Diencephalon Lecture Review

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Diencephalon General Information

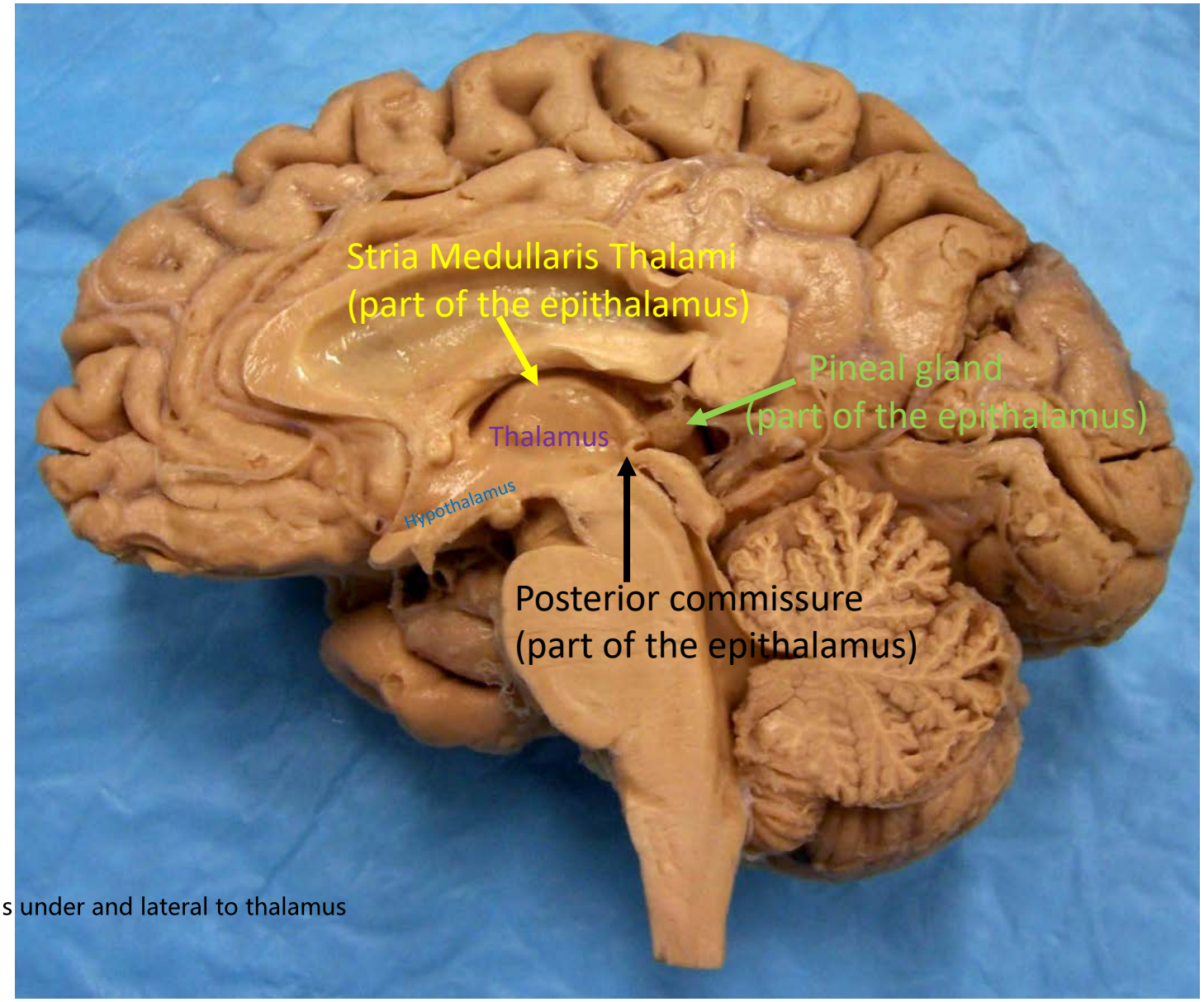
during fetal development forebrain develops into diencephalon and telencephalon

- 4 major components

1. (Dorsal) thalamus
2. Hypothalamus
3. Subthalamus
4. Epithalamus
    a. Pineal gland
    b. Posterior commissure
    c. Stria Medullaris Thalami
    d. Habenular nuclei and Habenular commissure

