Elbow in Motion

Trace how muscle attachments and muscle cells move a joint.

HAP.4 "Develop and build a three-dimensional model to illustrate the structures of the muscular system, including muscle locations, origins, and insertions, and explain their roles in movement and support. a..."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB As you read, circle the biceps origin and insertion, underline what causes a muscle fiber to contract and relax, and number the two effects of muscle cell activity described in the last paragraph.

What Lifts a Backpack?

1. Imagine lifting a backpack by its handle. The biceps brachii lies along the front of your upper arm. Its two upper tendons attach to the scapula, its origins, and its lower tendon attaches to the radius, its insertion. When the biceps shortens, it pulls the forearm toward the upper arm, bending the elbow. The triceps brachii on the back of the upper arm pulls the ulna to straighten the elbow. Bones act as levers, while tendons carry the muscles' pull.

2. Inside each skeletal muscle fiber, a signal from a nerve causes calcium ions to leave storage areas in the cell. Calcium exposes binding sites on actin filaments. Myosin heads attach to actin, then use energy from ATP to pull, shortening units called sarcomeres. ATP also helps myosin release actin. When nerve signals stop, the cell uses ATP to pump calcium back into storage. The binding sites become covered again, and the fiber stops actively pulling.

3. During repeated lifts, a muscle may produce less force even while you try just as hard. This is fatigue, which does not always mean the cell has run out of ATP. Changes in ion balance and calcium release can reduce how strongly muscle fibers pull. Even at rest, muscles maintain slight tension called tone because the nervous system activates some fibers. Tone helps steady your elbow between lifts and supports posture without a full contraction.

2 ANSWER WITH EVIDENCE

Use the passage

1. Where are the biceps origins and insertion, and which attachment moves when you bend your elbow?

2. How do calcium and ATP help a muscle fiber shorten?

3. What must happen inside the fiber for active pulling to stop?

4. A person holds a backpack still, then has trouble lifting it again. How might tone and fatigue explain these different effects?

3 YOUR TURN

Your own words

Design a buildable 3D model of an elbow bending. Label the bones, biceps, tendons, origin, and insertion, then add brief notes showing what calcium and ATP do during contraction and relaxation and how tone or fatigue could affect movement.

Elbow in Motion

PART 1 · READ AND MARK

As you read, circle the biceps origin and insertion, underline what causes a muscle fiber to contract and relax, and number the two effects of muscle cell activity described in the last paragraph. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	Where are the biceps origins and insertion, and which attachment moves when you bend your elbow?	**The biceps originates on the scapula and inserts on the radius. The radius moves toward the upper arm as the elbow bends.**
2	How do calcium and ATP help a muscle fiber shorten?	**Calcium exposes binding sites on actin. Myosin attaches and uses ATP to pull actin, shortening sarcomeres.**
3	What must happen inside the fiber for active pulling to stop?	**Nerve signals stop, and ATP powers the return of calcium to storage. Actin's binding sites become covered, so the fiber stops actively pulling.**
4	A person holds a backpack still, then has trouble lifting it again. How might tone and fatigue explain these different effects?	**Tone provides slight tension that helps steady the elbow. After repeated lifts, fatigue may reduce force because changes in ion balance and calcium release affect the fibers.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

Sketch: A raised biceps band runs along the front of the upper arm. Two tendon lines connect it to the scapula, labeled origins. A lower tendon line connects it to the radius, labeled insertion. An arrow shows the radius moving toward the upper arm as the elbow bends. Notes: Calcium exposes actin sites, and myosin uses ATP to pull. When signals stop, ATP helps return calcium to storage so pulling stops. Tone helps steady the elbow.

Accept models that place the biceps on the front of the upper arm and show its pull bending the elbow. Students may use either tone or fatigue in the final note if they connect it to muscle cell activity.