

Basic Human Anatomy

Lesson 5: Muscular System

Welcome to Lesson 5 of the Basic Human Anatomy Course. Today, we'll be studying the Human Muscular System.

I have 4 goals for you in this lesson:

1. Describe the general features of the skeletal muscles.
2. Describe the general arrangement of the trunk and limb musculature.
3. Give a sample drawing, identify the class of lever.
4. Name the components of a skeleton-muscular unit. Given a description of a muscle's role in a motion, name that role.

MUSCLE TISSUES

The cellular elements of muscle tissues are specialized to produce motion by contraction. They also produce body heat. (See lesson 2 for a discussion of muscle tissues.)

- a. Smooth muscle tissue is utilized to make up the muscular portion of the various visceral organs (stomach, blood vessels, etc.).
- b. Cardiac muscle tissue makes up the muscular wall of the heart—the myocardium.
- c. Striated muscle tissue is used in the makeup of several types of muscles. The main type of muscle is the skeletal muscle. Other types of muscles made with striated muscle tissue are the facial or integumentary muscles and muscles of the jaw apparatus.

THE SKELETAL MUSCLE

Each skeletal muscle is an individual organ of the human body. Each is made up of several types of tissues--mainly, striated muscle fibers and FCT (fibrous connective tissue). Each is attached to and moves bones. Bones are parts of the skeleton serving as levers.

a. **General Construction of a Skeletal Muscle.** The large portion of a muscle is known as its belly or fleshy belly. This muscle is attached to bones by tendons or aponeuroses. Tendons and aponeuroses are similar to each other. However, tendons are cord-like and aponeuroses are broad and flat. The fleshy portion may be directly connected to the bone. If so, it is called a "fleshy attachment."

b. **Muscular NAVL (Nerves, Arteries, Veins, Lymphatics).**

(1) From the main NAVL (nerve, artery, vein, lymphatic), there are branches going to each muscle. These muscular branches are bound together by an FCT sheath to form a neurovascular bundle.

(2) The motor point is that specific location on the surface of the muscle where the neurovascular bundle enters.

(3) A motor unit is the single motor neuron and the number of striated muscle fibers activated by it (innervation). The importance of the motor unit is that its fibers work in unison. Either all fibers within a unit contract or none contract. When a certain amount of force is needed, one unit after another is recruited until just enough units are available to produce the desired action.

NAMING SKELETAL MUSCLES

The name of a muscle may appear with the abbreviation M., meaning Musculus or muscle. We abbreviate muscles (plural) with the symbol Mm. Skeletal muscles are named according to their physical attributes (shape, size, length, etc.), their location, or their function. For example:

SHAPE	deltoid M. (DELTA = D , Greek letter D) biceps M. (BICEPS = two-head, BI = two CEPS = head)
SIZE	adductor magnus M. (MAGNUS = great, large)
LENGTH	adductor longus M. (LONGUS = long)
LOCATION	biceps brachii M. (BRACHII = of the arm) biceps femoris M. (FEMORIS = of the thigh)
FUNCTION	rotatores Mm. (ROTATORES = rotators) (They turn/rotate the vertebral column.)

ARRANGEMENT OF HUMAN SKELETAL MUSCLES

See figures 5-1 and 5-2 for some of the skeletal muscles.

