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Microscopic Anatomy and Organization of Skeletal Muscle

Skeletal Muscle Cells and Their Packaging into Muscles

1. What capability is most highly expressed in muscle tissue? *contractility*

2. Use the items on the right to correctly identify the structures described on the left.

g; perimysium	1. connective tissue ensheathing a bundle of muscle cells	a. endomysium
c; fascicle	2. bundle of muscle cells	b. epimysium
i; sarcomere	3. contractile unit of muscle	c. fascicle
d; fiber	4. a muscle cell	d. fiber
a; endomysium	5. thin reticular connective tissue investing each muscle cell	e. myofilament
h; sarcolemma	6. plasma membrane of the muscle fiber	f. myofibril
f; myofibril	7. a long filamentous organelle with a banded appearance found within muscle cells	g. perimysium
e; myofilament	8. actin- or myosin-containing structure	h. sarcolemma
k; tendon	9. cord of collagen fibers that attaches a muscle to a bone	i. sarcomere
		j. sarcoplasm
		k. tendon

3. Why are the connective tissue wrappings of skeletal muscle important? (Give at least three reasons.)

The connective tissue wrappings (a) bundle the muscle fibers together, increasing coordination of their activity; (b) add strength to the muscle; and (c) provide a route for entry and exit of blood vessels and nerves to the muscle fibers.

4. Why are indirect—that is, tendinous—muscle attachments to bone seen more often than direct attachments?

They conserve space (less bulky than fleshy muscle attachments) and are more durable than muscle tissue where bony prominences must be spanned.

5. How does an aponeurosis differ from a tendon? *An aponeurosis is a sheet of white fibrous connective tissue; a tendon is a band or cord of the same tissue. Both serve to attach muscles to bones (or to other muscles).*

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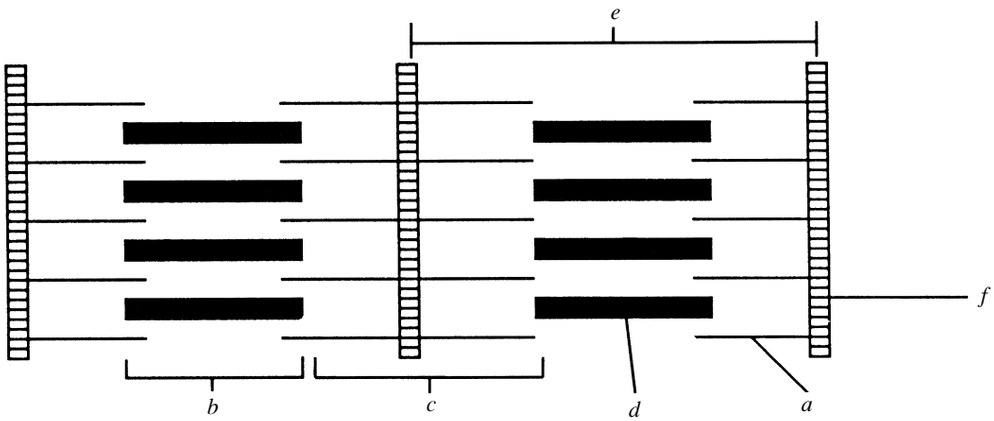
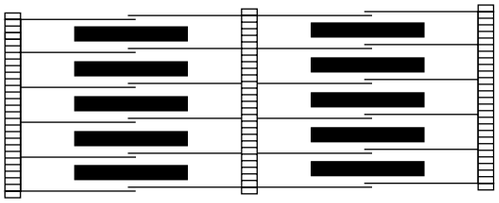
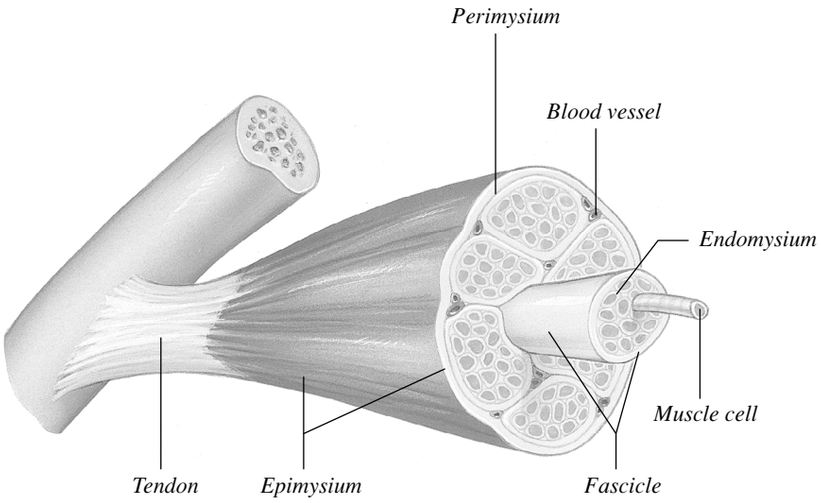
6. The diagram illustrates a small portion of a muscle myofibril. Using letters from the key, correctly identify each structure indicated by a leader line or a bracket. Below the diagram make a sketch of how this segment of the myofibril would look if contracted.

