

Biology 48 - Human Physiology

Lecture Summary Sheet - Norris

Endocrine Physiology

I. Definitions

- A. Endocrine
- B. Exocrine
- C. Hormone
- D. Target Cell

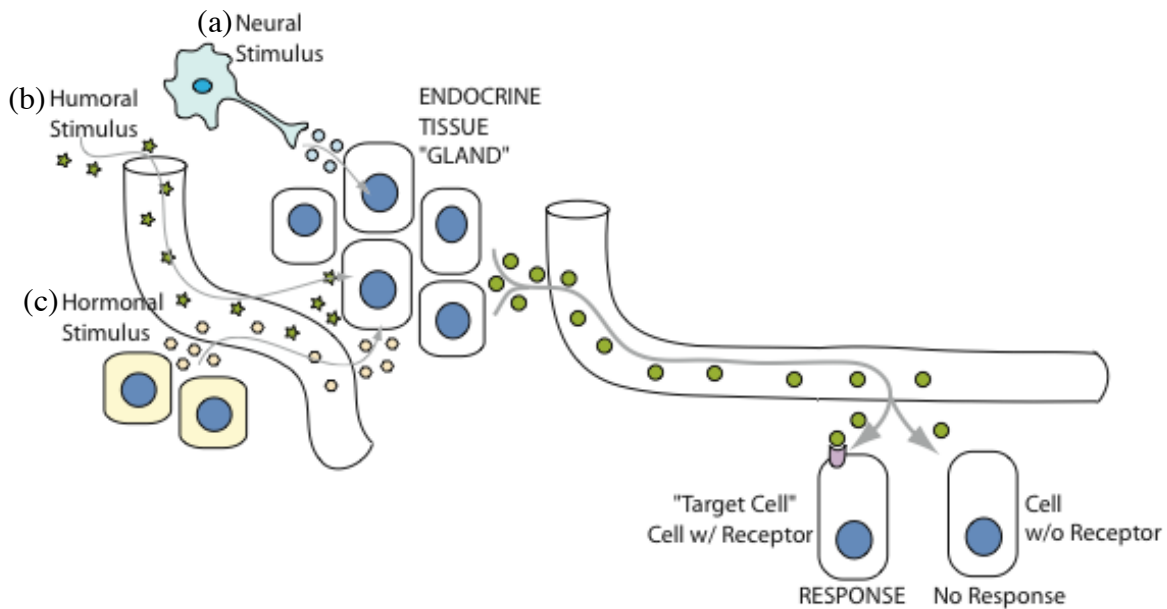
II. General Overview

A. Function / Basic Mechanism of Action

1. Endocrine System vs. Nervous System

2. Control of Hormone Secretion

- a. Nervous (*i.e. adrenal medulla*)
- b. Humoral (*i.e. blood glucose level*)
- c. Hormonal (*i.e. hypothalamic releasing hormones*)
- d. Feedback Regulation (via any of the above mechanisms)



3. Synthesis & Secretion

- a. Active
- b. Inactive

4. Chemical Classification of Hormones

- a. Water Soluble / Membrane Impermeable
 - i. Polypeptide (amino acid derived)
 - ii. Catecholamine (amino acid derived)
- b. Water Insoluble / Membrane Permeable
 - i. Steroid
 - ii. Thyroid (amino acid derived)

5. Transport

III. Mechanism of Hormone Action

A. Membrane Receptor / Second Messenger Systems

1. Cyclic AMP (cAMP)

2. Calcium

B. Cytoplasmic / Nuclear Receptor

1. Steroid Hormones

2. Thyroid Hormones

C. Effect of Hormone

1. Target Cell (*specific receptor*)

- Up and Down Regulation (*modifies response*)
- Synergistic effect / Permissive effect
- Antagonistic effect

2. Secondary Hormone (relay of control)

IV. Major Endocrine Organs

A. Hypothalamus

a. Releasing and Inhibiting Hormones

B. Pituitary Gland (aka hypophysis)

1. Posterior Pituitary (aka neurohypophysis, pars nervosa)

- Antidiuretic Hormone (ADH, or vasopressin) (*from the supraoptic nucleus (SON)*)
- Oxytocin (OT) (*from the paraventricular nucleus (PVN)*)