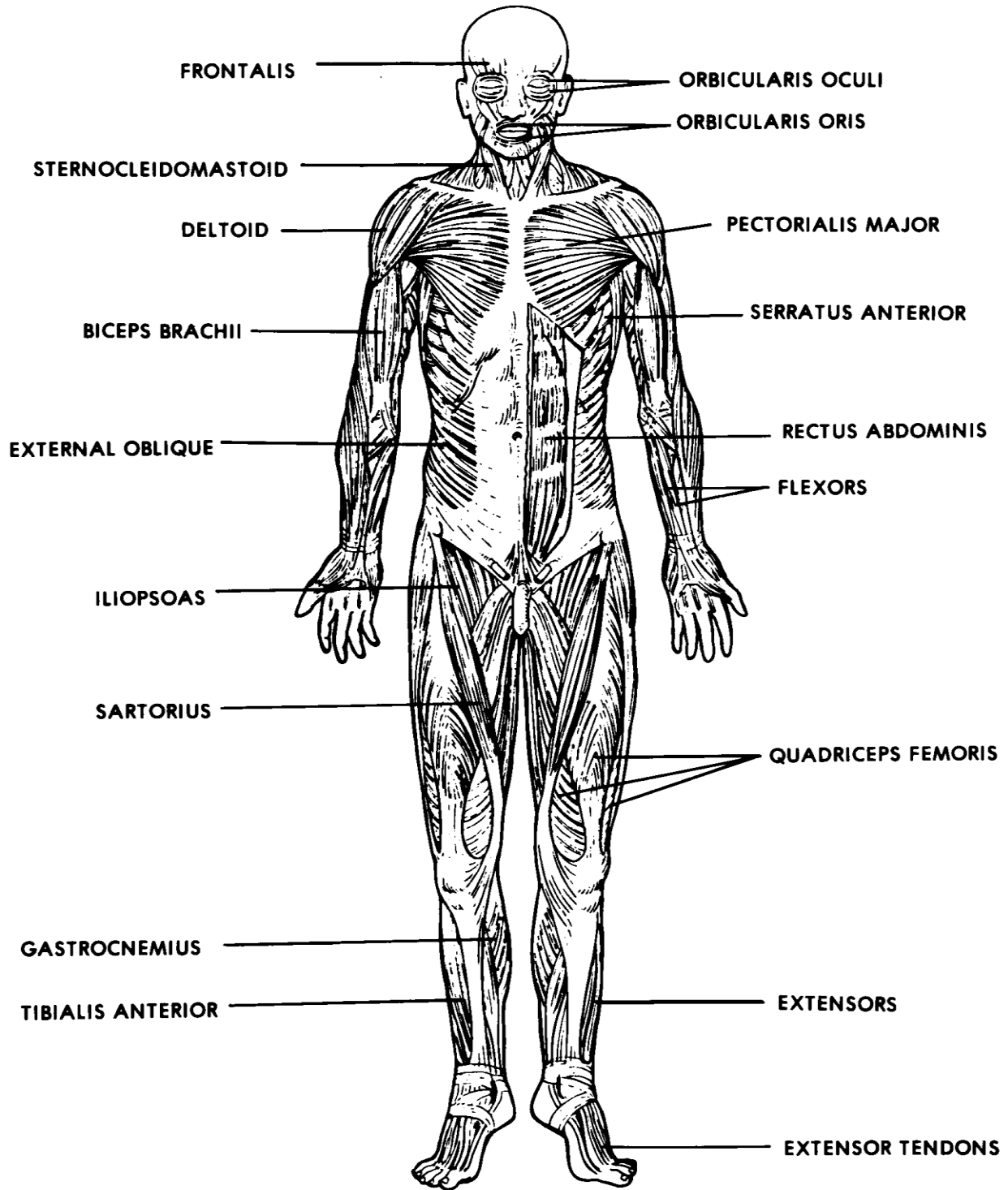


Figure 5-1. Skeletal and facial muscles, anterior view.

