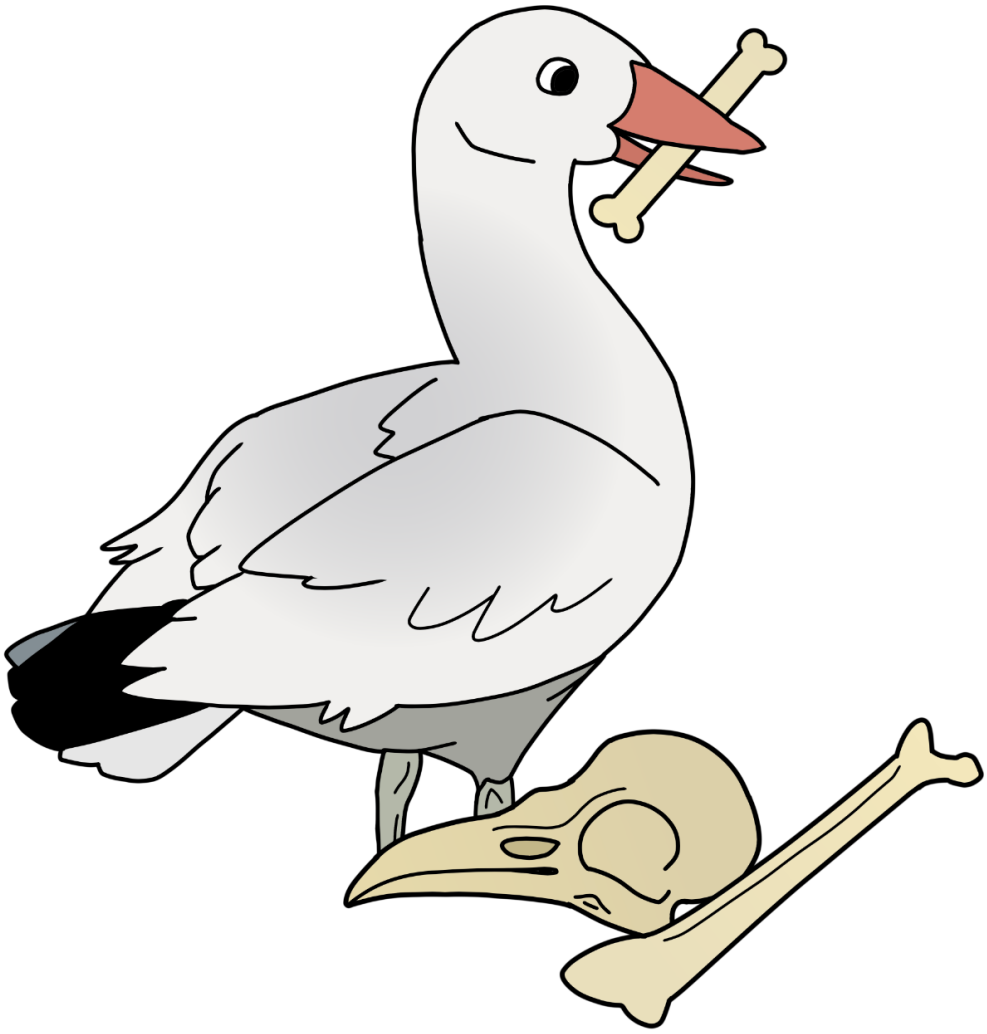
Anatomy and Physiology



Directions:

- 118 questions, split roughly equally between the Integumentary, Skeletal and Muscular systems
- 50 minutes
- One double-sided cheat sheet

Score: /190

Integumentary System

For questions 1 through 6, identify which layer of the epidermis is being described. Answer using the letter only.

