

The Brain

lecture/lab presentation

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Part 3

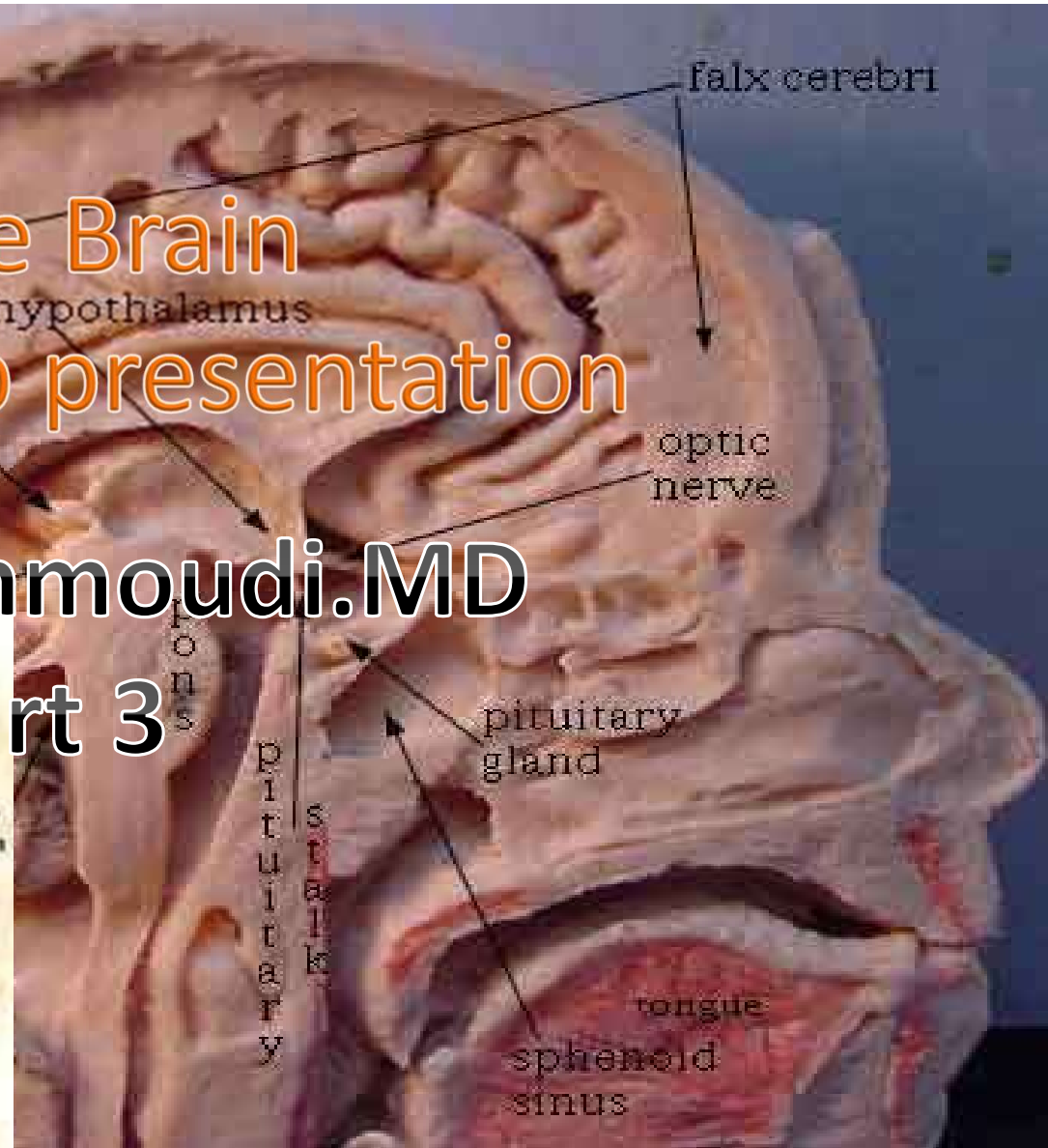
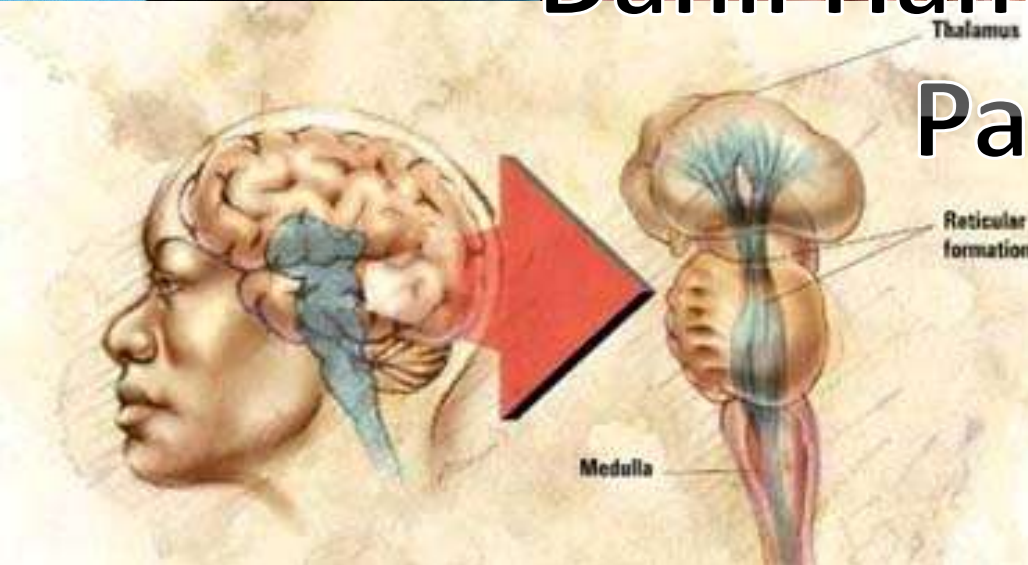


Figure 12.14: Ventral aspect of the human brain, showing the three regions of the brain stem, p. 447.

