

BIO 3303 Final Exam Study Questions Set 2

- Which of the following statements is true concerning sonic muscles?
 - A) They contract at much higher frequencies than the locomotor muscles found in the same organism
 - B) They utilize completely different muscle proteins
 - C) They have a very slow rate of cross-bridge cycling
 - D) They are able to contract rapidly while producing large amounts of force
- Vertebrate striated muscles composed of twitch fibers are able to produce a graded contraction by:
 - A) recruiting different numbers of motor units
 - B) summing EPSPs in the motor end-plate region
 - C) having excitatory and inhibitory input to a single muscle
 - D) Vertebrate muscles are unable to produce graded contractions
- The greatest diversity in muscle is seen in
 - A) arthropods
 - B) vertebrates
 - C) molluscs
 - D) cnidarians
- _____ vesicles are transported to the membrane by the motor protein _____.
 - A) Filled; kinesin
 - B) Filled; dynein
 - C) Empty; kinesin
 - D) Empty; dynein
- The microfilament _____ is commonly used with its motor protein, _____.
 - A) actin; dynein
 - B) nexin; dynein
 - C) actin; myosin
 - D) nexin; kinesin
- The _____ of the myosin is where ATP is broken down, providing energy for movement.
 - A) tail
 - B) neck
 - C) head
 - D) light chains
- In the cross-bridge cycle, the power stroke of myosin is immediately preceded by which of the following events?
 - A) the hydrolysis of ATP
 - B) binding the actin
 - C) releasing Pi

D) binding new ATP

8. The unitary displacement of the myosin refers to

A) how many actins are displaced by myosin

B) how far along the actin filament the myosin can move in one cycle

C) how many units of time pass during one cross-bridge cycle

D) how much time the myosin stays bound to the actin before it is displaced

9. During which phase of an excitation-contraction cycle does depolarization occur?

A) excitation

B) inhibition

C) contraction

D) relaxation

10. A single skeletal muscle cell is referred to as a

A) cardiomyocyte

B) sarcomyocyte

C) myofibril

D) myofiber

11. Which myosin isoform is found in fast-twitch muscle?

A) perinatal

B) extraocular

C) type I

D) type IIb

12. In striated muscle, Ca^{2+} regulates contraction by interacting with troponin and tropomyosin. Explain how Ca^{2+} is able to regulate the timing of contraction as well as affecting the kinetics of contraction.

Typically, cytosolic Ca^{2+} levels are very low. When Ca^{2+} concentration rises, it can bind to troponin. Troponin is actually composed of three protein subunits: TnC binds to the Ca^{2+} , TnI binds to the actin (inhibiting myosin/actin interactions), and TnT binds to the tropomyosin. It is the tropomyosin that physically blocks the myosin binding site on actin. When Ca^{2+} binds to TnC, it causes a conformational change so that TnC and TnI become more tightly bound to each other. This, in turn, decreases the interaction between TnI and actin, so that the whole troponin/tropomyosin complex slides over, exposing the myosin binding sites on actin. As long as Ca^{2+} is present, cross-bridge formation can occur. When Ca^{2+} is removed from the cytosol, it is also released from TnC, causing the whole complex to return to its original position. Clearly, the point of control is how quickly and tightly TnC binds to Ca^{2+} , thereby allowing the interactions between troponin, tropomyosin, actin, and myosin to occur. By having different isoforms of all these proteins, organisms can regulate these interactions and their sensitivities to physiological variables (pH, temperature, etc.). Ultimately, this affects the time it takes for contractions to occur.

13. The tension that a sarcomere can produce is related to its length. The same is true for a skeletal muscle, as it is composed of sarcomeres arranged end to end. Explain how the structure of a sarcomere allows the most tension to be generated at an intermediate length, while the longest and shortest lengths will produce very little tension.

A sarcomere extends from one Z-disk to the next. Actin filaments are attached to the Z-disks, while the myosin bundle is attached at the M-line and stretches out toward the Z-disk. Neither group of proteins reaches completely across the sarcomere. When the myosin heads bind to the actin, they are able to generate tension. Thus, the more myosin is able to form cross-bridges with actin, the more tension can be generated. At the longest lengths, there is very little overlap between actin and myosin, making it difficult for any cross-bridges to form. As the sarcomere shortens, the amount of overlap, and therefore cross-bridge number, begins to increase. There is a small range of maximum overlap before the actin fibers from opposite Z-disks begin to overlap each other. At this point, they prevent the normal formation of cross-bridges, and tension begins to decrease. Thus, the more cross-bridges that are formed, the more tension is generated. At the extremes of length, few cross-bridges exist so that little tension is produced. The intermediate length is the point where the maximum number of cross-bridges formed means the most tension is generated as well.

14. Which of the following structures from the vertebrate inner ear is NOT part of the vestibular apparatus?

- A) ampulla
- B) utricle
- C) saccule
- D) cochlea

15. The hair cells of the mammalian cochlea are contained in the

- A) vestibular duct
- B) tympanic membrane
- C) round window
- D) organ of Corti

16. The focal point is the

- A) point between the center of the lens and the retina
- B) point where light waves converge after passing through the lens
- C) small region in the center of the retina responsible for high-acuity vision
- D) narrow band of the electromagnetic spectrum that contains visible light

17. In the vertebrate spinal cord, the dorsal horn is associated with _____ neurons, and the ventral horn is associated with _____ neurons.

- A) motor; sensory
- B) inter; sensory
- C) afferent; efferent
- D) spinal; cranial

18. The efferent branch of the peripheral nervous system is composed of the _____ and _____ divisions.

- A) somatic motor; autonomic
- B) visceral; emotional
- C) sympathetic; parasympathetic
- D) autonomic; involuntary

19. The autonomic nervous system can be differentiated into three branches. Which of the following is NOT one of them?

- A) enteric
- B) sympathetic
- C) parasympathetic
- D) limbic

20. Tropic or trophic hormones

- A) are found in tropical organisms
- B) have the ability to cause other hormones to be released
- C) are secreted only from the hypothalamus
- D) both B and C

21. What endocrine gland secretes ACTH?

- A) anterior pituitary
- B) posterior pituitary
- C) hypothalamus
- D) adrenal medulla

22. In a _____ feedback loop, both the endocrine and nervous systems can be involved.

- A) first order
- B) second order
- C) third order
- D) both B and C

23. Peptide hormones (chains of 50 or fewer amino acids) are first synthesized as

- A) the hormone itself
- B) prehormones
- C) prohormones
- D) preprohormones

24. There are multiple ways in which two cells in an organism can communicate with each other: gap junctions, paracrine and autocrine signals, endocrine signals, and neural signals. Discuss the advantages and drawbacks for each of these types of signals.

Gap junctions allow direct communication, which is very fast, and allows hydrophilic signals to pass through the aqueous channel. They can be used only with cells that are adjacent to each other. Paracrine and autocrine signals are rapid, but can be used only over short distances because they rely on diffusion. Neural communication is very rapid

over long distances, but the signals will not remain effective for a long period of time. Endocrine signals travel more slowly because they rely on a circulatory system for transport, but they remain active for a longer period of time.