

PowerPoint Lecture Outlines
to accompany

Hole's Human
Anatomy and Physiology
Tenth Edition
Shier • Butler • Lewis

CHAPTER 13 ENDOCRINE SYSTEM

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GENERAL CHARACTERISTICS OF THE ENDOCRINE SYSTEM

1. homeostasis
2. Glands are effectors
3. endocrine glands

Glands

1. ENDOCRINE GLAND
 - A. a gland that secretes hormones directly into the bloodstream
 - B. a ductless gland.

Glands

1. Exocrine gland
 - A. a gland that secretes substances into ducts
 - B. Exocrine glands are not part of the endocrine system.

General Characteristics of the Endocrine System

1. endocrine glands secrete hormones.
 - A. secreted into the bloodstream
 - B. affects "target" cell.

Other Chemical Signaling

1. Paracrine secretions act locally..
2. Autocrine secretions affect the secreting cell itself.

Comparison of Nervous System and Endocrine System

1. Neurons release neurotransmitters
 - A. paracrine
2. Glands release hormones into the bloodstream
 - A. Only target of hormone responds

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HORMONE ACTION

1. General Characteristics
 - A. needed in very small amounts
 - B. long-lasting effects
 - C. regulate metabolic processes
 - D. roles in reproduction, development, and growth

Chemistry of Hormones

1. Steroid hormones
 - A. produced from cholesterol
 - B. fat-soluble
 - C. pass through cell membrane
 - D. sex hormones
 - E. adrenal cortex hormones

Chemistry of Hormones

1. Non-steroid hormones
 - A. amines, proteins, peptides, glycoproteins
 - B. water-soluble.
 - C. require a receptor on the target cell membrane
 - D. most hormones

Actions of Hormones

1. Hormones alter metabolic processes.
2. Only affect cells that have appropriate receptors.
3. The more receptors, the greater the response.

Steroid Hormones

1. Enter cell membrane
2. Bind to receptor in nucleus
3. hormone-receptor complex alters gene expression
4. synthesis of mRNA activated
5. New proteins

Non-steroid Hormones

1. Hormone binds to receptor on cell membrane and acts as first messenger
2. Adenylate cyclase is activated
3. ATP is converted to cAMP as the second messenger
4. cAMP promotes a series of reactions leading to cellular changes

Prostaglandins

1. paracrine
- 2.
- 3.
- 4.
5. an activate or inhibit adenylate cyclase
6. wide variety of functions

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Control of Hormonal Secretions

1. primarily controlled by negative feedback mechanism
2. generally one or any combination of 3 types of control
 - A. Hormonal control
 - B. Nervous control
 - C. Direct control by glands

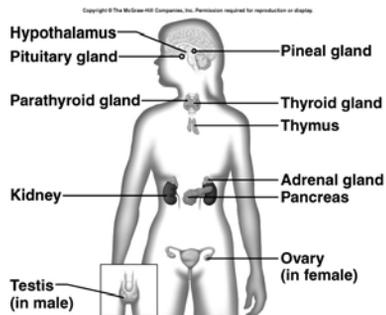
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Negative Feedback

1. hormone levels remain relatively stable.

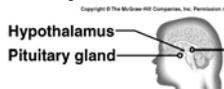
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Major Endocrine Glands



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Pituitary Gland



1. “master gland”
2. controls the functions of other glands
3. two distinct lobes
 - A. anterior pituitary (adenohypophysis)
 - B. posterior pituitary (neurohypophysis)

Hypothalamus

1. Region in the forebrain
2. Contains hormone-secreting cells
3. Interacts with pituitary

Anterior Pituitary Gland Control

1. the HYPOTHALAMUS secretes releasing hormones
2. Releasing hormones target the anterior pituitary gland

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Anterior Pituitary Hormones

1. Growth Hormone (GH)
 - A. Also called Somatotrophic Hormone (STH)
 - B. Regulates growth of bone, muscle, and other body tissues
 - a.
 - b.
 - c.