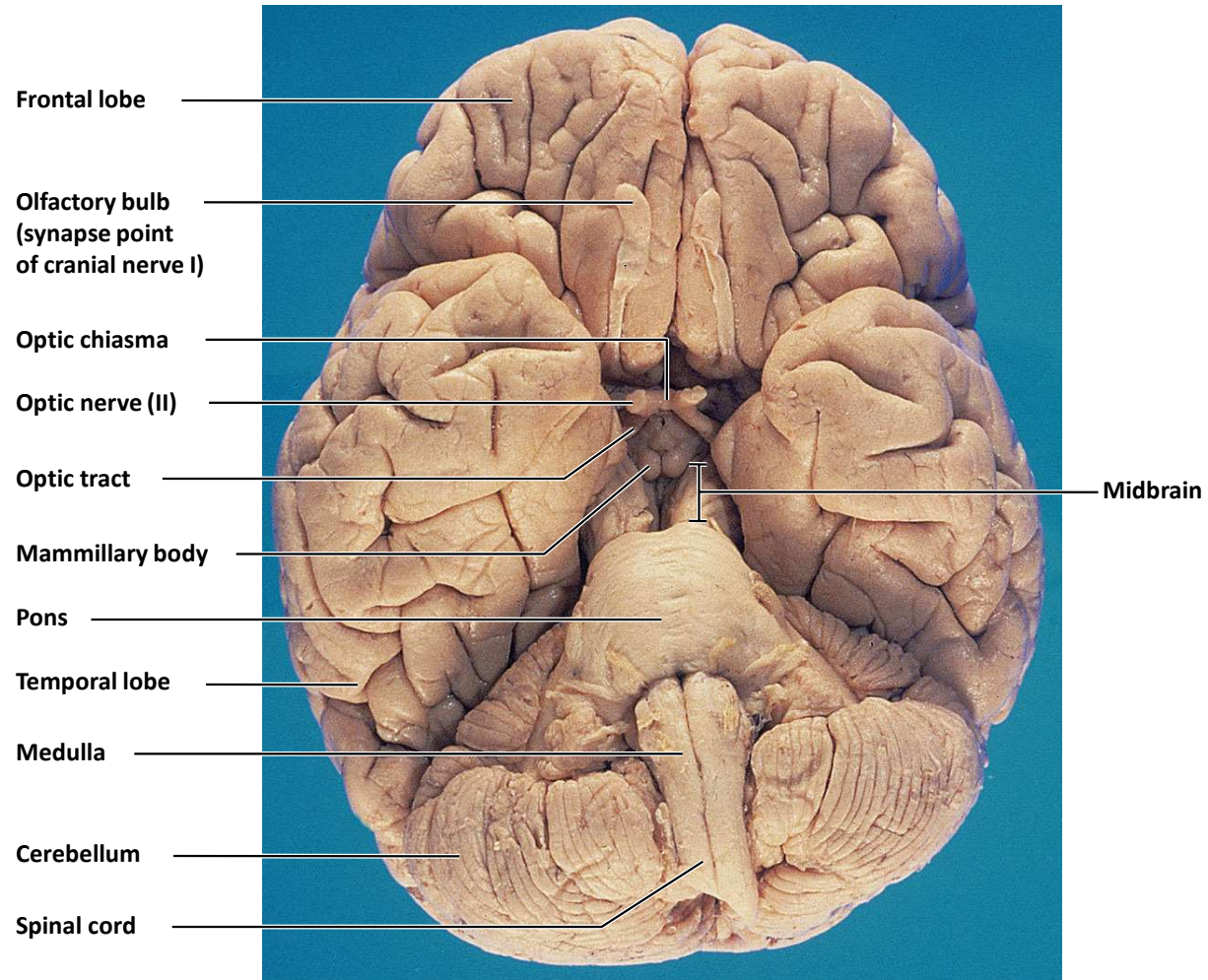
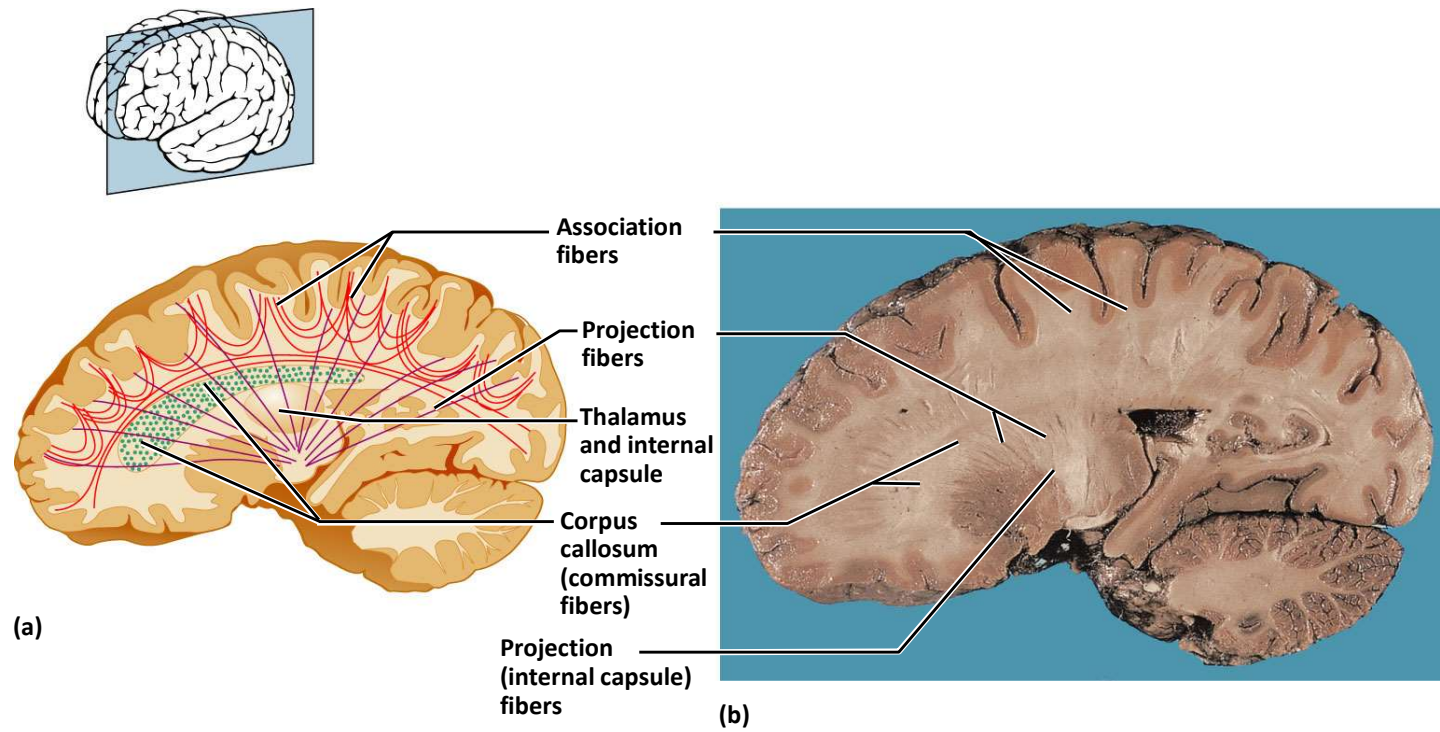


Figure 12.10a-b: Types of fiber tracts in white matter, p. 442.

