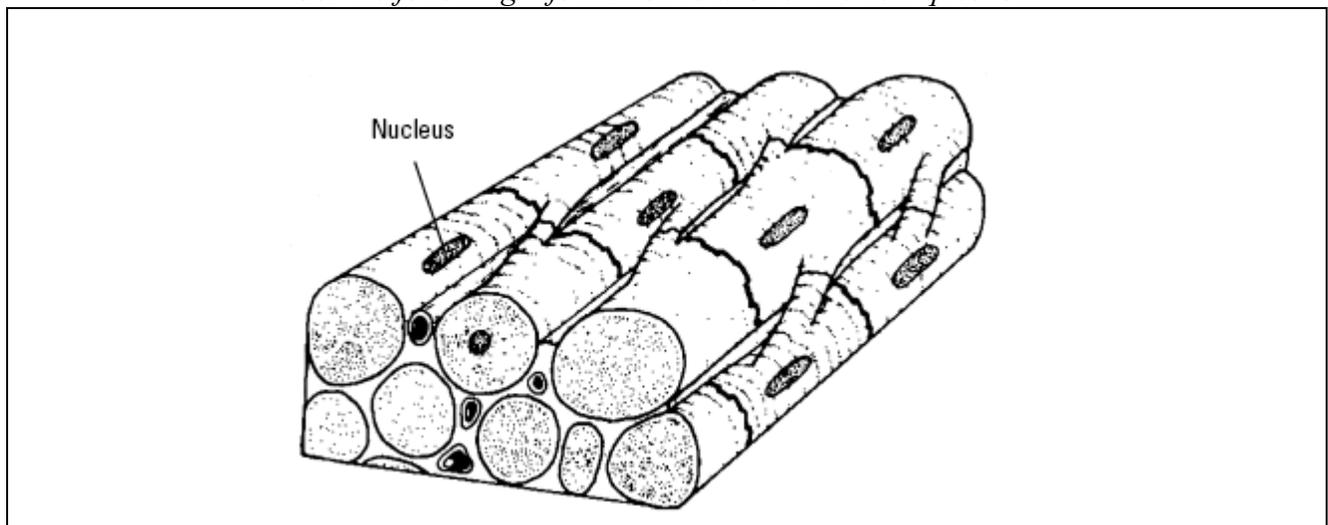


Multiple Choice Questions

- Decide which of the choices best completes the statement or answers the question.
 - Locate that question number on the separate answer sheet provided.
 - Use the procedure described by your teacher to answer each question. For example, “fill in the circle that corresponds to your choice” or “make an X over the letter corresponding to your choice.”
1. Which of the following best describes the muscles that line the digestive tract?
 - a. striated; tubular; branched; voluntary
 - b. non-striated; single nucleus; involuntary
 - c. striated; tubular; multinucleated; involuntary
 - d. non-striated; tubular; branched; voluntary
 2. Which of the following best describes cardiac muscle?
 - a. striated; tubular; branched; involuntary
 - b. non-striated; single nucleus; involuntary
 - c. striated; tubular; multinucleated; involuntary
 - d. non-striated; tubular; branched; voluntary
 3. Which of the following is NOT a function of skeletal muscles?
 - a. The contraction of skeletal muscle opposes the force of gravity and enables humans to stand and remain upright.
 - b. The contraction of skeletal muscles accounts for not only the movement of arms but also for movements of the eye.
 - c. Skeletal muscles found in arteries constrict, raising blood pressure.
 - d. Skeletal muscle pads the bones that protect the organs.

Use the following information to answer the next question.

