FIGURE 10.1 Relationships of connective tissue to skeletal muscle showing the relative positions of the epimysium, perimysium, and endomysium.

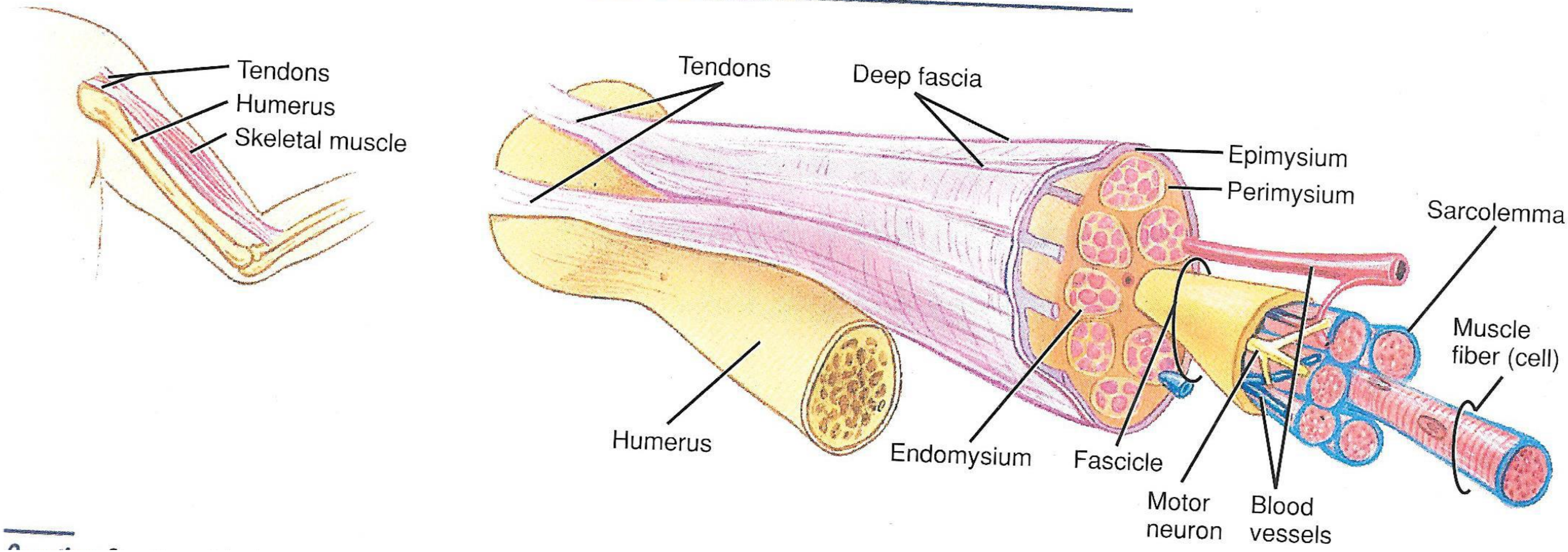


FIGURE 10.2 Motor unit. Shown are two motor neurons, one in red and one in green, each supplying the muscle fibers of its motor unit.

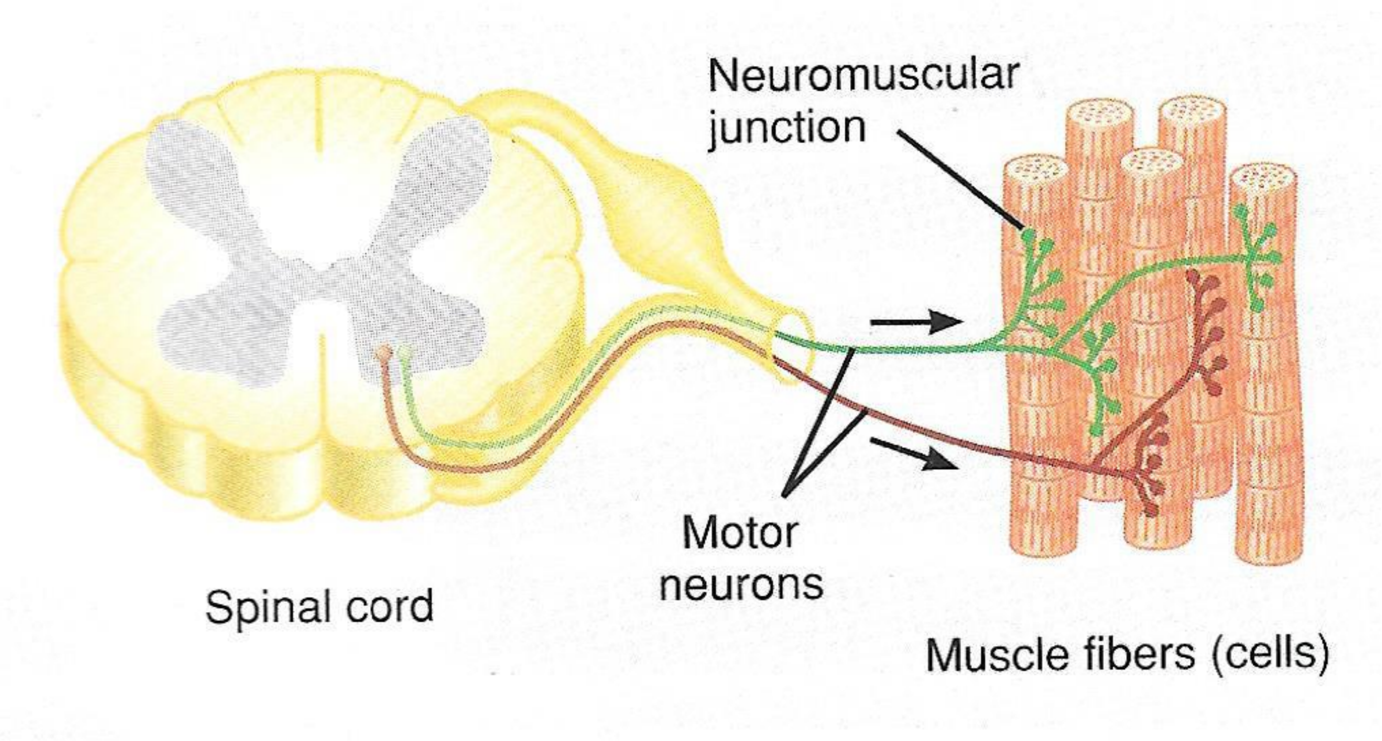
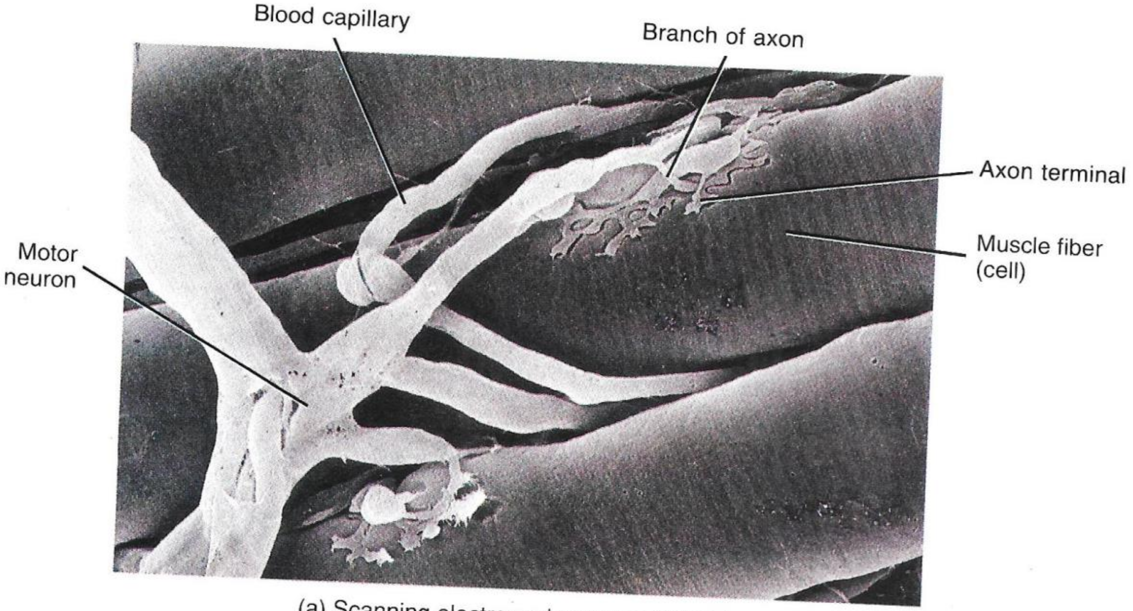
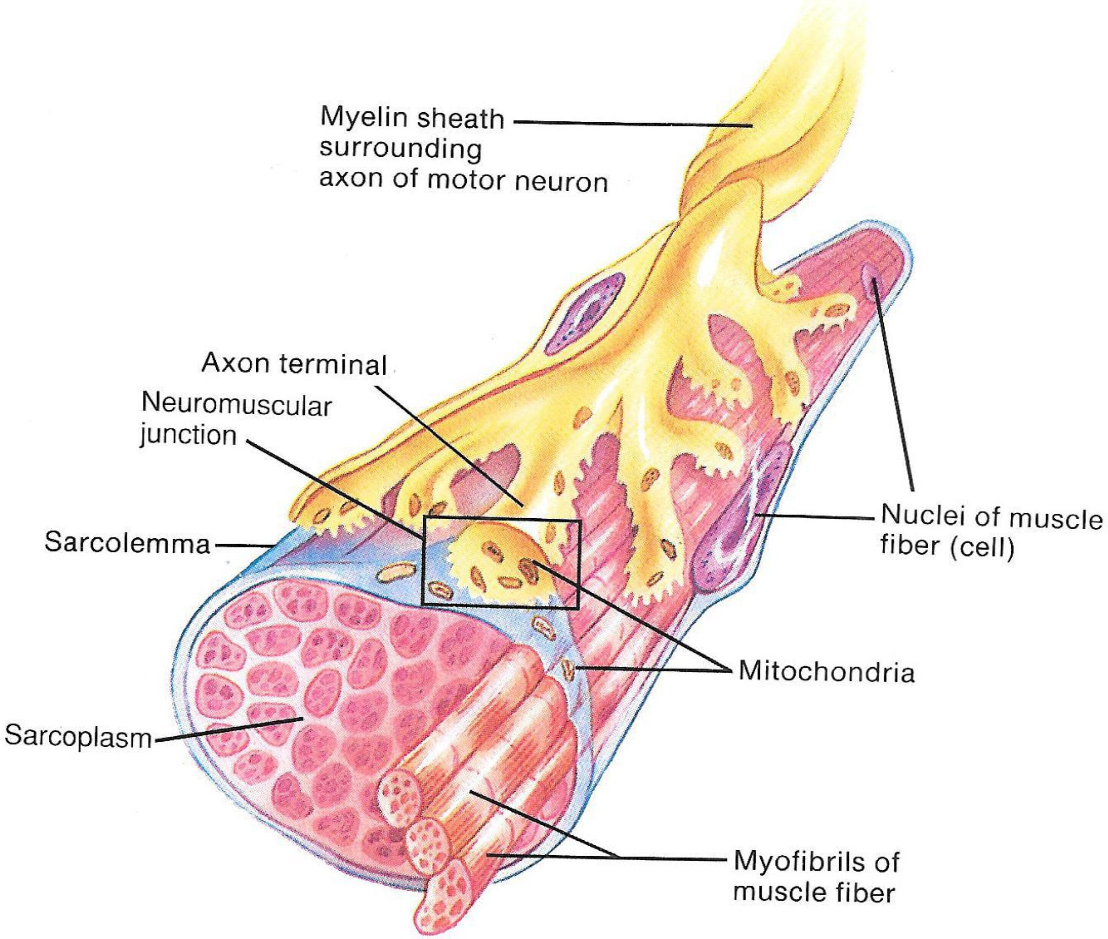