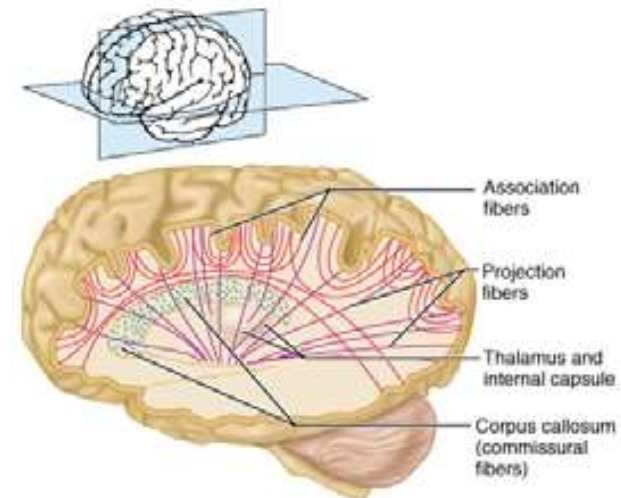
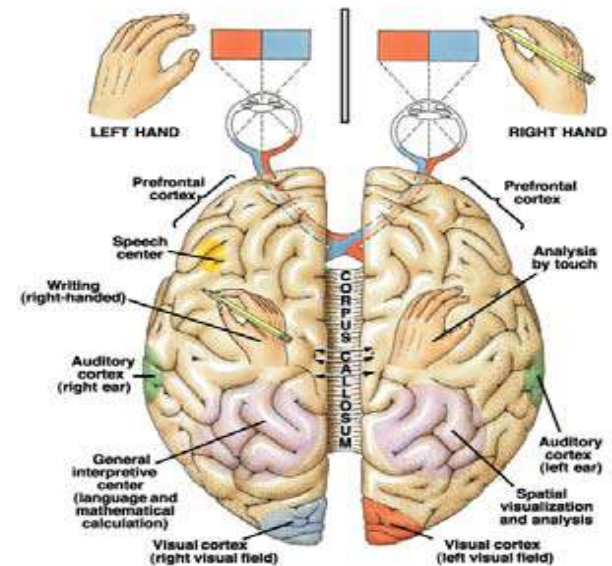


Cerebral White Matter

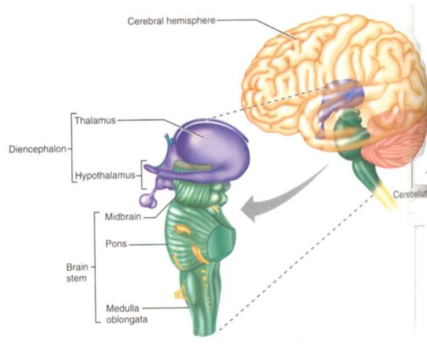
- Is white matter involved in communication?

- **3 types of fibers:**

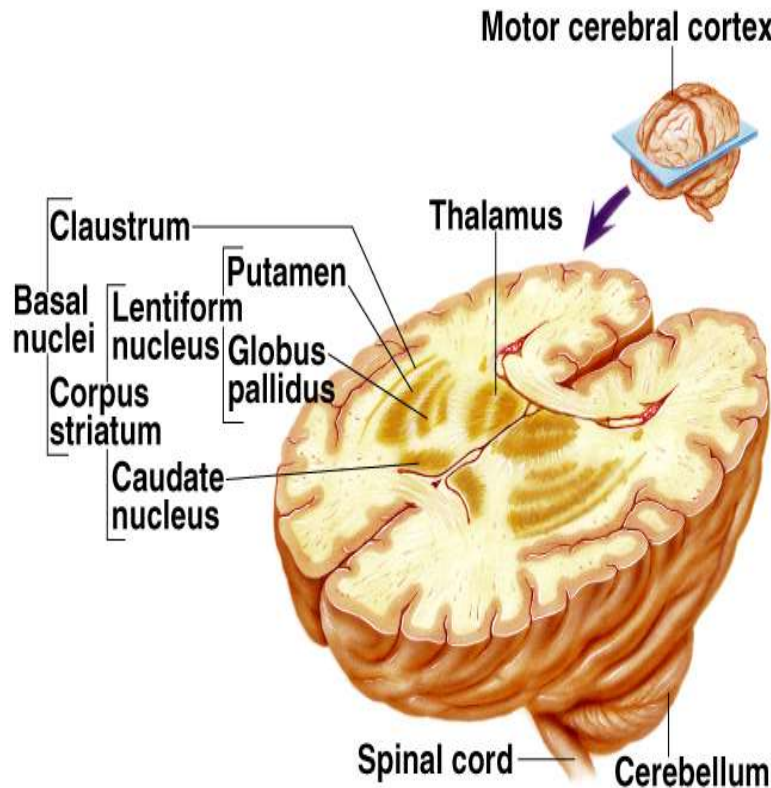
1. Commissural –connect corresponding areas of the hemispheres. Largest is the corpus callosum.
2. Association fibers –connect different parts of the same hemisphere
3. Projection fibers – Fibers entering and leaving the cerebral hemispheres from/to lower structures



