

Lecture Learning Objectives

ORGANIZATION OF THE HUMAN BODY & HOMEOSTASIS (REVIEW)

Upon completion of this unit and with review, the student will be able to

1. Define homeostasis, describe the general mechanisms by which it is maintained, and explain its importance to survival with at least one example.
2. Differentiate between aerobic and anaerobic cellular metabolism, between anabolic and catabolic reactions, and explain how several reactions can form a metabolic pathway.
3. Explain the role of enzymes in cellular metabolism and the factors that affect enzyme function.
4. Describe the general catabolic pathway for a molecule of protein, lipid, and glycogen as each is hydrolyzed to produce ATP.
5. Describe the role of ribosomes, both free and fixed, in protein synthesis.
6. Describe the structure and function of an array of eukaryotic cellular components, including the cytoskeleton.
7. Describe the properties of water as the physiological solvent, how body fluids are distributed within compartments, how the fluid composition differs between compartments, and the transport mechanisms that move water and other materials from one compartment to another.
8. Describe the general functions of each organ system.
9. Briefly describe the morphogenesis and differentiation of the 3 embryonic germ layers and list the tissue specializations that develop from these germ layers.

CELL MEMBRANE FUNCTION & ELECTROCHEMICAL SIGNALING

Upon completion of this unit and with review, the student will be able to

1. Describe the structure and function of cell membranes and intercellular junctions.
2. Describe the structure of biological membranes. Compare and contrast the mechanisms for the movement of materials across cell membranes in terms of their physical and chemical properties (active and passive transport).
3. Compare and contrast the steps in signal transduction for steroidal and non-steroidal chemical messages. Discuss the role of second-messenger systems in signal transduction.
4. Differentiate between chemically-gated, mechanically-gated, and voltage-gated ion channels.
5. Explain the characteristics of a polarized, depolarized and repolarized membrane. How are these changes in the transmembrane electrical potential accomplished? How is the transmembrane electrical potential utilized by cells?
6. Differentiate between a graded potential and an all-or-none action potential; and describe the events that lead to the conduction of a unidirectional action potential.
7. Define the terms neurotransmitter and threshold. Discuss examples of excitatory and inhibitory neurotransmitters, and the concept of a grand-synaptic potential.
8. Define neuropeptide, and describe the functions of this group of chemical messages.
9. Describe the sequence of events that occur at a chemical synapse, including the events which stop stimulation of the post-synaptic membrane.
10. Distinguish between excitatory and inhibitory post-synaptic potentials. Describe temporal summation, spatial summation and the components which comprise the grand synaptic potential.
11. Describe the anatomical and functional differences between myelinated and unmyelinated nerve fibers; and compare conduction of an impulse along these fibers.
12. Discuss how temperature, fiber diameter, and the presence of myelination affect speed of conduction along a nerve fiber.

ENDOCRINE PHYSIOLOGY

Upon completion of this unit, the student will be able to

1. Describe how hormones can be classified according to their chemical composition and corresponding action on target tissue cells.
2. Explain the three basic mechanisms that regulate hormone secretions, and how hormones are transported to target tissues.
3. Name and describe the locations of the major endocrine glands of the body, list the hormones they secrete, and the action(s) of each hormone.
4. Explain how the hypothalamus regulates hypophyseal secretions, with examples.
5. Discuss the hormonal regulation of the utilization of energy nutrients.
6. Distinguish between physical and psychological stress, and describe the sequence of changes associated with the general adaptation response.
7. Describe the direct nervous regulation of the adrenal medulla.
8. Explain how prostaglandins differ from hormones in general, and describe their functions.
9. Describe the homeostatic mechanisms involved in water balance (water volume and blood pressure).

FUNCTIONS OF THE AFFERENT AND EFFERENT DIVISIONS OF THE PERIPHERAL NERVOUS SYSTEM & SPECIAL SENSES

1. Compare and contrast exteroceptors, visceroreceptors, and proprioceptors, and describe their importance in homeostatic mechanisms.
2. Describe each of the 5 major receptor types, and the transduction of specific stimuli into receptor potentials.
3. Discuss the following features of the somatic senses: acuity, receptive field size, lateral inhibition, and projection.
4. Explain the phenomenon of sensory adaptation, and list the sensations in which adaptation occurs.
5. Discuss the anatomy and physiology of both slow and fast pain pathways, and the inherent mechanisms for natural pain control.
6. Describe the conduction pathways that lead to the perception of various stimuli (for the somatic and special senses).
7. Describe the general anatomical features of both divisions of the Autonomic NS
8. Relate neurotransmitter substances, membrane receptors and dual innervation of visceral organs to the normal function of the Autonomic Nervous System.
9. Describe the structure and function of the neuromuscular junction for skeletal muscles.

MUSCLE PHYSIOLOGY

Upon completion of this unit, the student will be able to

1. Compare and contrast the structure and function of skeletal, cardiac and smooth muscle tissues.
2. Describe the sequence of chemical and physical events that produce muscle contraction and relaxation.
3. Distinguish between the all-or-none and graded responses with neuronal stimulation of a skeletal muscle.
4. Explain how energy is supplied to the muscle fiber contraction mechanism, how oxygen debt develops, and how a muscle may become fatigued.
5. Discuss the mechanics of contraction in whole muscles, including the factors that determine tension.
6. Compare and contrast skeletal muscle fiber types, in terms of their structural and metabolic adaptations, and their response to "training".

7. Discuss the various levels of control on the motor neurons that innervate skeletal muscle fibers, to include cortical (pyramidal), subcortical (extrapyramidal) and afferent (somatic receptors and proprioceptors) pathways.
8. Discuss the fundamental concepts and workings of the muscle spindle apparatus and golgi tendon organ in the control of skeletal muscle.
9. Describe the structural and functional differences between multi-unit and visceral (single-unit) smooth muscle, and between these smooth muscle types, cardiac muscle and skeletal muscle.

CARDIOVASCULAR PHYSIOLOGY and the BLOOD

Upon completion of this unit, the student will be able to

1. Discuss the normal cardiac cycle, and the function of autorhythmic tissues in the cardiac conduction system which coordinate cardiac function.
2. Discuss the mechanisms of intrinsic and extrinsic regulation on cardiac output (heart rate and stroke volume), including ANS reflexes.
3. Compare and contrast the function of autorhythmic and contractile cells in the heart.
4. Relate the mechanical events in the normal cardiac cycle to the electrical events recorded in an ECG.
5. Describe some of the common pathologic conditions that affect heart function.
6. Describe the relationship of blood pressure to cardiac output, blood volume, viscosity of blood, and peripheral resistance.
7. Describe the mechanisms that are responsible for maintaining arterial blood flow, and those that aid in returning venous blood to the heart.
8. Differentiate between local control (chemical and physical factors) and extrinsic control of arteriolar blood flow.
9. Discuss the mechanisms of regulating blood pressure.
10. Review the physiological processes involved in tissue fluid formation and return, and the possible causes of edema.
11. Describe the general characteristics of the formed elements of blood and blood plasma; and discuss the major functions of each.
12. Describe hematopoiesis and its homeostatic regulation.
13. Discuss the life cycle of a red blood cell (production, destruction, recycling), and the homeostatic regulation of RBC production.
14. Define hemostasis, and explain the 3 basic mechanisms that help to achieve it (blood vessel spasm, platelet plug formation, and coagulation), and the mechanism to later restore circulation to the area of damage.
15. Discuss the clinical uses of anticoagulants and clot dissolving chemicals.
16. Explain the genetic basis for blood typing.
17. Describe how blood reactions may occur between the fetal and maternal tissues.