will not have to ID posterior commissure on exam

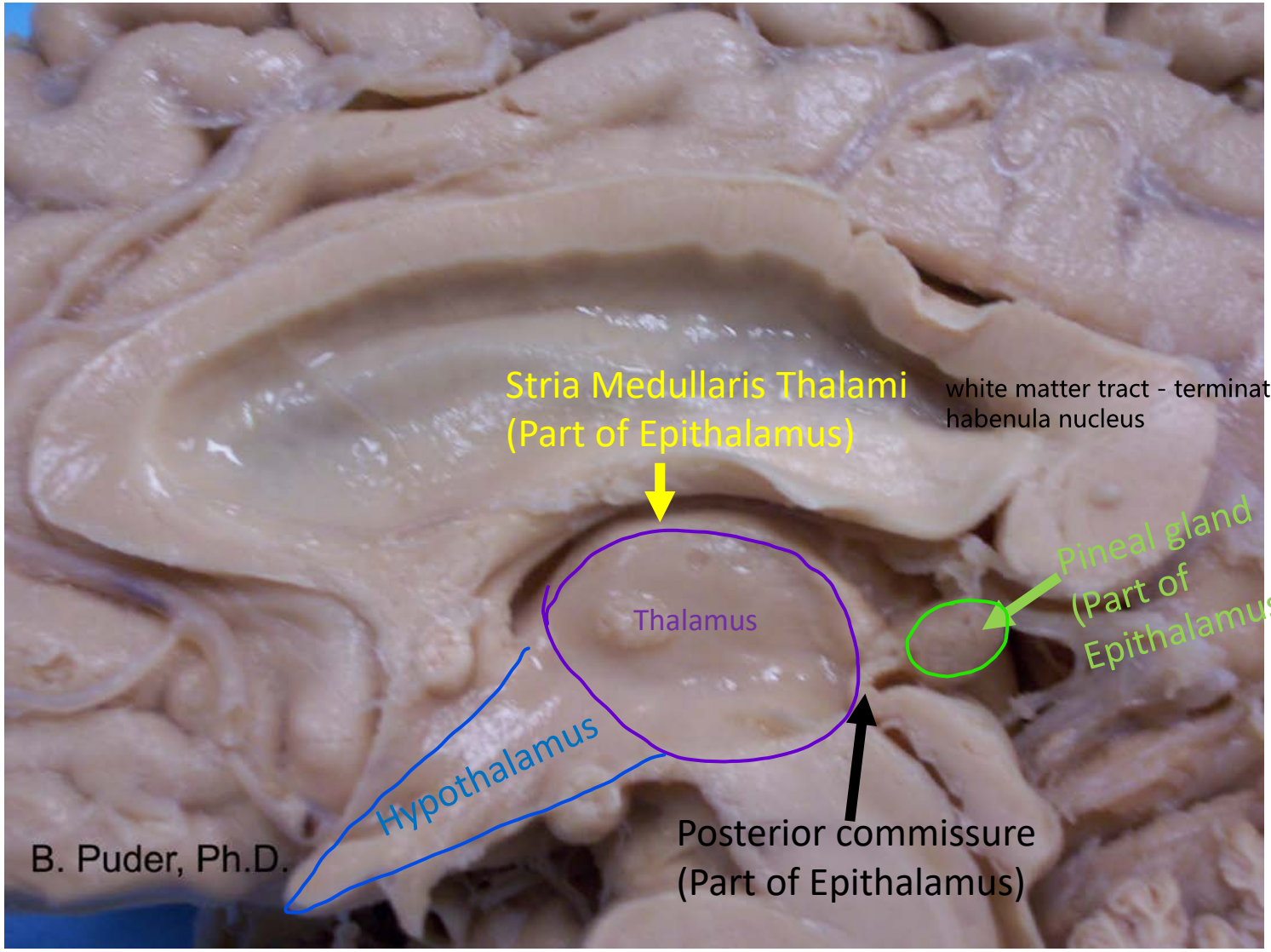
Diencephalon Anatomy



subthalamus under and lateral to thalamus

Mid-sagittal brain section depicting the medial aspect of right brain hemisphere

Diencephalon Anatomy



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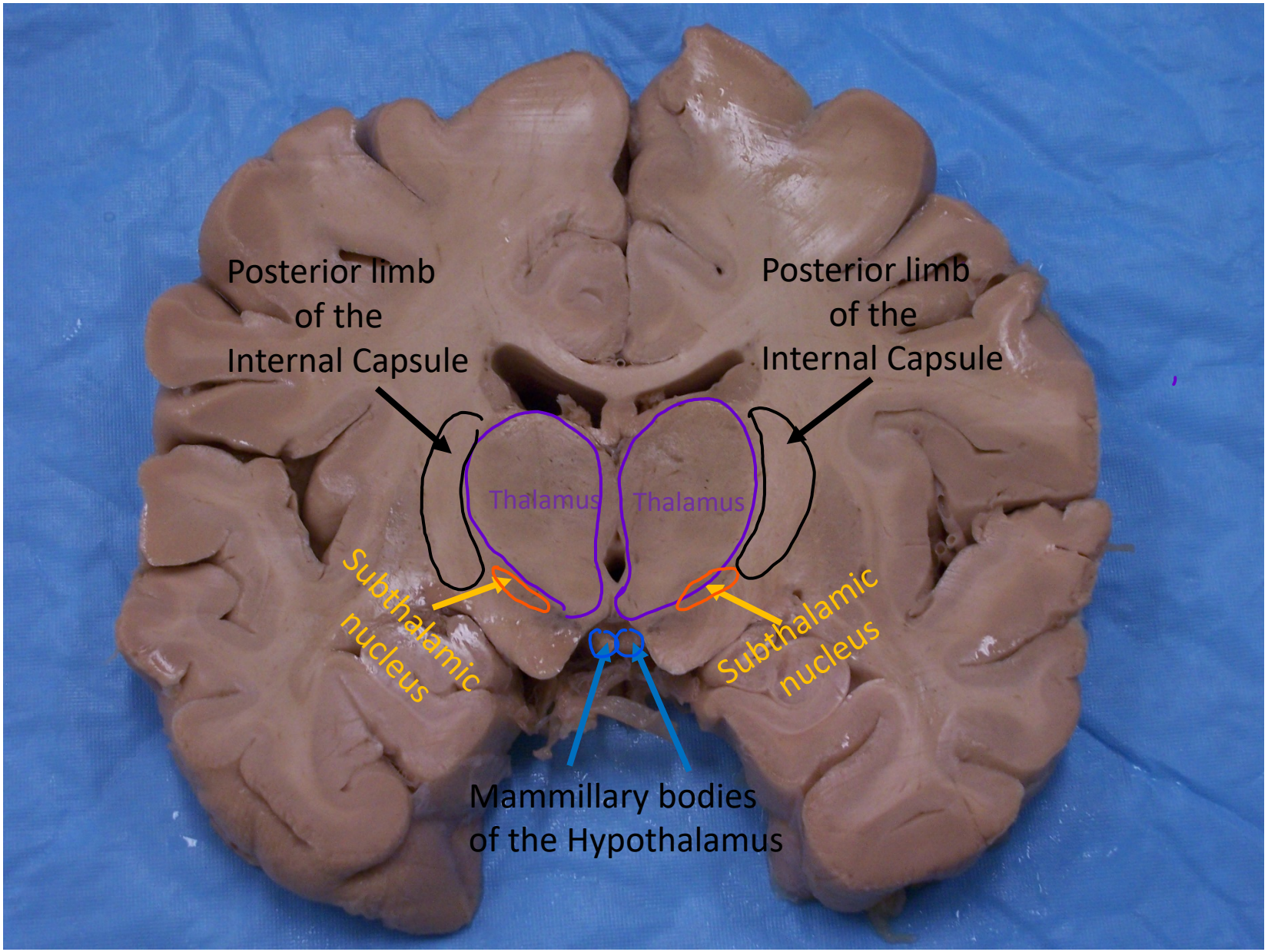
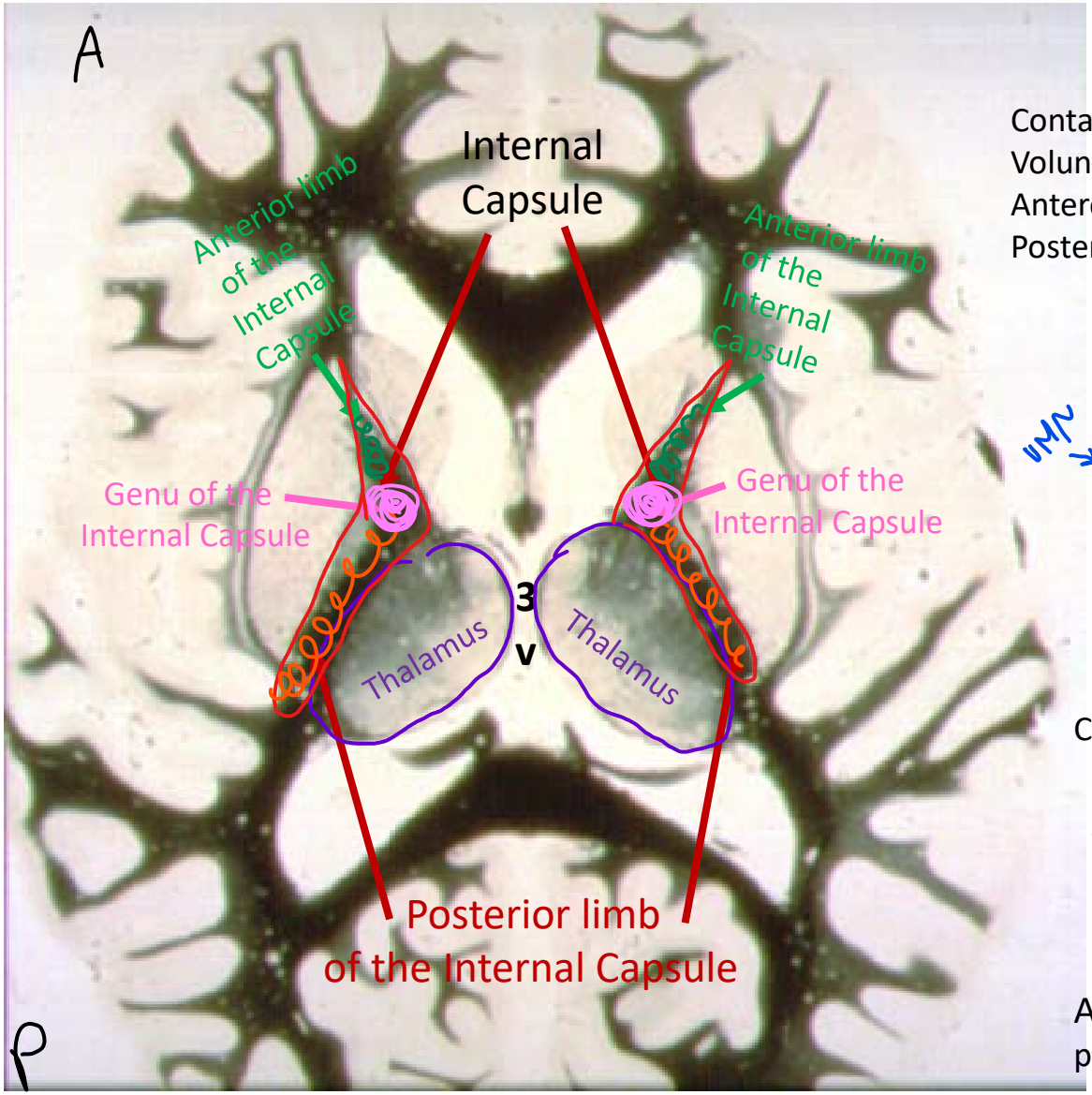