DIENCEPHALON



DIENCEPHALON



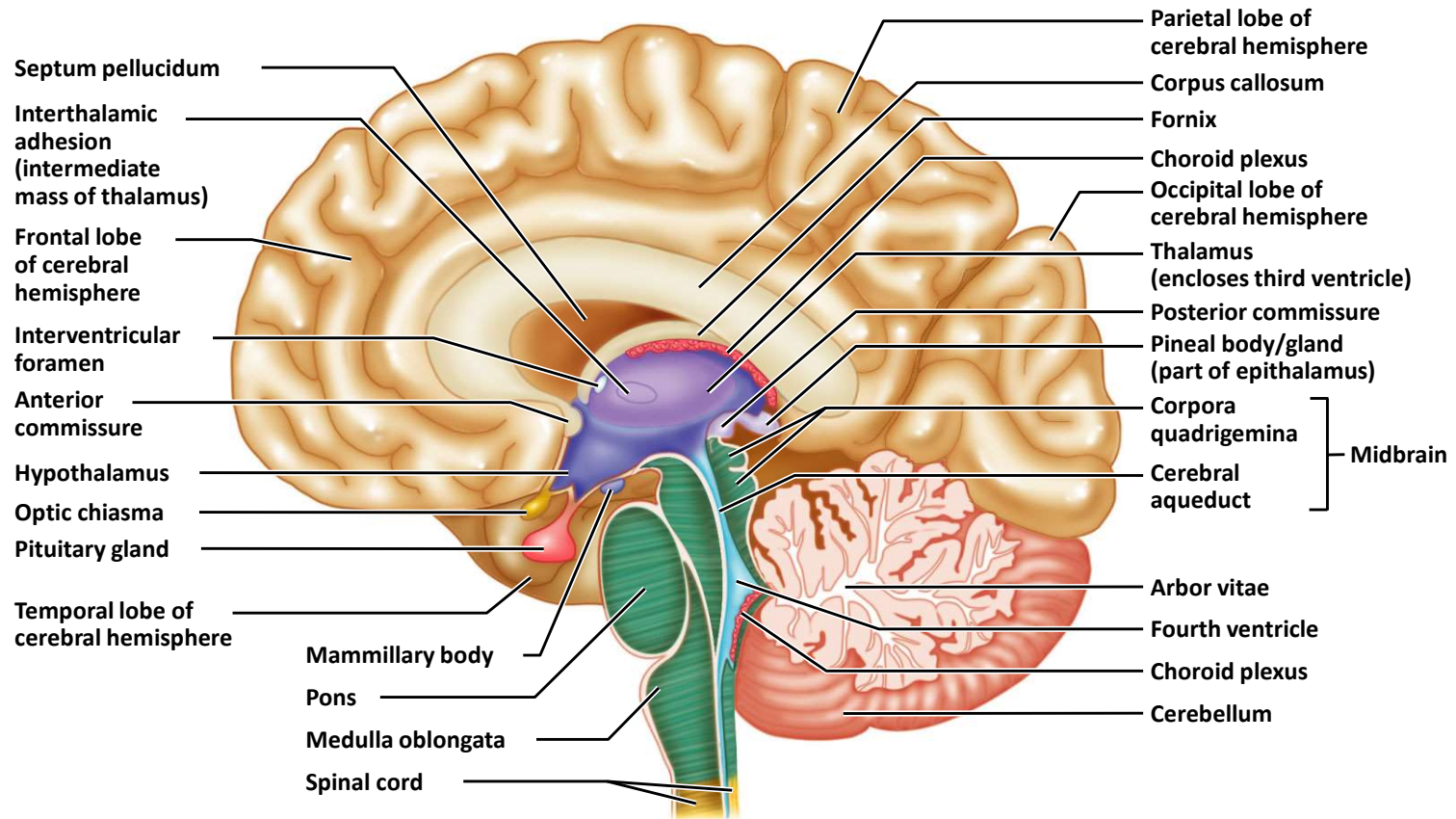
2 Major Structures

- Thalamus
- Hypothalamus

EPITHALAMUS

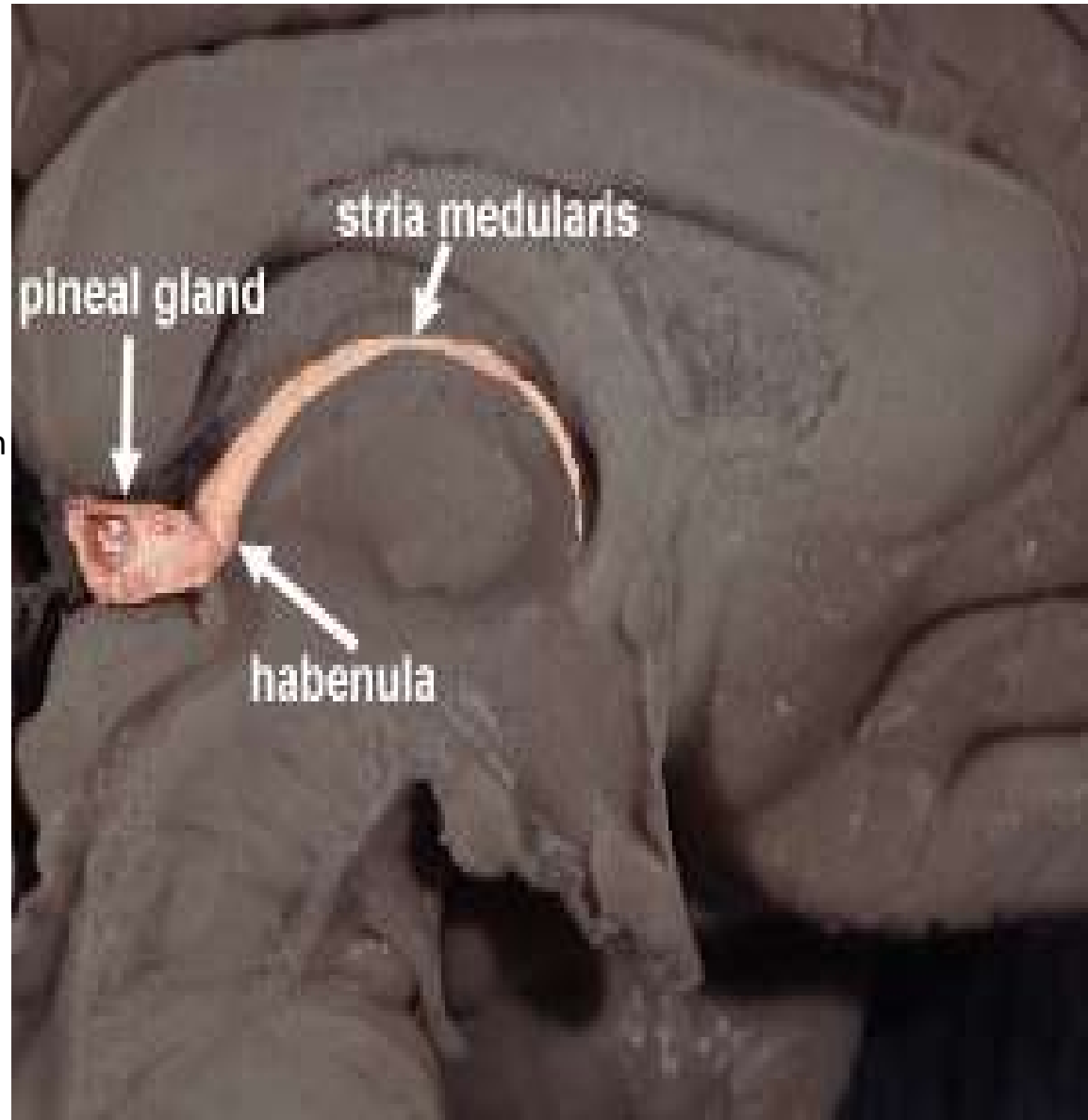


Figure 12.12: Midsagittal section of the brain illustrating the diencephalon and brain stem, p. 445.



