

Muscle & NMJ

[MU01](#) [a] Characteristics of muscle action potential:

- A. RMP -90 mV
- B. APD 2 to 4 msec **action potential duration**
- C. ERP 1 to 3 msec **absolute refractory period**
- D. Conduction velocity 0.25 to 0.5 m/sec **5m/sec**
- E. All of the above

[MU02](#) [ad] During muscle contraction:

- A. Myosin heads hydrolyse ATP
- B. Z-lines move together **A bands constant**
- C. Myosin cross-links & swivels 90 degrees **bends from 90 to 45deg**
- D. Interaction between actin & tropomyosin occur. **actin & myosin interaction**
- E. Calcium passively passes into SR in relaxation

[MU03](#) [a] Muscle spindle functions:

- A. Increased gamma efferent tone smooths contraction
- B. Increased alpha efferent tone smooths contraction
- C. ?
- D. ?
 - **A gamma efferents supply muscle spindles (intrafusal fibres)**
 - **A beta efferents supply both intrafusal and extrafusal fibres.**
 - **A alpha efferents supply extrafusal fibres.**
 - **The muscle spindle functions as feedback mechanism to maintain muscle length**

[MU04](#) [d] Clonus is more likely if:

- A. Increase in alpha-efferent discharge.

1a > split: 1 to nuclear bag, 1 to nuclear chain fibre of spindle. Also supply extrafusal fibres contributing to stretch reflex which can ↑ clonus

1b originate from GTO. Link to extrafusal fibres > inhibitory interneurons of same mm & excitatory of antagonist. May ↑ clonus

B. Increase in gamma-efferent discharge. causes ↑ ed clonus

C. There is a delay in the circuit- delay gives clonus its characteristic beat

D. Increased tone Increased tone is generally a result of increased gamma efferent discharge, thus more likely to produce clonus

E. All of the above

[MU05](#) [dk] In skeletal muscle:

A. Relaxation is due to passive Ca^{++} uptake by sarcoplasmic reticulum

B. Contraction is due to Ca^{++} release from T tubules

C. Contraction is due to Ca^{++} binding to tropomyosin

D. Z lines move together in contraction

(See also [MU09](#) & its variations as it seems there are 2 or more questions and the options seem to be a little jumbled)

[MU06](#) [d] In smooth muscle:

A. Spontaneous pacemaker potentials are generated. wandering baseline only

B. An action potential is required for contraction. many other processes can cause extracellular Ca entry

C. Ca^{++} is released from sarcoplasmic reticulum. SR poorly developed & Ca is principally extracellular

D. Multiple spiking action potentials occur with increased membrane potential ie less -ve & closer to threshold

[MU07](#) [efklop] Contraction in smooth muscle is different from skeletal muscle:

A. Source of Ca^{++} is different from ECF as SR poor

- B. Force is greater in ?smooth muscle ?skeletal muscle
- C. Unable to produce same force of contraction
- D. Unable to maintain same duration of contraction longer & stronger
- E. Has prolonged latency x50
- F. Sarcomere of skeletal muscle is > smooth muscle is no sarcomere in smooth mm
- G. Increased actin:myosin ratio. smooth mm = 1/3 myosin, x2 action
- H. Increased numbers of mitochondria - v few in smooth mm
- I. More developed endoplasmic reticulum less

[MU07b](#) [q] Vascular smooth muscle differs from skeletal muscle in:

- A. Different source of Calcium
- B. Absence of tropomyosin - does not contain troponin
- C. Contraction not dependant on interaction between actin and myosin
- D. Force developed is less

[MU08](#) [el] Force developed during isotonic contraction is:

- A. Dependent on the load condition
- B. Independent of the load condition
- C. Independent of muscle fibre length
- D. ?

[MU09](#) [f] Muscle :

- A. The A band is dark because it contains thick actin filaments thick myosin
- B. Myosin filaments are attached to the Z line??? titin connects Z lines to M lines providing structure for sarcomere
- C. Sarcomere is the area between 2 adjacent M lines Z
- D. ?

[MU09b](#) [hij] Isotonic contraction of a skeletal muscle fibre is not associated with a change in ? distance between:

- A. Sarcomere length
- B. A bands
- C. I bands
- D. Z-lines move closer together
- E. M-lines move closer together

[MU09c](#) [k] During Isotonic contraction of a skeletal muscle fibre:

- A. Calcium enters from the T tubular system near the myofibrils
- B. ?
- C. ?
- D. Z-lines move closer together
- E.

