

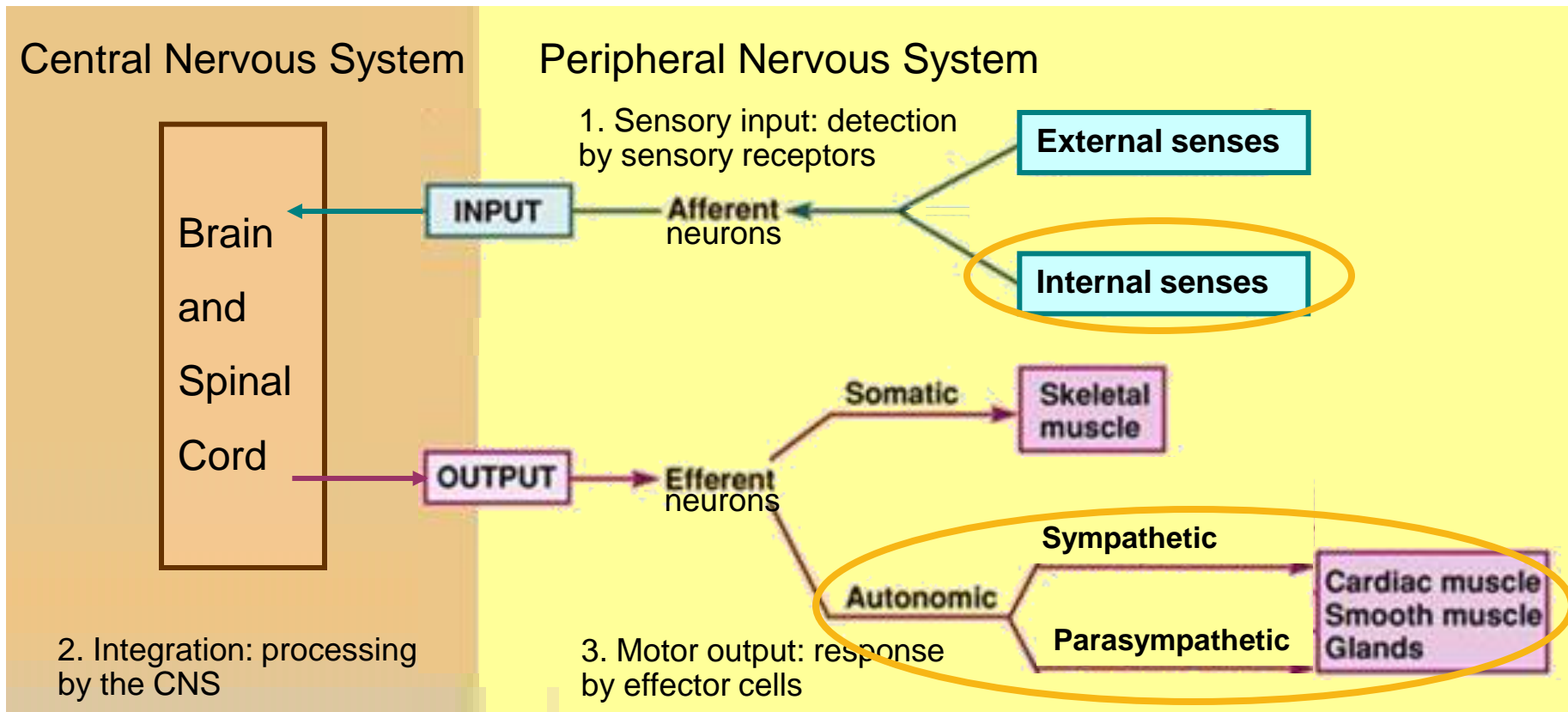
Endocrine System

Part 1 - Overview

Nervous vs Endocrine System

- Nervous system: coordinates **rapid** responses to stimuli via action potentials (**electrical** signal)
- Endocrine system: coordinates **long-term** responses using **chemical** signals (hormones)

Integration of nervous and endocrine



Dual roles of some hormones

- Some chemicals are both hormones in the endocrine system and signals in the nervous system
- Example: epinephrine
 - “flight or fight” hormone produced by adrenal medulla (endocrine gland)
 - Neurotransmitter that conveys message between neurons

Hormones

- Chemical signals carried by blood and cause specific changes in target cells
- Function:
 - regulate energy use, metabolism and growth
 - maintain homeostasis

Target Cell

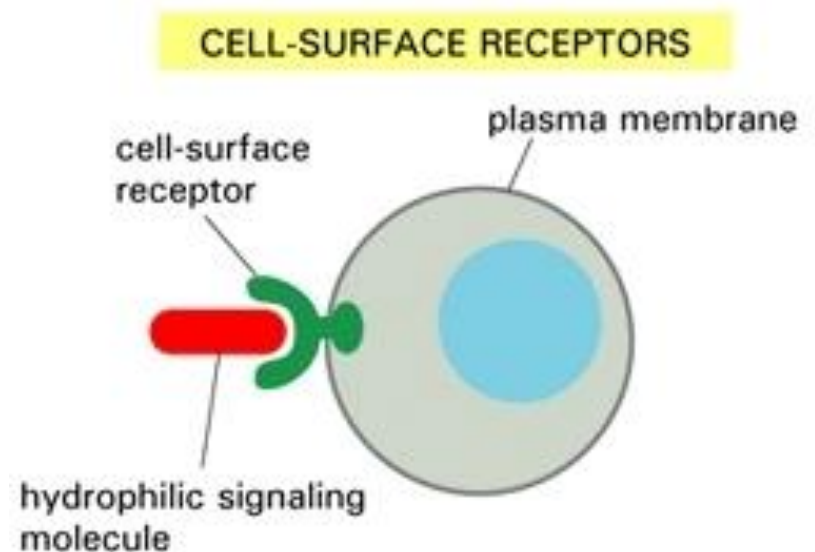
- Cells that respond to a regulatory signal
- E.g. have specific receptors for hormones
- Performs the body's response to the hormonal signals

Types of Hormones

- Peptide Hormones
- Steroid Hormones

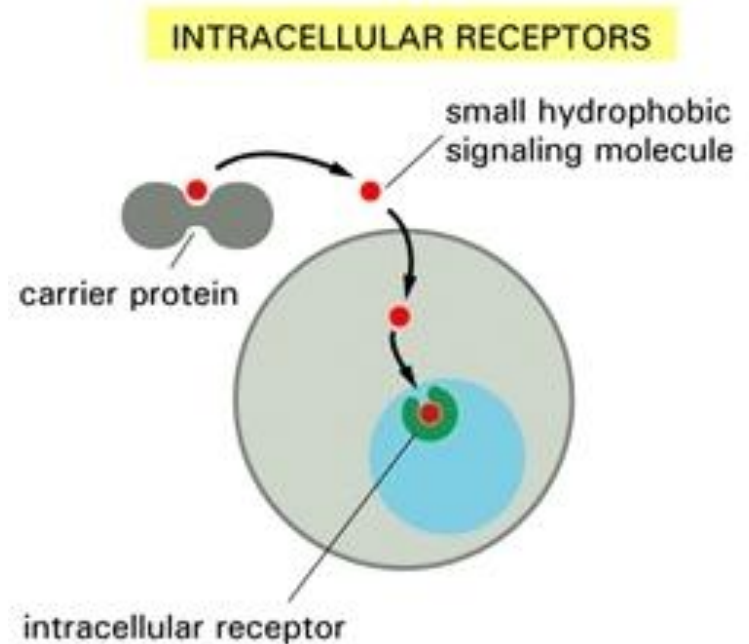
Peptide Hormone

- short peptide sequences
- water soluble
- Cannot pass through cell membrane (phospholipid)
- Binds to receptor on surface of target cell and triggers a signal transduction pathway



Steroid Hormone

- made from cholesterol
- insoluble in water, lipid-soluble
- Can enter target cell by diffusion through cell membrane
- Bind to intracellular receptor in cytoplasm or nucleus