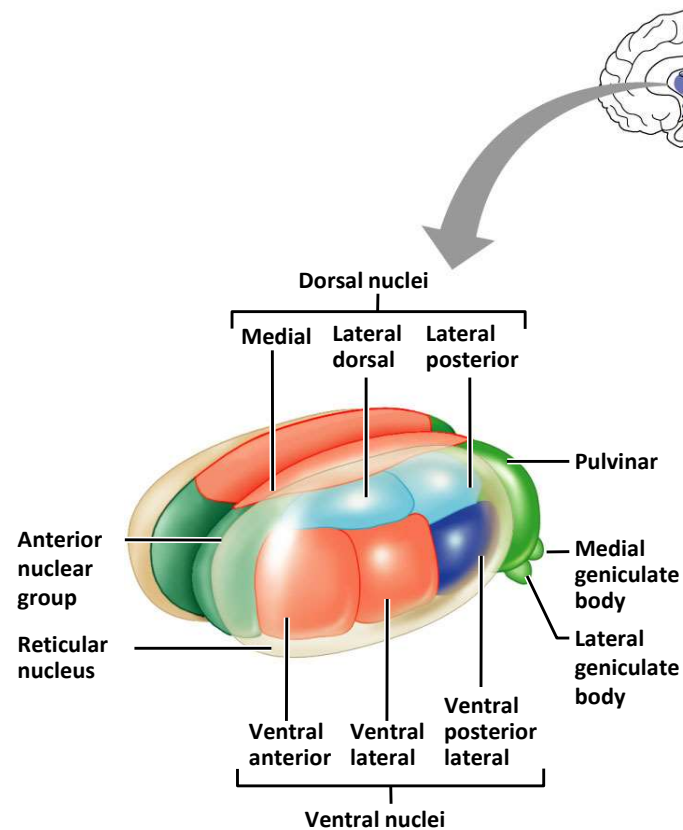
Epithalamus

- 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 and water intake



Thalamus

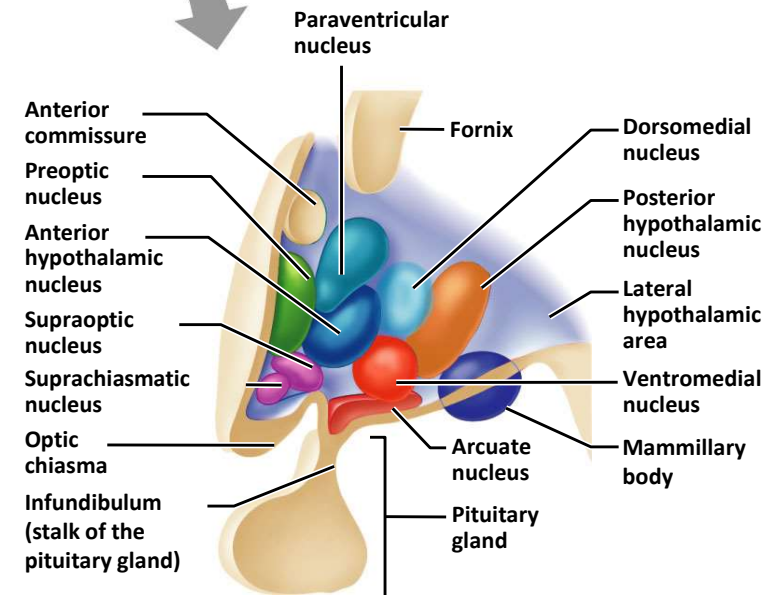
- Two lobes that relay sensory projection fiber info to the cerebral cortex



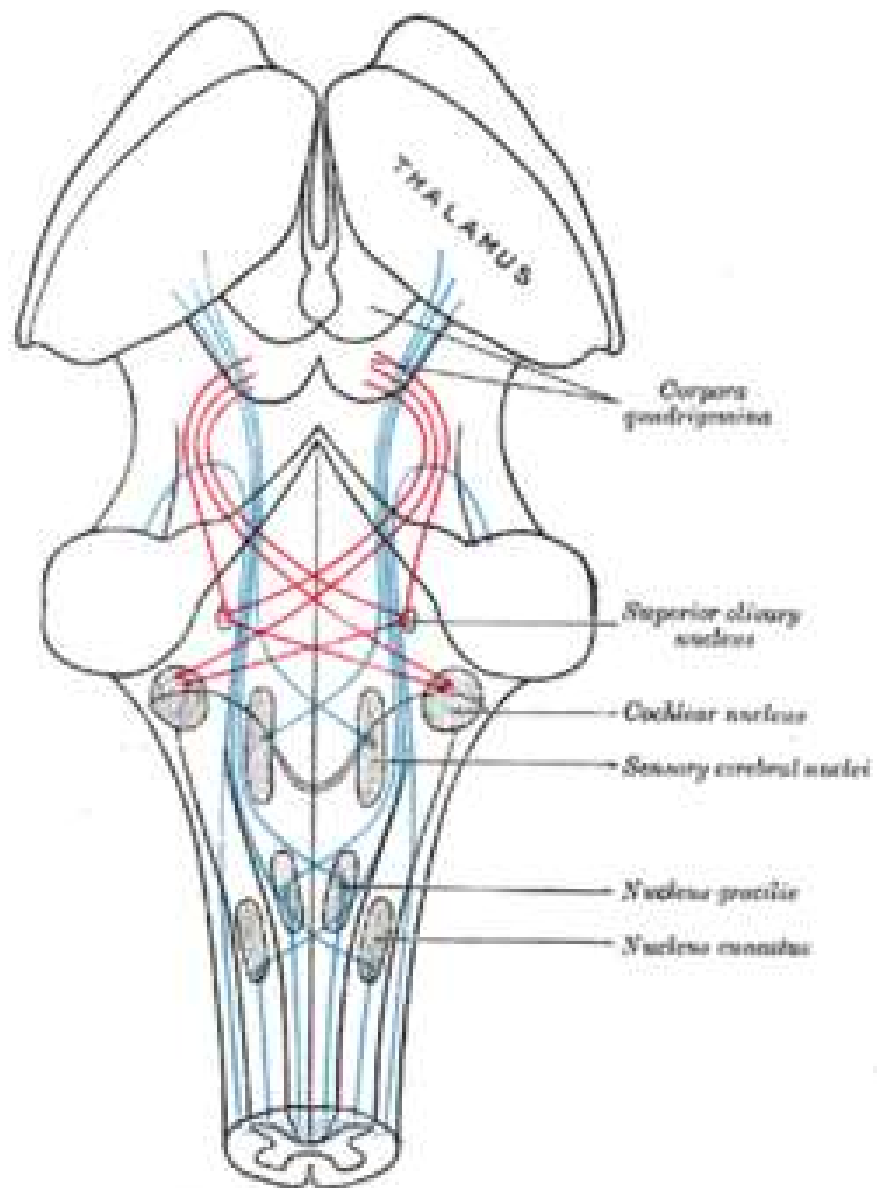
(a)