2. Intermediate Pituitary (aka pars intermedia)

a. Melanocyte Stimulating Hormone (MSH)

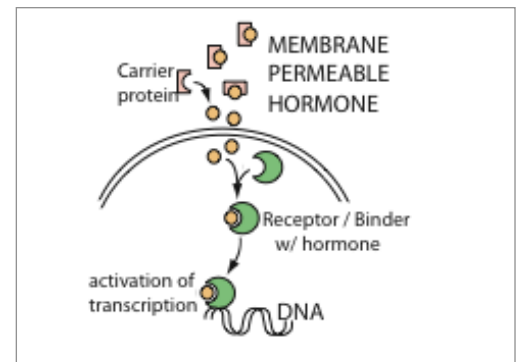
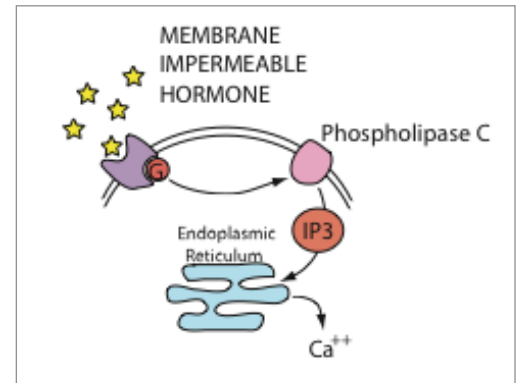
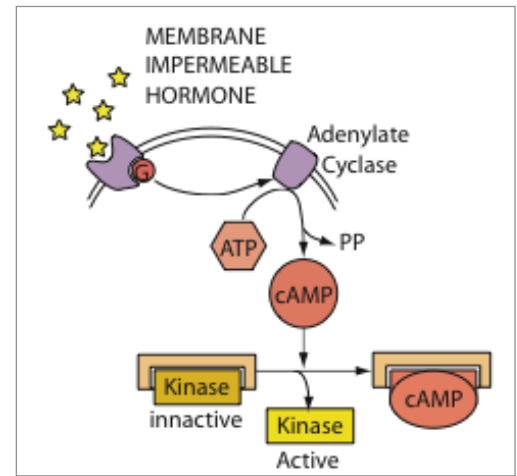
3. Anterior Pituitary (aka adenohypophysis, pars distalis)

- five cell types (regulated by the hypothalamus), secreting six hormones

a. Thyroid Stimulating Hormone (TSH) (*cells: thyrotropes*) - stimulated by thyrotropin releasing hormone (TRH)

b. Adrenocorticotrophic hormone (ACTH) (*cells: corticotropes*) - stimulated by corticotropin releasing hormone (CRH)

c. Growth Hormone (GH, or somatotropin) (*cells: somatotropes*) - stimulated by GH releasing hormone (GHRH) and inhibited by somatostatin



- d. Prolactin (PRL) (*cells: lactotropes*)
 - inhibited by prolactin inhibiting hormone (PIH)
- e. Gonadotropins (FSH and LH) (*cells: gonadotropes*)
 - stimulated by gonadotropin releasing hormone (GnRH)
 - i. FSH (Follicle Stimulating Hormone)
 - ii. LH (Leutinizing Hormone)

