

18 Hormones

I. Behavioral Objectives

Students should be able to

1. draw a diagram contrasting the mechanism of action of peptide-type hormones with those of steroid-type hormones;
2. define a hormone and name the endocrine glands studied;
3. categorize each hormone studied as either a peptide-type or steroid-type hormone;
4. explain the anatomical relationship between the posterior pituitary and the hypothalamus, name two hormones produced by the hypothalamus but secreted by the posterior pituitary, and relate the hormone ADH to diabetes insipidus;
5. name six hormones produced by the anterior pituitary and indicate which of these causes this gland to be the master gland;
6. discuss the physiological action of GH and relate stature, including that of a midget or giant, and the disorder acromegaly to this hormone;
7. explain the anatomical relationship between the anterior pituitary and the hypothalamus;
8. draw a diagram indicating the relationship between the hypothalamus, anterior pituitary, and a gland controlled by the anterior pituitary and show how each of these is controlled by negative feedback;
9. discuss the macroscopic and microscopic anatomy of the thyroid gland, the chemistry and physiological function of thyroxin, and hypo- and hyperthyroidism;
10. state the location of the adrenal glands and describe the relationship between the adrenal medulla and adrenal cortex;
11. discuss the function of the adrenal medulla and its relationship to the nervous system;
12. name three categories of hormones produced by the adrenal cortex and give an example of each category and discuss its physiological action;
13. describe the symptoms of Addison's disease and Cushing syndrome, relating these to malfunction of the adrenal cortex;
14. state the location of the parathyroid glands and discuss the function of PTH and calcitonin, relating this to osteoporosis and tetany;
15. state the location of the pancreas, describe its microscopic anatomy, and name two hormones produced by the pancreas and discuss their function;
16. discuss the two types of diabetes mellitus and the diagnosis of diabetes by means of urinalysis and contrast insulin shock to diabetic coma;
17. state how prostaglandins are exceptions to general statements regarding hormones, name several of their functions, and tell how prostaglandins function in cells.

II. Pretest

1. Hormones are transported in the body via the _____.
2. The hypothalamus controls the secretion of the _____ gland.
3. A hyperactive person may produce a high level of _____.
4. A low level of adrenal cortex hormones produces the symptoms characteristic of _____.
5. The parathyroid glands regulate the level of _____ and _____ in the blood.
6. When the islets of Langerhans in the pancreas do not secrete enough insulin, there is a (high or low) level of sugar in the blood. _____

7. The target organ for ACTH is the _____.
8. A giant could possibly have a tumor of the _____.
9. The _____ is called the master gland.
10. A goiter signifies a malfunctioning _____ gland.

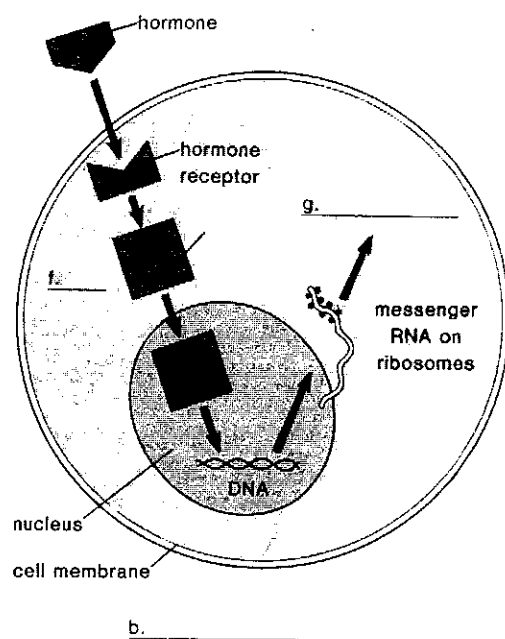
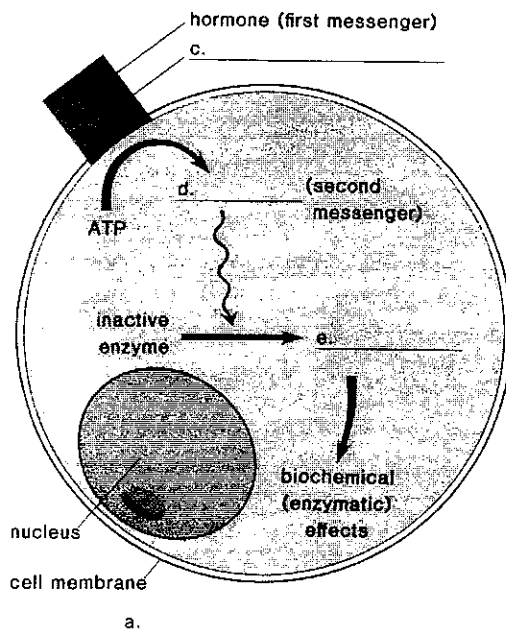
III. Definitions

