

Table 11.1

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Structural Unit	Description
Muscle	A contractile organ, usually attached to bones by way of tendons. Composed of bundles (fascicles) of skeletal muscle fibers, being parallel cylindrical fibers. Supplied with nerves and blood vessels and enclosed in a fibrous sheath appropriate to form a myofascium.
Fascicle	A bundle of muscle fibers within a muscle. Supplied by nerves and blood vessels and enclosed in a fibrous perineurium separating it from neighboring fascicles.
Muscle fiber	A single muscle cell. Slender, elongated, fibrous, enclosed in a special and dense membrane (sarcolemma). Contains striated parallel myofibrils. Myofibrils of striated muscle fibers are arranged in parallel, extending through the sarcolemma, and an extensive network of specialized smooth endoplasmic reticulum (sarcoplasmic reticulum). Enclosed in a fibrous sheath called endomysium.
Myofibril	A bundle of protein myofilaments within a muscle fiber. Extends most of the sarcolemma. Formed by sarcolemma, sarcoplasm, and mitochondria. Plus a functional apparatus due to orderly overlap of protein myofilaments.
Sarcomere	A segment of myofibril from one Z disc to the next in the fiber's striation pattern. Consists of alternating units of thin and thick filaments. The functional contractile unit of the muscle fiber.
Myofilaments	Protein strands that carry out the contractile process. Two types: thick filaments composed mainly of myosin, and thin filaments composed mainly of actin. Thick and thin filaments slide over each other to produce muscle contraction. Shortening of actin and myosin filaments shortens the entire muscle.

