Didactic Answers

1. Epimysium surrounds
A. skeletal muscle fibers
B. cardiomyocytes
C. smooth muscle cells
D. skeletal muscle fascicles
E. skeletal muscles

2. Perimysium surrounds
A. skeletal muscle fibers
B. cardiomyocytes
C. smooth muscle cells
D. skeletal muscle fascicles
E. skeletal muscles

3. Endomysium surrounds
A. skeletal muscle fibers
B. cardiomyocytes
C. smooth muscle cells
D. skeletal muscle fascicles
E. skeletal muscles

4. Fascicles are
A. groupings of skeletal muscle fibers
B. groupings of arteries supplying skeletal muscle fibers
C. groupings of veins supplying skeletal muscle fibers
D. groupings of nerve fibers innervating skeletal muscle fibers
E. groupings of collagen surrounding skeletal muscle fibers

5. Muscle fibers normally refer to
A. individual skeletal muscle cells
B. groupings of skeletal muscle cells
C. individual smooth muscle cells
D. groupings of smooth muscle cells
E. groupings of cardiomyocytes

6. Myofibers are
A. muscle fibers
B. cardiomyocytes
C. smooth muscle cells
D. groupings of actomyosin fibers
E. actomyosin fibers

7. Myofibrils are
A. muscle fibers
B. cardiomyocytes
C. smooth muscle cells
D. groupings of actomyosin fibers

E. actomyosin fibers

8. Myofilaments are
A. muscle fibers
B. cardiomyocytes
C. smooth muscle cells
D. groupings of actomyosin fibers
E. actomyosin fibers

9. The sarcolemma is
A. the plasma membrane of muscle cells
B. the endoplasmic reticulum of muscle cells
C. the contractile unit of muscle cells
D. the ATP generating machinery of muscle cells
E. the connective tissue layer between the plasma membrane and the endomysium

10. The external lamina is
A. the plasma membrane of muscle cells
B. the endoplasmic reticulum of muscle cells
C. the contractile unit of muscle cells
D. the ATP generating machinery of muscle cells
E. the connective tissue layer between the plasma membrane and the endomysium

11. The sarcoplasmic reticulum is
A. the plasma membrane of muscle cells
B. the endoplasmic reticulum of muscle cells
C. the contractile unit of muscle cells
D. the ATP generating machinery of muscle cells
E. the connective tissue layer between the plasma membrane and the endomysium

12. The sarcomere is
A. the plasma membrane of muscle cells
B. the endoplasmic reticulum of muscle cells
C. the contractile unit of muscle cells
D. the ATP generating machinery of muscle cells
E. the connective tissue layer between the plasma membrane and the endomysium

13. The A-band
A. is the band where myosin filaments are anchored
B. is the band where actin filaments are anchored
C. contains myosin, but not actin
D. contains actin, but not myosin
E. contains both actin and myosin

14. The H-band
A. is the band where myosin filaments are anchored
B. is the band where actin filaments are anchored
C. contains myosin, but not actin
D. contains actin, but not myosin

E. contains both actin and myosin

15. The I-band
A. is the band where myosin filaments are anchored
B. is the band where actin filaments are anchored
C. contains myosin, but not actin
D. contains actin, but not myosin
E. contains both actin and myosin

16. The Z-line
A. is the band where myosin filaments are anchored
B. is the band where actin filaments are anchored
C. contains myosin, but not actin
D. contains actin, but not myosin
E. contains both actin and myosin

17. The M-line
A. is the band where myosin filaments are anchored
B. is the band where actin filaments are anchored
C. contains myosin, but not actin
D. contains actin, but not myosin
E. contains both actin and myosin

18. Thick filaments contain
A. myosin
B. tubulin
C. nebulin
D. desmin
E. alpha-actinin

19. Thin filaments contain
A. myosin
B. tubulin
C. nebulin
D. desmin
E. alpha-actinin

20. Titin is present in the
A. A-band, but not I-band
B. I-band, but not H-band
C. M-line, but not H-band
D. Z-line, but not I-band
E. A-band and I-band

21. Nebulin is present in the
A. A-band, but not I-band
B. I-band, but not H-band
C. M-line, but not H-band
D. Z-line, but not I-band

E. A-band and I-band

22. Actin is present in the
A. A-band, but not I-band
B. I-band, but not H-band
C. M-line, but not H-band
D. Z-line, but not I-band
E. A-band and I-band

23. Tropomyosin is present in the
A. A-band, but not I-band
B. I-band, but not H-band
C. M-line, but not H-band
D. Z-line, but not I-band
E. A-band and I-band

24. Troponin is present in the
A. A-band, but not I-band
B. I-band, but not H-band
C. M-line, but not H-band
D. Z-line, but not I-band
E. A-band and I-band

