Microscopy of the diencephalon

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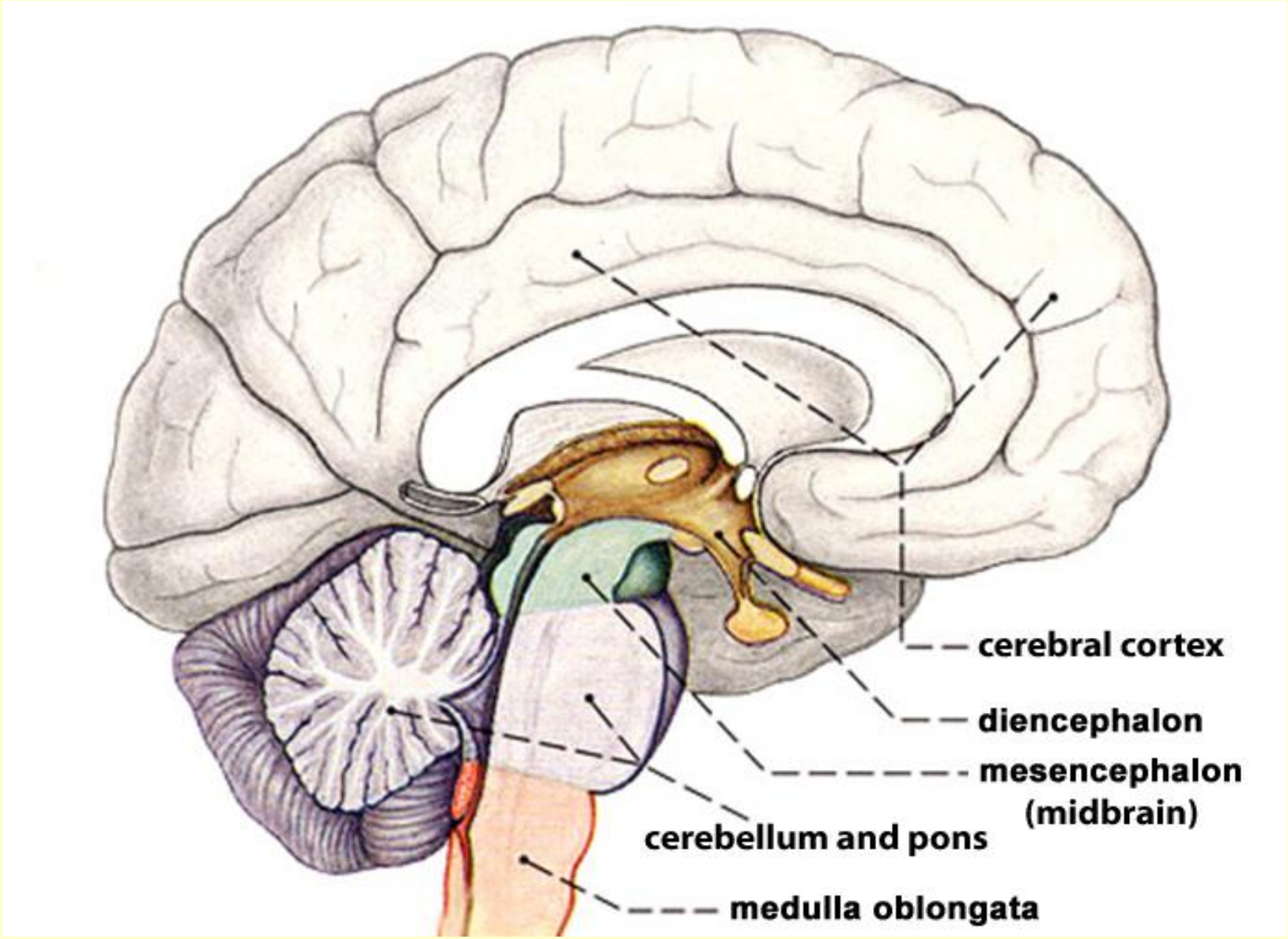
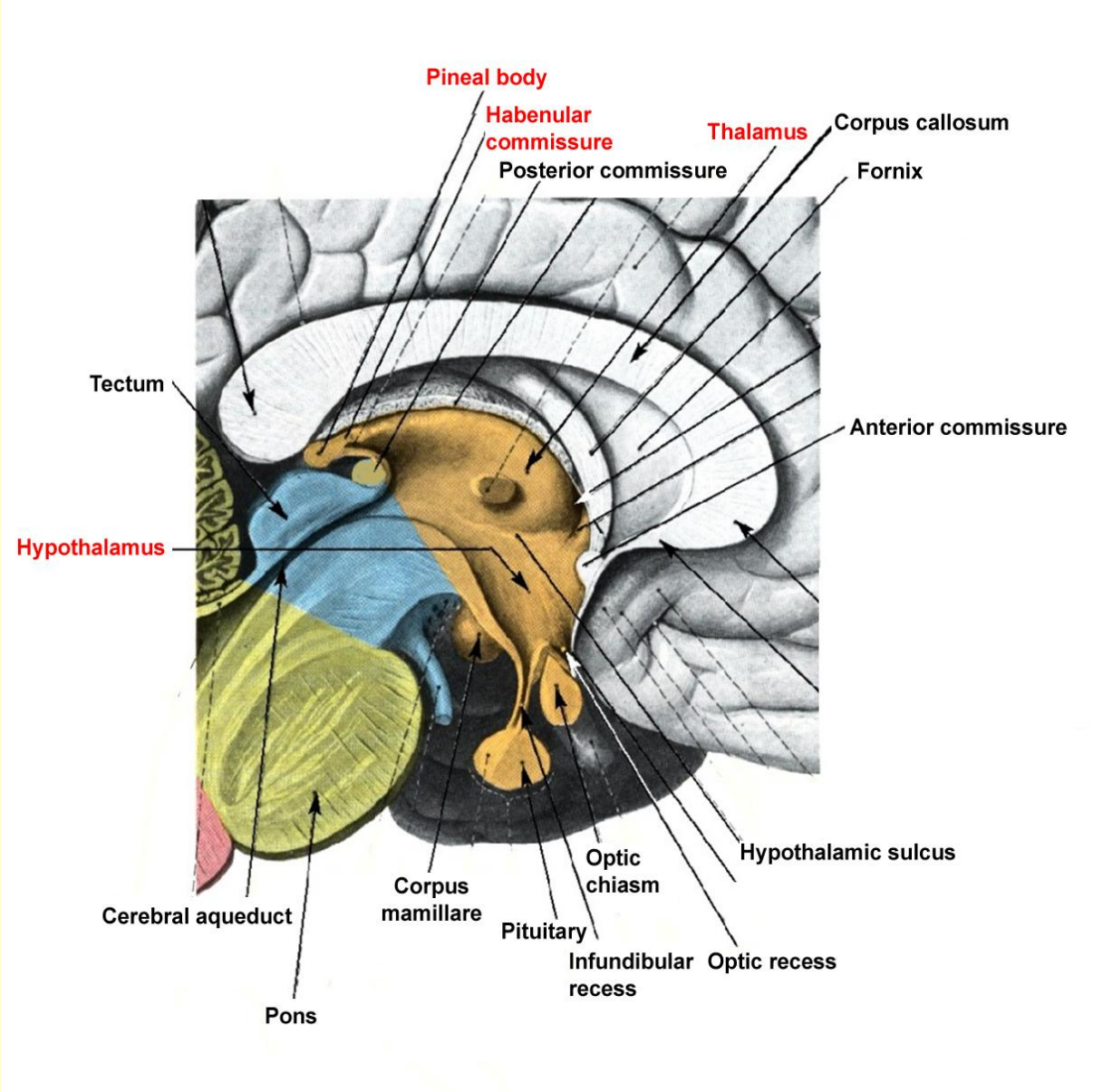
The position of the diencephalon in the brain

