

Muscle and motility · supported focus

Supported focus · HL

Supported scope

- Supported HL focus. First assessment 2025; current subject brief acquired; full Biology guide not acquired. Remaining guide, assessment and practical requirements retain their recorded holds.
- State model conditions and distinguish fictional data from measurements.

Muscle · 1.1

Reasoning

A sarcomere becomes shorter during contraction although its thick and thin filaments keep approximately the same length. Start with a prediction. State the quantities or features you would compare, then decide what evidence could distinguish two explanations.

Muscle · 2.1

Reasoning

Actin and myosin interact in a sliding-filament mechanism. Calcium permits the interaction through regulatory proteins; ATP binding and hydrolysis support the cross-bridge cycle. Skeletal muscles pull through tendons and work in coordinated groups. sarcomere: The repeating contractile unit between two Z lines; cross-bridge: A myosin-actin interaction during the contraction cycle.

Muscle · 3.1

Reasoning

During shortening, overlap increases. The A-band length stays approximately constant while I bands and the H zone become smaller. Movement at a joint also depends on tendon insertion, lever geometry and opposing muscle activity. Annotate two sarcomere diagrams at different lengths using the same scale. Track band widths separately from filament length. Use prepared models or existing images, not painful or maximal-exertion tasks.

Muscle · 4.1

Reasoning

State the known values and their units. Choose the relation because its assumptions fit this case, then rearrange before substitution. Known: sarcomere length changes from 2.5 to 2.0 micrometres. Percentage shortening = $(2.5 - 2.0)/2.5 \times 100 = 20\%$. This does not mean either filament shortened by 20%.

Muscle · 4.2

Reasoning

A sarcomere shortens from 3.0 to 2.4 micrometres. Calculate percentage shortening.

Use the same sequence: known quantities → model → relation → substitution → unit and interpretation.

Muscle · 5.1

Reasoning

ATP is required for myosin detachment as well as the continuing cycle. A muscle pulling harder does not mean all its fibres become shorter under every load. Return to the original observation. Explain what the result supports, which conditions it assumes, and one way to test a competing explanation.

Muscle · 5.2

Reasoning

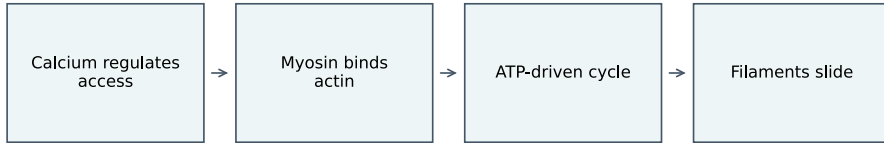
Contracting muscle shortens by shrinking every actin filament. This claim is false: ATP is required for myosin detachment as well as the continuing cycle. A muscle pulling harder does not mean all its fibres become shorter under every load.

Muscle · 5.3

Reasoning

Muscle contraction: filaments slide: During shortening, overlap increases. The A-band length stays approximately constant while I bands and the H zone become smaller. Movement at a joint also depends on tendon insertion, lever geometry and opposing muscle activity.

Muscle · diagram



- Original teaching diagram: Muscle contraction: filaments slide
- Use the labels and the stated model together.

Muscle · original transfer

Your turn

A fictional sarcomere shortens from 2.8 to 2.1 micrometres. Calculate shortening and explain whether the model requires actin filaments to shorten.

Muscle · transfer reasoning

Method and interpretation

25% shortening. Sliding-filament reasoning changes overlap and sarcomere length, not filament length. The numerical observation alone does not measure force or diagnose function.

Check yourself

- Explain sarcomere using the stated model.
- Explain cross-bridge using the stated model.
- Change one value in the original transfer; explain which assumption still matters.