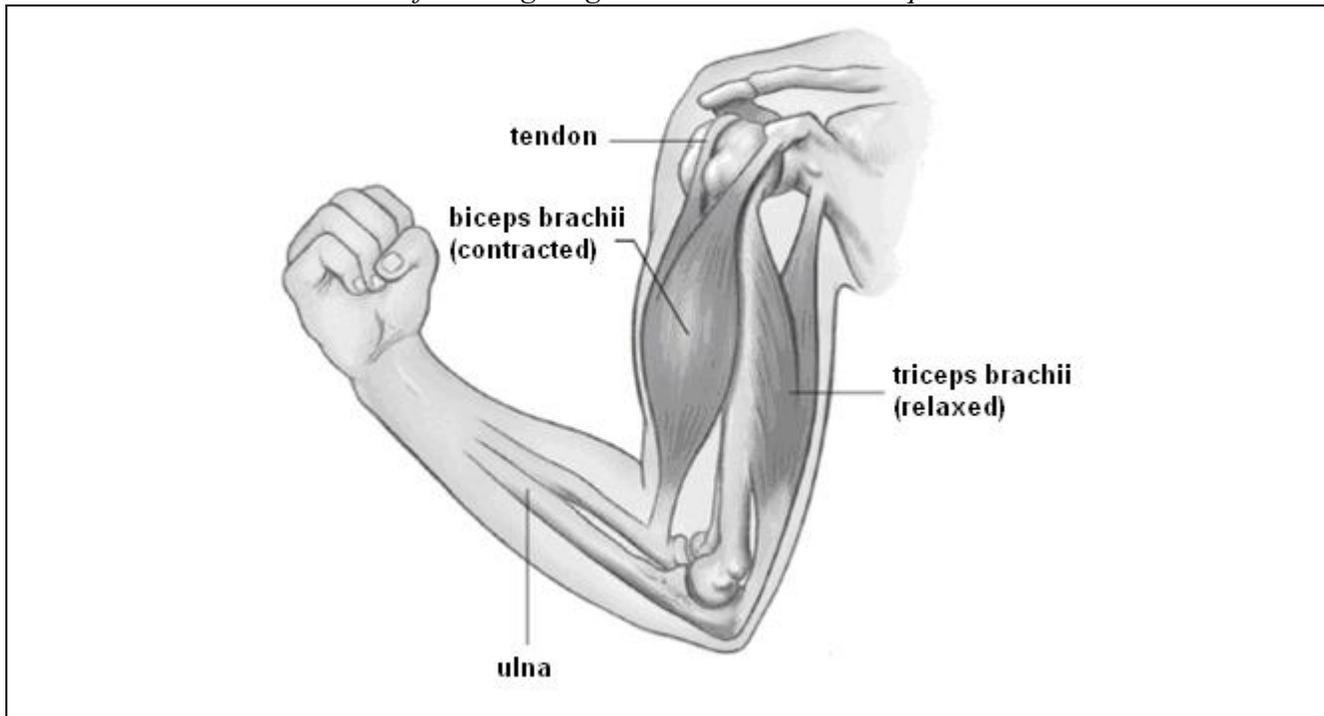


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4. Which row below identifies the type of muscle and where it could be found in the human body?

Row	Muscle Type	Location
a.	smooth muscle	small intestine
b.	voluntary muscle	stomach
c.	skeletal muscle	bicep
d.	cardiac muscle	heart

Use the following diagram to answer the next question.

