

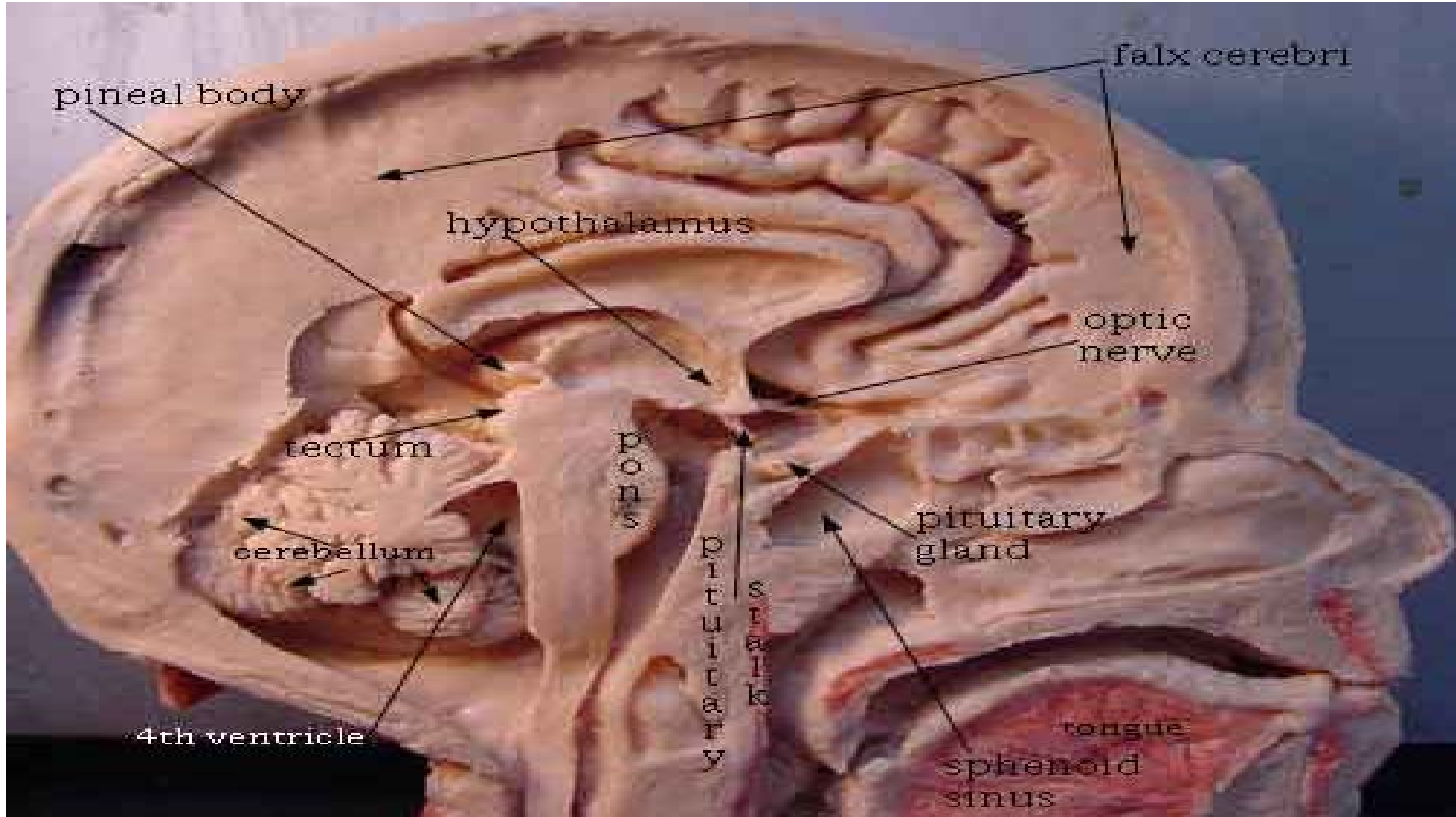
NEUROENDOCRINOLOGY

Danil Hammoudi.MD

The hypothalamus and pituitary gland are key regulators of the hormone system.

Sensory and endocrine information is processed and integrated in the brain and hormone release is controlled by neuroendocrine secretion in the posterior pituitary lobe.

In addition, other hypothalamic neurons secrete releasing (RH) or release-inhibiting hormones (RIH) into the portal blood system that control hormone release from specific endocrine cells in the anterior pituitary lobe.





HYPOTHALAMUS

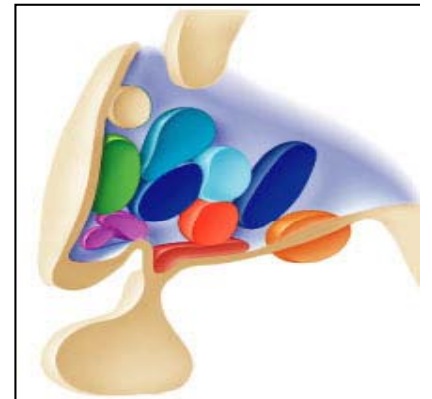
Hypothalamus

Below the thalamus, it caps the brainstem and forms the inferolateral walls of the third ventricle

Mammillary bodies - small, paired nuclei bulging anteriorly from the hypothalamus - relay stations for olfactory pathways

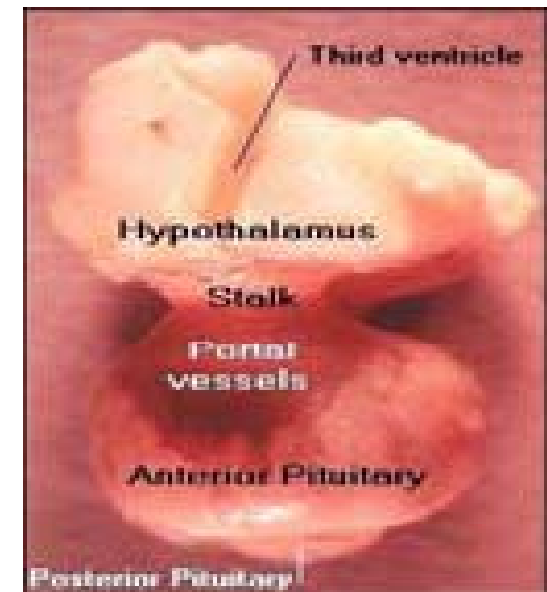
Infundibulum – stalk of the hypothalamus connecting to the pituitary gland

Main visceral control center of the body, important to overall body homeostasis



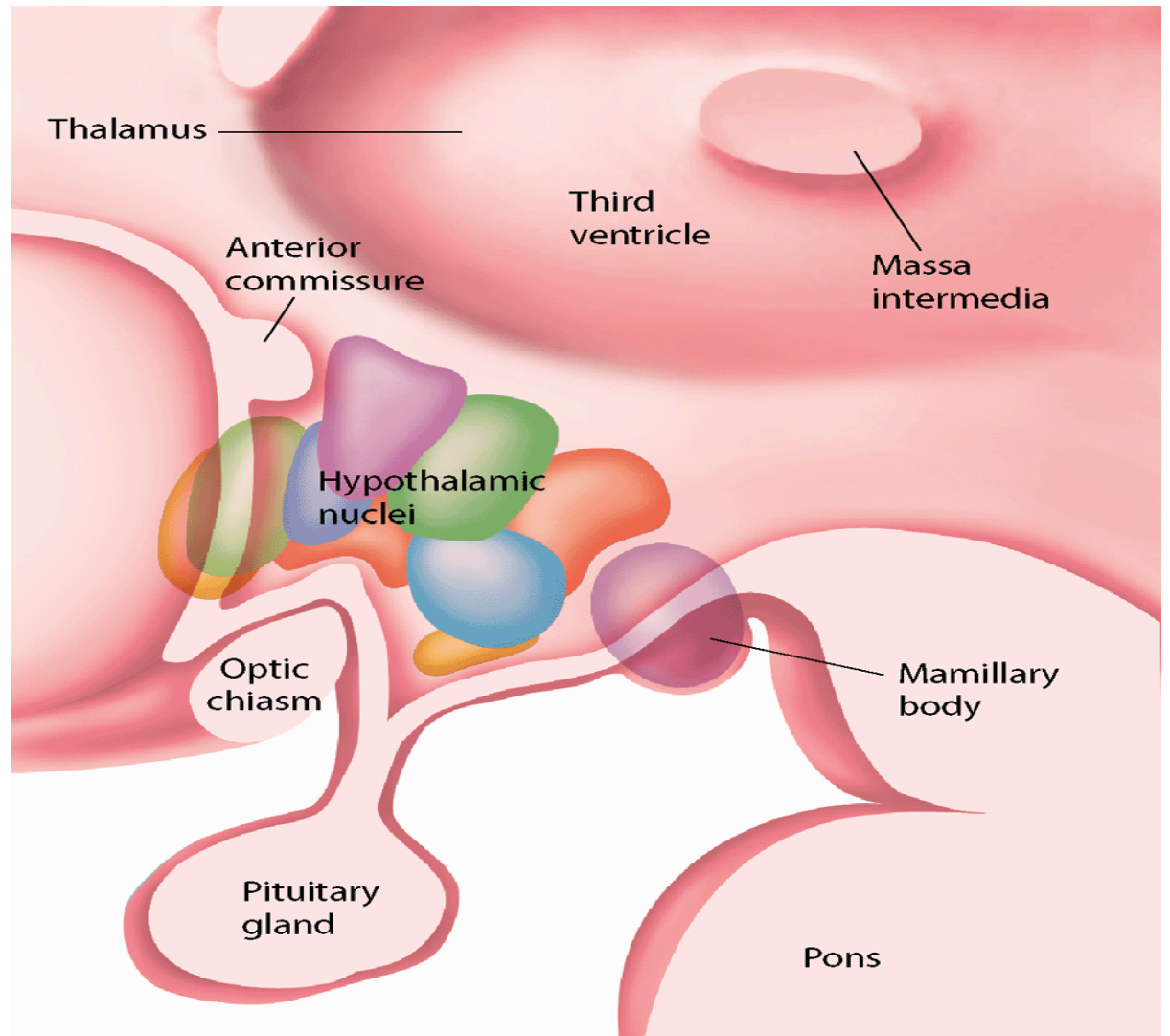
- Functions:
 - Autonomic regulatory center
- Influences HR, BP, resp. rate, GI motility, pupillary diameter.
- Can you hold your breath until you die?
 - Emotional response
- Involved in fear, loathing, pleasure
- Drive center: sex, hunger
 - Regulation of body temperature
 - Regulation of food intake
- Contains a satiety center
 - Regulation of water balance and thirst
 - Regulation of sleep/wake cycles
 - Hormonal control
- Releases hormones that influence hormonal secretion from the anterior pituitary gland.

