Motor Neurons Cause Muscles to Contract

1. Define a motor unit.
2. Compare the relative number of motor units in the forearm muscles (that control the fingers) versus the number of motor units in the trapezius.
3. Define the terms: epimysium, perimysium and endomysium.
4. What is the difference between the terms fascicle and perimysium? How are the two terms related?
5. Starting with the sarcolemma, name the structures we have studied in muscle anatomy from biggest to smallest.
6. Compare the purpose of the Z line with the purpose of myosin.
7. What is the relationship between striations visible through a microscope and the structure of muscle?
8. In a prepared muscle slide, why is the H zone missing?
9. What type of filament is found in the I band? In the A band? In the H zone?
10. Compare the terms sarcophagus; sarcolemma; and sarcomere.
11. Compare the position of myosin and actin (to each other) during an isotonic and an eccentric contraction.
12. Muscles can contract in parts; and each part of a muscle can contract with different strengths. Explain both of these phenomena.

Answers:

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1. Define a motor unit.
   One neuron and all the muscle cells (fibers) that it controls.
2. Compare the relative number of motor units in the forearm muscles (that control the fingers) versus the number of motor units in the trapezius.
   The same number of muscle fibers will have more neurons controlling them for hand muscles than for trapezius muscles. Or said another way, there a greater number of motor units for regions that require fine motor skill.
3. Define the terms: epimysium, perimysium and endomysium.
   - **epimysium: connective tissue/fascia that surrounds the entire muscle.**
   - **perimysium: connective tissue that is found within a muscle, separating groups of cells into fascicles.**
   - **endomysium: microscopic connective tissue that encapsulates each muscle fiber.**
4. What is the difference between the terms fascicle and perimysium? How are the two terms related?
   - **Fascicle: group of muscle fibers within a muscle.**
   - **Perimysium: connective tissue that surrounds a fascicle.**
5. Starting with the sarcolemma, name the structures we have studied in muscle anatomy from biggest to smallest.
   - **Sarcolemma: cell membrane**
   - **Myofibril: a bundle of sarcomeres within one cell**
   - **Sarcomere: a section of a myofibril**
   - **Myofilament (actin or myosin): one long chain of proteins**
6. Compare the purpose of the Z line with the purpose of myosin.
   - **Z line: connects all the sarcomeres together from the top of the cell to the bottom of the cell.**
   - **Myosin: The thick myofilament that pulls on actin to cause contraction.**
7. What is the relationship between striations visible through a microscope and the structure of muscle?
   The striations visible under the microscope correspond to the A band and the I band that make up a sarcomere.
8. In a prepared muscle slide, why is the H zone missing?
   When a cell is stressed when it is cut, it contracts and the H zone is gone.
9. What type of filament is found in the I band? In the A band? In the H zone?
   - **I band: just actin**
   - **A band: actin and myosin overlapped**
   - **H zone: just myosin (only visible in resting muscle cells)**
10. Compare the terms sarcophagus; sarcolemma; and sarcomere.
    - **sarcophagus: "flesh-eater" = coffin**
    - **sarcolemma: "flesh-husk" = muscle cell membrane**
    - **sarcomere: "flesh-measure" = contractile units found within myofibrils**
11. Compare the position of myosin and actin (to each other) during an isotonic and an eccentric contraction.
    - **Isotonic: Completely overlapped during maximal isotonic contraction**
    - **Eccentric: Barely overlapped; at risk of ripping if pulled too far ("hanging on by its fingernails")**
12. Muscles can contract in parts; and each part of a muscle can contract with different strengths. Explain both of these phenomena.
    Motor units explain why a muscle can only have part of it contract at one time. This has to do with neuronal stimulation of particular muscle cells.
    Availability of calcium and ATP helps explain why a muscle cell can contract with varying strength. As a particular muscle cell is frequently stimulated, more and more calcium and ATP will hopefully become available, until the cell has reached its maximal contraction point.