Define these terms:

1. hormone (p. 371) _____
2. steroid (p. 371) _____
3. endocrine gland (p. 373) _____
4. target organ (p. 373) _____
5. releasing hormone (p. 374) _____
6. portal system (pp. 214, 374) _____
7. ADH (p. 374) _____
8. growth hormone (GH) (p. 375) _____
9. somatomedins (p. 375) _____
10. feedback control (p. 376) _____
11. hyperthyroidism (p. 378) _____
12. glucocorticoids (p. 379) _____
13. gluconeogenesis (p. 379) _____
14. mineralocorticoids (p. 379) _____
15. osteoporosis (p. 381) _____
16. maturity-onset diabetes (p. 384) _____
17. juvenile-onset diabetes (p. 384) _____

IV. Study Questions

1. Mechanism of action. Write either *peptide-type* hormone or *steroid-type* hormone on the line provided below each diagram. Place an appropriate word or phrase on the lines within each diagram.

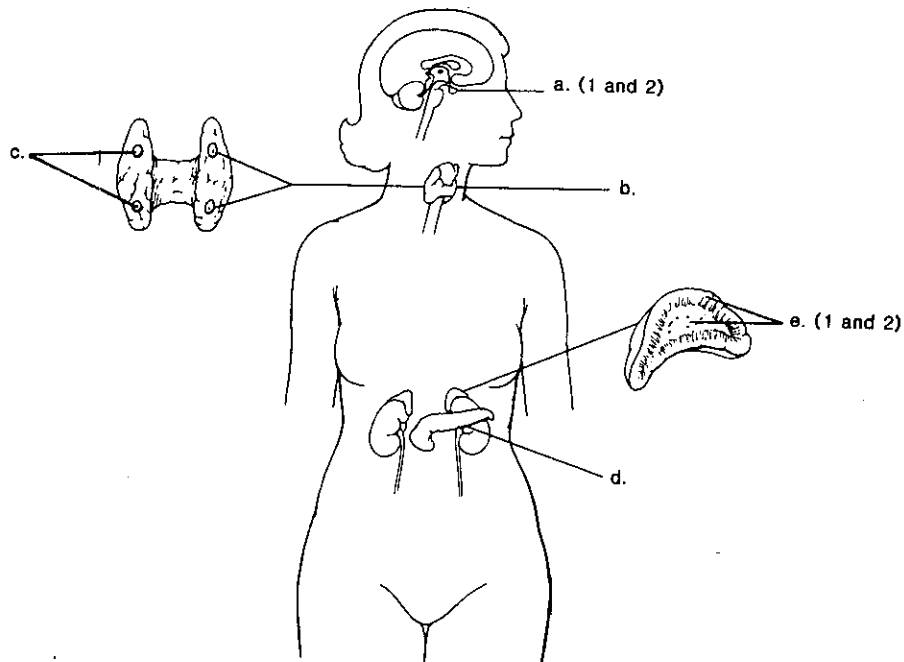


h. Explain in your own words the mechanism of action of

(1) a peptide-type hormone _____

(2) a steroid-type hormone _____

2. Identify the glands in the diagram, and list their names and hormones in the table.



After Chaffee and Greisheimer, *Basic Physiology and Anatomy*, 3rd ed., 1974.
Used by permission of J. B. Lippincott.