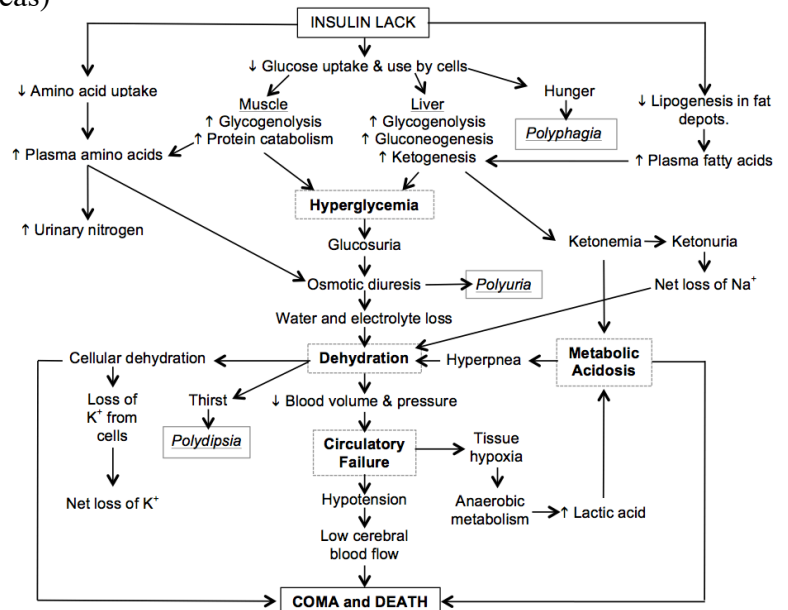
C. Pancreas

1. Pancreatic Acini (exocrine pancreas = 99% of cells)
2. Islets of Langerhans (endocrine pancreas)

- a. Alpha Cells - *Glucagon*
- b. Beta Cells - *Insulin*

3. Diabetes Mellitus

- a. Type I
(insulin dependent, IDDM)
- c. Type II
(non-insulin dependent, NIDDM)



D. Thyroid Gland

1. Follicular cells - *Thyroid Hormones (thyroxin T4, triiodothyronine T3)*
2. Extrafollicular cells - *Calcitonin*

E. Parathyroid Glands - *Parathyroid Hormone*

F. Adrenal (suprarenal) Glands

1. Cortex
 - a. Mineralocorticoids (*i.e. aldosterone*)
 - b. Glucocorticoids (*i.e. hydrocortisone, aka cortisol*)
 - c. Sex Hormones (primarily androgens)
2. Medulla - *Catecholamines (epinephrine & norepinephrine)*

G. Local Regulation - Autocrine and Paracrine Regulation (*i.e. prostaglandins*)

H. Other Endocrine Tissues

Thymus, Pineal, Gonads (testis and ovaries), GI Tract, Kidneys, Heart, and more...

V. Additional Key Terms / Topics

agonist amplification antagonist gluconeogenesis glycogenolysis half-life
 neuroendocrine pheromone receptor trophic hormone

Study Questions – Endocrine Physiology:

1. Define “endocrine,” “exocrine,” “hormone,” and “target cell”.
2. Compare and contrast between endocrine and exocrine glands.
3. Compare and contrast between the endocrine and the nervous systems.
4. Describe the different mechanisms of endocrine tissue control.
5. Describe the different chemical classifications used to describe hormones.
6. Describe the steps in the cAMP second messenger system. What type of hormone (chemical classification) uses this activation system?
7. Describe the steps in the calcium second messenger system. What type of hormone (chemical classification) uses this activation system?
8. Describe the steps in target cell activation by steroid hormones.
9. Describe the steps in target cell activation by thyroid hormones.
10. Describe the process of up and down regulation and its significance.
11. Name each of the lobes of the pituitary and describe the structure (origin) of each lobe.
12. Describe the relationship between the hypothalamus and the anterior pituitary.
13. Identify all of the hormones produced by the anterior pituitary and the general function of each. How many regulate the function of another endocrine gland?
14. Describe the relationship between the hypothalamus and the posterior pituitary.
15. Identify the hormones produced by the intermediate and posterior pituitary and describe the general function of each.
16. Describe the endocrine and exocrine structure of the pancreas.
17. Identify the different cell types of the endocrine pancreas and their products.
18. Describe the function of insulin on cells in general, on liver tissues, on adipose tissues and on skeletal muscle tissues.
19. Describe the function of glucagon on cells in general, on liver tissues, on adipose tissues and on skeletal muscle tissues.
20. Distinguish between type I (IDDM) and type II (NIDDM) diabetes mellitus.
21. What are the cardinal symptoms of diabetes mellitus (three P’s)? Explain how each symptom comes about.
22. Compare and contrast between diabetes mellitus and diabetes insipidus.
23. Identify the different hormones of the thyroid gland, their specific origin and their general function.
24. Identify the hormone of the parathyroid gland and its general function.
25. Identify the different hormones of the adrenal gland, their specific origin and their general functions.