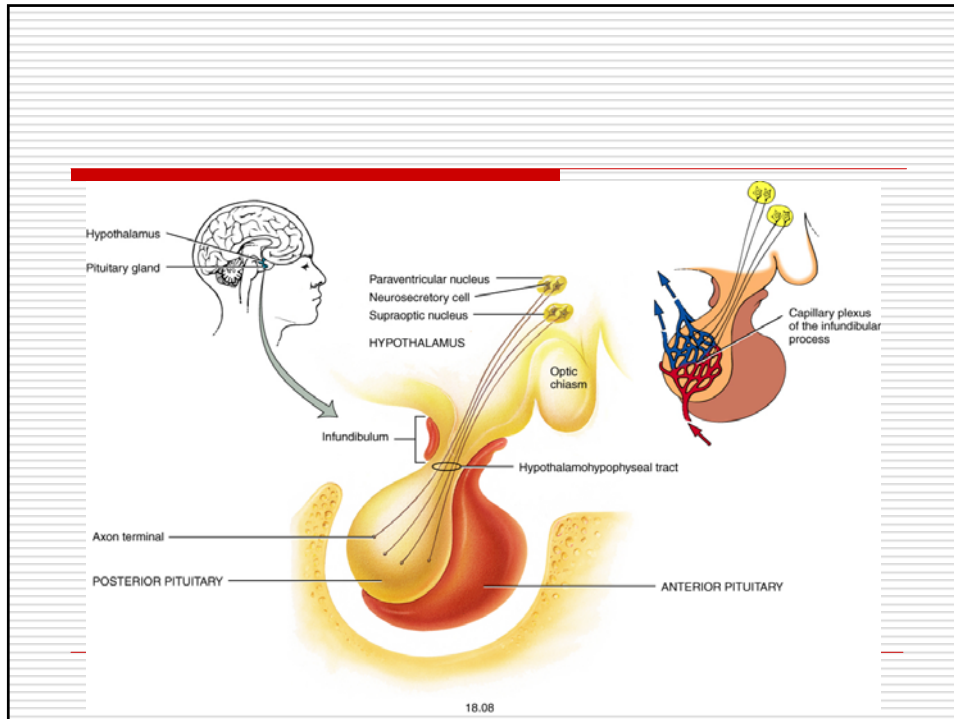


Hypothalamo – Hypophysial Unit

Amelyn R. Rafael, MD

Pituitary Gland

- Hypophysis
 - Small gland which lies in the sella turcica
 - Connected to the Hypothalamus by the pituitary stalk
 - 2 distinct portions:
 - Anterior pituitary – Adenohypophysis
 - Posterior pituitary - Neurohypophysis
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Anterior pituitary

- Originate from Rathke's pouch, which is an embryonic invagination of the pharyngeal epithelium
 - Hormones secreted play a major role in the control of metabolic functions throughout the body
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Hormones secreted

- hGH (somatotropin) – promote growth of the entire body by affecting protein formation, cell multiplication, and cell differentiation by stimulating several tissues to secrete IGF
 - Adenocorticotropin (corticotropin) – controls secretion of some of the adenocortical hormones, which in turn affect the metabolism of glucose, proteins, and fats
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- TSH (thyrotropin) – controls the rate of secretion of thyroxine and triiodotyronine by the thyroid gland, and these hormones in turn control the rates of most intracellular chemical reactions of the entire body
 - Prolactin – promotes mammary gland development and milk production
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- Gonadotropic hormones – control growth of the gonads as well as their hormonal and reproductive activities
 - FSH (Follicle Stimulating Hormone)
 - LH (Luteinizing Hormone)

Hormones that stimulate another endocrine gland are called tropic hormones or tropins

Cell types

- Somatotropes – hGH
 - 30-40% of AP cells
 - Stain strongly with acid dyes, therefore called acidophils
 - Pituitary tumors that secrete large quantities of hGH are called acidophilic tumors
 - Corticotropes – ACTH
 - 20% of AP cells
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- Thyrotropes – TSH
 - Gonadotropes – FSH, LH
 - Lactotropes – Prolactin

3-5% of AP cells

Posterior Pituitary

- Originate from an outgrowth of the Hypothalamus
 - Its origin from the neural tissue explains the presence of large numbers of glial-type cells in this gland
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Hormones secreted

