

EDUCATIONAL AND METHODOLOGICAL COMPLEX OF DISCIPLINE
OMiF1214 Morphology and physiology of human body
Course – 1 Semester – 2
Number of credits – 8
Almaty 2021

Lecture №1
The muscular system 1

The Functions of Muscles, Muscle Attachments.
Functional Groups of Muscles, Innervation and Blood Supply,
Muscle Names and Learning Strategy.
Behavior of whole Muscle

Outcomes:

1. Describe the various functions and characteristics of muscular tissue
2. Describe the connective tissue components of a muscle and their relationship to the internal organization of a muscle and compartmentalization of muscle groups
3. Name the types of muscle bone attachments and explain the shortcoming of calling their attachments origins and insertions;
4. Distinguish between intrinsic and extrinsic muscles;
5. Distinguish between spinal and cranial nerves

Muscles constitute nearly half of the body's weight and occupy a place of central interest in several fields of health care and fitness. Physical and occupational therapists must be well acquainted with the muscular system to plan and carry out rehabilitation programs. Athletes and trainers, dancers and acrobats, and amateur fitness enthusiasts follow programs of resistance training to strengthen individual muscle groups through movement regimens based on knowledge of muscle, bone, and joint anatomy. Nurses employ their knowledge of the muscular system to give intramuscular injections correctly and to safely and effectively move patients who are physically incapacitated.

The Functions of Muscles

Collectively, the three types of muscle serve the following functions:

- **Movement.** Muscles enable us to move from place to place and to move individual body parts; they move body contents in the course of breathing, blood circulation, feeding and digestion, defecation, urination, and childbirth; and they serve various roles in communication—speech, writing, facial expressions, and other body language.
- **Stability.** Muscles maintain posture by preventing unwanted movements. Some are called antigravity muscles because, at least part of the time, they resist the pull of gravity and prevent us from falling or slumping over. Many muscles also stabilize the joints by maintaining tension on tendons and bones.
- **Control of body openings and passages.** Muscles encircling the mouth serve not only for speech but also for food intake and retention of food while chewing. In the eyelid and pupil, they regulate the admission of light to the eye. Internal muscular rings control the movement of food, bile, blood, and other materials within the body. Muscles encircling the urethra and anus control the elimination of waste. (Some of these muscles are called sphincters, but not all; this is clarified later.)

- Heat production. The skeletal muscles produce as much as 85% of one's body heat, which is vital to the functioning of enzymes and therefore to all metabolism.
- Glycemic control. This means the regulation of blood glucose concentration within its normal range. The skeletal muscles absorb, store, and use a large share of one's glucose and play a highly significant role in stabilizing its blood concentration. In old age, in obesity, and when muscles become deconditioned and weakened, people suffer an increased risk of type 2 diabetes mellitus because of the decline in this glucose-buffering function.

Muscle Connective Tissues, Fascicles, and Compartments

Skeletal muscles vary considerably in size, shape, and arrangement of fibers. They range from extremely tiny strands such as the stapedium muscle of the middle ear to large masses such as the muscles of the thigh. Some skeletal muscles are broad in shape and some narrow. In some muscles the fibers are parallel to the long axis of the muscle; in some they converge to a narrow attachment; and in some they are oblique.

Each skeletal muscle fiber is a single cylindrical muscle cell. An individual skeletal muscle may be made up of hundreds, or even thousands, of muscle fibers bundled together and wrapped in a connective tissue covering. Each muscle is surrounded by a connective tissue sheath called the epimysium. Fascia, connective tissue outside the epimysium, surrounds and separates the muscles. Portions of the epimysium project inward to divide the muscle into compartments. Each compartment contains a bundle of muscle fibers. Each bundle of muscle fiber is called a fasciculus and is surrounded by a layer of connective tissue called the perimysium. Within the fasciculus, each individual muscle cell, called a muscle fiber, is surrounded by connective tissue called the endomysium.

Skeletal muscle cells (fibers), like other body cells, are soft and fragile. The connective tissue covering furnish support and protection for the delicate cells and allow them to withstand the forces of contraction. The coverings also provide pathways for the passage of blood vessels and nerves.

Commonly, the epimysium, perimysium, and endomysium extend beyond the fleshy part of the muscle, the belly or gaster, to form a thick ropelike tendon or a broad, flat sheet-like aponeurosis. The tendon and aponeurosis form indirect attachments from muscles to the periosteum of bones or to the connective tissue of other muscles. Typically a muscle spans a joint and is attached to bones by tendons at both ends. One of the bones remains relatively fixed or stable while the other end moves as a result of muscle contraction.

Skeletal muscles have an abundant supply of blood vessels and nerves. This is directly related to the primary function of skeletal muscle, contraction. Before a skeletal muscle fiber can contract, it has to receive an impulse from a nerve cell. Generally, an artery and at least one vein accompany each nerve that penetrates the epimysium of a skeletal muscle. Branches of the nerve and blood vessels follow the connective tissue components of the muscle of a nerve cell and with one or more minute blood vessels called capillaries.

Questions for control

1. List some functions of the muscular system other than movement of the body.
2. Describe the relationship of endomysium, perimysium, and epimysium to each other. Which of these separates one fascicle from another? Which separates one muscle from another?
3. Distinguish between direct and indirect muscle attachments to bones.
4. Define belly, action, and innervation.

5. Describe the five basic muscle shapes (fascicle arrangements).
6. Distinguish between a synergist, antagonist, and fixator. Explain how each of these may affect the action of a prime mover.

Basic literature:

1. Saladin, Kenneth S: Anatomy & Physiology. The Unity of Form and Function (2016, McGraw-Hill Education) на англ. яз.
2. Costanzo, Linda S.: BRS Physiology. Board Review Series. 7 edition. - Wolters Kluwer Health, 2018. - 307p. - ISBN 1496367693, 9781496367693
3. Leslie P. Gartner: Color Atlas and Text of Histology. - 7th Edition. - Wolters Kluwer, 2017. ISBN 1496346734, 9781496346735
4. Russell K. Hobbie, Bradley J. Roth: Intermediate Physics for Medicine and Biology. - Springer, 2015. - ISBN 3319126822, 9783319126821
5. Andersson D, Medical Terminology: The Best and Most Effective Way to Memorize, Pronounce and Understand Medical Terms: Second Edition, ISBN-13 : 978-1519066626, 2016