25. alpha-actinin is present in the
A. A-band, but not I-band
B. I-band, but not H-band
C. M-line, but not H-band
D. Z-line, but not I-band
E. A-band and I-band

26. Desmin is present in the
A. A-band, but not I-band
B. I-band, but not H-band
C. M-line, but not H-band
D. Z-line, but not I-band
E. A-band and I-band

27. The neuromuscular junction consists of
A. neuronal membrane but not muscle membrane
B. muscle membrane but not neuronal membrane
C. both the neuronal and muscle membranes
D. the space between the neuronal and muscle membranes
E. neuronal membrane, muscle membrane and the space between them

28. The presynaptic membrane consists of
A. neuronal membrane but not muscle membrane
B. muscle membrane but not neuronal membrane
C. both the neuronal and muscle membranes
D. the space between the neuronal and muscle membranes

E. neuronal membrane, muscle membrane and the space between them

29. The post-synaptic membrane consists of
A. neuronal membrane but not muscle membrane
B. muscle membrane but not neuronal membrane
C. both the neuronal and muscle membranes
D. the space between the neuronal and muscle membranes
E. neuronal membrane, muscle membrane and the space between them

30. The motor end plate consists of
A. neuronal membrane but not muscle membrane
B. muscle membrane but not neuronal membrane
C. both the neuronal and muscle membranes
D. the space between the neuronal and muscle membranes
E. neuronal membrane, muscle membrane and the space between them

31. The synaptic cleft consists of
A. neuronal membrane but not muscle membrane
B. muscle membrane but not neuronal membrane
C. both the neuronal and muscle membranes
D. the space between the neuronal and muscle membranes
E. neuronal membrane, muscle membrane and the space between them

32. Junctional folds consists of
A. neuronal membrane but not muscle membrane
B. muscle membrane but not neuronal membrane
C. both the neuronal and muscle membranes
D. the space between the neuronal and muscle membranes
E. neuronal membrane, muscle membrane and the space between them

33. Motor units consists of
A. Fascicles of muscle fibers
B. Groupings of cardiomyocytes linked through gap junctions to a single Purkinje cell
C. Groupings of cardiomyocytes enervated by a common neuron
D. Groupings of muscle fibers enervated by a common neuron
E. Groupings of smooth muscle fibers enervated by a common neuron

34. Acetylcholine is
A. the only natural trigger for skeletal muscle contraction
B. a common natural trigger for skeletal muscle contraction
C. the only natural trigger for smooth muscle contraction
D. a common natural trigger for cardiac muscle contraction
E. the only natural trigger for cardiac muscle contraction

35. The acetylcholine receptor is present
A. at the tips of junctional folds
B. at the base of junctional folds
C. on the presynaptic membrane
D. in the synaptic cleft

E. on Schwann cells

36. T-tubules are contiguous with which other membrane system
A. sarcolemma
B. sarcoplasmic reticulum
C. endosome
D. lysosome
E. golgi

37. Triads are positioned near
A. Z-lines
B. I-band
C. I-band/A-band border
D. A-band
E. M-line

38. Calsequestrin is present in
A. Terminal cisternae
B. Golgi
C. T-tubules
D. Cytoplasm near t-tubules
E. mitochondria

39. Type I fibers have which of the following properties
A. slow twitch, oxidative, myoglobin rich
B. fast twitch, oxidative, myoglobin rich
C. slow twitch, glycolytic, myoglobin rich
D. fast twitch, oxidative, myoglobin poor
E. fast twitch, glycolytic, myoglobin poor

40. Type IIb fibers have which of the following properties
A. slow twitch, oxidative, myoglobin rich
B. fast twitch, oxidative, myoglobin rich
C. slow twitch, glycolytic, myoglobin rich
D. fast twitch, oxidative, myoglobin poor
E. fast twitch, glycolytic, myoglobin poor

41. All of the following is true of type IIa fibers except
A. they use oxidative phosphorylation to generate ATP
B. they use glycolysis to generate ATP
C. they use myoglobin to store oxygen
D. they are rich in mitochondria
E. they have longer endurance than either type I or type IIb fibers

42. At the myotendinous junction, muscle fibers penetrate the tendon with processes rich in
A. desmin
B. actin
C. myosin
D. tubulin

E. keratin

43. The Golgi tendon organ is a sensory structure that senses
A. tension
B. rate of muscle extension, but not the extent of muscle extension
C. rate of muscle contraction, but not the extent of muscle extension
D. both the rate of muscle extension and the extent of muscle extension
E. both the rate of muscle contraction and the extent of muscle extension

