Laboratory Exercise 19

Skeletal Muscle Structure

Materials Needed

Textbook
Compound light microscope
Prepared microscope slide of skeletal muscle tissue
Human torso model with musculature
Model of skeletal muscle fiber

For Demonstration:
Fresh round beefsteak

Safety

- Wear disposable gloves when handling the fresh beefsteak.
- Wash your hands before leaving the laboratory.

A skeletal muscle represents an organ of the muscular system and is composed of several types of tissues. These tissues include skeletal muscle tissue, nervous tissue, blood, and various connective tissues.

Each skeletal muscle is encased and permeated with connective tissue sheaths. The connective tissue often extends beyond the end of a muscle, providing an attachment to other muscles or to bones. The connective tissues also extend into the structure of a muscle and separate it into compartments. The outer layer, called *epimysium*, extends deeper into the muscle as *perimysium*, containing bundles of cells (fascicles), and farther inward extends around each muscle cell (fiber) as a thin *endomysium*. The connective tissues provide support and reinforcement during muscular contractions and allow portions of a muscle to contract somewhat independently. Some of the collagen fibers are continuous with the tendon, periosteum, and inward extensions as bone fibers, allowing a strong structural continuity.

Muscles are named according to their location, size, action, shape, attachments, or the direction of the fibers. Examples of how muscles are named include: gluteus maximus (location and size); adductor longus (action and shape); sternocleidomastoid (attachments); and orbicularis oculi (direction of fibers and location).

Purpose of the Exercise

To review the structure of a skeletal muscle.

LEARNING OUTCOMES

After completing this exercise, you should be able to

1. Locate the major structures of a skeletal muscle fiber on a microscope slide of skeletal muscle tissue and on a model.
2. Describe how connective tissue is associated with muscle tissue within a skeletal muscle.
3. Distinguish between the origin and insertion of a muscle.
4. Describe and demonstrate the general actions of prime movers (agonists), synergists, and antagonists.

EXPLORE

Procedure—Skeletal Muscle Structure

1. Study the section entitled "Skeletal Muscle Tissue" in chapter 5 of the textbook.
2. Reexamine the microscopic structure of skeletal muscle by observing a prepared microscope slide of this tissue. Use figure 19.1 of skeletal muscle tissue to locate the following features:

   skeletal muscle fiber (cell)
   nuclei
   striations (alternating light and dark)

3. Review the section entitled "Structure of a Skeletal Muscle" in chapter 9 of the textbook.
4. As a review activity, label figure 19.2 and study figure 19.3.
5. Examine the human torso model and locate examples of fascia, tendons, and aponeuroses. An origin tendon is attached to a fixed location, while the insertion tendon is attached to a more movable location. Sheets of connective tissue, called aponeuroses, also serve for some muscle attachments. Locate examples of tendons in your body.
6. Complete Part A of Laboratory Report 19.

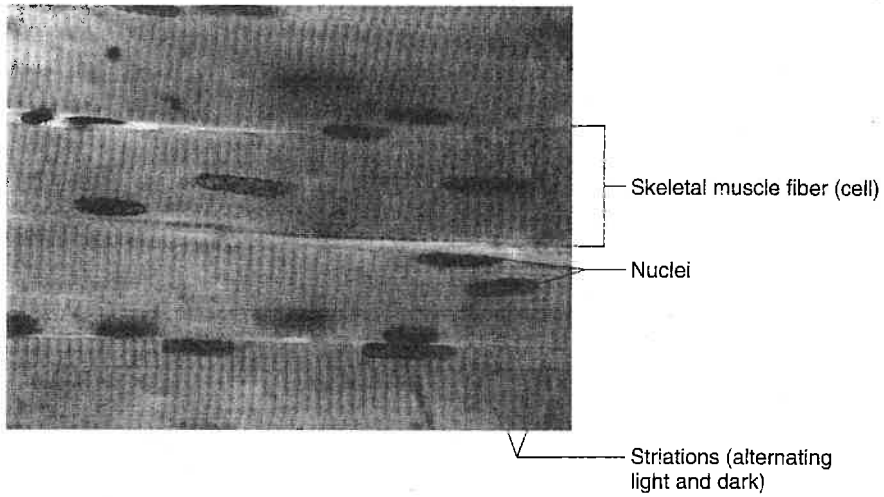

Figure 19.1 Structures found in skeletal muscle fibers (cells) (250× micrograph enlarged to 700×).