FIGURE 10.3 Neuromuscular junction (NMJ).

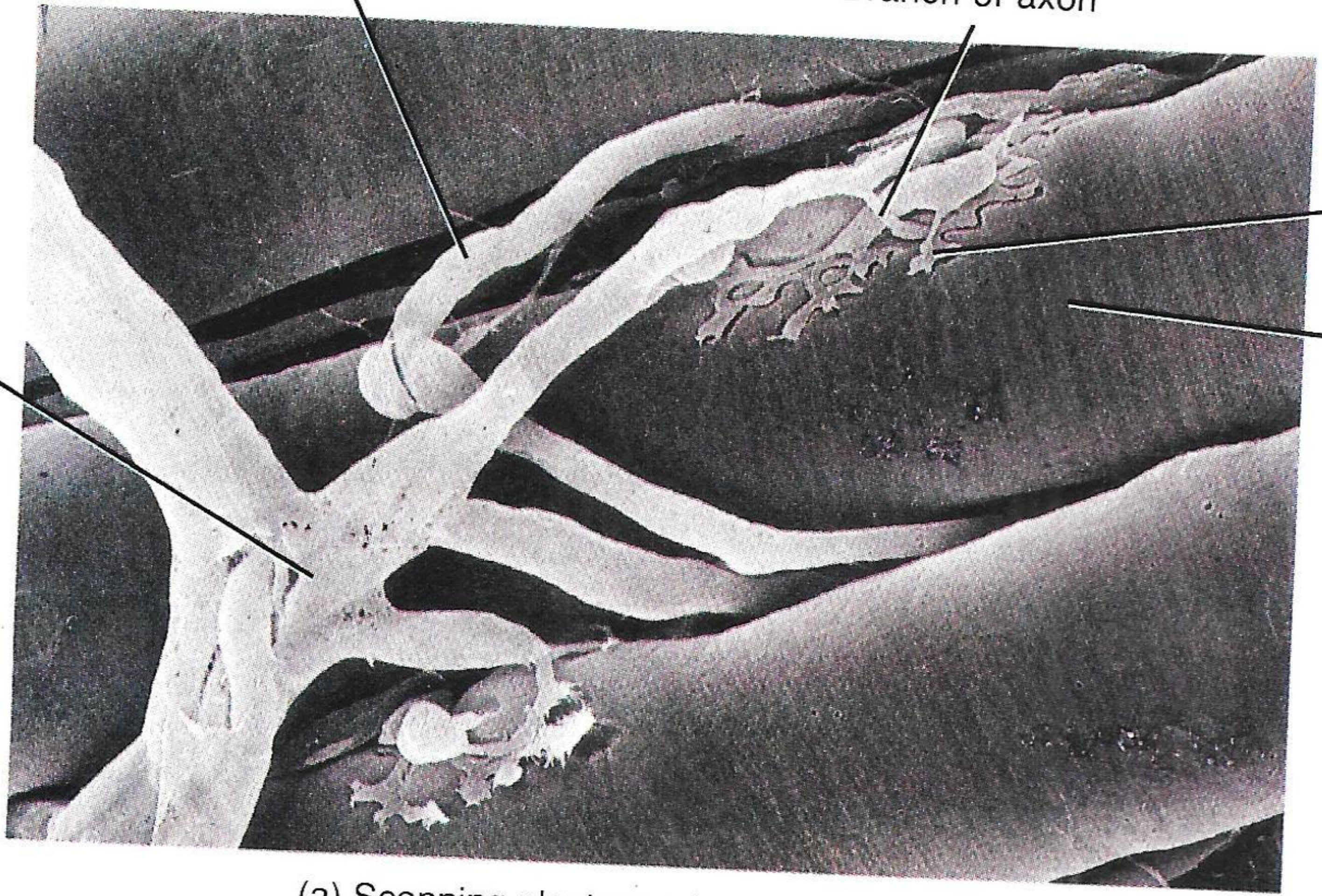


(a) Scanning electron micrograph (1650x)