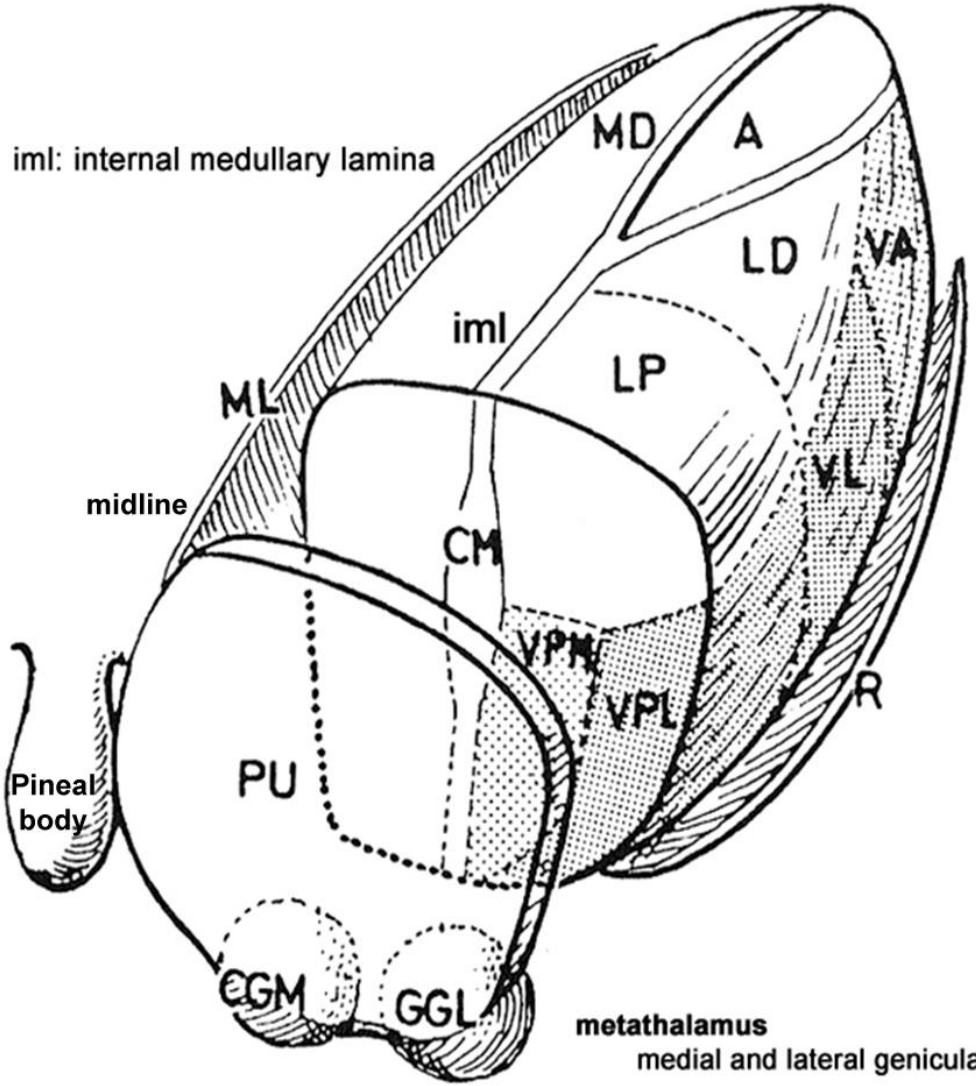


Parts of the diencephalon

- **Thalamus**
- **Epithalamus**
  - Pineal body
  - Habenulae
  - Trigonum habenulae
  - Habenular nuclei
  - Stria medullaris
  - Habenular commissure
- **Metathalamus**
  - Medial geniculate body
  - Lateral geniculate body
- **Subthalamus**
  - Subthalamic nucleus
  - Zona incerta
  - H fields of Forel
- **Hypothalamus**



Nuclear groups and nuclei of the thalamus



anterior nuclear group (A)
- anteromedial nu.
- anterodorsal nu.
- anteroventral nu.

medial nuclear group
- mediodorsal nu. (MD)

lateral nuclear group
- **dorsal nuclei**
  - lateral dorsal nu. (LD)
  - lateral posterior nu. (LP)
  - pulvinar (PU)
- **ventral nuclei**
  - ventral anterior nu. (VA)
  - ventral lateral nu. (VL)
  - ventral posterolateral nu. (VPL)
  - ventral posteromedial nu. (VPM)

midline nuclei (ML)

intralaminar nuclei
- **anterior intralaminar nuclei**
- **posterior intralaminar nuclei**
  - central medial nu. (CM)
  - parafascicular nu.
  - subparafascicular nu.