A. Stratum basale
B. Stratum spinosum
C. Stratum granulosum
D. Stratum lucidum
E. Stratum corneum

1. (1.00 pts) Thickest layer of the epidermis (by size)
B

2. (1.00 pts) Beginning of keratinization and cell death
C

3. (1.00 pts) Contains melanocytes and Merkel cells
A

4. (1.00 pts) Forms a water barrier through the secretion of lamellar bodies
C

5. (1.00 pts) Contains a clear, transformed product of keratohyalin
D

6. (1.00 pts) Scaly layer that contains anucleate cells
E

7. (2.00 pts) The stratum spinosum was named for its spine-like appearance. What causes the formation of these spine-like projections?
The projections are an artifact of tissue preparation due to the shrinking of cells.

8. (2.00 pts) Which of the following statements about keratinocytes is FALSE?
A) They are attached to Merkel cells by desmosomes

B) They take up melanin through the phagocytosis of the tips of melanocyte processes

C) They regulate calcium absorption through the formation of vitamin D

D) They are attached to the basement membrane by hemidesmosomes

9. (2.00 pts) Select all of the following that correctly match the cell or layer and the tissue it is derived from.

A) Epidermis--ectoderm

B) Dermis--mesoderm

C) Hypodermis--endoderm

D) Langerhans cells--ectoderm

E) Melanocytes--mesoderm

10. (2.00 pts) Why is melanin found only in the deeper layers of the epidermis?

A) It is broken down by lysosomes over time

B) It is lost when cells die in the surface layers of the skin

C) It is recycled by melanocytes in the stratum spinosum

D) It is degraded by long-term exposure to UV light

11. (2.00 pts) In addition to protecting the hypodermis from UV rays, melanocytes also function in the immune response. Which of the following is NOT an attribute of melanocytes that supports their characterization as immune cells?

A) They have a branched structure that is similar to dendritic cells

B) They are derived from the same cells that produce Langerhans cells

C) They express Class II MHCs and can activate T-cells

D) They secrete cytokines

12. (1.00 pts) Which of the following is the only region of hair containing soft keratin?

A) Hair matrix

B) Cortex

C) Cuticle

D) Medulla

13. (1.00 pts) Women tend to have a greater proportion of which type of hair than men?

A) Lanugo hair

B) Vellus hair
C) Terminal hair
D) Axillary hair

14. (1.00 pts) Which of the following correctly describes the catagen phase of hair growth?
A) Shedding of hair
B) Active growth
C) Resting phase prior to shedding
D) Transition phase between active growth and the resting phase

15. (2.00 pts) Aging causes what changes in melanin production that lead to grey hair?
Decreased melanin production

16. (2.00 pts) Hair and nails are composed of hard keratin, while epidermal cells contain soft keratin. What is the difference between these two types of keratin?
Hard keratin contains more cross-links than soft keratin

17. (1.00 pts) The hyponychium of the nail consists of a thickened layer of which layer of the epidermis?
A) Stratum corneum
B) Stratum lucidum
C) Stratum granulosum
D) Stratum spinosum
E) Stratum basale

18. (1.00 pts) The base of the nail often has a curved, white region. What is the name of this region and why is it colored differently from the rest of the nail?
The lunula or lunule. It has a thicker nail matrix (1), which blocks color from the capillaries.

19. (2.00 pts) The secretion of sebum by sebaceous glands is characterized by which of the following?
A) Exchange through channel proteins
B) Release of a secretory vesicle

C) Loss of a portion of the cytoplasm

D) Destruction of the cell

20. (2.00 pts) Which of the following is FALSE regarding sebaceous glands?

