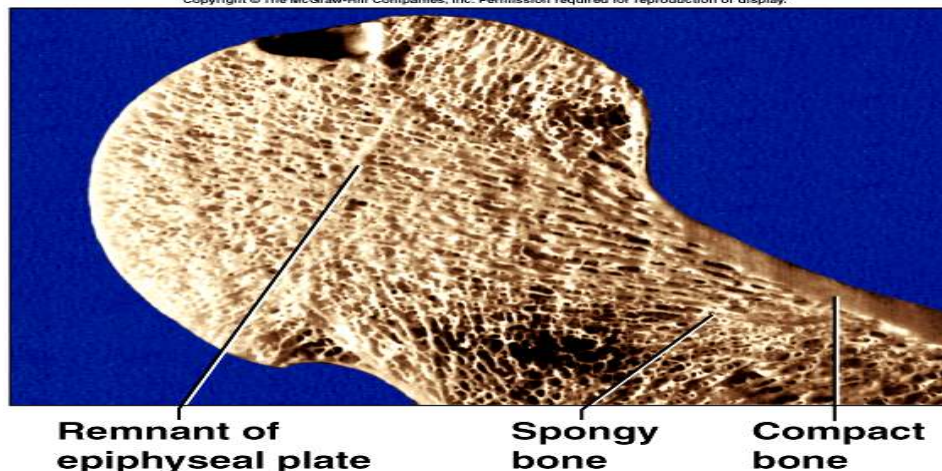
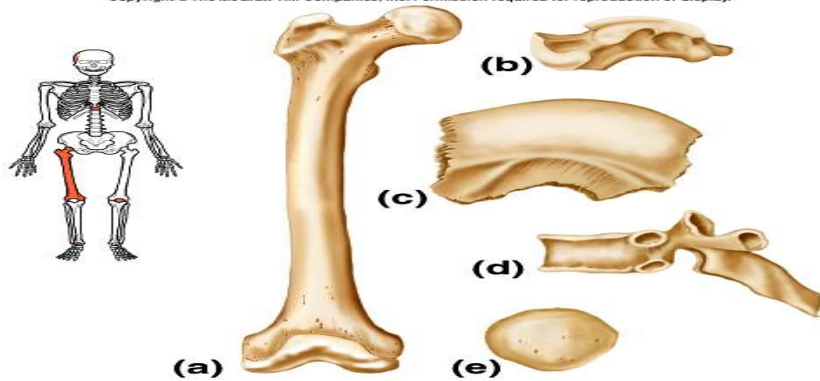


Chapter Seven: The Skeletal System

- Bone Functions
 - Support and Protection – The skeleton gives the basic shape of the body and bears the weight of the body. The skeleton protects vital viscera.
 - Body movement – The bones of the skeletal system act as levers and provide sites for muscles to attach in order to manipulate and to provide movement.
 - Blood cell formation – The red bone marrow in bones will be the site where blood cells originate from before entering the blood.
 - Storage of fats – Yellow marrow is located in the shaft of the bone and functions to store fat and can be converted into red bone marrow if blood cell count is down.
 - Storage of inorganic salts – Bone tissue is a type of connective tissue. The intercellular matrix will serve as a reservoir for important inorganic salts such as calcium phosphate and calcium carbonate. The bone tissue will not discriminate what type of inorganic salt is stored. The bone can store dangerous and toxic “heavy metals” if the body is exposed to the chemicals.
- Types of bone tissue
 - Remember bone tissue is a type of connective tissue so bone cell is called osteocyte and the matrix contain calcium salts.
 - Types of bone tissue
 - Spongy bone tissue is a porous bone tissue. The bone mass is not organized in any manner and are in irregular plates consisting of the osteocytes and matrix. The openings within the tissue will be occupied by red bone marrow.
 - Compact bone tissue is uniform and highly organized. The walls of long bones are compact bone tissue.