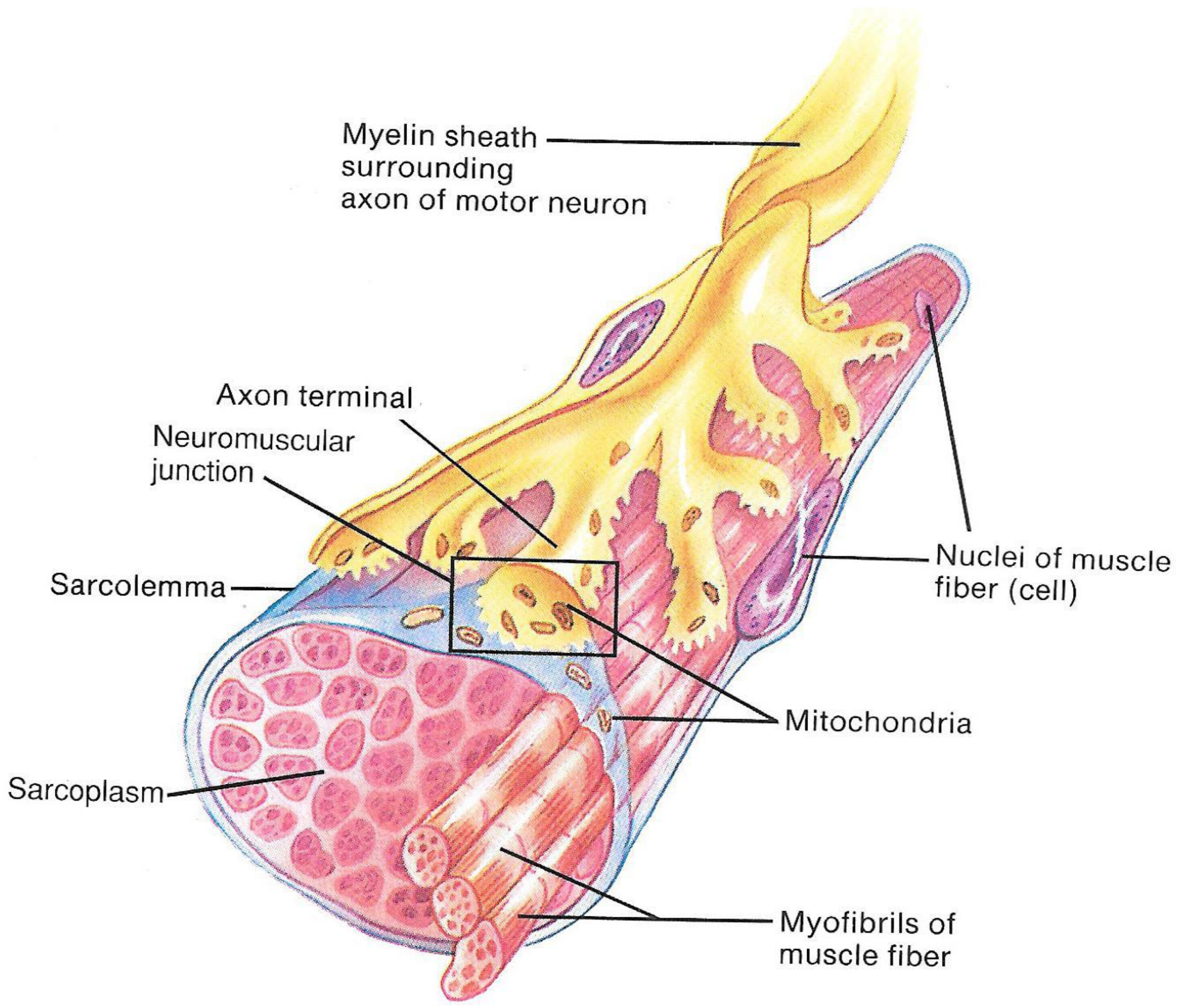


(b) Diagram based on photomicrograph

FIGURE 10.3 Neuromuscular junction (NMJ).

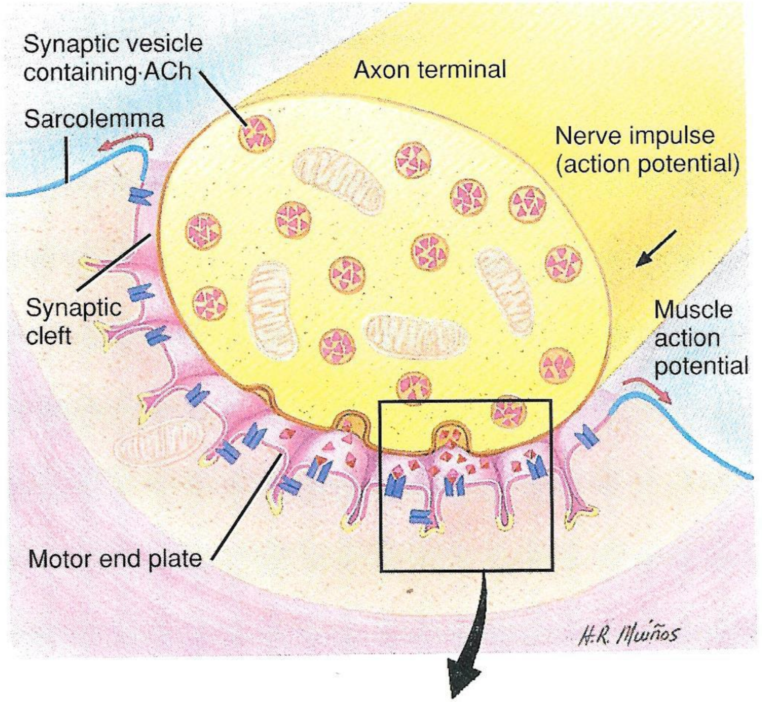


(a) Scanning electron micrograph (1650x)

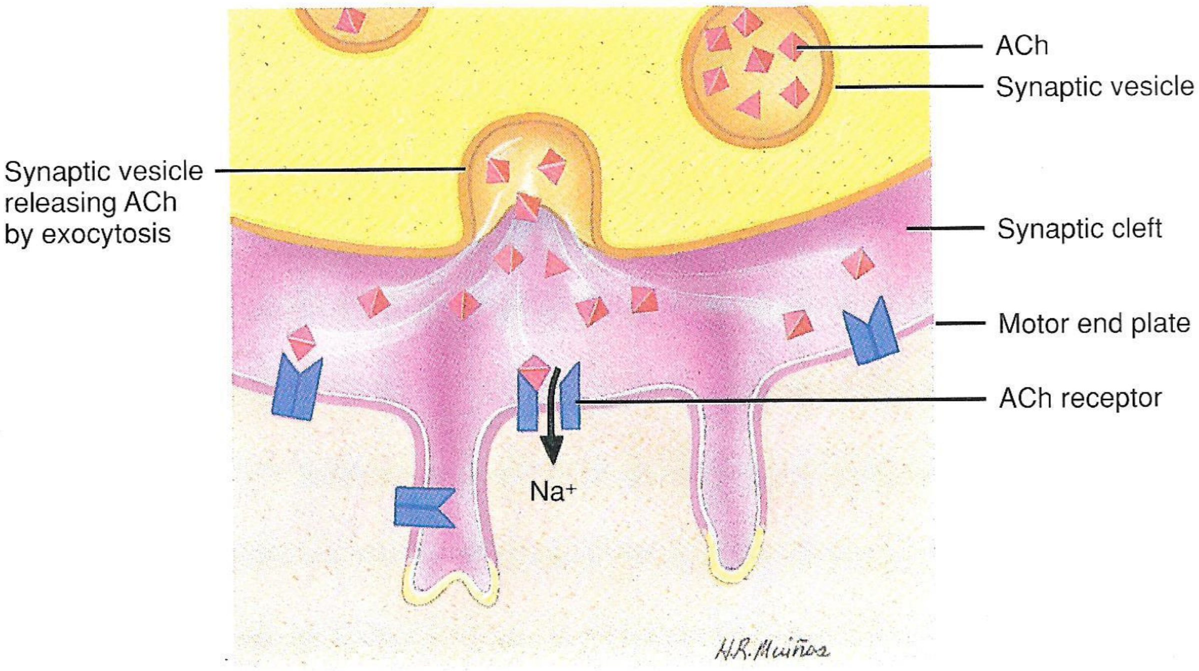


(b) Diagram based on photomicrograph

FIGURE 10.3 (continued)