Hypothalamus

- Lies at the base of the brain
- Controls and regulates the endocrine system (hormones), autonomic system, species survival (the four Fs) and sleeping.
- Contains many nuclei and fiber tracts



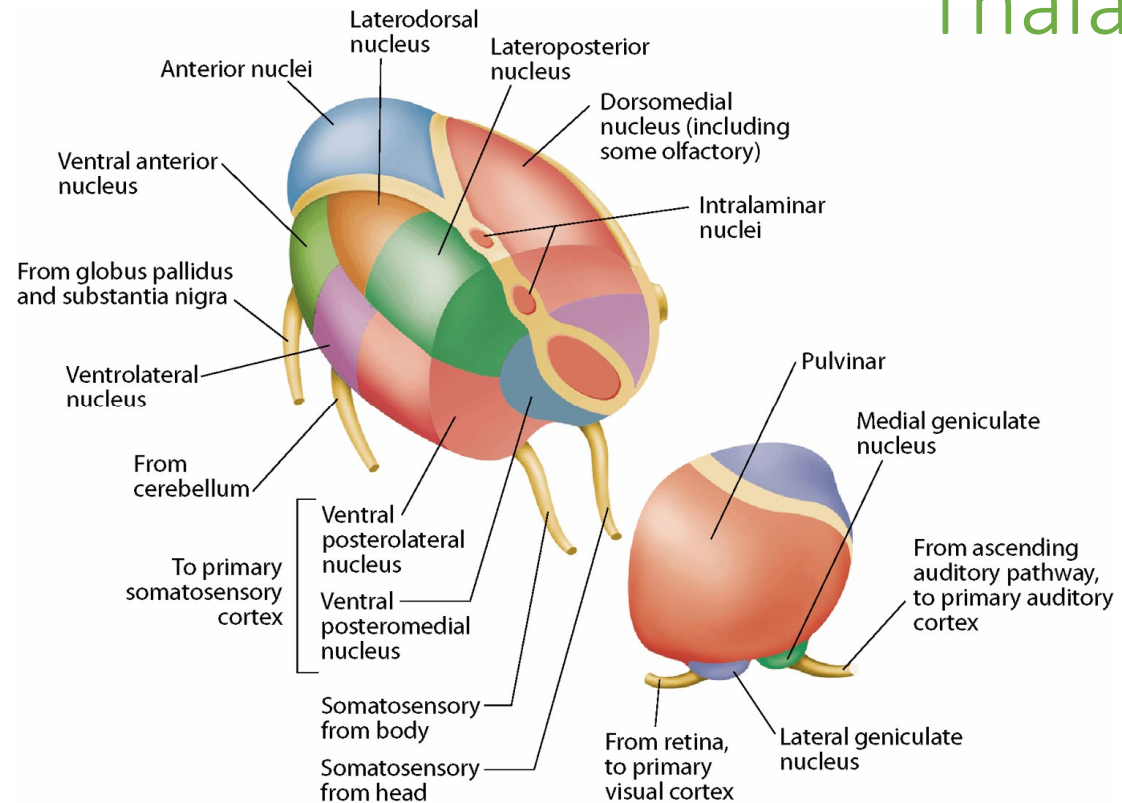
(b)



is the largest division of the diencephalon.

- receives precortical input from all sensory systems except the olfactory system.
- receives its largest input from the cerebral cortex.
- projects primarily to the cerebral cortex and to a lesser degree to the basal ganglia and hypothalamus.
- plays an important role in sensory and motor systems integration.

Thalamus



- *All sensory modalities relay through the thalamus*



Thalamus – “gateway” to the cerebral cortex

- Afferent impulses from all senses converge and synapse in the thalamus
- Impulses of similar function are sorted out, “edited”, and relayed as a group to the appropriate area of the sensory cortex or association areas
- **All inputs ascending to the cerebral cortex pass through the thalamus**
- **Plays a key role in mediating sensation, motor activities, cortical arousal, learning, and memory**

Hypothalamus

- **Functions:**

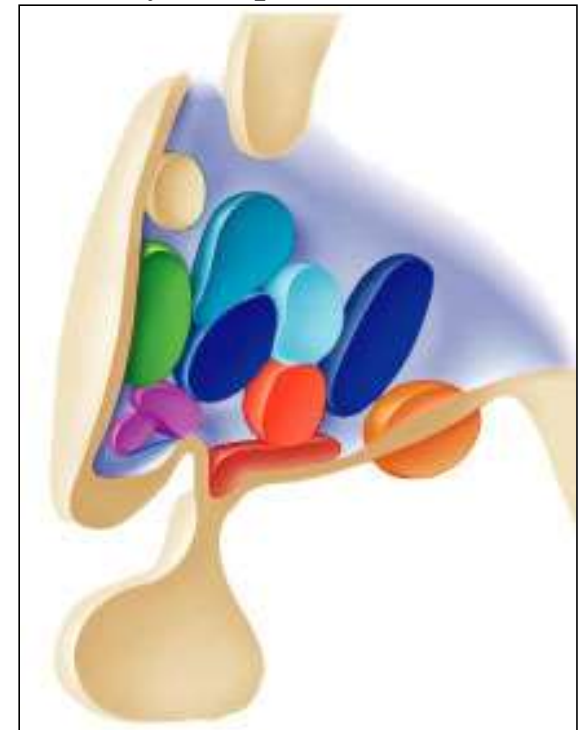
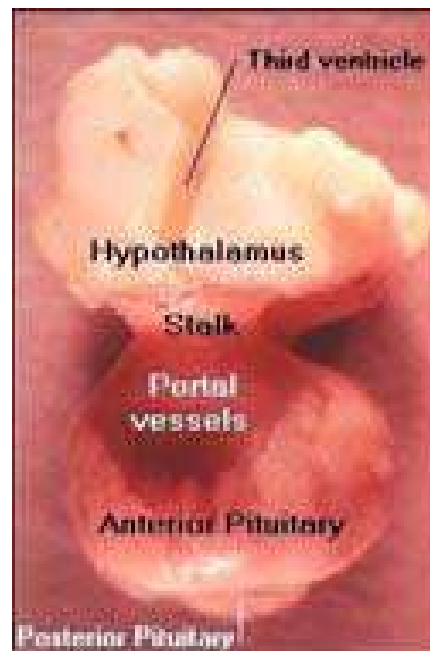
- Autonomic regulatory center
- Influences HR, BP, resp. rate, GI motility, pupillary diameter.
- **Can you hold your breath until you die?**
- Emotional response
- Involved in fear, loathing, pleasure
- Drive center: sex, hunger
- Regulation of body temperature
- Regulation of food intake
- Contains 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.

