

BIOLOGY 205 OBJECTIVES

(Spring 2007)

Chapter 1, The Human Body: An Orientation

An overview of anatomy and physiology

1. Define the following terms: biology, anatomy, physiology, gross anatomy, cytology, histology, embryology, and pathology.

Levels of structural organization

2. Describe the hierarchical arrangement of the human body. The levels of organization are chemical, cellular, tissue, organ, organ system, and organismal.

Maintaining life

3. List the twelve organ systems of the human body, and identify the major functions and components of each. The twelve systems are illustrated in Figure 1.3 of your text.

Homeostasis

4. Define the following terms: homeostasis, variable, and stress.
5. Describe the components of a typical homeostatic mechanism. This description should include the following terms: stimulus, receptor, afferent pathway, control center, efferent pathway, effector, and response.
6. Compare general aspects of positive feedback systems with negative feedback systems. Describe the importance of positive and negative feedback systems in homeostasis, and discuss the prevalence of each in the human body. Provide examples of both positive and negative feedback systems.

Chapter 3, Cells: The Living Units

The plasma membrane: structure

7. Describe the plasma membrane according to the fluid mosaic model. Include glycoproteins, phospholipids, cholesterol, integral proteins, and peripheral proteins.
8. Describe the structures and functions of the following membrane junctions: tight junctions, desmosomes, and gap junctions.

The plasma membrane: functions

9. Define the following terms: intracellular fluid, extracellular fluid, and interstitial fluid.
10. Define and describe the passive processes by which materials are transported across cell membranes. These processes include simple diffusion, facilitated diffusion, and filtration. Include carriers and channels in your description of facilitated diffusion.

11. Define and describe osmosis. Include the following terms in your description: solvent, solute, solution, hypertonic, hypotonic, and isotonic.
12. Explain what happens to a cell placed in a hypertonic, hypotonic, or isotonic solution.
13. Define and describe active processes by which materials move across cell membranes. Active processes include active transport and vesicular transport. Include the following terms in your description: ATP, pumps, exocytosis, endocytosis, phagocytosis, and receptor-mediated endocytosis.
14. List and explain the five factors that affect the rate of transport of substances across cell membranes. These factors are size of the material, temperature, the presence or absence of channels or other facilitating devices, particle charges, and the concentration gradient for the material being transported.

Chapter 4, Tissue: The Living Fabric

15. Define “tissue,” list the four primary types of tissue in the human body, and give the general functions of each. The primary tissue types are epithelial, connective, muscle, and nervous.

Epithelial tissue

16. Describe the characteristics of epithelial tissues that differentiate them from the other three primary tissue types. The major defining characteristics of an epithelium are polarity, specialized contacts, support by connective tissue, avascularity, and its capacity for regeneration. Include the following terms in your description: apical surface, basal surface, basement membrane.
17. Explain the classification of epithelium as to cell shape (squamous, cuboidal, or columnar) and the arrangement of layers (simple, pseudostratified, or stratified).
18. Describe the characteristics, functions, and locations of the following epithelial tissues: simple squamous, simple cuboidal, simple columnar, pseudostratified columnar, stratified squamous, and transitional. Where appropriate, include goblet cells, microvilli, cilia, and keratin.
19. Compare and contrast exocrine and endocrine glands as to their general structures and functions. Include the fact that exocrine glands use ducts to deliver their secretions to specific locations whereas endocrine glands secrete their products into the bloodstream.

Connective tissue

20. List the general characteristics of connective tissues that distinguish them from the other primary tissue types. The key distinguishing feature of connective tissues is the presence of an extracellular matrix.
21. Describe the functions of the following components of connective tissues: collagen fibers, elastic fibers, reticular fibers, mast cells, and macrophages.
22. Identify the various characteristics, properties of the matrix, functions, and locations of the following connective tissues within the body: areolar, adipose, reticular, dense irregular, dense regular, hyaline cartilage, elastic cartilage, and fibrocartilage.

Tissue repair

23. Describe the steps in the process of tissue repair and the conditions that affect repair. Include the terms “fibrosis” and “regeneration” in your description. Identify tissues with little capacity for regeneration and those with a high capacity for regeneration.

Chapter 5, The Integumentary System

The skin

24. Identify the two main layers of the cutaneous membrane: the epidermis and the dermis. Describe the hypodermis (subcutaneous tissue), and note that it is not truly part of the skin.
25. Identify the five layers of the epidermis. The five layers are the stratum basale, stratum spinosum, stratum granulosum, stratum lucidum (in thick skin only), and stratum corneum.
26. Describe the processes of cornification and pigmentation. Include the following terms: keratin, keratinocyte, melanin, and melanocyte.
27. Identify the two layers of the dermis and the tissues of which they are made. Describe the functions of various structures within the dermis, including blood vessels and sensory nerve endings.

