

Endocrine System Review

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Page 1. Endocrine System Review

- Consists of discrete individual glands that produce and secrete chemical messengers known as hormones.
- Hormones travel from endocrine organs to their targets via the blood.
- Target cells are cells that have receptors for specific hormones on them.

Page 2. Goals/ What You Need to Know

Goals

- To identify the well established endocrine glands in the body.
- To review some of the well-understood hormones that are produced by each gland or tissue.
- To identify some of the major target tissues for each gland or tissue.
- To understand a simplified function for each hormone that is reviewed.

What You Need to Know

- The difference between endocrine and exocrine glands and the composition of a mixed gland.
- The difference between endocrine glands and endocrine tissues.
- The basic categories of organic molecules.
- The components and functions of a negative feedback system.

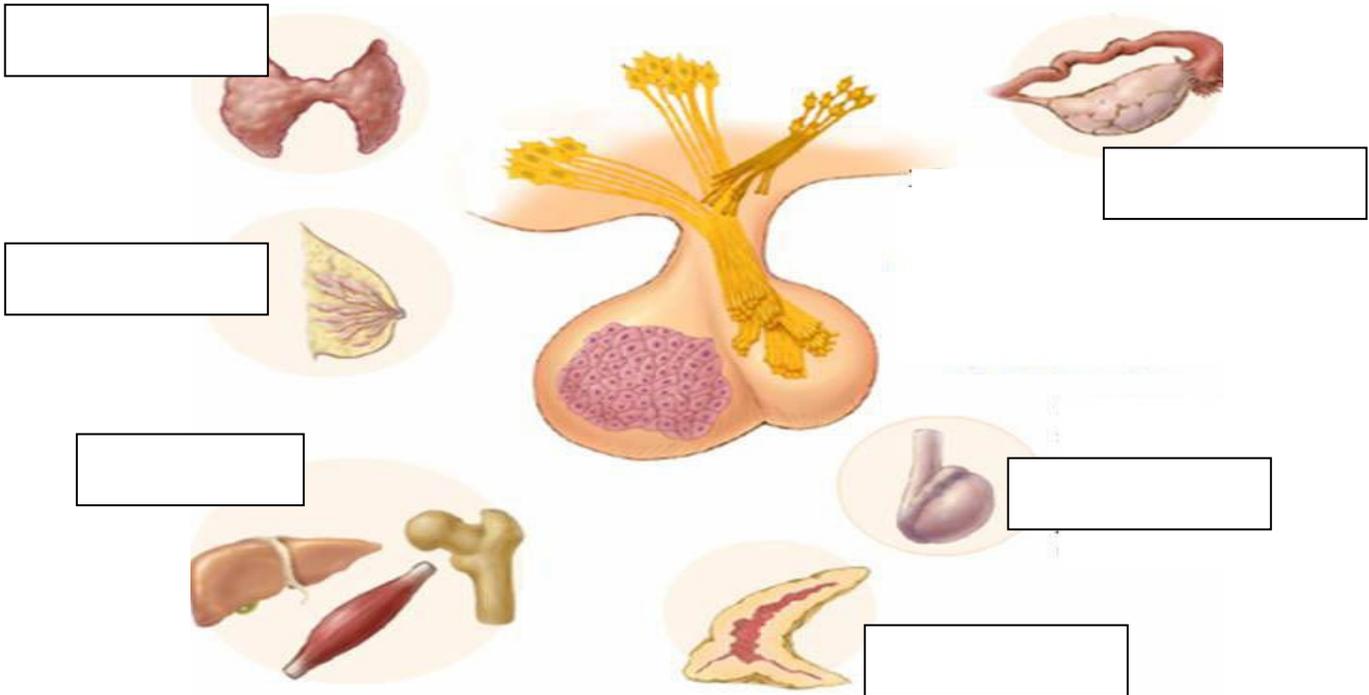
Page 3. Endocrine Glands: Hormones and Functions