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



Hypothalamus

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

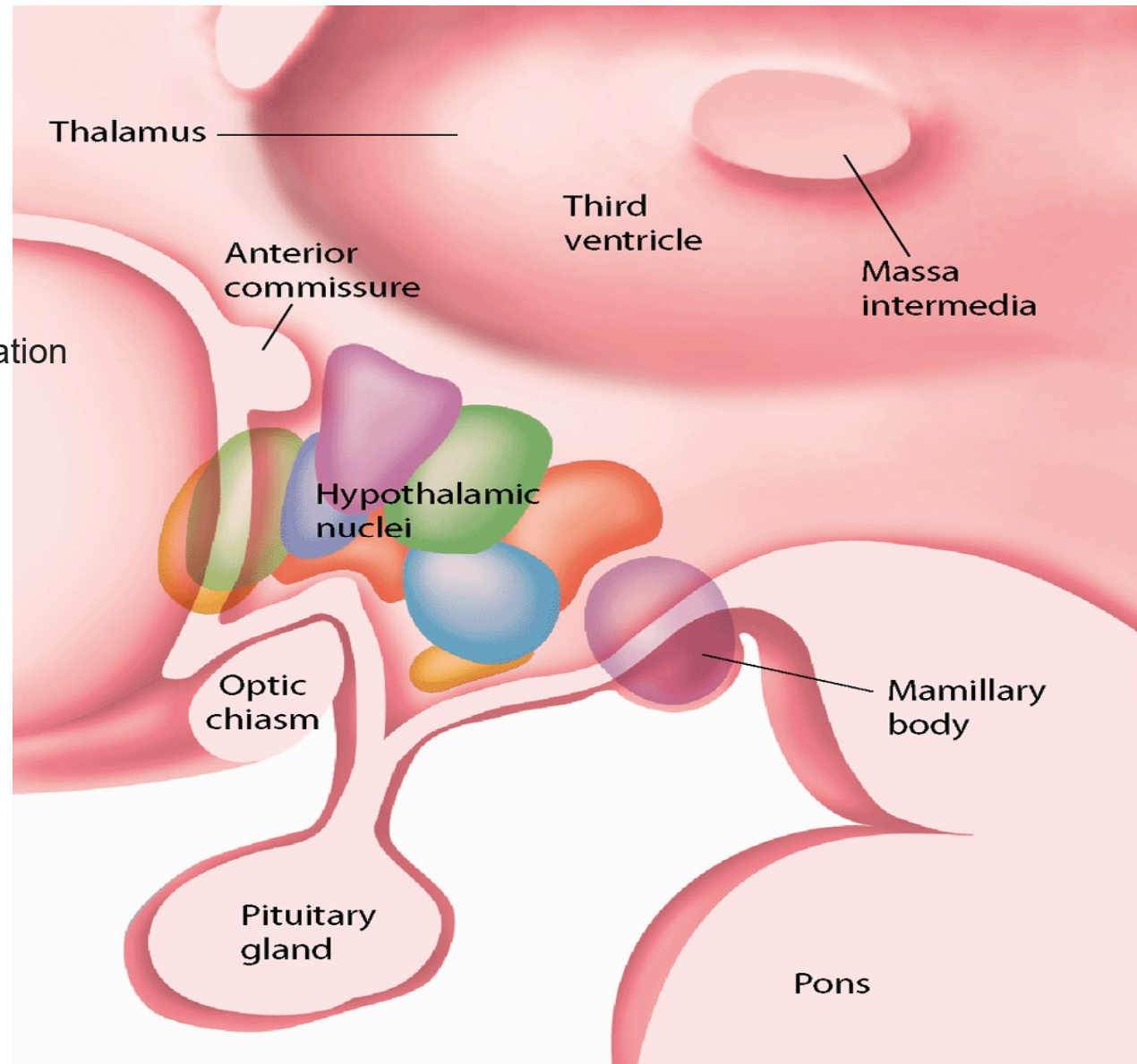
4 F'S: fighting, fleeing, feeding, and fornication