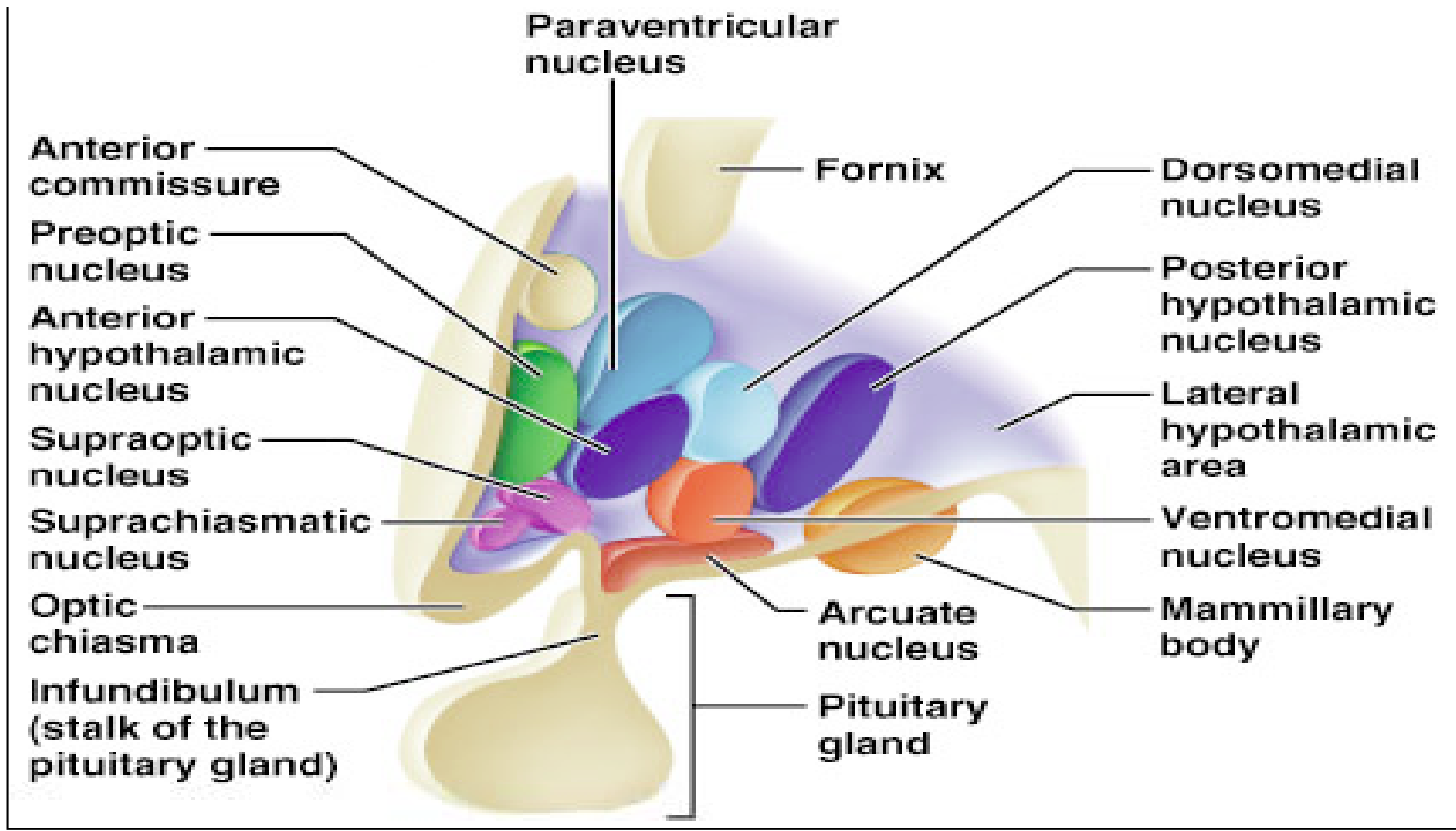
Hypothalamus



Hypothalamus

- *A group of nuclei critical for regulating homeostasis, the four Fs, and hormones*





Hypothalamic Nuclei

Hypothalamic Function

Regulates ANS by controlling activity of centers in brains stem and spinal cord

- Regulates blood pressure, rate and force of heartbeat, digestive tract motility, respiratory rate and depth, pupil size, and many other visceral activities
- Center for emotional response - involved in perception of pleasure, fear, rage
- Regulates body temperature – the body’s “thermostat”
- Regulates food intake - feelings of hunger and satiety
- Regulates sleep-wake cycle

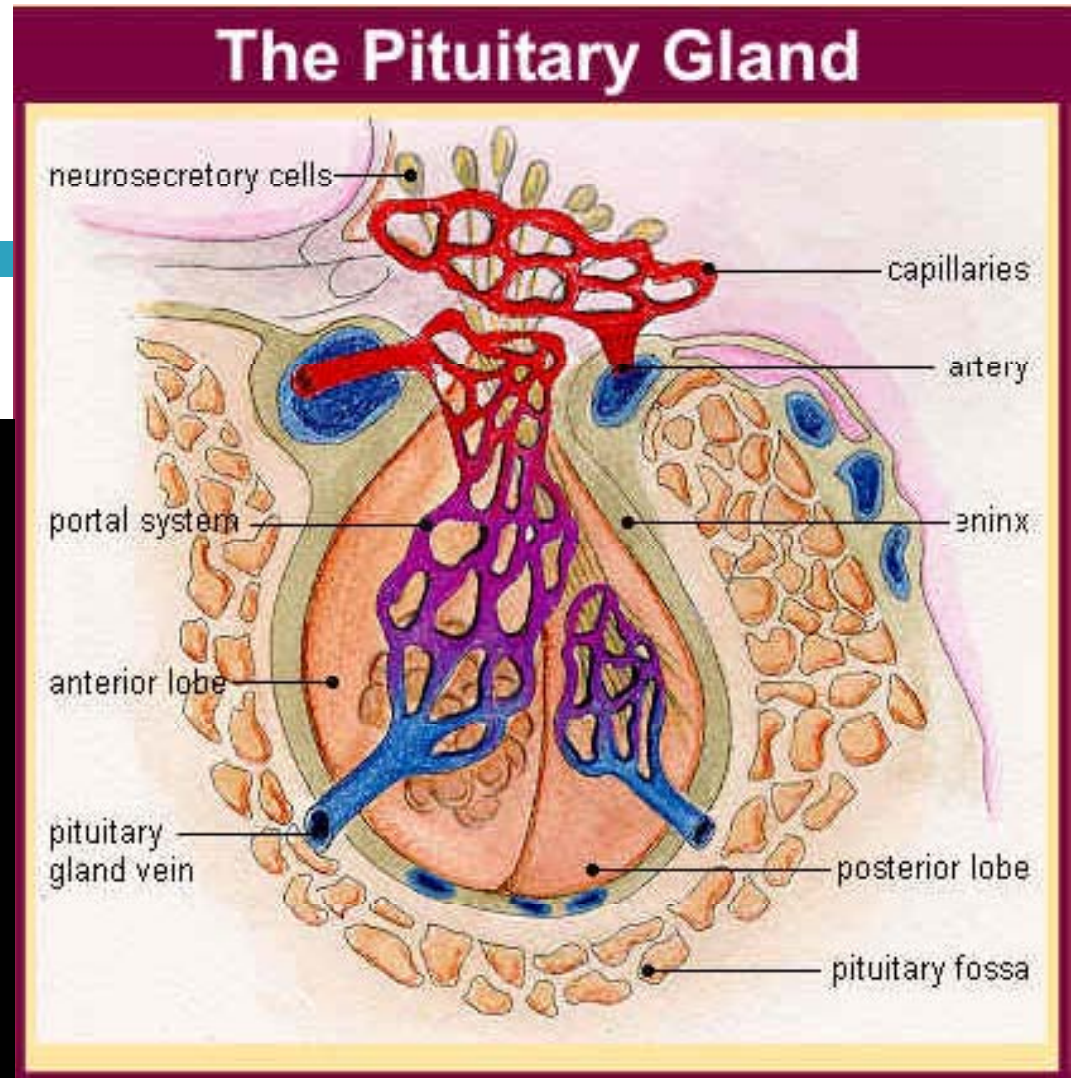
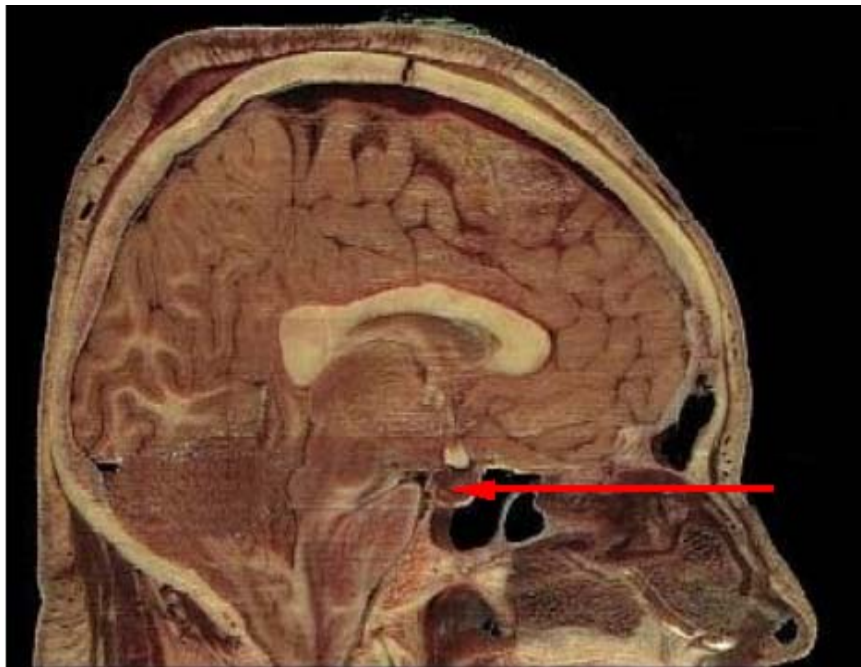
Endocrine Functions of the Hypothalamus