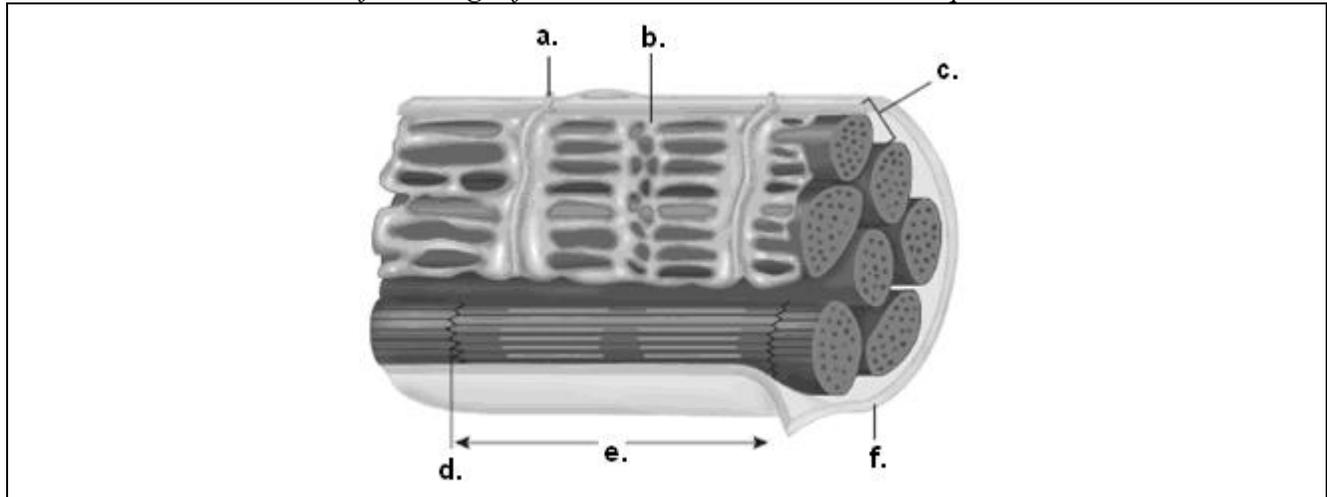


5. Which row below completes the following statement?

“The biceps and the triceps pictured in this diagram are acting as ***i*** of muscles because the work of a skeletal muscle is only done during its ***ii***.”

Row	<i>i</i>	<i>ii</i>
a.	a synergistic pair	relaxation
b.	an opposing pair	contraction
c.	a circular and longitudinal pair	relaxation
d.	an involuntary pair	contraction

Use the following information to answer the next two questions.



6. The function of the structure labelled with the letter “d” on the diagram is to regulate the entry and exit of materials into the muscle fibre. This structure is called the
 - a. sarcolemma.
 - b. myofibril.
 - c. sarcomere.
 - d. thick filament.

7. The function of the structure labelled by the letter “b” on the diagram is to store calcium ions needed for muscle contraction. This structure is called the
 - a. sarcomere.
 - b. thin filament.
 - c. thick filament.
 - d. sarcoplasmic reticulum.

Use the following information to answer the next question.

Muscular Dystrophy

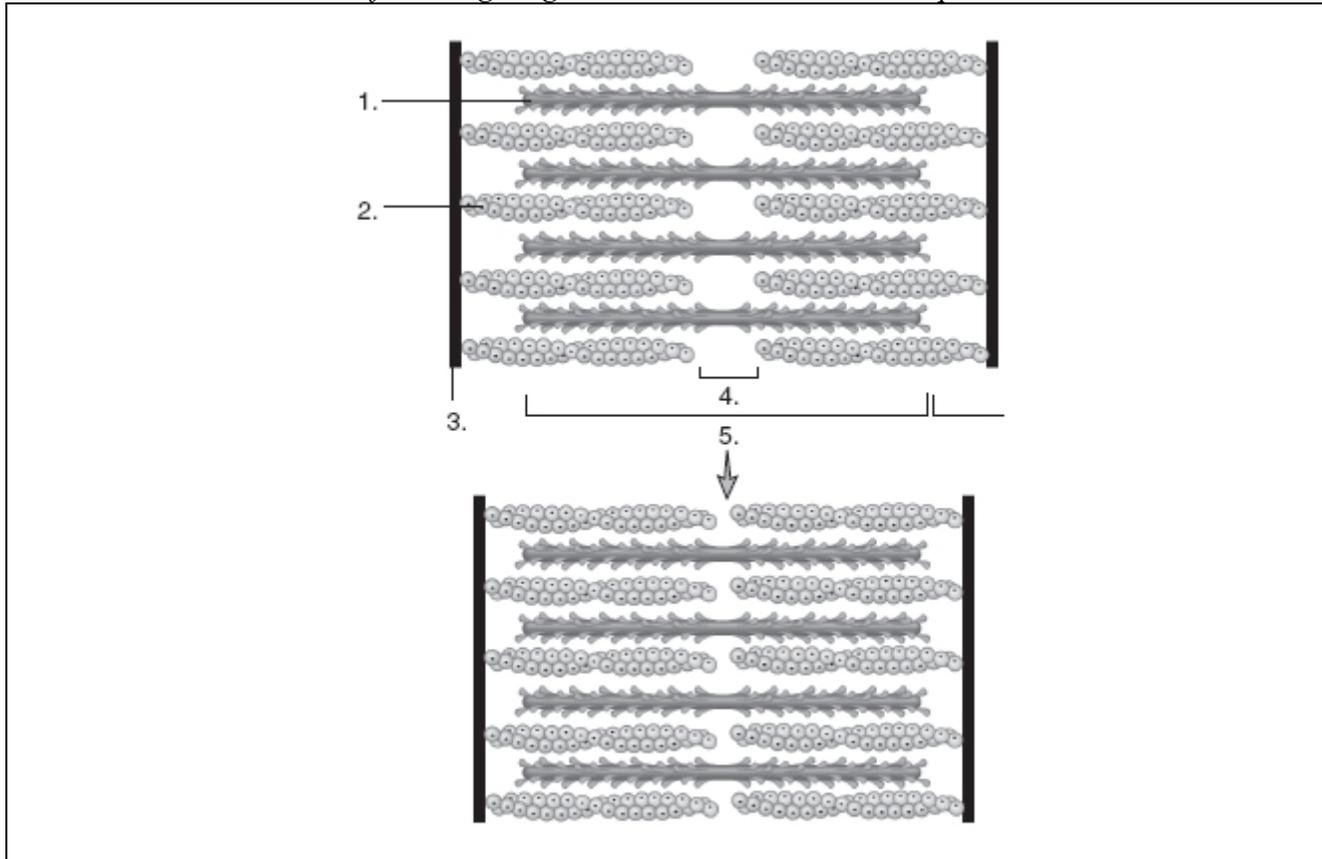
Muscular Dystrophy (MD) is the name of a group of muscle disorders that are characterized by progressive weakness and wasting of the voluntary muscles that control body movement. As muscle tissue weakens and wastes away, it is replaced by fatty and connective tissue. **Duchenne muscular dystrophy** is the most severe form of dystrophinopathy. It occurs mostly in young boys and is the most common form of MD that affects children.

