

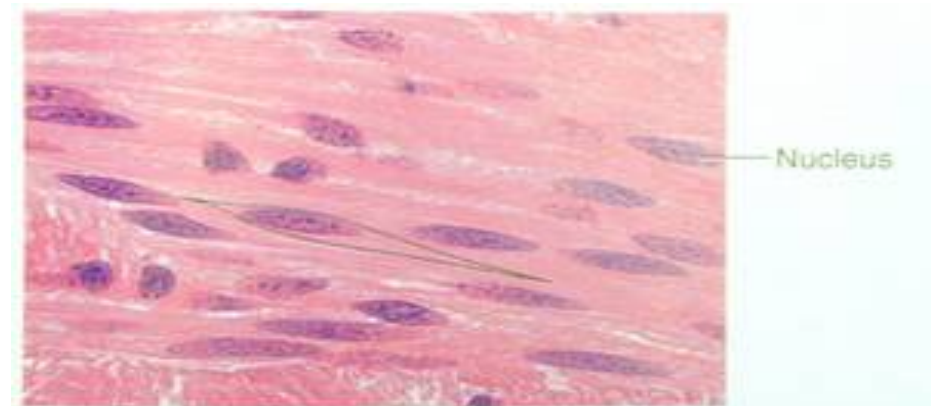
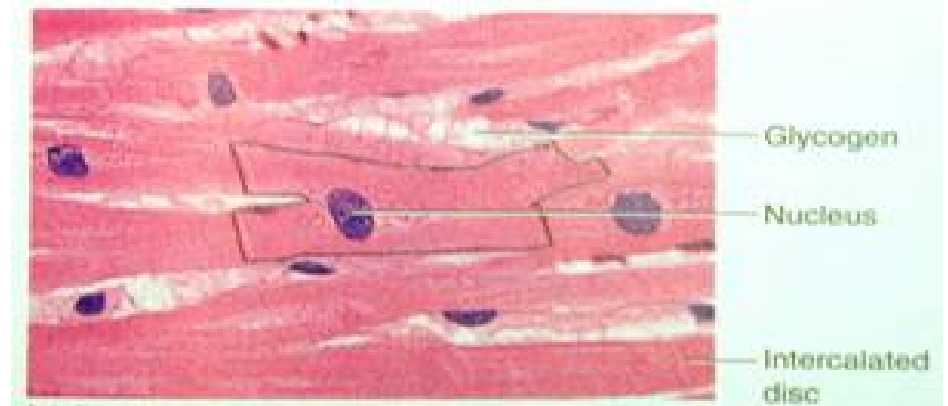
Introduction to the Muscular System

Types of Muscles and Functions

- **skeletal muscle:** striated muscle that is under voluntary control and usually attached to two bones
- **cardiac muscle:** also striated, but not under voluntary control (involuntary), found in the heart
- **smooth muscle:** lacks striations, is not under voluntary control (involuntary)

Muscle Histology

- skeletal muscle
- cardiac muscle
- smooth muscle



Functions of Muscle

- **movement:** locomotion, breathing, pumping blood, bowel movements
- **stability:** maintain posture, stabilization of joints
- **control of body openings and passages:** muscles around the mouth, changes in pupil size, muscular rings (sphincters) controlling passage of bowel contents
- **heat production:** skeletal muscle can be responsible for 85% of body heat