Patterns of Hormonal Control

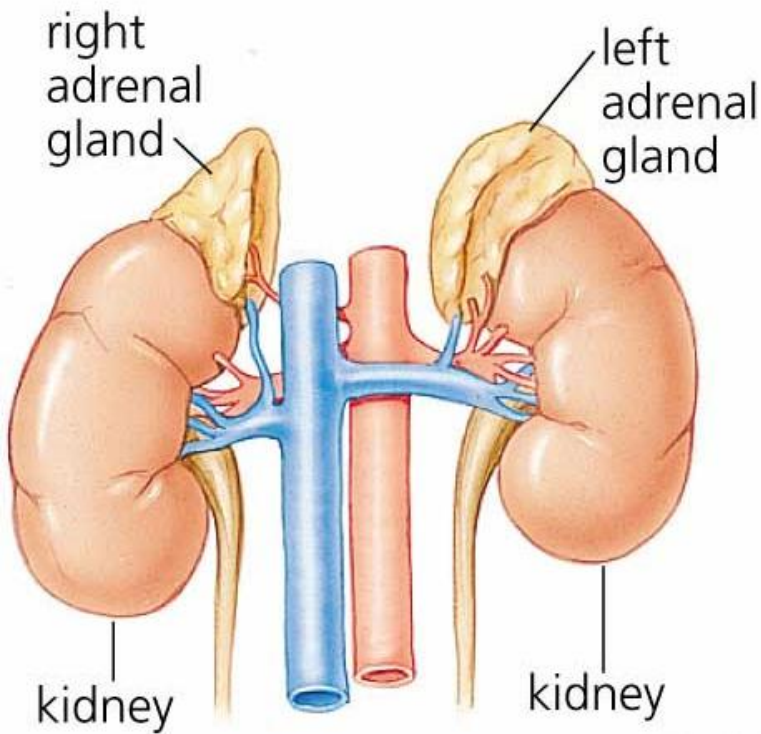
Endocrine pathway	Neurohormone pathway	Neuroendocrine pathway
Stimulus Endocrine gland Blood vessel Target Response	Stimulus Hypothalamus Blood vessel Target Response	Stimulus Hypothalamus Blood vessel Endocrine gland Blood vessel Target Response

Endocrine Pathway

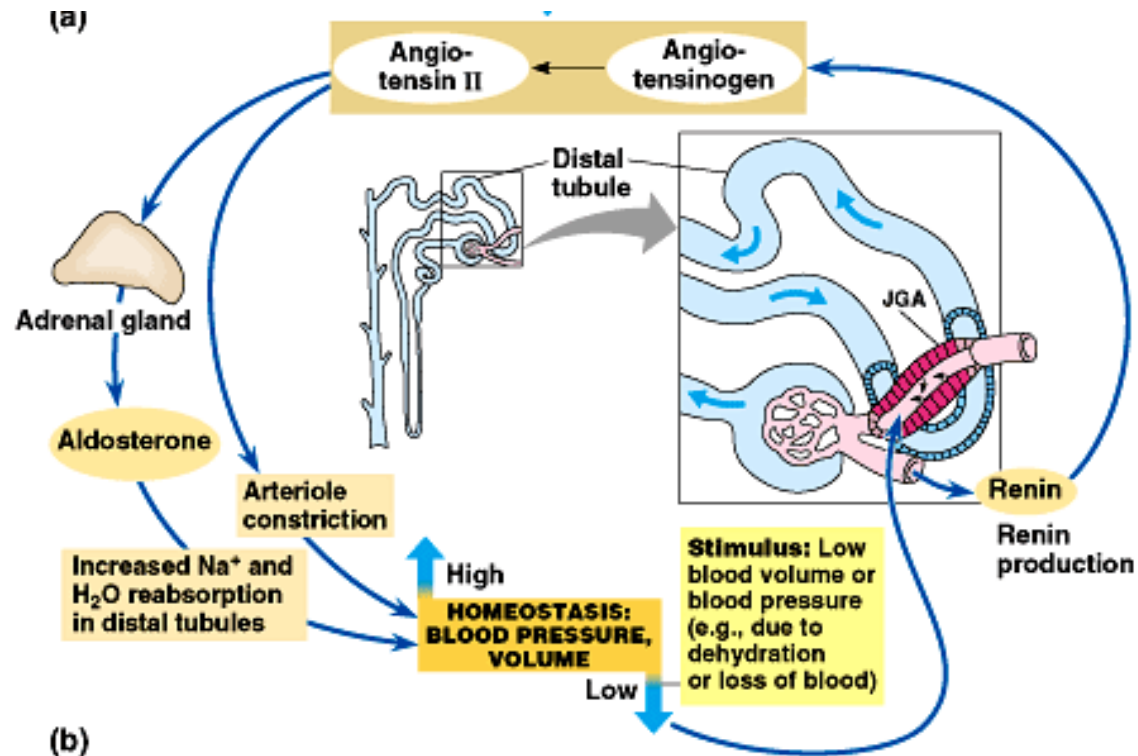
- Stimulus signals endocrine glands to produce hormones. Bypasses the nervous system entirely.
- Examples:

Stimulus	High blood glucose	Low blood Pressure
Gland	Pancreas	Adrenal
Hormone	Insulin / glucagon	Aldosterone
Target cells	Body cells	In collecting duct
Response	Uptake glucose into body cells decreasing blood glucose levels	Reabsorption of water into blood vessels increasing blood volume and pressure