- ADH (vasopressin) – controls the rate of water excretion into the urine
 - Helps control the concentration of water in the body fluids
 - Oxytocin – helps deliver milk from the glands of the breast to the nipples during suckling
 - Possibly helps in the delivery of the baby at the end of gestation
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- The cell bodies of the cells that secrete the posterior pituitary hormones are not located in the posterior pituitary gland itself but are large neurons located in the supraoptic and paraventricular nuclei of the hypothalamus
 - The hormones are then transported to the posterior pituitary glands in the axoplasm of the neuron's nerve fibers passing from the hypothalamus to the posterior pituitary gland
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Pituicytes

- Glial-like cells which make up the posterior pituitary gland
 - Do not secrete hormones
 - Simply act as supporting structure for large numbers of terminal nerve fibers and terminal nerve endings from nerve tracts that originate in the supraoptic and paraventricular nuclei of the hypothalamus
 - These tracts pass to the neurohypophysis through the pituitary stalk (hypophysial stalk)
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- If the pituitary stalk is cut above the pituitary gland but the hypothalamus is left intact, the posterior pituitary hormones continue, after a transient decrease for a few days, to be secreted almost normally
 - They are secreted by the cut ends of the fibers within the hypothalamus
 - The hormones are initially synthesized in the cell bodies of the supraoptic and paraventricular nuclei
 - They are transported in combination with carrier proteins called neurophysins down to the nerve endings in the posterior pituitary
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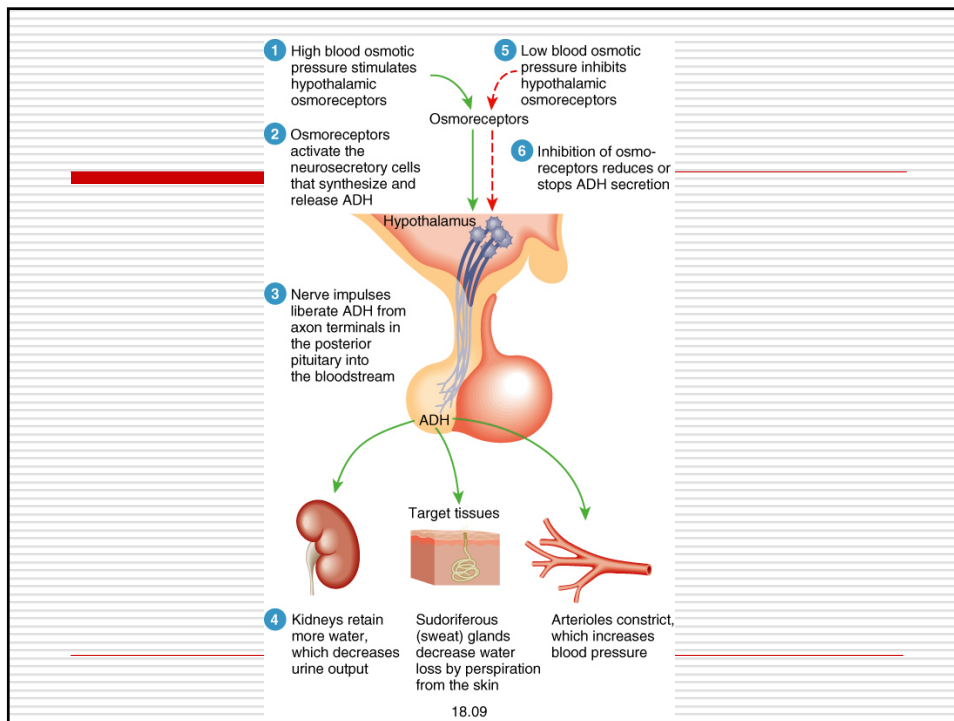
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- ADH is formed primarily by the supraoptic nuclei
 - Oxytocin is formed primarily by the paraventricular nuclei
 - Each of these nuclei can synthesize about one sixth as much of the second hormone as of its primary hormone
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ADH

- Physiological Functions
 - Absence of ADH
 - The collecting tubules and ducts are almost impermeable to water, which prevents significant reabsorption of water
 - Extreme loss of water in the urine
 - Extreme dilution of the urine
 - Presence of ADH
 - The permeability of the CD and tubules to water increases, increased reabsorption
 - Water conservation; very concentrated urine
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□ Osmotic regulation