Coronal brain section depicting some components of the diencephalon

Diencephalon Anatomy



Posterior limb of the internal capsule:

Contains axons of the 3 major body pathways:
Voluntary motor pathway
Anterolateral system
Posterior columns/Medial lemniscus pathway

lateral striate arteries
Lenticulostriate arteries are the blood supply to the internal capsule.

Contralateral body will display signs of:
spastic paresis, loss of somatosensation (includes loss of pain/temperature, and loss of tactile/vibratory/position sense)

in front of thalamus

Genu of the internal capsule:

Contains axons of the major face pathways

Contralateral face will display signs of:
spastic paresis, loss of somatosensation (includes loss of pain/temperature, and loss of tactile/vibratory/position sense)

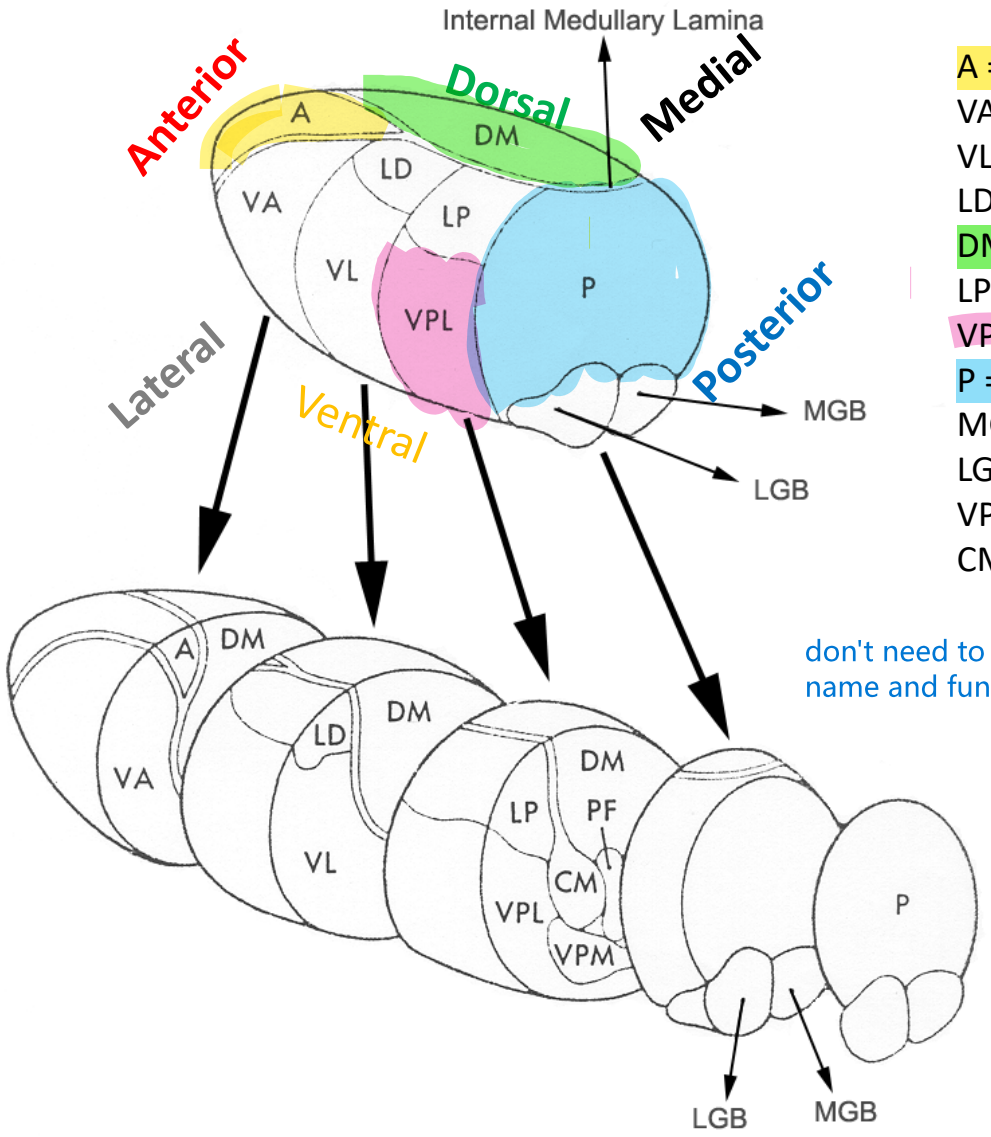
Anterior limb of the internal capsule:

pathways that are part of the limbic system

Horizontal myelin stained brain section depicting the thalamus and internal capsule