Endocrine Pathway Example: Aldosterone



Carlyn Iverson

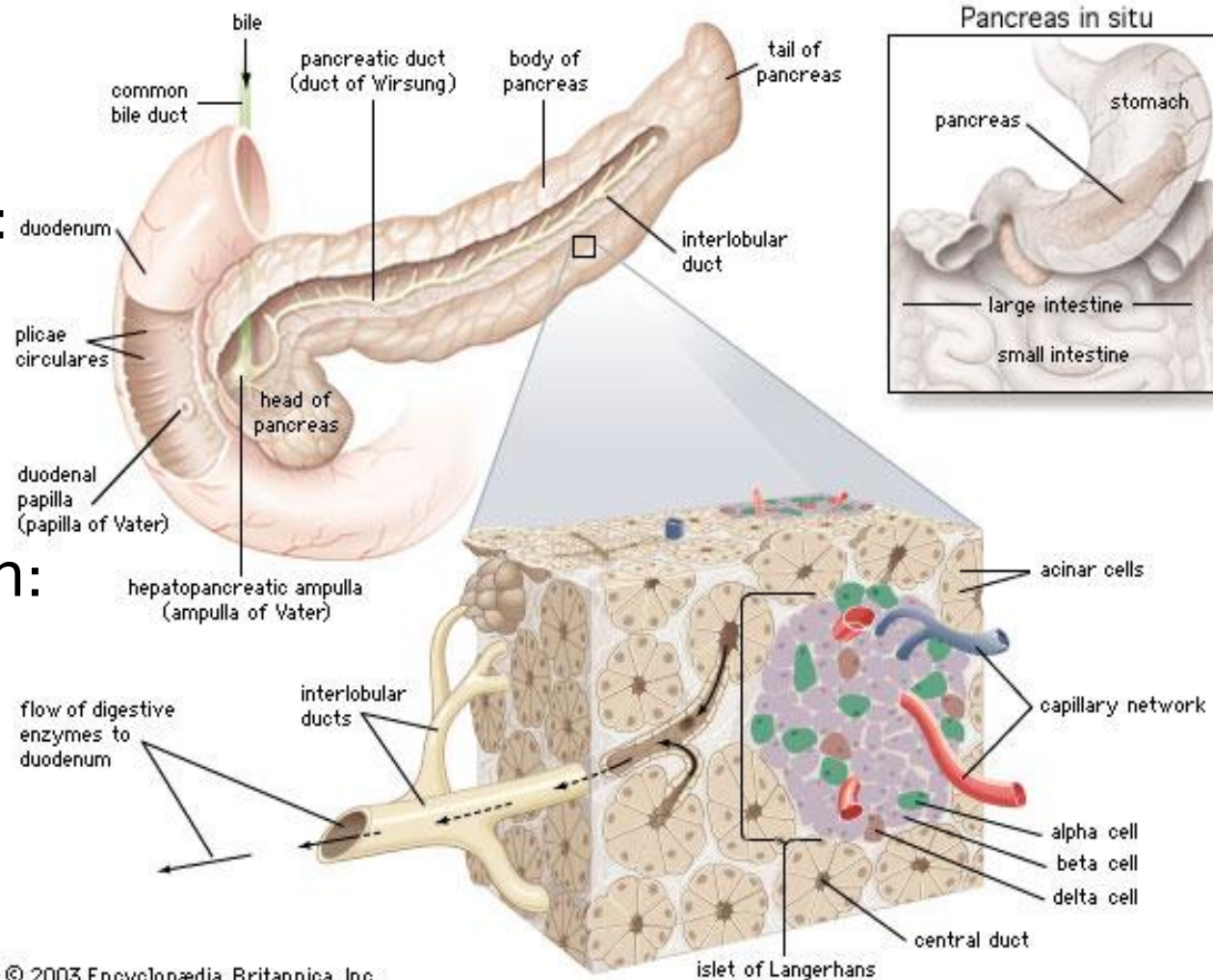


Glands

- **Endocrine glands:** organs producing hormones delivered by blood stream
 - Blood vessels are considered “inside” your body = endo
- **Exocrine glands:** organs producing hormones delivered by ducts
 - Ducts are considered “outside” the body = exo

Example of Exocrine Glands

- Digestive system:
 - digestive glands (pancreas)
 - salivary glands
- Thermoregulation:
 - sweat glands



Human endocrine glands

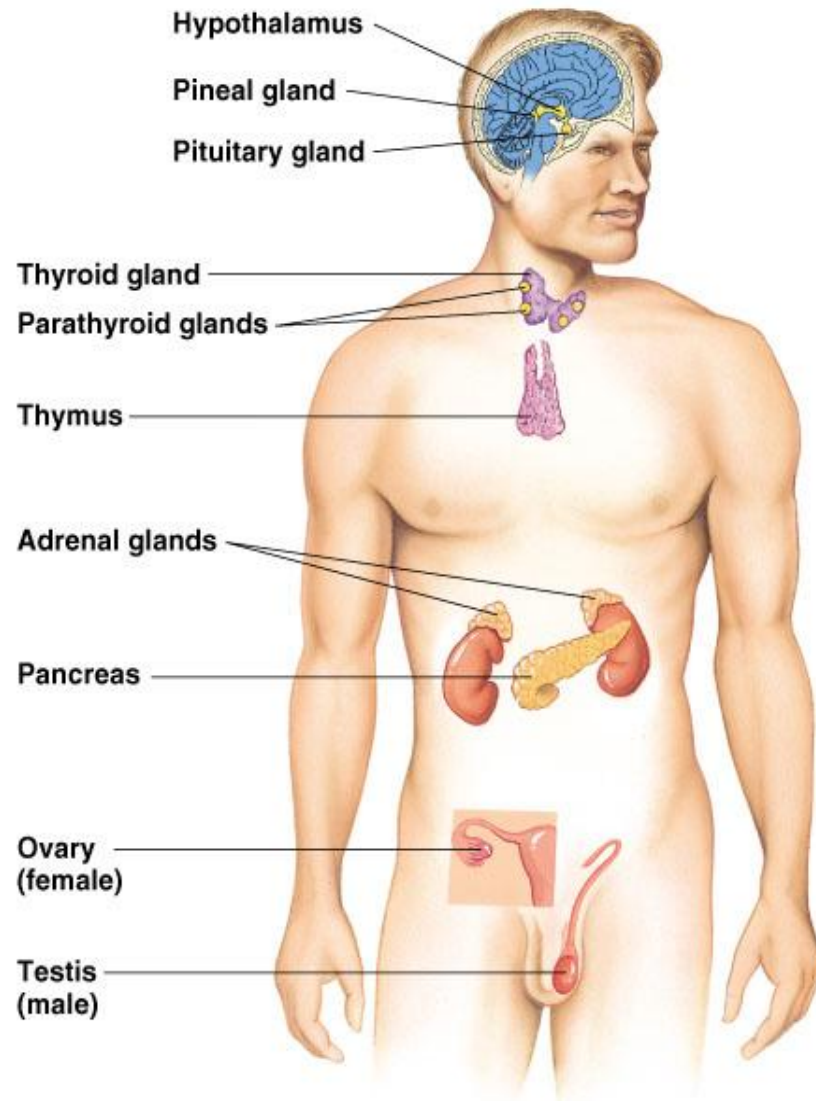


Fig. 45.5

Patterns of Hormonal Control

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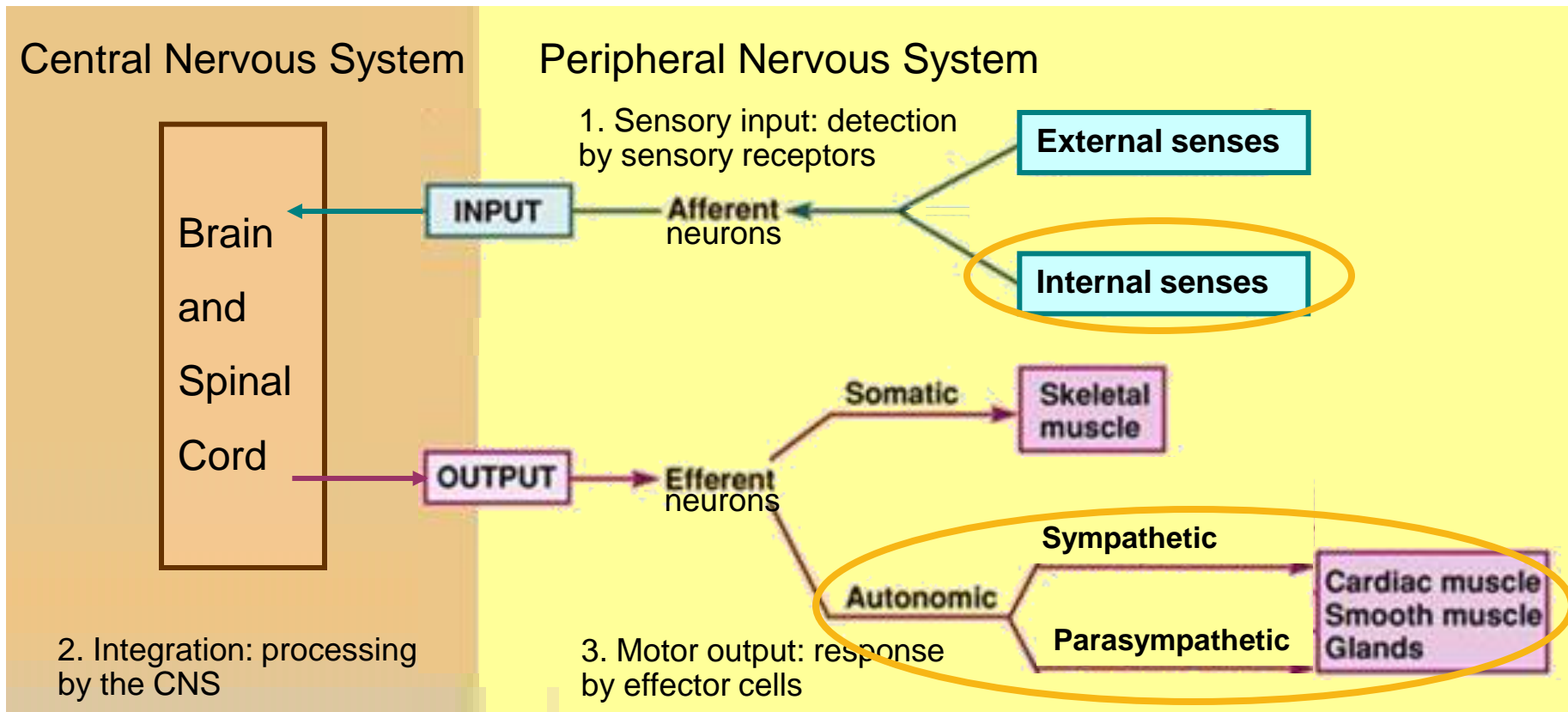
Neurohormone Pathway