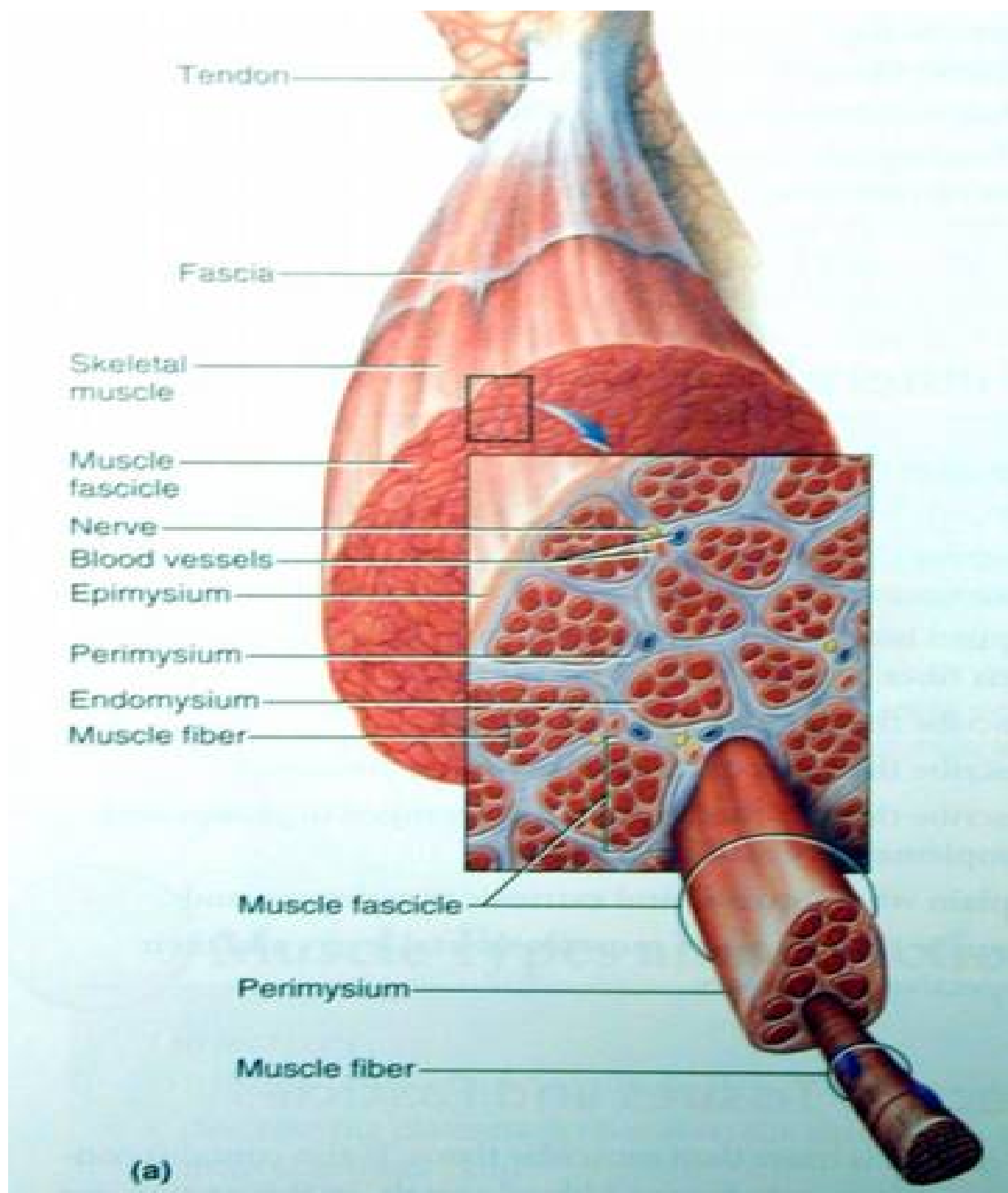
Properties of Muscle

- **excitability** (responsiveness)
- **conductivity** (responsive along length of cell)
- **contractility** (ability to shorten when excited)
- **extensibility** (ability to stretch without rupturing)
- **elasticity** (ability to recoil)