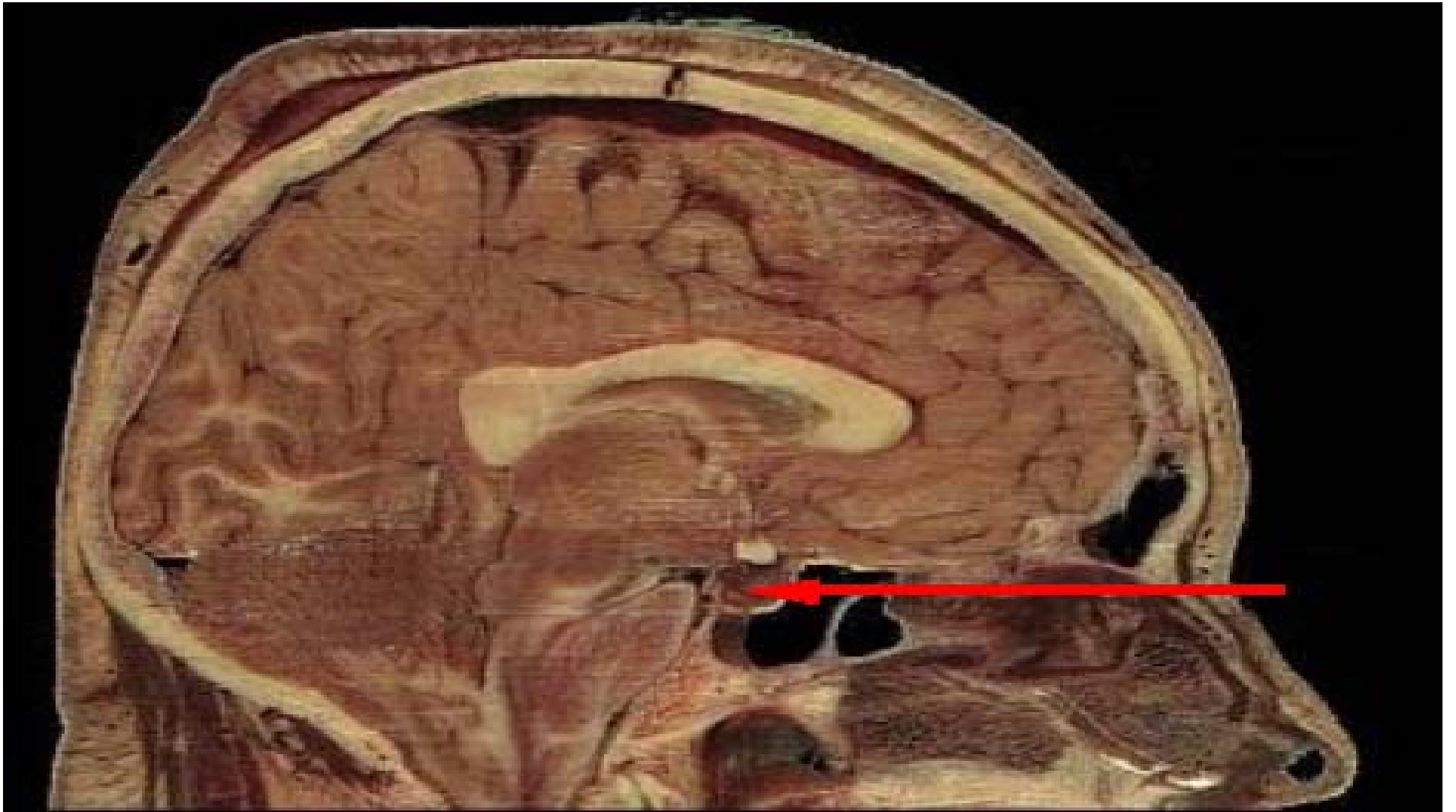
Releasing hormones control the secretion of hormones by the anterior pituitary

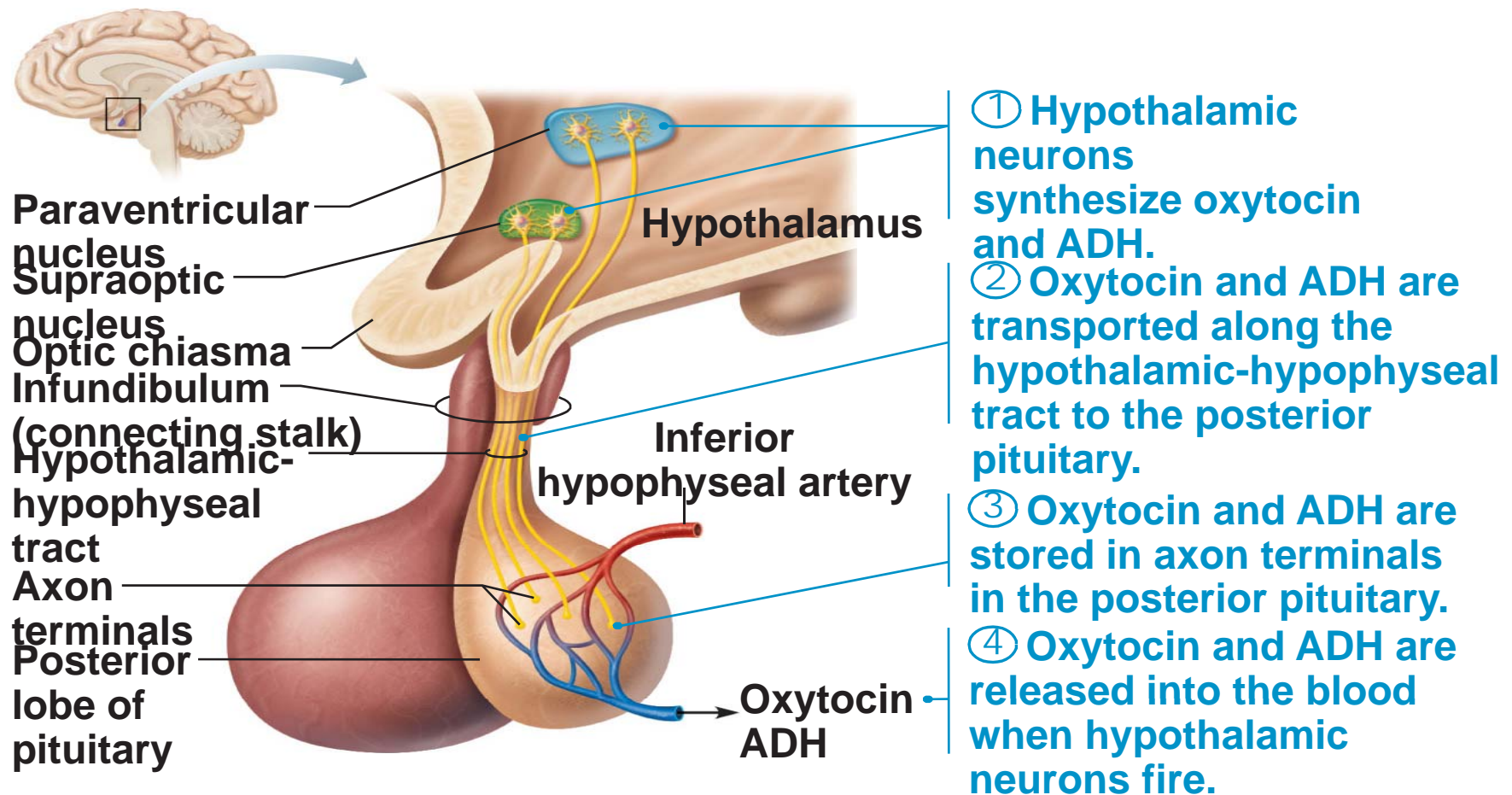
Stimulates ADH release from the posterior pituitary

Anti-diuretic hormone- causes kidneys to retain water

PITUITARY GLAND







(a) Relationship between the posterior pituitary and the hypothalamus. **Figure 16.5a**

Pituitary-Hypothalamic Relationships

- Anterior Lobe:
 - ▣ Originates as an out-pocketing of the oral mucosa
 - ▣ Hypophyseal portal system
 - Primary capillary plexus
 - Hypophyseal portal veins
 - Secondary capillary plexus
- Carries releasing and inhibiting hormones to the anterior pituitary to regulate hormone secretion