- Stimulus signals hypothalamus to produce hormones that directly act on target cells without stimulating endocrine glands

Hypothalamus

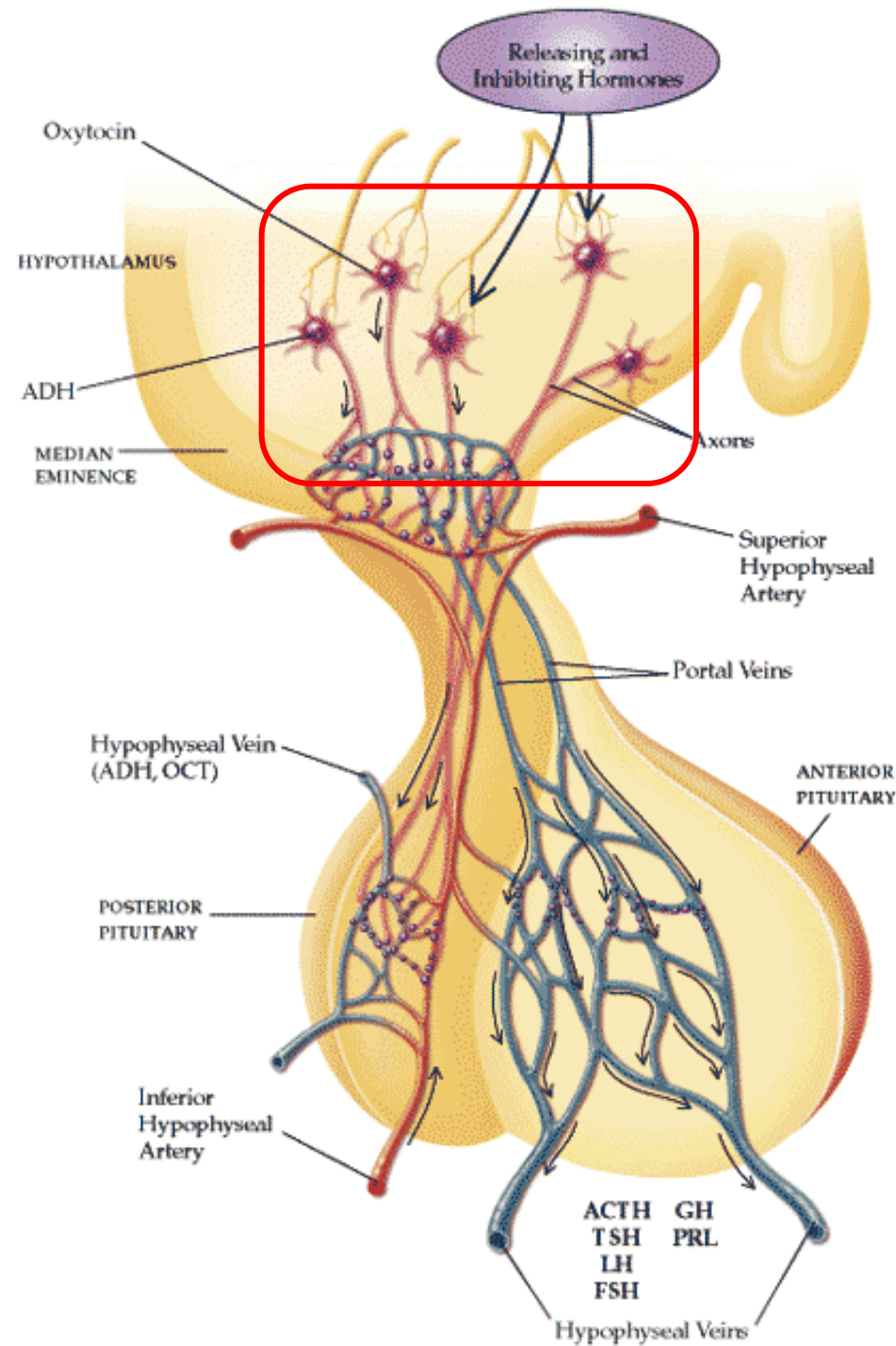
- Input: Internal senses
 - Signals from the inside of the body travel through afferent neurons to hypothalamus
- Output: Hormones
 - Effector neurons secrete hormones that act on glands of the autonomic nervous system