Macro Anatomy of Muscles

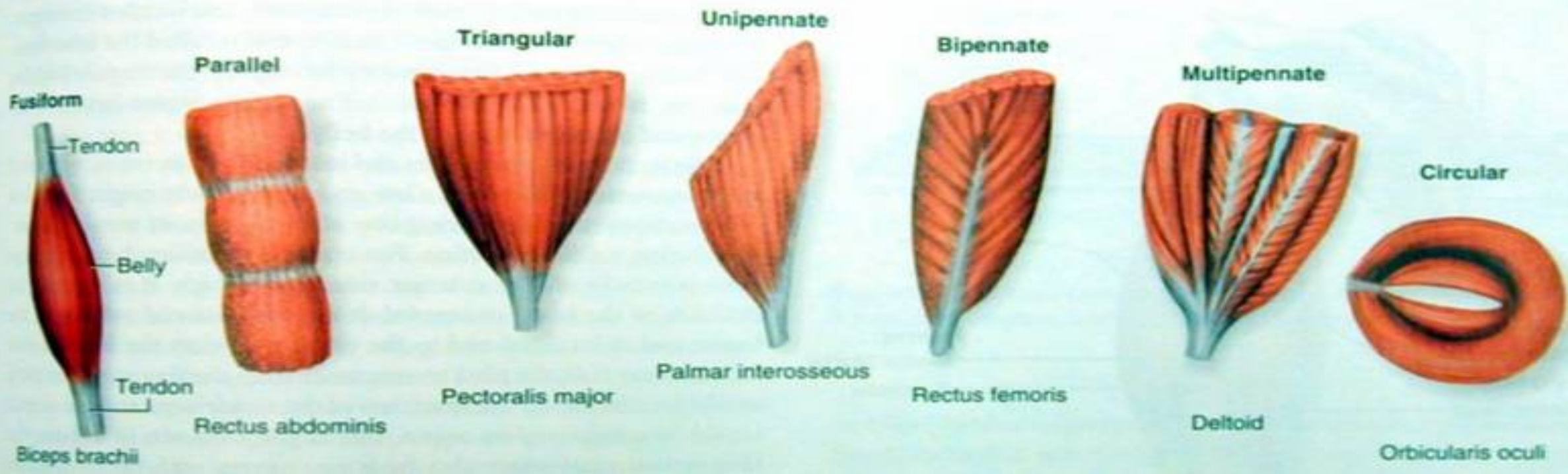
Connective Tissue and Fascicles

- **endomysium:** thin sleeve of loose connective tissue that surrounds each muscle fiber, makes room for blood vessels and nerves
- **perimysium:** thick connective tissue sheath that wraps muscle fibers into bundles called **fascicles** (“grain” of cut meat)
- **epimysium:** fibrous sheath that surrounds an entire muscle
- **fascia:** sheet of connective tissue that separates adjacent muscles or muscle groups



Muscle Shapes

- **fusiform** (thick in the middle)
- **parallel** (uniform width)
- **triangular** (fan shaped)
- **pennate** (feather shaped)
- **circular** (sphincters)

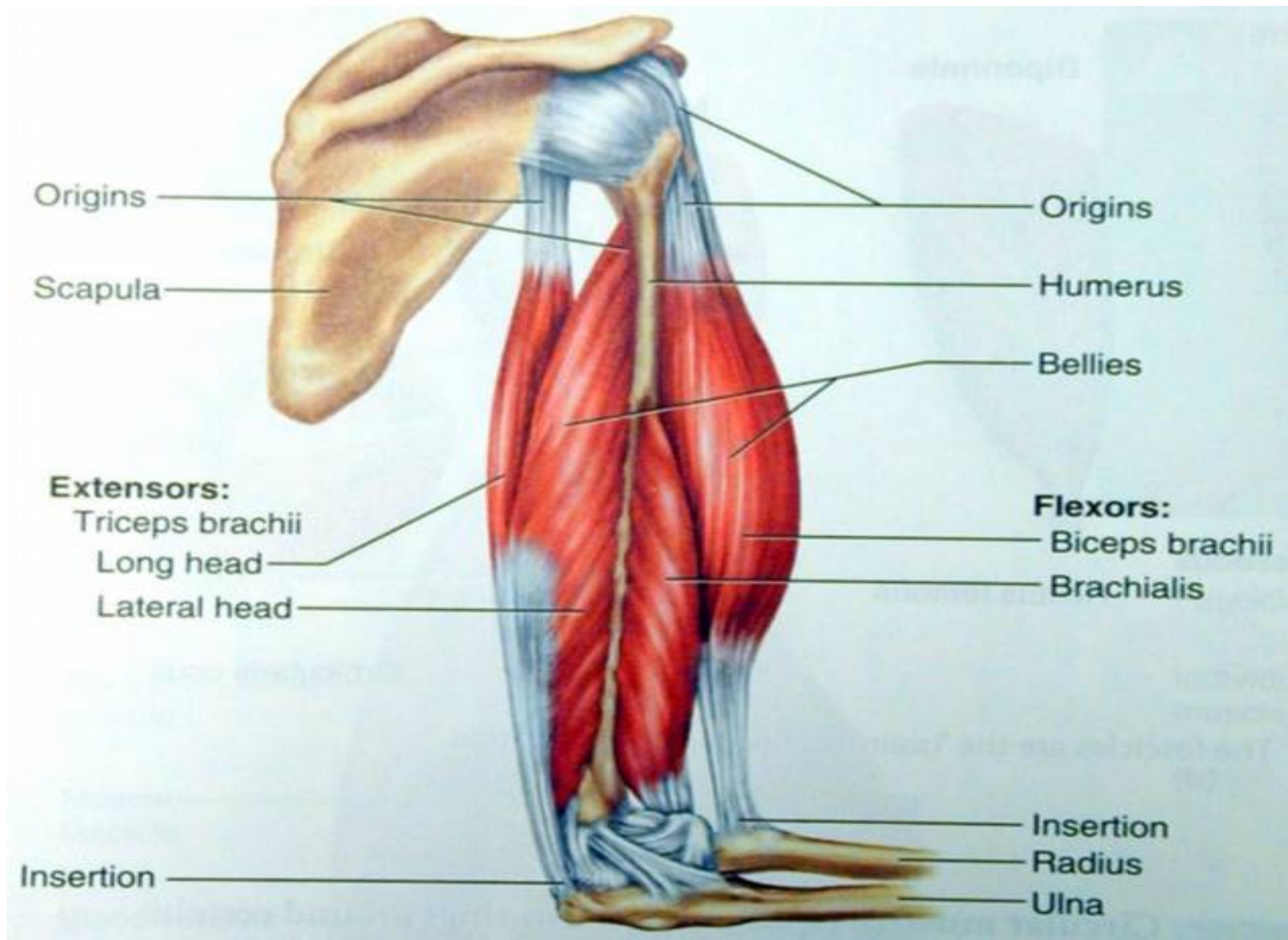


Muscle Attachments

- **indirect attachment:** muscle attached to bone by a conspicuous tendon
- **direct attachment:** little separation between muscle and bone (there is a tendon, but not visible to the naked eye)