Appendages of the skin

28. Describe the general structures and functions of the following appendages of the skin: sudoriferous glands, sebaceous glands, ceruminous glands, hairs, and hair follicles.

Functions of the integumentary system

29. Describe the general functions of the skin. These functions include protection, regulation of body temperature, sensation, metabolism, serving as a blood reservoir, and excretion. Include in your description the importance of vitamin D and the importance of protection from UV radiation.

Chapter 6, Bones and Skeletal Tissues

Functions of bones

30. Discuss the five functions of the skeletal system and, where appropriate, indicate how structure and function are interdependent. The five functions are support, protection, movement, storage of minerals, and blood cell formation.

Bone structure

31. Compare and contrast compact and spongy bone as to structure, composition, location, and function. Include the term trabeculae in your response.

32. Identify the major parts of a long bone and a flat bone, and state the function of each part. These parts should include the diaphysis, proximal and distal epiphyses, medullary cavity, nutrient foramen, endosteum, periosteum, red bone marrow, yellow bone marrow, articular cartilage, epiphyseal plate, epiphyseal line, and diploë.
33. Describe the structure of the osteon, both in cross and longitudinal sections. The description should include the central canal, lamella, lacuna, canaliculi, perforating canal, osteocyte, and matrix.
34. Describe the inorganic and organic components of bone matrix. Include calcium phosphate, collagen, and osteoid in your description. Explain how the inorganic and organic components act to resist compressive forces and tensile forces, respectively.
35. Discuss the locations and functions of osteoblasts, osteocytes, and osteoclasts. Include the words osteogenesis and osteolysis in your discussion.

Bone development

36. Briefly describe how long bones grow in length at their epiphyseal plates. Briefly describe how all bones grow in thickness.

Bone homeostasis: remodeling and repair

37. Define the term “bone remodeling.” Describe the changes that occur within a mature bone during remodeling. Include in your description the roles of calcium, parathyroid hormone (PTH), and calcitonin.
38. Describe the environmental, dietary, and hormonal factors involved in bone homeostasis. These factors should include mechanical stress, vitamins C and D, hormones (calcitonin, parathyroid hormone, growth hormone, estrogen, and testosterone), and minerals (calcium and phosphorus).

Chapter 8, Joints

Classification of joints

39. Describe the three classes of joints according to their functional classification. These three classes are immovable joints, slightly moveable joints, and freely moveable (synovial) joints. Include the following terms in your description: ligament, suture, and symphysis.

Synovial joints

40. Describe the general structure of a synovial joint. Include the following terms: articular cartilage, joint cavity, articular capsule, synovial fluid, and reinforcing ligaments.
41. Define the following types of motions: gliding, flexion, extension, hyperextension, abduction, adduction, and rotation.
42. Describe and give examples of each of the six types of synovial joints. These are plane, hinge, pivot, condyloid, saddle, and ball-and-socket joints. Relate each joint to the motions it allows as described in objective 41.

Chapter 11, Fundamentals of the Nervous System and Nervous Tissue

43. Compare and contrast the nervous and endocrine systems with regard to the maintenance of homeostasis. This discussion should include mode of action, speed of action, the duration of action, and target organs.
44. List the three basic functions of the nervous system. These three basic functions are to gather sensory information, process and integrate information, and send motor commands.

Organization of the nervous system

45. Describe the divisions of the nervous system, giving the basic components and functions of each. These divisions are the central and peripheral systems, the afferent and efferent divisions, the somatic and autonomic systems, and the parasympathetic and sympathetic divisions.

Histology of nervous tissue

46. Describe the various functions performed by glial cells.
47. Draw and label a diagram of a neuron, including the following structures: cell body (soma), dendrite, axon (nerve fiber), axon collateral, telodendria, axonal terminal, Nissl body, neurofibril, axolemma, myelin, node of Ranvier, synaptic vesicle, Schwann cell, and neurilemma. Identify the functions of each of these structures.
48. Describe how neurons are classified according to structure. The three categories are multipolar, bipolar, and unipolar.
49. Describe how neurons are classified according to function. The three categories are sensory (afferent) neurons, motor (efferent) neurons, and interneurons (association neurons). Relate these functional categories to the structural categories given in objective 48.

Neurophysiology

50. Define the following terms and understand their significance to neurophysiology: voltage (potential difference), current, and resistance.
51. Define resting membrane potential. Describe the conditions that must exist to establish and maintain the resting potential. This description should include the following terms: Na^+ , K^+ , open (leak) channels, and the Na^+/K^+ -ATPase pump.
52. Define graded potential. Describe how opening chemical-gated channels leads to graded potentials across the plasma membrane. Your description should include the following terms: depolarization, hyperpolarization, and repolarization.
53. Define threshold and action potential. Describe the series of events that occurs during production of an action potential. Understand the importance of voltage-gated channels to the production of an action potential.