Abnormal Somatotropin Output

1. Gigantism
2. Pituitary dwarfism
3. Acromegaly



Acromegaly

1. enlarged hands, feet, and facial bones
2. widened fingers or toes due to skin overgrowth with swelling, redness, and pain
3. enlarged jaw (prognathism)
4. thickening of the skin
5. enlarged sebaceous glands



Anterior Pituitary Hormones

1. Prolactin (PRL)
 - A. Promotes development of breasts during pregnancy
 - B. Stimulates secretion of milk from breasts after delivery of baby
 - C. amplifies effect of LH in males

Affects of Prolactin

Anterior Pituitary Hormones

1. Thyroid Stimulating Hormone (TSH)
 - A. Promotes and maintains normal thyroid gland
 - B. Stimulates thyroid gland hormones
2. Adrenocorticotrophic Hormone (ACTH)
 - A. Stimulates normal adrenal cortex and secretion of corticosteroids

Anterior Pituitary Hormones

1. Follicle-Stimulating Hormone (FSH)
 - A. Stimulates secretion of estrogen and production of eggs
 - B. Stimulates production of sperm
2. Luteinizing Hormone (LH)
 - A. Stimulates ovulation or
 - B. the secretion of testosterone

Posterior pituitary

1. continuous with nerve fibers of hypothalamus;
2. does not produce hormones, but stores them until stimulated to release them

Posterior Pituitary Hormones

1. Antidiuretic Hormone (ADH)
 - A. causes kidneys to reduce water excretion
 - B. raises blood pressure
 - C. controlled by hypothalamus
2. Oxytocin (OT)
 - A. stimulates uterine contractions
 - B. stimulates mammary glands to release milk
 - C. controlled by hypothalamus

Thyroid Gland

1. Located in front of the neck just below the larynx, on either side of the trachea

Thyroid Gland Hormones

1. Thyroxine (T4) & Triiodothyronine (T3)
 - A. increase basal metabolic rate
 - B. regulate metabolism
 - C. increase protein synthesis
 - D. accelerate growth
 - E. stimulate activity in the nervous system
2. Calcitonin
 - A. lowers blood calcium and phosphate
 - B. increases rate at which calcium and phosphate are deposited in bones

Thyroid Gland Disorders

1. Cretinism
 - A. hyposecretion of T3/T4 during fetal life and infancy.
 - B. dwarfism & mental retardation;
 - C. prevention
 - D. treatment



Thyroid Gland Disorders

1. Myxedema
 - A. hyposecretion during adulthood.
 - B. Low metabolic rate
 - C. Symptoms include:
 - D. Oral thyroid hormones reduce symptoms.

Thyroid Gland Disorders

1. General Hyperthyroidism
 - A. high metabolic rate
 - B. hyperactivity
 - C. weight loss
 - D. protruding eyes



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Thyroid Gland Disorders

1. Grave's disease
 - A. an autoimmune disorder that causes growth of thyroid and hypersecretion of thyroid hormones
 - B. overstimulation by antibodies
 - C. peculiar edema of the eyes
 - D. Symptoms:
 - E. Treatment
 - a. .

Goiter

1. low thyroid hormones due to iodine deficiency.
2. Iodine needed to synthesize T3 and T4
3. Thyroid is overstimulated



Parathyroid Glands

1. 4 small glands located within the thyroid gland
2. Produce parathyroid hormone

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Parathyroid Hormone (PTH)

1. Antagonistic action of calcitonin and parathyroid hormone maintain blood calcium levels within normal limits
 - A.
 - B.
 - C.
 - D.
 - E.