Muscle Origins and Insertions

- **origin:** site of muscle attachment to bone that is relatively stationary
- **insertion:** site of muscle attachment to bone that is relatively mobile
- **belly:** middle region between the origin and insertion
- *note: muscle name, location, origin, insertion and type of action will be on exams; however, goal is for students to rationally determine likely answers and NOT to encourage memorization*



Muscle Functional Groups

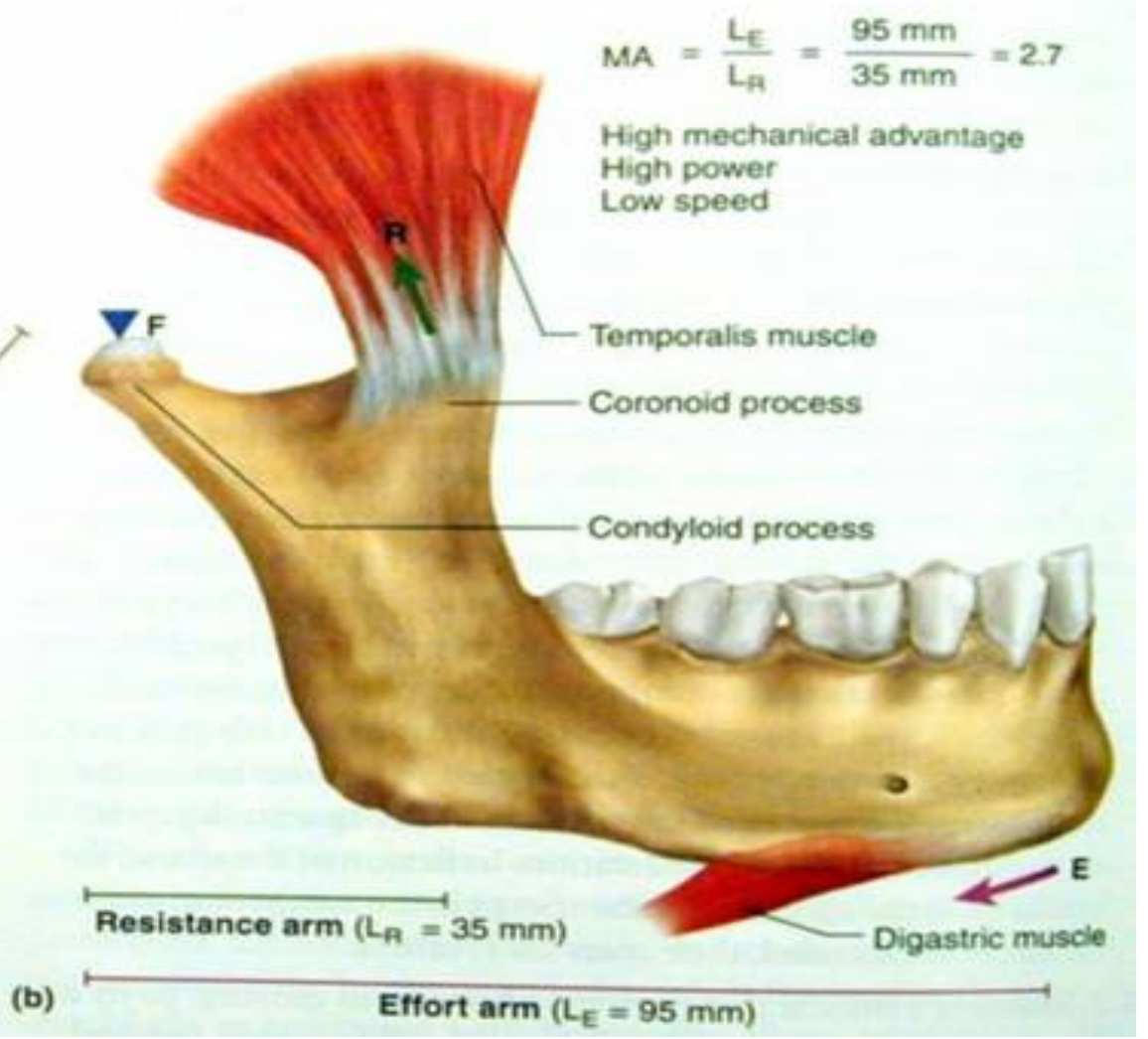
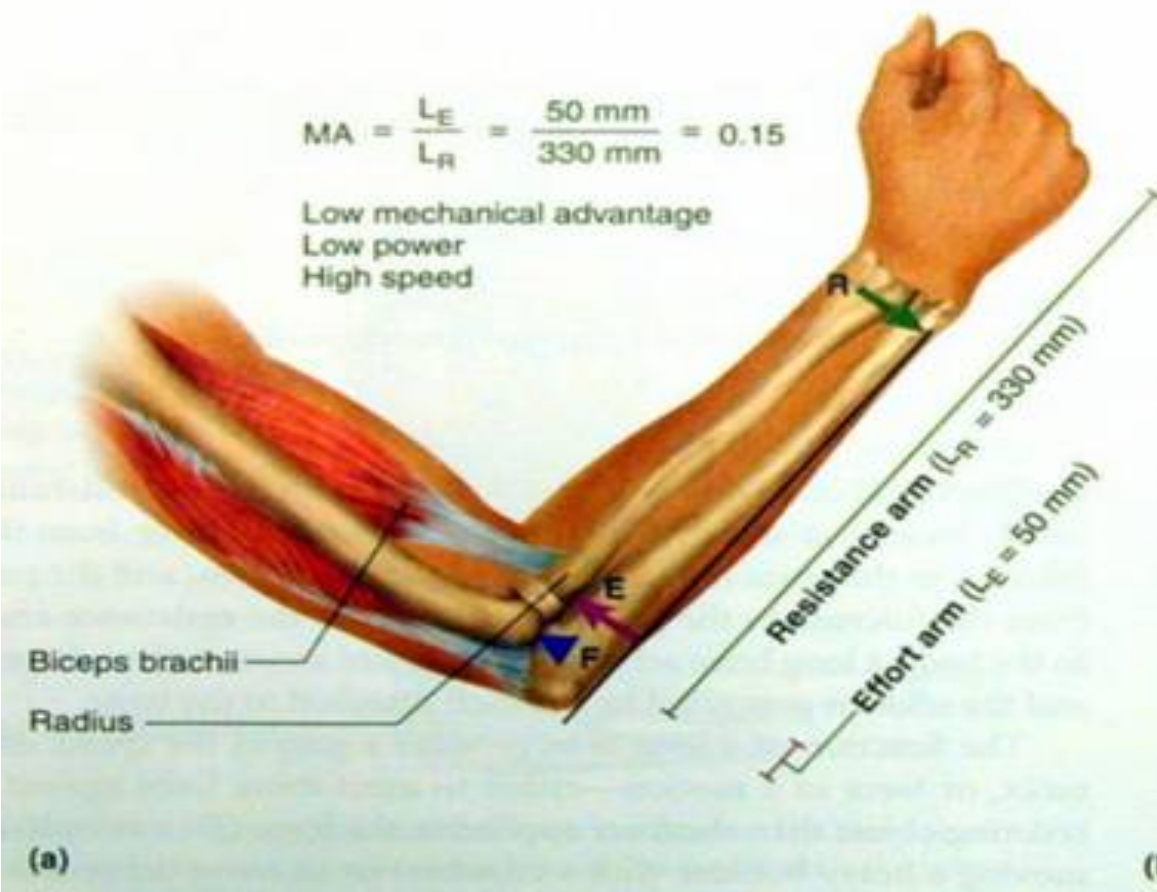
- **prime mover**
- **synergist**
- **antagonist (antagonistic pair)**
- **fixator**

