

Chapter 9 The Endocrine System

OVERVIEW

The purpose of this chapter is to teach the anatomy and physiology of the endocrine system. The latter part of the chapter teaches the pathology associated with the endocrine system.

This chapter focuses on the interaction of hormones to carry out the functions of the system. This is accomplished by looking at the interplay of hormones in four scenarios. The students first chart the relevant gland, hormone, target tissue, and function for hormones relative to the scenario. Then they use that information to explain the hormone interactions necessary to fulfill each scenario.

Chapter figures can be found in the Online Learning Center (OLC). Discussion points, group activities, and quizzes listed in the summary table below are explained under their individual outcomes following the table. Answer keys to the text chapter review questions, workbook concept maps, and workbook review questions are located at the end of the chapter.

A review guide is also available on the OLC. This guide lists all of the learning outcomes for the chapter and gives space for students to take notes and make sketches. This can be an important tool to encourage students to pay attention to what they are learning and to use to either take initial notes or to organize their existing notes before exams.

COMPETENCY CORRELATION GRID

Learning Outcome	CAAHEP Competencies	ABHES Competencies
9.1 Use medical terminology related to the endocrine system.	I.C.1. Describe structural organization of the human body	3.a. Define and use entire basic structure of medical words and be able to accurately identify in the correct context, i.e., root, prefix, suffix, combinations, spelling and definitions
9.2 Compare and contrast the endocrine and nervous systems in terms of type, specificity, speed, and duration of communication.	I.C.4. List major organs in each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
9.3 Define gland, hormone, and target tissue.	I.C.4. List major organs in each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
9.4 List the major hormones, along with their target tissues and functions, of each of the endocrine system glands.	I.C.5. Describe the normal function of each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.

9.5 Locate and identify endocrine system glands.	I.C.4. List major organs in each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
9.6 Describe the chemical makeup of hormones, using estrogen, insulin, and epinephrine as examples.	I.C.4. List major organs in each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
9.7 Compare the location of receptors for protein hormones with that of receptors for steroid hormones.	I.C.4. List major organs in each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
9.8 Differentiate autocrine, paracrine, endocrine, and pheromone chemical signals in terms of the proximity of the target tissue.	I.C.4. List major organs in each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
9.9 Explain the regulation of hormone secretion and its distribution.	I.C.5. Describe the normal function of each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
9.10 Explain how the number of receptors can be changed.	I.C.5. Describe the normal function of each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
9.11 Explain how hormones are eliminated from the body.	I.C.5. Describe the normal function of each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
9.12 Explain the function of hormones by showing how they interact to maintain homeostasis.	I.C.5. Describe the normal function of each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
9.13 Explain the effects of aging on the endocrine system.	I.C.10. Compare body structure and function of the human body across the life span	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
9.14 Describe common diagnostic tests used to diagnose endocrine system disorders.	I.C.13. Identify common diagnostic tests.	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
9.15 Describe endocrine system disorders and relate abnormal function to pathology.	I.C.6. Identify common pathology related to each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.

SUMMARY TABLE 9

LEARNING OUTCOME	LECTURE OUTLINE	ACTIVITIES – TALKING POINTS	ASSIGNMENTS/ ASSESSMENTS
9.1 Use medical terminology related to the		<i>WkBk Word Roots and Combining forms</i>	<i>WkBk Review Questions:</i>

endocrine system.			<ul style="list-style-type: none">Word Deconstruction: 1-5
9.2 Compare and contrast the endocrine and nervous systems in terms of type, specificity, speed, and duration of communication.	I. Overview Chapter Figure: 9.2 (Communication of the nervous and endocrine systems)	WkBk Lab Exercises and Activities: <ul style="list-style-type: none">Comparison of the endocrine and nervous systems	Spot Check: 2 WkBk Review Questions: <ul style="list-style-type: none">MS: 3
9.3 Define <i>gland</i> , <i>hormone</i> , and <i>target tissue</i> .	II. Anatomy of the endocrine system	Talking Point: Stress that there are organs or tissues that produce some hormones that we normally do not think of as being a gland. Examples are: Heart tissue: produces ANP Kidneys: produce EPO	Spot Check: 1 WkBk Review Questions: <ul style="list-style-type: none">MS: 6
9.4 List the major hormones, along with their target tissues and functions, of each of the endocrine system glands.	A. Glands <ol style="list-style-type: none">Pineal glandhypothalamus and pituitary glandThyroid glandParathyroid glandsPancreasAdrenal glands<ol style="list-style-type: none">adrenal cortexadrenal medullaGonads<ol style="list-style-type: none">OvariesTestesOther tissues Table 9.1 (Glands, hormones, target tissues, and	Talking Point: It is important to stress that the study of this system is more than memorizing a list of glands, hormones, target tissues, and functions. Stress that hormones often interact to achieve homeostasis.	Spot Check: 3, 4 WkBk Review Questions: <ul style="list-style-type: none">MS: 4, 9, 10Matching: 1-5Completion: 2

