Laboratory Exercise 12

Bone Structure and Classification

Materials Needed

Textbook
Prepared microscope slide of ground compact bone
Human bone specimens including long, short, flat, irregular, and sesamoid types
Human long bone, sectioned longitudinally
Fresh animal bones, sectioned longitudinally and transversely
Compound light microscope
Dissecting microscope

For Demonstration:

Fresh chicken bones (radius and ulna from wings)
Vinegar or dilute hydrochloric acid

Safety

- Wear disposable gloves for handling fresh bones and for the demonstration of a bone soaked in vinegar or dilute hydrochloric acid.
- Wash your hands before leaving the laboratory.

A bone represents an organ of the skeletal system. As such, it is composed of a variety of tissues including bone tissue, cartilage, dense connective tissue, blood, and nervous tissue. Bones are not only alive, but also multifunctional. They support and protect softer tissues, provide points of attachment for muscles, house blood-producing cells, and store inorganic salts.

Bones are classified according to their shapes as long, short, flat, irregular, or sesamoid. Although bones of the skeleton vary greatly in size and shape, they have much in common structurally and functionally.

Purpose of the Exercise

To review the way bones are classified and to examine the structure of a long bone.

LEARNING OUTCOMES

After completing this exercise, you should be able to

1. Locate the major structures of a long bone.
2. Distinguish between compact and spongy bone.
3. Differentiate the special characteristics of compact bone tissue.
4. Arrange five groups of bones based on their shapes and identify an example for each group.
5. Describe the functions of various structures of a bone.

EXPLORE

Procedure—Bone Structure and Classification

1. Review the section entitled "Connective Tissues" in chapter 5 of the textbook and the section entitled "Bone Structure" in chapter 7 of the textbook.
2. As a review activity, label figures 12.1 and 12.2.
3. Reexamine the microscopic structure of bone tissue by observing a prepared microscope slide of ground compact bone. Use figure 12.3 of bone tissue to locate the following features:

osteon (Haversian system)—cylinder-shaped unit
central canal (Haversian canal)—contains blood vessels and nerves
lamella—concentric ring of matrix around central canal
lacuna—small chamber for an osteocyte
bone extracellular matrix—collagen and calcium phosphate
canaliculus—minute tube containing cellular process