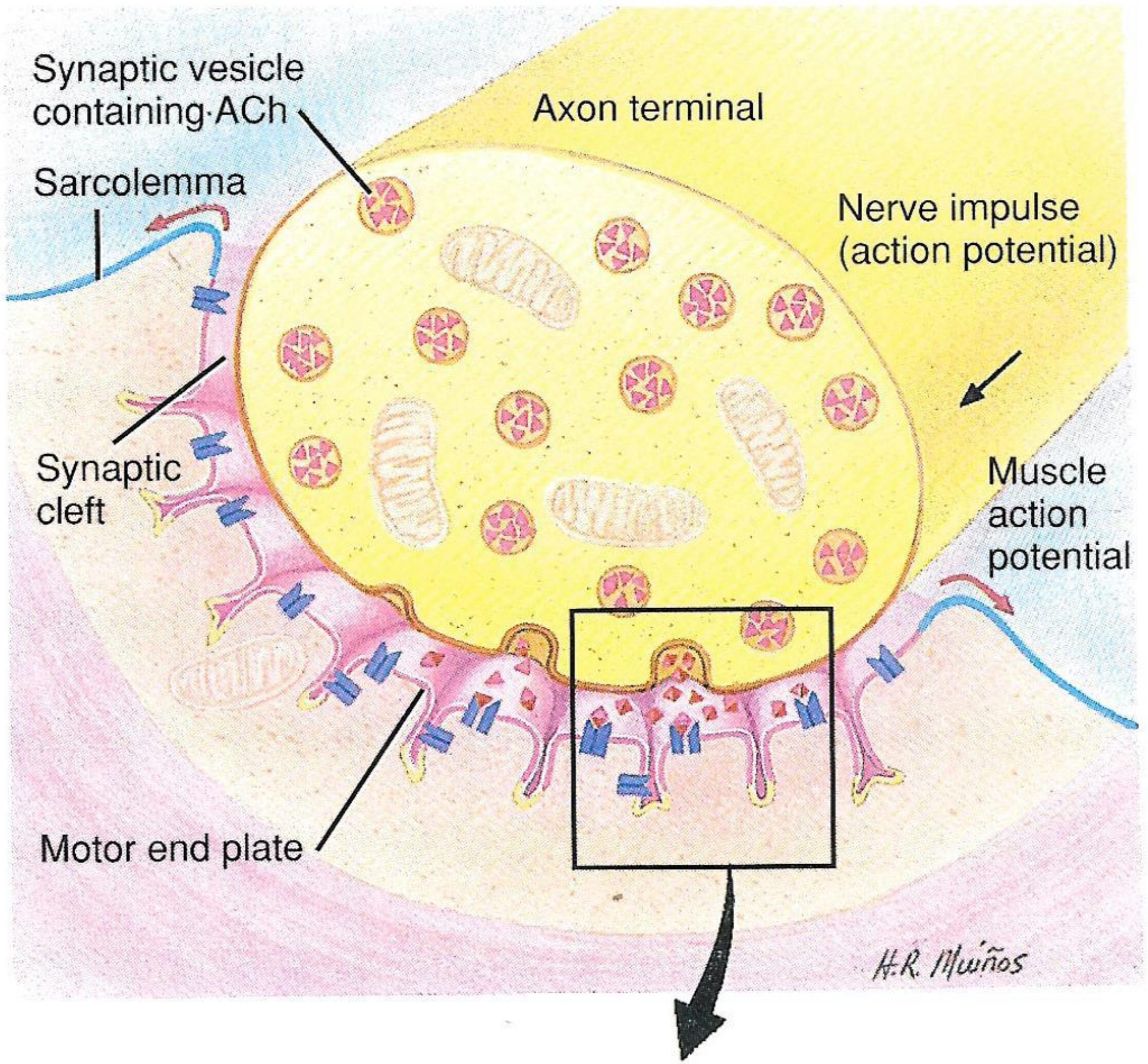


(c) Enlarged view of the neuromuscular junction

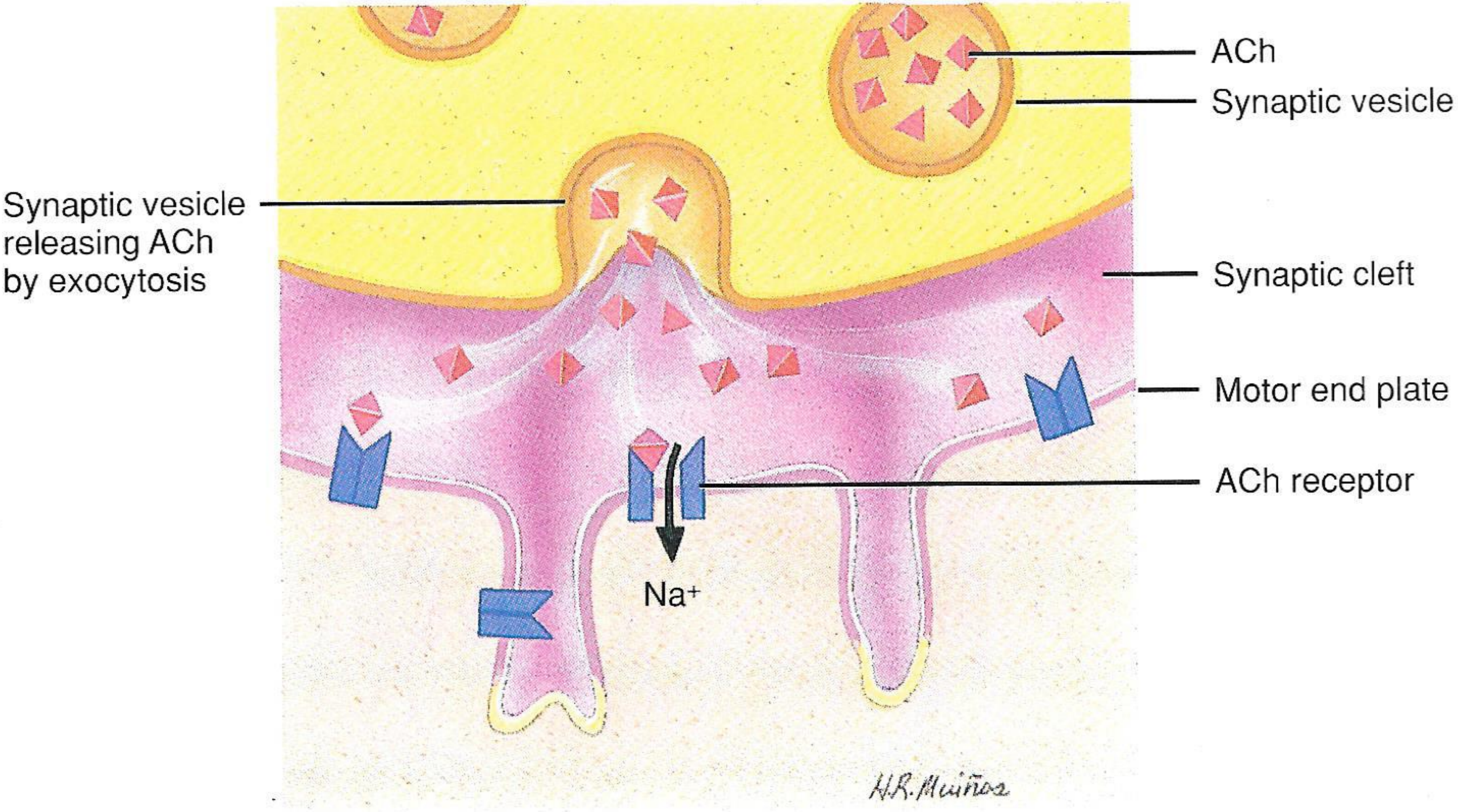


(d) Binding of acetylcholine to ACh receptors in motor end plate.

FIGURE 10.3 (continued)



(c) Enlarged view of the neuromuscular junction



(d) Binding of acetylcholine to ACh receptors in motor end plate.

FIGURE 10.4 Organization of a skeletal muscle from gross to molecular levels.