	functions)		
9.5 Locate and identify endocrine system glands.	Chapter Figures: 9.3 (Endocrine system glands) 9.4 (Hypothalamus – anterior pituitary target-tissue relationship) 9.5 (Hypothalamus – pituitary relationship) 9.6 (Parathyroid glands) 9.7 (Pancreas) 9.8 (Adrenal cortex and adrenal medulla)	WkBk Coloring Book: WkBk Figure 9.1 (Endocrine system glands)	Quiz: 1 (Covers LO 9.4, 9.5 See Individual Outcome 9.5) WkBk Review Questions: <ul style="list-style-type: none">Completion: 2-5
9.6 Describe the chemical makeup of hormones, using estrogen, insulin, and epinephrine as examples.	B. Hormones 1. Steroids 2. Amino acid derivatives 3. Proteins Chapter Figure: 9.9 (A teen injecting insulin)		Spot Check: 5 WkBk Review Questions: <ul style="list-style-type: none">MS: 2Matching: 6-10
9.7 Compare the location of receptors for protein hormones with that of receptors for steroid hormones.	C. Target tissues 1. Location of hormone receptors Chapter Figures: 9.10 (Location of receptors – protein hormones) 9.11 (Location of receptors – steroid hormones)		WkBk Review Questions: <ul style="list-style-type: none">MS: 8
9.8 Differentiate autocrine, paracrine, endocrine, and pheromone chemical signals in terms of the proximity of the target tissue.	2. Location of the target tissue	WkBk Concept Maps: WkBk Figure: 9.4 (Location of target tissues concept map)	WkBk Review Questions: <ul style="list-style-type: none">MS: 7

9.9 Explain the regulation of hormone secretion and its distribution.	<p>III. Physiology of the endocrine system</p> <p>A. Regulation of hormone secretion and distribution</p> <p>Chapter Figures:</p> <p>9.12 (Negative feedback inhibition of the hypothalamus and pituitary gland by the thyroid gland)</p> <p>9.13 (Transport and action of protein and steroid hormones)</p>	<p>Discussion: See Individual Outcome .9.9</p> <p>WkBk Concept Maps:</p> <p>Figure: 9.5 (Regulation of hormone secretion concept map)</p>	<p>Spot Check: 6, 8</p> <p>WkBk Review Questions:</p> <ul style="list-style-type: none">MS: 9, 10Critical Thinking: 2
9.10 Explain how the number of receptors can be changed.	<p>B. Receptor regulation</p> <p>Chapter Figure:</p> <p>9.14 (Receptor regulation)</p>		<p>WkBk Review Questions:</p> <ul style="list-style-type: none">MS: 5
9.11 Explain how hormones are eliminated from the body.	<p>C. Hormone regulation</p>	<p>WkBk Concept Maps:</p> <p>Figure: 9.6 (Hormone elimination concept map)</p>	<p>Spot Check: 7</p> <p>WkBk Review Questions:</p> <ul style="list-style-type: none">MS: 9, 10Completion: 1
9.12 Explain the function of hormones by showing how they interact to maintain homeostasis.	<p>D. Functions: 4 scenarios</p> <ol style="list-style-type: none">1. Insulin and glucagon secretion2. Consequences of reduced melatonin at puberty3. Adrenal cortex degeneration4. Hormonal regulation of childbirth <p>Chapter Figure:</p>	<p>Talking Point: The charting used in these 4 scenarios works well with any endocrine problem in that it helps organize the information in a useable form and gives the student an orderly plan to follow for critical thinking.</p> <p>WkBk Lab Exercises and Activities:</p> <ul style="list-style-type: none">Graphing an endocrine problem	<p>Spot Check: 9-17</p> <p>Quiz: 2 (Covers LO 9.4, 9.5, 9.12 See Individual Outcome 9.12)</p> <p>WkBk Review Questions:</p> <ul style="list-style-type: none">Critical Thinking: 3

	<p>9.15 (Oxytocin’s effect on childbirth)</p> <p>Chapter table:</p> <p>9.2 (Insulin and glucagon)</p> <p>9.3 (Effects of melatonin)</p> <p>9.4 (Hormones of the adrenal cortex)</p> <p>9.5 (Hypothalamus response to decreased cortisol)</p> <p>9.6 (Hormone involved in childbirth)</p>	<ul style="list-style-type: none">• <p><i>WkBk</i> Figure:</p> <p>9.2 (Graph of normal response to a need for hormone A)</p> <p>9.3 (The graphs of the six groups of A&P students)</p> <p>Talking Point: <i>WkBk</i> Figure 9.2 shows the level of hormone A over time. It is released when there is a need, so the level of hormone goes up. The peak happens when the need is met. Once the need is met, the hormone is no longer needed. The decline in the level of hormone happens as the hormone is eliminated.</p> <p>Group Activity: 1</p> <p>The workbook activity of graphing an endocrine problem can be done first as a class activity to generate graphs for class discussion.</p>	
9.13 Explain the effects of aging on the endocrine system.	IV. Effects of aging on the endocrine system		<p><i>WkBk Review Questions:</i></p> <ul style="list-style-type: none">• Critical Thinking: 1
9.14 Describe common diagnostic tests used to diagnose endocrine system disorders.	V. Diagnostic tests for endocrine system disorders <ul style="list-style-type: none">A. Blood testB. CTC. DEXAD. MRIE. X-ray	<p>Group activity: 2</p> <p>Endocrine disorders (See Individual Outcome 9.14).</p>	<p><i>Spot check:</i> 18</p> <p><i>WkBk Review Questions:</i></p> <ul style="list-style-type: none">• MS: 1 <p><i>WkBk Case Study</i></p> <ul style="list-style-type: none">• 3