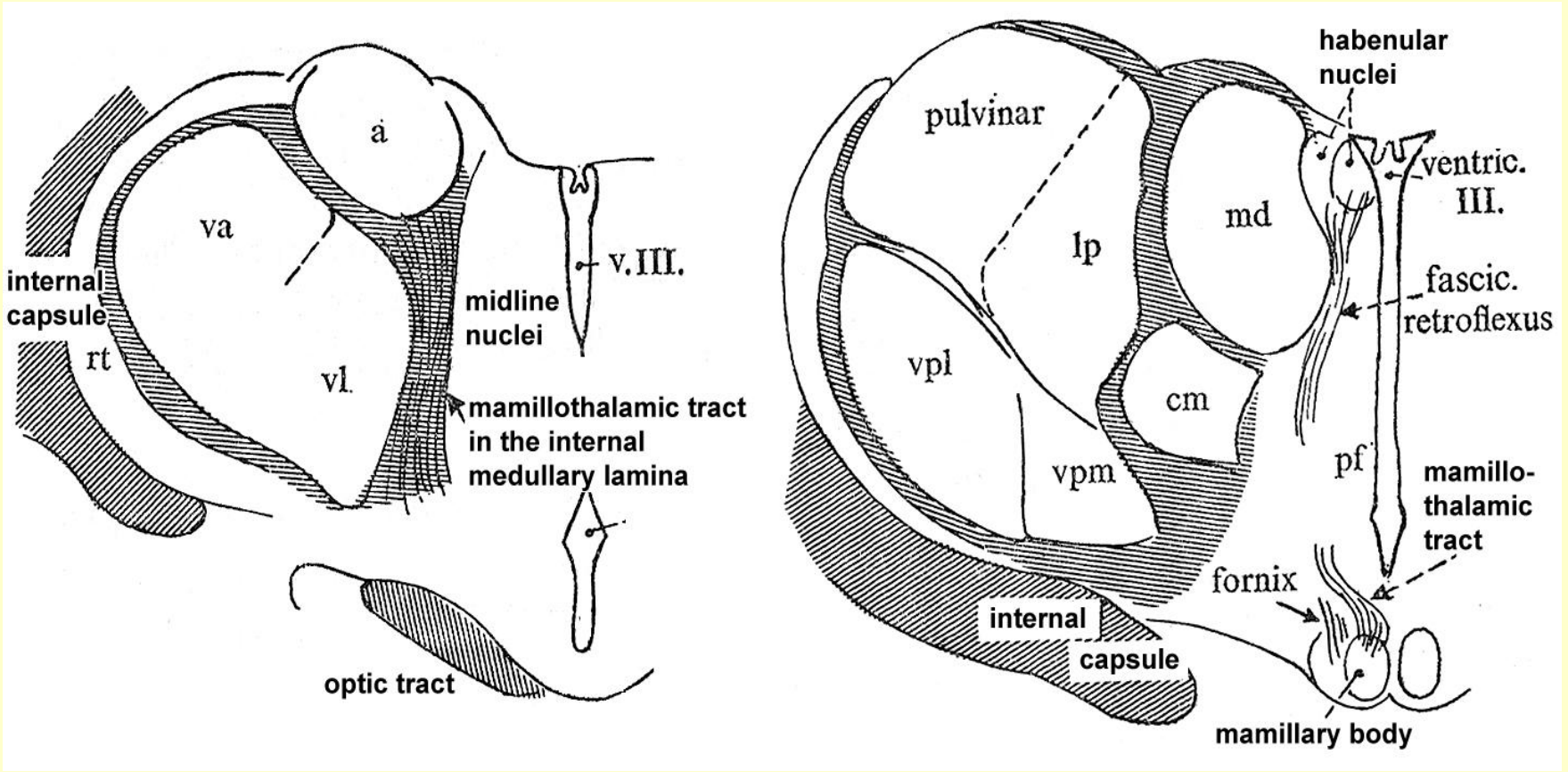
reticular thalamic nu. (R)

metathalamus
medial and lateral geniculate body (MGB or CGM, and LGB or CGL)

Frontal sections of the thalamus

Anterior section

Middle section



Functional classification of thalamic nuclei

- **Specific nuclei:** specific input, project to specific part of the cortex
  - sensory relay nuclei: VPL, VPM, MGB, LGB
  - motor relay nuclei: VA, VL
  - limbic relay nuclei: AV, AD, AM

- **Association nuclei:** cortical input, project to associative areas of the cortex
  - MD, LD, LP, pulvinar