Integration of nervous and endocrine



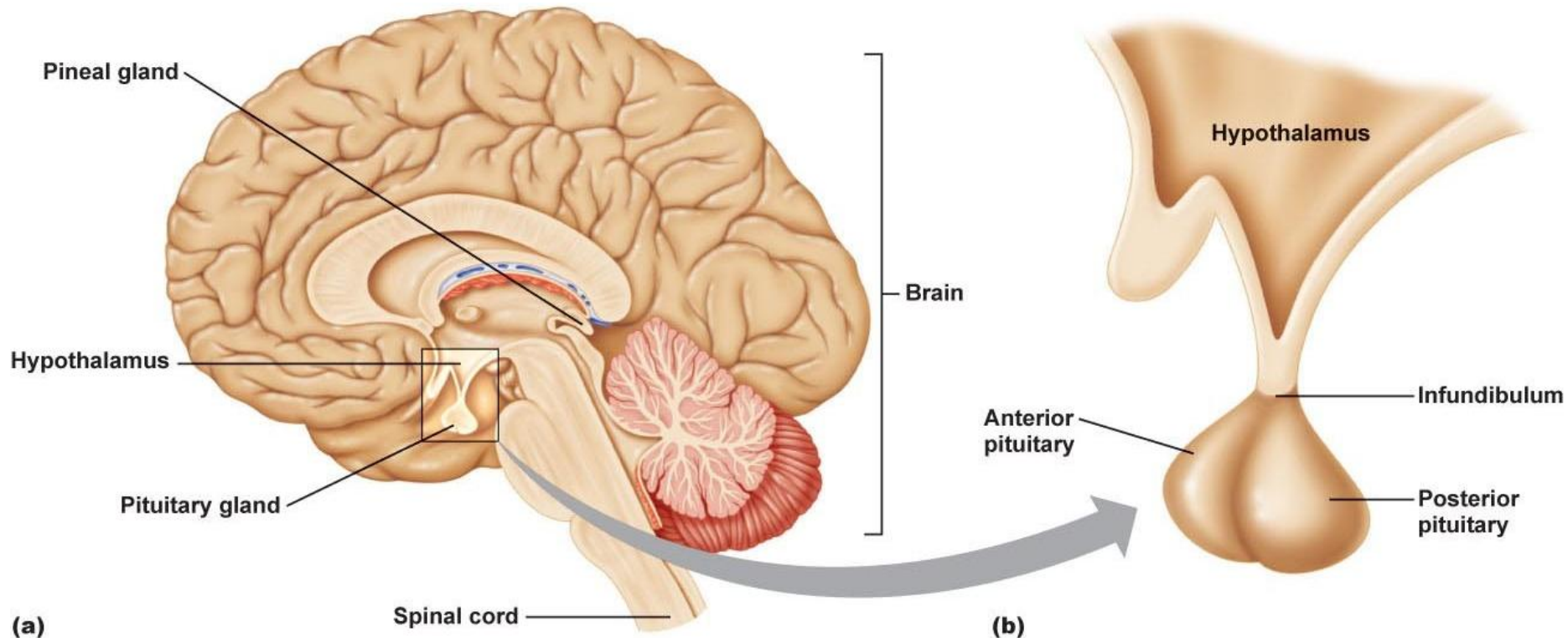
Hypothalamus

- **Neurosecretory** cells: specialized nerve cells that secrete hormones



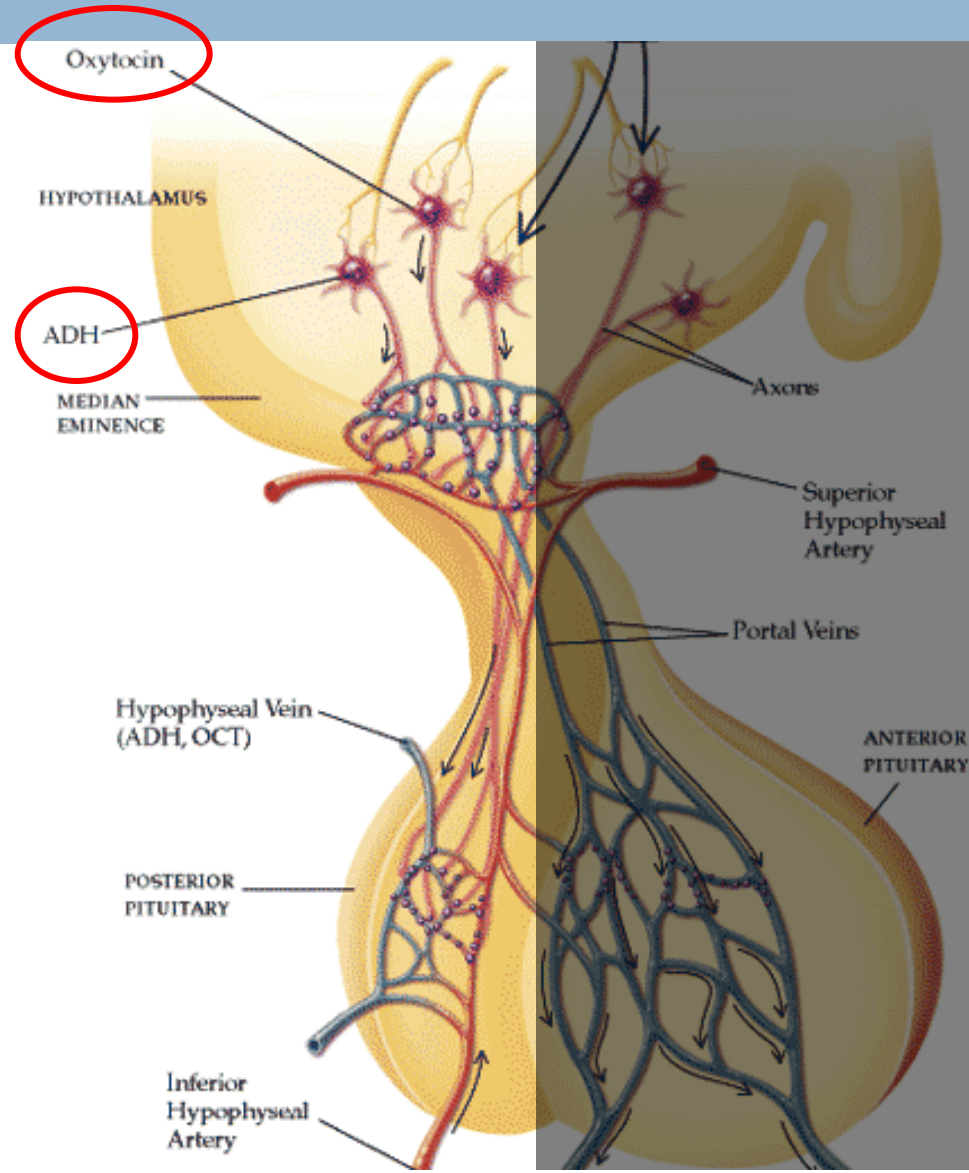
Pituitary Gland

- located at the base of the hypothalamus
- 2 parts: anterior & posterior



Posterior Pituitary

- Extension of the brain (hypothalamus)
- Does not make hormones itself
- Stores and secretes hormones that were synthesized by the neurosecretory cells in the hypothalamus
- 2 hormones released from posterior pituitary: ADH & oxytocin



