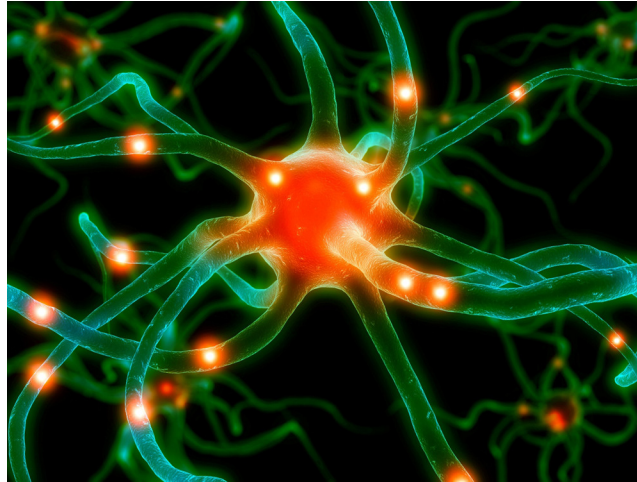
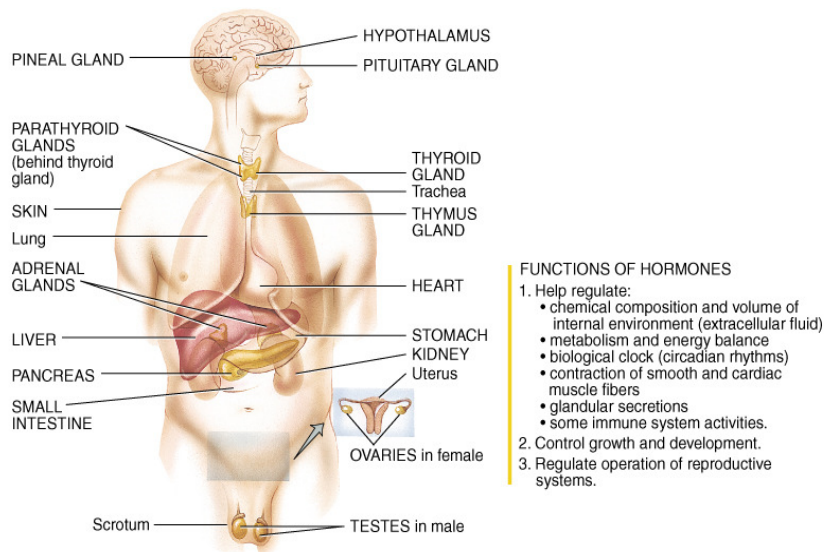


PTA 106

Unit 1 Lecture 2



Introduction to the Endocrine System



- FUNCTIONS OF HORMONES**
1. Help regulate:
 - chemical composition and volume of internal environment (extracellular fluid)
 - metabolism and energy balance
 - biological clock (circadian rhythms)
 - contraction of smooth and cardiac muscle fibers
 - glandular secretions
 - some immune system activities.
 2. Control growth and development.
 3. Regulate operation of reproductive systems.

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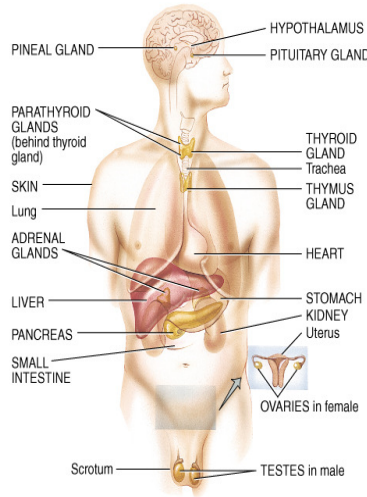
Hormone Interactions

Synergistic Effect:

Two hormones acting together have a greater or more extensive effect.