The Thalamus "The Gateway to the Cortex"

grouping of cell bodies that project to different areas of the
groups are cell bodies that function together



A = Anterior nucleus
VA = Ventral anterior nucleus
VL = Ventral lateral nucleus
LD = Lateral dorsal nucleus
DM = Dorsomedial nucleus
LP = Lateral posterior nucleus
VPL = Ventral posterolateral nucleus
P = Pulvinar
MGB = Medial geniculate body
LGB = Lateral geniculate body
VPM = Ventral posteromedial nucleus
CM = Central median nucleus

don't need to label where the nuclei are but know name and function

Image from Fundamental Neuroscience for Basic and Clinical Applications, 4th edition, Duane E. Haines

The Thalamus "The Gateway to the Cortex"

Thalamic Nuclei Functions

Anterior and Lateral Dorsal nuclei = part of the limbic system

Dorsomedial nucleus = Moods, emotions, behaviors
where would cut in frontal lobotomies

Ventral anterior and Ventral lateral nuclei = Cerebellar and Basal nuclei motor pathways

Ventral posterolateral nucleus = 3rd order cell bodies relaying somatosensation (pain/temp, tactile/vibration) from the contralateral body

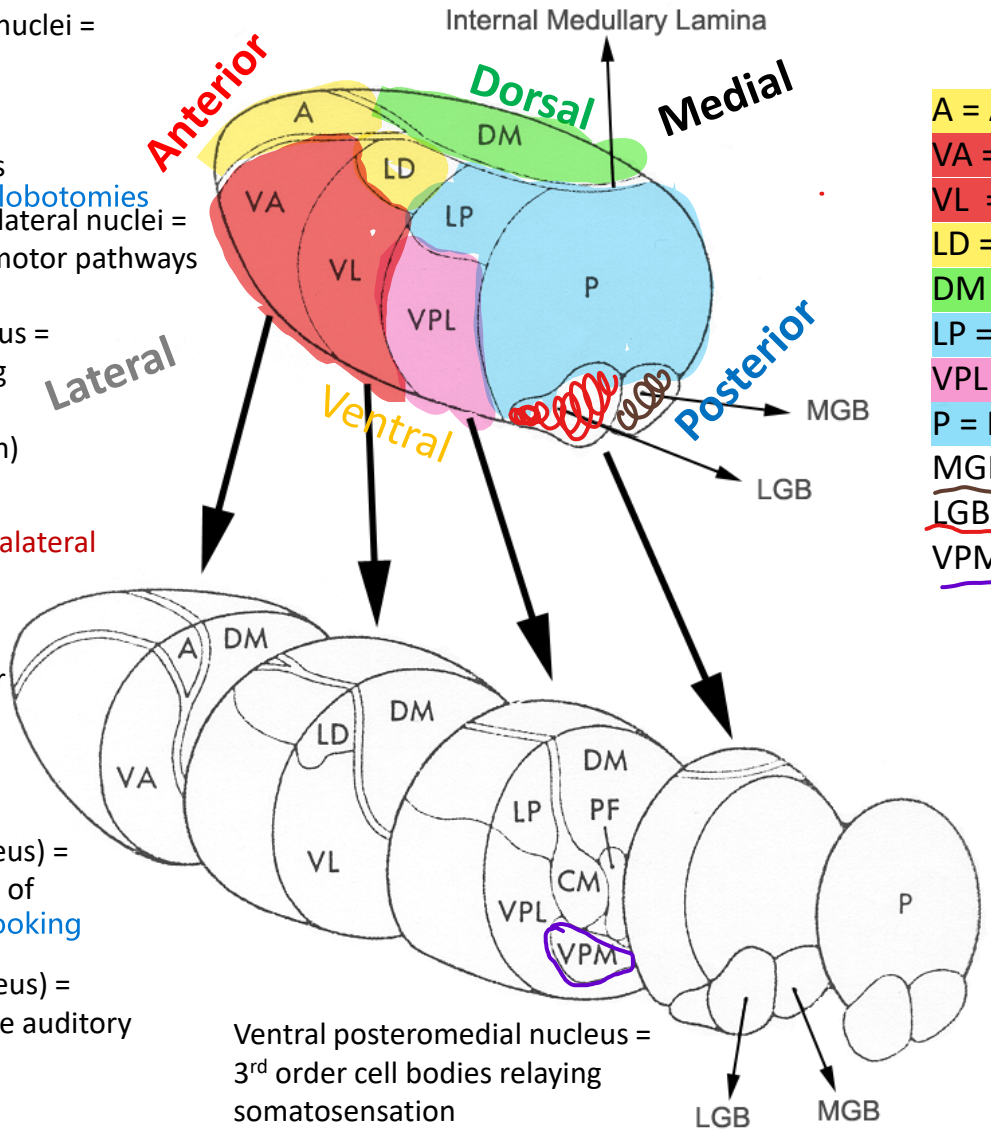
Lesion to VPL results in contralateral loss of somatosensation from the body

Pulvinar and Lateral posterior nucleus = Learning and interpreting written symbols
helps with reading

Lateral geniculate body (nucleus) = 3rd order neuronal cell bodies of the visual pathway
L for looking

Medial geniculate body (nucleus) = Cell bodies that are part of the auditory pathway
Heschel's gyrus

M for music - need to hear



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Ventral posteromedial nucleus = 3rd order cell bodies relaying somatosensation (pain/temp, tactile/vibration) from the contralateral face