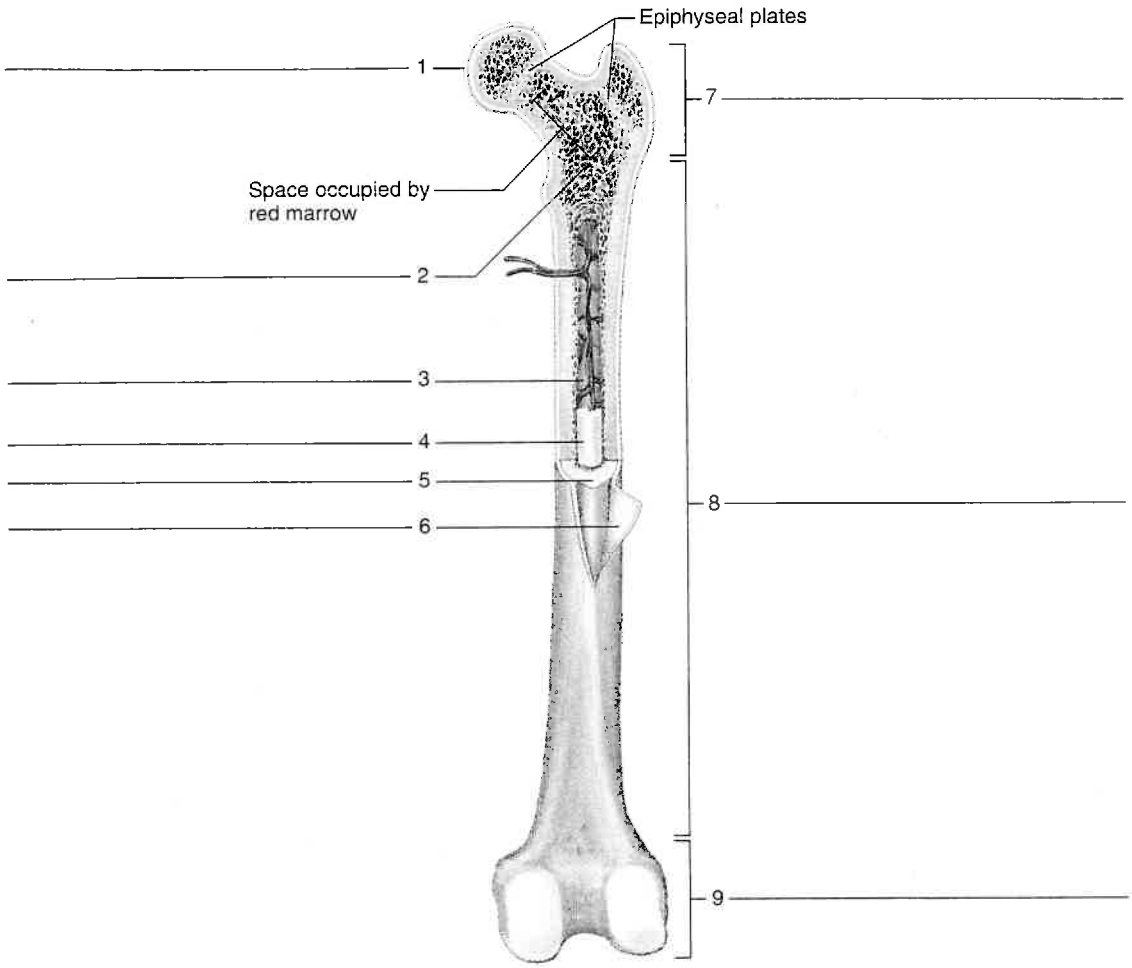


Figure 12.1 Label the major structures of this long bone (femur). 1 2

Critical Thinking Application

Explain how bone cells embedded in a solid ground substance obtain nutrients and eliminate wastes.

4. Observe the individual bone specimens and arrange them into groups, according to the following shapes and examples: 4

   long—femur; humerus; phalanges
   irregular—vertebrae
   short— carpals; tarsals
   sesamoid (round)—patella
   flat—ribs; most cranial bones

5. Complete Part A of Laboratory Report 12.

6. Examine the sectioned long bones and locate the following:

   epiphysis
   proximal—nearest torso
   distal—farthest from torso
   epiphyseal plate—growth zone of hyaline cartilage
   articular cartilage—on ends of epiphyses
   diaphysis—shaft between epiphyses
   periosteum—membrane around bone (except articular cartilage) of dense irregular connective tissue
   compact bone—forms diaphysis and epiphyseal surfaces
   spongy bone—within epiphyses
   trabeculae—a structural lattice in spongy bone
   medullary cavity—hollow chamber
   endosteum—thin membrane lining medullary cavity of reticular connective tissue
   yellow marrow—occupies medullary cavity
   red marrow—occupies spongy bone in some epiphyses and flat bones