Antagonistic Effect:

One hormone opposes the action of another hormone



- FUNCTIONS OF HORMONES**
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Patterns of Hormone Action

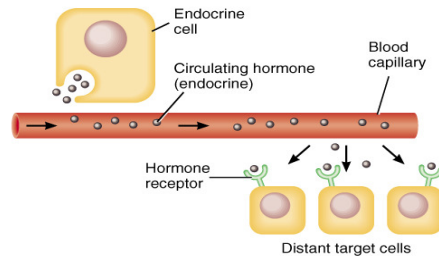
Target cells or tissue:

Specific cells affected by a hormone

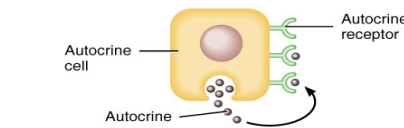
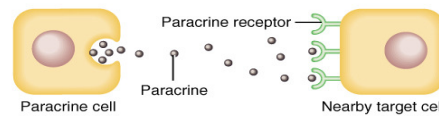
Endocrine: circulated by blood to target cells

Paracrine: Hormones that affect neighboring cells

Autocrine: Hormones that act on the cells that secrete them



(a) Circulating hormones (endocrines)



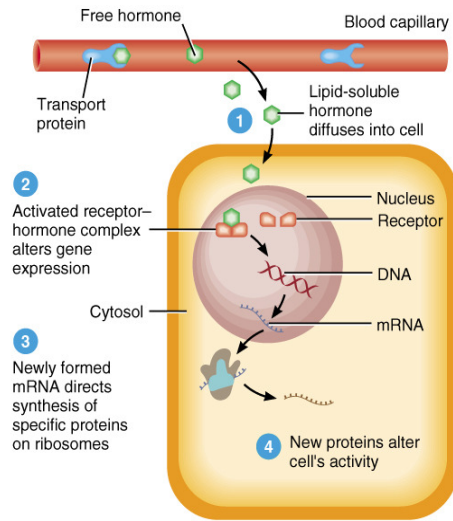
(b) Local hormones (paracrines and autocrines)

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Mechanism of Action for lipid-soluble or steroid Endocrine hormones

Lipid-Soluble Hormones

- Aldosterone**
- Calcitriol**
- Testosterone**
- Estrogen**
- Progesterone**
- T3 & T4**

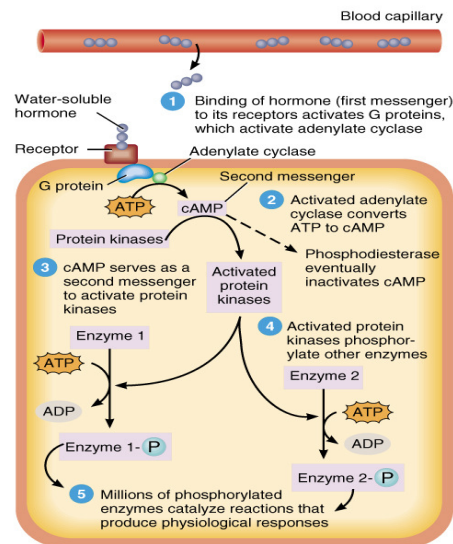


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Mechanism of action for water-soluble Hormones

Anterior Pituitary Hormones

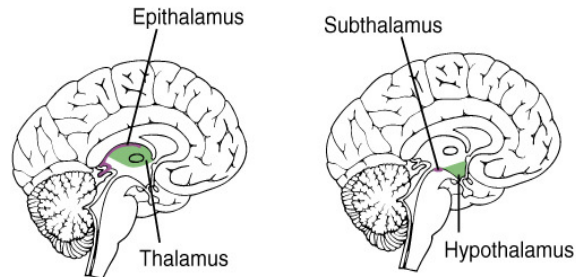
- Human Growth hormone**
- TSH**
- ACTH**
- FSH**
- LH**
- Prolactin**
- MSH**



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Action of the Hypothalamus as the “Master” Gland

- **Hypothalamus:**
Controls the activity of the pituitary gland by releasing hormones called releasing or inhibiting hormones



(c) Diencephalon

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Action of the Hypothalamus as the “Master” Gland

Hormone Produced:

Growth Hormone Releasing Hormone or Somatocrinin (GHRH)

Growth Hormone Inhibiting Hormone or Somatostatin (GHIH)

Thyrotropin Releasing Hormone (TRH)

Gonadotropin Releasing Hormone (GnRH)

Prolactin Releasing Hormone (PRH)

Prolactin Inhibiting Hormone (PIH)

Corticotropin Releasing Hormone (CRH)

Dopamine.