Source: Muscular Dystrophy Canada

8. Which of the following would NOT likely be a sign or symptom of Duchenne muscular dystrophy?
 - a. frequent falls
 - b. difficulty getting up from a lying or sitting position
 - c. lack of peristalsis in the digestive tract
 - d. weakness in lower leg muscles, resulting in difficulty running and jumping

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Use the following diagram to answer the next three questions.



9. The actin and myosin filaments in this diagram are numbered, respectively
- 1 and 2.
 - 2 and 1.
 - 3 and 4.
 - 4 and 3.
10. The movement of the actin past myosin is part of the
- sliding filament model of a muscle contraction.
 - creatine phosphate breakdown model of a muscle contraction.
 - slow- and fast-twitch model of a muscle contraction.
 - summation, tetanus, and fatigue model of a muscle contraction.
11. Which of the following statements best explains the role of creatine phosphate in the contraction of a skeletal muscle?
- Creatine phosphate is broken down into fatty acids that produce the ATP required for muscle contraction.
 - Creatine phosphate quickly regenerates the ATP required for the contraction.
 - Creatine phosphate binds to oxygen directly in the bloodstream. This provides much-needed oxygen for the muscle contraction.
 - Creatine phosphate provides the energy for summation of a muscle twitch.

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12. Which of the following is a TRUE statement with respect to a skeletal muscle contraction?
- The myofibrils increase in length.
 - The actin myofilament breaks down ATP to form ADP.
 - The myosin filaments slide past the actin filaments.
 - The Z-lines are pulled closer together.

13. Which of the following pairs is mismatched?

Row	Muscle Type	Location
a.	aerobic cellular respiration	provides most of the muscle's ATP
b.	fermentation of glucose	provides small amounts of ATP in anaerobic conditions
c.	creatine phosphate breakdown	regenerates ATP from ADP for the first few seconds of a muscle contraction
d.	oxygen debt	skeletal muscle in oxygen debt uses aerobic means to generate ATP