[MU10](#) [fgk] Tetany does NOT occur in cardiac muscle because:

- A. Long absolute refractory period
- B. Acts as a syncitium
- C. Pacemaker signal can overcome any tetany
- D. ?
- E. ?

[MU11](#) [gn] Sarcomere:

- A. From I line to I line
- B. Actin filament attached to M line
- C. ?
- D. Z line crosses across myofibrils & from muscle fiber to muscle fiber
- E. Smooth muscle cells are larger than skeletal muscle cells. skel mm x20 as thick, x1000 as long

[MU12](#) [fghlopq] The soleus muscle:

- A. High glycogen stores
- B. Few mitochondria
- C. Large nerve fibre
- D. Long duration of contraction**
- E. Large muscle fibre (OR: Large muscle diameter)
- F. High capacity for glycolysis

Fatigue resistant muscles are red because of high myoglobin content.

high mitochondrial content (therefore aerobic metabolism),

slow myosin ATPase (therefore strong sustained contractions up to 100ms),

low levels of glycolytic enzymes (unable to function anaerobically by glycolysis).

Fast twitch muscle fibres are at least twice the diameter of slow twitch fibres.

MU13 [g] Skeletal muscle action potential:

- A. Na & K conductance begin to increase at same time **Sodium conductance increases first then potassium conductance (same as in nerve AP's)**
- B. Units of conductance are mA/cm³ **mmho/cm²**
- C. ?

MU14 [i] An increase in force of a skeletal muscle contraction is initially achieved by:

- A. Recruitment of nerve fibres
- B. Recruitment of muscle fibres
- C. Recruitment of motor units**
- D. Increased intracellular calcium
- E. None of the above

Factors responsible for Grading of muscle contraction

- **recruitment of motor units**
- **frequency of discharge of motor nerves**
- **length of muscle fibre**
- **the asynchronous firing of motor units**

MU15 [io] In a large nerve fibre, the typical action potential duration is:

- A. 0.03 millisecs
- B. 0.3 millisecs**
- C. 3 millisecs
- D. 30 millisecs
- E. 300 millisecs

MU16 [j] The muscular contractions in skeletal muscle working at what level of efficiency?

- A. 10%
- B. 15%
- C. 35%
- D. 50%** work done/ total energy expenditure) ranges up to 50% while lifting a weight during isotonic contraction
- E. 75%

MU17 [j] Annulospiral endings are involved in:

- A. afferent to receptors measuring tension
- B. afferent to receptors measuring length** annulospiral ending is the sensory nerve terminal whose discharge rate increases as the sensory ending is stretched
- C. supply to intrafusal & extrafusal fibres
- D. ?

MU18 [kq] Denervated muscle extrajunctional receptors differ from the motor end plate receptors...

- A Have 1 alpha subunit **gamma substituted for epsilon unit**
- B Open for shorter time **2-10 folder longer**
- C Not produced in the end plate - **extrajunctional ARE also found in MEP**
- D. ?

E None of the above

[MU19](#) [mnop] ("question about energy source for muscles")

A. ?

B. ?

C. Skeletal muscle uses creatine, cardiac and smooth use ATP

D. Skeletal and cardiac muscle uses creatine and smooth muscle uses ATP

E. All muscles utilise creatine

Alt version: An immediate available energy source in muscle is:

A. ATP in all 3 muscles

B. ATP in smooth, phosphorylcreatine in skeletal and cardiac muscle

C,D,E. ("combinations of the above")

[MU20](#) [p] Cardiac muscle is different from skeletal muscle because of:

A. Fast Ca channels

B. Slow Ca channels

C. Fast Na channels

D. Actin and myosin

E. ?

[MU21](#) [qr] Intrafusal fibres

A. Shorter than extrafusal fibres same length as attached to tendons at either end

B. Measure tension in muscle

C. Contain contractile elements

1. "The γ motor fibres supply the contractile ends of the spindle ..."
2. "The sensory nerves are excited by any stretching of the non-contractile centre ..."
3. The primary endings (Ia) are more sensitive to movement and are called 'Dynamic'.
4. The secondary endings (II) are more sensitive to absolute length, and are called 'Static'.

5. Spindle change in length reflexly excite the motor neuron to the extrafusal fibres of the muscle in which they lie.
6. γ efferents are involved in "The γ Loop", a reflex contraction of the skeletal muscle due to activity in the Extra-Pyramidal System. This is referred to as " α - γ linkage" in Ganong (see fig 6-3 and text). The control of γ efferent discharge adjusts the sensitivity of the spindles, which aids postural control.