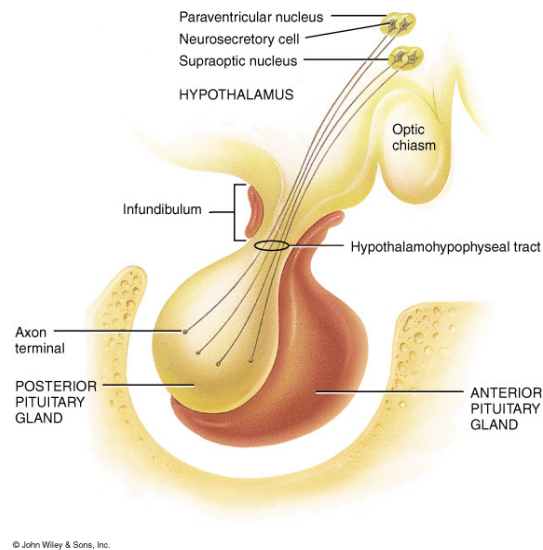
* Hormone are released to blood in the Hypophyseal portal artery which is part of the Hypophyseal portal system. *

Actions of the Posterior Pituitary or Neurohypophysis

Neurohypophysis

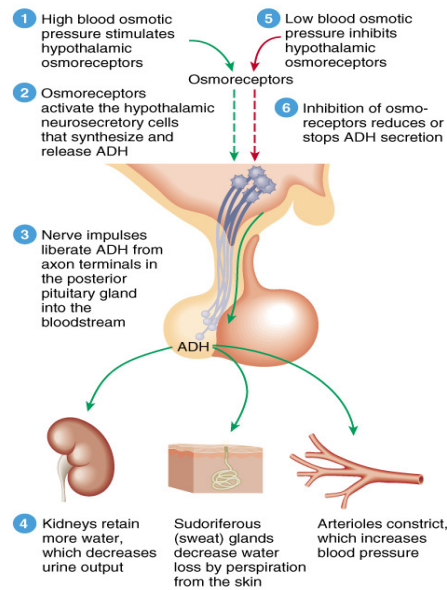
does not synthesize hormones, however, it stores and releases two hormones produced by the neurosecretory cells of the hypothalamus

- ADH
- Oxytocin



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Actions and Regulation of ADH



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Major Actions of Oxytocin

- Stimulates contraction of smooth muscle cells of the uterus during childbirth
- Stimulates contraction of myoepithelial cells in the breast to cause milk letdown



Hormones Released from the Anterior Pituitary or Adenohypophysis

Somatotrophs:

Human growth hormone or somatotrophin (hGH)

Hypothalamic control:

hGH releasing hormone (GHRH)

hGH inhibiting hormone (GHIH)

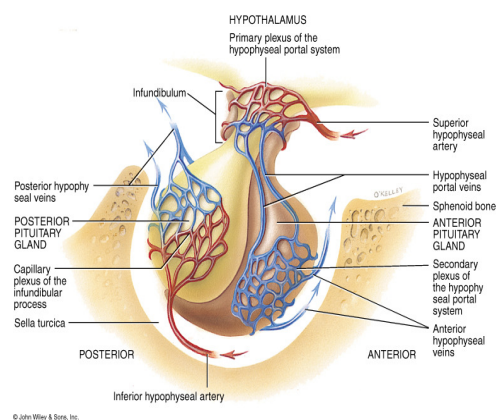
Thyrotrophs:

Thyroid-stimulating hormone (TSH)

Hypothalamic control:

Thyrotropin releasing hormone (TRH)

(GHIH)



Hormones Released from the Anterior Pituitary or Adenohypophysis

- **Gonadotrophs:**
 Follicle-stimulating hormone (FSH)
 Luteinizing hormone (LH)

Hypothalamic control:

Gonadotropic releasing hormone (GnRH)

