Name: ____________________________________________

Instructions
This exam consists of 50 questions. You may write on the exam itself, but be sure to answer all your questions on a “Scantron” sheet with a #2 pencil. For each question there is one response that is the best response. You must select the one best response to receive credit for each question. If you select more than one response for a question, then you will receive no credit for that question.

If you fill in a response on the answer sheet and wish to change your response, then be sure to completely erase the errant response. I recommend that you read all responses for a question before selecting your answer. **In fact, you should answer all your questions on this exam, and then fill out your Scantron sheet after you are sure of your answers.**

Be sure to write your name on this exam booklet and on the answer sheet. Turn in both the exam booklet and answer sheet as you leave the testing center. If you believe that a question on this exam is in error or unclear, then you may write comments on the exam booklet or on a separate sheet of paper.
1. Which type of muscle tissue is generally considered to be “voluntary”?
   a. smooth muscle
   b. cardiac muscle
   c. skeletal muscle
   d. Responses “a” and “b” are correct.
   e. Responses “b” and “c” are correct.

2. The cells of cardiac muscle tissue are connected to each other with gap junctions. This is also true of which other type of muscle tissue?
   a. skeletal muscle
   b. visceral smooth muscle
   c. multiunit smooth muscle
   d. Responses “a” and “b” are correct.
   e. Responses “a” and “c” are correct.

3. Which type of muscle tissue is found in arrector pili muscles and the iris of the eye?
   a. visceral smooth muscle
   b. multiunit smooth muscle
   c. cardiac muscle
   d. skeletal muscle

4. __________________ is the characteristic of a muscle cell most closely related to the fact that a muscle cell can be stretched beyond its resting length.
   a. Contractility
   b. Excitability
   c. Elasticity
   d. Extensibility
   e. Flexibility

5. A cell is an “excitable” cell if it can
   a. generate tension.
   b. contract.
   c. respond to stimuli.
   d. produce ATP.
   e. conduct action potentials.
6. Which one of the following functions is typically performed by skeletal muscle tissue?
   a. generate heat
   b. maintain posture of the body
   c. stabilize joints
   d. All of the responses above are correct.
   e. None of the responses above is correct.

7. Which structure contains all of the others?
   a. myofibril
   b. fascicle
   c. muscle fiber
   d. sarcolemma
   e. endomysium

For each question 8-10, select one of the following responses:
   a. aponeurosis
   b. endomysium
   c. epimysium
   d. perimysium
   e. tendon

8. What is the connective tissue that wraps around an entire muscle?

9. What is a narrow, rope-like connective tissue structure that attaches a muscle to a bone?

10. What is the connective tissue that wraps a fascicle?

11. In a muscle cell the term “sarcolemma” refers to the cell’s
    a. T tubules.
    b. endoplasmic reticulum.
    c. plasma membrane.
    d. Golgi bodies.
    e. myofibrils.
For questions 12-14, select your answers from the following responses:

a. terminal cisterna
b. sarcoplasmic reticulum
c. T tubule
d. myofibril
e. More than one of the responses above is correct.

12. Which structure is involved in conducting action potentials?

13. Which structure is a bundle of actin and myosin filaments?

14. Which structure forms part of a triad?

For questions 15-17 select one of the letters a-d from the diagram below.
Select the letter “e” on your answer sheet if MORE THAN ONE of the letters a-d is correct.

