

## Chapter 17: Functional Organization of the Endocrine System

### I. General Characteristics of the Endocrine System

#### A. Terminology

1. What does the term endocrine imply? \_\_\_\_\_  
\_\_\_\_\_
2. Endocrine glands secrete \_\_\_\_\_
3. A hormone is a ligand (chemical substance) that:
  - a. \_\_\_\_\_
  - b. \_\_\_\_\_
  - c. \_\_\_\_\_
  - d. \_\_\_\_\_

#### B. Endocrine versus Nervous System Regulation

1. Increasing or decreasing hormone concentration in body fluids is referred to as \_\_\_\_\_
  - a. The effects produced are in relation to hormone \_\_\_\_\_
2. The all-or-none of action potentials in the nervous system is referred to as \_\_\_\_\_
  - a. What represents a weak stimulus? \_\_\_\_\_
  - b. What represents a strong stimulus? \_\_\_\_\_
3. Compared to the nervous system, the responses of the endocrine system are:
  - a. Usually \_\_\_\_\_
  - b. Longer \_\_\_\_\_
  - c. More \_\_\_\_\_
4. The two systems cannot be separated either \_\_\_\_\_ or \_\_\_\_\_
  - a. Where does a neurohormone come from and what does it do? \_\_\_\_\_  
\_\_\_\_\_
  - b. Some neurons directly \_\_\_\_\_ endocrine glands and influence \_\_\_\_\_
  - c. Some hormones from endocrine glands affect \_\_\_\_\_ and significantly \_\_\_\_\_

**D. Types of Chemical Signals**

1. Intercellular chemical signals allow \_\_\_\_\_
  - a. The nervous system uses \_\_\_\_\_ & \_\_\_\_\_
  - b. The endocrine system uses \_\_\_\_\_
2. Autocrine chemical signals are released by cells and have a \_\_\_\_\_ effect on \_\_\_\_\_
3. Paracrine chemical signals are released by cells and affect \_\_\_\_\_ without being \_\_\_\_\_
4. Pheromones are chemical signals \_\_\_\_\_ the environment that modify the \_\_\_\_\_ & \_\_\_\_\_ of \_\_\_\_\_

**II. Chemical Structure of Hormones****A. Chemically hormones can be either:**

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_

B. Glycoprotein hormones are composed of \_\_\_\_\_ & \_\_\_\_\_

C. Lipid hormones are either \_\_\_\_\_ or \_\_\_\_\_

**III. Control of Secretion Rate**

A. The secretion of each hormone is controlled by a \_\_\_\_\_ so that the body activity it regulates is \_\_\_\_\_ & \_\_\_\_\_

**B. Three major patterns of hormone regulation:****1. Pattern One**

- a. Involves the action of a substance other than a \_\_\_\_\_
- b. The action causes hormone levels to \_\_\_\_\_ or \_\_\_\_\_

**2. Pattern two involves \_\_\_\_\_ of the endocrine gland**

- a. Neurons synapse with cells that \_\_\_\_\_
- b. When action potentials occur in the neurons they release \_\_\_\_\_

1. If stimulatory it causes \_\_\_\_\_
2. If inhibitory it causes \_\_\_\_\_
3. Pattern three involves control of secretory activity of one endocrine gland by a \_\_\_\_\_ or \_\_\_\_\_ secreted by \_\_\_\_\_
4. In addition to the major patterns a few hormones are regulated in a \_\_\_\_\_ mechanism

#### IV. Transport and Distribution in the Body

A. Hormones are dissolved in \_\_\_\_\_ and transported either in a \_\_\_\_\_ or bound to \_\_\_\_\_

##### B. Free Hormone Molecules

1. Free hormones can diffuse from \_\_\_\_\_ to \_\_\_\_\_
2. The rate of hormone movement is concentration dependent:
  - a. When blood hormone levels are higher \_\_\_\_\_
  - b. When blood hormone levels are lower \_\_\_\_\_

##### C. Protein Bound Hormones

1. Hormones bind to plasma proteins in a \_\_\_\_\_
2. There is an equilibrium between the \_\_\_\_\_ & \_\_\_\_\_
  - a. The equilibrium is important because only \_\_\_\_\_ diffuse

D. Since hormones circulate in the blood they are \_\_\_\_\_

#### V. Metabolism and Excretion

A. What limits the length of time that hormones are active? \_\_\_\_\_

B. What is a half-life? \_\_\_\_\_

1. What type of hormone has a relatively short half-life? \_\_\_\_\_
  - a. Their concentrations within the blood \_\_\_\_\_
  - b. They regulate activities that have a \_\_\_\_\_ & \_\_\_\_\_
2. Lipid-soluble hormones commonly are combined with \_\_\_\_\_
  - a. The combination reduces rate of \_\_\_\_\_ & increases \_\_\_\_\_
  - b. Hormones with a long half-life have \_\_\_\_\_ blood levels

## C. Hormones removed from the blood in four major ways:

1. Excretion by:
  - a. \_\_\_\_\_ into the \_\_\_\_\_
  - b. \_\_\_\_\_ into the \_\_\_\_\_
2. Metabolized or chemically modified by \_\_\_\_\_ in the blood
3. Actively transported into cells and \_\_\_\_\_
4. Conjugation by:
  - a. \_\_\_\_\_ attaches \_\_\_\_\_ to the hormone