***Be sure to review all the highlighted endocrine glands on this page.**

Pituitary gland

- Divided into the glandular anterior lobe and the neuronal posterior lobe.
- All six anterior pituitary hormones are peptides.
- The Six Major Anterior pituitary hormones are:
 1. Thyroid Stimulating Hormone (TSH or thyrotropin)
 2. Follicle Stimulating Hormone (FSH, a gonadotropin)
 3. Luteinizing Hormone (LH, a gonadotropin)
 4. Adrenocorticotrophic Hormone (ACTH, or corticotropin)
 5. Growth Hormone (GH)
 6. Prolactin (PRL)
- Targets and Functions of the Anterior Pituitary Hormones
 1. TSH – target thyroid gland and stimulates secretion of thyroid hormone (TH).
 2. FSH – targets follicles in the ovaries of females and stimulates growth of follicle and production of estrogen. In males it targets the testes and stimulates sperm cell production.
 3. LH – targets follicle, triggers ovulation and increases secretion of progesterone. In males it stimulates testosterone production.
 4. ACTH – targets the adrenal cortex and causes the secretion of glucocorticoids.
 5. GH - targets most bodily tissues and stimulates metabolism and growth of those tissues.
 6. PRL - targets the breasts in females. Stimulates breast development and lactation. Role is uncertain in males.

- For each target gland/tissue here fill in the correct anterior pituitary hormone.