face info next to body info somatosensation

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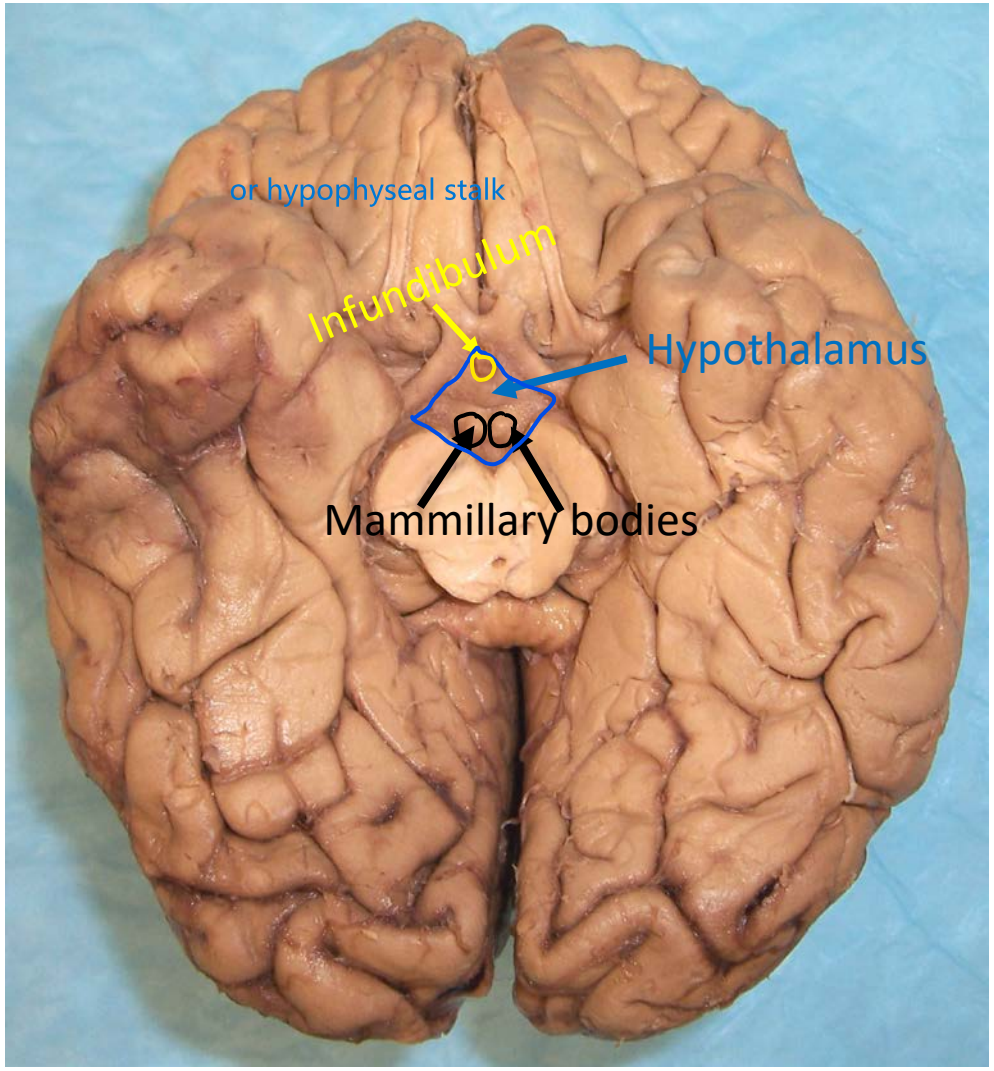
The Hypothalamus