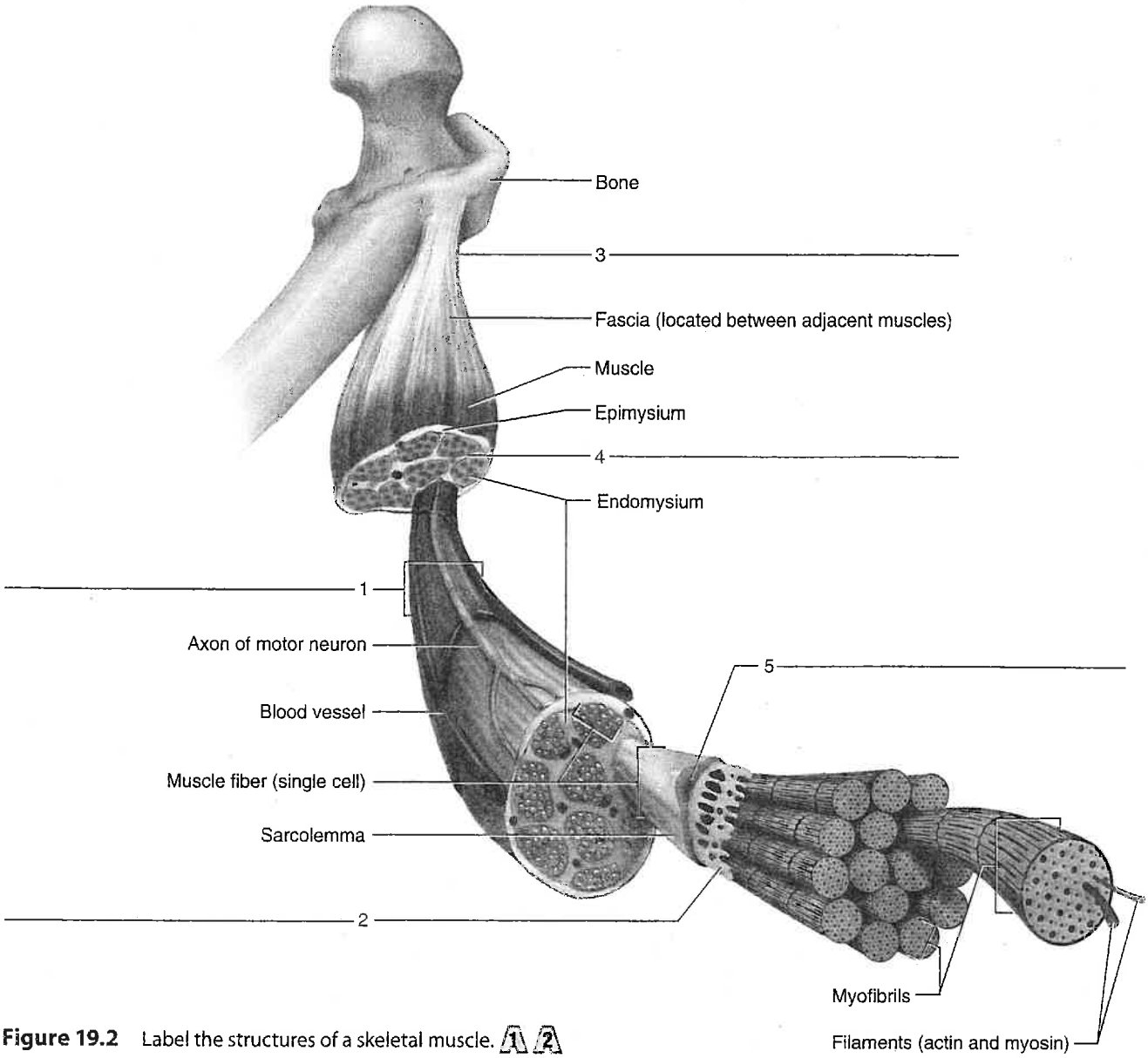

Figure 19.2 Label the structures of a skeletal muscle. A 2

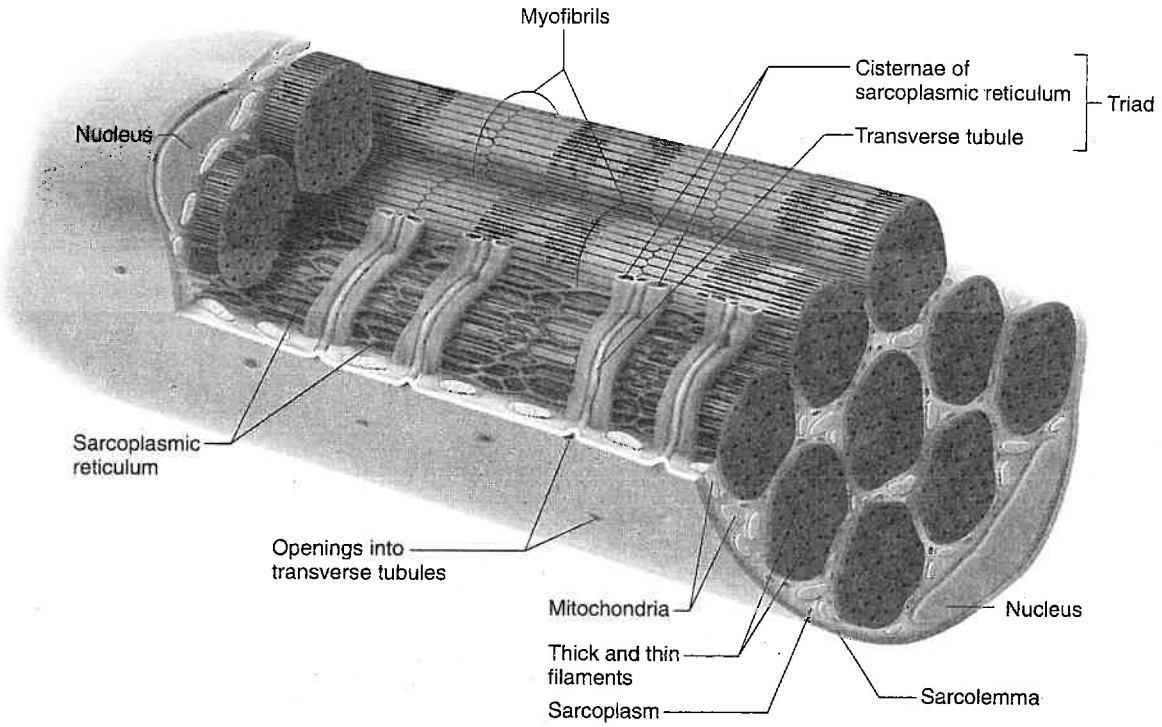

Figure 19.3 Structures of a skeletal muscle fiber.

Demonstration

Examine the fresh round beefsteak. It represents a cross section through the beef thigh muscles. Note the white lines of connective tissue that separate the individual skeletal muscles. Also note how the connective tissue extends into the structure of a muscle and separates it into small compartments of muscle tissue. Locate the epimysium and the perimysium of an individual muscle.

7. Examine the model of the skeletal muscle fiber and locate the following:

sarcolemma

sarcoplasm

myofibril

thick (myosin) filament

thin (actin, tropomyosin, and troponin) filament

sarcomere (functional contractile unit)

A band (dark)

I band (light)

H zone

M line

Z line (disc)

sarcoplasmic reticulum

cisternae

transverse (T) tubules

8. Complete Part B of the laboratory report.