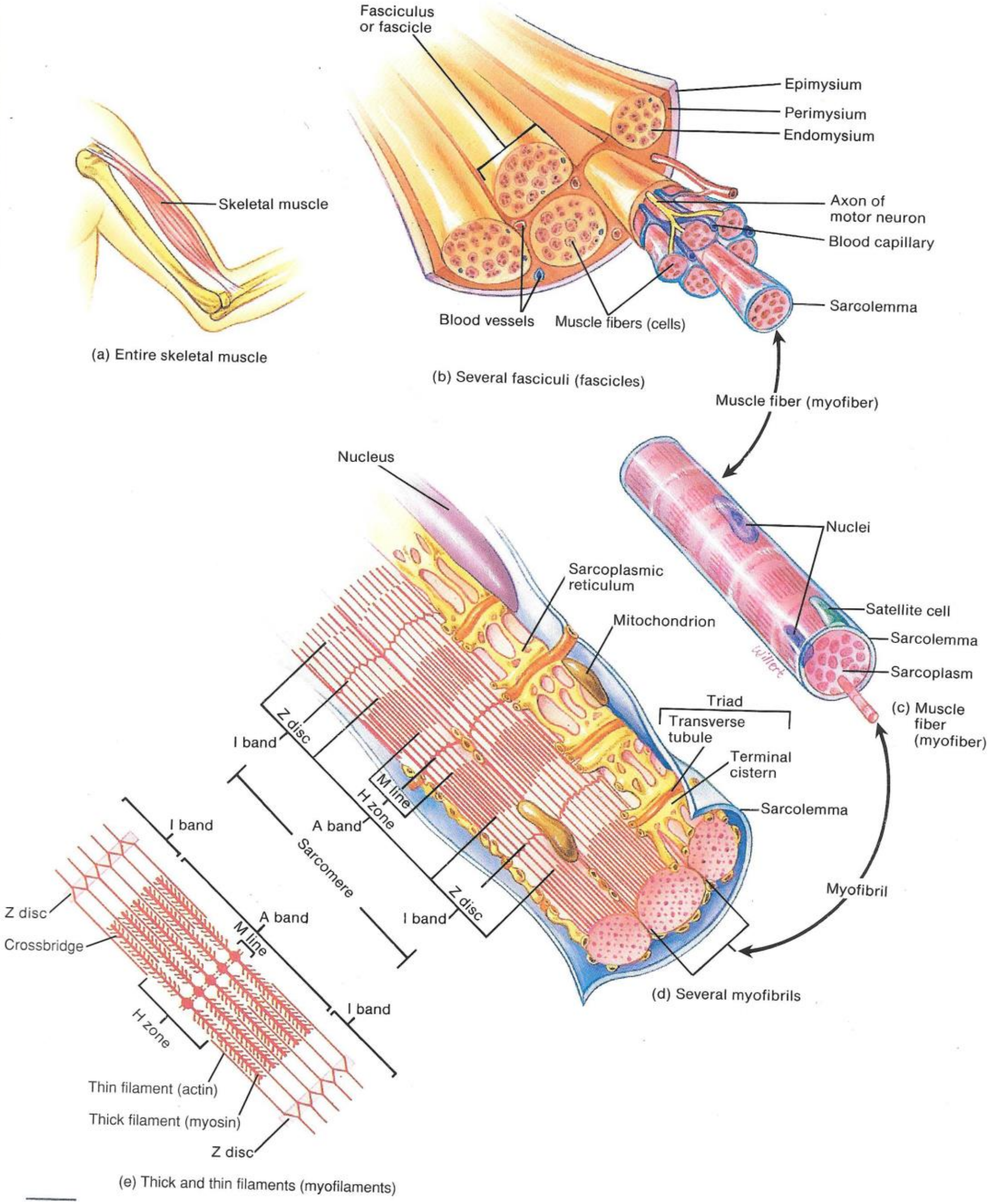
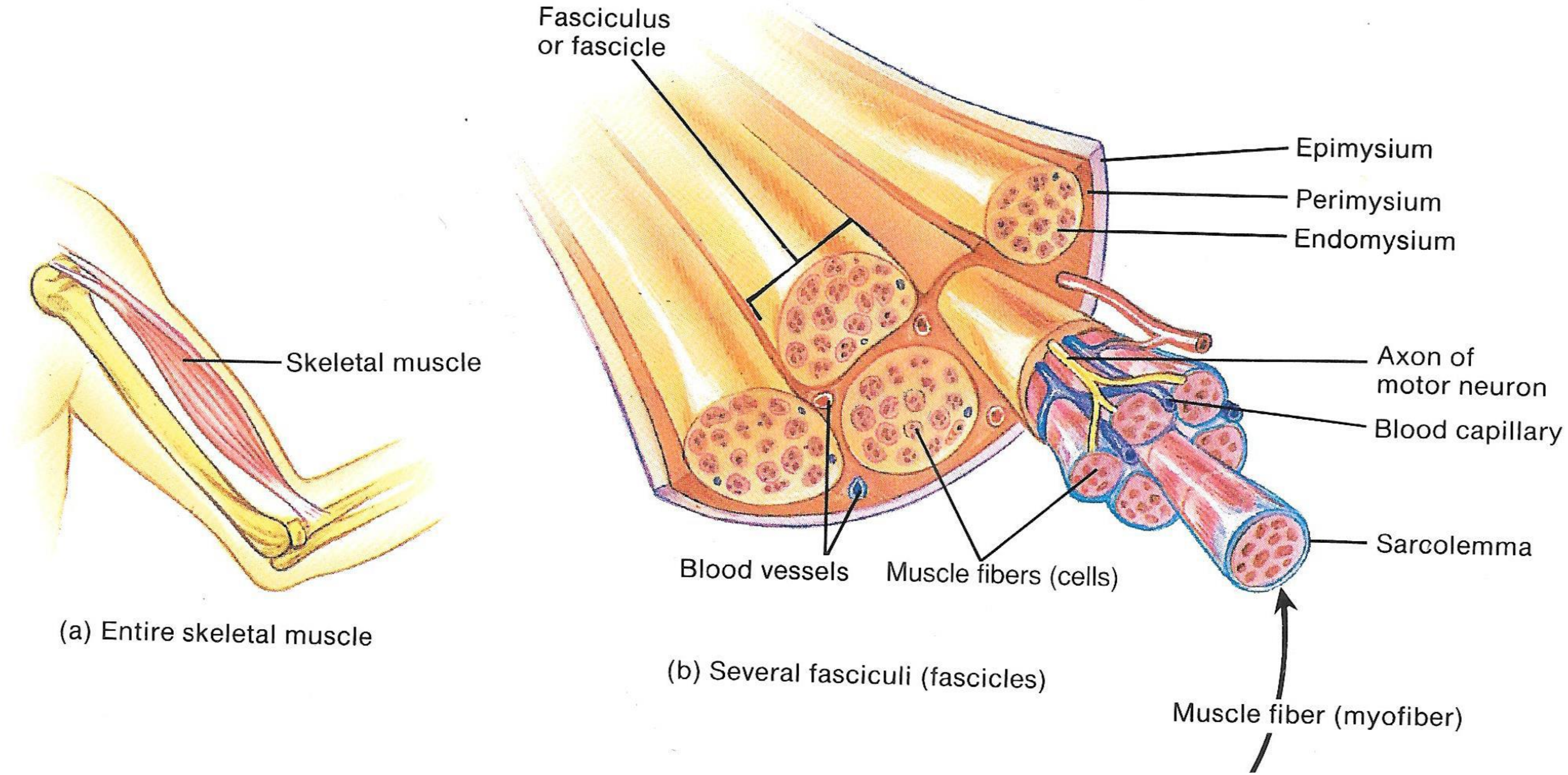
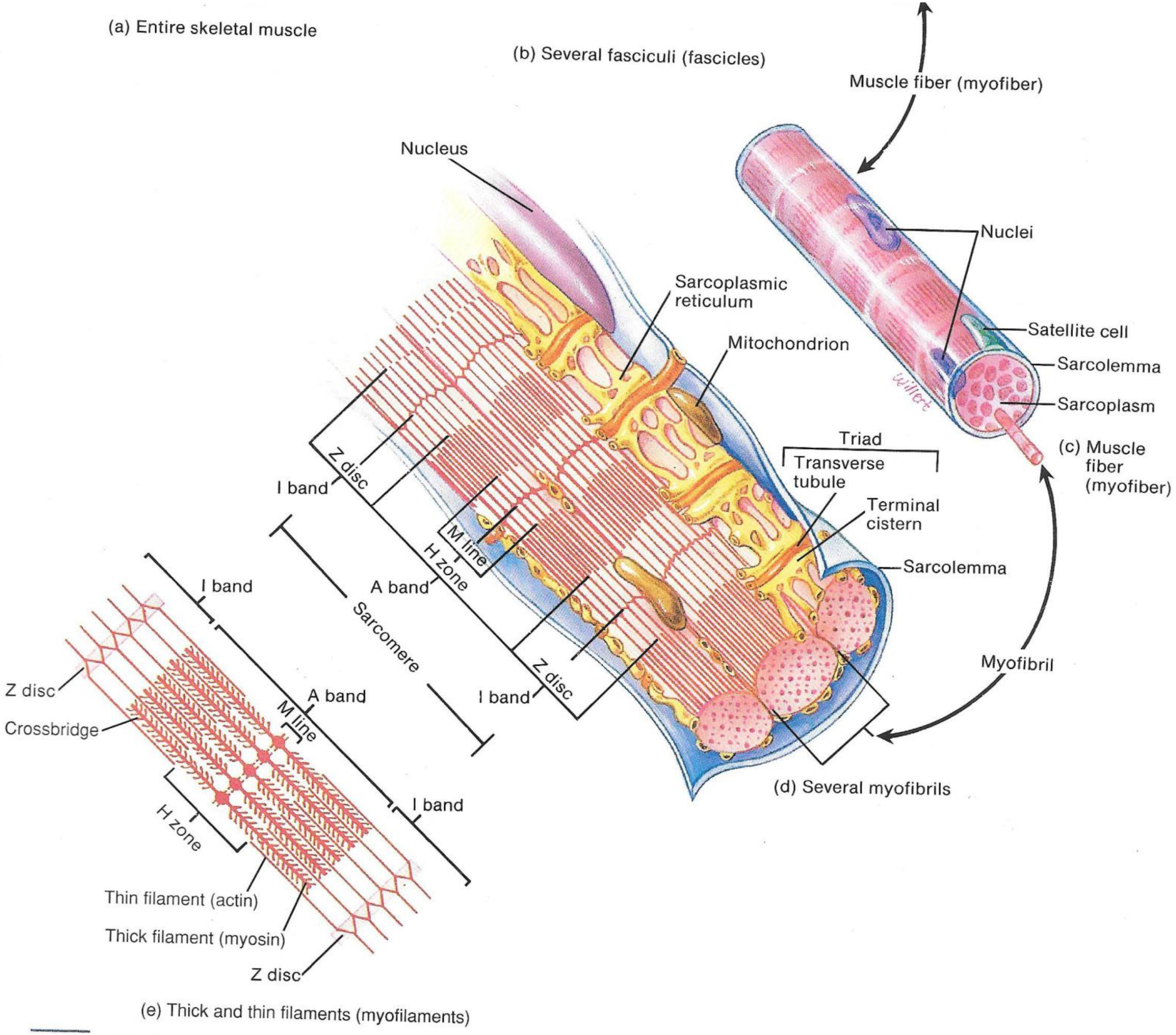