Key:
a. actin filament
b. A band
c. I band
d. myosin filament
e. sarcomere
f. Z disc





7. On the following figure, label blood vessel, endomysium, epimysium, fascicle, muscle cell, perimysium, and tendon.



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The Neuromuscular Junction

8. Complete the following statements:

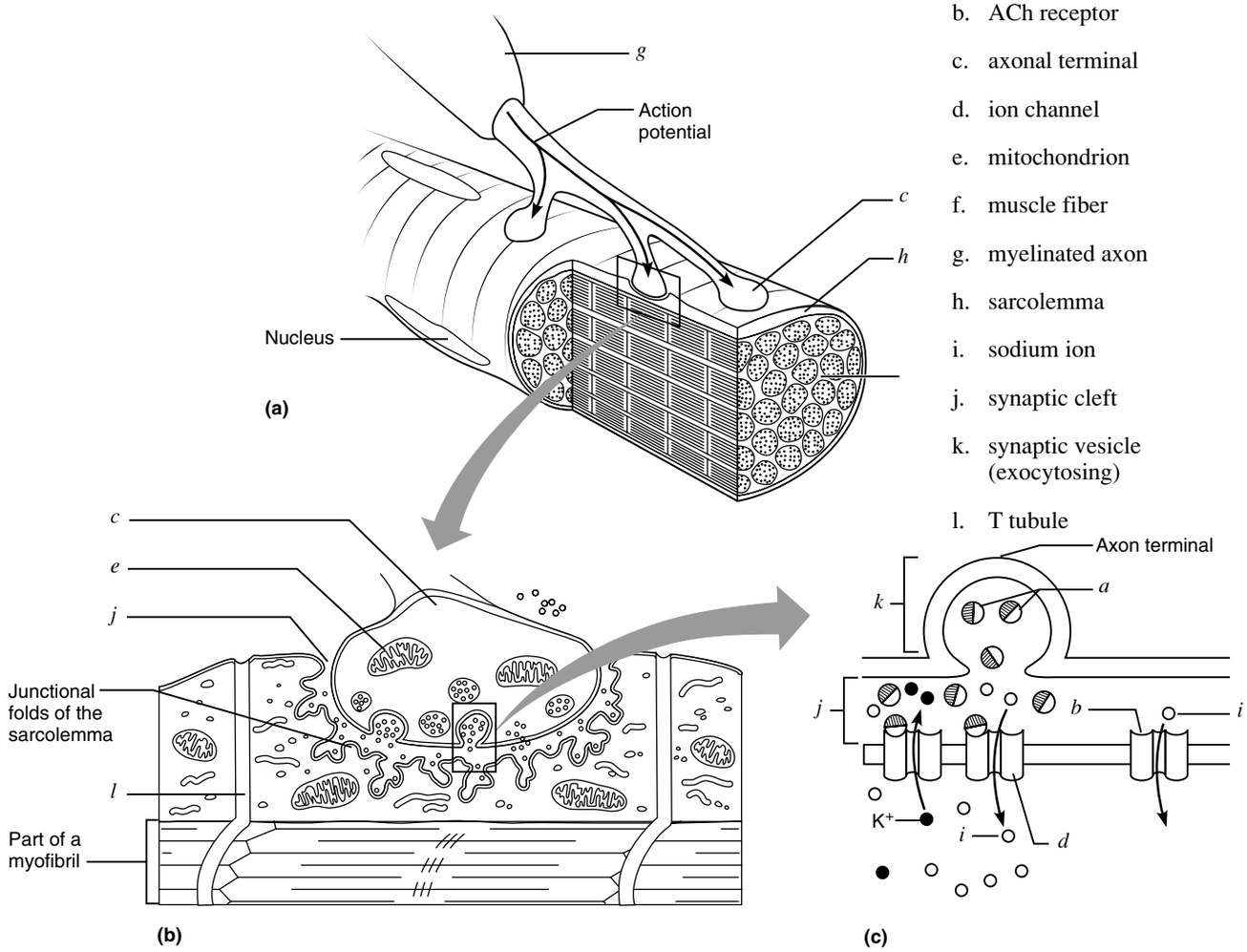
The junction between a motor neuron's axon and the muscle cell membrane is called a neuromuscular junction or a __1__ junction. A motor neuron and all of the skeletal muscle cells it stimulates is called a __2__. The actual gap between the axonal terminal and the muscle cell is called a __3__. Within the axonal terminal are many small vesicles containing a neurotransmitter substance called __4__. When the __5__ reaches the ends of the axon, the neurotransmitter is released and diffuses to the muscle cell membrane to combine with receptors there. The combining of the neurotransmitter with the muscle membrane receptors causes the membrane to become permeable to both sodium and potassium. The greater influx of sodium ions results in __6__ of the membrane. Then contraction of the muscle cell occurs. Before a muscle cell can be stimulated to contract again, __7__ must occur.