44. Muscle spindles sense
A. tension
B. rate of muscle extension, but not the extent of muscle extension
C. rate of muscle contraction, but not the extent of muscle extension
D. both the rate of muscle extension and the extent of muscle extension
E. both the rate of muscle contraction and the extent of muscle extension

45. Extrafusal fibers are also called
A. muscle fibers
B. muscle fascicles
C. endomysium
D. perimysium
E. epimysium

46. Intrafusal fibers are also called
A. muscle fibers
B. muscle fascicles
C. endomysium
D. perimysium
E. epimysium

47. Satellite cells are the stem cells of
A. Skeletal muscle
B. cardiac muscle
C. smooth muscle
D. endothelial cells
E. motor neurons

48. Dystrophin is a component of which cytoskeletal system in muscle
A. myofilament
B. intermediate filament
C. microtubule
D. membrane skeleton
E. stress fiber

49. Lipofuscin granules cluster near
A. mitochondria
B. the nucleus
C. the sarcolemma
D. myofibrils

E. golgi

50. The pericardium is
A. a layer of connective tissue that surrounds the heart
B. a layer of mesothelium that surrounds the heart
C. a layer of connective tissue that separates fascicles within the heart
D. a layer of connective tissue that separates the myocardium from lumen of the heart
E. a layer of connective tissue that separates individual cardiomyocytes

51. The epicardium is
A. a layer of connective tissue that surrounds the heart
B. a layer of mesothelium that surrounds the heart
C. a layer of connective tissue that separates fascicles within the heart
D. a layer of connective tissue that separates the myocardium from lumen of the heart
E. a layer of connective tissue that separates individual cardiomyocytes

52. The endocardium is
A. a layer of connective tissue that surrounds the heart
B. a layer of mesothelium that surrounds the heart
C. a layer of connective tissue that separates fascicles within the heart
D. a layer of connective tissue that separates the myocardium from lumen of the heart
E. a layer of connective tissue that separates individual cardiomyocytes

53. The myocardium of ventricles contains
A. just cardiomyocytes
B. cardiomyocytes and Purkinje fibers
C. cardiomyocytes and smooth muscle cells
D. cardiomyocytes and fibroblasts
E. cardiomyocytes and adipocytes

54. All of the following are true of cardiomyocytes except
A. they generate ATP through oxidative phosphorylation
B. their myofilament system is organized into sarcomeres
C. they have secretory functions
D. they are multinucleate
E. they transfer mechanical force to their neighbors through the external lamina

55. Purkinje fibers are
A. a type of neuronal cell
B. a type of cardiomyocyte
C. a type of muscle fiber
D. a type of extracellular matrix
E. a type of myofibril

56. All of the following are differences between diads and triads except
A. The t-tubule of diads have one associated terminal cisternae, while triads have two
B. Diads have larger t-tubules than triads
C. Diads are localized to the Z-line, while triads are localized to the I-band/A-band transition
D. Diads and triads use different channels during excitation coupling

E. Relaxation is primarily driven by pumping calcium into the t-tubule of diads and the terminal cisternae of triads

57. Intercalated discs contain
A. desmosomes and fascia adherens but not gap junctions
B. fascia adherens and gap junctions but not desmosomes
C. desmosomes and gap junctions but not fascia adherens
D. desmosomes, fascia adherens and gap junctions
E. just fascia adherens

58. ANP granules are produced by
A. Vascular smooth muscle cells
B. Skeletal muscle fibers
C. Atrial cardiomyocytes
D. Ventricular cardiomyocytes
E. The kidney

59. The external lamina transmits force between
A. Smooth muscle cells
B. Skeletal muscle cells
C. Cardiomyocytes
D. Smooth muscle cells and cardiomyocytes
E. Skeletal muscle cells and cardiomyocytes

60. Dense bodies appear dark in electron micrographs because
A. they have a high protein density
B. they have lipofusin associated with them
C. they have lipid membranes associated with them
D. they are rich in carbohydrate
E. they are rich in myoglobin

61. Caveolae contribute what during smooth muscle contraction
A. site of calcium entry
B. site of potassium entry
C. site of ATP synthesis
D. site of attachment of myofilaments
E. site of attachment between smooth muscle cells

62. Myoepithelial cells use which actin for contraction
A. alpha1-actin (skeletal muscle actin)
B. alpha2-actin (smooth muscle actin)
C. alphaC-actin (cardiac muscle actin)
D. beta-actin
E. gamma1-actin

63. Myofibroblasts use which actin for contraction
A. alpha1-actin (skeletal muscle actin)
B. alpha2-actin (smooth muscle actin)
C. alphaC-actin (cardiac muscle actin)

D. beta-actin
E. gamma1-actin