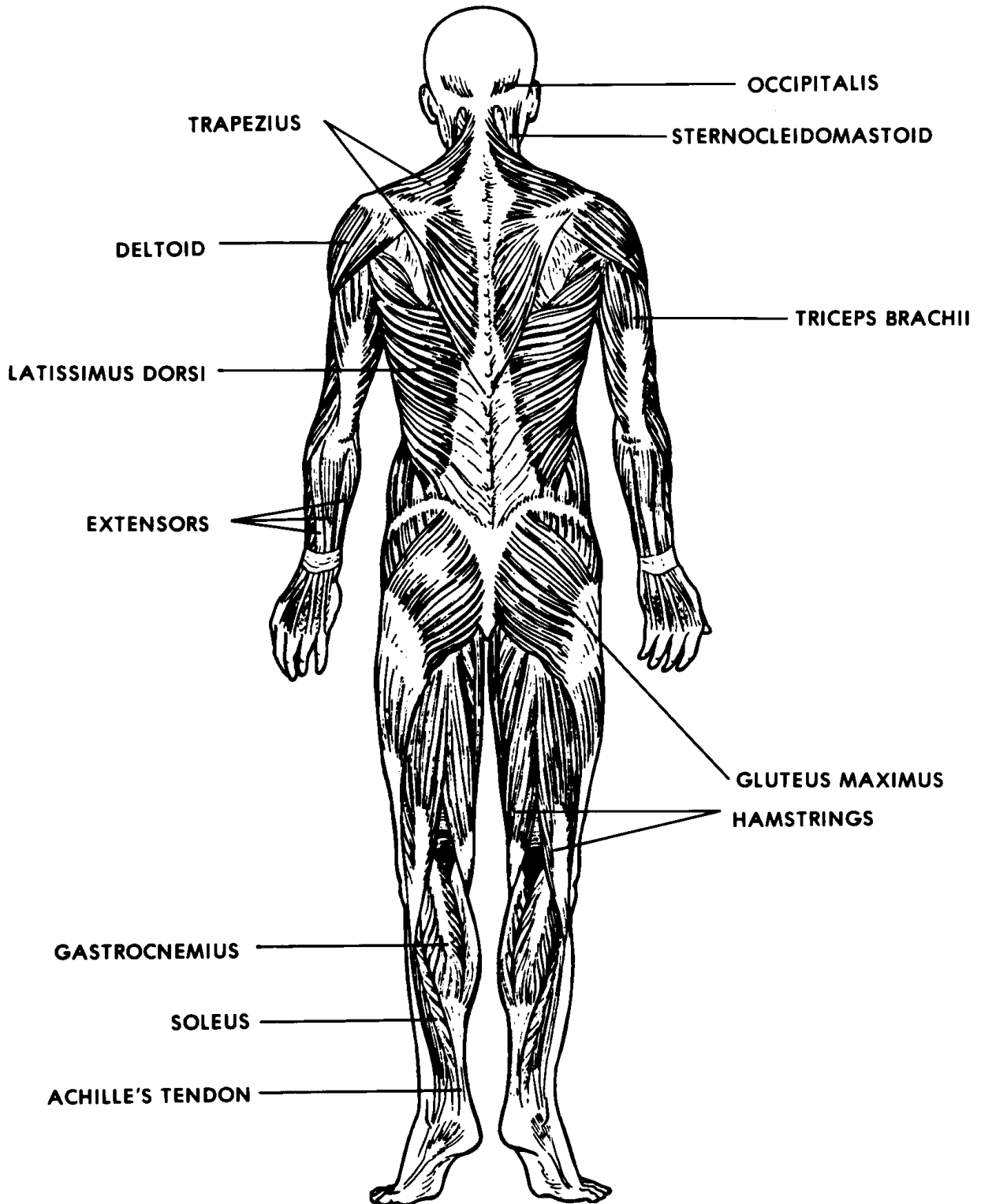


Figure 5-2. Skeletal and facial muscles, posterior view.

a. **Trunk Musculature.** The trunk musculature is arranged in two ways-- longitudinal muscles and oblique muscles. Together, they:

(1) Maintain trunk posture.

(2) Move the parts of the trunk.

(3) Adjust the internal pressures of the trunk to perform certain functions such as breathing.

b. **Limb Musculature.** The limb musculature is arranged around the joints to produce the appropriate motions of the limbs. Elementary mechanics are described in the next section to help you to understand typical arrangements of limb musculature.

SOME ELEMENTARY SKELETO-MUSCULAR MECHANICS

GENERAL

Muscles and bones together work like machines within the laws of physics and chemistry. Lever and pulley systems are examples of simple machines found commonly in the human body.