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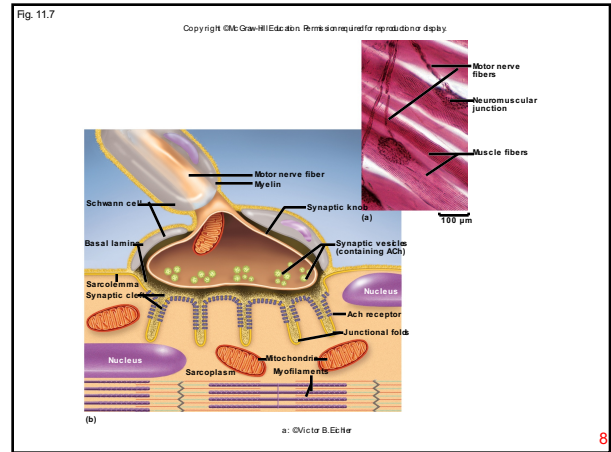
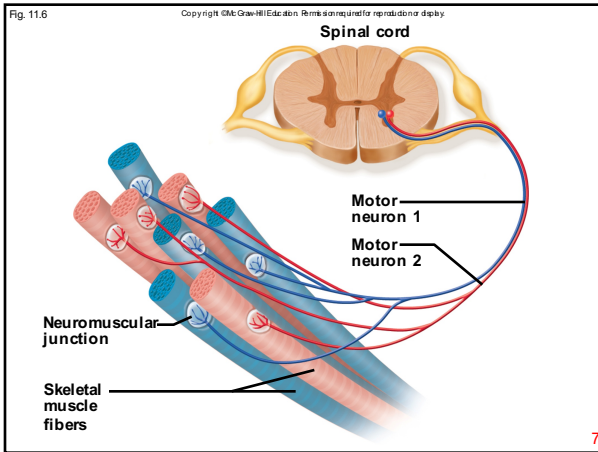
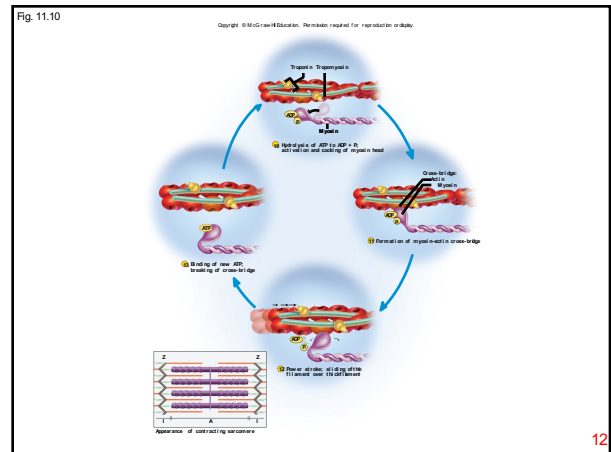
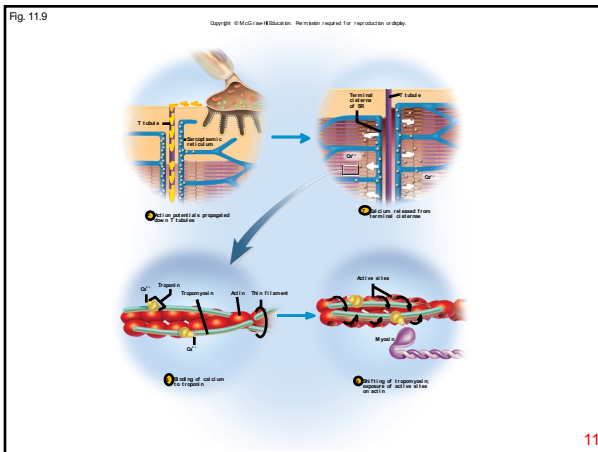
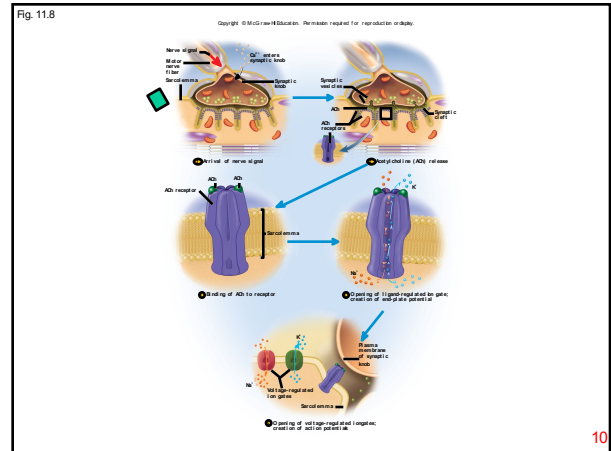