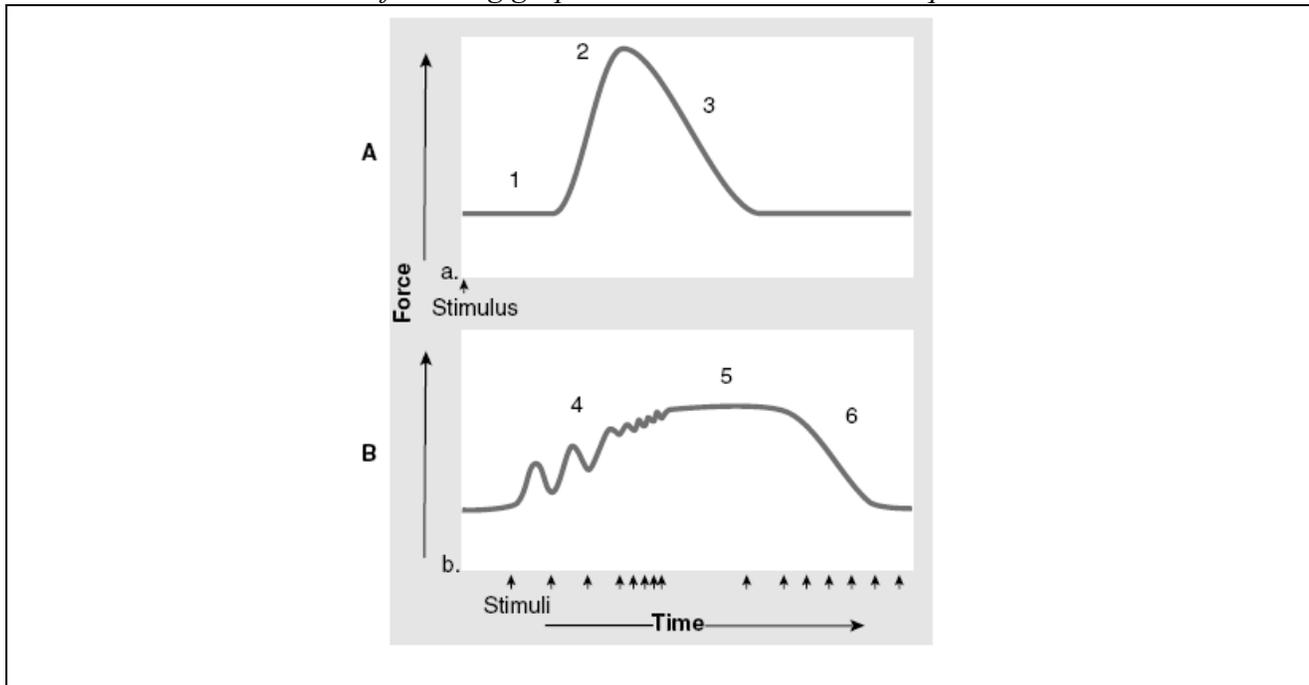
14. The oxygen-carrying molecule found in skeletal muscle cells and the cellular organelle where aerobic cellular respiration takes place, **respectively** are
- creatine phosphate; sliding filaments.
 - glucose; chloroplasts.
 - myoglobin; mitochondria.
 - hemoglobin; red blood cell (erythrocytes).

15. Which of the following best describes what happens in a skeletal muscle when the muscle is producing ATP through fermentation?
- Glucose is broken down to produce carbon dioxide and water.
 - Glucose is broken down to produce fatty acids and glycogen.
 - Glucose is broken down to produce lactate.
 - Glucose is broken down to produce creatine phosphate.

16. Which of the following statements is INCORRECT?
- As soon as the strength of a stimulus reaches a certain threshold, the muscle contracts and then relaxes.
 - Stimulation of an individual muscle fibre within a muscle usually results in a maximal, or all-or-none contraction.
 - The contraction of a whole muscle can vary in strength depending on the number of muscle fibres contracting.
 - When a muscle is not allowed to relax completely between stimuli, the contraction gradually decreases in intensity until it reaches a minimum, which is sustained until the muscle fatigues.

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Use the following graphs to answer the next three questions.



These graphs of the force of muscle contraction over time are called myograms.

17. Graph A in this diagram represents
- summation and tetanus of a skeletal muscle fibre.
 - summation and tetanus of a smooth muscle fibre.
 - a simple smooth muscle twitch.
 - a simple skeletal muscle twitch.

18. Number 5 in Graph B represents *i* and is the result of *ii*.

Row	<i>i</i>	<i>ii</i>
a.	summation	a single stimulus to the muscle
b.	tetanus	the muscle not being able to completely relax between stimuli being applied
c.	fatigue	the muscle relaxing even though the stimuli are still being applied
d.	latent period	the period of time in between muscle contractions

19. Identify the statement from the list below that does NOT involve a method of replenishing the oxygen debt in a skeletal muscle cell.
- Replenishing fatty acid supplies in the sarcoplasmic reticulum (endoplasmic reticulum of a skeletal muscle cell).
 - Replenishing creatine phosphate supplies in the muscle cell.
 - Lactate is changed back to pyruvate and metabolized in the mitochondria.
 - Lactate can be sent back to the liver to synthesize glycogen.

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20. Which row below completes the following statement?