**VI. Interaction of Hormones with Their Target Tissues**

## A. Define the following terms:

1. Ligand \_\_\_\_\_
2. Binding site \_\_\_\_\_
3. Receptor site \_\_\_\_\_
4. Specificity \_\_\_\_\_

B. What determines which cells will respond to a particular hormone? \_\_\_\_\_  
\_\_\_\_\_

## C. Drugs with structures similar to ligands \_\_\_\_\_

1. A drug may \_\_\_\_\_ the receptor or \_\_\_\_\_ of the receptor

## D. Target Cell Responsiveness

1. Response to a given ligand concentration is \_\_\_\_\_ in some cases and \_\_\_\_\_ in others
2. The term "down-regulation" refers to \_\_\_\_\_
  - a. Two known mechanisms for down-regulation are:
    1. Decreases in the rate receptors are \_\_\_\_\_
    2. Increases in the rate receptors are \_\_\_\_\_
      - a. Ligand and receptor are taken into the cell by \_\_\_\_\_
3. Tissues that exhibit down-regulation are adapted to \_\_\_\_\_
4. Tissues that do not exhibit down-regulation respond to hormones maintained \_\_\_\_\_
5. The term "up-regulation" refers to \_\_\_\_\_

## VII. Classes of Hormone Receptors

### A. Categories of Ligands

1. Ligands that cannot pass through the plasma membrane
  - a. They are \_\_\_\_\_ molecules and \_\_\_\_\_ molecules
  - b. They interact with \_\_\_\_\_
    1. The receptor sites are exposed to \_\_\_\_\_
  - c. The ligand binding to the receptor site initiates a \_\_\_\_\_
2. Ligands that pass through the plasma membrane
  - a. They are \_\_\_\_\_ and \_\_\_\_\_
  - b. They \_\_\_\_\_ through the membrane and bind to \_\_\_\_\_
    1. Intracellular receptors are in the \_\_\_\_\_ or the \_\_\_\_\_
  - c. The ligand and receptor bound together then interact with:
    1. \_\_\_\_\_ or
    2. \_\_\_\_\_

### B. Membrane-Bound Hormone Receptors

1. Receptors That Directly Alter Membrane Permeability
  - a. Protein molecules that make up part of \_\_\_\_\_
  - b. When the ligand binds to the receptor site it alters the \_\_\_\_\_  
\_\_\_\_\_
    1. This causes the channel to either \_\_\_\_\_ or \_\_\_\_\_
    2. These channels are called \_\_\_\_\_
  - c. The result is a change in the \_\_\_\_\_
  - d. Examples:
    1. What type of channel does serotonin bind to? \_\_\_\_\_
    2. Acetylcholine causes skeletal muscle contraction by \_\_\_\_\_
2. Receptors That Activate G Proteins
  - a. List the three subunits of a G protein from largest to smallest:
    1. \_\_\_\_\_
    2. \_\_\_\_\_
    3. \_\_\_\_\_
  - b. Why are they called "G proteins"? \_\_\_\_\_

- c. When inactive a G protein has a guanine diphosphate bound to \_\_\_\_\_
- d. The activation of G proteins by a receptor involves:
1. \_\_\_\_\_ binds to the receptor on the outside of the cell
  2. Causes the receptor to \_\_\_\_\_
  3. As a result the receptor joins with \_\_\_\_\_ inside the cell
  4. This binding causes GDP to be released from \_\_\_\_\_
  5. This allows the more abundant guanine triphosphate to bind to the \_\_\_\_\_ which \_\_\_\_\_
  6. Then the G proteins separate from the \_\_\_\_\_
  7. The activated \_\_\_\_\_ subunit separates from \_\_\_\_\_ & \_\_\_\_\_
  8. The activated \_\_\_\_\_ produces cellular responses by altering the activity of molecules:
    - a. Within \_\_\_\_\_
      1. Such as opening or closing \_\_\_\_\_
    - b. Inside \_\_\_\_\_
      1. Altering the activity of \_\_\_\_\_
  9. After a short time:
    - a. The activated \_\_\_\_\_ is turned off because \_\_\_\_\_
    - b. The \_\_\_\_\_ then recombines with the \_\_\_\_\_ & \_\_\_\_\_
3. Receptors That Alter the Activity of Intracellular Enzymes
- a. Ligand binds to membrane-bound receptor and directly \_\_\_\_\_
    1. Increases or decreases \_\_\_\_\_
    2. Results in the \_\_\_\_\_
  - b. The mediators or phosphorylated proteins activate \_\_\_\_\_
  - c. What is the cascade effect? \_\_\_\_\_
- 

### C. Intracellular Hormone Receptors

1. Intracellular receptors are either in the \_\_\_\_\_ or in the \_\_\_\_\_
2. The activation of DNA by receptors involves:
  - a. Lipid-soluble ligands cross into the cell by the process of \_\_\_\_\_

- b. If the receptor is in the cytoplasm:
    - 1. The ligand \_\_\_\_\_ to its receptor
    - 2. The receptor and ligand \_\_\_\_\_ into the nucleus & \_\_\_\_\_
  - c. If the receptor is in the nucleus:
    - 1. The ligand \_\_\_\_\_ into the nucleus
    - 2. Then binds to \_\_\_\_\_ and then \_\_\_\_\_
  - d. "Fingerlike" projections interact with \_\_\_\_\_
  - e. This increases the synthesis of \_\_\_\_\_
  - f. The \_\_\_\_\_ molecules then move to the \_\_\_\_\_
  - g. They attach to \_\_\_\_\_ and increase the \_\_\_\_\_
  - h. The newly synthesized \_\_\_\_\_ produce the \_\_\_\_\_
- 3. Ligands operating in this manner have a \_\_\_\_\_
    - a. During this time \_\_\_\_\_
  - 4. The cells \_\_\_\_\_ return to \_\_\_\_\_