A) They cause acne through blocking of the gland duct

B) They secrete the vernix caseosa, a greasy layer that covers the skin at birth

C) They produce secretions that mix with sweat to form the acid mantle

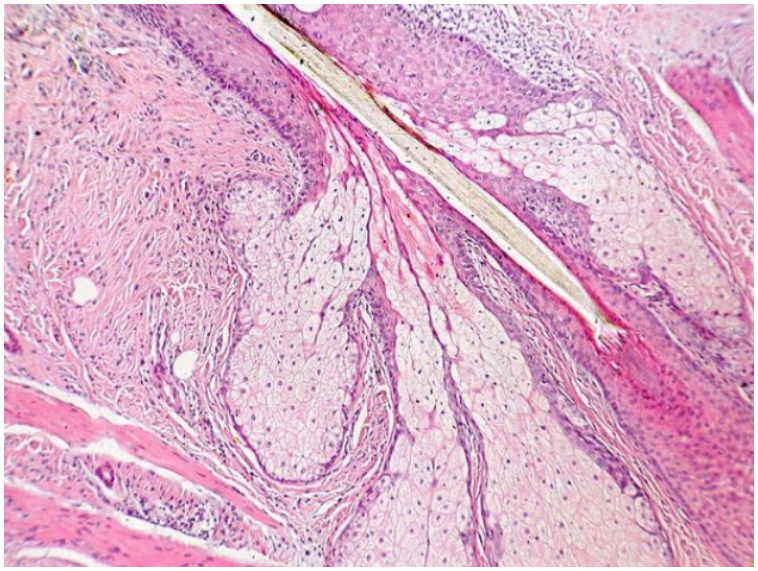
D) They produce earwax through specialized ceruminous glands

21. (2.00 pts) Exocrine glands are classified by their method of secretion into which three groups?

Merocrine/eccrine, apocrine, holocrine

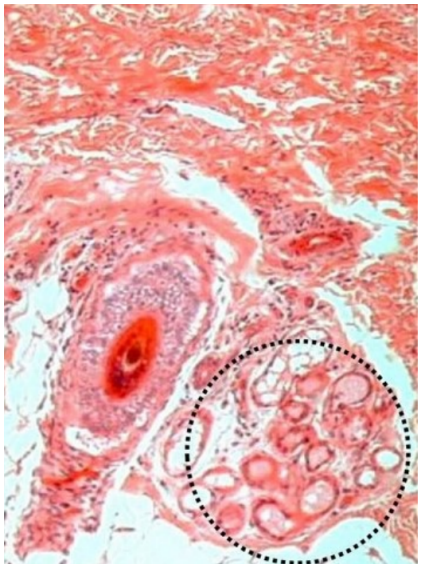
For questions 22 through 24, identify the sweat gland based on the image.

22. (1.00 pts)



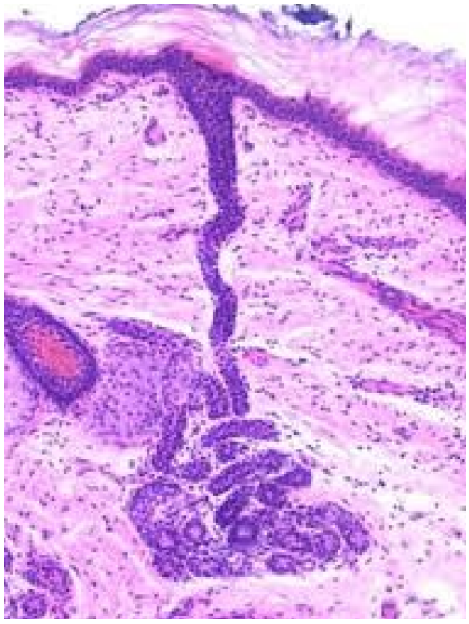
Sebaceous gland

23. (1.00 pts)



Apocrine gland

24. (1.00 pts)



Eccrine gland

25. (2.00 pts) Pacinian corpuscles are sensory structures that are correctly described by which of the following?

A) Tactile corpuscles that detect light touch

B) Lamellar corpuscles that detect deep pressure

C) Bulbous corpuscles that detect warmth and stretch

D) Bulboid corpuscles that detect cold

26. (2.00 pts) Which of the following mechanoreceptors detects light touch with a frequency of 10-50 Hz at the level of the dermal papillae?

A) Meissner's Corpuscles
B) Krause End Bulbs
C) Ruffini Corpuscles
D) Merkel Disks
E) Pacinian Corpuscles

27. (1.00 pts) What is the most immediate threat of severe burns?
Loss of body fluids

28. (1.00 pts) In what degree of burns are nerve endings first destroyed?