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Adrenal Glands

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Adrenal Medulla Hormones

1. Epinephrine and Norepinephrine
 - A. controlled by sympathetic nervous system
 - B. increases heart rate and blood pressure
 - C. dilates respiratory airways
 - D. promotes breakdown of glycogen
 - E. activates reticular formation
 - F. increases metabolic rates

Adrenal Cortex Hormones

1. Cortisol
 - A. decreases protein synthesis
 - B. increases fatty acid release
 - C. stimulates glucose synthesis from noncarbohydrates

Stress

1. Types of Stress
 - A. physical stress
 - B. psychological stress
2. Responses to Stress
 - A. hypothalamus
 - B. epinephrine
 - C. cortisol

Adrenal Cortex Hormones

1. Aldosterone
 - A. regulates salt and water balance
 - B. increases blood volume and pressure by promoting conservation of sodium ions and water

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Adrenal Cortex Hormones

1. Adrenal androgens
 - A. supplement sex hormones from the gonads
 - a. gonadocorticoids: mostly male sex hormones (androgens) that stimulate libido
 - b. may be converted to estrogen

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Addison's Disease

1. Hyposecretion of AC hormones due to autoimmunity or disease (TB).
2. Symptoms:

Pancreas

1. Exocrine: digestive juices
2. Endocrine: pancreatic islets (Islets of Langerhans), produce and secrete insulin and glucagon

Pancreatic Hormones

1. Glucagon
 - A. stimulates liver to break down glycogen
 - B. stimulates liver to convert noncarbohydrates into glucose
 - C. stimulates break down of fats
 - D. controlled by blood glucose concentrations

Pancreatic Hormones

1. Insulin
 - A. promotes formation of glycogen from glucose
 - B. inhibits conversion of noncarbohydrates into glucose
 - C. enhances movement of glucose into adipose and muscle cells
 - D. decreases blood glucose concentrations
 - E. promotes transport of amino acids
 - F. enhances synthesis of proteins and fats
 - G. controlled by blood glucose concentrations

Insulin and Glucagon

1. Insulin and glucagon function together to stabilize blood glucose concentrations

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Diabetes Mellitus

1. body cells are unable to take up and/or metabolize glucose
 - A. Type I: Pancreas is not producing insulin
 - B. Type II: Pancreas produces insulin, but the liver and muscle cells do not respond in the normal fashion

Diabetes Mellitus

1. Type I (10%):
 - A. absolute insulin deficiency.
 - B. Patients < 20 years;
 - C. autoimmune disorder where β -cells are destroyed;
 - D. Hyperglycemia results.
 - E. ketoacidosis lowers blood pH, and causes death.
 - F. Atherosclerosis, CV disease, gangrene, blindness due to cataracts and retinal vascular disease; renal failure.

Diabetes Mellitus

1. Type II (90%)
 - A. patients used to be mostly > 40 years,
 - B. overweight,
 - C. hypertension,
 - D. Problem with receptors on target cells;
 - E. Controlled by diet, exercise, and weight loss

Other Endocrine Glands

1. Thymus Gland
 - A. secretes thymosins
 - B. thymosin promotes the maturation of T lymphocytes

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Pineal Gland



1. body's biological clock
 - A. circadian rhythms
 - B. Regulation of patterns of eating, sleeping, and reproduction
 - C. may control onset of puberty
 - D. helps regulate female reproductive cycle
2. Secretes melatonin
 - A. Induces sleep

Other Endocrine Glands

1. Reproductive Glands
 - A. ovaries secrete estrogen and progesterone
 - B. testes secrete testosterone
 - C. placenta secretes estrogen, progesterone, and gonadotropins

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Life-Span Changes

1. Endocrine glands tend to shrink and accumulate fibrous connective tissue,
2. GH levels even out, muscular strength decreases
3. Levels of ADH increase with age and as a result, the kidneys reabsorb more water.
4. The decrease of calcitonin levels with age increases the risk of osteoporosis.
5. insulin resistance may develop
6. changes in melatonin secretion affect the body clock
7. thymosin production declines increasing risk of infections

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