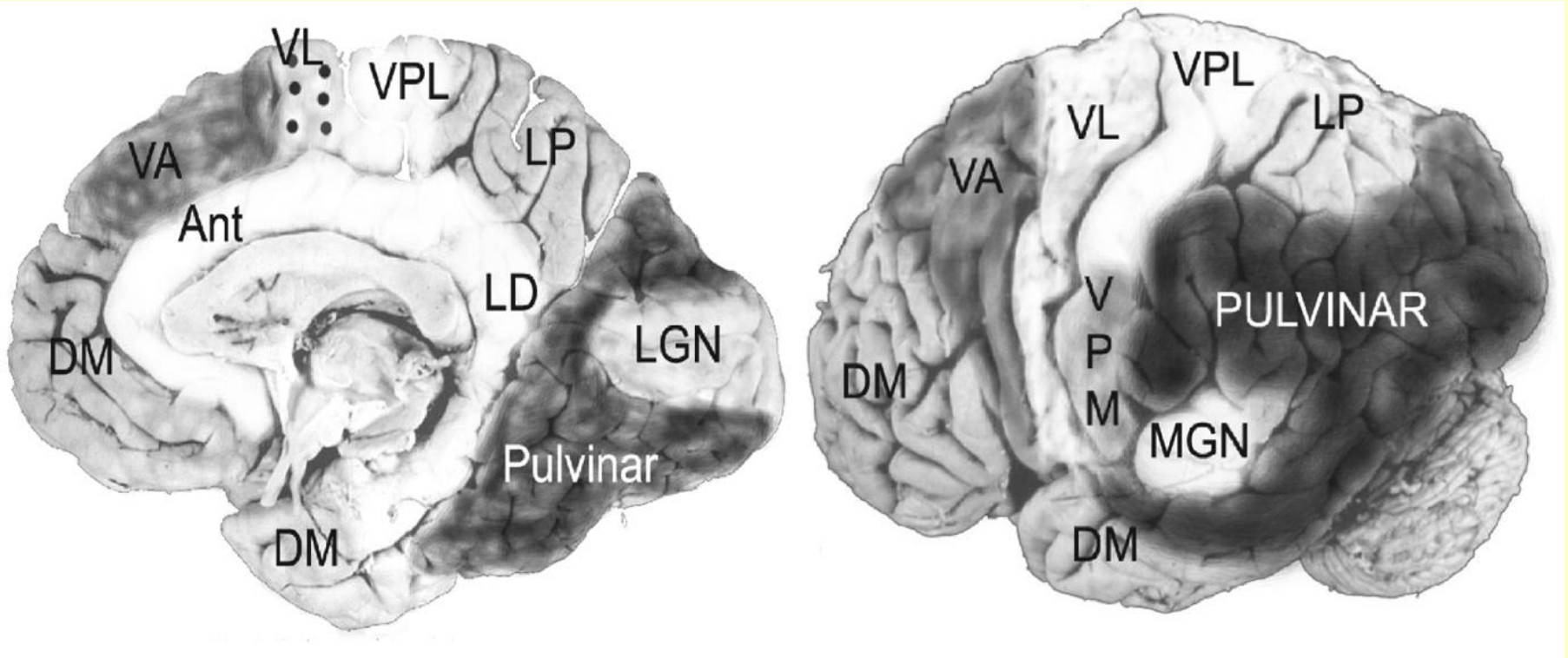
- **Non-specific nuclei:** ascending input, diffuse projection to the cortex
  - midline and intralaminar nuclei

- **Nuclei not projecting to the cerebral cortex**
  - n. reticularis thalami, n. parafascicularis, n. subparafascicularis

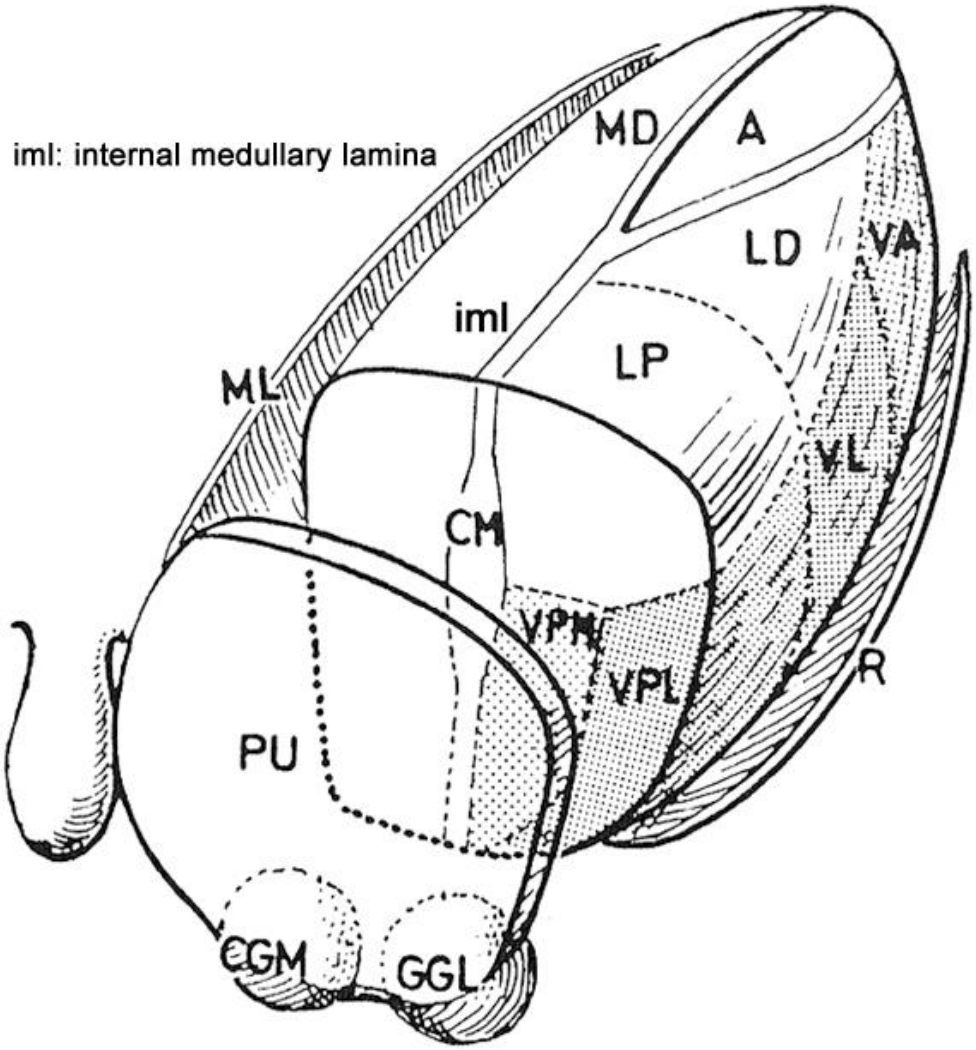
Cortical projections of (specific and association) thalamic nuclei