A) First
B) Second
C) Third
D) Fourth

29. (2.00 pts) An adult has been burnt on their right leg, right arm, and lower back. What percentage of their body is this? Answer with the number only.
36

30. (2.00 pts) Which of the following is NOT a correct step in the synthesis of vitamin D?

A) Absorption of UVA radiation by the lower layers of the epidermis
B) Synthesis of cholecalciferol from a cholesterol derivative
C) Conversion of calcifediol to calcitriol in the kidney
D) Conversion of cholecalciferol to calcifediol in the liver

31. (2.00 pts) HPV infection has been linked to the development of squamous cell carcinoma. What is the cause of this relationship?

A) It directly mutates the p53 gene by disrupting it when integrating into nuclear DNA.
B) It inhibits the apoptosis that normally occurs in response to exposure to UV light

C) It disrupts the expression of proteins that are involved in DNA repair, leading to the accumulation of lesions in DNA
D) It depresses the local immune system, decreasing immune surveillance for tumor cells

32. (1.00 pts) Squamous cell carcinoma arises from mutations in what type of cell?
Keratinocytes

33. (2.00 pts) Which of the following is NOT true of impetigo?
A) It is a bacterial infection that most commonly occurs in young children
B) It occurs primarily in the non-bulbous form
C) It can be spread through contact with dried bacteria in the air
D) It is usually treated through antibiotics, but individuals often recover without treatment within three weeks

Questions 34-36:
Jan, who is 24 years old, has developed a dry rash with white scales across her skin. She notices that the condition worsens in the winter and during times of stress.

34. (2.00 pts) What condition does Jan have?
Psoriasis

35. (2.00 pts) What is the cause of this condition? What cell type does it involve?
Auto-immune disease causing excessive growth of the epidermis due to premature proliferation of keratinocytes

36. (1.00 pts) Name one other condition that Jan's condition has been associated with.
Ex. obesity, diabetes, hypertension, heart disease, etc

Skeletal System

37. (1.00 pts) Which of the following structures is made up of non-fibrillar collagen?

A) Bone (Type I)

B) Cartilage (Type II)

C) Reticulate (Type III)

D) Basal lamina (Type IV)

38. (1.00 pts) All connective tissues develop from which germ layer?

Mesoderm

For questions 39 to 42, select the type of cartilage that matches the description. Answer with only the letter.

A. Hyaline cartilage

B. Fibrocartilage

C. Elastic cartilage

39. (1.00 pts) Forms the temporary embryonic skeleton and is later replaced by bone

A

40. (1.00 pts) Forms scar tissue at joints when damage to articular cartilage reaches the subchondral bone

B

41. (1.00 pts) Made up of both type I and type II collagen

B

42. (1.00 pts) Composed of chondrocytes that lie between dark bundles of fibers

C

43. (2.00 pts) Hydroxyapatite is made up of which two minerals?

Calcium phosphate, calcium carbonate

44. (2.00 pts) Osteoclasts are most directly formed from which of the following?

A) Monocytes

B) Osteogenic cells
C) Osteoblasts
D) Stromal cells

45. (2.00 pts) What is the function of osteocytes?
A) Forms new bone by secreting collagen and calcium salts
B) Differentiates into osteoblasts and maintains existing cells
C) Breaks down and resorbs bone
D) Maintains the mineral concentration of the matrix

46. (1.00 pts) Which of the following cell types is multinucleated and has a ruffled border?
A) Osteoblasts
B) Osteoclasts
C) Osteogenic cells
D) Osteocytes

47. (2.00 pts) Select all of the statements that correctly describe bone structure.
A) Lacunae are oblong spaces that sit between lamellae and contain osteocytes
B) Volkmann's canals supply blood vessels and nerves to osteons and run parallel to the long axis of the bone
C) Canaliculi contain cytoplasmic projections from osteocytes, which are joined together by gap junctions
D) Osteons are composed of circumferential lamellae that surround a central canal

48. (2.00 pts) The periosteum is connected to the underlying bone by what structures?
Sharpey's fibers

49. (2.00 pts) How does the distribution of bone marrow change in adulthood? Where is most red bone marrow found in adults?
Much of the red bone marrow is replaced by yellow bone marrow. Red marrow is found only in the flat bones (1) and the heads of the femur and humerus.

