Muscles at Work

Compare muscle cells by their structures and jobs.

HS-AP4-1 "Compare and contrast between the structural and functional characteristics of skeletal, cardiac, and smooth muscle."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline two cell-structure clues and circle two action or control clues for each muscle type. Use your marks to compare how the three types work.

A Climb Inside Your Body

1. On a steep staircase, your thigh muscles pull on bones to lift your body. These are skeletal muscles, attached to the skeleton by tendons. Their fibers are long, roughly cylindrical cells with many nuclei. Under a microscope, alternating light and dark bands give the fibers a striped, or striated, look. You can choose to climb faster or stop, so skeletal muscle is under voluntary control. Its contractions can be powerful and quick, but some fibers tire during repeated intense effort. The same tissue also steadies your posture when you pause on a step.

2. As you climb, your heart sends more blood toward working muscles. Cardiac muscle forms the thick wall of the heart. Its cells are shorter and branched, usually with one nucleus, and they also look striated. Neighboring cells meet at intercalated discs, connections that hold cells together and help electrical signals spread. Unlike the thigh muscle, cardiac muscle contracts without a conscious decision. Its cells generate a coordinated rhythm, and nerves can adjust the rate. With a steady supply of oxygen and fuel, this muscle keeps pumping throughout your life rather than tiring after a short climb.

3. After the climb, food continues moving through your digestive tract even while you sit still. Smooth muscle lines much of the tract's wall and also surrounds many blood vessels. Its cells are spindle shaped, with one nucleus and no visible stripes. They do not form the long fibers found in skeletal muscle or the branching network found in cardiac muscle. Smooth muscle acts without conscious control. In the gut, waves of contraction push food along; in blood vessels, sustained contraction can narrow the passage. These slower, sustained actions suit jobs that continue while your attention is elsewhere.

2 ANSWER WITH EVIDENCE

Use the passage

1. How are skeletal and cardiac muscle alike in appearance but different in cell shape and control?

2. Compare cardiac and smooth muscle: How does each move material, and how do their cells differ in appearance?

3. How do skeletal and smooth muscle differ in control and in the movements they produce during or after the climb?

4. Compare the structures that connect skeletal muscle to bones and cardiac muscle cells to one another. How does each connection support a different job?

3 YOUR TURN

Your own words

Imagine designing a soft robot with a steerable arm, a nonstop fluid pump, and a tube that slowly moves gel. In one paragraph, choose a muscle type as a model for each part, connect a cell structure to a useful action for each choice, and state one similarity and one difference among your models.

ANSWER KEY

Muscles at Work

HIGH SCHOOL · HS-AP4-1

PART 1 · READ AND MARK

Underline two cell-structure clues and circle two action or control clues for each muscle type. Use your marks to compare how the three types work. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	How are skeletal and cardiac muscle alike in appearance but different in cell shape and control?	**Both are striated. Skeletal muscle has long, roughly cylindrical cells and is under voluntary control; cardiac muscle has shorter, branched cells and contracts without conscious control.**
2	Compare cardiac and smooth muscle: How does each move material, and how do their cells differ in appearance?	**Cardiac muscle pumps blood and has branched, striated cells. Smooth muscle pushes food through the gut or narrows blood vessels and has spindle-shaped cells without visible stripes.**
3	How do skeletal and smooth muscle differ in control and in the movements they produce during or after the climb?	**Skeletal muscle is under voluntary control and pulls on bones to move or steady the body. Smooth muscle acts without conscious control and moves food through the gut or narrows blood vessels.**
4	Compare the structures that connect skeletal muscle to bones and cardiac muscle cells to one another. How does each connection support a different job?	**Tendons attach skeletal muscle to the skeleton so it can pull on bones. Intercalated discs hold cardiac cells together and help electrical signals spread for coordinated pumping.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

I would model the steerable arm on skeletal muscle because its long fibers pull on tendons attached to bones, and a user could choose when to move it. I would model the pump on cardiac muscle: its branched cells connect at intercalated discs, helping them beat together without conscious control. For the gel tube, I would copy smooth muscle cells in the gut wall, which make slow waves that move contents. Cardiac and skeletal muscle both have stripes, but only cardiac muscle generates its own pumping rhythm.

Accept other accurate comparisons supported by the passage. In Part 3, look for a structure and a useful action linked to each of the three choices, plus an accurate similarity and difference.