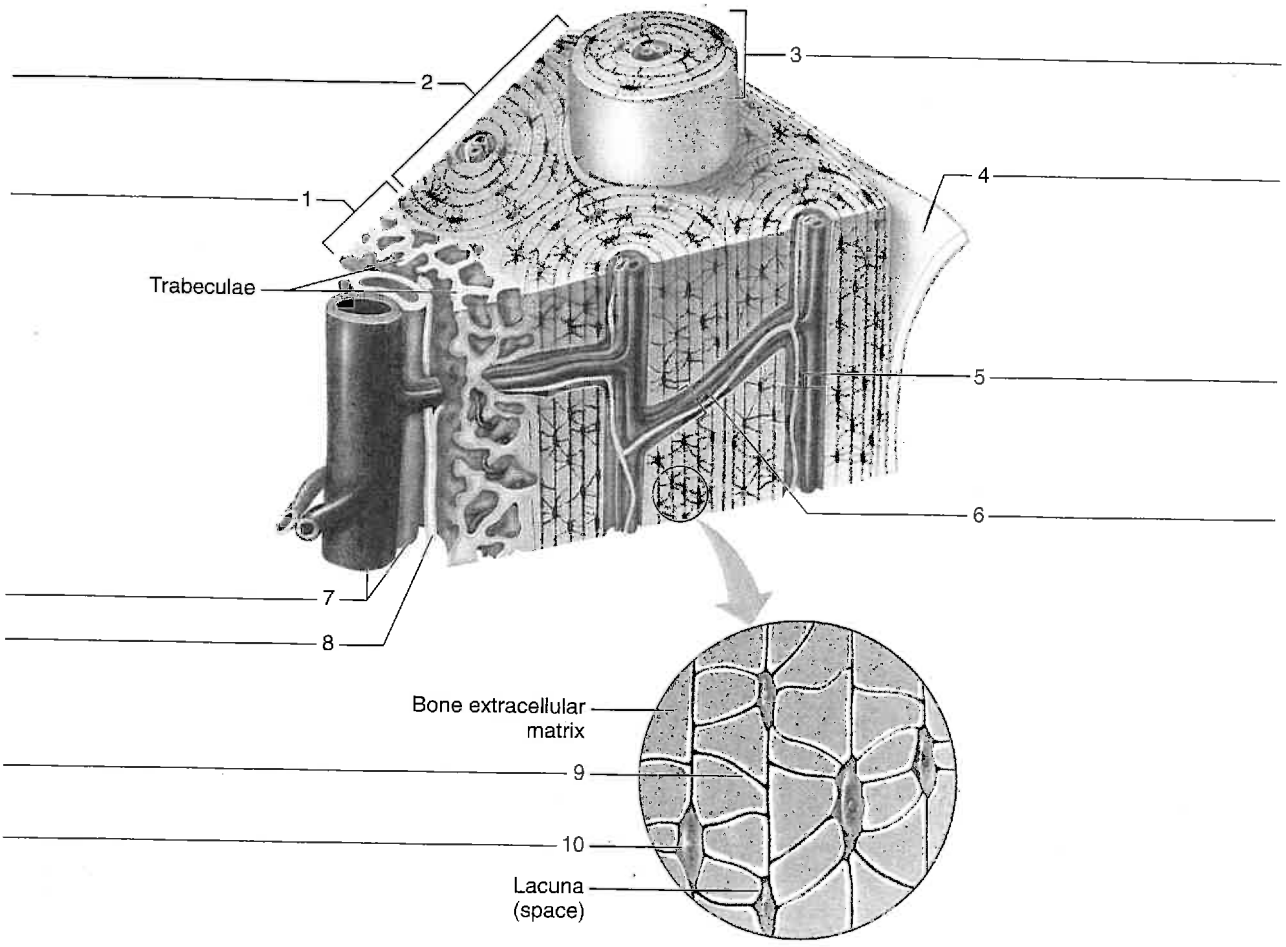


Figure 12.2 Label the features associated with the microscopic structure of bone. 2 3

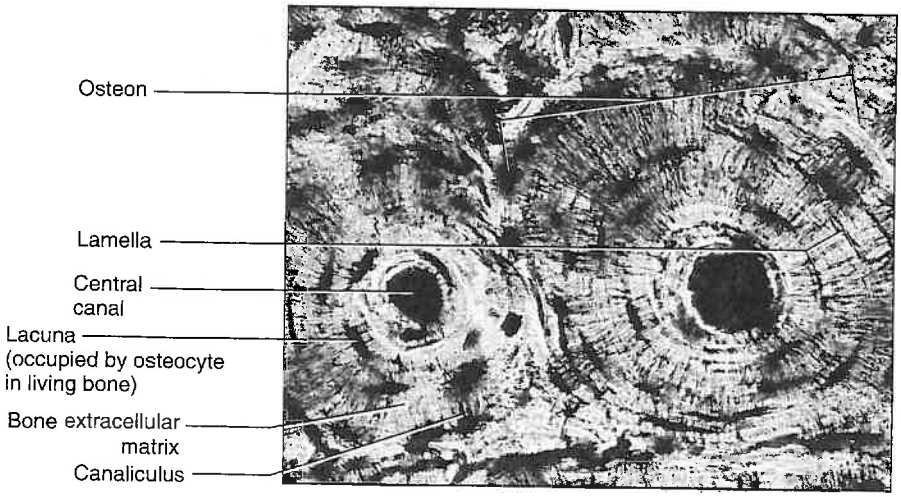


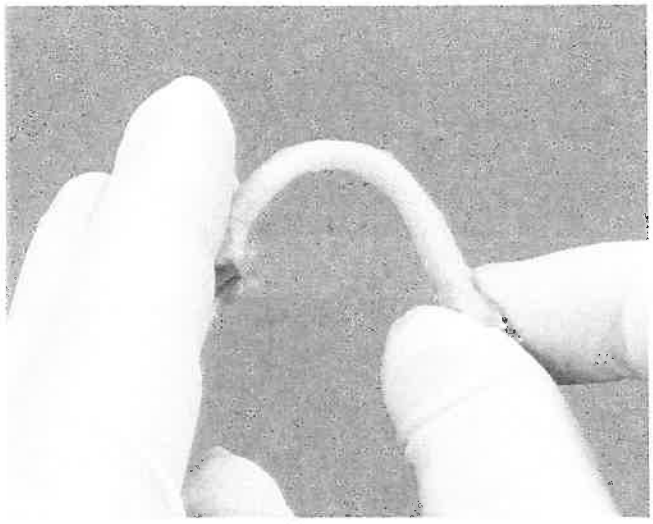
Figure 12.3 Micrograph of ground compact bone tissue (160×).

7. Use the dissecting microscope to observe the compact bone and spongy bone of the sectioned specimens. Also examine the marrow in the medullary cavity and the spaces within the spongy bone of the fresh specimen.
8. Complete Parts B and C of the laboratory report.

Demonstration

Examine a fresh chicken bone and a chicken bone that has been soaked for several days in vinegar or overnight in dilute hydrochloric acid. Wear disposable gloves for handling these bones. This acid treatment removes the inorganic salts from the bone extracellular matrix. Rinse the bones in water and note the texture and flexibility of each (fig. 12.4*a*). Based on your observations, what quality of the fresh bone seems to be due to the inorganic salts removed by the acid treatment? 3

Examine the specimen of chicken bone that has been exposed to high temperature (baked at 121°C [250°F] for 2 hours). This treatment removes the protein and other organic substances from the bone extracellular matrix (fig.12.4*b*). What quality of the fresh bone seems to be due to these organic materials? 3



(a)

(b)

Figure 12.4 Results of fresh chicken bone demonstration: (*a*) soaked in vinegar; (*b*) baked in oven.