50. (2.00 pts) What is the role of the "sacrificial bonds" that form between collagen fibers in the bone?

These bonds break energy, dissipating energy when stress is placed on the bone

51. (2.00 pts) Which of the following statements is FALSE regarding intramembranous ossification?

A) It is initiated by mesenchymal cells, which develop into osteoblasts

B) Osteoblasts secrete osteoid and form spicules, which fuse to form a trabecular network

C) The periosteum forms around the trabeculae from osteogenic cells

D) The trabecular bone crowds blood vessels, which condense into red bone marrow

52. (2.00 pts) In endochondral ossification, what does the periosteum develop from?

A) The perichondrium

B) The primary ossification center

C) Peripheral mesenchymal cells

D) Osteogenic cells

53. (1.00 pts) About what percentage of the skeleton is remodeled annually?

A) 1-2%

B) 5-10%

C) 12-15%

D) 20-25%

54. (2.00 pts) Select all that are true of bone modeling and remodeling.

A) Modeling leads to appositional growth, which is growth in length

B) In remodeling, resorption occurs along the medullary cavity while deposition occurs beneath the periosteum

C) In modeling, osteoblasts produce new bone by intramembranous ossification

D) Remodeling is necessary because the calcium salts crystallize over time, making the bone brittle

55. (1.00 pts) Dan has a fracture that injures his metaphysis (but not his epiphysis). How is this fracture classified under the Salter-Harris system (I, II, III...)?
VIII

56. (2.00 pts) According to Wolff's law, bone is remodeled according to the stress that is placed upon it. How do osteocytes detect the deformation of bone that occurs in response to stress?
Bone deformation pushes fluid containing ions through the canaliculi, which creates an electrical current

For questions 57 to 61, select all of the classifications that the following joints fall under. Enter only the letter.

A. Fibrous
B. Cartilaginous
C. Synovial
D. Synarthrosis
E. Amphiarthrosis
F. Diarthrosis

57. (1.00 pts) Intervertebral disk
B, E

58. (1.00 pts) Periodontal ligament
A, D

59. (1.00 pts) Suture
A, D

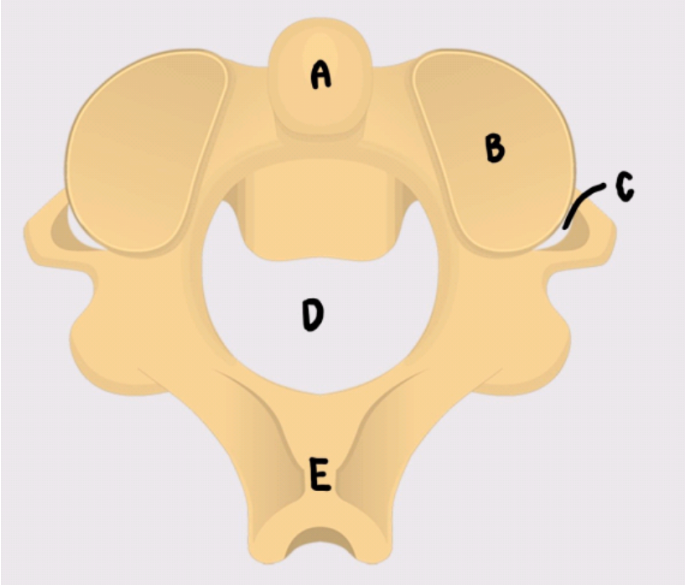
60. (1.00 pts) Radiocarpal joint
C, F

61. (1.00 pts) Interosseous membrane
A, E

62. (1.00 pts) Which of the following types of joints is composed of fibrocartilage and functions in shock absorption?