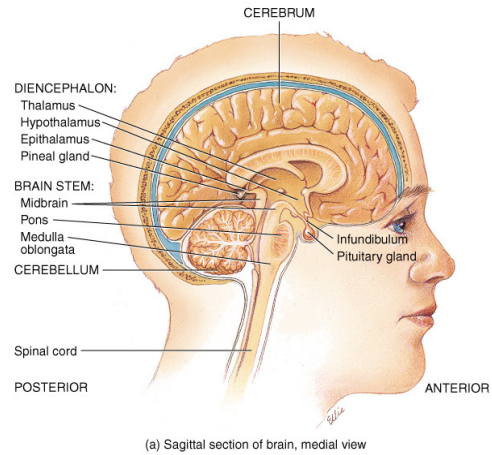
- **Lactotrophs:**

Prolactin (PRL)

Hypothalamic control:

Prolactin releasing hormone (PRH) and TRH

Prolactin inhibiting hormone PIH or dopamine



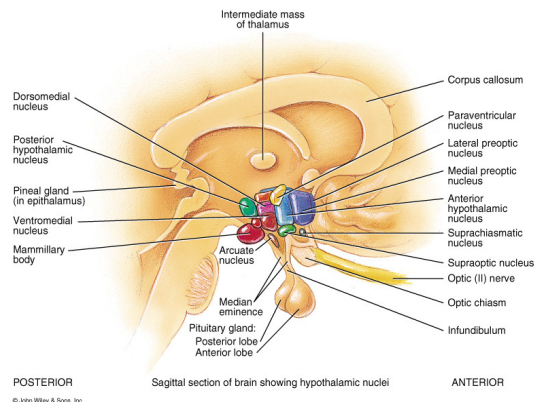
Hormones Released from the Anterior Pituitary or Adenohypophysis

Corticotrophs:

- Adrenocorticotrophic hormone (ACTH)
- Melanocyte-stimulating hormone (MSH)

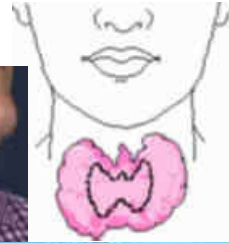
Hypothalamic control:

- Corticotrophin releasing hormone (CRH)
- For MSH inhibition dopamine



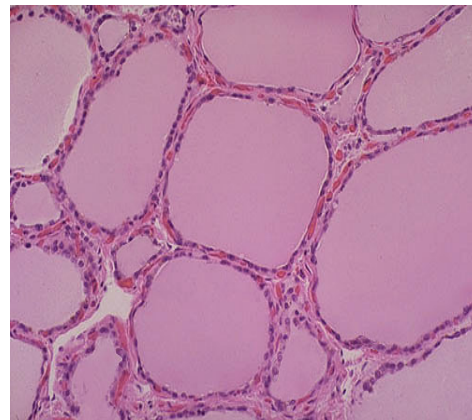
Endocrine activity of the Thyroid Gland

- **Hypothyroidism:**
Cretinism: Physical and mental growth and development is greatly retarded
- **Hyperthyroidism**
Toxic goiter
Graves disease with exophthalmos



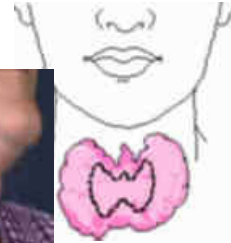
Endocrine activity of the Thyroid Gland

- **Follicular cells:**
T3 and T4
- **Target Tissue;**
Almost all body tissues
- **Hormone Affects:**
Increase body Metabolism
Increases gluconeogenesis
Increases glycolysis
Increases Lipolysis
Increased basal metabolic rate
Increases Heart Rate and force of contraction