LEVER SYSTEMS

See figure 5-3 for an illustration of the three classes of levers.

a. **First Class.** In a first class lever, the weight to be moved is at one end of the lever, the applied force is at the other end, and the fulcrum (the pivot or turning point) is between the two.

b. **Second Class.** In a second class lever, the weight to be moved is between the applied force and the fulcrum. This type of lever enables a weight to be moved with less force than would be required without a lever. (Many feel that there are no second class levers in the human body.)

c. **Third Class.** In a third class lever, the weight to be moved is at one end of the lever, the fulcrum is at the other end, and the applied force is between the weight and the fulcrum. This type of lever provides speed, but a greater amount of force is required for a given weight. This is the most common type of lever in the human body.

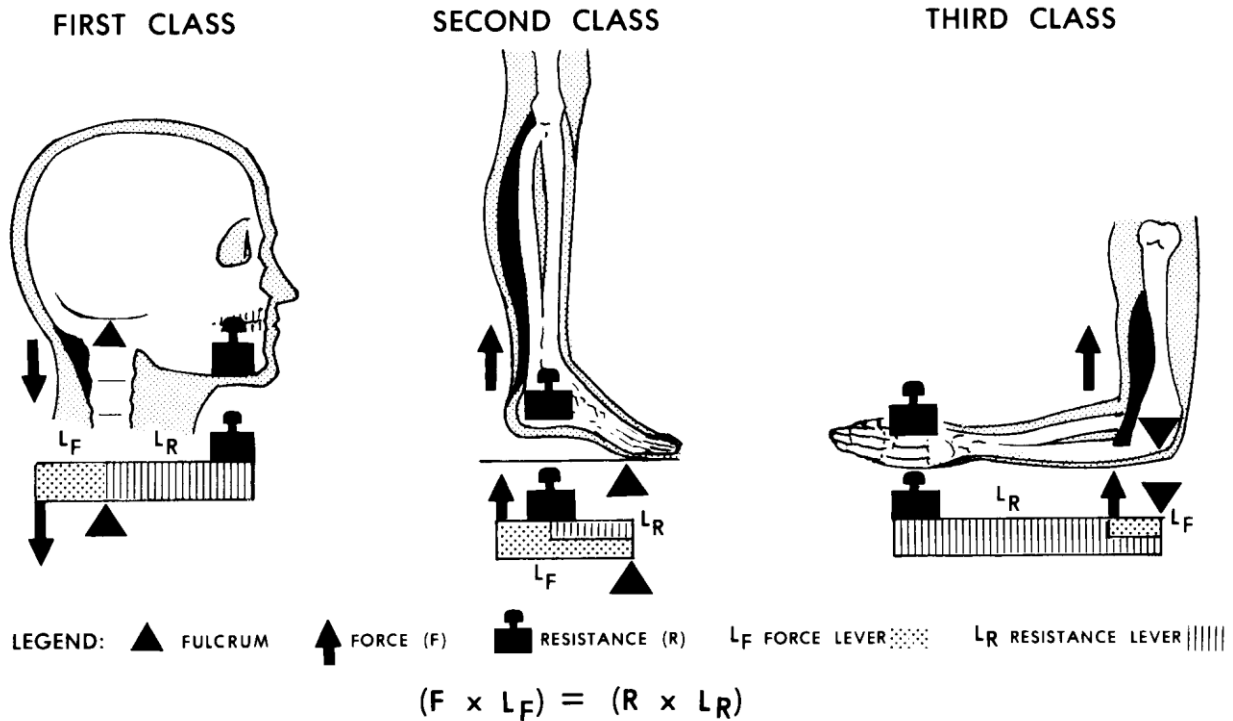


Figure 5-3. Types of lever systems.

SIMPLE PULLEY SYSTEM

a. In the human body when the tendon of a skeletal muscle slides over a round bony surface, the "system" acts like a simple pulley (figure 5-4). A simple pulley provides a change in the direction of the force or muscle pull. There is no change in the amount of force produced by the muscle. For example, the knee acts as a simple pulley by which the quadriceps femoris M. extends the leg.