mediosagittal view

lateral view



Specific sensory relay nuclei



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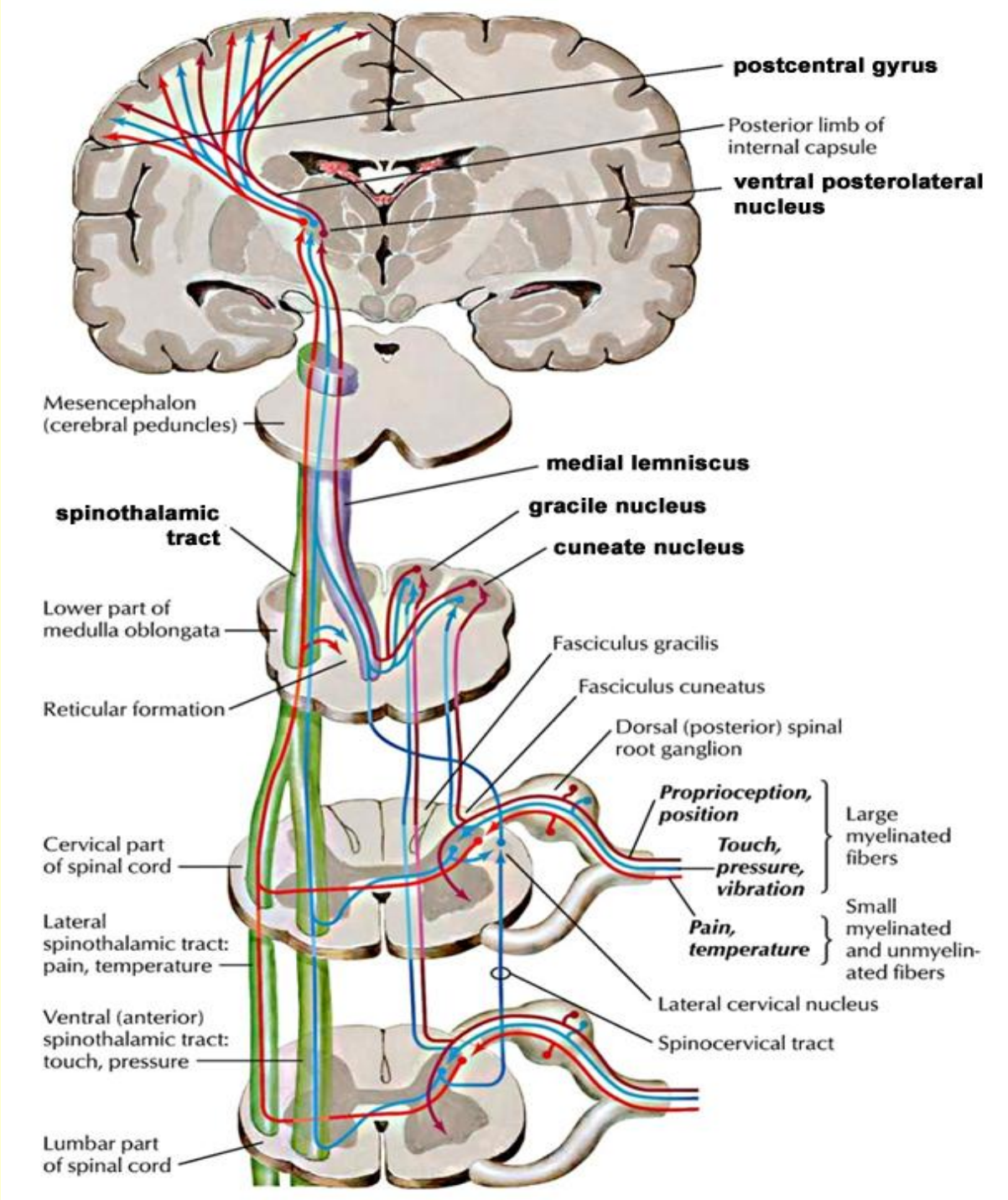
- medial and lateral geniculate body (MGB and LGB)

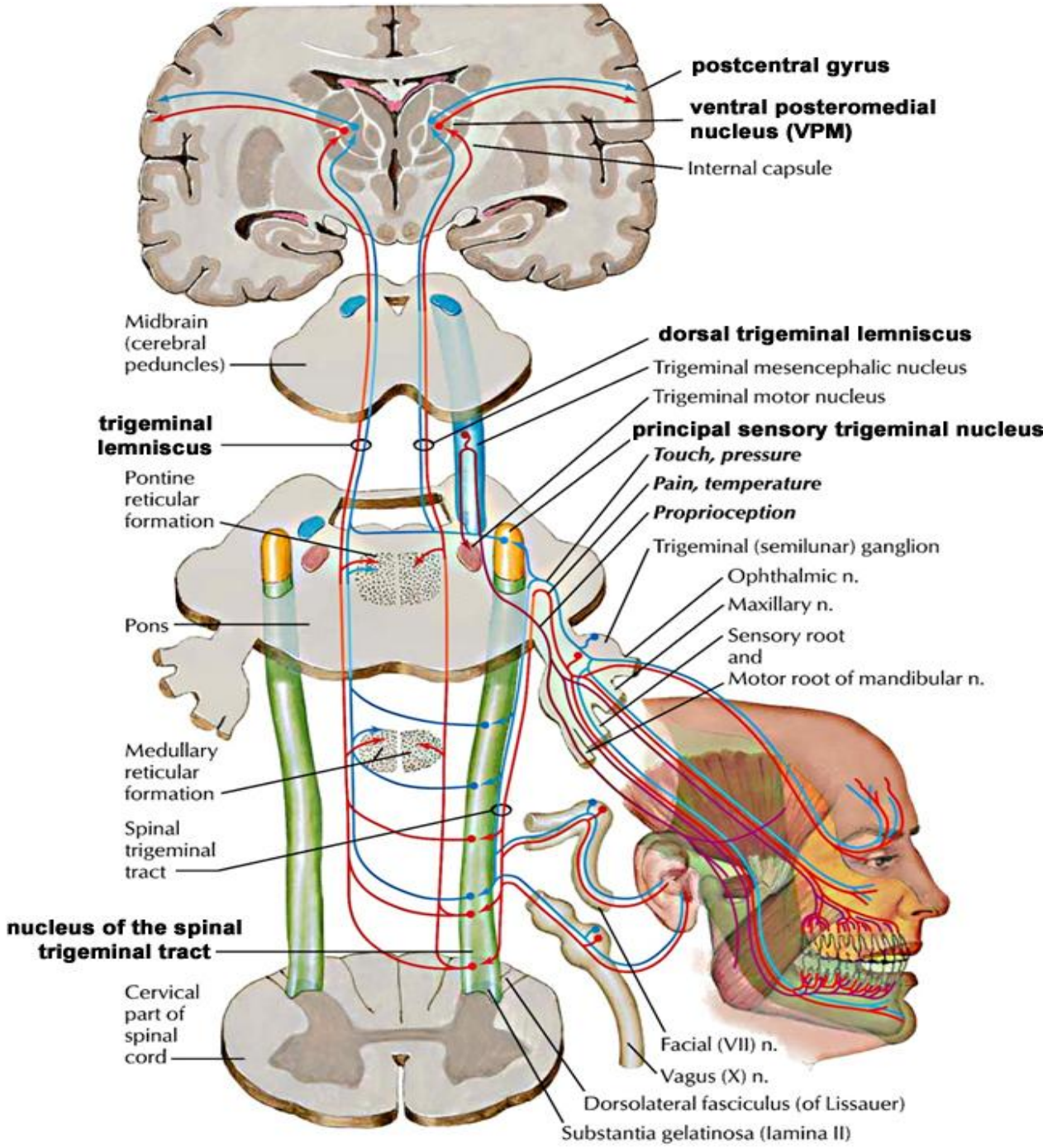
The VPL relays sensory inputs from the body to the cerebral cortex