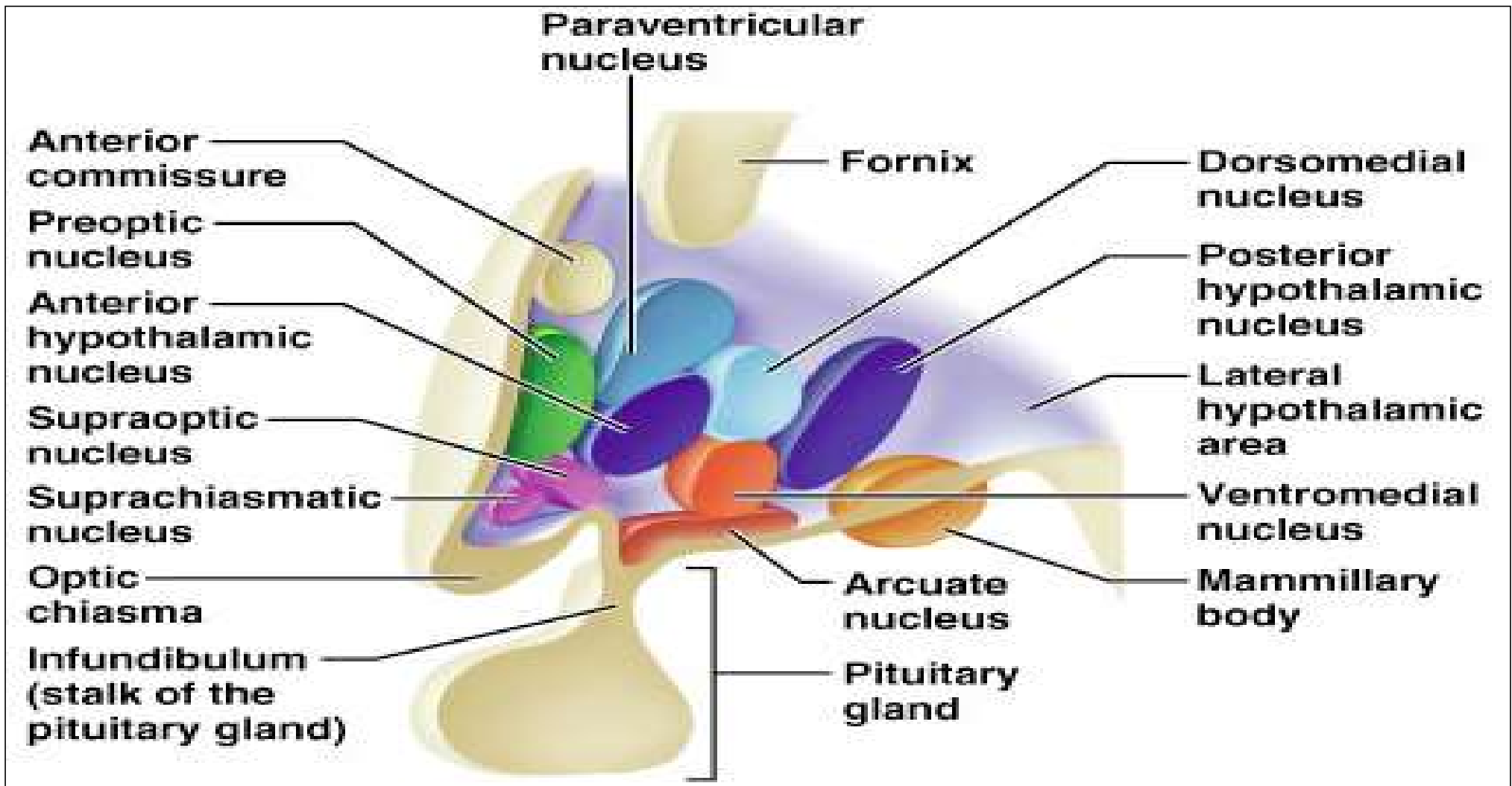
Releasing hormones

- Thyrotropin-releasing hormone
- Corticotropin-releasing hormone
- Growth hormone-releasing hormone
- Somatostatin
- Gonadotropin-releasing hormone
- Dopamine
- Neurotensin

Neurohypophysal hormones

- Oxytocin
- Vasopressin





Hypothalamic Nuclei

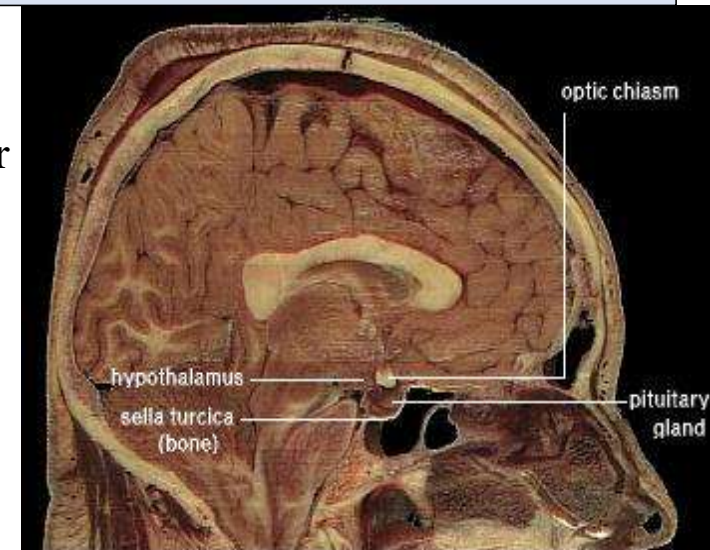
Hypothalamic Function

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



List of nuclei, their functions, and the neurotransmitters, neuropeptides, or hormones that they utilize

Region	Area	Function
Anterior (supraoptic)	Preoptic	<ul style="list-style-type: none"> •Thermoregulation
	Medial	<ul style="list-style-type: none"> •Regulates the release of gonadotropic hormones from the adenohypophysis •Contains the sexually dimorphic nucleus, which releases GnRH, differential development between sexes is based upon in utero testosterone levels •Thermoregulation^[10] •Vasopressin release •Oxytocin release •thyrotropin-releasing hormone release •corticotropin-releasing hormone release •oxytocin release •vasopressin release •somatostatin release •thermoregulation •panting •sweating •thyrotropin inhibition •Circadian rhythms
	Lateral	<p>primary source of orexin neurons that project throughout the brain and spinal cord</p>

Middle (tuberal)	Medial		<ul style="list-style-type: none"> •blood pressure •heart rate •GI stimulation
			•satiety
			<ul style="list-style-type: none"> •neuroendocrine control •Growth hormone-releasing hormone (GHRH) •feeding •Dopamine-mediated prolactin inhibition
Posterior (mammillary)	Medial	Mammillary nuclei (part of mammillary bodies)	<ul style="list-style-type: none"> •memory •Increase blood pressure
		Posterior nucleus	<ul style="list-style-type: none"> •pupillary dilation •shivering •vasopressin release
	Lateral	Lateral nucleus	primary source of orexin neurons that project throughout the brain and spinal cord

Secreted hormone	Abbreviation	Effect
Thyrotropin-releasing hormone (Prolactin-releasing hormone)	TRH, TRF, or PRH	Stimulate thyroid-stimulating hormone (TSH) release from anterior pituitary (primarily) Stimulate prolactin release from anterior pituitary
Corticotropin-releasing hormone	CRH or CRF	Stimulate adrenocorticotrophic hormone (ACTH) release from anterior pituitary
Dopamine (Prolactin-inhibiting hormone)	DA or PIH	Inhibit prolactin release from anterior pituitary
Growth-hormone-releasing hormone	GHRH	Stimulate growth-hormone (GH) release from anterior pituitary
Gonadotropin-releasing hormone	GnRH or LHRH	Stimulate follicle-stimulating hormone (FSH) release from anterior pituitary Stimulate luteinizing hormone (LH) release from anterior pituitary
Somatostatin (growth-hormone-inhibiting hormone)	SS, GHIH, or SRIF	Inhibit growth-hormone (GH) release from anterior pituitary Inhibit (moderately) thyroid-stimulating hormone (TSH) release from anterior pituitary

Secreted hormone	Abbreviation	Effect
Oxytocin	OXY or OXT	Uterine contraction Lactation (letdown reflex)
Vasopressin (antidiuretic hormone)	ADH or AVP	Increase in the permeability to water of the cells of distal tubule and collecting duct in the kidney and thus allows water reabsorption and excretion of concentrated urine