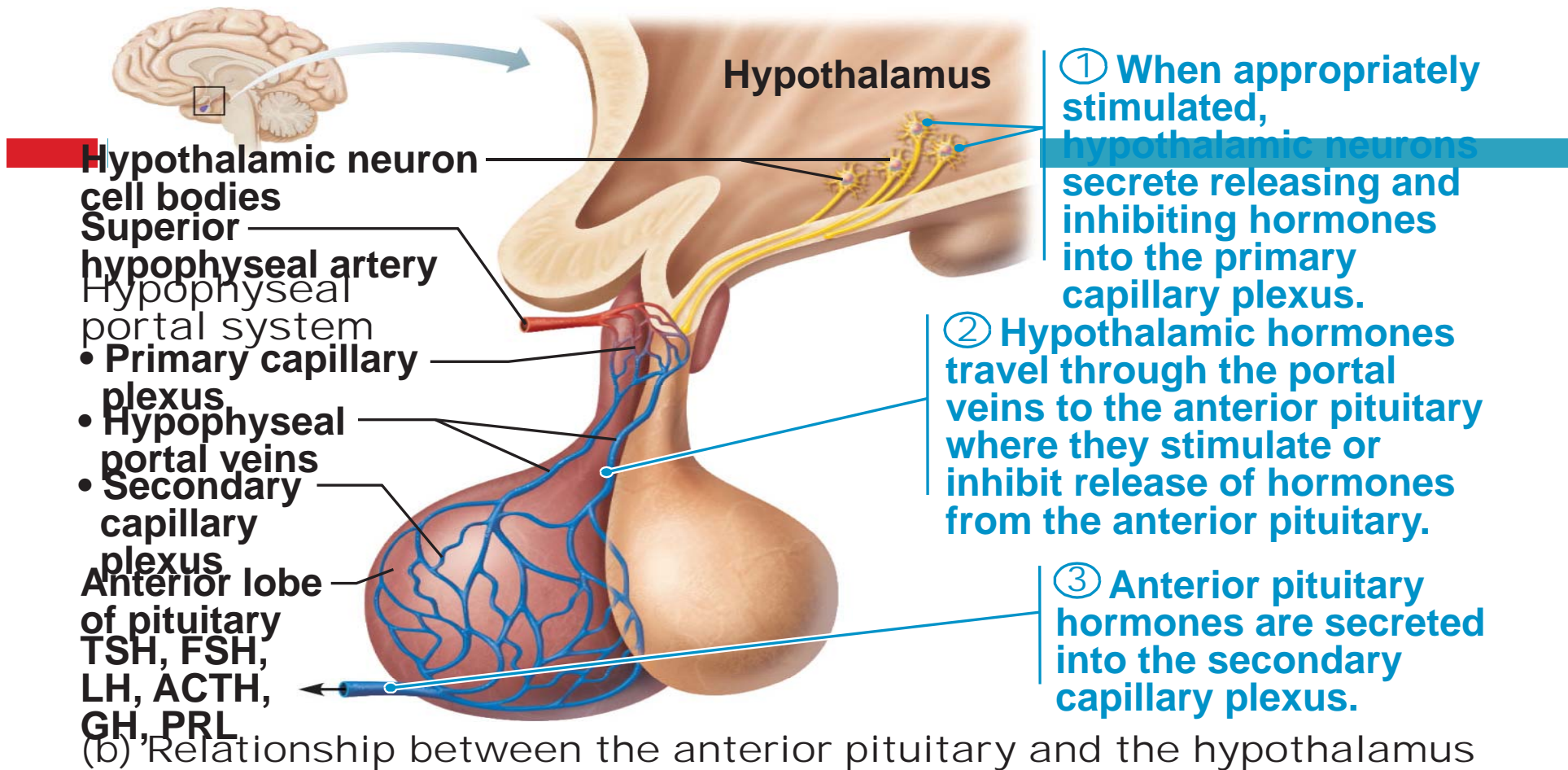
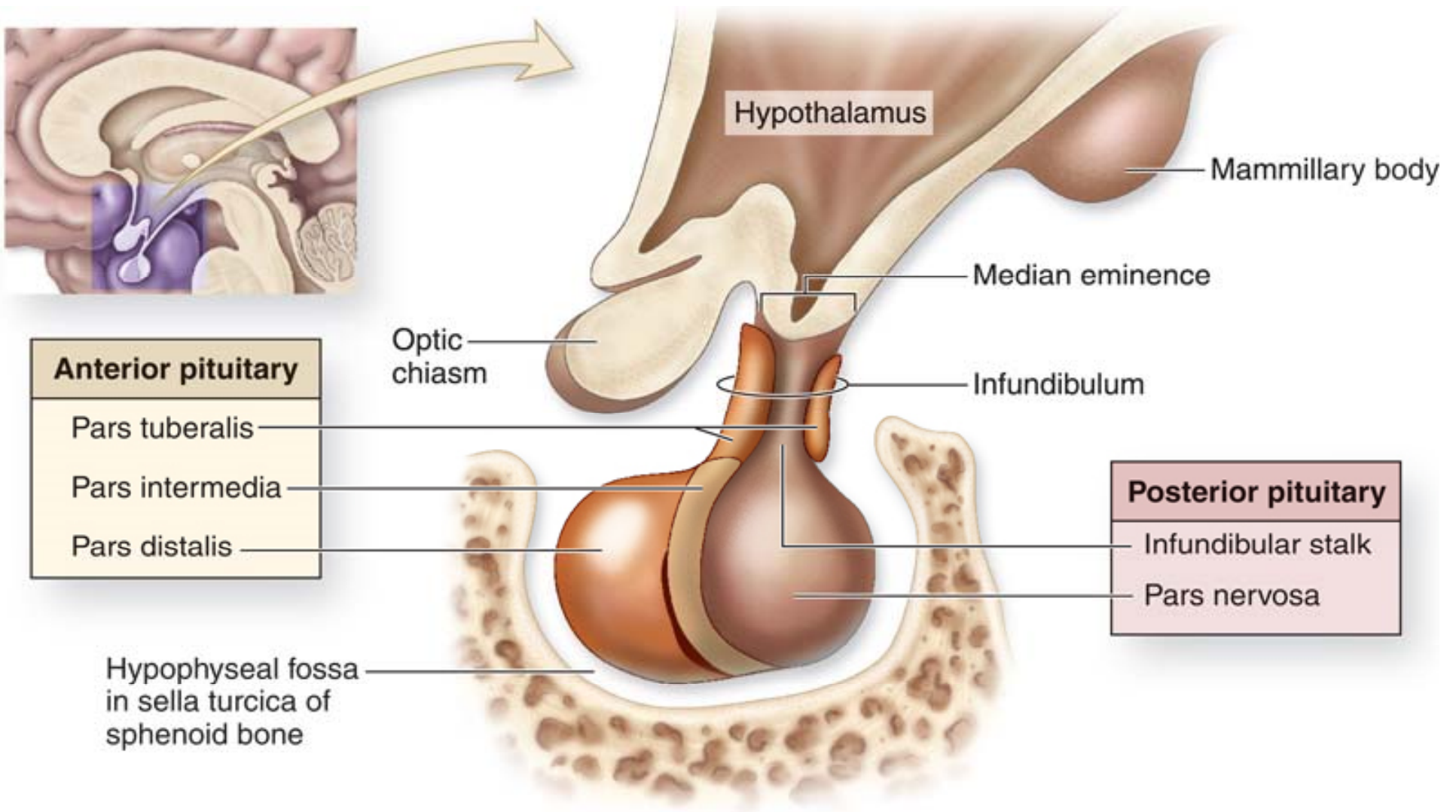


Figure 16.5b

- The pituitary gland (or hypophysis) is attached to the inferior surface of the brain by an extension of the nervous tissue of the **tuber cinereum /eminentia mediana of the hypothalamus, the infundibulum.**
- The pituitary gland is located in the sella turica, the hypophyseal fossa of the sphenoid bone.
- Macroscopically, the pituitary gland can be divided into **neurohypophysis**, which includes :
 - all neuroectodermal hypophyseal derivatives,
 - adenohypophysis, which includes all ectodermal hypophyseal derivatives.