(Input: spinothalamic tract and the medial lemniscus)

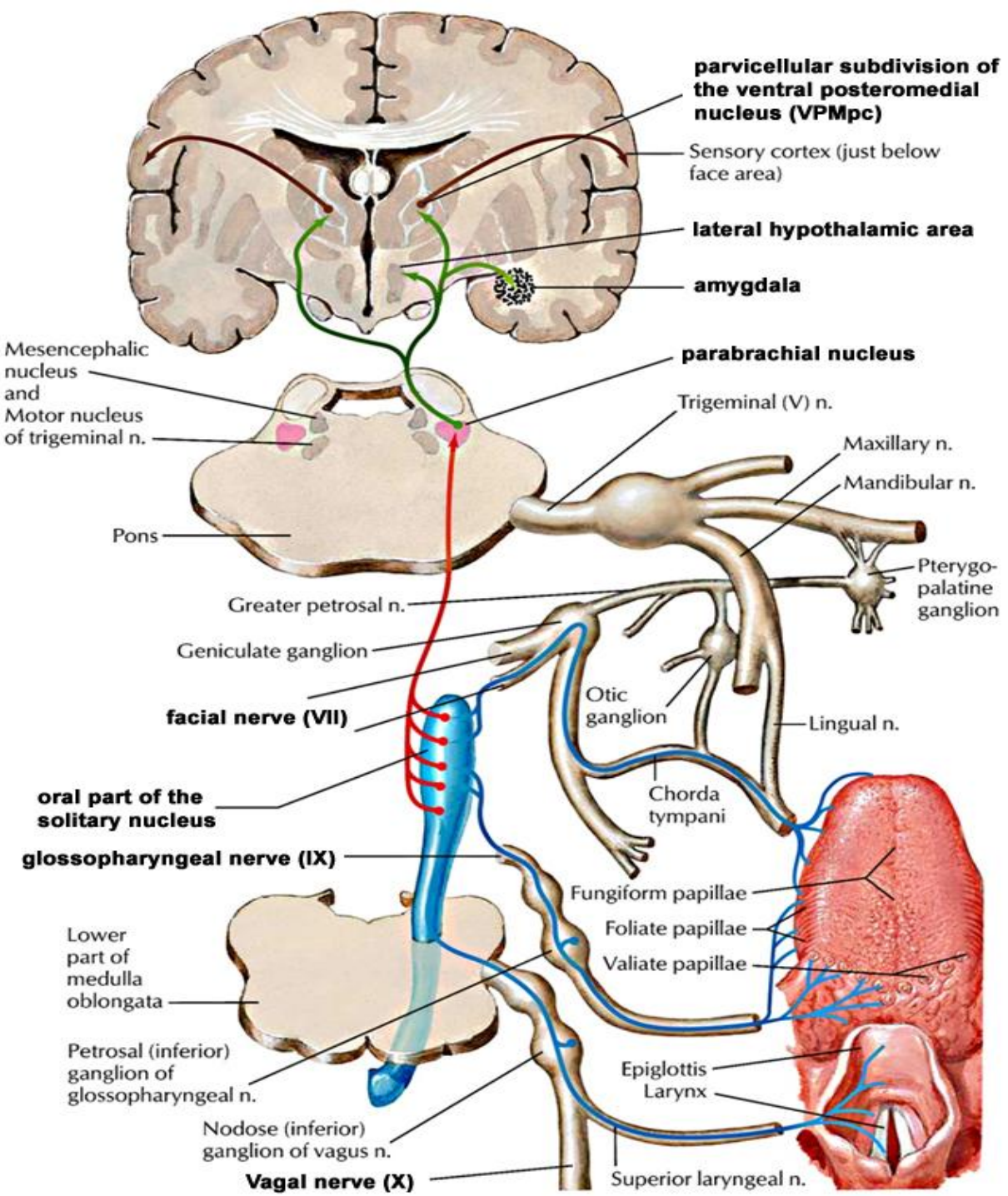


The VPM relays sensory inputs from the head to the cerebral cortex

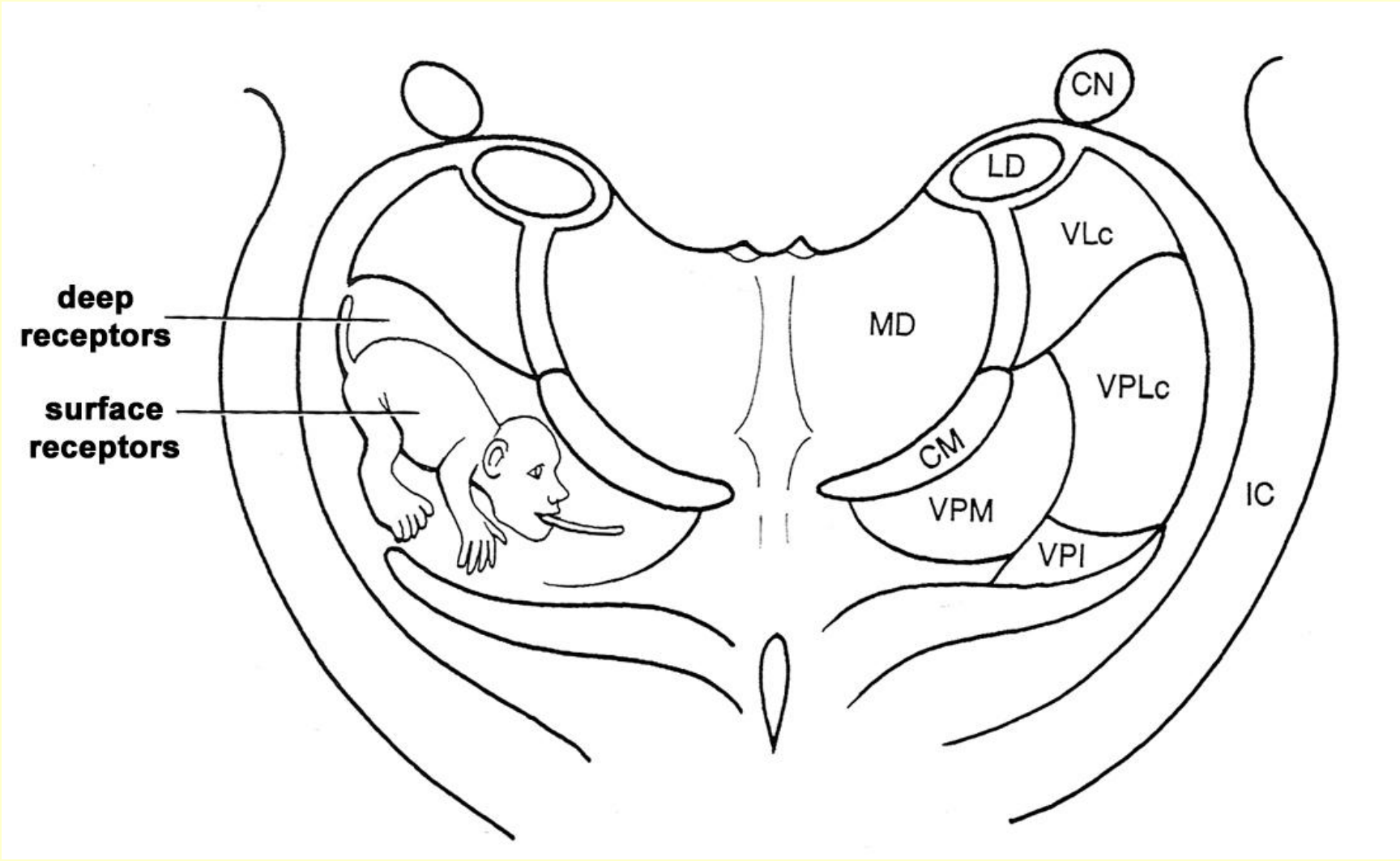