	Table: 9.7 (Common diagnostic tests for endocrine system disorders)		
9.15 Describe endocrine system disorders and relate abnormal function to pathology.	<p>VI. Endocrine system disorders</p> <p>A. Diabetes mellitus</p> <p>1. Type 1 diabetes mellitus</p> <p>2. Type 2 diabetes mellitus</p> <p>B. Diabetes insipidus</p> <p>C. Growth disorders</p> <p>1. Gigantism</p> <p>2. Acromegaly</p> <p>3. Pituitary dwarfism</p> <p>D. Goiters</p> <p>E. Hypothyroidism</p> <p>F. Cushing’s Syndrome</p> <p>Chapter Figures:</p> <p>9.16 (A glucometer measures the blood glucose level)</p> <p>9.17 (Acromegaly)</p> <p>9.18 (Pituitary dwarfism)</p> <p>9.19 (Endemic goiter resulting from an iodine deficiency)</p> <p>9.20 (Cushing’s syndrome)</p> <p>Table: 9.8 (Endocrine diseases and disorders)</p>	<p>Group activity: 2</p> <p>Endocrine disorders (See Individual Outcome 9.14).</p>	<p><i>Spot check:</i> 19</p> <p>WkBk Review Questions:</p> <ul style="list-style-type: none">MS: 1 <p>WkBk Case Study</p> <ul style="list-style-type: none">1, 2

INDIVIDUAL OUTCOMES

OUTCOME 8.2

Spot Check 2: Can the pancreas target specific cells to respond to insulin?

Answer: No, the insulin will travel throughout the body in the blood stream and will affect all cells that have a receptor for it.

OUTCOME 8.3

Spot Check 1: The target tissue for insulin is most tissues. What do all of the target cells for insulin have in common?

Answer: Receptors for insulin

OUTCOME 8.4

Spot Check 3: What is common in the naming of hormones produced by the hypothalamus that target the anterior pituitary?

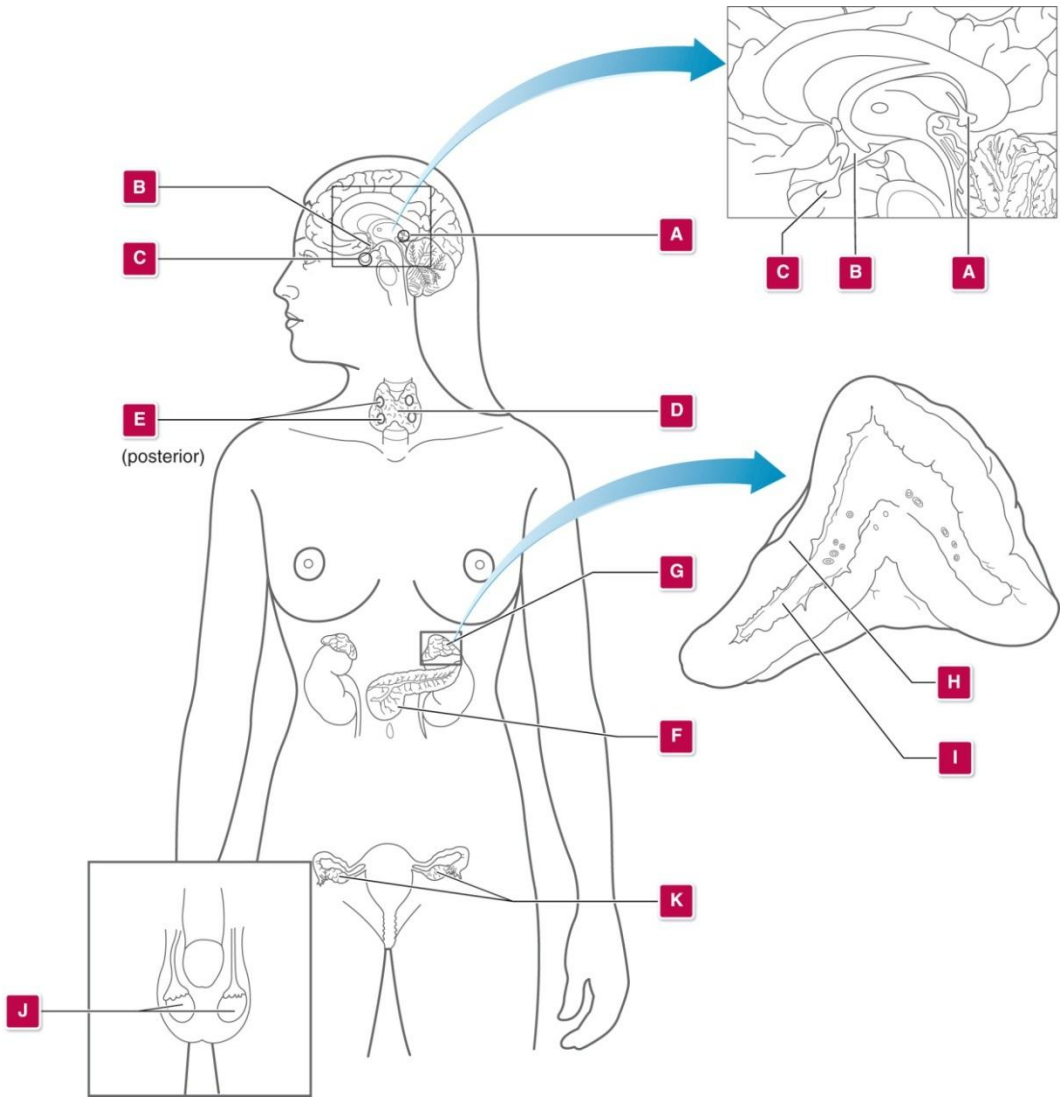
Answer: They are called releasing hormones.