54. Describe the three phases of an action potential. The three phases are the depolarizing phase, the repolarizing phase, and hyperpolarization (undershoot). Identify which voltage-gated channels are open and closed during each of the three phases.
55. Describe the process of propagation of an action potential. Compare and contrast saltatory conduction and continuous conduction.
56. Describe the all-or-none principle as it relates to action potential initiation and propagation.
57. Define refractory period.
58. Explain the structure and function of a synapse. Include the following terms in your discussion: voltage-gated calcium channel, neurotransmitter, synaptic vesicle, presynaptic membrane, synaptic cleft, receptor, and postsynaptic membrane.
59. Describe the three mechanisms by which neurotransmitters are removed from the synaptic cleft. The three mechanisms are deactivation by enzymes, uptake by the presynaptic cell or glial cells, and diffusion. Include acetylcholinesterase in your description.
60. Explain how the synapse acts as a regulator or integrator of the nervous system. Include the following terms in your explanation: EPSP, IPSP, spatial summation, and temporal summation. Note that postsynaptic potentials and graded potentials are the same phenomenon.

Chapter 12, The Central Nervous System

The spinal cord

61. Explain the three major functions of the spinal cord. The three functions are (1) to transmit sensory impulses from the periphery to the brain, (2) to transmit motor commands from the brain to the periphery, and (3) to serve as an integration center for various reflexes.
62. Describe the gross structure of the spinal cord, and include the following terms in your description: cervical and lumbar enlargements, spinal segments, conus medullaris, cauda equina, and filum terminale.
63. Describe the spinal meninges, including their locations, characteristics, and functions. The meninges are the dura mater, arachnoid, and pia mater. Include the following terms in your description: epidural space, subarachnoid space, and cerebrospinal fluid.
64. Draw and label a cross section of the spinal cord. Include the following structures: white matter (columns), gray matter (commissure and horns), central canal, anterior median fissure, and posterior median sulcus.
65. Define the terms nucleus and tract as they apply to neuron bodies and axons in the CNS.

Chapter 13, The Peripheral Nervous System and Reflex Activity

Nerves and associated ganglia

66. Describe the structure of a nerve. Include the terms epineurium, perineurium, fasciculus, endoneurium, and ganglion in your description.

Spinal nerves

67. Draw and label the components of a spinal nerve. Include the following structures: spinal nerve, spinal cord, dorsal root and ganglion, ventral root, dorsal ramus, ventral ramus, rami communicantes, and sympathetic chain ganglion. Show the locations of sensory, motor, and interneuron cell bodies, axons, and dendrites.
68. Define plexus, and describe the four major nerve plexuses formed by the ventral rami. Include the fibers involved in each plexus, location of each plexus, and functional significance of each plexus.

Chapter 12, The Central Nervous System (continued)

The Brain

69. List the four principle parts of the brain. These four parts are the cerebrum, diencephalon, brain stem, and cerebellum.
70. Describe the structure and general functions of the cerebrum. Include the following terms: cerebral cortex, cerebral hemispheres, gray matter, white matter, fibers, gyri, sulci, and fissures
71. Identify the locations and functions of the following portions of the cerebral cortex: precentral gyrus, Broca's area, postcentral gyrus, primary visual cortex, primary auditory cortex, olfactory cortex, prefrontal cortex, and Wernicke's area.
72. Describe the three types of fibers associated with the cerebral white matter and give the locations and functions of each. The three fiber types are the commissural, association, and projection fibers. Refer specifically to the corpus callosum in your description.
73. Briefly describe the structure and functions of the basal nuclei.
74. Identify the location and functions of the thalamus.
75. Identify the location and functions of the hypothalamus. Specifically address its role in maintaining homeostasis.
76. Briefly describe the locations and functions of the midbrain, pons, and medulla oblongata.
77. Describe the location, structure, and functions of the cerebellum.

Protection of the brain

78. Describe the three cranial meninges, including their locations, characteristics, functions, and spaces. Compare and contrast the cranial meninges with the spinal meninges.
79. Describe the functions of cerebrospinal fluid, how it is produced, and how it is reabsorbed. This description should include the roles of the choroid plexuses, arachnoid villi, the subarachnoid space, the central canal, and the ventricles.
80. Explain the concept of the blood-brain barrier.

Chapter 13, The Peripheral Nervous System and Reflex Activity (continued)

Cranial nerves

81. Identify the twelve cranial nerves by Roman numeral and name. Identify the main functions of and structures innervated by each cranial nerve.