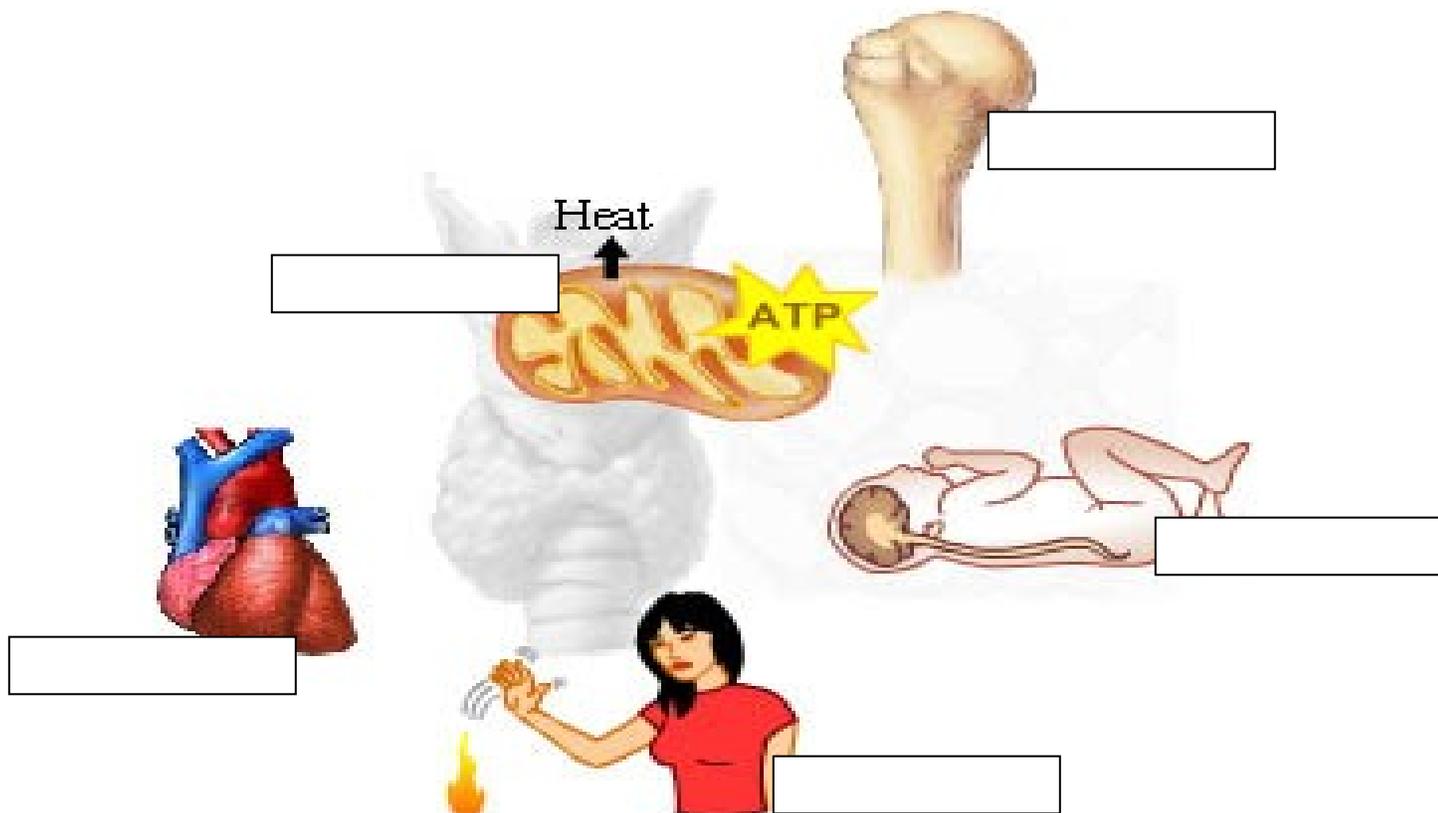
Pineal Gland

- Produces the amine hormone melatonin.
- Functions not well understood in humans but thought to play a role in regulating light-dark cycles.

Thyroid gland

- Produces two very different hormones.
 - Follicular cells produce the amine-based thyroid hormone (TH).
 - Parafollicular cells produce the peptide hormone calcitonin.
- Targets and functions of TH include:
 - Regulate many metabolic functions.
 - Essential for normal growth.
 - Essential for the development of the nervous system.
 - Essential for nervous system function in adults.
 - Amplifies the effects of the sympathetic nervous system.

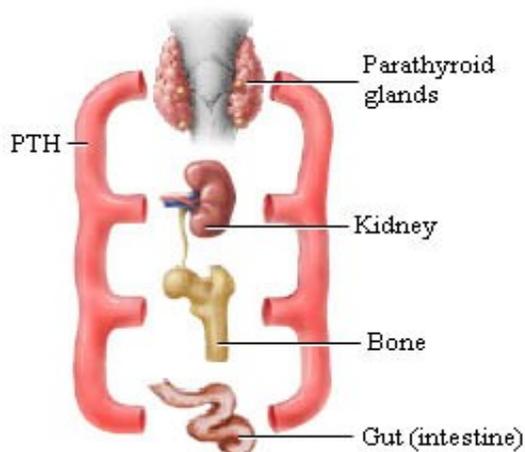
- Label this diagram with the correct functions of TH.



- Calcitonin helps regulate blood calcium levels by inhibiting osteoclast activity, thus preventing excessive resorption of bone.

Parathyroid glands

- A cluster of small glands on the posterior of the thyroid gland.
- Secrete the peptide hormone parathyroid hormone (PTH).
- PTH secretion is stimulated by a drop in blood calcium levels.
- PTH targets the following tissues:



- Kidneys – PTH causes direct reabsorption of calcium.

- Bone- PTH causes the resorption of bone.
- Gut – PTH stimulates conversion of vitamin D to calcitriol, which regulates absorption of calcium by the intestines.

Thymus

- Large at birth and increases in size until puberty. Decreases until unnoticeable in adults.
- Secretes the peptide hormones thymosin and thymopoietin.
- Function is poorly understood, but they play a role in the development of T-cell lymphocytes (hence the name).

Adrenal glands

- Small, paired glands that sit atop the kidneys.
- Composed of an outer epithelial cortex and inner neuronal medulla.
- Cortex secretes three classes of steroid hormones (mineralcorticoids, glucocorticoids, and androgens) and medulla secretes the catecholamines.
- There are three zones to the cortex:
 1. Zona Glomerulosa – secretes mineralcorticoids.
 2. Zona Fasciculata – secretes glucocorticoids and androgens.
 3. Zona Reticularis – secretes glucocorticoid and androgens.
- Important cortex hormones include:
 1. Aldosterone – mineralcorticoid that causes the reabsorption of sodium and the secretion of potassium.
 2. Cortisol – glucocorticoid that regulates metabolism, regulates the immune system, and facilitates the stress response.
 3. Androgens – stimulates growth spurt early in puberty and controls female sex drive.
- Adrenal medulla secretes the catecholamines epinephrine and norepinephrine.
 - Epinephrine is more abundant.
 - Both hormones facilitate the sympathetic fight or flight response.
 - Label the different regions of the adrenal cortex and medulla and indicate which hormones they produce.