FIGURE 10.4 Organization of a skeletal muscle from gross to molecular levels.



(a) Entire skeletal muscle

(b) Several fasciculi (fascicles)



(a) Entire skeletal muscle
(b) Several fasciculi (fascicles)
Muscle fiber (myofiber)
Nucleus
Nuclei
Sarcoplasmic reticulum
Mitochondrion
Satellite cell
Sarcolemma
Sarcoplasm
Willert
Triad
Transverse tubule
Terminal cistern
(c) Muscle fiber (myofiber)
Sarcolemma
Myofibril
Z disc
I band
M line
H zone
A band
Sarcomere
Z disc
I band
(d) Several myofibrils
I band
Z disc
Crossbridge
A band
M line
I band
H zone
Thin filament (actin)
Thick filament (myosin)
Z disc
(e) Thick and thin filaments (myofilaments)

FIGURE 10.6 Detailed structure of muscle filaments. (a) The relation of thick (myosin), thin (actin), and elastic (titin) filaments in a sarcomere. Note that actin filaments are anchored directly at the Z discs while myosin filaments are connected to the Z discs by titin (also known as connectin). (b) About 200 myosin molecules comprise a thick filament. The myosin tails all point toward the center of the sarcomere. (c) Thin filaments contain actin, troponin, and tropomyosin.

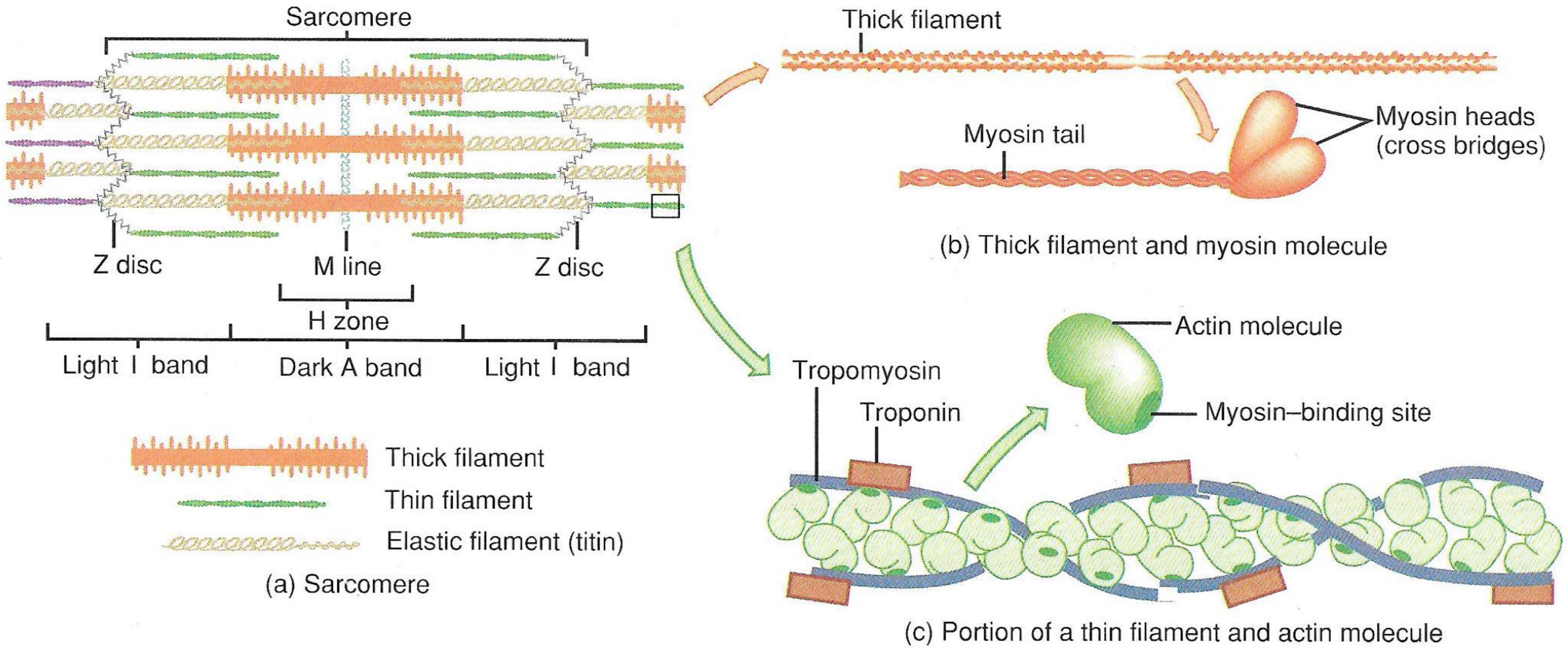


FIGURE 10.7 Sliding filament mechanism of muscle contraction. For simplicity, the elastic filaments are not illustrated.

