

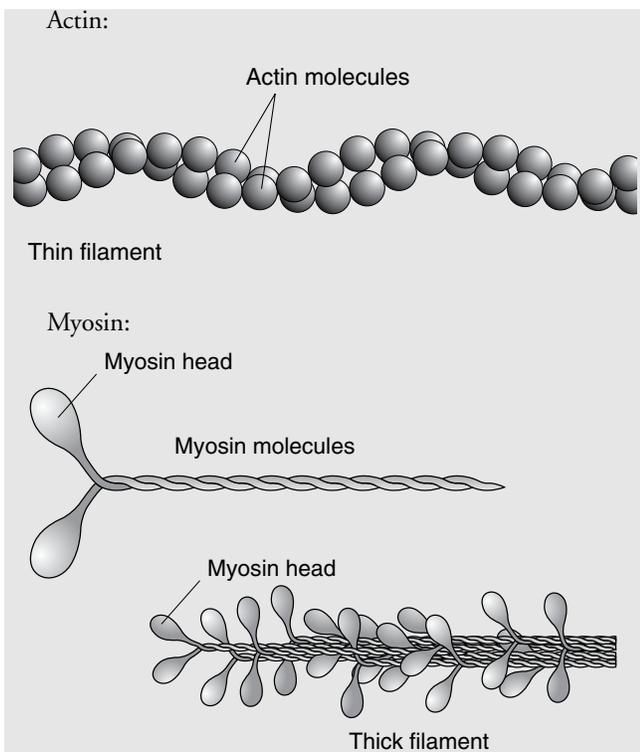
Section 10.1: Review Answers

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1.

	Cardiac Muscle	Smooth Muscle	Skeletal Muscle
Shape	Tubular, branched	Long and tapered	Very long and tubular
Number of Nuclei/Fibre	One	One	Many
Presence of Striations	Yes	No	Yes
Voluntary or Involuntary	Involuntary	Involuntary	Voluntary
Location in Body	Walls of the heart	Walls of the internal organs; iris of the eye	Usually attached to bones
Function	Pump blood	Peristalsis; dilation and constriction of blood vessels; contraction of uterus; iris of the eye	Body movement; maintenance of body temperature; support; protection of internal organs; stabilizing joints

- Muscles shorten when they contract, so they can only pull, not push.
- A sketch should show that a skeletal muscle is made of many multinucleated muscle fibres. The muscle is attached to bone at each end with a tendon. Striations are visible.
- Skeletal muscles have a rich supply of blood vessels to supply oxygen and nutrients to the mitochondria, which will produce energy needed for contraction. Any wastes produced, such as carbon dioxide, will be removed via capillaries and veins.
- Actin is a thin myofilament. Two strands of protein molecules wrap around each other, making it globular. Myosin is a thick myofilament. Two strands of protein are wound around each other. It is ten times longer than an actin myofilament and has a definite shape, with one end being the “head” and the other being a long rod.

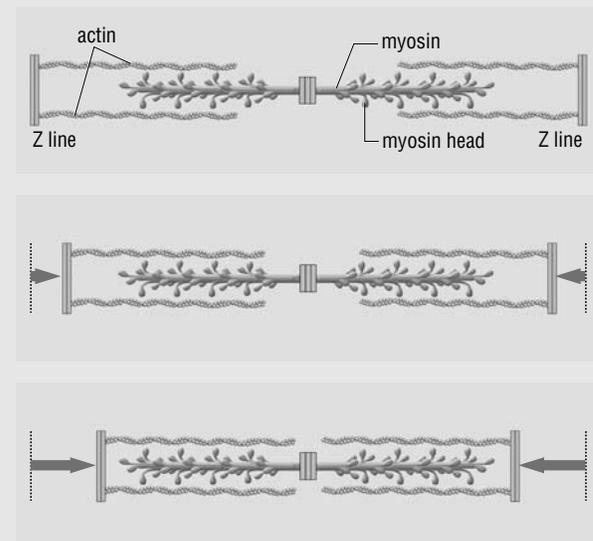


6. The following components of skeletal muscle tissue are given in order of decreasing size and complexity in their hierarchy of organization:

Component	Structure	Function
muscle fibres	single muscle cells grouped into muscle fibre bundles	muscle contraction
myoglobin	oxygen-binding pigment (similar to hemoglobin) inside the sarcoplasm of muscle fibres	binds to oxygen and stores it for use during aerobic cellular respiration in muscle fibres
sarcolemma	membrane surrounding a muscle fibre	regulates the movement of materials into and out of the muscle fibre
sarcoplasm	cytoplasm inside a muscle fibre	site of metabolic processes for cell activities; contains myoglobin and glycogen
sarcoplasmic reticulum	smooth endoplasmic reticulum inside a muscle fibre	stores calcium ions needed for muscle contractions
myofibrils	cylindrical bundles of myofilaments inside a muscle fibre; as long as the muscle fibre itself	contain myofilaments of proteins called actin and myosin

Component	Structure	Function
actin myofilaments	thin filaments inside a myofibril that are composed of the protein called actin	bind to myosin during muscle contractions (part of the functional unit of contraction)
myosin myofilaments	thick filaments inside a myofibril that are composed of the protein called myosin	bind to actin during muscle contractions (part of the functional unit of contraction)

7. Student sketches and captions should be similar to the diagrams below.



8. When calcium ions are released, they bind to troponin that causes the troponin-tryopomyosin complex to shift away from the myosin heads. This exposes the attachment sites on the actin. The myosin now binds to the actin and contraction occurs. In other words, calcium ions reposition the molecules that inhibit muscle contraction, so without calcium, actin and myosin would not come together.

9. There are three sources of ATP for muscle contraction: the breakdown of creatine phosphate, aerobic cellular respiration, and fermentation.

(a) Creatine phosphate is a high-energy compound stored in resting muscle. It breaks down and generates ATP for immediate use at the onset of muscle contraction. It provides enough energy for about eight seconds of intense activity. The release of energy from ATP is not dependent on the presence of oxygen.

(b) The process of aerobic cellular respiration takes place in the mitochondria and usually provides most of the ATP for muscle contraction, provided that oxygen is available. The fuels for this cellular respiration are glucose (from glycogen stores) and fatty acids (from fats).

- (c)** The release of energy from glucose through fermentation generates ATP without the use of oxygen and it creates an oxygen debt in the form of lactate. Fermentation is limited by accumulating lactate and increasing acidity in the sarcoplasm, resulting in cramping and fatigue.
- 10.** Lactate forms in skeletal muscle tissue when oxygen is in short supply and fermentation occurs. It is removed during prolonged heavy breathing after strenuous exercise, as lactate is converted to pyruvate, which is metabolized aerobically in the mitochondria. Lactate is also transported to the liver and converted into glycogen.