Chapter 6 Content Review Questions 1-8

1. The skeletal system consists of what connective tissues?
   - Bone
   - Cartilage
   - Dense fibrous CT (tendons & nonelastic ligaments)
   - Dense elastic CT (elastic ligaments)

List the functions of these tissues.
   - Bone: supports the body, protects internal organs, provides levers on which muscles act, store minerals, and produce blood cells.
   - Cartilage provides a model for bone formation and growth, provides a smooth cushion between adjacent bones, and provides firm, flexible support.
   - Tendons attach muscles to bones and ligaments attach bone to bone.

2. Name the major types of fibers and molecules found in the extracellular matrix of the skeletal system.
   - Collagen
   - Proteoglycans
   - Hydroxyapatite
   - Water
   - Minerals

How do they contribute to the functions of tendons, ligaments, cartilage and bones?
   - The collagen fibers of tendons and ligaments make these structures very tough, like ropes or cables.
   - Collagen makes cartilage tough, whereas the water-filled proteoglycans make it smooth and resistant. As a result, cartilage is relatively rigid, but springs back to its original shape if it is bent or slightly compressed, and it is an excellent shock absorber.
   - The extracellular matrix of bone contains collagen and minerals, including calcium and phosphate. Collagen is a tough, ropelike protein, which lends flexible strength to the bone. The mineral component gives the bone compression (weight-bearing) strength. Most of the mineral in the bone is in the form of hydroxyapatite.

3. Define the terms diaphysis, epiphysis, epiphyseal plate, medullary cavity, articular cartilage, periosteum, and endosteum.
   - Diaphysis – the central shaft of a long bone.
   - Epiphysis – the ends of a long bone.
   - Epiphyseal plate – the site of growth in bone length, found between each epiphysis and diaphysis of a long bone and composed of cartilage.
   - Medullary cavity – a large cavity in the diaphysis of a long bone or smaller cavities in the epiphyses of long bones and in the interior of other bones. These spaces are filled with either yellow or red marrow.
   - Articular cartilage – a thin layer of hyaline cartilage that covers the ends of the epiphyses where the bone articulates with other bones.
   - Periosteum – dense connective tissue that covers most of the outer surface of bone.
   - Endosteum – thinner connective tissue membrane that lines the surface of the medullary cavity.
4. Describe the structure of compact bone.

- Most of the lamellae of compact bone are organized into sets of concentric rings with each set surrounding a central, or Haversian, canal. Blood vessels that run parallel to the long axis of the bone are contained within the central canals. Each central canal, with the lamellae and osteocytes surrounding it, is called an osteon, or Haversian system. Osteocytes, located in lacunae, are connected to one another by processes in canaliculi. The canaliculi give the osteon the appearance of having tiny cracks in the lamellae.

How do nutrients reach the osteocytes in compact bone?
- Osteocytes receive nutrients and eliminate wastes through blood vessels in the compact bone. Blood vessels in the periosteum and endosteum supply blood to blood vessels in the central canals. Nutrients leave the blood vessels of the central canals and diffuse to the osteocytes through the canaliculi. Waste products diffuse in the opposite direction.

5. Describe the structure of cancellous bone.

- Cancellous bone consists of delicate interconnecting rods or plates of bone called trabeculae, which add strength to the bone without the added weight. The spaces between the trabeculae are filled with marrow. Each trabecula consists of several lamellae with osteocytes between the lamellae. Usually no blood vessels penetrate the trabeculae, and the trabeculae have no central canals. Nutrients exit vessels in the marrow and pass by diffusion through canaliculi to the osteocytes of the trabeculae.

What are trabeculae?
- They are delicate interconnecting rods or plates of bone, which resemble the beams or scaffolding of a building. They add strength to a bone w/o added weight.

6. Define and describe intramembranous and endochondral ossification.

- Intramembranous ossification occurs when osteoblasts begin to produce bone in CT membranes. This primarily occurs in the bones of the skull. Osteoblasts line up on the surface of CT fibers and begin depositing bone matrix to form trabeculae. This process begins in areas called ossification centers and the trabeculae radiate out from the centers.

- Endochondral ossification occurs in the cartilage models of the bones at the base of the skull and most of the remaining skeletal system. During endochondral ossification, cartilage cells, called chondrocytes, increase in number, hypertrophy (enlarge), and die; and the cartilage matrix becomes calcified, forming an ossification center. As this process is occurring in the center of the cartilage model, blood vessels accumulate in the perichondrium. The presence of blood vessels in the outer surface of future bones causes some of the unspecified CT cells on the surface to become osteoblasts. These osteoblasts then produce a collar of bone around part of the outer surface of the diaphysis and eventually the perichondrium becomes the periosteum. The center part of the diaphysis is a primary ossification center. Osteoblasts invade the space left by dying cartilage cells. Some of the calcified cartilage matrix is removed by osteoclasts and the osteoblasts line up on the remaining calcified matrix and begin to form bone lamellae. As the bone develops, the medullary cavity forms in the diaphysis. Osteoclasts remove the bone which gets repalaced by marrow. Secondary ossification sites form in the epiphyses.
7. How does bone grow?
   - All bone growth occurs by the apposition of new bone lamellae onto existing bone or other CT. As osteoblasts deposit new bone matrix on the surface of bones between the periosteum and the existing bone matrix, the bone increases in width or diameter.

   How do long bones grow in length?
   - Growth in the length of a bone occurs in the epiphyseal plate. Chondrocytes increase in number within the proliferating zone of the epiphyseal plate. They line up in columns parallel to the long axis of the bone, causing elongation of the bones, and then hypertrophy and die.

8. What is accomplished by bone remodeling?
   - Remodeling of newly formed bone in the epiphyseal plate is involved in bone growth. It is responsible for changes in bone shape, the adjustment of bone to stress, bone repair, and calcium ion regulation in the body fluids.

   How does bone repair occur?
   - When a bone is broken, blood vessels are also ruptured. They bleed and form a clot in the damaged area.
   - Two to three days after the injury, blood vessels and cells from surrounding tissues begin to invade the clot. Some of these cells produce a fibrous network between the broken bone, which holds the bone fragments together and fills the gap between the fragments.
   - Other cells produce islets of cartilage in the fibrous network, forming a callus. Osteoblasts enter the callus and begin forming cancellous bone.