INTRODUCTION TO MYOLOGY

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The muscular system consists of all the muscles of the body. The discipline related to the study of muscles is myology. Musculus (muscle) is derived from the word mus-mouse; musculus- little mouse. All skeletal muscles are composed of one specific type of muscle tissue. These muscles move the skeleton, therefore, move the body parts.

1. TYPES OF MUSCLES

Three types of muscle are described based on distinct characteristics relating to:
- Whether it is normally willfully controlled (voluntary vs. involuntary).
- Whether it appears striped or unstriped when viewed under a microscope (striated vs. smooth or unstriated).
- Whether it is located in the body wall (soma) and limbs or makes up the hollow organs (viscera) of the body cavities or blood vessels (somatic vs. visceral).

There are three muscle types:
- **Skeletal striated muscle** is voluntary somatic muscle that makes up the gross skeletal muscles that compose the muscular system, moving or stabilizing bones and other structures (e.g., the eyeballs). Striated muscles are innervated by the somatic nervous system.
- **Cardiac striated muscle** is involuntary visceral muscle that forms most of the walls of the heart and adjacent parts of the great vessels, such as the aorta, and pumps blood.
- **Smooth muscle (unstriated muscle)** is involuntary visceral muscle that forms part of the walls of most vessels and hollow organs (viscera), moving substances through them by coordinated sequential contractions (pulsations or peristaltic contractions). Non-striated and cardiac muscle are innervated by the autonomic nervous system.

2. SKELETAL MUSCLES

2.1. Features of skeletal muscles

All skeletal muscles commonly referred to simply as “muscles,” have fleshy, reddish, contractile portions (one or more heads or bellies) composed of skeletal striated muscle. Some muscles are fleshy throughout, but most also have white non-contractile portions (tendons), composed mainly of organized collagen bundles, that provide a means of attachment. When referring to the length of a muscle, both the belly and the tendons are included. In other words, a muscle's length is the distance between its attachments.

Most skeletal muscles are attached directly or indirectly to bones, cartilages, ligaments, or fascias or to some combination of these structures. Some muscles are attached to organs (the eyeball, for example), skin (such as facial muscles), and mucous membranes (intrinsic tongue muscles). Muscles are organs of locomotion (movement), but they also provide static support, give form to the body, and provide heat.

The architecture and shape of muscles vary. The tendons of some muscles form flat sheets, or aponeuroses, that anchor the muscle to the skeleton (usually a ridge or a series of spinous processes) and/or to deep fascia (such as the latissimus dorsi muscle of the back), or to the aponeurosis of another muscle (such as the oblique muscles of the anterolateral abdominal wall).

2.2. Muscle terminology

Many terms provide information about a structure's shape, size, location, or function or about the resemblance of one structure to another.
- Most muscles are named on the basis of their function or the bones to which they are attached. The abductor digiti minimi muscle, for example, abducts the little finger. The sternocleidomastoid muscle (G. kleidos, bolt or bar, clavicle) attaches inferiorly to the sternum and clavicle and superiorly to the mastoid process of the temporal bone of the cranium. Another example is the levator scapulae which elevates the scapula (L. shoulder blade).
Some muscles have **descriptive names to indicate their main characteristics**. The deltoid muscle, which covers the point of the shoulder, is triangular, like the symbol for delta, the fourth letter of the Greek alphabet. The suffix -oid means “like”; therefore, deltoid means like delta.

- Other muscles are named on the basis of their **position** (medial, lateral, anterior, posterior) or **length** (brevis, short; longus, long).
- Some muscles are named according to their **shape**—the piriformis muscle, for example, is pear shaped (L. pirum, pear + L. forma, shape or form).
- Other muscles are named according to their **location**. The temporal muscle is in the temporal region (temples) of the cranium (skull).

Muscles may be described or classified according to their shape, for which a muscle may also be named:

- **Flat muscles** have parallel fibers often with an aponeurosis—for example, the external oblique (broad flat muscle). The sartorius is a narrow flat muscle with parallel fibers.
- **Pennate muscles** are feather-like (L. pennatus, feather) in the arrangement of their fascicles, and may be unipennate, bipennate, or multi-pennate—for example, the extensor digitorum longus (unipennate), the rectus femoris (bipennate), and deltoid (multi-pennate).
- **Fusiform muscles** are spindle shaped with a round, thick belly (or bellies) and tapered ends—for example, biceps brachii.
- **Convergent muscles** arise from a broad area and converge to form a single tendon—for example, the pectoralis major.
- **Quadrate muscles** have four equal sides (L. quadratus, square)—for example, the rectus abdominis, between its tendinous intersections.
- **Circular or sphincteral muscles** surround a body opening or orifice, constricting it when contracted—for example, orbicularis oculi (closes the eyelids).
- **Multi-headed or multi-bellied muscles** have more than one head of attachment or more than one contractile belly, respectively. Biceps muscles have two heads of attachment (e.g., the biceps brachii), triceps muscles have three heads (e.g., triceps brachii), and the digastric and gastrocnemius muscles have two bellies.

### 3. CONTRACTION OF MUSCLES

Skeletal muscles function by contracting; they pull and never push. When a muscle contracts and shortens, one of its attachments usually remains fixed while the other (more mobile) attachment is pulled toward it, often resulting in movement. Attachments of muscles are commonly described as the origin and insertion; the origin is usually the proximal end of the muscle, which remains fixed during muscular contraction, and the insertion is usually the distal end of the muscle, which is movable. However, this is not always the case. Some muscles can act in both directions under different circumstances.

### 4. FUNCTIONS OF MUSCLES

Muscles serve specific functions in moving and positioning the body.

- **A prime mover (agonist)** is the main muscle responsible for producing a specific movement of the body. It contracts concentrically to produce the desired movement, doing most of the work (expending most of the energy) required. In most movements, there is a single prime mover, but some movements involve two prime movers working in equal measure.
- **A fixator** steadies the proximal parts of a limb through isometric contraction while movements are occurring in distal parts.
- **A synergist** complements the action of a prime mover. It may directly assist a prime mover, providing a weaker or less mechanically advantageous component of the same movement, or it may assist indirectly, by serving as a fixator of an intervening joint when a prime mover passes over more than one joint, for example. It is not unusual to have several synergists assisting a prime mover in a particular movement.
- **An antagonist** is a muscle that opposes the action of another muscle.

The same muscle may act as a prime mover, antagonist, synergist, or fixator under different conditions.
5. FASCIA

Fascias (L. fasciae) constitute the wrapping, packing, and insulating materials of the deep structures of the body. Underlying the subcutaneous tissue (superficial fascia) almost everywhere is the deep fascia. The deep fascia is a dense, organized connective tissue layer, devoid of fat, that covers most of the body parallel to (deep to) the skin and subcutaneous tissue. In the limbs, groups of muscles with similar functions sharing the same nerve supply are located in fascial compartments, separated by thick sheets of deep fascia, called intermuscular septa, that extend centrally from the surrounding fascial sleeve to attach to bones. These compartments may contain or direct the spread of an infection or a tumor.

6. NERVES AND ARTERIES OF MUSCLES

Variation in the nerve supply of muscles is rare; it is a nearly constant relationship. In the limb, muscles of similar actions are generally contained within a common fascial compartment and share innervation by the same nerves. Nerves supplying skeletal muscles (motor nerves) usually enter the fleshy portion of the muscle (vs. the tendon), almost always from the deep aspect (so the nerve is protected by the muscle it supplies). The blood supply of muscles is not as constant as the nerve supply and is usually multiple. Arteries generally supply the structures they contact.