A) Syndesmosis
B) Synchondrosis
C) Symphysis
D) Synostosis

For questions 63 to 67, label the following vertebra.



63. (1.00 pts) A
Odontoid process/dens

64. (1.00 pts) B
Superior articular facet

65. (1.00 pts) C
Transverse foramen

66. (1.00 pts) D
Vertebral foramen

67. (1.00 pts) E
Spinous process

68. (2.00 pts) Select all of the statements that are true regarding the hormonal regulation of calcium levels in the blood.

A) Parathyroid hormone acts on the kidney to stimulate calcitriol production

B) An excess of calcium in the blood leads to the production of calcitonin by the thyroid gland

C) The effects of parathyroid hormone and calcitonin oppose each other

D) Vitamin D is used to produce calcitonin, and deficiencies in vitamin D lead to defective mineralization

69. (2.00 pts) Which of the following is NOT a characteristic of hypocalcemia?

A) Impaired blood coagulation

B) Lethargy

C) Brittle bones

D) Difficulty in muscle contraction

70. (3.00 pts) Displacement of the ____ group in hydroxyapatite by fluoride leads to the formation of _____, which helps _____ the bone.

Hydroxyl, fluorapatite, strengthen

71. (3.00 pts) A lateral blow to the knee, particularly in certain athletic injuries may result in the rupture of which three structures, also known as the "unhappy triad"?

Anterior cruciate ligament, tibial/medial collateral ligament, medial or lateral meniscus

For questions 72 to 74, identify the condition in the image.

72. (1.00 pts)

Disc herniation

73. (1.00 pts)

Ankylosing spondylitis

74. (1.00 pts)

Spinal fracture

75. (2.00 pts) Achondroplasia is a genetic disorder that exhibits what inheritance pattern?

A) Autosomal dominant
B) Autosomal recessive
C) Y-linked dominant
D) Y-linked recessive

Questions 76 to 78: Deb, a 55-year-old woman, has numbness and weakness in her arms and legs, which worsens over time. Leaning forward helps alleviate Deb's symptoms. Deb's doctor thinks that Deb's osteoarthritis has caused her new condition.

76. (2.00 pts) What condition does Deb have?
Spinal stenosis

77. (2.00 pts) Why is this condition linked to Deb's osteoarthritis?
Wearing of the vertebrae by osteoarthritis can lead to thickening of the ligaments or the formation of bone spurs, which narrows the spinal canal and compresses nerves

78. (2.00 pts) What surgical procedure can be done to treat this condition?
Decompressive laminectomy

Muscular System

For questions 79 through 81, identify the type of muscle that is described by each of the following. Answer with the letter only.

A. Skeletal
B. Smooth
C. Cardiac

79. (1.00 pts) Held together by desmosomes and contains gap junctions to allow currents to travel between cells.
C

80. (1.00 pts) Lacks neuromuscular junctions and responds to neurotransmitters released from axon varicosities.
B

81. (1.00 pts) Organized into long, multinucleate fibers
A

82. (2.00 pts) Select all of the following statements that are true about muscle structure

A) **The epimysium surrounds the whole muscle**
B) The endomysium surrounds each muscle fascicle
C) The perimysium surrounds each individual muscle cell
D) **The sarcoplasmic reticulum surrounds each myofibril**

83. (2.00 pts) Which of the following is FALSE regarding the structure of myosin?

A) It is composed of two heavy chains and four light chains
B) **Each myosin molecule has a single globular head**
C) It has a long tail formed from two heavy chains
D) The myosin head(s) have one actin and one ATP binding site

84. (2.00 pts) In a muscle cell, what is a triad composed of?
A t-tubule and its two flanking terminal cisternae

85. (2.00 pts) Which of the following statements about sarcomere contraction is true?