Function of Hypothalamus = Homeostasis

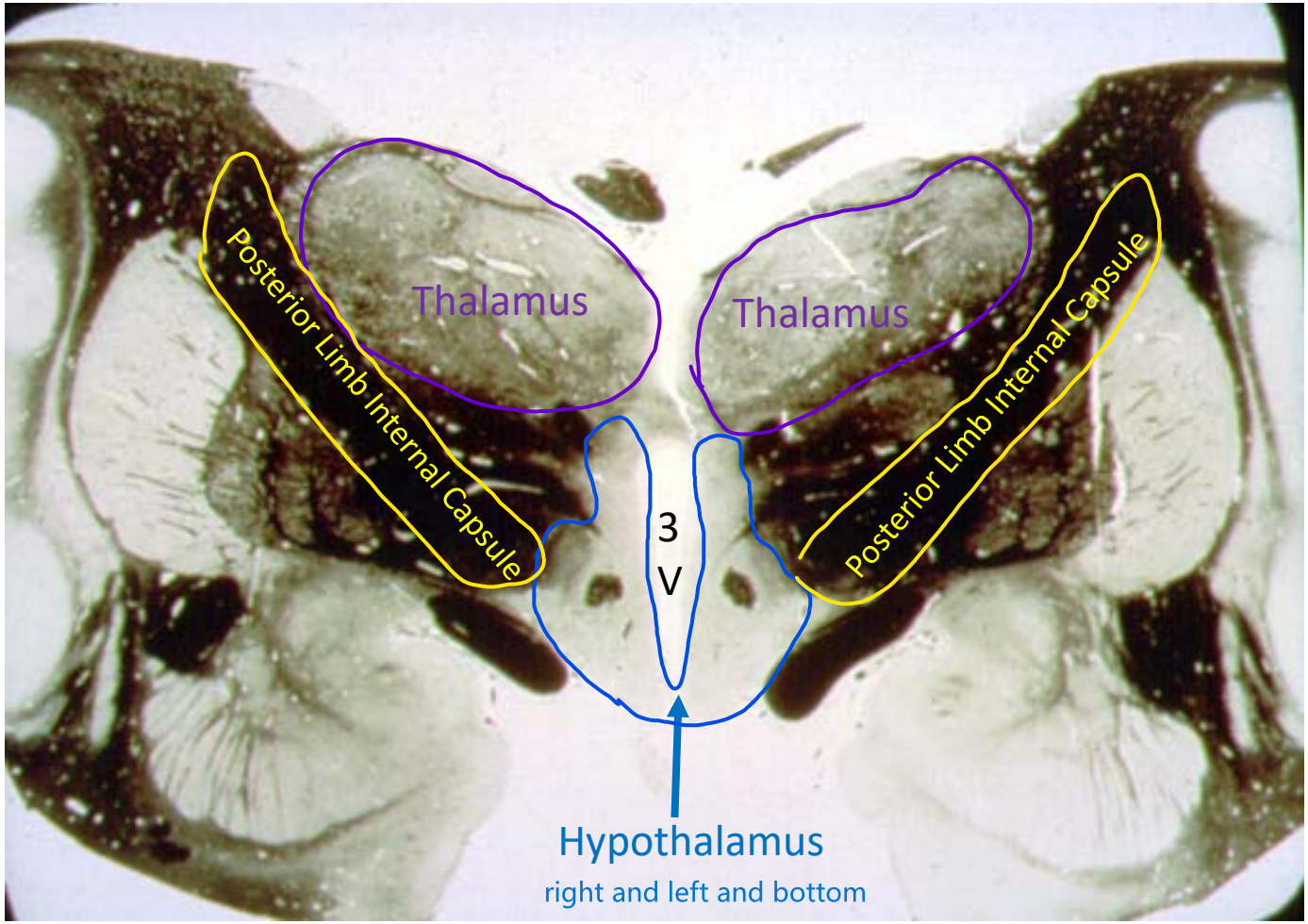


maintain homeostasis

infundibulum connects hypothalamus to pituitary

Inferior view of brain with cerebellum and lower brainstem removed

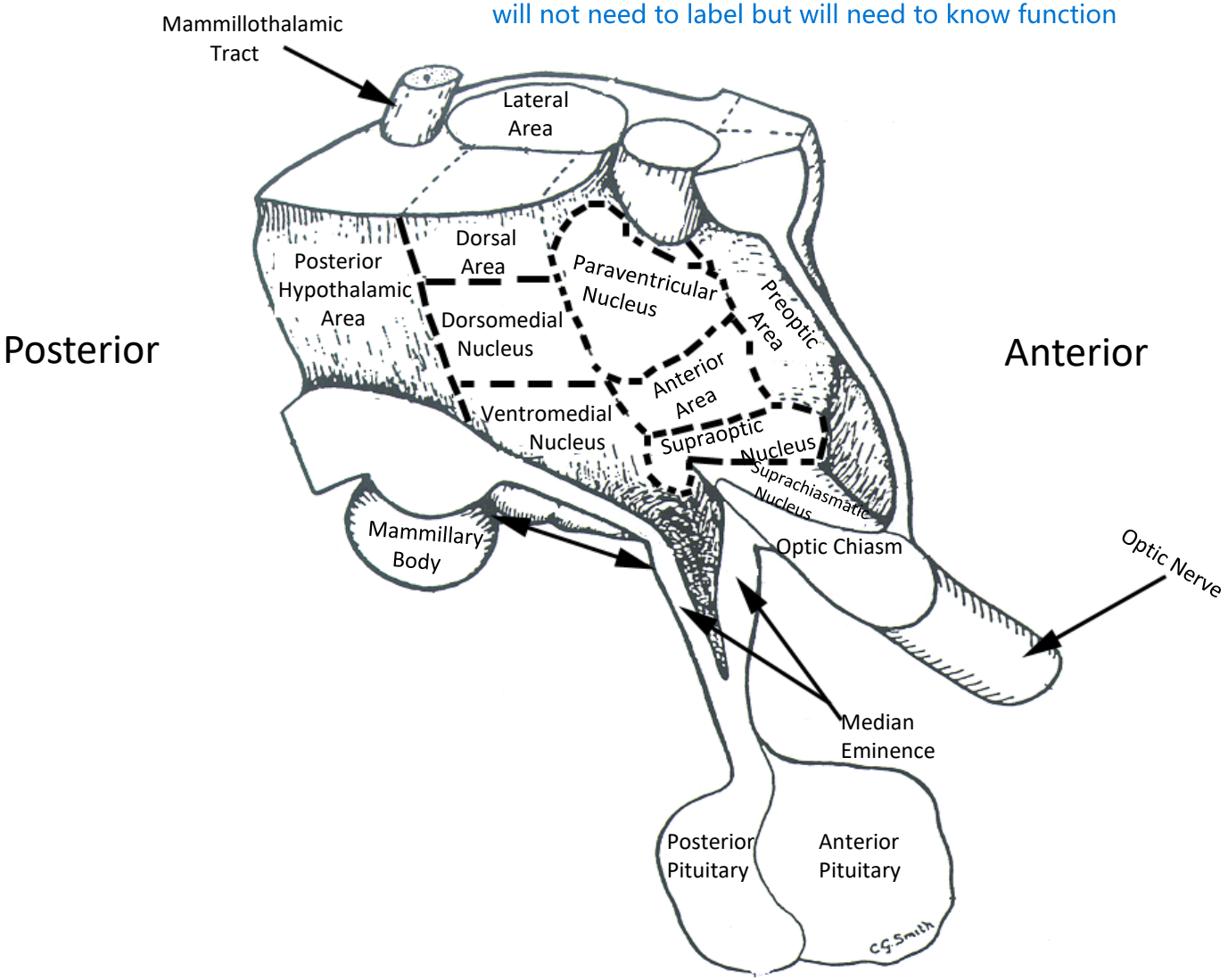
The Hypothalamus



Coronal Brain section depicting the hypothalamus

The Hypothalamus

will not need to label but will need to know function



Mid-sagittal section through hypothalamus depicting left side

Hypothalamic Nuclei/Areas and their Function

1. Control of Autonomic Nervous System

red = anterior (P-ANS) subduing, green = posterior (S-ANS) activating

Anterior and Medial areas of the Hypothalamus
not a specific nucleus

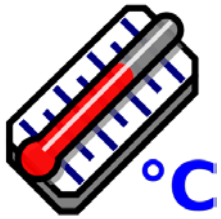
Control of Parasympathetic nervous system
cranial and sacral

Posterior and Lateral areas of the Hypothalamus
IMLN

Control of Sympathetic nervous system
thoracic spinal cord

98.6

2. Temperature Regulation



Anterior Hypothalamus

Heat Dissipation center
sweating

Posterior Hypothalamus

Heat Conservation center
shiver

3. Sleep/Wake cycles

Anterior Hypothalamus

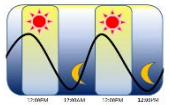
Sleep cycle

Posterior Hypothalamus and Mammillary bodies

Wake cycle

Suprachiasmatic nucleus
sits just above optic chiasm

Circadian rhythm (24 hour bio clock)



Hypothalamic Nuclei and Areas and their Function

4. Food Intake

near the middle and super skinny so if you're always full stay super skinny

Ventromedial nucleus — Satiety center

Lateral hypothalamic area — Feeding center

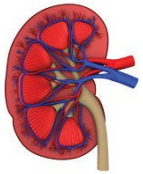
will grow more lateral

damage or lesion = opposite effect will occur

5. Water balance

Supraoptic and paraventricular nuclei — Produces ADH (anti-diuretic hormone) to control water balance

micturition



6. Regulation of Pituitary and Hormone release

Median eminence — Controls female cyclicity and onset of puberty

Preoptic nucleus — Regulates reproductive hormones (LH/FSH)

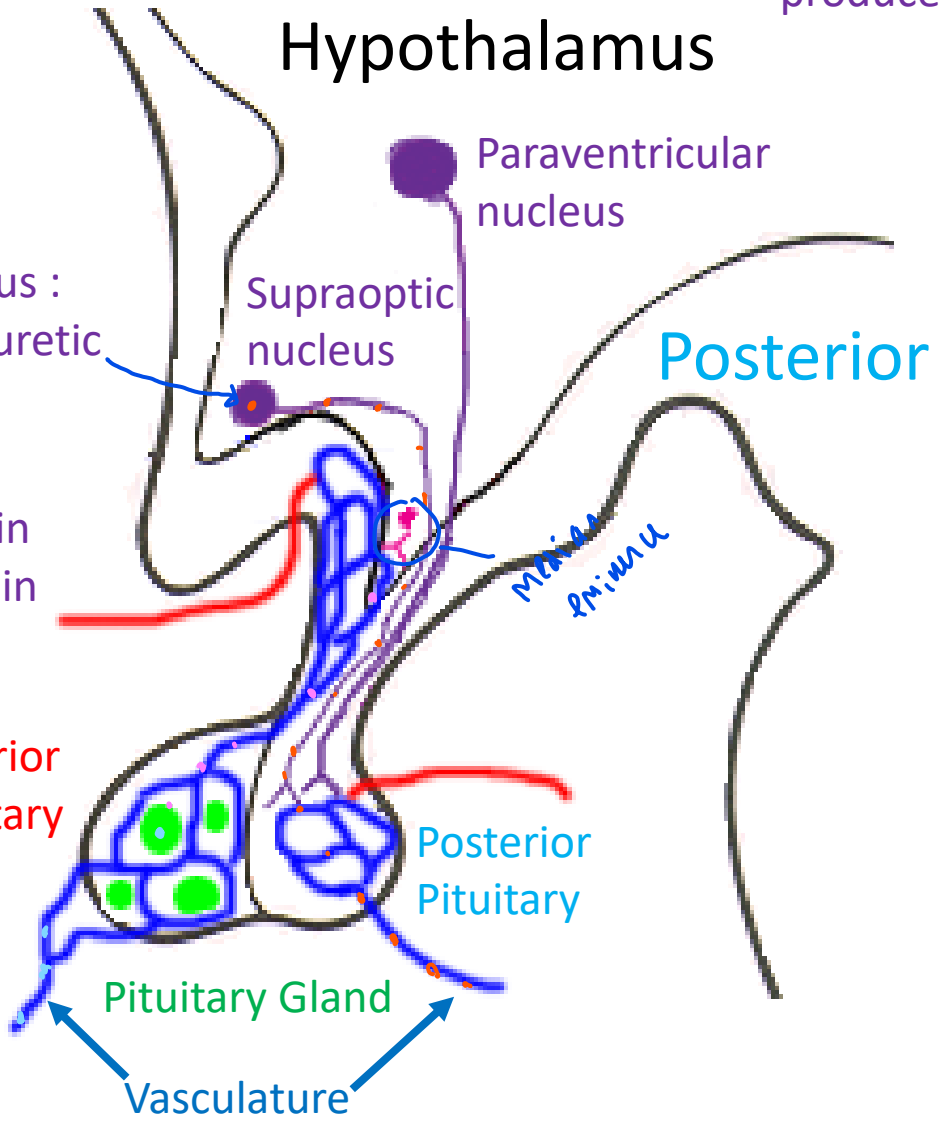
produced in pituitary - preoptic allows for hormones to be produced