15. Which letter indicates an A band?

16. Which letter indicates a Z disc?

17. Which letter indicates a structure that may change in length during a contraction?
18. Which one of the following lists places parts of a muscle in proper order of increasing size?
   a. thick filament—myofibril—muscle fiber—fascicle—muscle
   b. myofibril—thick filament—muscle fiber—fascicle—muscle
   c. muscle fiber—thick filament—sarcomere—fascicle—muscle
   d. thick filament—sarcomere—fascicle—muscle fiber—muscle
   e. sarcomere—muscle fiber—myofibril—fascicle—muscle

19. Consider a muscle fiber in which Ca\(^{++}\) is present at a high concentration in the myofibrils, but there is no ATP. What state will the muscle fiber be in?
   a. relaxation
   b. contraction
   c. rigor
   d. extension

20. Consider a relaxed muscle in the human body. Imagine that all of a sudden, all of the troponin magically disappears. What state is the muscle in now?
   a. relaxation
   b. contraction
   c. rigor
   d. extension

21. Wave summation occurs because
   a. the amount of myosin binding to actin decreases when a muscle is stimulated rapidly.
   b. rapid stimulations allow more calcium to enter the myofibrils.
   c. rapid stimulations cause calcium channels to close more quickly.
   d. calcium channels are blocked by rapid stimulations.
   e. action potentials become stronger during rapid stimulation.

22. A muscle is stimulated repeatedly. Each stimulation occurs after the muscle has begun to relax, but before the muscle has relaxed completely. Which term below best describes this situation? (I suggest you draw a picture.)
   a. incomplete tetanus
   b. complete tetanus
   c. separate, identical twitches
   d. paralysis
   e. None of the responses above is correct.
23. Which one of the following sentences best defines “isotonic”?
   a. The force being generated remains fairly constant as the length changes.
   b. The force being generated increases at a constant rate.
   c. The length remains fairly constant.
   d. The length decreases before it increases.
   e. The force remains equal to the length.

24. What happens during the contraction phase of a muscle twitch?
   a. The number of myosin heads doing the crossbridge cycle increases.
   b. The amount of Ca\(^{++}\) bound to troponin decreases.
   c. The concentration of Ca\(^{++}\) in the sarcoplasmic reticulum increases.
   d. More than one of the responses above is correct.

25. In skeletal muscle tissue, a motor unit typically consists of
   a. one somatic motor neuron and more than one skeletal muscle fibers.
   b. one skeletal muscle fiber and more than one somatic motor neurons.
   c. one somatic motor neuron and one skeletal muscle fiber.
   d. many somatic motor neurons and many skeletal muscle fibers.

26. A child is born with a mutation in the gene that makes troponin in the skeletal muscles. As a result of this mutation, calcium cannot bind to the troponin. Which one of the following statements is true about this child when he is born?
   a. This child’s muscles are in a constant state of contraction, like tetanus.
   b. This child’s muscles cannot contract.
   c. This child’s muscles are in a state of rigor.
   d. This child’s muscles are constantly twitching.
   e. This child is able to function normally.

27. Which one of the following molecules can myosin attach to?
   a. actin
   b. ATP
   c. ADP
   d. All of the answers above are correct.
   e. None of the answers above is correct.
28. You discover a chemical that blocks calcium pumps in the sarcoplasmic reticulum. Which one of the following processes cannot occur in a muscle fiber with this chemical?
   a. binding of acetylcholine to receptors on the motor end plate
   b. myosin crossbridge cycling
   c. spread of an action potential across the sarcolemma
   d. release of acetylcholine by a somatic motor neuron
   e. relaxation of muscle fibers

29. Consider a myosin head that is attached to a thin filament. As ADP and P\textsubscript{i} are **released** from the myosin head
   a. the myosin head will release the thin filament.
   b. the myosin head will bind to calcium.
   c. the myosin head will generate the powerstroke.
   d. the myosin head will “recock” so that it can grab actin again.

30. If a muscle is in a state of contraction and getting shorter, then the muscle is performing
   a. a concentric isometric contraction.
   b. a concentric isotonic contraction.
   c. an eccentric isometric contraction.
   d. an eccentric isotonic contraction.
   e. The question does not provide enough information to determine the correct answer.