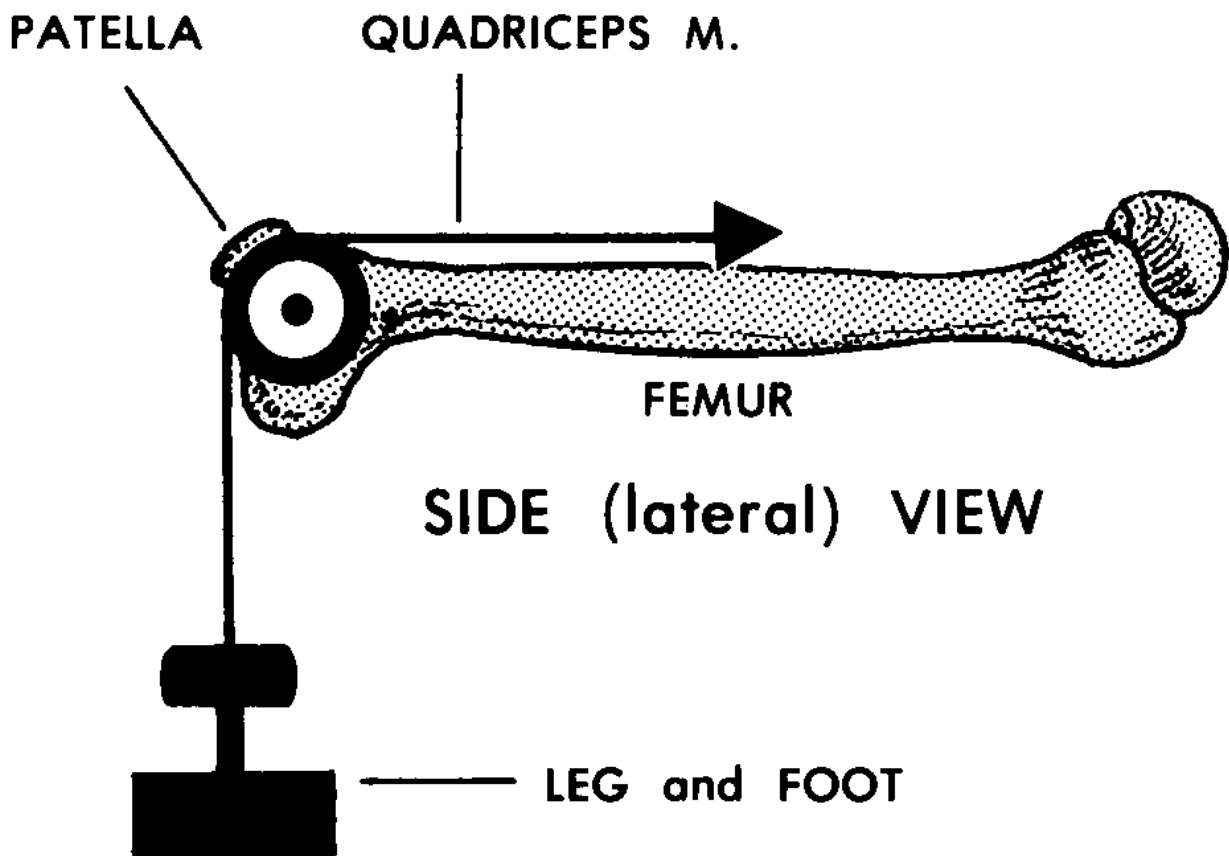


Figure 5-4. A simple pulley (the human knee mechanism).

b. Sesamoid bones, such as the patella (kneecap), develop in tendons where pressure is applied to the tendon.

THE SKELETO-MUSCULAR UNIT

The skeleto-muscular unit (figure 5-5) is a working concept of muscle and skeleton producing motion. The components of an S-M unit are bones, a joint, and skeletal muscle(s).