Neurohormone Pathway Example: Posterior Pituitary Hormones

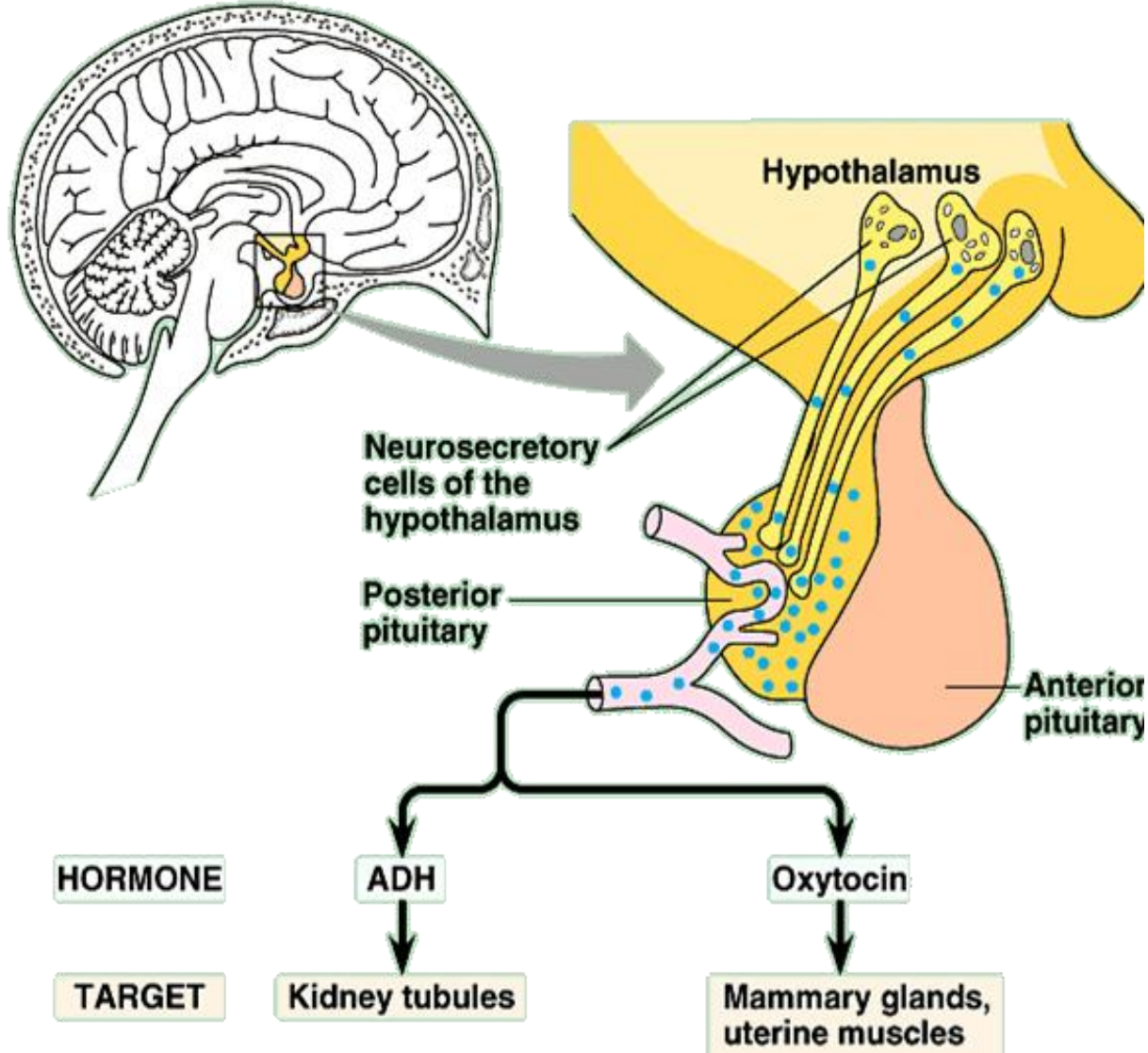
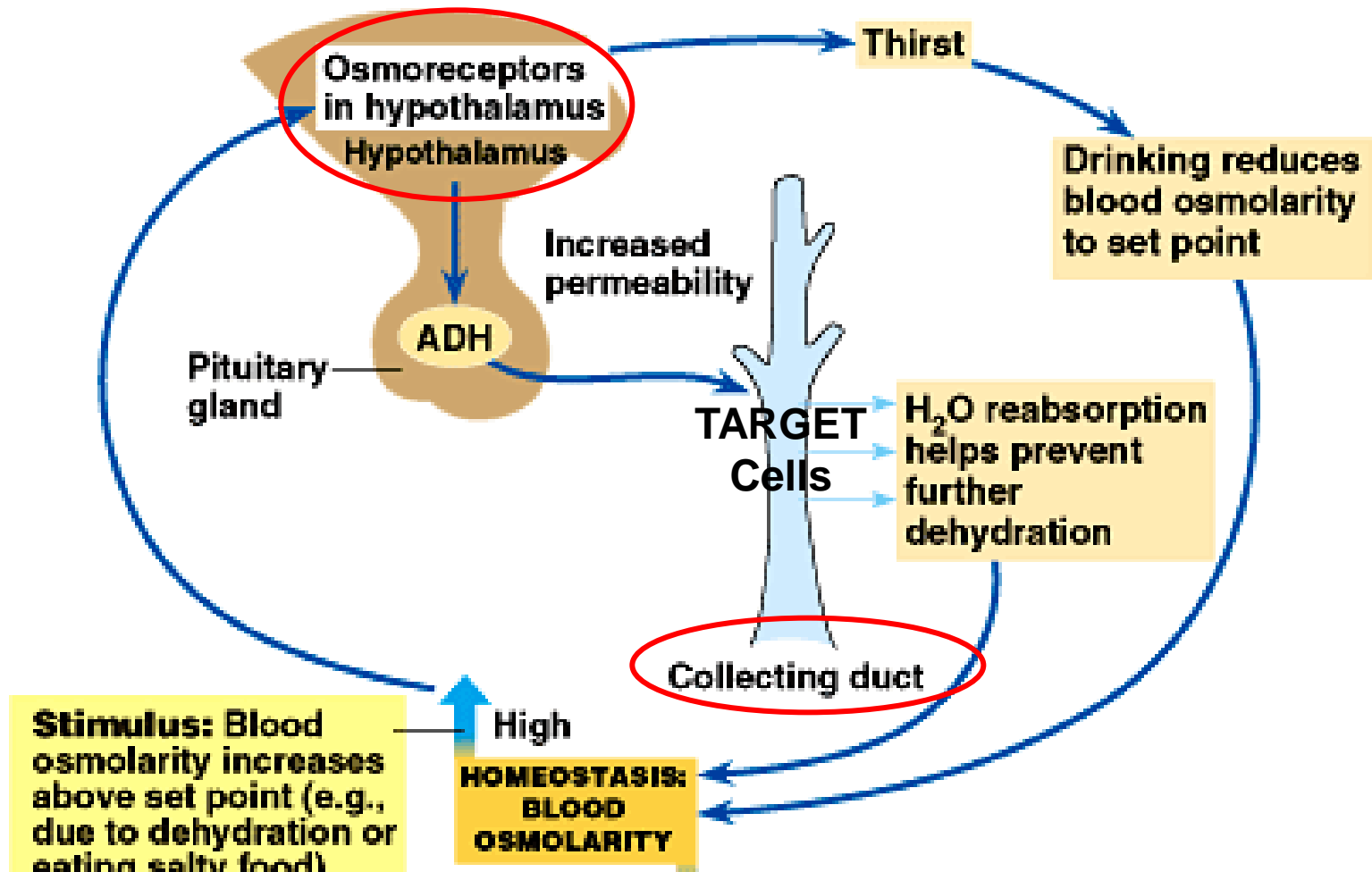