Hypothalamus and Hormone Producing Neurons

Paraventricular nucleus:
produces Oxytocin

Oxytocin:
involved in maternal/ mating behaviors, bonding and social interactions

powerful contractions during labor



Supraoptic nucleus :
produces Anti-diuretic hormone

Anti-diuretic hormone: involved in water reabsorption in the kidneys

median eminence makes rest of hormones (releasing hormones)

Clinical Aspect: Pituitary Tumor

Pituitary tumors usually originate in the anterior pituitary.

sits inferior to hypothalamus

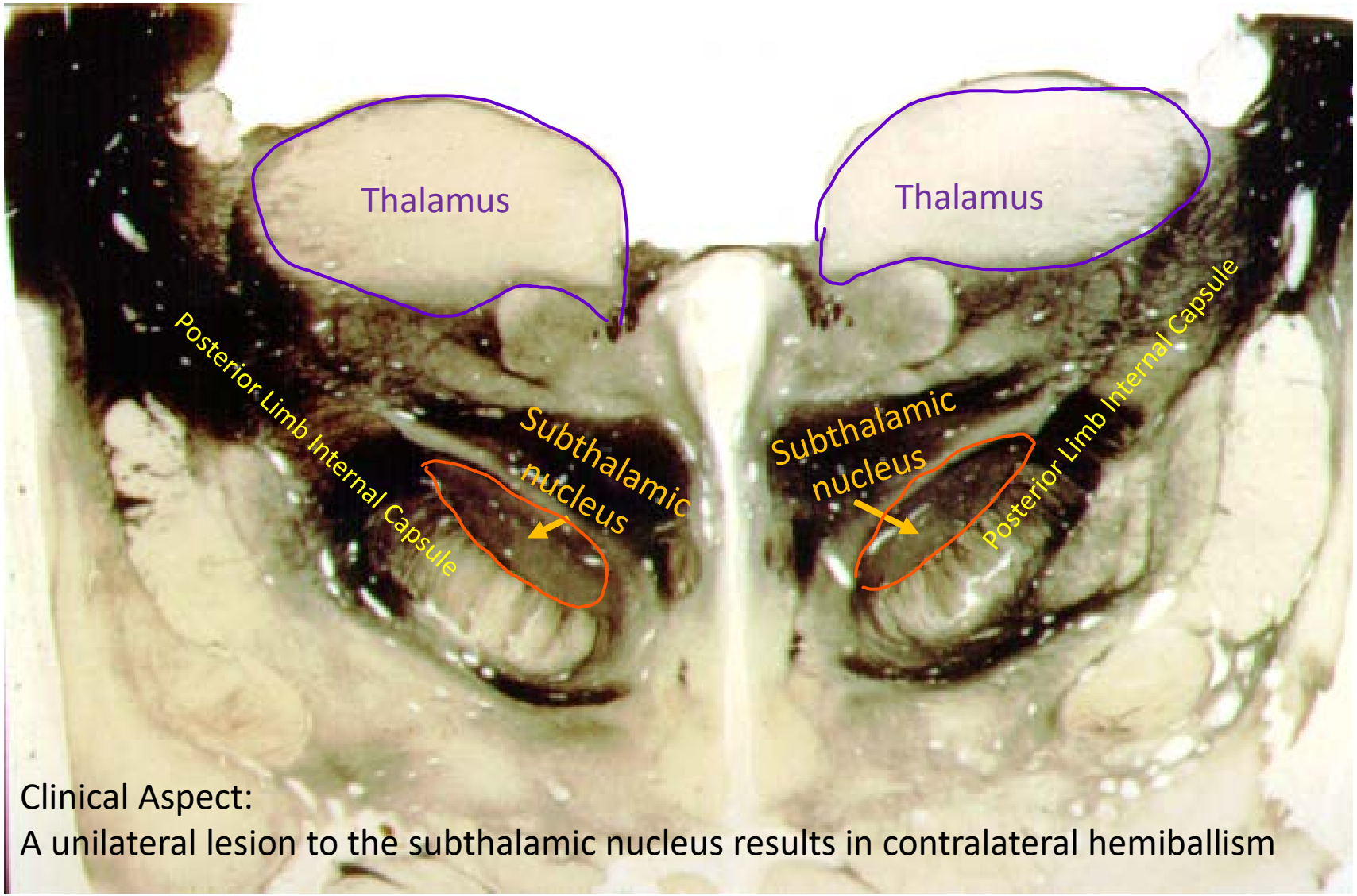
As the tumor grows, it impedes the release of hormones from the pituitary resulting in panhypopituitarism.

reproductive, growth, moods, behaviors, etc.