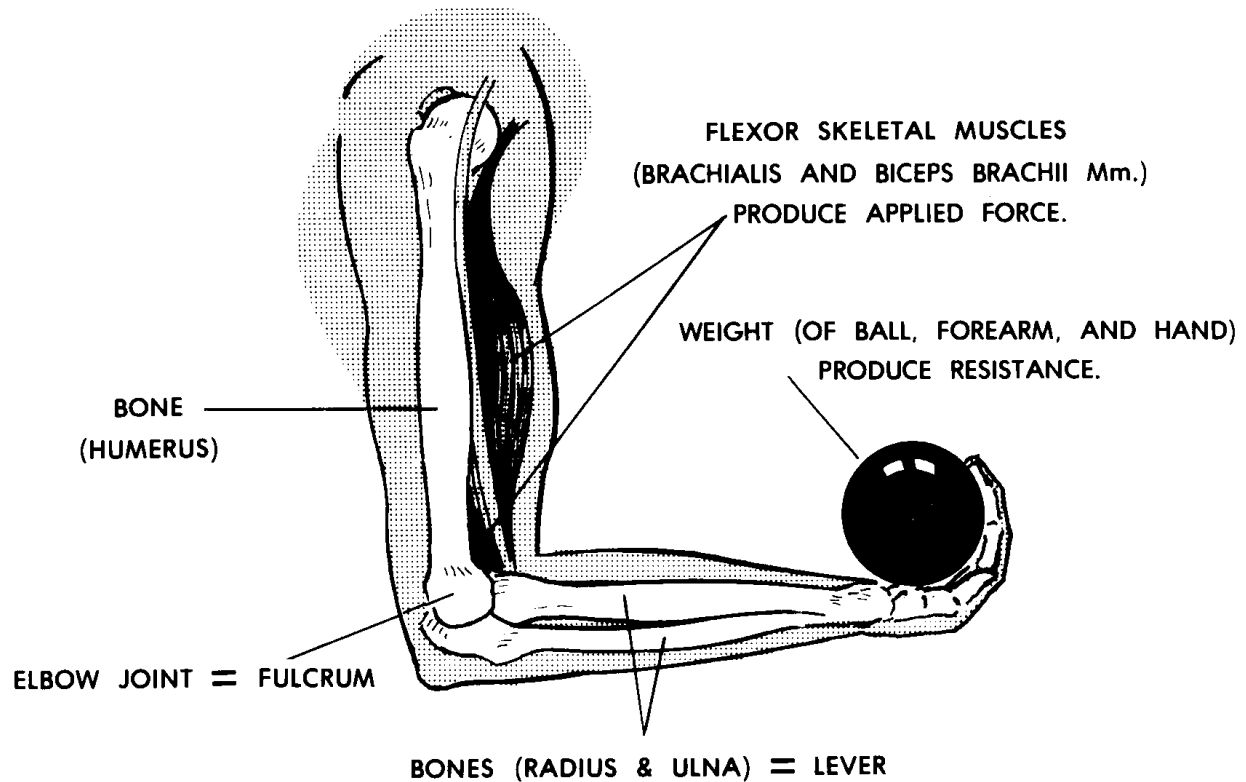


Figure 5-5. The skeleto-muscular unit (arm-forearm flexion) (3rd class lever system)).

- Bones.** Bones act as levers and as attachment sites for skeletal muscles.
- Joint (Articulation).** The joint is the center, fulcrum, point, or axis of motion.

c. **Skeletal Muscle(s)**. Skeletal muscles apply the forces for motion. Any given motion utilizes a group of muscles working together. A skeletal muscle may serve only one of the three following major roles during a particular motion:

(1) Prime mover. The muscle which makes the main effort for a given motion is called the prime mover, or agonist.

(2) Synergist. A synergist is a muscle which assists the prime mover.

SYN = together

ERG = unit of effort

(3) Antagonist. An antagonist applies a force opposite to that of the prime mover.

(a) By opposing the prime mover, the antagonist helps control the motion.

(b) The antagonist also brings the limb or other part back to its original position.

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