Name of Gland	Hormone(s)
a. (1)	
(2)	
b.	
c.	
d.	
e. (1)	
(2)	

3. Circle the letter if the statement is true of *most* vertebrate hormones.

- a. can be any type chemical
- b. peptide-type (amino acid, peptide, protein) or a steroid
- c. produced by cell in which it is active
- d. produced by one set of cells but affects a different set
- e. secreted by exocrine glands
- f. secreted by endocrine glands
- g. secreted into blood stream
- h. secreted into a cavity

d. A person suffering from hypothyroidism may be slow and sluggish; a person suffering from hyperthyroidism may be quick and nervous. Relate these symptoms to the function of thyroxin:

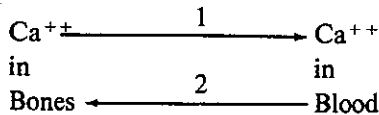
9. Adrenal cortex. Distinguish between cortisol and aldosterone by writing *yes* or *no* on each line.

	Cortisol	Aldosterone
a. Controlled by ACTH	_____	_____
b. Glucocorticoid	_____	_____
c. Mineralocorticoid	_____	_____
d. Relieves stress	_____	_____
e. Na ⁺ /K ⁺ balance	_____	_____
f. Amino acids → glucose	_____	_____
g. What three types of hormones are produced by the adrenal cortex? _____ (for example, cortisol); _____ (for example, aldosterone), and _____ (for example, androgens)		

h. Indicate whether these symptoms are indicative of Addison's disease (lack of adrenal cortex hormones) or Cushing's disease (abundance of adrenal cortex hormones) by placing *AD* or *CS* beside each statement.

- (1) _____ cannot handle stress.
- (2) _____ cannot maintain glucose level of blood.
- (3) _____ tendency toward diabetes mellitus.
- (4) _____ low blood pressure because Na⁺ is excreted.
- (5) _____ high blood pressure because Na⁺ is retained.
- (6) _____ edema because too much Na⁺ in system.
- (7) _____ bronzing of skin.
- (8) _____ masculinization in women.

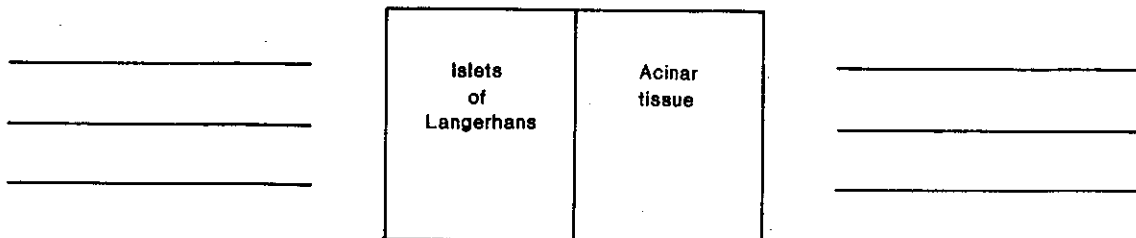
10. Calcium metabolism. Study the following diagram and write either *1* or *2* beside each statement below.



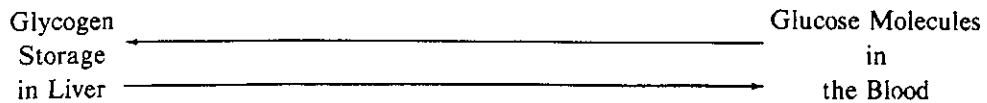
- a. _____ mistaken removal of parathyroid glands during a thyroid operation
- b. _____ calcitonin is present
- c. _____ PTH is present
- d. _____ postmenopausal women who no longer produce estrogen
- e. _____ osteoporosis
- f. _____ child with tetany

11. Pancreas.

a. The figure below diagrammatically represents the pancreas, which is composed of two types of cells as indicated. On the lines provided write these phrases: *hormones* or *digestive enzymes*; *endocrine gland* or *exocrine gland*; *exit by way of blood* or *exit by way of pancreatic duct*.



b. Write the word *insulin* or the word *glucagon* on the appropriate arrow.



- c. Explain why diabetes mellitus is "starvation in the midst of plenty." _____

- d. What urinalysis test is positive in a diabetic? _____

- e. Why is an untreated diabetic subject to acidosis (low blood pH)? _____

V. Hormone Quiz

Use this key for the matching exercises in questions 1-3.