Hypothalamus

Mammillary body

Median eminence

Infundibulum

Optic chiasm

Posterior pituitary

Infundibular stalk

Pars nervosa

Anterior pituitary

Pars tuberalis

Pars intermedia

Pars distalis

Hypophyseal fossa in sella turcica of sphenoid bone

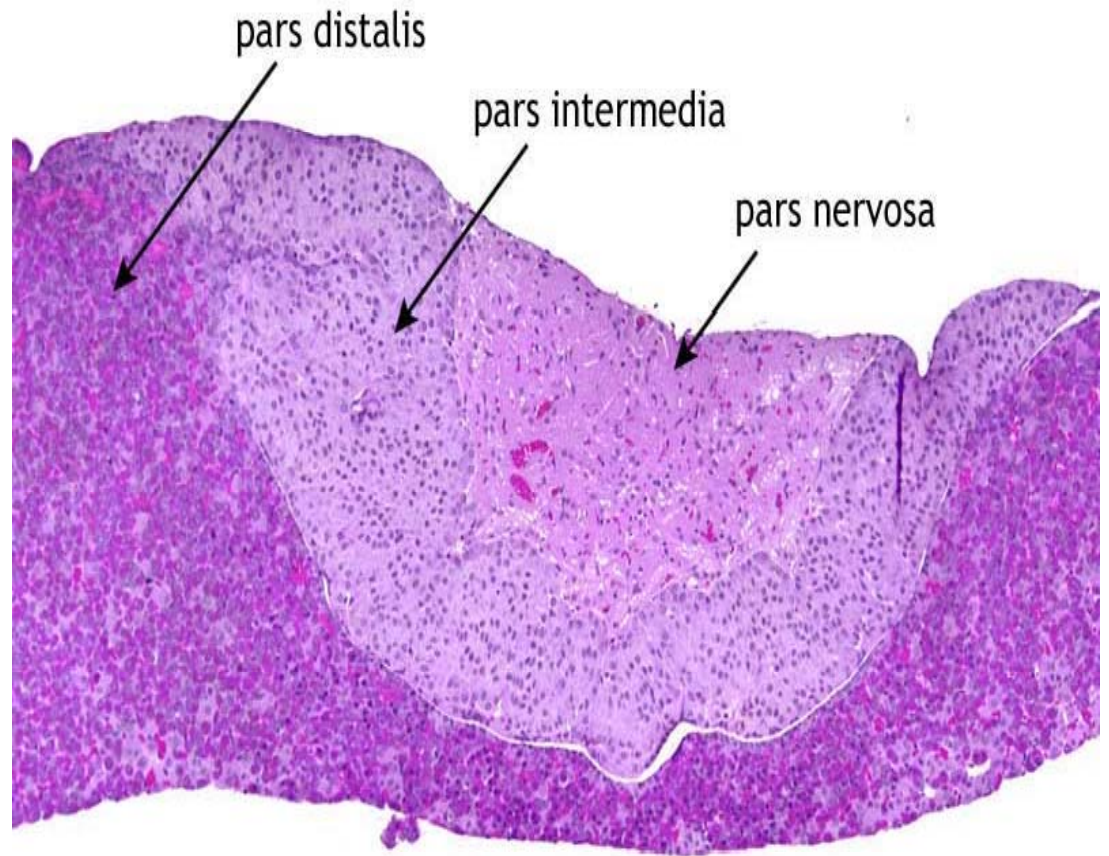
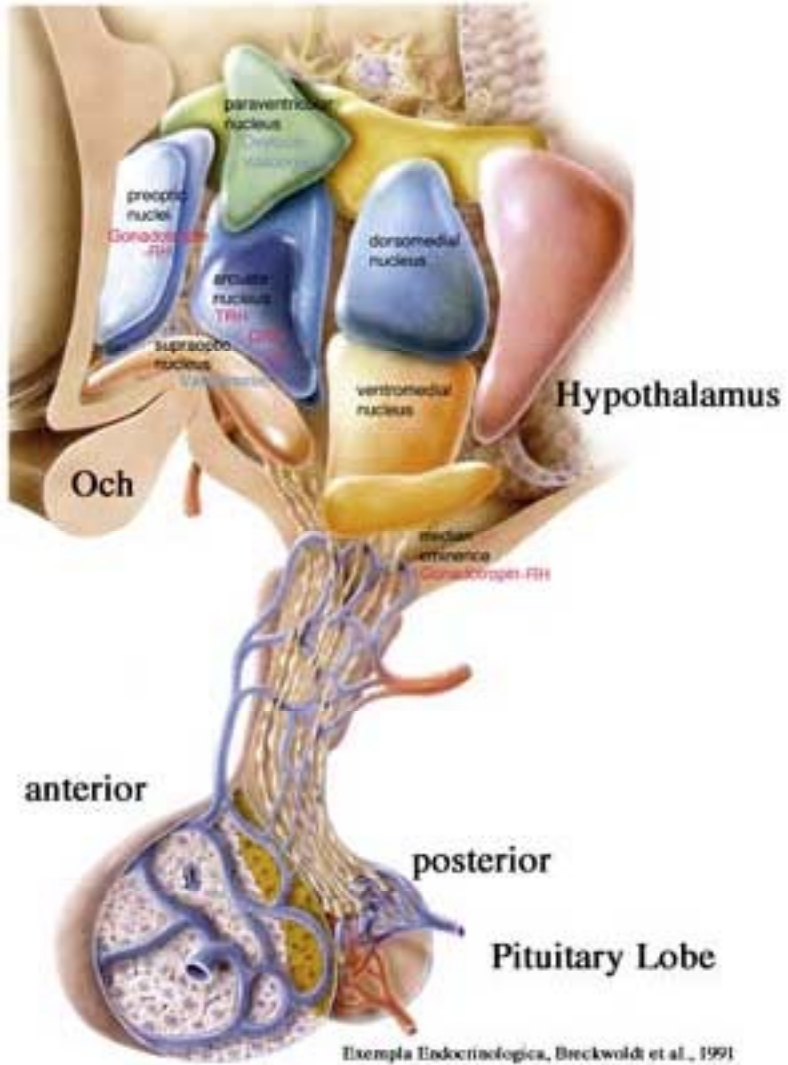
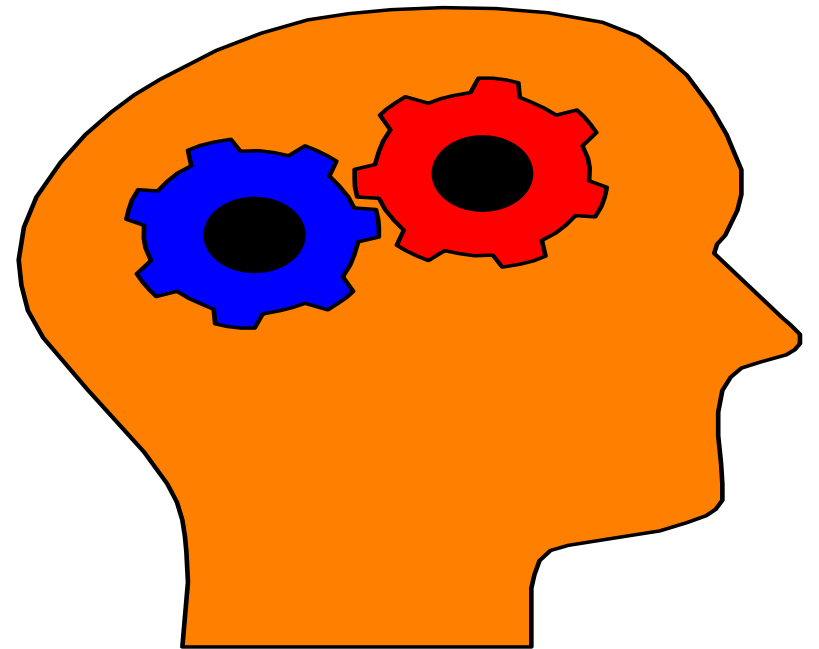