31. Which type of skeletal muscle fiber typically has the most mitochondria and myoglobin?
   a. slow oxidative
   b. fast glycolytic
   c. fast oxidative

32. Which type of skeletal muscle fiber is most important for intense, high-strength exercise (such as lifting heavy weights)? These fibers may increase in size considerably as a result of this exercise.
   a. slow oxidative
   b. fast glycolytic
   c. fast oxidative
For questions 33 to 35 refer to the following diagram of a muscle twitch:

33. Which letter shows the point at which the most myosin heads are pulling on actin?

34. Which letter indicates the latent phase of the muscle twitch?

35. Which letter indicates the contraction phase of the muscle twitch?

36. When acetylcholine is released by a motor neuron at the neuromuscular junction, it stimulates depolarization of the muscle fiber. Which type of channel does acetylcholine directly stimulate to open?
   a. chemical-gated sodium channel
   b. chemical-gated potassium channel
   c. voltage-gated sodium channel
   d. voltage-gated potassium channel
   e. voltage-gated calcium channel

37. By what process does Ca^{2+} move through a calcium channel in the sarcoplasmic reticulum?
   a. simple diffusion
   b. facilitated diffusion
   c. filtration
   d. active transportation
   e. exocytosis

38. A person who studies skeletal, cardiac, and smooth muscle tissue is best described as a
   a. cytologist.
   b. histologist.
   c. physiologist.
   d. gross anatomist.
39. Which of the following structures contains collagen?
   a. tendon
   b. compact bone
   c. articular cartilage
   d. All of the responses above are correct.
   e. None of the responses above is correct.

40. A tendon is made of
   a. stratified squamous epithelium
   b. areolar connective tissue
   c. elastic cartilage
   d. dense regular connective tissue
   e. transitional connective tissue

41. ________________ is defined as “the study of living things.”
   a. Anatomy
   b. Biology
   c. Cytology
   d. Embryology
   e. Physiology

42. Which one of the following lists has structures ordered from the simplest level of organization to the most complex?
   a. actin–muscle fiber–skeletal muscle tissue–biceps brachii
   b. muscle fiber–myosin–skeletal muscle tissue–trapezius
   c. cardiac muscle fiber–troponin–cardiac muscle tissue–heart
   d. calcium–smooth muscle cell–stomach–visceral smooth muscle

43. Which one of the following phrases best defines “homeostasis”?
   a. the body’s ability to use positive feedback systems
   b. the body’s ability to use negative feedback systems
   c. the body’s ability to respond to change
   d. control exerted by the nervous and endocrine systems
   e. the ability to maintain a fairly constant internal environment
44. If blood calcium levels are low, which type of cell is stimulated to become more active?  
   a. osteocyte  
   b. osteoblast  
   c. osteoclast  
   d. All of the responses above are correct.  
   e. None of the responses above is correct.

45. The most superficial layer of the skin on a person’s chest is the stratum  
   a. basale.  
   b. corneum.  
   c. granulosum  
   d. lucidum  
   e. spinosum.

46. The peripheral nervous system is divided into the  
   a. brain and spinal cord.  
   b. sympathetic and parasympathetic systems.  
   c. CNS and PNS.  
   d. somatic and autonomic systems.  
   e. afferent and efferent systems.

47. Which type of joint allows the most different kinds of movement?  
   a. plane  
   b. hinge  
   c. pivot  
   d. ball-and-socket  
   e. suture

48. Of the four major regions of the brain, which is mostly responsible for conscious thought?  
   a. cerebrum  
   b. diencephalon  
   c. brain stem  
   d. cerebellum
49. Which one of the following statements best describes the role of the autonomic nervous system?
   a. The ANS controls homeostasis of the body.
   b. The ANS carries sensory and motor information between the CNS and effectors.
   c. The ANS is responsible for exciting organs of the body.
   d. The ANS carries motor commands from the CNS to glands, smooth muscle, and the heart.

50. Which of the following structures is stimulated by the sympathetic nervous system?
   a. smooth muscle of the stomach
   b. salivary gland
   c. cardiac muscle
   d. smooth muscle of the bladder
   e. None of the responses above is correct.