“The skeletal muscle fibres that are most likely involved in long-distance running are called *i* because these muscle fibres *ii*.”

Row	<i>i</i>	<i>ii</i>
a.	fast-twitch fibres	produce most of their energy aerobically; they tire only when their fuel supply is gone.
b.	fast-twitch fibres	have little or no myoglobin, fewer mitochondria, and depend on anaerobically produced energy.
c.	slow-twitch fibres	produce most of their energy aerobically; they tire only when their fuel supply is gone.
d.	slow-twitch fibres	have little or no myoglobin, fewer mitochondria, and depend on anaerobically produced energy.

Numerical Response Questions

- Record your answer on the answer sheet provided.
- If an answer is a value between 0 and 1 (e.g., 0.25), be sure to record the 0 before the decimal place.

Use the following information to answer the next question.

The following are steps in the contraction of a myofilament.

1. The myosin head is attached to the actin filament.
2. The myosin head flexes, advancing the actin filament.
3. The myosin head releases and unflexes, powered by ATP.
4. The myosin reattaches to actin farther along the fibre.

1. When these steps are placed in the correct sequence, the order in the contraction of a myofilament would be _____, _____, _____, and _____. Record your **four-digit answer** in the numerical response section on the answer sheet.

Use the following information to answer the next question.

Role of Calcium Ions in the Contraction of a Myofibril

1. Calcium ions bond to a protein molecule called toponin that is part of the actin myofilament.
2. The attachment sites for the myosin heads on the actin are physically blocked by a protein called tropomyosin.
3. When a muscle is relaxed, its myosin heads are raised and ready, through the splitting of ATP.
4. The myosin heads can bind to the actin, and contraction occurs.
5. The calcium ion/toponin complex exposes the myosin binding sites of actin.

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2. When these steps are placed in the correct sequence of events, the order of this sequence would be _____, _____, _____, _____, and _____. Record your **five-digit** answer in the numerical response section on your answer sheet.

Use the following information to answer the next question.

The following are the events that take place during a single skeletal muscle twitch.

1. relaxation period
2. latent period
3. contraction period
4. threshold stimulus

3. The correct order of events is _____, _____, _____, and _____. Record your **four-digit** answer in the numerical response section on your answer sheet.

Written Response Questions

Use the following information to answer the following questions.

Mitochondrial Myopathy

A mitochondrial disease that causes prominent muscular problems is called a mitochondrial myopathy (*myo* means muscle, and *pathos* means disease). The main symptoms of mitochondrial myopathy are muscle weakness and wasting, and exercise intolerance. It's important to remember that the severity of any of these symptoms varies greatly from one person to the next, even in the same family.

Weakness and wasting usually are most prominent in muscles that control movements of the eyes and eyelids. Two common consequences are the gradual paralysis of eye movements, called *progressive external ophthalmoplegia* (PEO), and drooping of the upper eyelids, called *ptosis*. Often, people automatically compensate for PEO by moving their heads to look in different directions and might not even notice any visual problems. *Ptosis* is potentially more frustrating because it can impair vision and also cause a listless expression, but it can be corrected by surgery, or by using glasses that have a "ptosis crutch" to lift the upper eyelids.

Mitochondrial myopathies can also cause weakness and wasting in other muscles of the face and neck, which can lead to slurred speech and difficulty with swallowing. In these instances, speech therapy or changing the diet to easier-to-swallow foods can be useful.

Exercise intolerance, also called exertional fatigue, refers to unusual feelings of exhaustion brought on by physical exertion. The degree of exercise intolerance varies greatly among individuals.

Source: Facts about Mitochondrial Disease

http://www.mda.org/publications/mitochondrial_myopathies.html

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1. Write a unified response addressing the following aspects of mitochondrial myopathy.

- Most aerobic cellular respiration takes place in the mitochondria of the muscle. **Explain**, in general terms, aerobic cellular respiration as it takes place in a skeletal muscle and **describe** the role myoglobin plays in this reaction. (Note: You do not have to provide the biochemical pathways involved in your answer.)

- **Explain**, using a diagram, the sliding filament model of a muscle contraction and **describe** how mitochondrial myopathy would disrupt the contraction of a skeletal muscle.

- **Predict** the impact on the daily life of a person who has mitochondrial myopathy, and **identify** two technologies that could be used to assist people with this disease.