Fig. 45.6a

Neurohormone Pathway Example: ADH

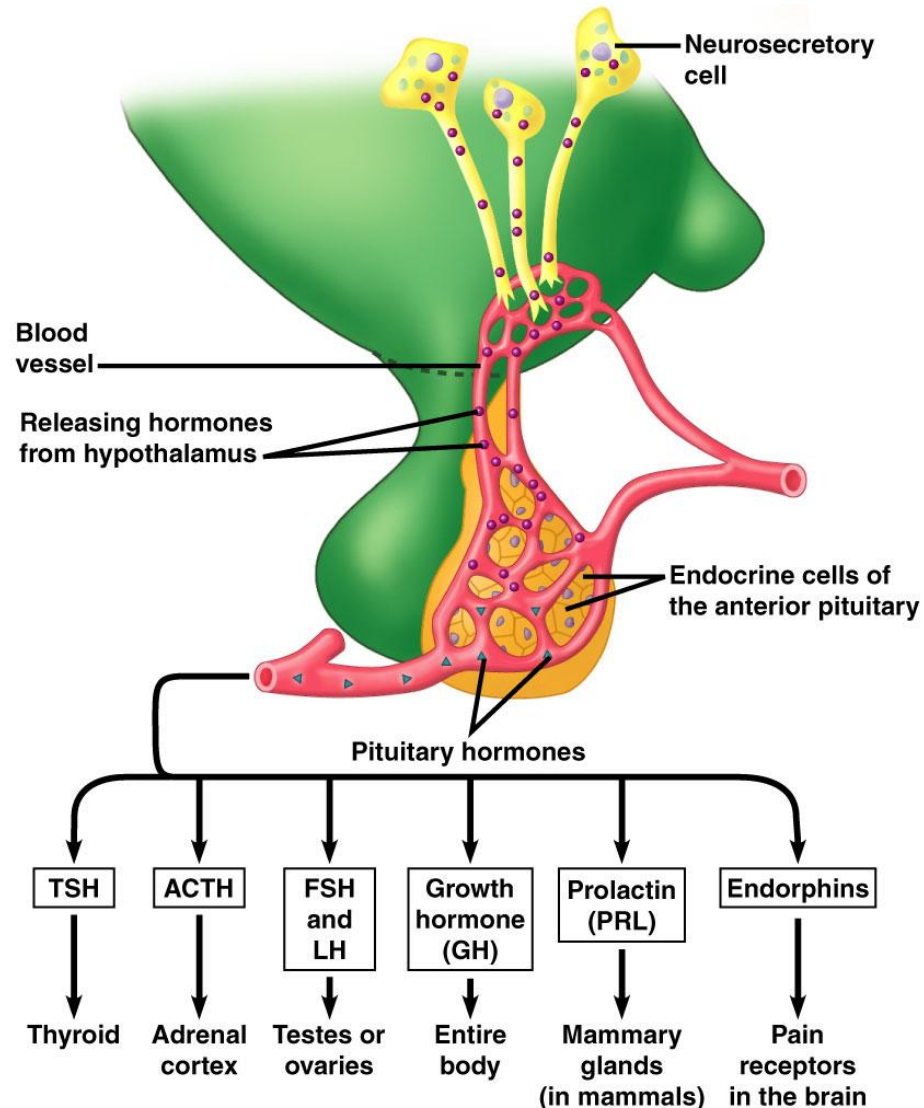


Patterns of Hormonal Control

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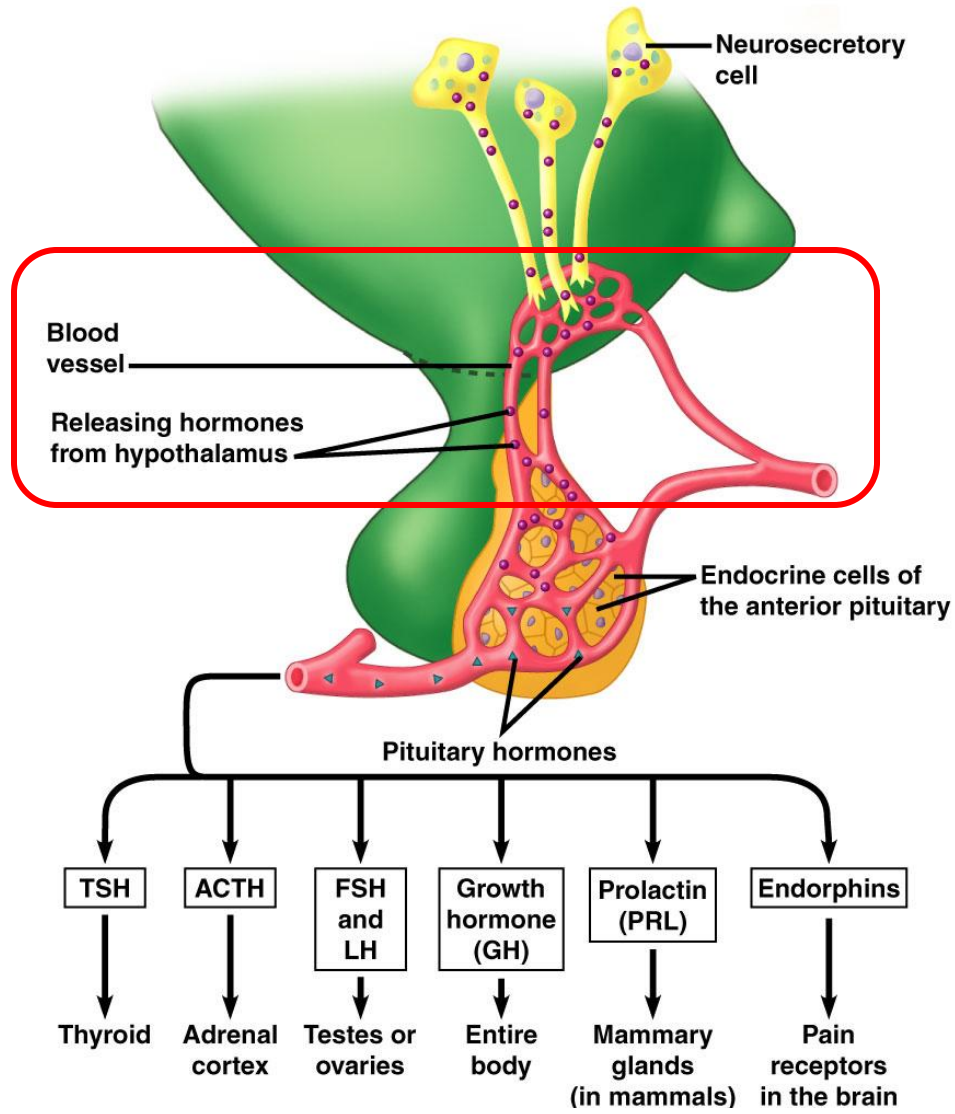
Neuroendocrine Pathway

- Stimulus signals **hypothalamus** to produce hormones which then signals **endocrine glands (anterior pituitary)** to produce other hormones
- Hypothalamus Integrates the nervous and endocrine systems



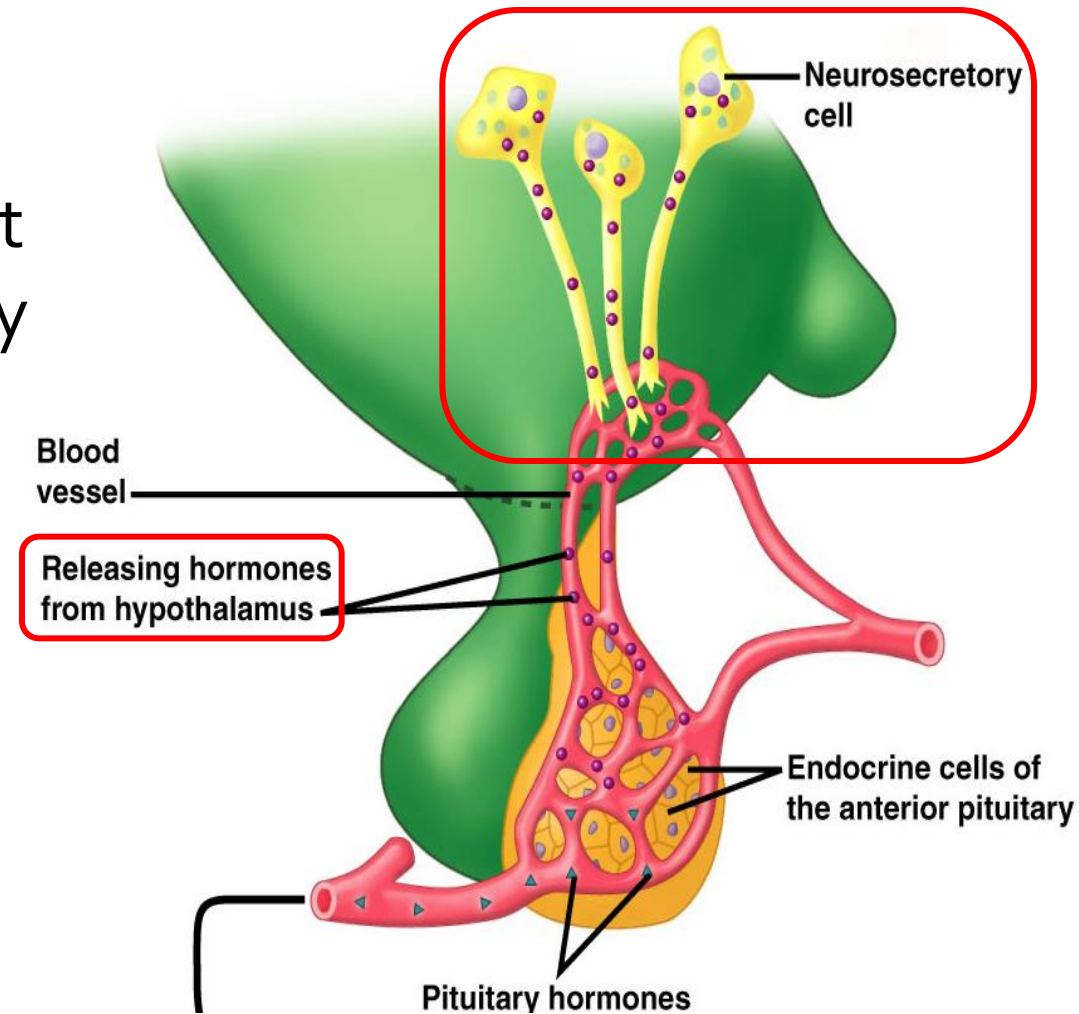
Anterior Pituitary

- Anterior pituitary is not developed from the brain
- A separate structure from the hypothalamus
- Connected to hypothalamus by portal blood vessel