Spot Check 4: Think back to the integumentary system and the skeletal system. What effects does the increased production of testosterone and estrogen at puberty have on sebaceous glands and osteoblasts?

Answer: Both hormones speed the production of sebum by sebaceous glands and speed the deposition of bone by osteoblasts.

OUTCOME 8.5

Quiz: 1



Use this figure to answer the following questions.

- | | |
|------------------------------------------------------|----------------------------------------------------------|
| 1. Identify G. | <i>Adrenal gland</i> |
| 2. Identify part of G labeled H. | <i>Adrenal cortex</i> |
| 3. What three classes of hormones are secreted by H? | <i>Mineralcorticoids, glucocorticoids, and androgens</i> |
| 4. What affect does ACTH have on H? | <i>Tells it to produce glucocorticoids</i> |
| 5. Identify part of G labeled I. | <i>Adrenal medulla</i> |
| 6. What hormone is produced by I? | <i>Epinephrine</i> |
| 7. Identify F. | <i>Pancreas</i> |
| 8. When does gland secrete glucagon? | <i>When blood glucose levels are low</i> |
| 9. Identify D. | <i>Thyroid gland</i> |
| 10. What hormone does D secrete concerning calcium? | <i>Calcitonin</i> |

OUTCOME 8.6

Spot Check 5: What is the chemical composition of the three classes of hormones secreted by the adrenal cortex?

Answer: Steroids.

OUTCOME 8.9

Spot Check 6: Which of the three ways of stimulating a gland is used to stimulate the anterior pituitary and thyroid gland?

Answer: A hormone stimulating a gland.

Spot Check 8: Which of the three ways to stimulate a gland caused the release of the hormones in this scenario?

Answer: A substance other than a hormone. In this case, it was glucose.

Discussion Point: What would be the consequences of liver disease that prevents the production of plasma proteins that normally bind to thyroid hormone.

The half-life of the hormone would be very short with the hormone going into cells much more quickly to increase metabolism. Metabolism would fall more quickly when the hormone is used up. TSH would then be released to tell the anterior pituitary to secrete more thyroid hormone. Metabolism would greatly increase and then fall instead of being more even.

OUTCOME 8.11

Spot Check 7: Why might it be an advantage to have a short half-life for epinephrine?

Answer: It is important to have epinephrine when it is needed to complement the sympathetic nervous system. It helps prepare for fight or flight. A long half-life of epinephrine during restful times would not be an advantage because it would put a strain on the heart.

OUTCOME 8.12

Spot Check 9: What type of feedback mechanism is involved in this case?

Answer: Negative feedback.

Spot Check 10: Would the pancreas ever release large quantities of insulin and glucagon at the same time? Explain.

Answer: No. Hormones are secreted when there is a need. Insulin and glucagon have opposite effects so they would not be used in response to the same need.

Spot Check 11: What physical changes will we see in Natalie due to these hormone interactions?

Answer: Breast development, menstruation begins, greater deposition of fat, axillary and pubic hair growth.

Spot Check 12: How would the charting differ if it had been for Nate instead of Natalie?

Answer: FSH and LH would target the testes instead of the ovaries resulting in the production of testosterone and male secondary sex characteristics.

Spot Check 13: What are the physical consequences of reduced melatonin production at puberty for Nate?

Answer: Axillary, facial, and pubic hair, skeletal and muscle development, deeper voice, aggression, sperm production.

Spot Check 14: What other levels in the blood might be examined to diagnose this disease?

Answer: Sodium and potassium.

Spot Check 15: Would Addison's disease have a different effect on a female?

Answer: Her sex drive would be reduced. She does not have an alternative source for androgens.

Spot Check 16: Which of the three ways to stimulate a gland was used to stimulate the posterior pituitary in this scenario?

Answer: Neural stimulation of a gland.

Spot Check 17: What type of feedback mechanism was involved in this case?

Answer: Positive feedback.

Spot Check 18: Which diagnostic tests listed in Table 9.7 can also be used to help diagnose disorders in systems other than the endocrine system? Give examples of the other uses.

Answer: Blood tests: can also be used to determine the presence of an infectious agent or liver enzyme determination

Computed tomography: can also be used to detect tumors other than those associated with the endocrine system.

DEXA: can also be used to determine changes in bone density

MRI: can also be used to detect tumors other than those associated with the endocrine system.

Urinalysis: can also be used to detect UTIs.