A) The A band increases in length during contraction
B) The length of the I band remains constant during contraction
C) The H zone decreases in length during contraction
D) The sarcomere increases in length during contraction

For questions 87 to 90, identify the protein described by each of the following.

86. (1.00 pts) A large, inelastic protein that attaches to the Z disk and helps align actin filaments
Nebulin

87. (1.00 pts) The largest known protein, stabilizes contractile filaments and returns muscles to their resting length
Titin

88. (1.00 pts) An intermediate filament that connects myofibrils to each other
Desmin

89. (1.00 pts) A protein that links actin filaments to the sarcolemma
Dystrophin

90. (2.00 pts) What effect would a mutation in the binding site of the T subunit of troponin have on sarcomere contraction?

A) Prevents tropomyosin from binding to troponin, resulting in unregulated contraction
B) Prevents tropomyosin from binding to actin, which inhibits contraction
C) Prevents actin from binding to troponin, resulting in unregulated contraction
D) Prevents Ca2+ from binding to troponin, which inhibits contraction

91. (2.00 pts) Perisynaptic Schwann cells are NOT responsible for which of the following at the neuromuscular junction?

A) Maintenance of the junction through the secretion of signaling molecules
B) Myelination of the neuron axon during development
C) Regeneration of axons after injury through the connection of adjacent neuromuscular junctions

D) Guidance of growth cones in the formation of the junction

92. (1.00 pts) The motor end plate of skeletal muscles largely contains what type of receptor channels?

A) Adrenergic
B) Muscarinic
C) Nicotinic
D) Dopaminergic

93. (6.00 pts) In a few sentences, describe the steps between the arrival of an action potential at the axon of a motor neuron and the depolarization of the muscle cell at the motor end plate.

Depolarization opens Ca2+ channels (2). Acetylcholine-containing vesicles fuse with the membrane and release acetylcholine into the neuromuscular junction (2) Acetylcholine binds to receptors and opens channels that allow the movement of sodium and potassium ions, depolarizing the cell (2)

94. (2.00 pts) Which structure responds to muscle tension in isometric contractions and causes muscle relaxation?

A) Alpha motor neurons
B) Muscle spindles
C) Gamma motor neurons
D) Golgi tendon organ
E) Proprioceptors

95. (2.00 pts) Junctional feet transmit signals by connecting the ____ of the sarcolemma to the ____ of the sarcoplasmic reticulum

T-tubules, terminal cisternae

96. (1.00 pts) Movement of what ion into the muscle fiber produces an end-plate potential in response to acetylcholine binding?

A) Potassium
B) Calcium
C) Sodium
D) Magnesium

97. (2.00 pts) Why does contraction of the muscle continue even after the action potential is no longer present?
Pumping of calcium ions from the cytosol back into the sarcoplasmic reticulum takes a longer period of time

98. (2.00 pts) Which of the following correctly describes a step of cross bridge cycling?

A) Dissociation of ADP and phosphate from the myosin head causes it to detach from actin

B) Binding of ATP to the myosin head initiates the "power stroke", leading to contraction

C) Sequential dissociation of ADP and phosphate lead to the detachment of the myosin head and the preparation for another binding step

D) Hydrolysis of ATP allows the myosin head to bind to actin

99. (2.00 pts) The contraction time is the interval between the end of the ____ period to the peak ____.
Latent, tension

100. (3.00 pts) What type of contraction occurs when the length of the muscle is constant? How does cross bridge cycling still occur when no length contraction is taking place?
Isometric contraction, The myosin heads repeatedly bind to the same actin molecule

101. (1.00 pts) Passive tension is produced by the stretching of what protein?
Titin

102. (1.00 pts) The stretching of what structures allows sarcomeres to shorten even in isometric contractions?
Series elastic elements

103. (2.00 pts) At moderate levels of activity, most ATP that is used in contraction comes from what source?

A) Phosphorylation of ADP by creatine phosphate

B) ATP that is already present in the cell

C) Glycolysis

D) Oxidative phosphorylation

104. (2.00 pts) Aerobic exercise is most likely to result in an increase of which of the following?

