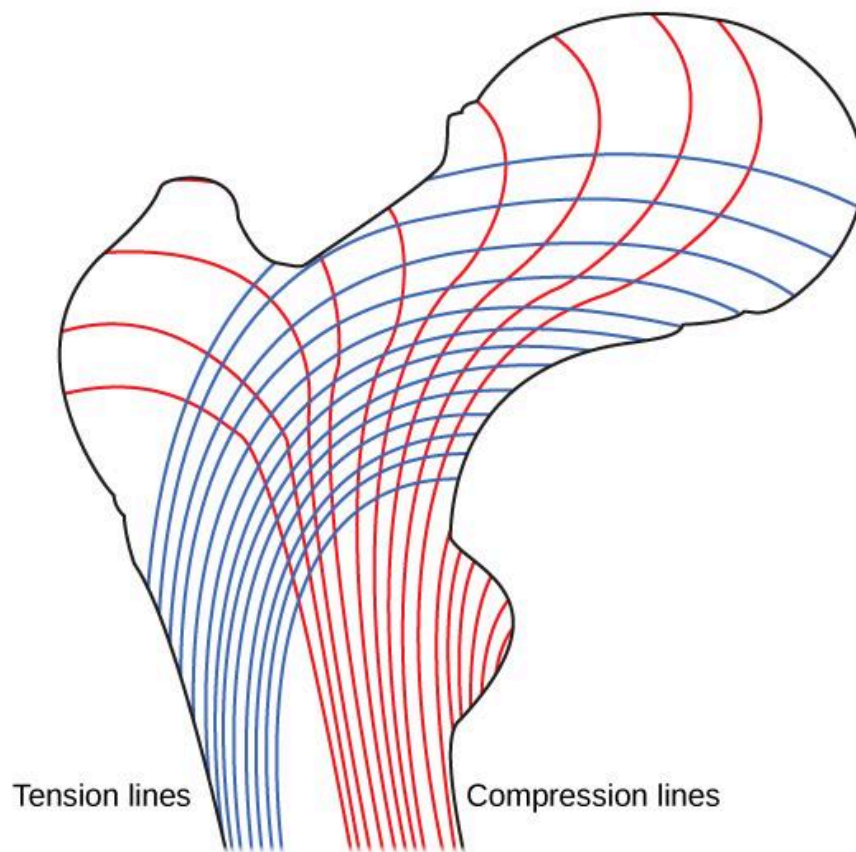
We will begin by describing the anatomy of a long bone and then compare that to the other types of bone.



Long Bone Structure: Author: OpenStax; License: Creative Commons Attribution 4.0 License. Site: <http://cnx.org/contents/FPtK1zmh@7.25:kwbeYj9S@4/Bone-Structure>

Long bones have two major regions, the **diaphysis** or shaft of the bone and the **epiphyses** (epiphysis; singular) or ends of the bones. The diaphysis is composed primarily of compact bone, the center of which is hollow and forms the **medullary cavity**. The epiphyses are made of cancellous bone, covered by a thin layer of compact bone.

It should be noted that the trabeculae are oriented in such a way as to withstand the normal stresses placed on the bone. If those stresses change, remodeling will occur to change the orientation of the trabeculae so that the bone can withstand the new stresses.