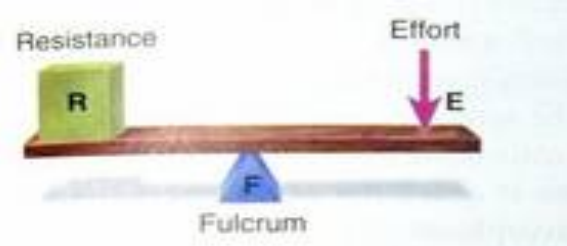
Intrinsic and Extrinsic Muscles

- **intrinsic muscles:** the insertion and origin are entirely contained within a specific region (biceps and triceps)
- **extrinsic muscles:** act on a specific region, but the origin is elsewhere (many movements of the fingers are controlled by muscles in the forearm connected by long tendons to the hand)

Muscle, Bone and Movement

- **muscle can only exert force in one direction by contracting**
- **muscles and bone form a lever** to produce movement
- the arrangement of the lever determines the force available
- maximum force sacrifices speed and range of movement
- speed and range of movement sacrifice strength

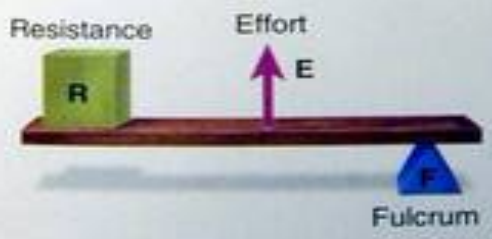




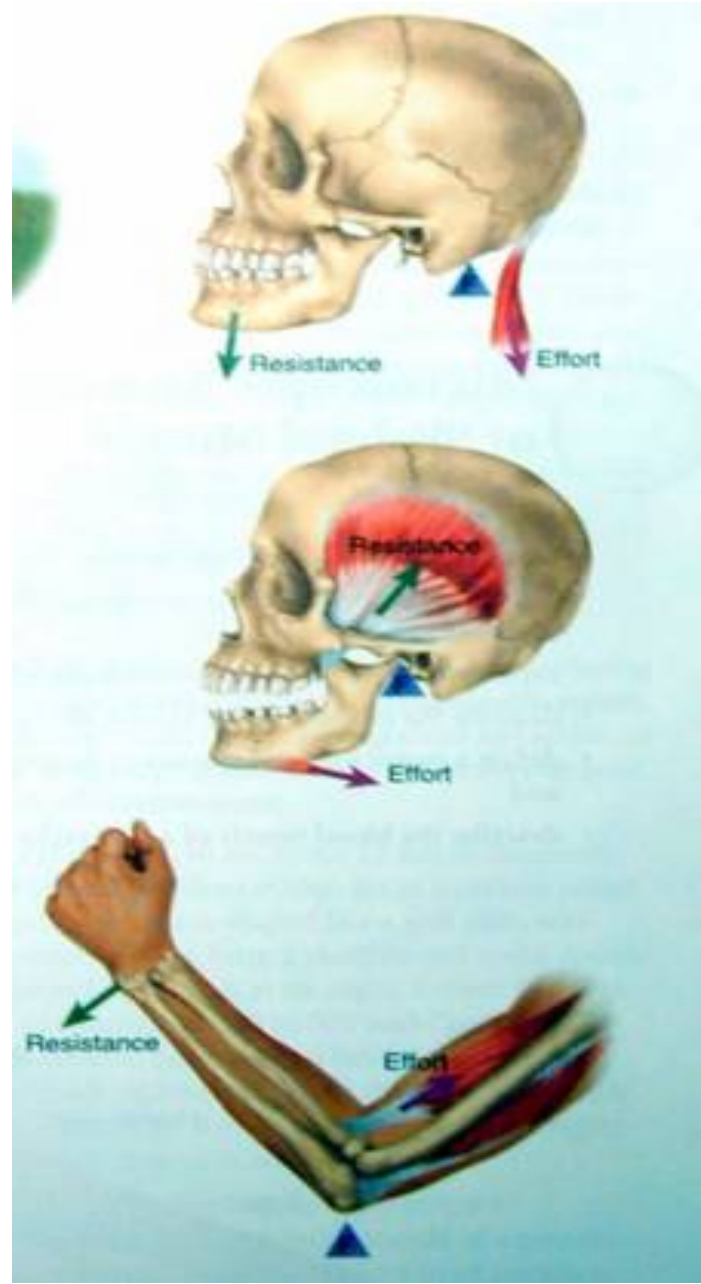
(a) First-class lever



(b) Second-class lever

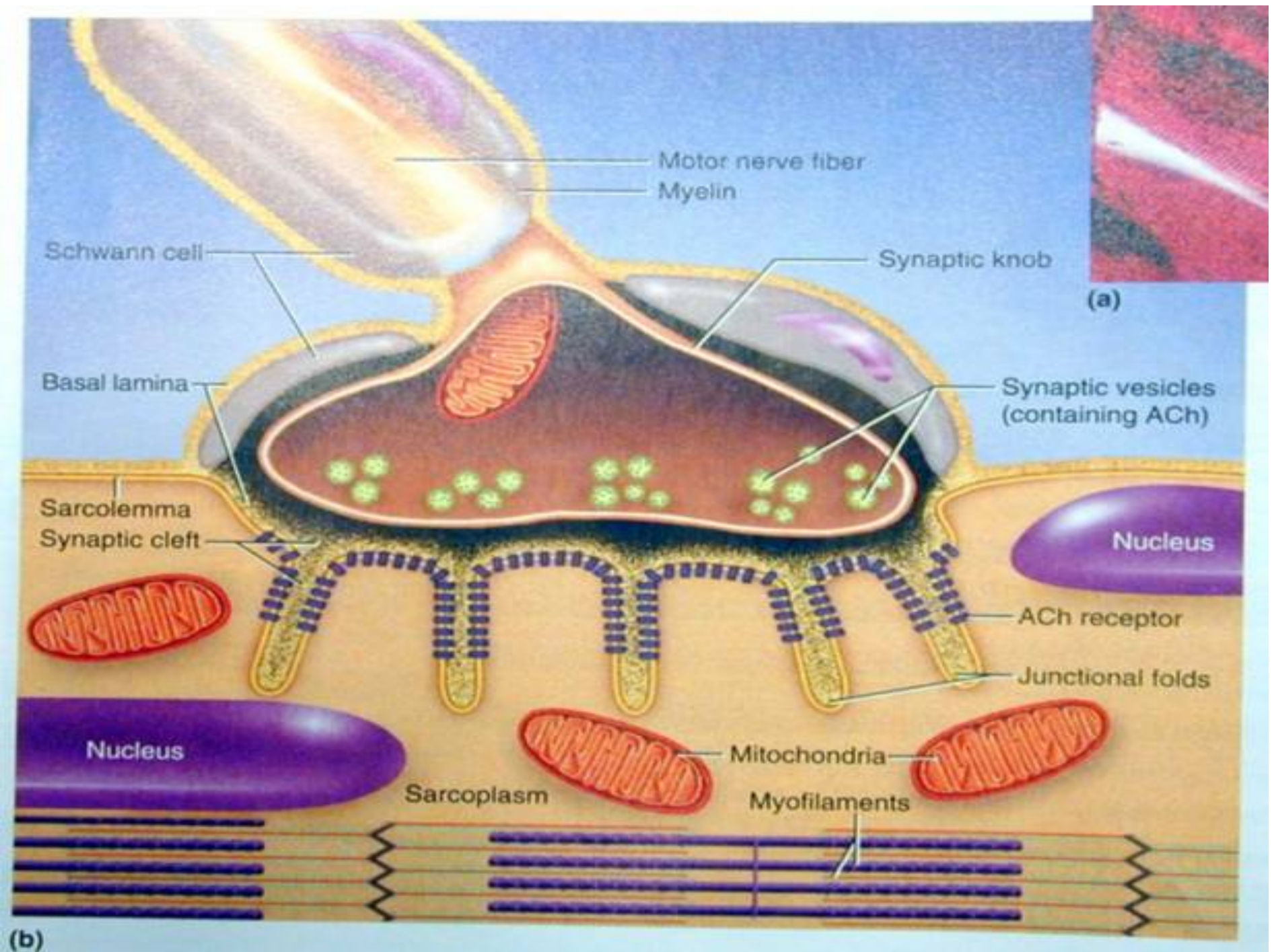


(c) Third-class lever



Nerve Muscle Relationship

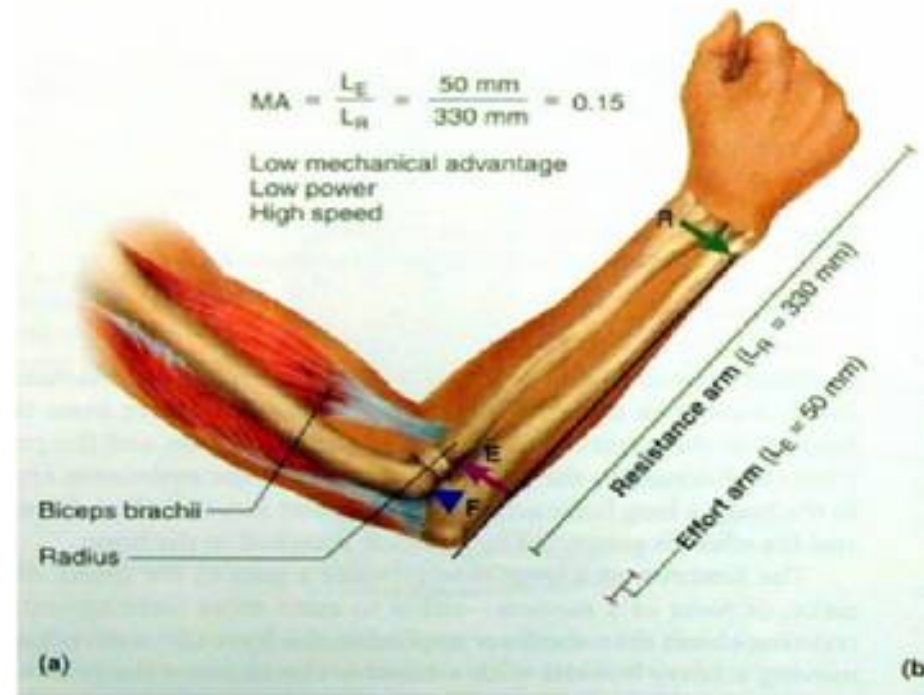
- skeletal muscle normally only contracts if stimulated by a nerve
- nerve impulses are transferred to the muscle fibers via the neuromuscular junction
- a chemical, acetylcholine (ACh), is released by the nerves to activate the contraction of the muscle
- an enzyme, acetylcholinesterase, destroys the ACh to remove the signal and relax the muscle