- Osmoreceptors – modified neuron receptors near the hypothalamus
 - When the ECF becomes too concentrated fluid is pulled by osmosis out of the osmoreceptor cell, increase ADH secretion
 - When the ECF becomes too dilute, water moves by osmosis in the opposite direction into the cell, decreasing the signal for ADH secretion
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Vasoconstrictor and Pressor Effects of ADH

- Higher concentrations of ADH have a potent effect of constricting the arterioles in the body and increasing arterial pressure (vasopressin)
 - One stimuli for intense ADH secretion: decreased blood volume by 15-25%
 - The RA have stretch receptors that are excited by overfilling → signals to the brain to (-) ADH secretion
 - When unexcited (underfilling) → ↑ADH secretion
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Oxytocin

- Effect on the uterus and on birth
 - Contraction
 - Effect on milk ejection
 - The suckling stimuli on the nipple cause signals to be transmitted through the sensory nerves to the brain
 - The signals finally reach the oxytocin neurons in the paraventricular and supraoptic nuclei → release of oxytocin
 - The oxytocin is carried to the breast causing contraction of the myoepithelial cells → milk let-down
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Control of pituitary secretion by the Hypothalamus

- Almost all secretion by the pituitary is controlled by either hormonal or nervous signals from the hypothalamus
 - Secretion from the posterior pituitary is controlled by nerve signals
 - Secretion by the anterior pituitary is controlled by hormones – the hypothalamic releasing and inhibitory hormones (or factors)
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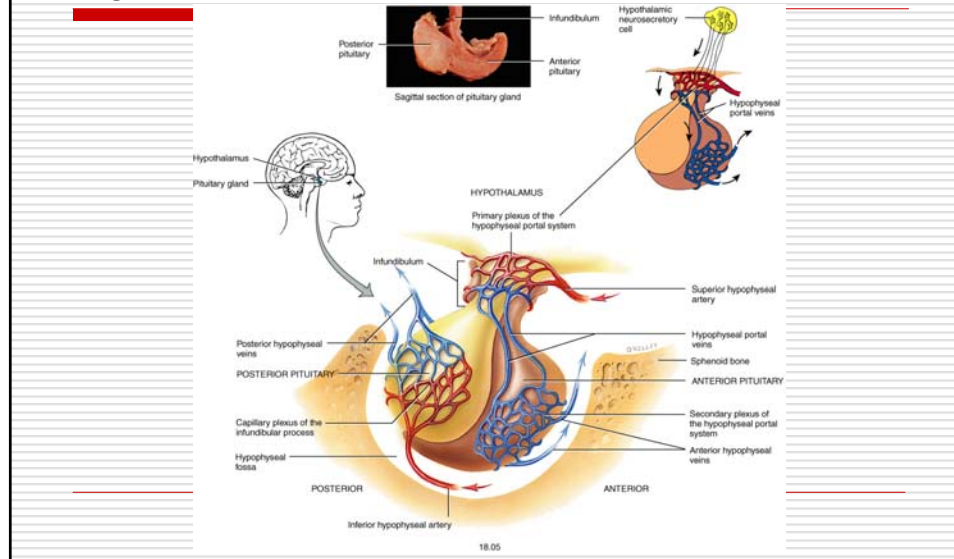
Hypothalamic releasing and inhibitory hormones

- Secreted in the hypothalamus itself and then conducted to the anterior pituitary through minute blood vessels (hypothalamic-hypophysial portal vessels)
 - They act on glandular cells to control their secretion
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- Thyrotropin-RH (TRH) – causes the release of TSH
 - Corticotropin-RH (CRH) – causes the release of adenocorticotropin
 - GHRH – causes release of GH
 - GHIH (somatostatin) – inhibits the release of GH
 - GnRH – causes release of the two gonadotropic hormones
 - PIH – causes inhibition of prolactin secretion
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- All or most are secreted at nerve endings in the median eminence before being transported to the anterior pituitary gland
 - Electrical stimulation of this region excites these nerve endings and causes release of essentially all the hypothalamic hormones
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Hypothalamic – Hypophysial Portal System



- ❑ Hypothalamic neurosecretory cells – synthesize the releasing and inhibiting hormones, are transported within axons and released at the axon terminals
- ❑ The hormones diffuse into capillaries of the primary plexus of the hypophysial portal system and are carried by the hypophysial portal veins to the secondary plexus of the hypophysial portal system for distribution to target cells in the anterior pituitary