(Input: trigeminal and dorsal trigeminal lemniscus pathways)



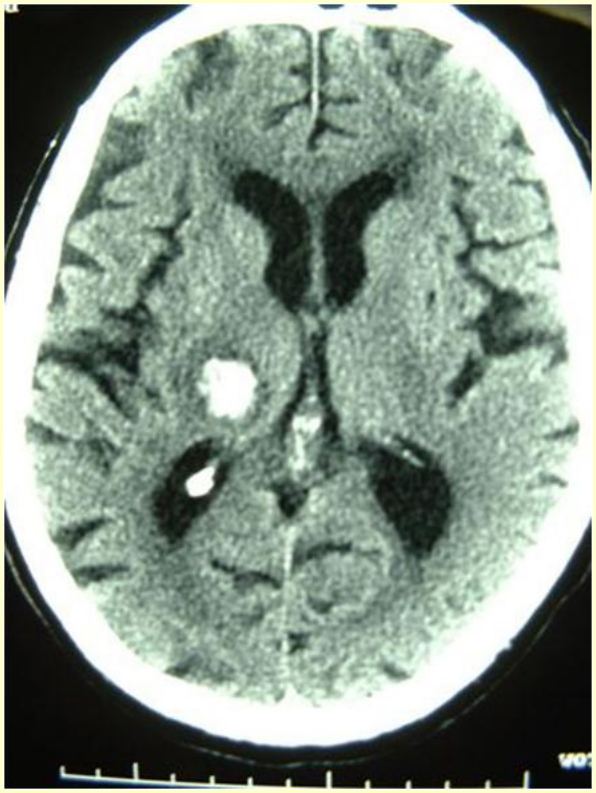
Relay of gustatory inputs to the cortex takes place in the VPMpc