1. *myoneural*
2. *motor unit*
3. *synaptic cleft*
4. *acetylcholine*
5. *nerve impulse (action potential)*
6. *depolarization*
7. *repolarization*

9. The events that occur at a neuromuscular junction are depicted below. Identify by labeling every structure provided with a leader line.

Key:

a. ACh molecules
b. ACh receptor
c. axonal terminal
d. ion channel
e. mitochondrion
f. muscle fiber
g. myelinated axon
h. sarcolemma
i. sodium ion
j. synaptic cleft
k. synaptic vesicle (exocytosing)
l. T tubule



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Gross Anatomy of the Muscular System

Classification of Skeletal Muscles

1. Several criteria were given relative to the naming of muscles. Match the criteria (column B) to the muscle names (column A). Note that more than one criterion may apply in some cases.

	Column A	Column B
e, g	1. gluteus maximus	a. action of the muscle
a, g	2. adductor magnus	b. shape of the muscle
d, e	3. biceps femoris	c. location of the origin and/or insertion of the muscle
e, f	4. transversus abdominis	d. number of origins
a, c, e	5. extensor carpi ulnaris	e. location of the muscle relative to a bone or body region
b	6. trapezius	f. direction in which the muscle fibers run relative to some imaginary line
e, f	7. rectus femoris	g. relative size of the muscle
e, f	8. external oblique	

2. When muscles are discussed relative to the manner in which they interact with other muscles, the terms shown in the key are often used. Match the key terms with the appropriate definitions.

Key: a. antagonist b. fixator c. prime mover d. synergist

c; prime mover 1. agonist

b; fixator 2. postural muscles, for the most part

a; antagonist 3. reverses and/or opposes the action of a prime mover

d; synergist 4. stabilizes a joint so that the prime mover may act at more distal joints

d; synergist 5. performs the same movement as the prime mover

b; fixator 6. immobilizes the origin of a prime mover