9. Review the section entitled "Skeletal Muscle Actions" in chapter 9 of the textbook.
10. Provide labels for figure 19.4.
11. Locate the biceps brachii and its origins and insertions in the human torso model and in your body.
12. Make various movements with your upper limb at the shoulder and elbow. For each movement, determine the location of the muscles that function as prime movers (agonists) and as antagonists. **Remember, when a prime mover contracts (shortens) and a joint moves, its antagonist relaxes (lengthens).** Antagonistic muscle pairs pull from opposite sides of the same body region. Synergistic muscles often supplement the contraction force of a prime mover, or by acting as fixators, they might also stabilize nearby joints. The role of a muscle as a prime mover, antagonist, or synergist depends upon the movement under consideration, as their roles can change.
13. Complete Part C of the laboratory report.

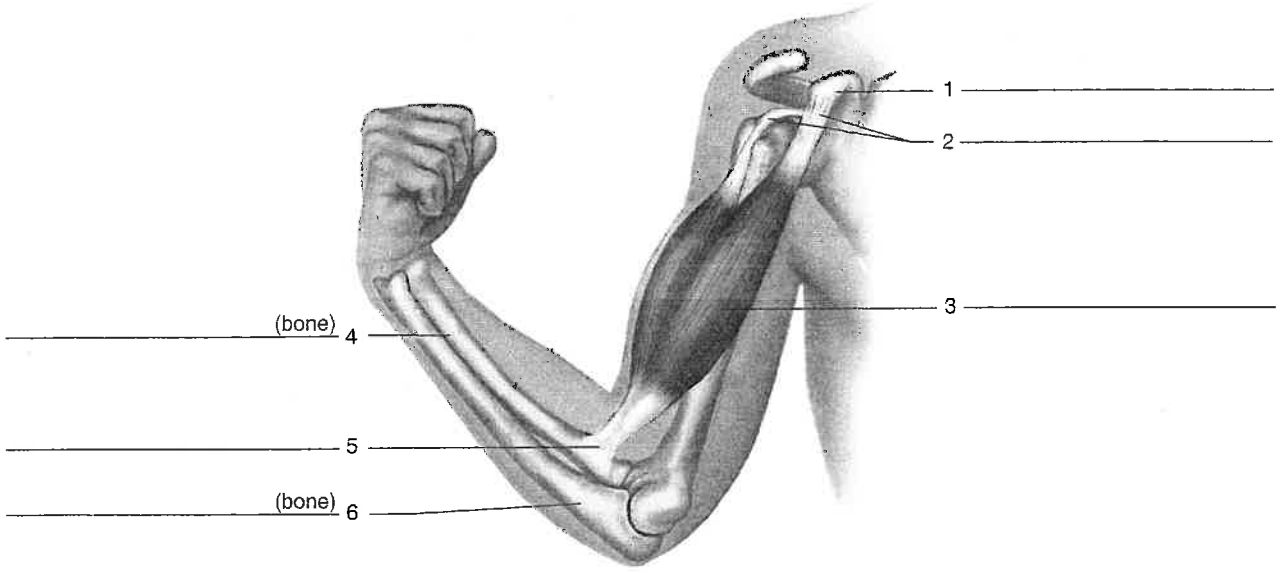

Figure 19.4 Label the major features of the upper limb.