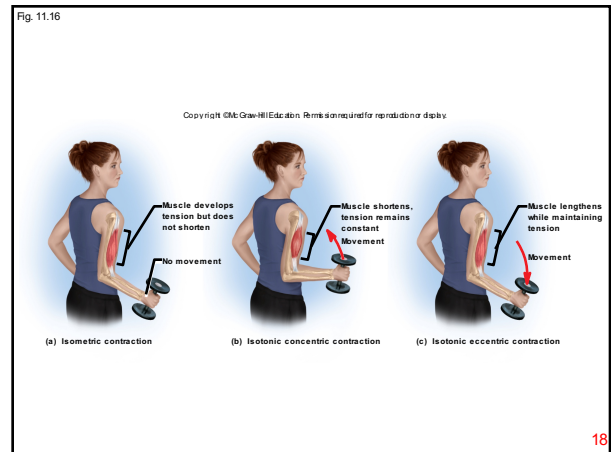
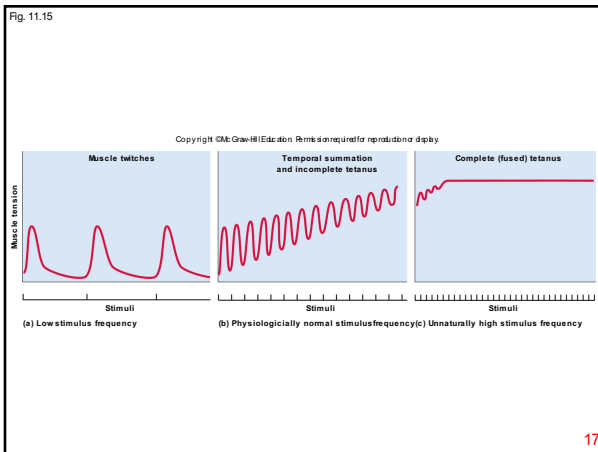
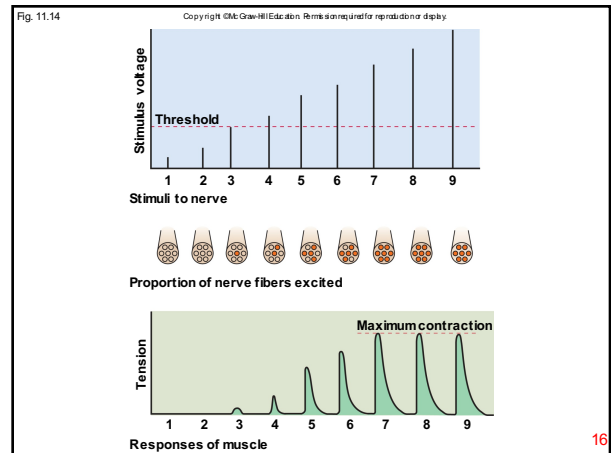
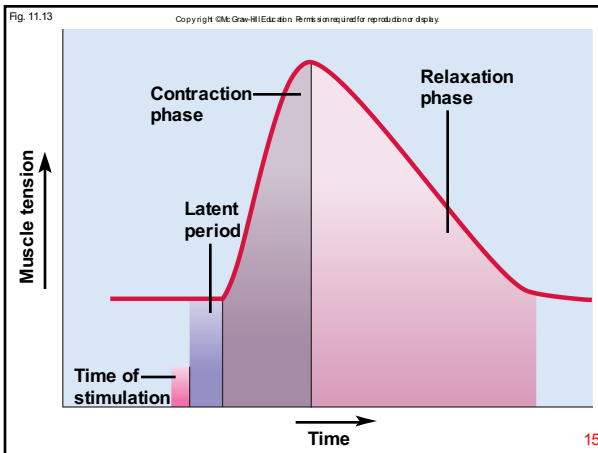
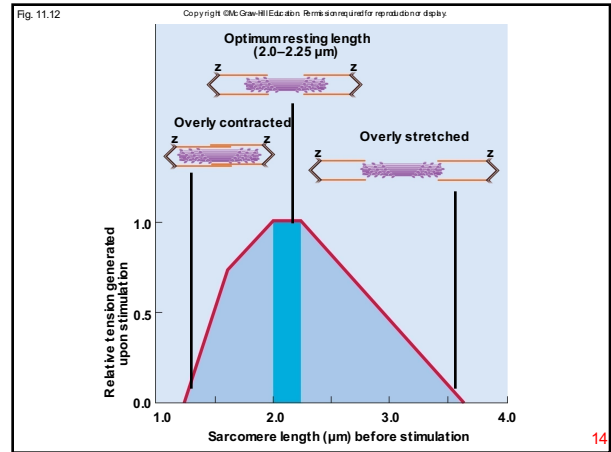
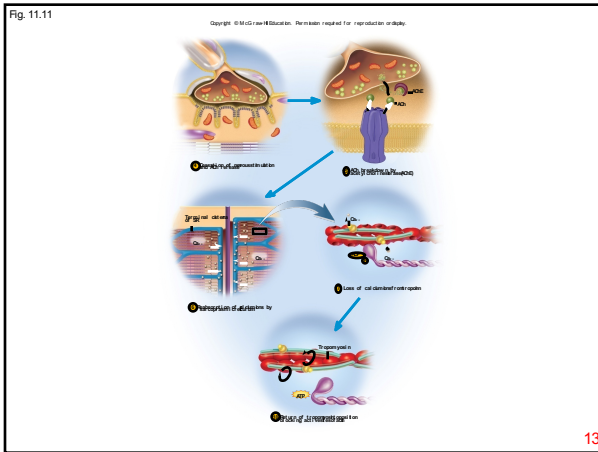