- Classification of bones
 - Long bone is a type of bone classified as the length of the bone is greater than the width of the bone. The walls of the bone is compact bone tissue but the ends of the bones are spongy bone tissue, but majority of bone mass consists of compact bone tissue. Examples are femur and humerus.
 - Short bone is a type of bone classified as the length and width of the bone are roughly equal. These bones contain more spongy bone than compact bone. Examples are carpals and tarsals.
 - Flat bone is a type of bone classified as thin yet have a broad surface. This type of bone consists of both bone tissues. Examples are skull bones and sternum.
 - Irregular bone is a type of bone classified as having no specific shape. This type of bone consists of both bone tissues. Examples are facial bones and vertebrae.
 - SLIDE OF TYPES OF BONES



- Long Bone: Gross Anatomy
 - **REFER TO FIGURE 7.1**
 - Articular cartilage covers the ends of the bone to decrease friction in a joint. The cartilage consists of hyaline cartilage.
 - Epiphysis (-ses) is the end of the bone made up of spongy bone tissue. There proximal and distal epiphyses and contain red bone marrow.
 - Diaphysis is the shaft of the bone. The wall of the diaphysis is mainly compact bone. Medial region of the diaphysis is hollow cavity called medullary cavity. The medullary cavity contains blood vessels, nerves, and yellow marrow.
 - Periosteum is a fibrous yet vascular connective tissue covering of the diaphysis. The periosteum plays a part in bone repair.
- Landmarks are sites of attachment of muscles, tendons, and ligaments. The landmarks are also passages for nerves and blood vessels. Please refer to page. 142 for the complete list of landmark terminology that will be helpful in the Skeletal System lab.
- Compact bone tissue: Microscopic Anatomy
 - **REFER TO FIGURE 7.3**
 - Osteon is the functional and structural unit of compact bone.
 - Components of the osteons
 - Central canal is an opening that extends longitudinally and contains blood vessels and nerves.
 - Perforating canal is an opening that extends perpendicular or transverse to the central canal and also contains blood vessels and nerves. The perforating canals will connect the central canals.
 - Osteocyte is a mature, fixed bone cell that is enclosed in a chamber called lacuna (-ae). There are many osteocytes in a given osteon. The osteocytes will lay down bone mass around them.
 - Lamella (-ae) is a concentric ring of bone mass around the central canal. There are several lamellae surrounding the central canal. The intracellular matrix are organized in lamellae and contain collagen, calcium phosphate and calcium carbonate.
 - Canaliculus (-li) is a tiny canal that radiate from the lacuna to transport nutrients and wastes among the osteocytes. There many canaliculi in a given osteon.
- Types of bone cells
 - Osteoblasts are “bone-building” cells. They will appear during bone formation and bone repair to deposit calcium and bone tissue. These cells can reside permanently in bone tissue to become osteocytes.
 - Osteocytes are mature and fixed bone cells. They will reside in bone tissue to lay down bone mass.

- Osteoclasts are “bone-breaking” cells. They will release calcium from bones if calcium levels are low in the blood and will form the medullary cavity during bone development.
- Osteoblasts and osteoclasts are working to maintain calcium homeostasis.
- **REFER TO FIGURE 7.8**
- Intramembranous Ossification
 - Physiological process
 1. Sheets of primitive connective tissue appear at the sites of future bones. Blood vessels invade primitive connective tissue.
 2. Some of the primitive connective tissue cells differentiate into osteoblasts which deposit spongy bone in all directions.
 3. The outermost layer of the primitive connective tissue develops into periosteum.
 4. Osteoblasts inside the periosteum form a layer of compact bone over the spongy bone.
 5. Osteoblasts become osteocytes and reside in lacunae when surrounded by bony matrix. Calcification occurs.