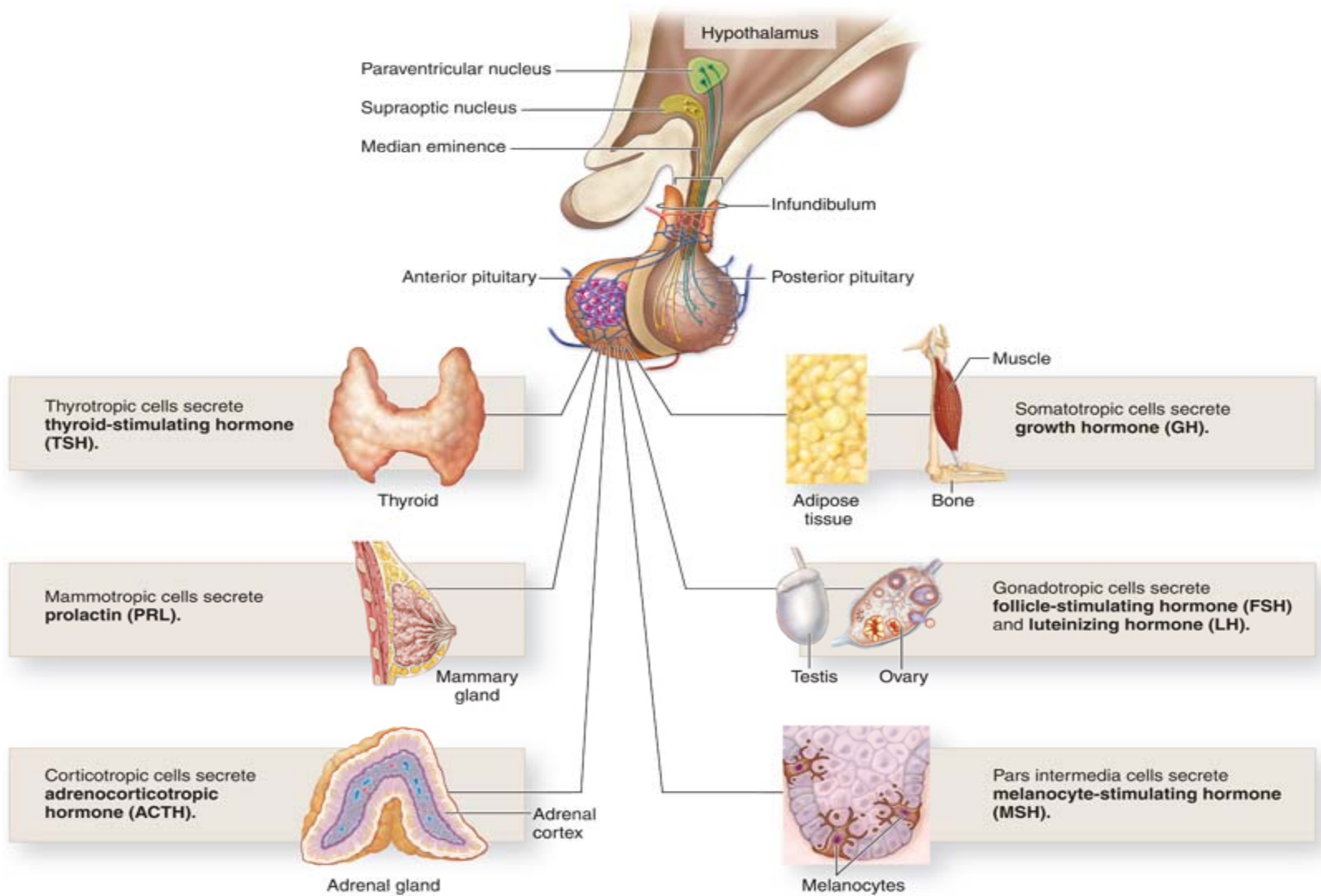
Table 20.3**Pituitary Gland Hormones**

| Hormone | Target Cells | Effects of Hormone |
|--|--|--|
| HORMONES OF THE ANTERIOR PITUITARY | | |
| Adrenocorticotrophic hormone (ACTH) | Adrenal cortex | Stimulates production of corticosteroid hormones |
| Follicle-stimulating hormone (FSH) | Female: Ovaries Male: Testes | Female: Stimulates growth of ovarian follicles Male: Stimulates sperm production |
| Luteinizing hormone (LH) | Female: Ovaries Male: Testes | Female: Stimulates ovulation, estrogen and progesterone synthesis in ovary Male: Stimulates androgen synthesis in testes |
| Thyroid-stimulating hormone (TSH) | Thyroid gland | Stimulates thyroid hormone synthesis and secretion |
| Prolactin (PRL) | Female: Mammary glands Male: Not known | Female: Stimulates milk production in mammary glands Male: May play a role in the sensitivity of the testes interstitial cells to LH |
| Growth hormone (GH) | Almost every cell in the body | Increased growth and metabolism in target cells; synthesis of somatomedin in the liver to stimulate growth at epiphyseal plate |
| Melanocyte-stimulating hormone (MSH) | Melanocytes | Stimulates synthesis of melanin and dispersion of melanin granules in epidermal cells |
| HORMONES STORED IN THE POSTERIOR PITUITARY | | |
| Antidiuretic hormone (ADH) (also called vasopressin) | Kidney Smooth muscle in arteriole walls | Stimulates reabsorption of water from urine in kidneys Stimulates vasoconstriction in arterioles of body, thereby raising blood pressure |
| Oxytocin (OT) | Female: Uterus, mammary glands Male: Smooth muscle of male reproductive tract | Female: Stimulates smooth muscle contraction in uterine wall; stimulates milk ejection from mammary glands Male: Stimulates contraction of smooth muscle of male reproductive tract |

Pituitary or Master Gland

- posterior lobe
 - ▣ neurohypophysis
- anterior lobe
 - ▣ adenohypophysis





Anterior Lobe

- growth hormone → GH somatotropin
- thyroid-stimulating hormone → TSH
- lactogenic hormone --→ Prolactin
- adrenocorticotropic hormone --→ ACTH
- follicle-stimulating hormone --→ FSH
- luteinizing hormone --→ LH

Posterior Lobe

- antidiuretic hormone = ADH
 - ▣ decrease ADH causes increase urine output
 - ▣ increase ADH causes decrease urine output

- oxytocin
 - ▣ stimulates contraction of pregnant uterus, labor, and childbirth
 - ▣ stimulates milk secretion

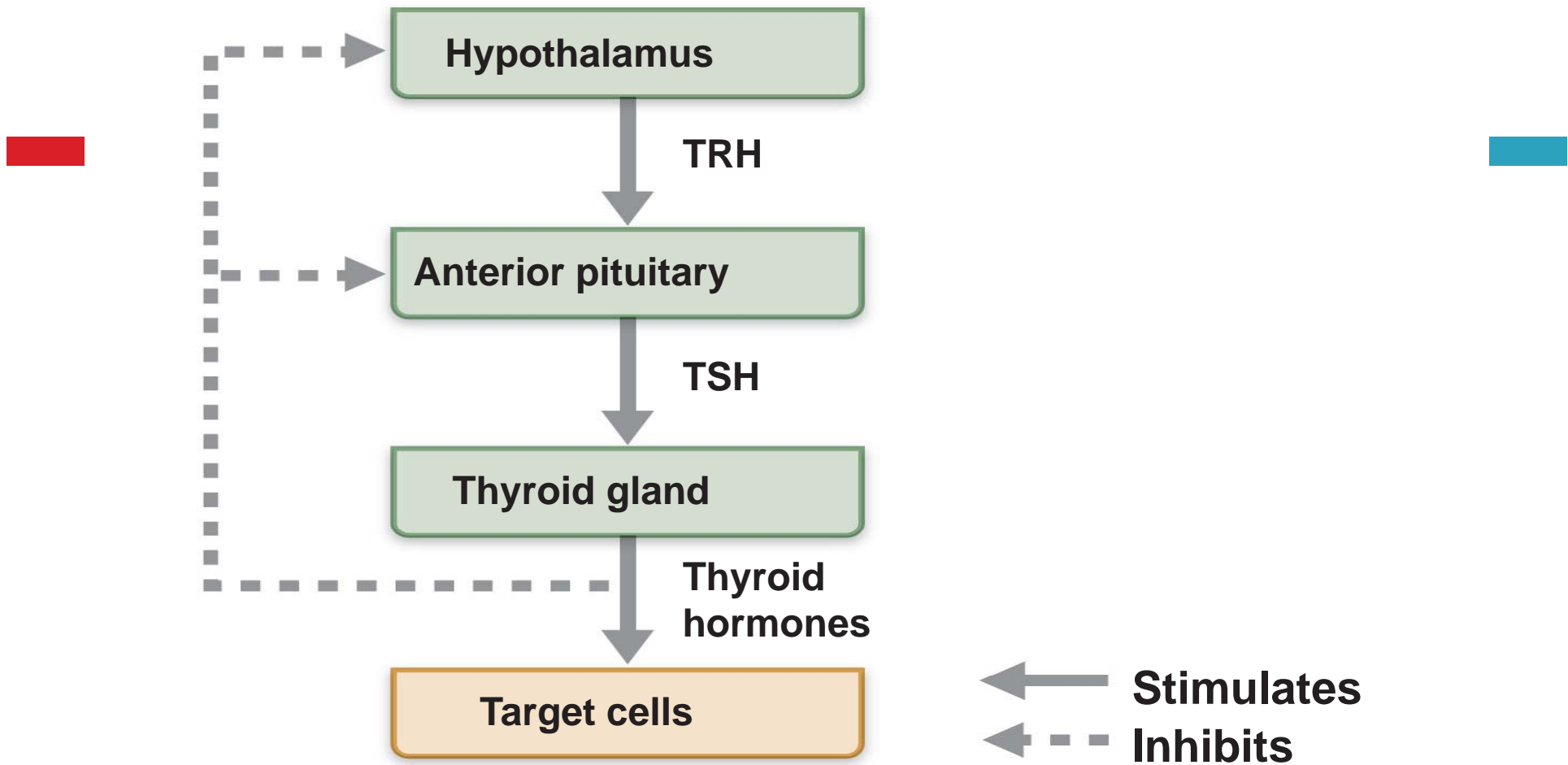
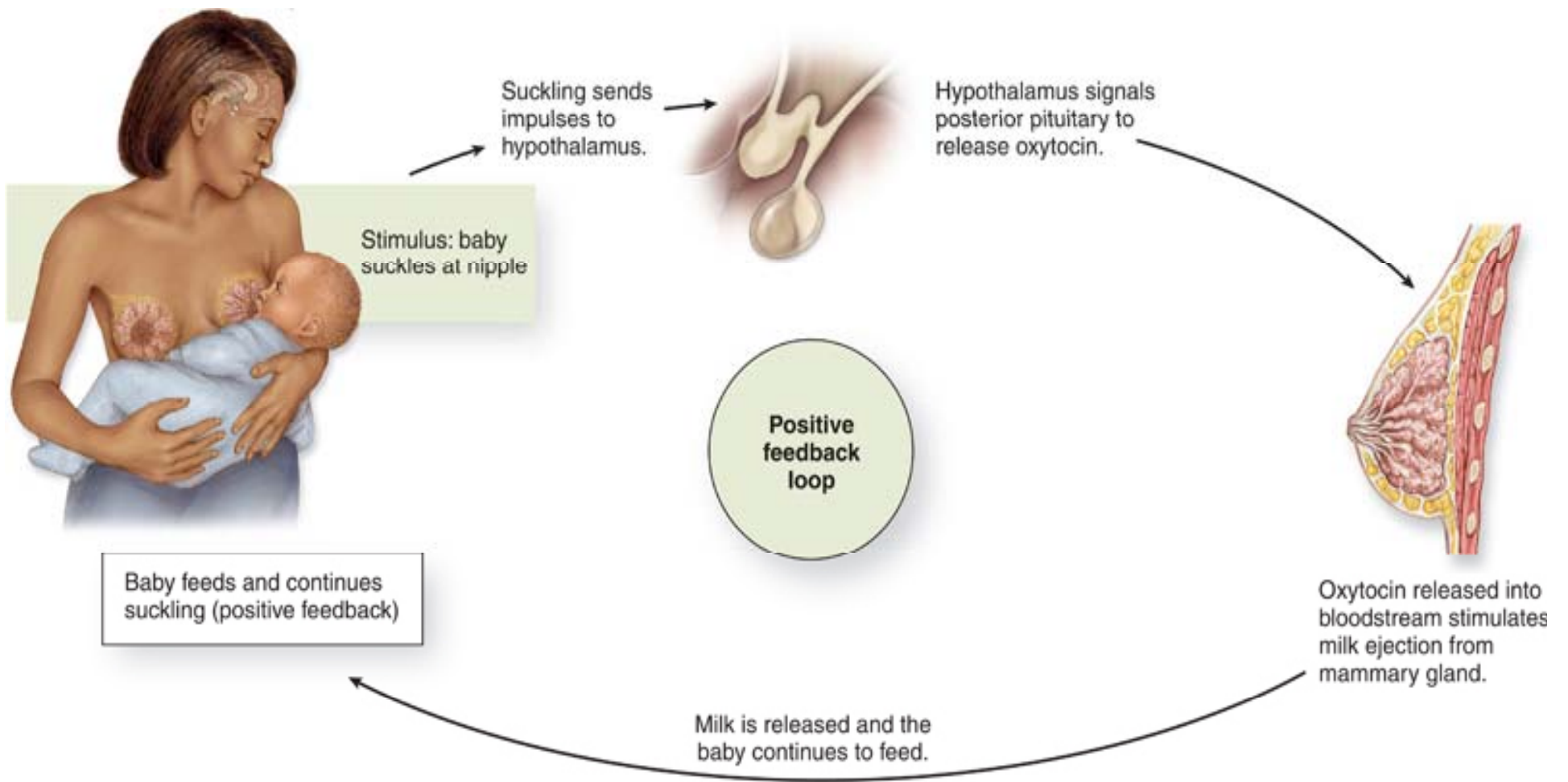
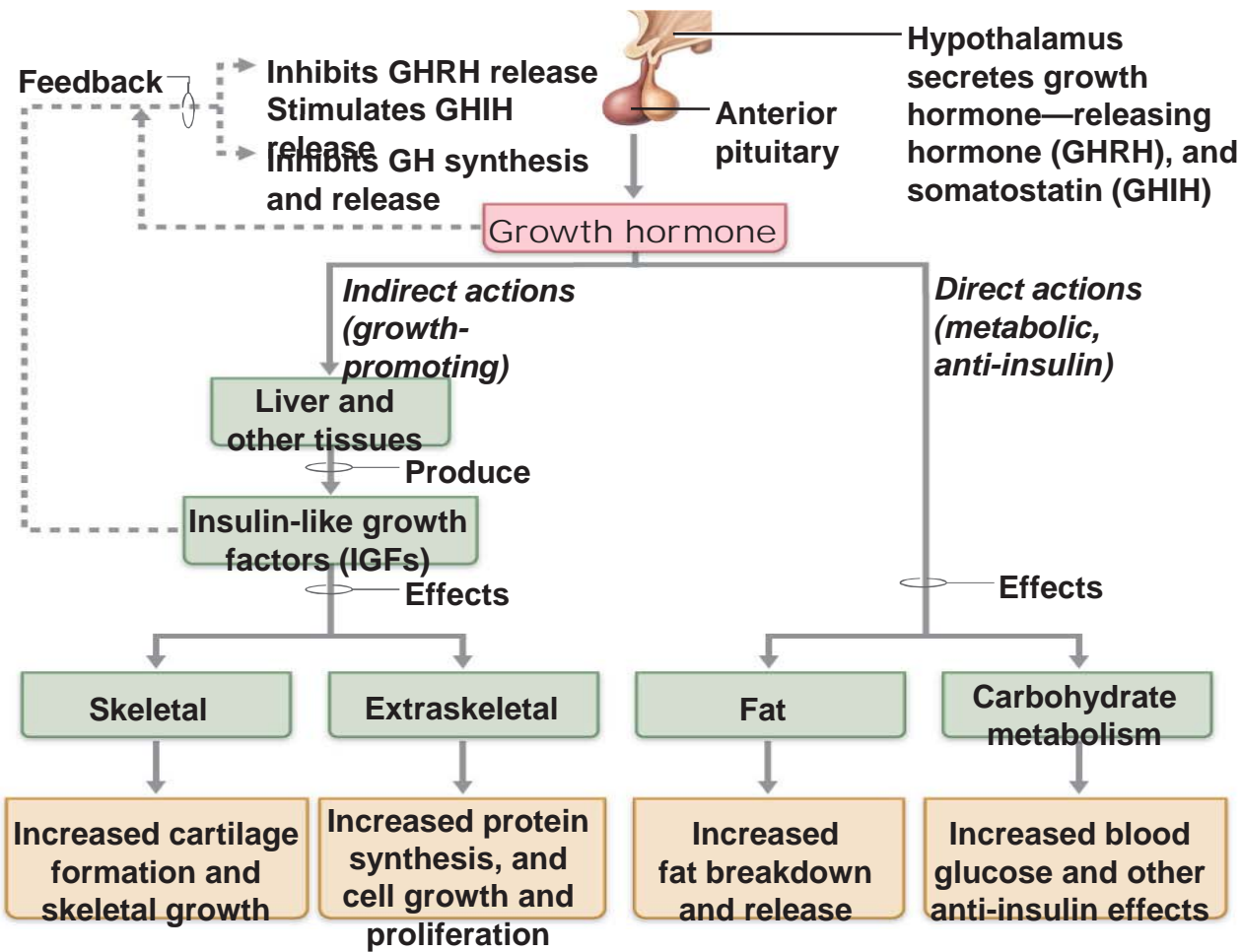