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Components of the Neuromuscular Junction	
Term	Definition
Neuromuscular junction	A functional connection between the distal end of a nerve fiber and the middle of a muscle fiber
Synaptic knob	The dilated tip of a nerve fiber; contains synaptic vesicles
Synaptic cleft	A gap of about 60 to 100 nm between the synaptic knob and sarcolemma
Synaptic vesicle	A secretory vesicle in the synaptic knob; contains acetylcholine
Junctional folds	Invaginations of the sarcolemma where ACh receptors are especially concentrated
Acetylcholine (ACh)	The neurotransmitter released by a somatic motor fiber that stimulates a skeletal muscle fiber (also used elsewhere in the nervous system)
ACh receptor	A transmembrane protein in the sarcolemma of the neuromuscular junction that binds to ACh
Acetylcholinesterase (AChE)	An enzyme in the sarcolemma and basal lamina of the muscle fiber in the synaptic region; responsible for degrading ACh and stopping the stimulation of the muscle fiber





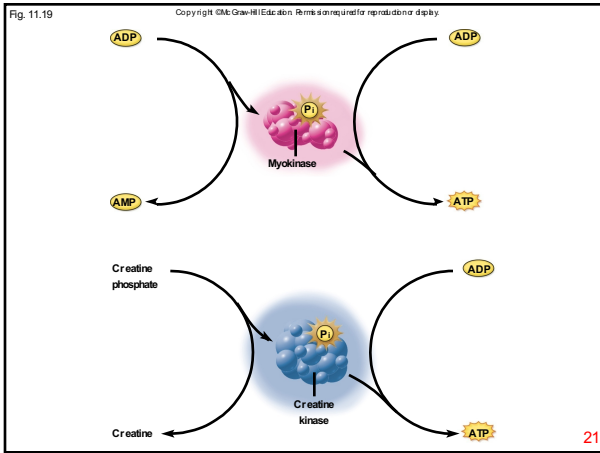
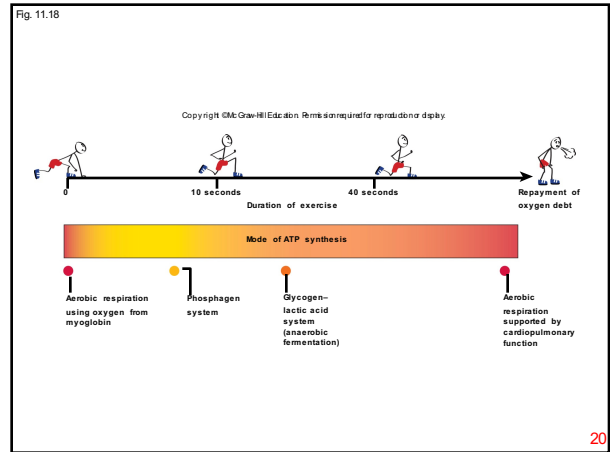
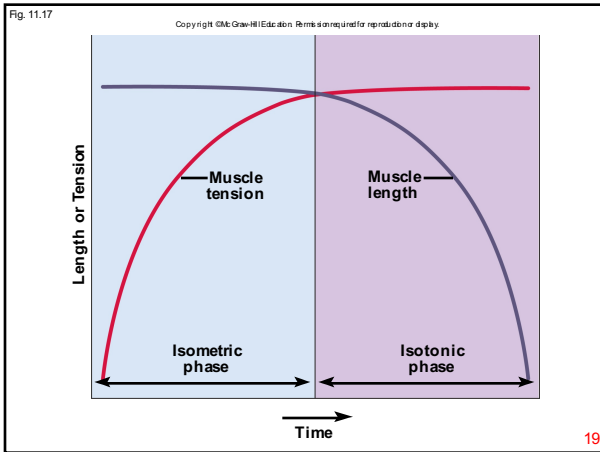


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Properties	Fiber Type	
	Slow-Twitch (Slow Oxidative)	Fast-Twitch (Fast Glycolytic)
Twitch duration	As long as 100 ms	As short as 7.5 ms
Motor unit size	Smaller	Larger
Motor neurons	Smaller, more excitable	Larger, less excitable
Motor unit strength	Weaker	Stronger
Relative diameter	Smaller	Larger
ATP synthesis	Aerobic	Anaerobic
Fatigue resistance	Good	Poor
ATP hydrolysis	Slow	Fast
Glycolysis	Moderate	Fast
Myoglobin content	Abundant	Low
Glycogen content	Low	Abundant
Mitochondria	Abundant and large	Fewer and smaller
Capillaries	Abundant	Fewer
Color	Red	White, pale
Representative muscles in which fiber type is predominant	Soleus Erector spinae Quadratus lumborum	Gastrocnemius Biceps brachii Muscles of eye movement

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Sample Population	SO	FG
Marathon runners	82%	18%
Swimmers	74	26
Average males	45	55
Sprinters and jumpers	37	63

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Feature	Skeletal Muscle	Cardiac Muscle	Smooth Muscle
Location	Associated with skeletal system	Heart	Walls of viscera and blood vessels, iris of eye, piloerector of hair follicles
Cell shape	Long threadlike fibers	Short, slightly branched cells	Short fusiform cells
Cell length	100 $\mu$ m–30 cm	50–100 $\mu$ m	30–200 $\mu$ m
Cell width	10–500 $\mu$ m	10–20 $\mu$ m	5–10 $\mu$ m
Striations	Present	Present	Absent
Nuclei	Multiple nuclei, adjacent to sarcolemma	Usually one nucleus, near middle of cell	One nucleus, near middle of cell
Connective tissues	Endomysium, perimysium, epimysium	Endomysium only	Endomysium only
Sarcoplasmic reticulum	Abundant	Present	Scanty
T tubules	Present, narrow	Present, wide	Absent
Gap junctions	Absent	Present in intercalated discs	Present in single-unit smooth muscle
Autohythmicity	Absent	Present	Present in single-unit smooth muscle
Thin filament attachment	Z discs	Z discs	Dense bodies
Regulatory proteins	Tropomyosin, troponin	Tropomyosin, troponin	Calmodulin, myosin light-chain kinase
Ca <sup>2+</sup> source	Sarcoplasmic reticulum	Sarcoplasmic reticulum and extracellular fluid	Mainly extracellular fluid
Ca <sup>2+</sup> receptor	Troponin of thin filament	Troponin of thin filament	Calmodulin of thick filament
Intervation and control	Somatic motor fibers (voluntary)	Autonomic fibers (involuntary)	Autonomic fibers (involuntary)
Nervous stimulation required?	Yes	No	No
Effect of nervous stimulation	Excitatory only	Excitatory or inhibitory	Excitatory or inhibitory
Mode of tissue repair	Limited regeneration, mostly fibrosis	Limited regeneration, mostly fibrosis	Relatively good capacity for regeneration