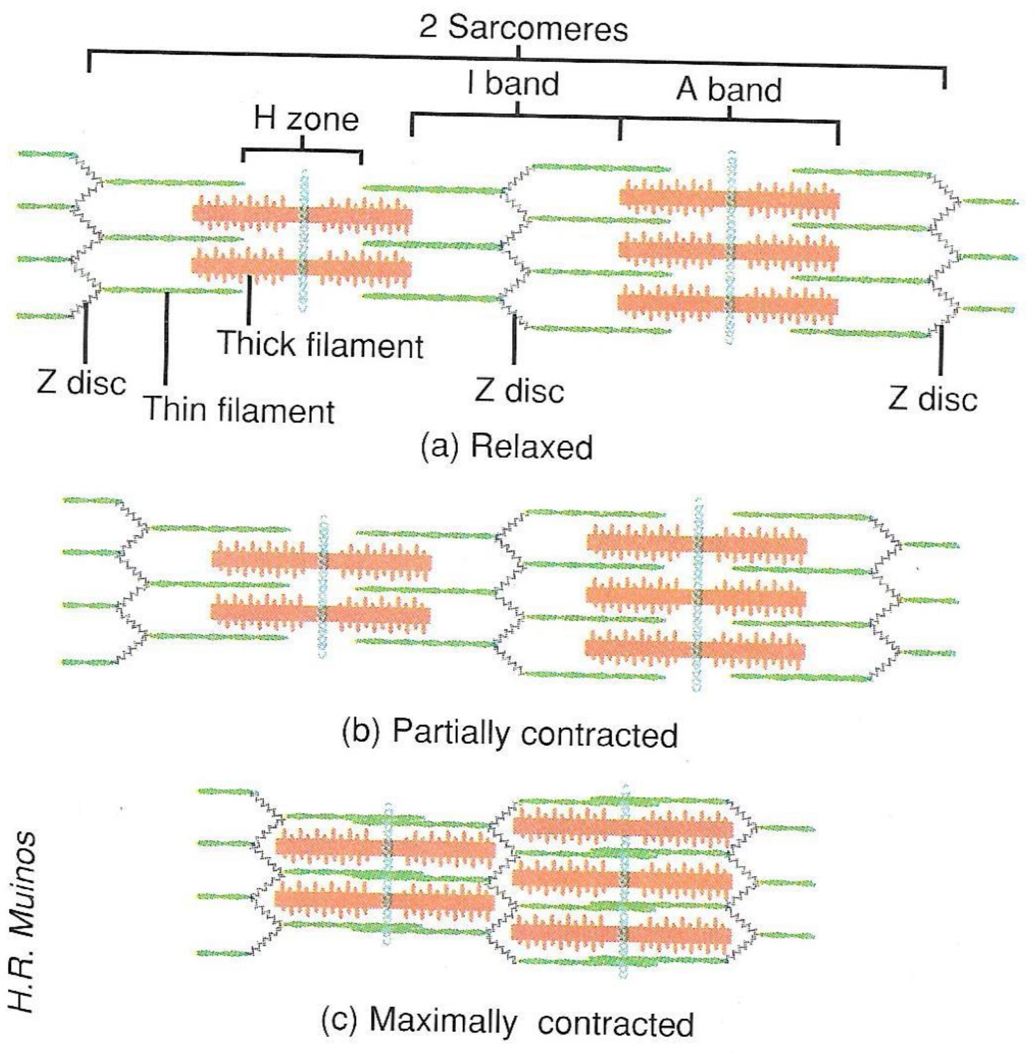


EXHIBIT 10.1

TYPES OF FILAMENTS IN SKELETAL MUSCLE FIBERS

Filament	Diameter	Protein Composition (percent of total protein)	Functions
Thick filament	16 nm	Myosin (44%)	Myosin heads (cross bridges) move thin filaments toward center of sarcomere during contraction.
Thin filament	8 nm	Actin (22%), troponin (5%), tropomyosin (5%)	Contains cross bridge binding sites; slides along thick filament during contraction.
Elastic filament	Less than 1 nm	Titin (connectin) (9%)	Anchors thick filaments to Z discs and stabilizes them during contraction and relaxation.

FIGURE 10.8 Regulation of contraction by troponin and tropomyosin when Ca^{2+} level changes. (a) The level of Ca^{2+} in the sarcoplasm is low during relaxation because it is pumped into the sarcoplasmic reticulum (SR) by Ca^{2+} active transport pumps. (b) A muscle action potential traveling along a transverse tubule opens calcium release channels in the SR and Ca^{2+} flows into the sarcoplasm. Note contraction is occurring since the thin filaments are closer in the center of the sarcomere.

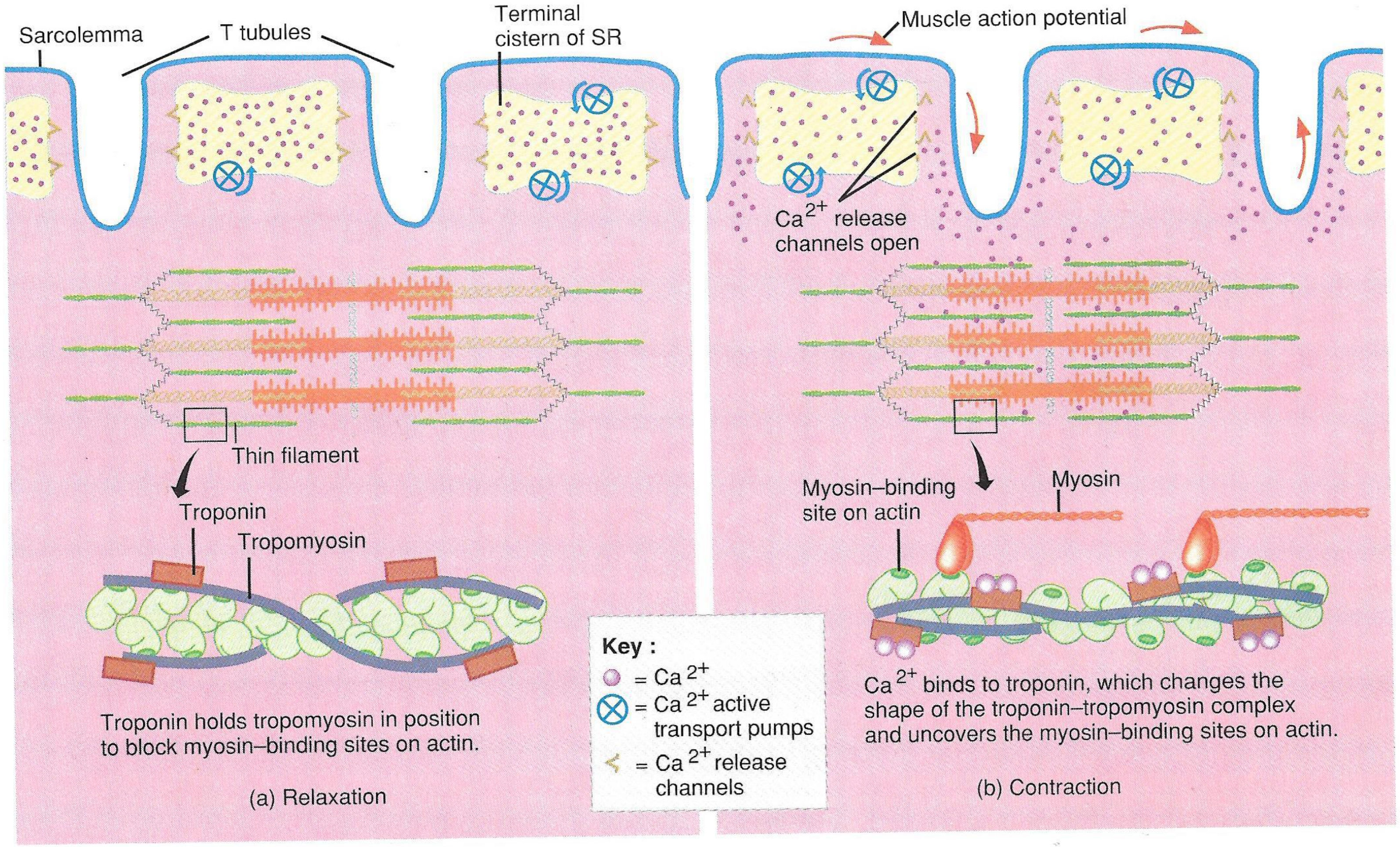


FIGURE 10.9 Role of ATP and the power stroke of muscle contraction. Sarcomeres shorten through repeated cycles in which the myosin heads attach to actin, swivel toward the center of the sarcomere, and detach.