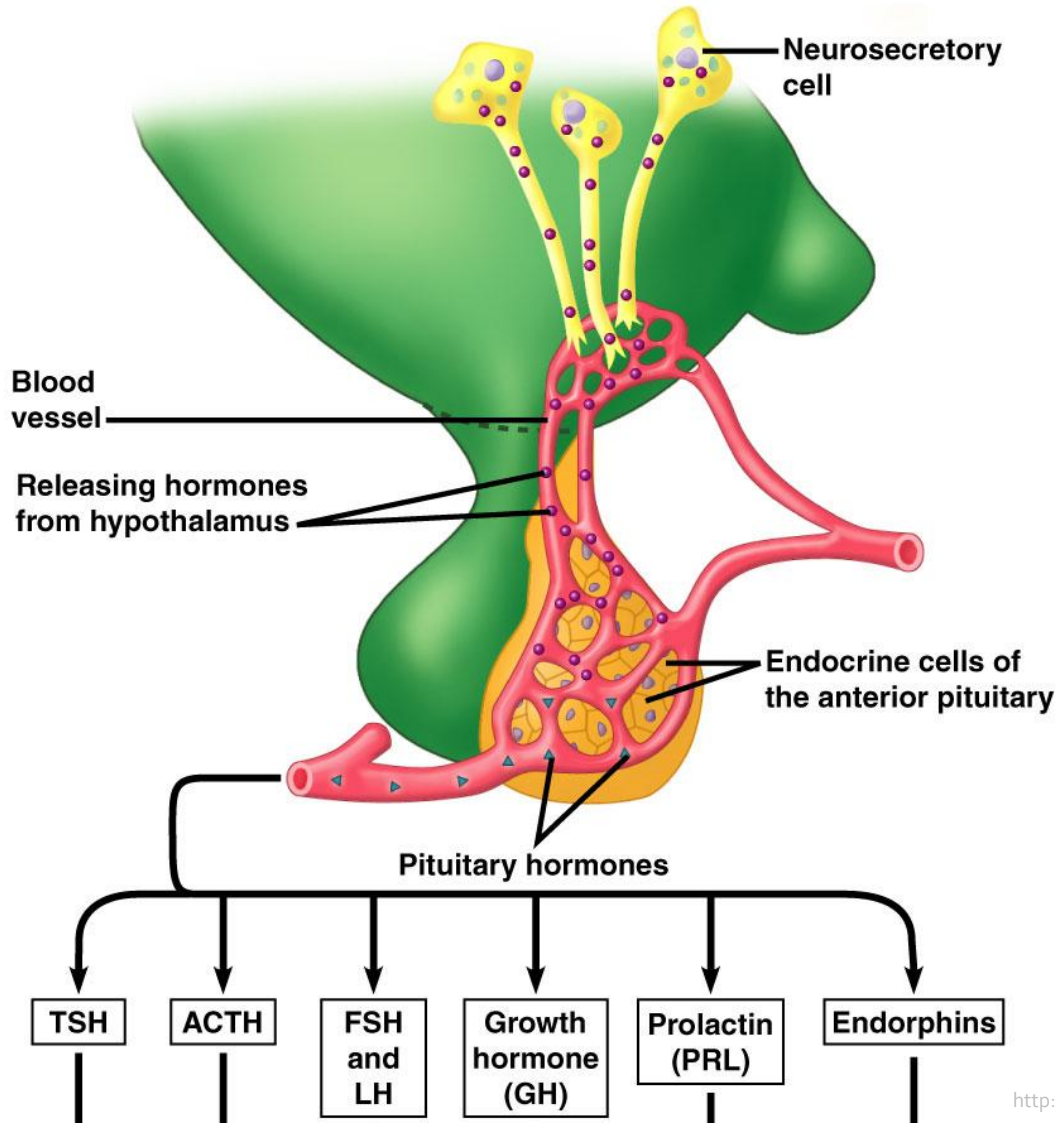


Hypothalamus

- **Neurosecretory** cells synthesize 2 types of hormones that are sent to the anterior pituitary
- **Releasing** hormone: **stimulate** gland to secrete hormones
- **Inhibiting** hormone: **inhibit** gland from secreting hormones



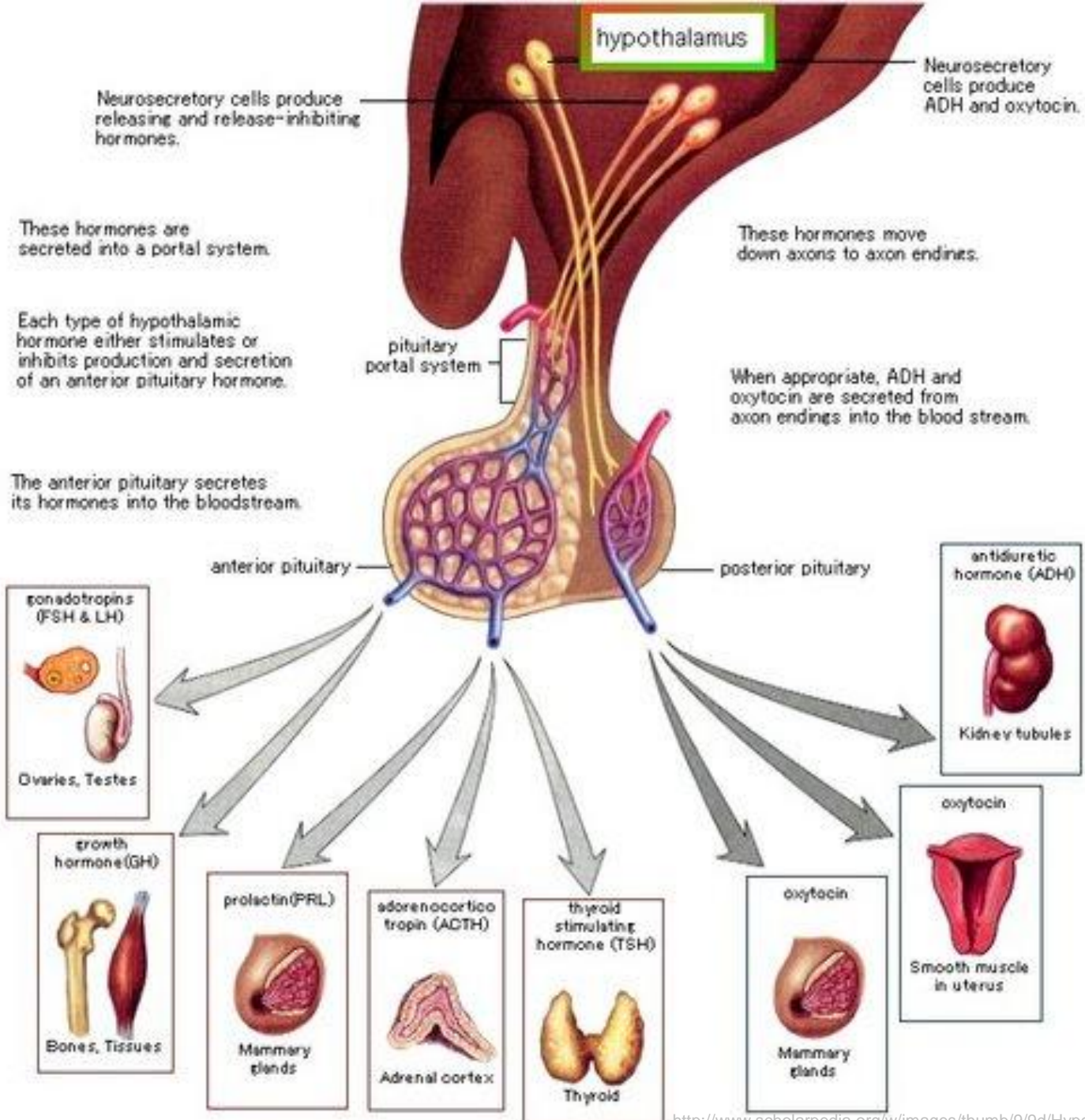
Anterior Pituitary



- Makes its own set of hormones that are stimulated or inhibited by hormones produced in the hypothalamus
- You will eventually need to know:
 - TSH
 - ACTH
 - FSH, LH
 - GH
 - PRL

Regulating Hormone Secretion in Anterior Pituitary

1. **Neurosecretory cells** in the **hypothalamus** produce **releasing** or **inhibiting** hormones
2. **Portal veins** (blood vessels) allow hormones from the hypothalamus to access cells in the anterior pituitary
3. **Endocrine (secretory) cells** of the **anterior pituitary** synthesize and secrete hormones into the blood



Tropic Hormone

- Target other endocrine glands rather than the final target cell
- Stimulate the synthesis and release of hormones from other endocrine glands

Anterior Pituitary Hormones

Hormone	Path	Tropic
Growth hormone (GH)	NE	x ✓
Prolactin (PRL)	NE	x
Follicle stimulating hormone (FSH)	NE	x ✓
Lutenizing hormone (LH)	NE	✓
Thyroid stimulating hormone (TSH)	NE	✓
Adrenocorticotropic hormone (ACTH)	NE	✓