A) Muscle hypertrophy

B) Myostatin production

C) The ratio of slow- to fast-twitch fibers

D) Muscle sarcopenia

105. (2.00 pts) Which of the following is the primary limitation to the rate of muscle activity?

A) Degree of ventilation

B) Cardiovascular output

C) Accumulation of H+

D) ATP depletion

106. (2.00 pts) What is the size principle in whole-muscle contraction?

Motor units with smaller muscle fibers are activated first since they are controlled by smaller and more excitable neurons

107. (2.00 pts) Oxygen debt is best characterized by which of the following?

A) Increased breathing rate during exercise to provide additional oxygen to cells

B) Increased production of ATP following exercise to restore energy reserves

C) Increased breathing rate after exercise to lower blood acidity

D) Decline in ability of muscles to contract due to muscle fatigue

108. (2.00 pts) Select all that are correct differences between Type I and Type II fibers.

A) Type I fibers are slow-twitch fibers, while Type II fibers are fast-twitch fibers

B) Type II fibers contain a myosin ATPase isoform that splits ATP more rapidly

C) Type I fibers pump Ca2+ back into the sarcoplasmic reticulum more rapidly and have a weaker response to action potentials

D) Type II fibers have a faster rate of cross-bridge cycling and produce a greater force from their cross bridges

109. (1.00 pts) What type of muscle fascicle arrangement is characterized by having a broad origin and a single tendon of insertion?
Convergent

110. (2.00 pts) The dense bodies of smooth muscle are most analogous to which structure in skeletal muscle?

A) Troponin
B) T-tubules
C) Z lines
D) Myofibrils

111. (2.00 pts) What role does calmodulin play in the contraction of smooth muscle?

A) It phosphorylates myosin light chains and activates the cross bridge
B) It binds to ryanodine receptor channels and facilitates release of Ca2+ into the cell
C) It binds Ca2+ and facilitates the binding of myosin to actin
D) It dephosphorylates myosin

112. (2.00 pts) Why is smooth muscle able to sustain contraction without fatiguing?

A) The production of ATP is more efficient in smooth muscle
B) Smooth muscle is able to maintain contraction with half the number of cross bridges than skeletal muscle
C) Smooth muscle contraction can be triggered by a smaller concentration of Ca2+ than skeletal muscle
D) The rate of ATP hydrolysis in smooth muscle declines under persistent stimulation

113. (2.00 pts) Why does the depletion of ATP after death cause rigor mortis?
Cross bridges detach upon ATP binding so a lack of ATP means that cross bridges remain in place.

114. (2.00 pts) Through what mechanism does botulinum toxin cause muscle weakness?

A) It inhibits acetylcholinesterase, preventing acetylcholine from being recycled from the synapse
B) It breaks down the SNARE complex, preventing release of acetylcholine into the synapse
C) It binds to acetylcholine receptors and resists destruction, but does not open ion channels
D) It binds to Ca2+ channels, preventing the depolarization of the axon membrane

115. (2.00 pts) Myasthenia gravis is an autoimmune disorder caused by the destruction of what protein? Name one treatment for this condition.
Acetylcholine receptor proteins. Acetylcholinesterase inhibitors, glucocorticoids, etc

116. (2.00 pts) Elevated levels of creatine kinase in the blood are an indicator of muscle damage, and the specific isoenzyme distribution indicates what type of muscle has been damaged. Tim's blood contains 70% CK-MM and 30% CK-MB. What does this indicate?
Damage to heart tissue or myocardial infarction/heart attack

Questions 118 to 119: Ree is a 30-year-old woman who is experiencing chronic, widespread muscle pain, including a heightened pain response to pressure. She is also forgetful and has trouble sleeping.

117. (2.00 pts) What condition is Ree experiencing?
Fibromyalgia

118. (2.00 pts) Name one treatment used to manage this condition.
Exercise, antidepressants, cognitive behavioral therapy, etc