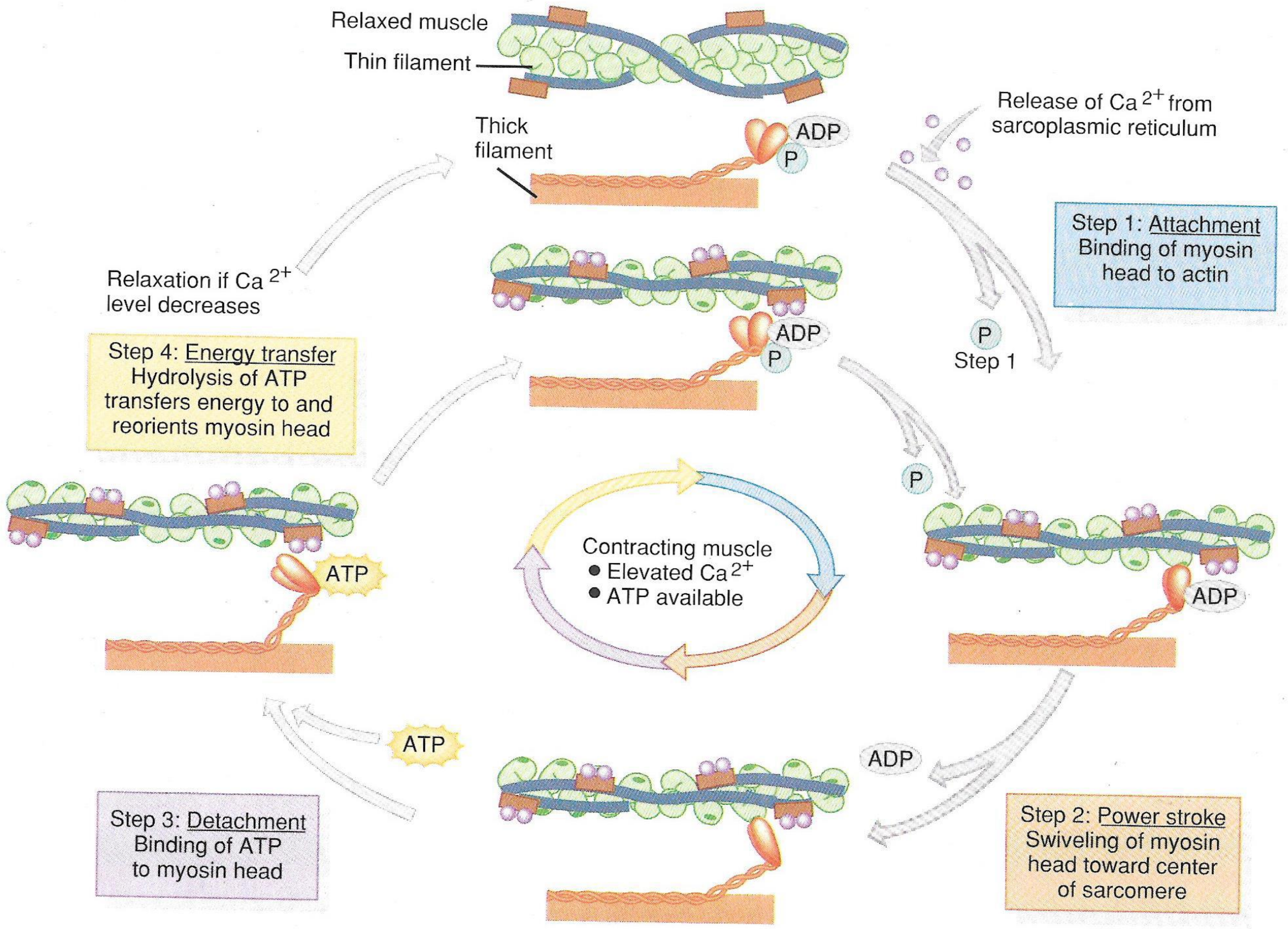


FIGURE 10.10 Summary of the events of contraction and relaxation.

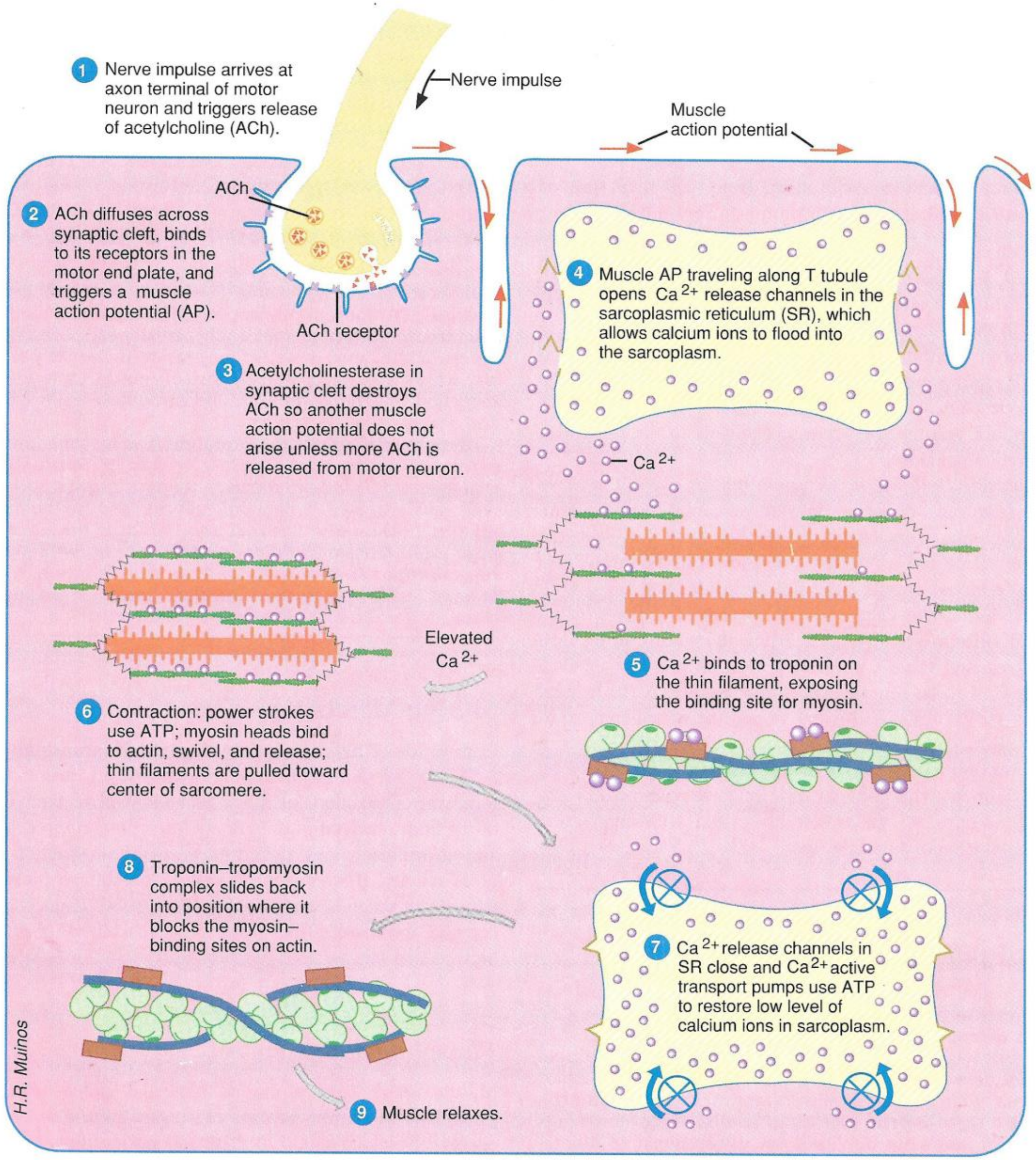


FIGURE 10.11 Muscle metabolism during contraction. (a) Creatine phosphate, formed while the muscle is relaxed, transfers a high-energy phosphate group to ADP, forming ATP. (b) Breakdown of muscle glycogen into glucose and metabolism of glucose via glycolysis produce both ATP and lactic acid. Since no oxygen is needed, this is an anaerobic pathway. (c) Within mitochondria, pyruvic acid produced by glycolysis, amino acids, and fatty acids liberated from adipose cells are used to produce ATP.