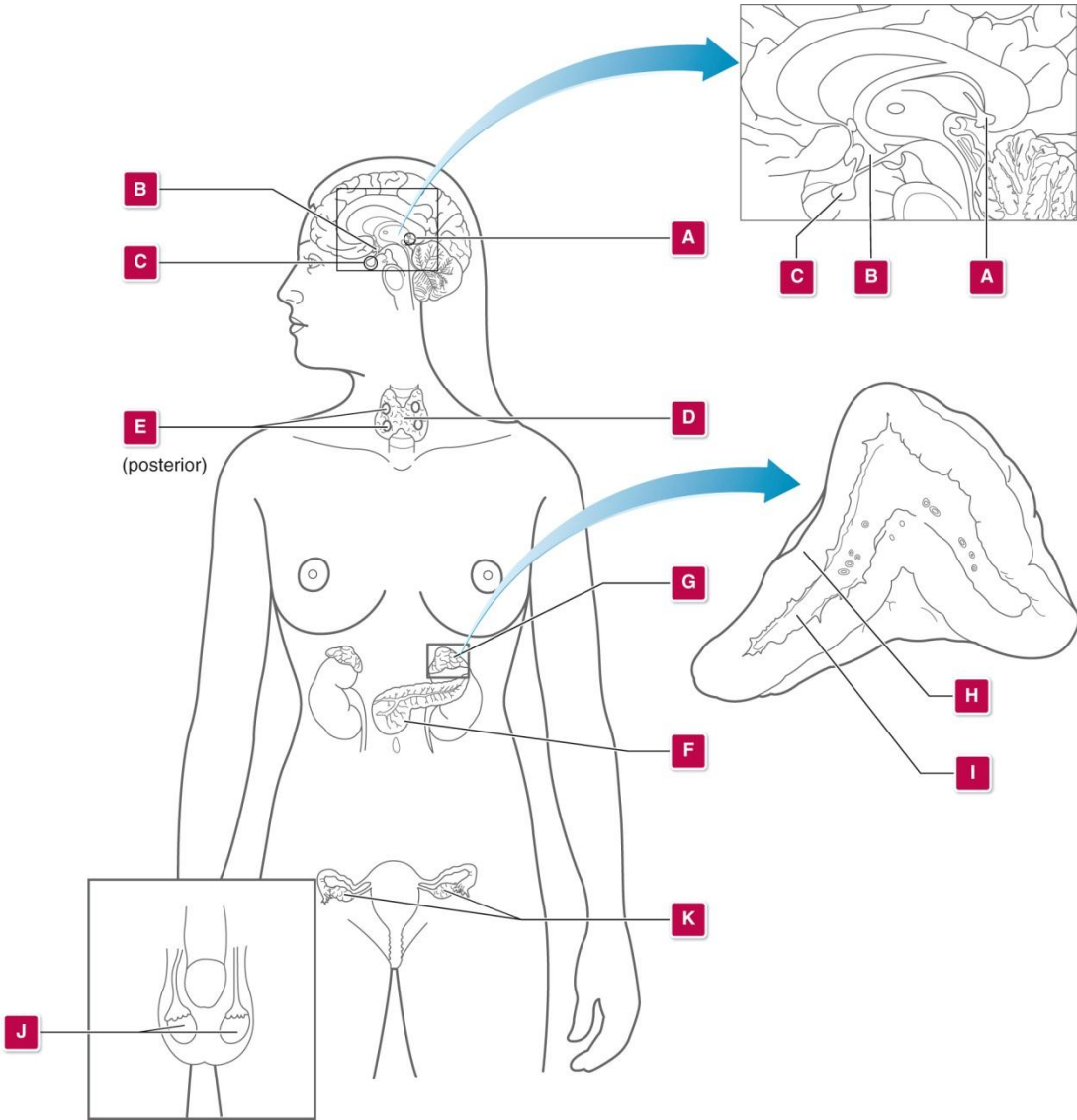
X-rays: can also be used to determine bone damage.

Spot Check 19: Compare and contrast the causes of hypothyroidism and hyperthyroidism.

Answer: Hashimoto's disease is an autoimmune disorder that results in chronic inflammation of the thyroid gland.

The removal of the thyroid gland can cause hypothyroidism or various medical treatments can also cause hypothyroidism.

Hyperthyroidism is the excess production of thyroid hormones. This can be caused by antibodies binding to the TSH receptors. This is an autoimmune disorder called Grave's disease.



Use this figure to answer the following questions.

- | | |
|--------------------------------------------------|------------------------------|
| 1. Identify B. | <i>Hypothalamus</i> |
| 2. What is the target tissue of GnRH? | <i>Anterior pituitary</i> |
| 3. What is the target tissue's response to GnRH? | <i>To secrete FSH and LH</i> |
| 4. What is the target tissue of TRH? | <i>Anterior pituitary</i> |
| 5. What is the target tissue's response to TRH? | <i>To secrete TSH</i> |
| 6. What is the target tissue of CRH? | <i>Anterior pituitary</i> |
| 7. What is the target tissue's response to CRH? | <i>To secrete ACTH</i> |
| 8. Identify A. | <i>Pineal body</i> |
| 9. What hormone does A produce? | <i>Melatonin</i> |
| 10. Identify E. | <i>Parathyroid glands</i> |

OUTCOME 8.14

Group Activity: Endocrine system disorders. Divide the class in groups and assign one endocrine disorder. Each group is to make a presentation to class on the disorder concerning the following: what hormone(s) is (are) involved, the physiology of the disorder, the prevalence of the disorder, and the treatment of the disorder.

