

Laboratory Exercise

12

Bone Structure

Materials Needed

Textbook

Human long bone, sectioned longitudinally

Fresh animal bones, sectioned longitudinally and transversely

Dissecting microscope

Compound light microscope

Prepared microscope slide of ground compact bone

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 skeleton 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.

Although bones of the skeleton vary greatly in size and shape, they have much in common structurally and functionally.

Purpose of the Exercise

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. Describe the functions of various structures of a bone.

Procedure—Bone Structure

1. Review the section entitled "Bone Structure" in chapter 7 of the textbook.
2. As a review activity, label figures 12.1 and 12.2.
3. Examine the sectioned bones and locate the following:

epiphysis (proximal and distal)

epiphyseal plate

articular cartilage

diaphysis

periosteum

compact bone

spongy bone

medullary cavity

endosteum

red marrow

yellow marrow

4. 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.
5. 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

lacuna—small chamber for an osteocyte

bone extracellular matrix—collagen and calcium phosphate

lamella—concentric ring of matrix around central canal

canaliculus—minute tube containing cellular process

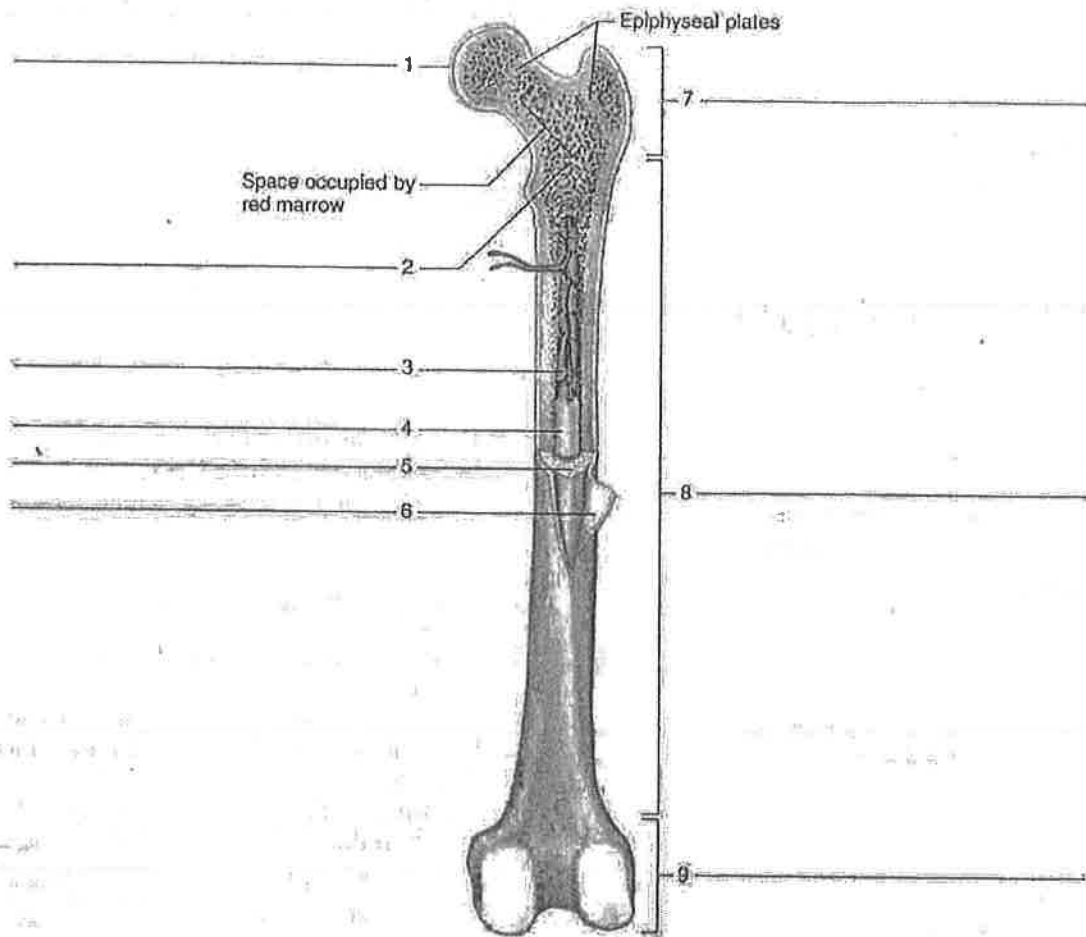


Figure 12.1 Label the major structures of this long bone (femur).

Critical Thinking Application

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

6. Complete Parts A and B of Laboratory Report 12.

Demonstration

Examine a fresh chicken bone and a chicken bone that has been soaked for several days in vinegar or exposed 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. 12.4a). Based on your observations, what quality of the fresh bone seems to be due to the inorganic salts removed by the acid treatment?

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. 12.4b). What quality of the fresh bone seems to be due to these organic materials?