Figure 16.7



(b) Positive feedback



- ← Increases, stimulates
- ← - - - Reduces, inhibits
- Initial stimulus
- Physiological response
- Result

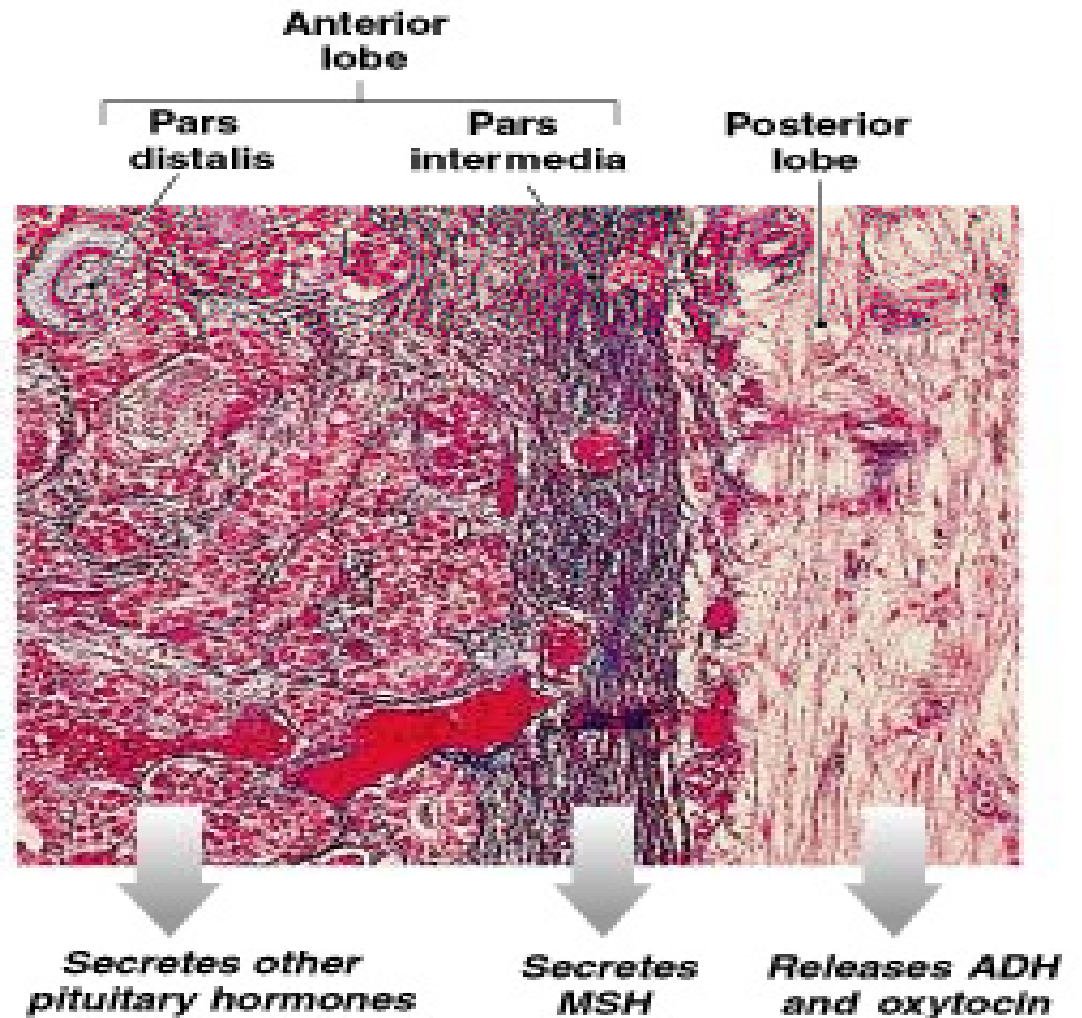
Figure 16.6

Pituitary Pathology

- Growth Hormone GH
 - ▣ dwarfism - hyposecretion
 - ▣ giantism, acromegaly - hypersecretion
- Thyroid Stimulating Hormone TSH
 - ▣ cretinism (infants) - hyposecretion
 - ▣ myxedema (adults) - hyposecretion
 - ▣ Toxic goiter (adults - hypersecretion
 - **exophthalmos**