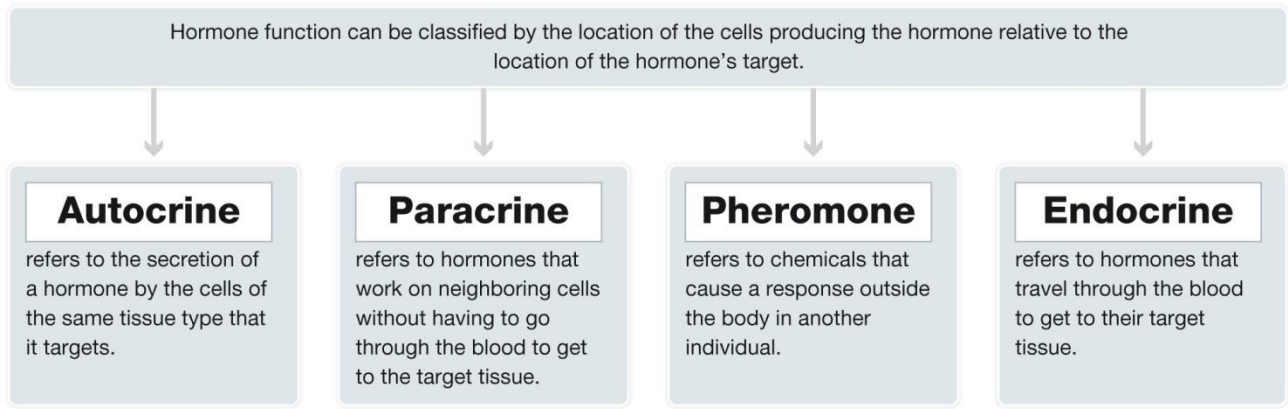
ANSWER KEYS

Chapter Review Questions

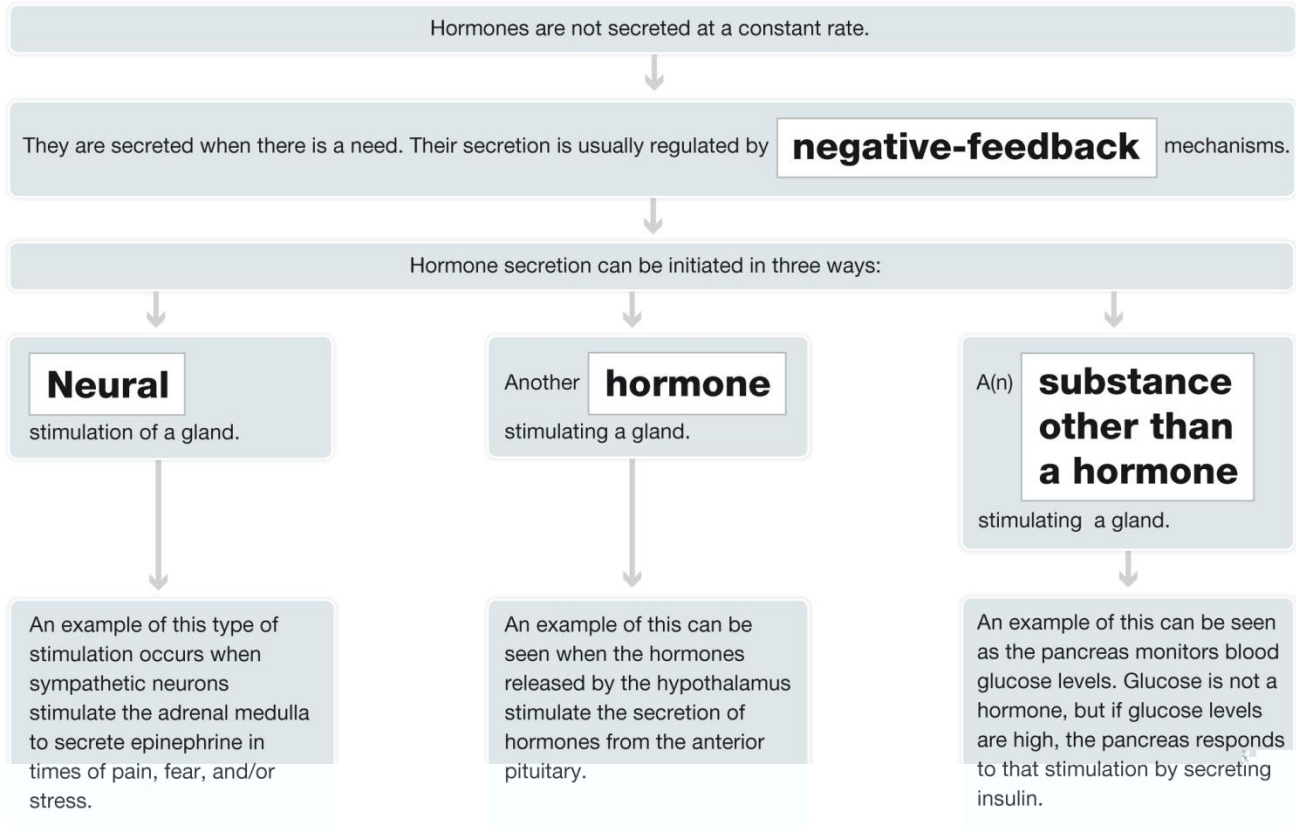
1. B
2. C
3. D
4. C
5. D
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10. C
11. A
12. A
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14. C
15. B