- | | |
|---------------|-----------------|
| (1) cortisol | (5) ADH |
| (2) GH | (6) aldosterone |
| (3) adrenalin | (7) glucagon |
| (4) insulin | (8) oxytocin |
| | (9) ACTH |

1. a. Which two of these hormones are produced by the adrenal cortex? _____, _____
b. Which two are produced by the anterior pituitary? _____, _____
c. Which two hormones are produced by the pancreas? _____, _____
2. Match the hormones in the key with the functions listed.
- a. uterine contraction _____
 - b. growth of bones _____
 - c. stimulate the adrenal cortex _____
 - d. flight or fight _____
 - e. storage of glucose as glycogen _____
3. For the hormones listed, name a hormone that acts opposite to it.
- a. insulin, _____
 - b. PTH, _____

Use this key for the matching exercises in questions 4 and 5.

- | | |
|------------------------|-------------------------|
| (1) acromegaly | (4) exophthalmic goiter |
| (2) diabetes insipidus | (5) osteoporosis |
| (3) diabetes mellitus | (6) Cushing's disease |
| | (7) Addison's disease |

4. Match the symptoms with the disorder.
- a. enlarged thyroid gland and bulging eyes _____
 - b. bronzing of skin _____
 - c. weak bones _____
 - d. enlarged bones _____
 - e. sugar in the urine _____

5. Match the illness in the key with the malfunctioning organ.

- a. thyroid _____
- b. adrenal cortex _____ and _____
- c. pancreas _____
- d. posterior pituitary _____

6. Each hormone listed below affects the quantity of the substance indicated. A plus sign means that the hormone is present and a minus sign means that the hormone is not present. Fill in the blank next to each substance with a plus or minus to indicate whether it will increase in amount or decrease in amount.

- | | |
|------------------|----------------------------|
| a. + insulin | _____ glucose in the blood |
| b. - ADH | _____ amount of urine |
| c. - PTH | _____ calcium in the blood |
| d. + aldosterone | _____ sodium in the blood |
| e. - thyroxin | _____ simple goiter |
| f. + estrogen | _____ action of PTH |
| g. + PTH | _____ calcium in the bones |
| h. - insulin | _____ glucose in the blood |

VI. Posttest

1. Tetany occurs when there is
 - a. too little calcium in the blood
 - b. too much calcium in the blood
 - c. too little sodium in the blood
 - d. too much sodium in the blood
2. The anterior pituitary stimulates the
 - a. thyroid
 - b. adrenal cortex
 - c. adrenal medulla
 - d. pancreas
 - e. all of these
3. Cushing's syndrome is due to a malfunctioning
 - a. thyroid
 - b. adrenal cortex
 - c. adrenal medulla
 - d. pancreas
4. Too much urine matches with
 - a. too little ADH
 - b. too much ADH
 - c. too little ACTH
 - d. too much ACTH
5. Oxytocin would be administered
 - a. if the blood sugar rises
 - b. if recovery from stress is needed
 - c. if the metabolic rate increases
 - d. before childbirth
6. A simple goiter is caused by
 - a. too much salt in the diet
 - b. too little iodine in the diet
 - c. too many sweets in the diet
 - d. a bland diet

7. Acromegaly might be due to a tumor of the
 - a. pancreas
 - b. anterior pituitary
 - c. thyroid
 - d. adrenal cortex
8. If a person is suffering from insulin shock he should
 - a. be given some sugar
 - b. sit with his head down
 - c. be given insulin
 - d. not eat fatty foods
9. All hormones are believed to
 - a. have membrane receptors
 - b. affect cellular metabolism
 - c. increase the amount of cAMP
 - d. increase the amount of protein synthesis
10. The hypothalamus controls the anterior pituitary via
 - a. nervous stimulation
 - b. the midbrain
 - c. vasopressin
 - d. releasing hormones
11. Due to negative feedback control, as the level of thyroxin increases in the blood,
 - a. more TSH is produced
 - b. less TSH is produced
 - c. more hypothalamic releasing hormone is produced
 - d. less hypothalamic releasing hormone is produced
12. Thyroxin, cortisol, adrenalin, insulin, and glucagon all
 - a. cause excessive growth
 - b. cause reduced urination
 - c. affect the nerves
 - d. affect glucose metabolism

In questions 13-15, fill in each blank with the proper term.

13. _____ is a type of lipid composed of four interlocking rings similar to cholesterol.
14. _____ is a system of regulation by which the increase in a product leads to a decrease in its production and vice versa.
15. _____ is a type of bone loss, observed particularly in older women.