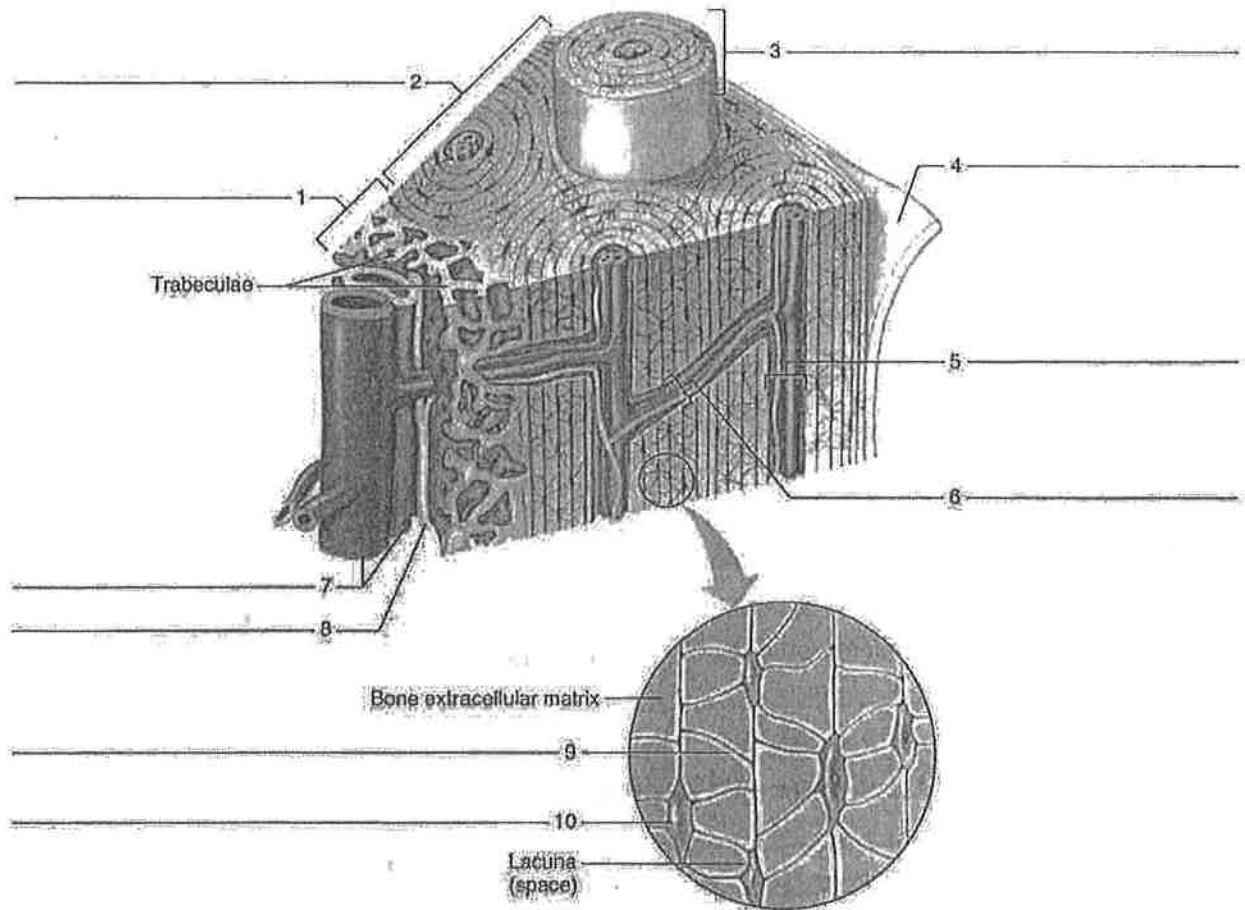


Figure 12.2 Label the features associated with the microscopic structure of bone. 2, 3

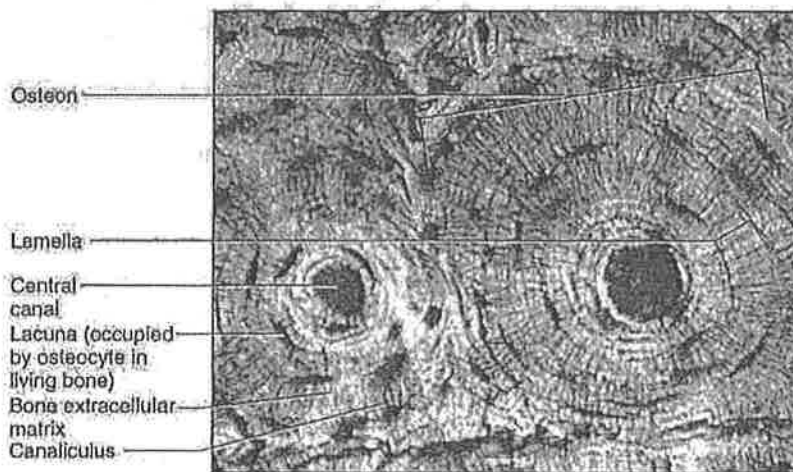


Figure 12.3 Micrograph of ground compact bone tissue (160X).