Chapter 14, The Autonomic Nervous System

Introduction

82. Compare and contrast the basic structural and functional differences between the somatic and autonomic portions of the efferent nervous system. Note that the somatic portion targets skeletal muscles; the autonomic portion targets glands, smooth muscles, and cardiac muscle.
83. Describe the general structure of the ANS. Include the following terms: preganglionic fiber, autonomic ganglion, and postganglionic fiber.
84. Explain the concept of dual innervation of organs by the ANS.
85. Describe the general roles of the parasympathetic and sympathetic divisions of the ANS.

ANS anatomy

86. Describe the pathways of the parasympathetic system from the CNS to the effectors. Explain why the term “craniosacral” is used in reference to the parasympathetic system. Identify the neurotransmitters used by parasympathetic motor neurons.
87. Describe the pathways of the sympathetic system from the CNS to the effectors. Include the following terms in your description: spinal nerve, rami communicantes, paravertebral ganglion, sympathetic chain, prevertebral ganglion, and splanchnic nerve. Explain why the term “thoracolumbar” is used in reference to the sympathetic system. Identify the neurotransmitters used by sympathetic motor neurons.
88. Compare and contrast the parasympathetic and sympathetic systems with regards to the following issues: (1) locations of preganglionic neuron bodies, (2) locations of autonomic ganglia, (3) lengths of preganglionic and postganglionic fibers, and (4) neurotransmitters released.

ANS physiology

89. Describe the two types of receptors for acetylcholine: nicotinic receptors and muscarinic receptors. Identify where each type of receptor is found.
90. Describe the two types of receptors for norepinephrine: alpha receptors and beta receptors (do not differentiate the subclasses). Give examples of where alpha and beta receptors are found.
91. Describe the “fight or flight” response. Include the following issues in your explanation: the reasons for the widespread, generalized response to the sympathetic division of the ANS; the special role of the adrenal medulla; and effects of the sympathetic division on metabolism.
92. Describe the effects of the sympathetic and parasympathetic systems on the major organ systems of the body. Identify exceptions to the dual innervation principle of the ANS.

Chapter 9, Muscles and Muscle Tissue

Overview of muscle tissues

93. Compare and contrast the three types of muscle tissue as to location, histology, function, and innervation.
94. List the four functional characteristics of muscle. These characteristics are excitability, contractility, extensibility, and elasticity.
95. List the general functions of muscle tissue. These functions include producing movement, maintaining posture, stabilizing joints, and generating heat. Relate these functions to the three types of muscle tissue given in objective 93.

Skeletal muscle

96. Describe the connective tissue components of a skeletal muscle. Include the following terms: fascia, epimysium, perimysium, endomysium, fascicle, aponeurosis, and tendon.
97. Describe the histology of a skeletal muscle fiber. Include the following terms: sarcoplasm, sarcoplasmic reticulum, triad, T tubule, mitochondrion, nucleus, myofibril, myofilament, sarcomere, and sarcolemma.
98. Describe the two contractile proteins (actin and myosin) and the two regulatory proteins (troponin and tropomyosin). Address their arrangements within a sarcomere and their functions.
99. Identify the following structures in a sarcomere: Z disc, M line, A band, and I band.
100. Explain the sliding filament theory of muscle contraction.
101. Compare and contrast the action potential generated by a muscle fiber with the action potential generated by a neuron.

102. Describe the structure and function of the neuromuscular junction. Include the following terms in your description: somatic motor neuron, axonal terminal, synaptic cleft, motor end plate, acetylcholine, and acetylcholinesterase.
103. List the sequence of events that occurs during excitation-contraction coupling.
104. Describe the crossbridge cycle. Include the terms ATP, ADP, and inorganic phosphate.
105. Describe the role of the SR-Ca⁺⁺-ATPase in relaxation of a muscle fiber.
106. Define the term “motor unit” and describe how muscle fibers are arranged into motor units. Explain the functional difference between motor units with many fibers and motor units with few fibers.
107. Diagram and label the three phases of a myogram obtained from a whole muscle. The three phases are the latent, contraction, and relaxation periods.
108. Explain how it is that a muscle can produce graded amounts of tension (graded muscle responses), even though contraction of a muscle fiber is an all-or-none event.
109. Define the following terms: wave summation, incomplete and complete tetanus, treppe, and fatigue.
110. Compare and contrast isometric and isotonic contractions. Distinguish between concentric and eccentric isotonic contractions.
111. Describe different circumstances under which a skeletal muscle relies on aerobic and anaerobic metabolism. The description should include the following terms: ATP, ADP, myoglobin, glycogen, pyruvic acid, lactic acid, and oxygen.
112. Explain the importance of creatine phosphate to muscle metabolism.
113. Identify the causes of muscle fatigue, and describe what is meant by oxygen debt.
114. Compare and contrast fast and slow twitch skeletal muscle fibers.
115. Discuss the effects of aerobic (endurance) exercise and resistance exercise on skeletal muscle fibers.

Smooth muscle

116. Compare and contrast the two types of smooth muscle (single-unit and multi-unit).