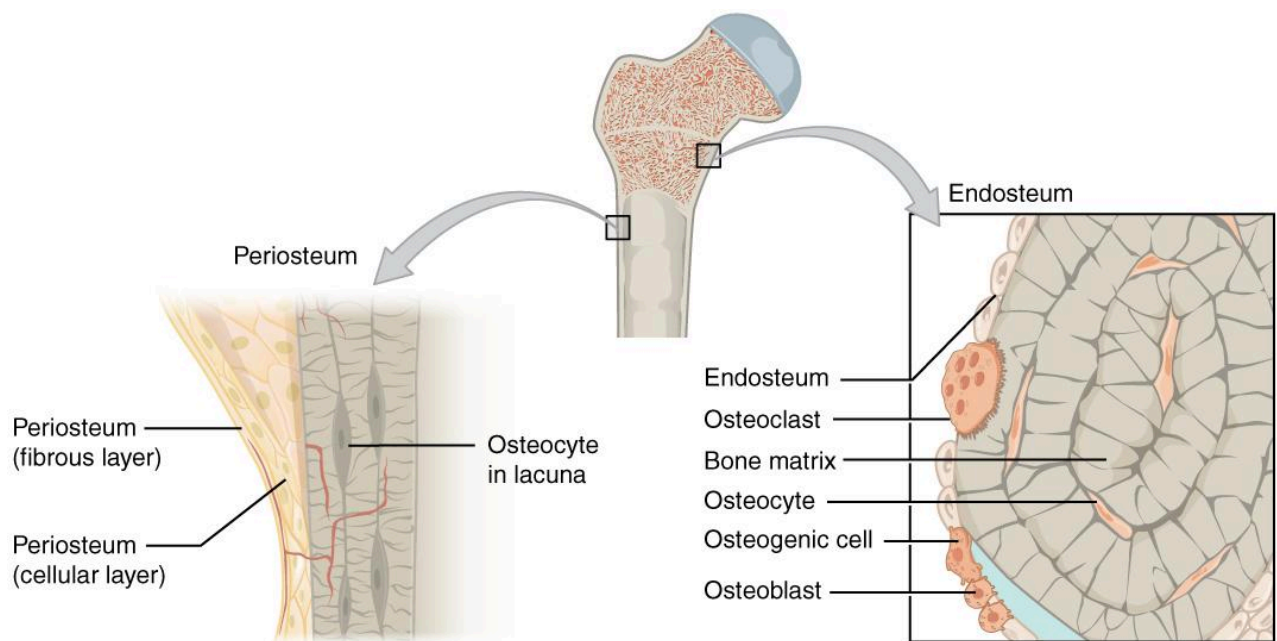


Arrangement of Trabeculae in Spongy Bone: One side of the bone bears tension and the other withstands compression. Author: OpenStax CNX License: CCBY: Attribution Link:

https://cnx.org/resources/7930aaf050a56777fccbb69663fa6938e718e588/Figure_38_02_05.jpg