Workbook Concept Maps

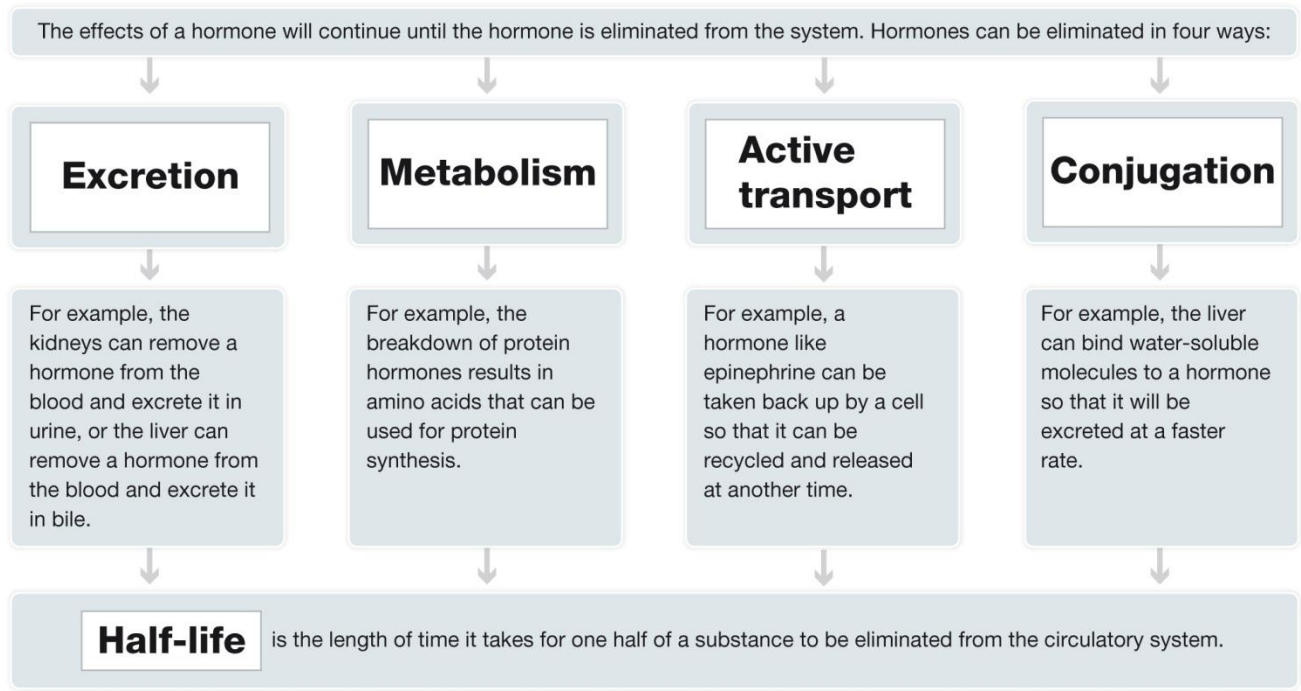
Location of Target Tissues



Regulation of Hormone Secretion



Hormone Elimination



Workbook Chapter Review Questions

Word Deconstruction:

In the textbook, you built words to fit a definition using combining forms, prefixes, and suffixes. Here you are to break down the term into its parts (prefixes, roots, and suffixes) and give a definition. Prefixes and suffixes can be found inside the back cover of the textbook.

FOR EXAMPLE Dermatitis: dermat/itis—inflammation of the skin

- 1. Polydipsia: Poly/dips/ia, a condition of excessive thirst
- 2. Hyperglycemia: Hyper/glyc/emia, excessive sugar in the blood
- 3. Gonadotropin: Gonado/tropin, a substance that stimulates the sex glands
- 4. Adenoma: Aden/oma, tumor of the gland
- 5. Corticosteroid: Cortico/ster/oid, steroid deriving from the cortex

Multiple Select:

Select the correct choices for each statement. The choices may be all correct, all incorrect, or any combination of correct and incorrect.

- 1. Diana comes into the clinic complaining of being thirsty all the time and having to use the bathroom often. Which of the following statements seem(s) consistent with this scenario?
 - a. *She is describing polyuria and polydipsia.*
 - b. She may have a problem with ACTH.
 - c. *She may have a problem with ADH.*

d. *She may have a problem with receptors for insulin.*

e. *These symptoms are consistent with diabetes mellitus and diabetes insipidis.*

2. What is important to understand about the chemical composition of a hormone?

a. Protein hormones can be delivered medically using a patch on the skin.

b. Steroid hormones are broken down in the stomach, so they cannot be given orally.

c. Protein hormones bind to plasma proteins.

d. Steroid hormones require a second messenger.

e. *The chemical composition matters in the clinical delivery of a hormone.*

3. How do the endocrine and nervous system compare?

a. *The nervous system is faster.*

b. The endocrine system is more specific.

c. *The effects of the endocrine system last longer.*

d. The endocrine system uses chemicals, and the nervous system does not.

e. All communication originates in the brain for both systems.

4. Emily is pregnant, and the fetus growing inside her is actively building bone. The calcium for the fetal bone deposition is taken from Emily's blood, lowering her normal blood calcium level. What is (are) the hormonal consequence(s) for Emily?

a. Emily's thyroid gland will produce calcitonin to bring her blood calcium level back to normal.

- b. Emily's thyroid gland will produce PTH to bring her calcium level back to homeostasis.
- c. ACTH is involved.
- d. ***TSH is involved.***
- e. There are no hormonal consequences.