Name _____

Date _____

Section _____

The _____ corresponds to the indicated outcome(s) found at the beginning of the laboratory exercise.

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Laboratory Report

Bone Structure

Part A Assessments

Complete the following:

1. Where in the human skeleton are long bones found? 1

2. Distinguish between the epiphysis and the diaphysis of a long bone. 1

3. Where is cartilage found on the surface of a long bone? 1

4. Where is dense connective tissue found on the surface of a long bone? 1

5. In general, what is the function of bony processes? 4

6. Distinguish the locations and tissues between the periosteum and the endosteum. 1

7. What structural differences did you note between the compact bone and the spongy bone? 2

8. How are these structural differences related to the locations and functions of these two types of bone? 2

9. From your observations, how does the marrow in the medullary cavity compare with the marrow in the spaces of the spongy bone? (4)

Part B Assessments

Identify the structures indicated in figure 12.5. (1, 2)

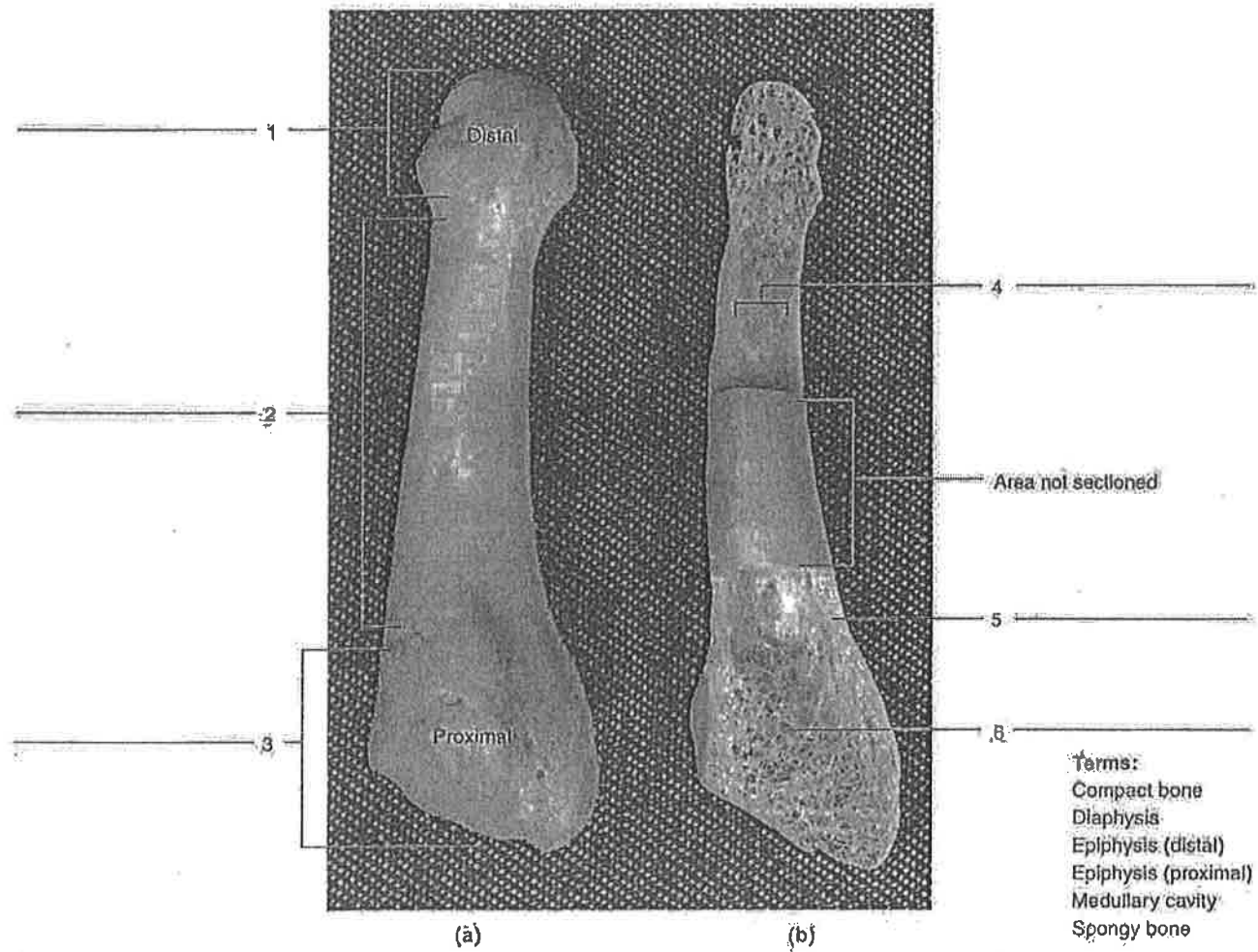


Figure 12.5 Identify the structures indicated in (a) the unsectioned long bone (fifth metatarsal) and (b) the partially sectioned long bone, using the terms provided.