REFER TO FIGURE 7.4

- Endochondral Ossification
 - Physiological process
 1. Hyaline cartilage model of future bone forms.
 2. Chondrocytes within the diaphysis enlarge, calcify, and die. Periosteum forms around cartilage.
 3. Blood vessels and osteoblasts invade to form spongy bone at the primary ossification center of the diaphysis.
 4. Osteoblasts beneath the periosteum lay down compact bone outside of the spongy bone.
 5. Osteoclasts break down spongy bone and form the medullary cavity
 6. Secondary ossification centers appear in the epiphyses and form spongy bone in all direction. A band of hyaline cartilage remains between the spongy bone in the epiphyses and the diaphysis—forming epiphyseal plate.
 7. Cartilage cells in epiphyseal plate undergo mitosis between the 2 ossification centers as long as bone is growing in length.
 - **REFER TO FIGURE 7.5 & 7.6**
- Bone Repair occurs when there is a break in bone.
 - **REFER TO TOPIC OF INTEREST: Bone Fractures—pp.138-139**
 - Bone repair process
 1. Blood escapes from the broken blood vessels and a hematoma forms. Blood vessels and osteoblasts from the periosteum invade the hematoma.
 2. Spongy bone tissue invade the injury site to close the blood vessels while fibrocartilage forms to surround the area to form a cartilaginous callus.
 3. The cartilaginous callus is replaced by bony callus.
 4. Osteoclasts remove excess bone tissue and the injury site is restored similar to the original.
- **7.5: SKELETAL ORGANIZATION, 7.6: SKULL, 7.7: VERTEBRAL COLUMN, 7.8: THORACIC CAGE, 7.9: PECTORAL GIRDLE, 7.10: UPPER LIMB, 7.11: PELVIC GIRDLE, 7.12: LOWER LIMB---COVERED IN LAB COMPONENT**
- Joints are articulations between bones.
 - Functions:
 - Bind parts of the skeletal system
 - Make bone growth possible
 - Permit parts of the skeleton to change shape during childbirth

- Enable the body to move in response to skeletal muscle contractions
- Types of joints
 - **REFER TO FIGURES 7.34, 7.35, & 7.36**
 - Fibrous joints consist of dense connective tissue between bones. Fibrous joints are considered immovable joints or synarthrotic.
 - Examples of fibrous joints are sutures of the skull and joint between the tibia and fibula at the distal end.
 - Cartilaginous joints consist of hyaline cartilage or fibrocartilage between bones. Cartilaginous joints are joints that allow limited movement or amphiarthrotic.
 - Examples of cartilaginous joints are fibrocartilage disks between the vertebrae, the symphysis pubis of the pelvic girdle, and the costal cartilage of the first ribs to the sternum.
 - Synovial joints are more complex than fibrous and cartilaginous joints. They allow for free movement or diarthrotic.
 - The components of synovial joints
 - Joint capsule is the outermost covering of the joint and will allow for ligaments to attach in order to reinforce the joint.
 - Synovial membrane is a connective membrane that is the inner membrane of the synovial joint. It is thin and vascular.
 - Joint cavity is the space enclosed laterally by the synovial membrane and the superior and inferior edges are the epiphyses of the bones. The synovial membrane will secrete synovial fluid into the cavity to provide lubrication and nutrients.
 - Meniscus (-ci) is a flattened fibrocartilage pad located between the articulating surfaces of the bones to aid in movement and serve as shock-absorbers.
 - Bursa (-ae) is a fluid-filled sac located near the between tendons and bone prominences to aid in tendon movement and to cushion the joint.
 - Types of synovial joints
 - **REFER TO FIGURE 7.37 & TABLE 7.4**
 - **Ball-and-socket joint** consists of a bone with a globular or egg-shaped head articulating with the cup-shaped cavity of another bone
 - **Condylloid joint** consists of an ovoid condyle fitting into an elliptical cavity
 - **Plane (gliding) joint** occur where articulating surfaces are nearly flat or slightly curved, allowing a back-and-forth motion
 - **Hinge joint** occur when a convex surface fits into a concave surface
 - **Pivot joint** occur when a cylindrical surface rotates within a ring of bone and fibrous tissue
 - **Saddle joint** forms where articulating surfaces have both concave and convex areas
 - Types of joint movements – Refer to pp. 165 -166
 - **REFER TO FIGURES 7.38, 7.39, & 7.40**
 - Flexion
 - Extension
 - Dorsiflexion
 - Plantar flexion
 - Hyperextension
 - Abduction
 - Adduction

- Rotation
- Circumduction
- Pronation
- Supination
- Eversion
- Inversion
- Retraction
- Protraction
- Elevation
- Depression