5. What is (are) the hormonal consequence(s) of a consistent diet overly high in carbohydrates?

- a. The receptors for glucose will remain the same.
- b. The receptors for insulin will likely be up-regulated.
- c. The receptors for glucagon will likely be down-regulated.
- d. ***The target tissues will likely become less sensitive to insulin.***
- e. The target tissues will likely become less sensitive to glucagon.

6. Cells in the heart produce a chemical that travels through the blood to the kidney to regulate urine production. Which of the following statements is (are) true given the definitions of *gland*, *hormone*, and *target tissue*?

- a. ***The cells in the heart qualify as an endocrine gland.***
- b. ***The chemical the heart produces qualifies as a hormone.***
- c. ***The kidney is the target tissue.***
- d. ***The kidney must have receptors for the chemical.***
- e. ***The chemical must fit in the receptors in the kidney like a key in a lock.***

7. Which of the following is (are) accurate concerning target tissues in relation to the gland that produces the hormone?

- a. *Pheromone refers to hormones that affect another individual as the target tissue.*
- b. *Autocrine refers to hormones that affect the cells that produced them.*
- c. *Endocrine* refers to hormones that affect neighboring cells without going through the bloodstream.
- d. Ceruminous glands are endocrine glands.
- e. *Paracrine* refers to hormones that travel through the bloodstream.

8. Which of the following statements is (are) accurate concerning insulin and estrogen?

- a. *The receptors for insulin are on a cell membrane.*
- b. The receptors for insulin are inside the cell.
- c. The receptors for estrogen must be on the cell membrane.
- d. *The receptors for estrogen can be anywhere in the cell.*
- e. The locations of the receptors for estrogen and insulin are the same since both hormones target most tissues.

9. Why is the liver important to the endocrine system?

- a. *It is a target tissue for glucagon.*
- b. *It produces plasma proteins.*
- c. *It produces cholesterol.*
- d. *It can excrete hormones in bile.*
- e. *It can conjugate hormones.*

10. Why is the kidney important to the endocrine system?

- a. *It is a target tissue for PTH.*
- b. It produces plasma proteins.
- c. It produces cholesterol.
- d. *It can excrete hormones in urine.*
- e. It produces aldosterone.

Matching:

Match the hormone to its function. Some answers may be used more than once.

- | | |
|--------------------------------------------------------------------------------------------------|--------------------|
| ___ <i>d</i> ___ 1. Tells cells to take in glucose, lowering blood glucose levels | A. Glucagon |
| | B. Epinephrine |
| ___ <i>a</i> ___ 2. Tells the liver to convert glycogen to glucose, raising blood glucose levels | C. Thyroid hormone |
| | D. Insulin |
| ___ <i>e</i> ___ 3. Tells the kidney to reabsorb Na ⁺ and excrete K ⁺ | E. Aldosterone |
| ___ <i>b</i> ___ 4. Increases heart and respiration rate and increases blood glucose levels | F. Cortisol |
| ___ <i>c</i> ___ 5. Stimulates appetite | |

Matching:

Match the hormone to its chemical composition. Some answers may be used more than once.

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- | | |
|-------------------------------------|--------------------------|
| ___ <i>a</i> ___ 6. Insulin | A. Protein |
| ___ <i>b</i> ___ 7. Epinephrine | B. Amino acid derivative |
| ___ <i>c</i> ___ 8. Estrogen | C. Steroid |
| ___ <i>b</i> ___ 9. Thyroid hormone | |
| ___ <i>c</i> ___ 10. Cortisol | |

Completion:

Fill in the blanks to complete the following statements.

1. ___*Half-life*_____ is the amount of time it takes for half of a substance to be removed from the system.
2. The adrenal ___*medulla*_____ is in the middle of the adrenal gland and produces the hormone ___*epinephrine*_____.
3. The ___*infundibulum*_____ is a stalk that connects the hypothalamus and pituitary glands.
4. The ___*pituitary gland*_____ sits in the sella turcica.
5. The ___*pineal gland*_____ is located inferior to the posterior corpus callosum.

Critical Thinking:

1. How could the effects of aging on the endocrine system be reduced? Explain one example.

Answers will vary. Exercise and a diet high in Ca^{++} and Vitamin D throughout life will lessen the effects of decreased testosterone and estrogen in later life.

2. The liver produces plasma proteins to extend the half-lives of some hormones. What will be the effect on the half-life of insulin if the liver is damaged and cannot produce plasma proteins? Explain.

No effect. Insulin is a protein hormone. Protein hormones do not bind to plasma proteins.

3. Iodine is needed in the diet for the thyroid to produce functional thyroid hormone. What will happen to levels of TRH and TSH if there is insufficient iodine in the diet? Explain.

Without enough iodine to produce thyroid hormone, levels of TRH from the hypothalamus would increase as would TSH from the anterior pituitary in an attempt to get more thyroid hormone to be produced. This will become a positive feedback mechanism with ever increasing TRH and TSH due to the lack of iodine.

Case Study:

1. Kenny may have diabetes mellitus.

2. Although Kenny is only 16, he most likely has type 2 diabetes considering his weight, activity level, and family history.

3. Blood test can determine hormone and glucose levels. Urinalysis can determine the presence of glucose in the urine.