Brain

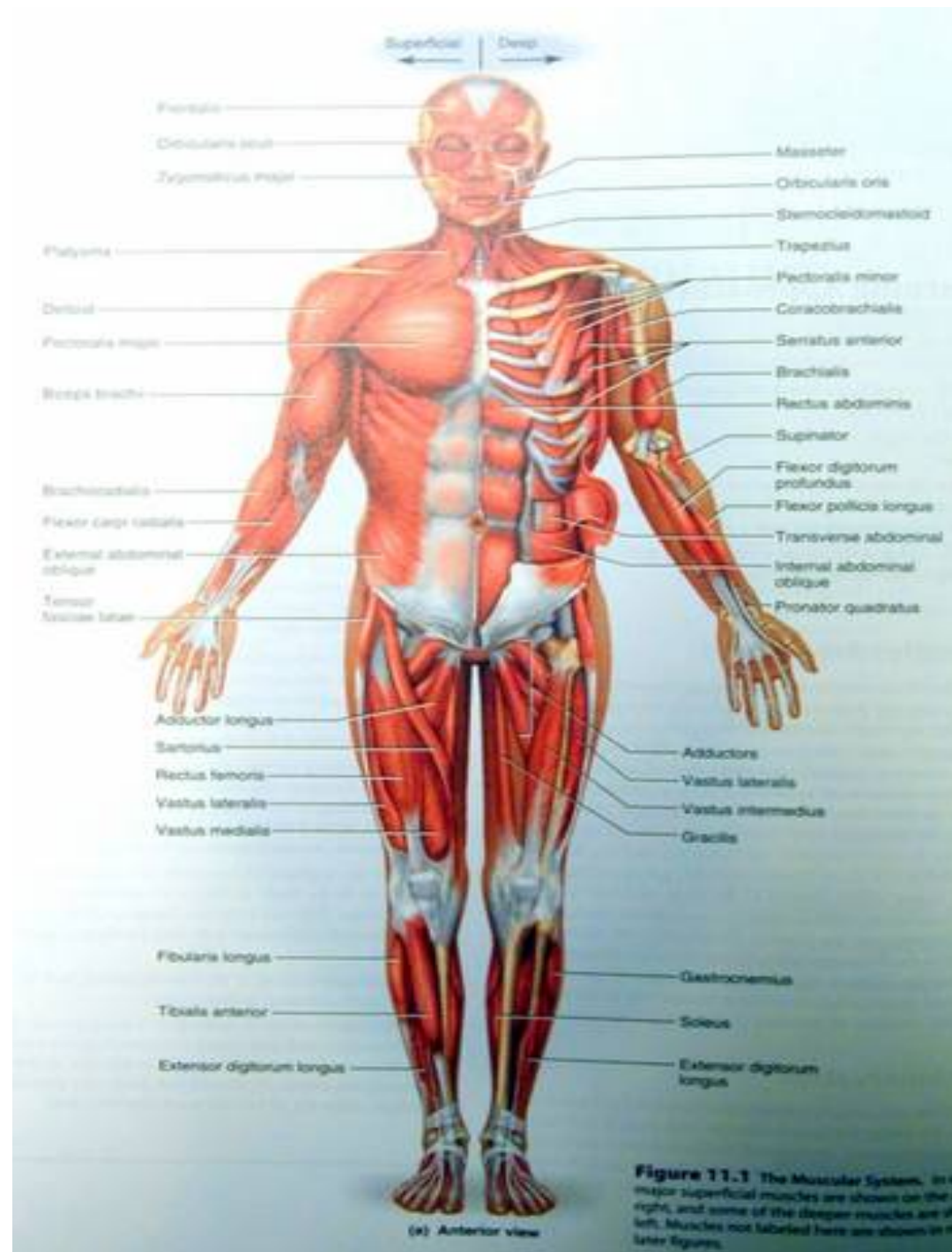
Spinal
Cord

Peripheral
Nerve



Remaining Lectures

- muscle names
- muscle locations
- muscle actions



- © Thomas Freeman
- Download [textbook] for free at <https://openstax.org/details/books/anatomy-and-physiology>
- Images from the following:
 - <https://openstax.org/details/books/anatomy-and-physiology>
 - Wikipedia.org
 - Saladin KS. 2010. Anatomy and Physiology: The Unity of Form and Function, 5th Edition. McGraw Hill Higher Education, Boston, MA. [used under fair use, be careful as these are copyrighted by publisher]

References

- Betts J, Desaix P, Johnson E, et al. 2017. Anatomy & Physiology. OpenStax, Houston, TX.
- Saladin KS. 2010. Anatomy and Physiology: The Unity of Form and Function, 5th Edition. McGraw Hill Higher Education, Boston, MA.
- Just about any reasonable Anatomy and Physiology textbook