Pancreas

- A larger mixed endocrine/exocrine gland that lies posterior to the stomach.
- Secretes two major peptide hormones, insulin and glucagon.
- Islet cells contain β -cells that secrete insulin and α -cells that secrete glucagon.
 1. Insulin
 - Lowers blood glucose levels by stimulating glucose uptake by cells, glycogen synthesis by the liver and triglyceride synthesis by adipose cells.
 2. Glucagon
 - Stimulates the breakdown of glycogen by the liver and the synthesis of glucose and ketones, thereby raising blood glucose levels.

<u>Region</u>	<u>Hormone Produced</u>

Ovaries

- Secrete the female steroid sex hormones estrogen and progesterone and the peptide hormone inhibin.

- Estrogen is important for egg development inside the ovarian follicles.
- Progesterone is important after ovulation for maintaining the integrity of the uterine lining and during pregnancy.
- Inhibin regulates the secretion of FSH from the anterior pituitary in a negative feedback mechanism.

*Be sure to view the animation of the ovary/uterine cycles.

Testes

- Secretes the male steroid sex hormone testosterone and the peptide hormone inhibin.
- Testosterone aids in the development of gametes, is responsible for secondary sex characteristics, and controls libido.
- Inhibin regulates the secretion of FSH by the anterior pituitary.

Page 4. Endocrine Tissues: Hormones and Functions

***Be sure to review all the endocrine tissues listed on this page.**

- Endocrine tissues are composed of groups of endocrine cells that are found in glands that are not specifically endocrine glands.
- The endocrine tissues include the following: hypothalamus, heart, stomach, small intestine and kidneys.

Hypothalamus

- Has clusters of neurons that secrete neurohormones into the circulation.
- The paraventricular and supraoptic nuclei secrete hormones into the posterior pituitary where they are released into the blood.
- The posterior pituitary hormones are:
 1. Oxytocin – a peptide that stimulates contractions of the uterus during labor and promotes milk ejection by the mammary glands.
 2. Antidiuretic Hormone (ADH) causes the kidneys to reabsorb water and has effects on blood pressure.
- The ventral hypothalamic neurons secrete releasing hormones that travel via the hypothalamic portal system into the anterior pituitary where they stimulate or inhibit the production of anterior pituitary hormones.
- The releasing hormones of the ventral hypothalamus are:
 1. Thyrotropin releasing hormone (TRH)
 2. Growth hormone releasing hormone (GHRH)
 3. Somatostatin – inhibits secretion of GH
 4. Gonadotropic releasing hormone (GNRH)
 5. Dopamine (DA) converts into prolactin inhibiting hormone (PIH)
 6. Corticotropic releasing hormone (CRH)

- Complete the following table.

Hypothalamic Hormone	Target	Pituitary Hormone	Target	Response of Endocrine Gland/ Target Tissue
TRH				
GHRH				

Somatostatin				
GnRH				
DA (PIH)				
CRH				

Heart

- Specialized cells of the atria secrete the hormone Atrial Natriuretic Peptide (ANP).
- ANP causes the kidneys to excrete excess sodium and therefore helps to regulate blood pressure and blood volume.

Stomach

- Cells lining the stomach secrete the peptide hormone gastrin.
- Gastrin travels via the bloodstream back to the stomach where it stimulates the release of HCl and growth of the stomach lining.