Neighboring neuroanatomical structures (optic chiasm and tracts and CN III, IV, V) can also be affected.

eye mvmt difficulties and sensation issues

The Subthalamus

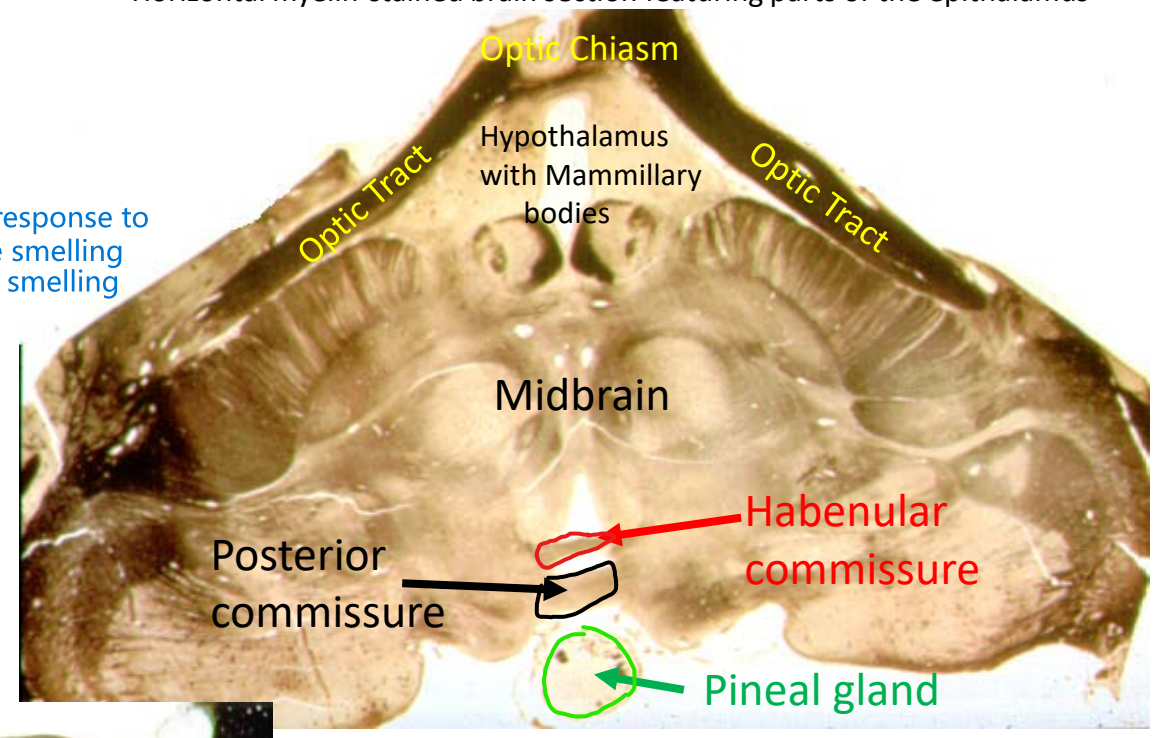


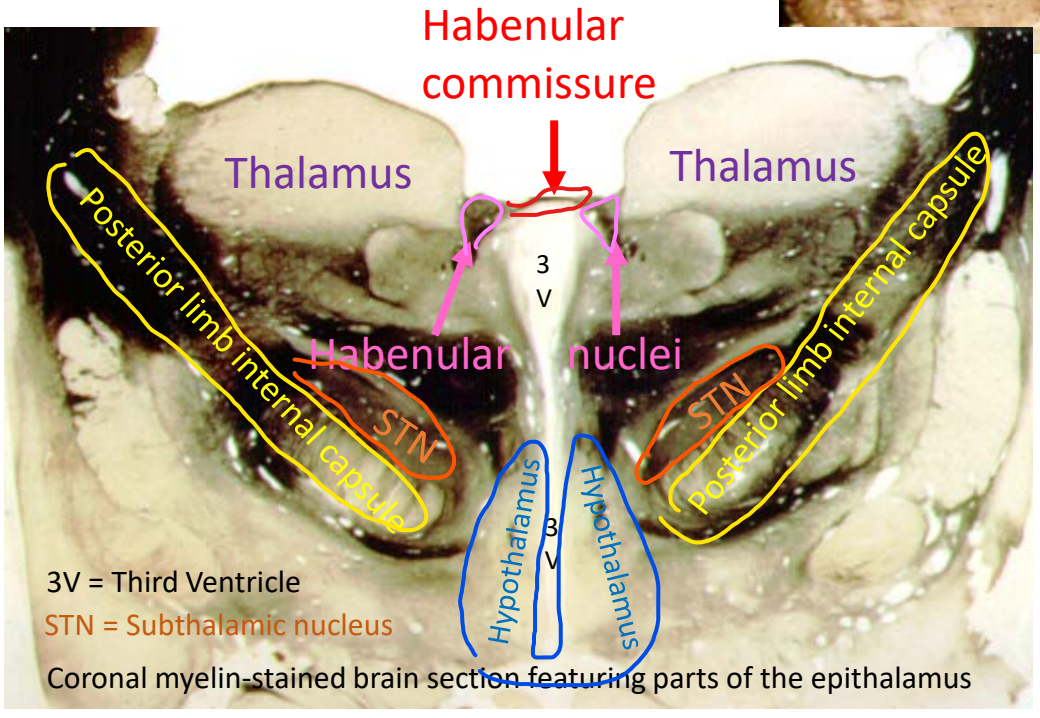
Coronal myelin-stained brain section featuring the subthalamic nucleus

The Epithalamus

1. Pineal gland
2. Posterior commissure
3. Stria Medullaris thalami — emotional response to what you're smelling
4. Habenular nuclei — knowing what you're smelling
5. Habenular commissure

Horizontal myelin-stained brain section featuring parts of the epithalamus





3V = Third Ventricle

STN = Subthalamic nucleus

Coronal myelin-stained brain section featuring parts of the epithalamus

Pineal gland functions:

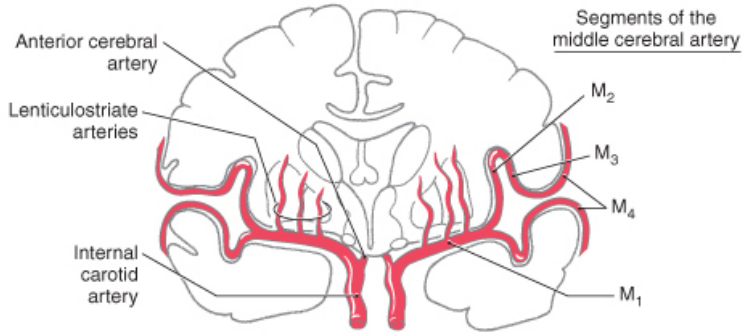
1. Converts serotonin into melatonin
2. Anti-gonadotrophic
3. Calcium deposits accumulate after puberty

Blood Supply to the Diencephalon

Thalamus = Choroidal arteries (which are branches of middle and posterior cerebral arteries)

Hypothalamus = Branches off of the circle of Willis

Internal capsule = Lenticulostriate (lateral striate) arteries which are branches of the middle cerebral artery



Clinical Aspects:

Lenticulostriate artery stroke will result in a lesion to the posterior limb of the internal capsule: Contralateral spastic paresis, loss of somatosensation to the body

ALS, PCL pathways

Thalamic syndrome: A vascular lesion that affects the VPL/VPM of the thalamus. Can result in constant pain sensation to the contralateral body(VPL) or face (VPM)

ID 4 component on gross pictures, function of each of the nuclei