Pituitary Histology

Development of the Hypophysis

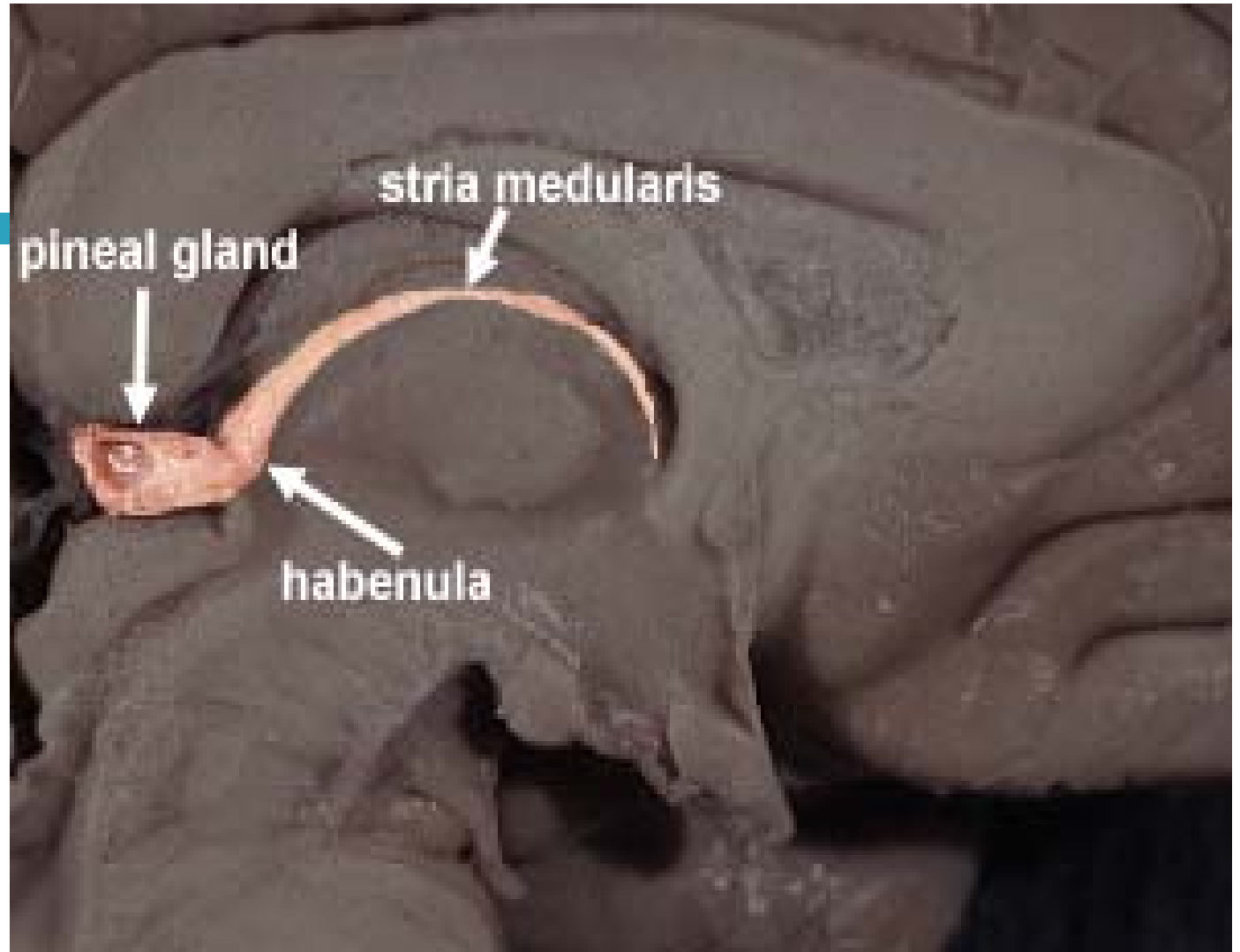


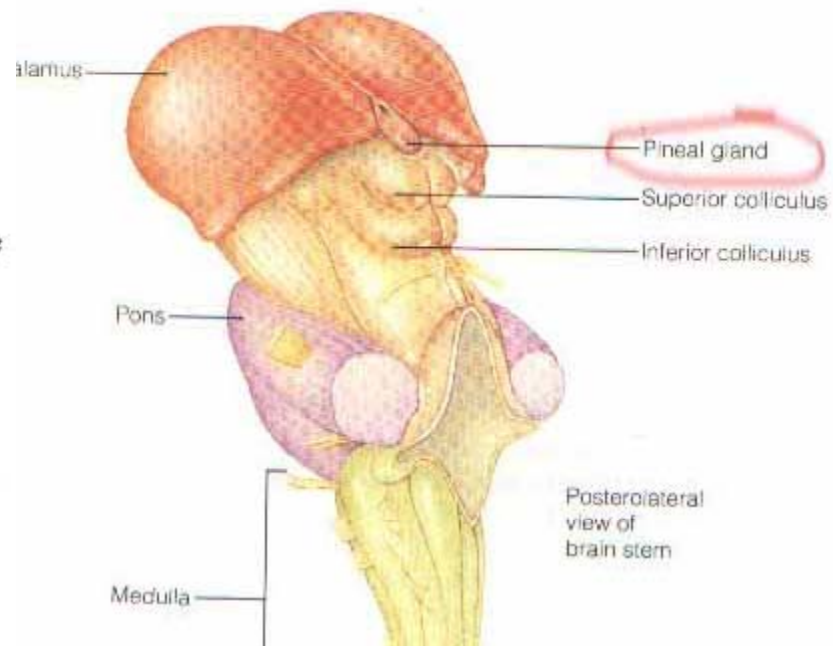
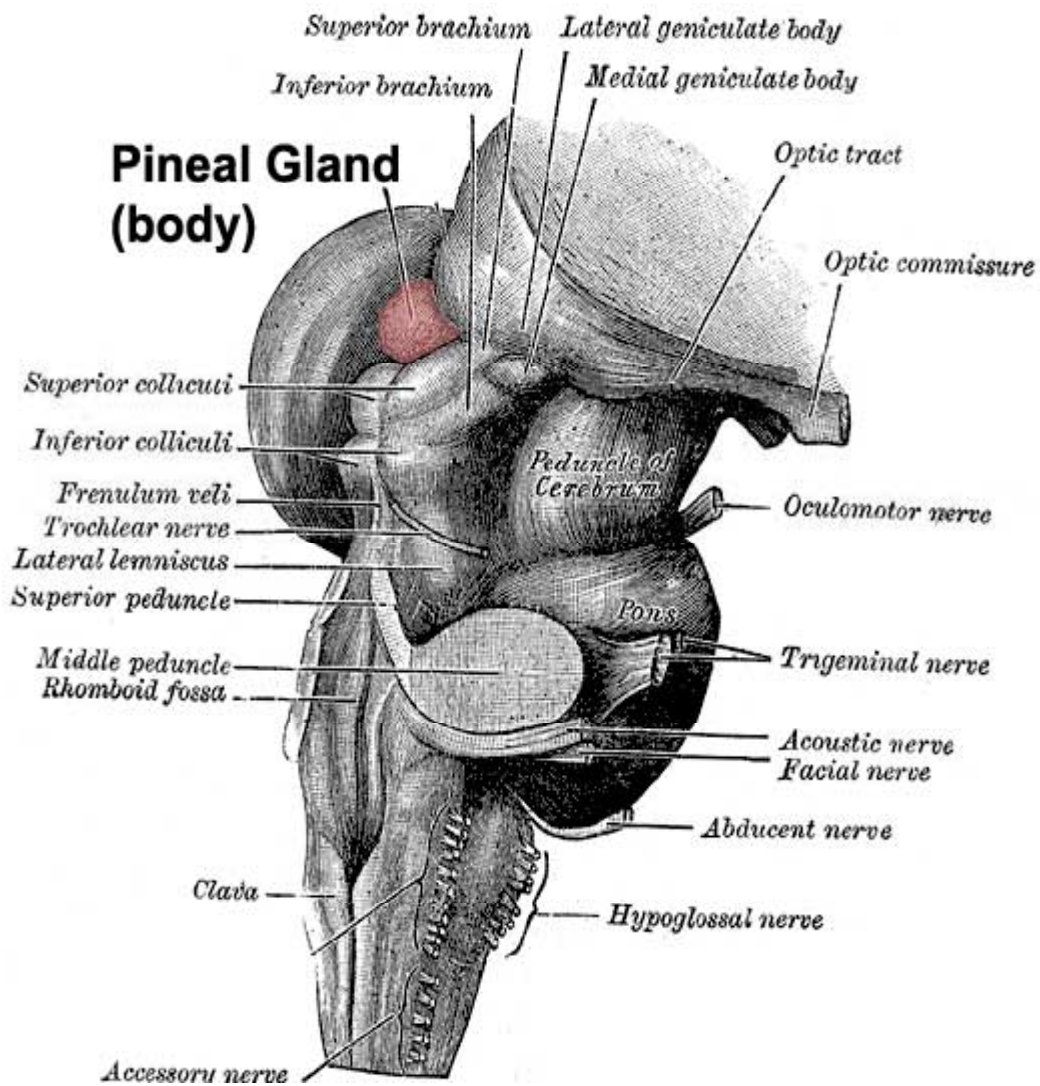


Pineal Gland

Epithalamus

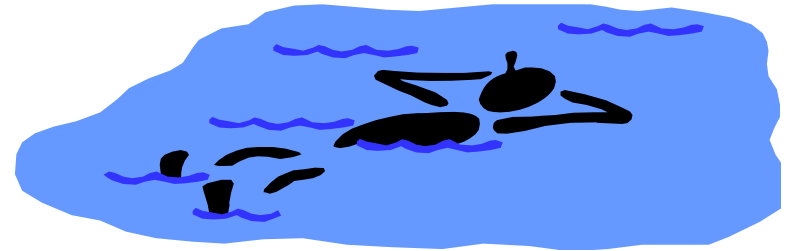
- Above the thalamus
- Contains the pineal gland which releases melatonin (involved in sleep/wake cycle and mood).
- Contains a structure called the habenula – involved in food and water intake





PINEAL GLAND

Pineal Gland



- **melatonin**-[N-acetyl-5-methoxytryptamine] may control biological cycles
 - regulation of the circadian rhythms
 - antioxidant with a particular role in the protection of nuclear and mitochondrial DNA.
- **inhibit ovarian activity**
- **Dreaming:** Some supplemental melatonin users report an increase in vivid dreaming. Extremely high doses of melatonin (50 mg) dramatically increased REM sleep time and dream activity in both people with and people without narcolepsy.
- **Autism** Individuals with autism spectrum disorders (ASD) may have lower than normal levels of melatonin

- **serotonin**-neurotransmitter, vasoconstrictor
 - stimulates smooth muscles and inhibits gastric secretion

Pineal Gland H&E