Gut (Small intestines)

- The upper portions of the small intestine produce four hormones:
 1. Cholecystokinin (CCK) – stimulates secretion of bile by gallbladder, stimulates secretions of digestive enzymes of pancreas, and promotes growth and maintenance of pancreas and gallbladder.
 2. Secretin – causes the gall bladder and pancreas to secrete bicarbonate ion into the small intestines where it neutralizes acidic chyme from the stomach.
 3. Glucose dependent insulinotropic peptide (GIP) – causes the pancreas to secrete insulin when glucose is present in the small intestine.
 4. Motilin – released about every 90 minutes and causes the smooth peristaltic waves that sweep food toward the terminus of the small intestine.

Kidneys

- Activates the peptide erythropoietin and the steroid calcitrol.
 1. Erythropoietin – stimulates the red bone marrow to produce new RBC's.
 2. Calcitrol – The active form of vitamin D formed in response to PTH. It aids in the absorption of calcium by the intestines.

Page 5. Summary

- You have reviewed the major endocrine glands and endocrine tissues of the body.
- You have learned about the well understood hormones of these glands and tissues.
- You have identified a target tissue for each of these hormones and have been given a simplified function of each hormone.

** Now is a good time to go to the quiz questions.

- Click the quiz button on the left side of the screen.
- Click on the scrolling page list at the top of the screen and completes questions 1-4.

Notes on Quiz Questions

Quiz Question #1: Hormone Identification

- This question asks you to match hormones from all the different endocrine glands or tissues with their functions in the body.

Quiz Question #2: Hormones and Target Tissues

- This game requires you to match a hormone from the scrolling list with its appropriate target tissue. You can play the game multiple times and the sequence of hormones will change each time.

Quiz Question #3: Hormone Function

- This is matching game that gives you a description of function and requires you to match it with the correct hormone name. There are two levels to this question.

Quiz Question #4: Hormone Production / Hormone Stimulation

- This is a two part question. In the first part you must choose whether a hormone is produced in the stomach or in the intestines. In the second part you have to match the hormones from part one with their correct target tissues.

Study Questions on Endocrine System Review

1. (Page 1.) How do hormones reach their target tissues?
2. (Page 3.) What is the major structural distinction between the anterior and posterior pituitary?
3. (Page 3.) Match the following pituitary hormones with their functions:
 TSH
 ACTH
 FSH
 LH
 PRL

 _____ a. Stimulates sperm cell production
 _____ b. Stimulates lactation
 _____ c. Triggers secretion of adrenal cortex hormones
 _____ d. Primarily stimulates testosterone production by the testes
 _____ e. Stimulates the thyroid gland
4. (Page 3.) What are the three targets of PTH?
5. (Page 3.) What is the main ion regulated by PTH?
6. (Page 3.) Match the following adrenal hormones with their functions.
 Cortisol
 Aldosterone
 Androgens
 Epinephrine

- a. Responsible for the reabsorption of Na⁺ and the secretion of K⁺
 - b. Responsible for some secondary sex characteristics in females
 - c. Most well known for its role in the immune response
 - d. the primary “fight or flight” hormone
7. (Page 3.) All of the hormones secreted by the adrenal cortex are of this chemical composition: _____.
8. (Page 3.) Which of the hormones from the pancreas lowers blood glucose by stimulating glucose uptake by cells?
9. (Page 3.) In the pancreatic islets _____ cells secrete insulin and _____ cells secrete glucagon.
10. (Page 3.) Match the following hormones with their functions:
Inhibin
Estrogen
Progesterone
LH
Testosterone
- a. Important during pregnancy
 - b. Responsible for male libido
 - c. Important in triggering ovulation at the midpoint of the menstrual cycle
 - d. Important for gamete production and maturation of the female reproductive organs
 - e. Regulates secretion of FSH by the anterior pituitary
11. (Page 4.) Give the targets and responses of the following hypothalamic hormones:
ADH
TRH
CRH
GnRH
Oxytocin
PIH
12. (Page 4.) How does atrial natriuretic peptide help regulate blood pressure?
13. (Page 4.) Of the following intestinal hormones: CCK, Secretin, GIP, or Motilin, which is responsible for creating peristaltic waves along the length of the intestines?
14. (Page 4.) Which hormone of the kidney stimulates blood cell formation?