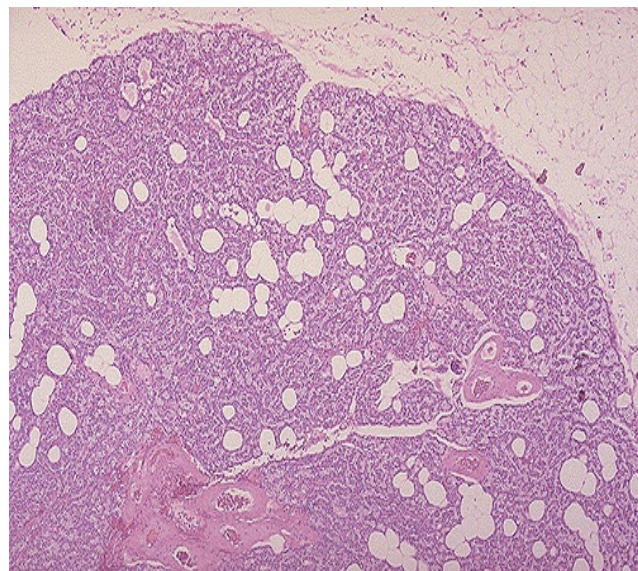
Endocrine activity of the Thyroid Gland

- **Hypothyroidism:**
 - endemic goiter: (due to I2 deficiency)
 - Myxedema: bagginess under the eyes and swelling of the face.
 - Arteriosclerosis: due to increase in blood cholesterol
 - Cretinism: extreme hypothyroidism during infancy and childhood

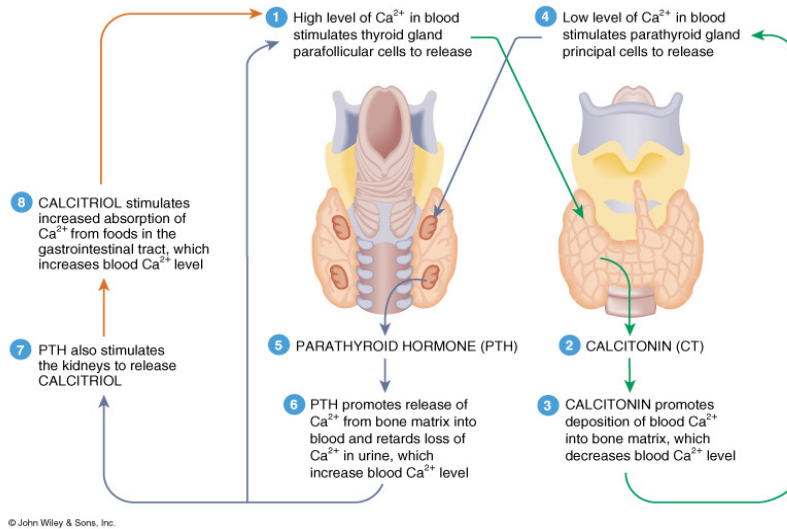


Parathyroid Hormones

- **Principle Cells**
PTH



Interactions of PTH and Calcitonin



Changes in Calcium Balance

Electrolyte	Causes	Symptoms
Hypocalcemia Low Calcium (<4 mEq/l) Normal Range: 4.5 – 5.3 mEq/l)	Hypoparathyroidism, increased loss, decreased intake, elevated phosphate	Numbness and tingling of fingers, hyperactive reflexes, muscle tetany, bone fractures, laryngeal muscle spasms that lead to asphyxiation
Hypercalcemia High Calcium (>11 mEq/l)	Hyperparathyroidism, excessive vitamin D, Paget's disease	Lethargy, weakness, anorexia, nausea, vomiting, polyuria, itching, bone pain, depression, confusion, and coma

Function of the Pineal Gland

- Pineal secretion peaks between the ages of 1 and 5 and declines by 75% by the end of puberty.
- Produces two hormones, serotonin and melatonin.
- Melatonin has been implicated in some human mood disorders such as depression, sleep disturbances, SAD and PMS. Evidence remains somewhat inconclusive, but melatonin is elevated in both SAD and PMS and melatonin levels can be reduced by phototherapy (exposure to 2 to 3 hours of bright light/day)
- Melatonin in other animals controls seasonal breeding patterns and sexual maturation. Some physiologists believe it may also regulate puberty in humans

Function of the Pineal Gland

- Serotonin is produced by the Pineal, CNS neurons, and GI enteroendocrine cells.
- Serotonin is believed to play an important role in regulation of aggression, body temperature, mood, sleep, vomiting, sexuality, and appetite.
- Low levels (hyposecretion) of serotonin have been associated with aggressive and angry behaviors, clinical depression, OCD (obsessive-compulsive disorder), migraines, irritable bowel syndrome, tinnitus, fibromyalgia, and SIDS (sudden infant death syndrome).
- Hyper secretion leads to Serotonin Syndrome which is potentially fatal. (usually caused by drug interactions)