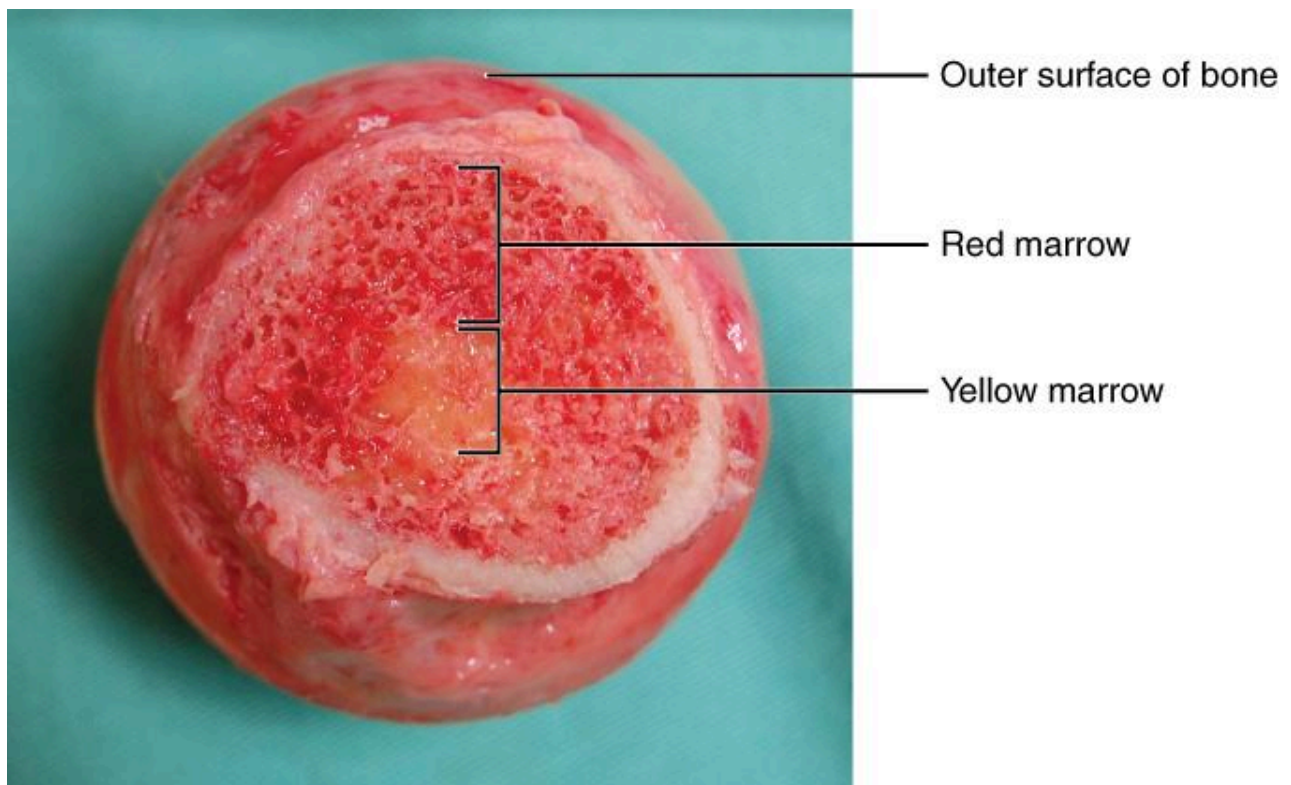
Between the epiphysis and diaphysis, in growing bone, is a plate of hyaline cartilage that allows the bone to grow in length. These cartilaginous plates are known as the **growth plates** or **epiphyseal plates**. The reason we stop growing as adults is because these growth plates have been converted to bone (more on this later).

The outer surface of the bone is covered by a membrane called the **periosteum** that is analogous to the perichondrium of hyaline cartilage. Like the perichondrium, the periosteum has two layers, an outer fibrous connective tissue layer and a delicate inner layer composed of a layer of osteoblasts, osteoclasts and osteochondral progenitor cells (stem cells that can become either osteoblasts or chondroblasts). The collagen fibers of the outer layer of the periosteum are continuous with the collagen fibers in the tendons that connect the bones to muscles as well as with the collagen fibers in the ligaments which connect bones to bones.



Periosteum and Endosteum. By OpenStax College [CC BY 3.0 (<http://creativecommons.org/licenses/by/3.0/>)], via Wikimedia Commons Link: https://commons.wikimedia.org/wiki/File%3A607_Periosteum_and_Endosteum.jpg

The inner surface of the bone is likewise covered by a membrane called the **endosteum**. The endosteum is similar to the inner layer of the periosteum and is composed of a single layer of osteoblasts, osteoclasts and osteochondral progenitor cells. The medullary cavity as well as the spaces between the trabeculae in the cancellous bone are filled with **bone marrow**. Two types of bone marrow exist, **red marrow**, comprised mainly of mesenchymal cells known as hematopoietic tissue and **yellow marrow** which is mainly fat cells.



Bone Marrow in Femur: Yellow marrow stores fat, red marrow is the site of hematopoiesis. Author: OpenStax; License:

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https://cnx.org/resources/9bfe278d5aa279706418a94099fa04a870a6ad50/619_Red_and_Yellow_Bone_Marrow.jpg

Red blood cells, platelets and most white blood cells are produced by the red marrow which generates about 500 billion blood cells per day. Once they are produced in the bone marrow, the blood cell can enter the capillaries of the bone marrow and move into the systemic circulation. In adults, red bone marrow is found in the bones of the axial skeleton and the proximal epiphyses of the humerus and femur. In young children, red bone marrow is found in all bones. Under extreme conditions, such as chronic anemia, some of the yellow bone marrow of adults can revert back to red bone marrow in order to make more blood cells.



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