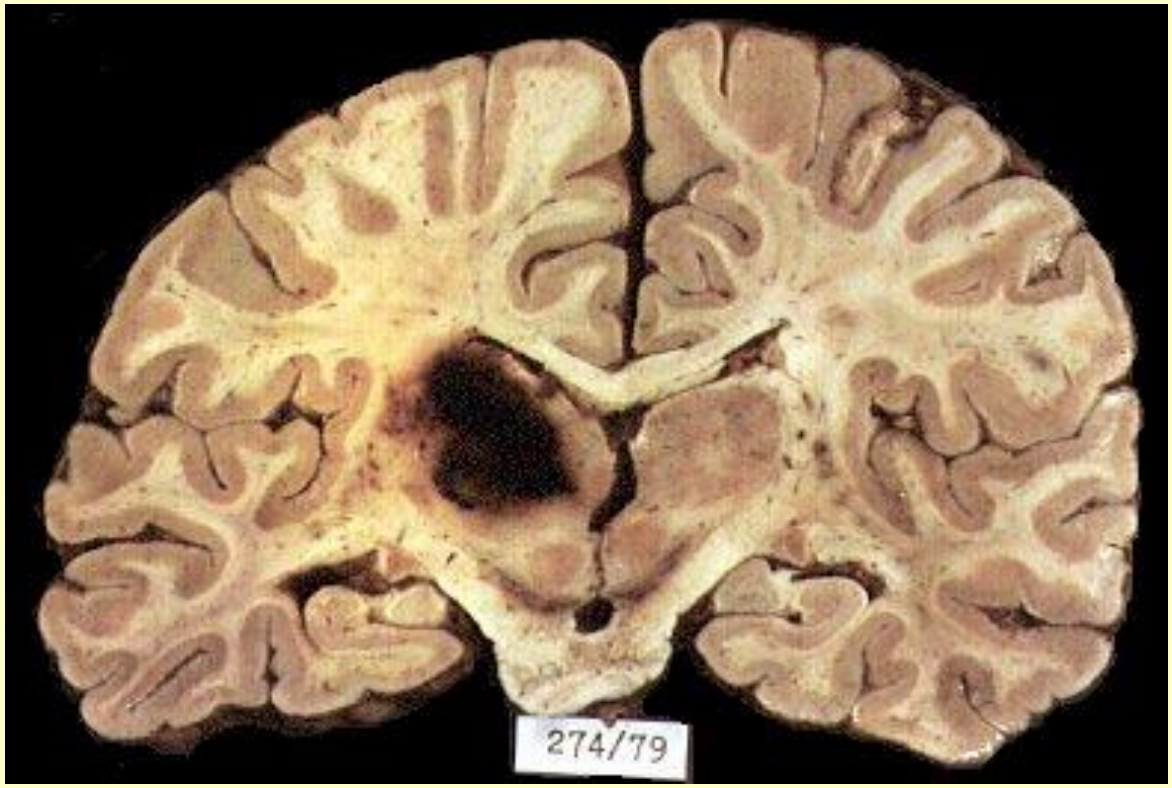


Somatotopy in the VPM/VPL

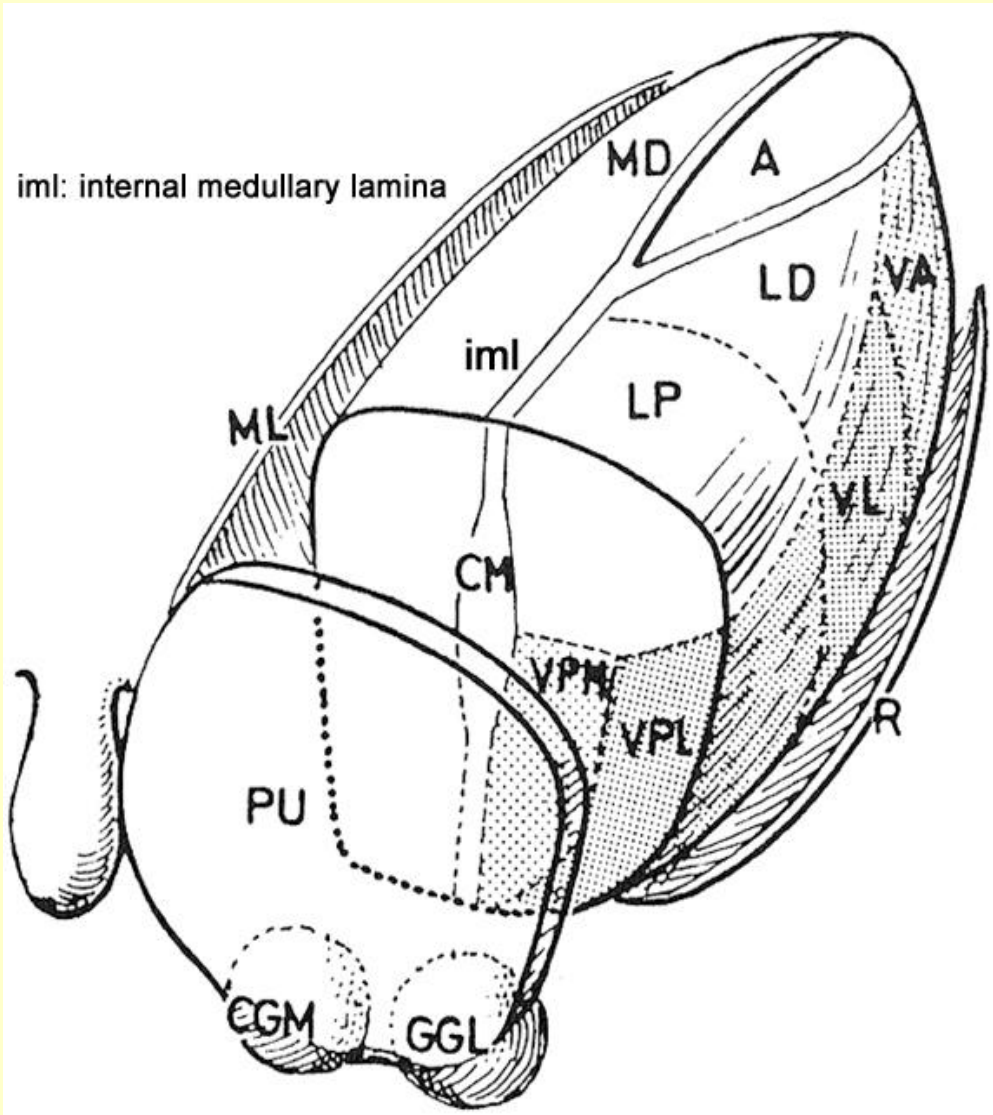


The thalamus pain (or Dejerine-Roussy) syndrome





Specific motor relay nuclei



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Inputs and projections of the motor relay nuclei in the ventral column of the lateral nuclear group

Specific thalamic motor relay nuclei:

Ventral anterior nucleus (VA)

Afferents (inputs): basal ganglia (pallidum)

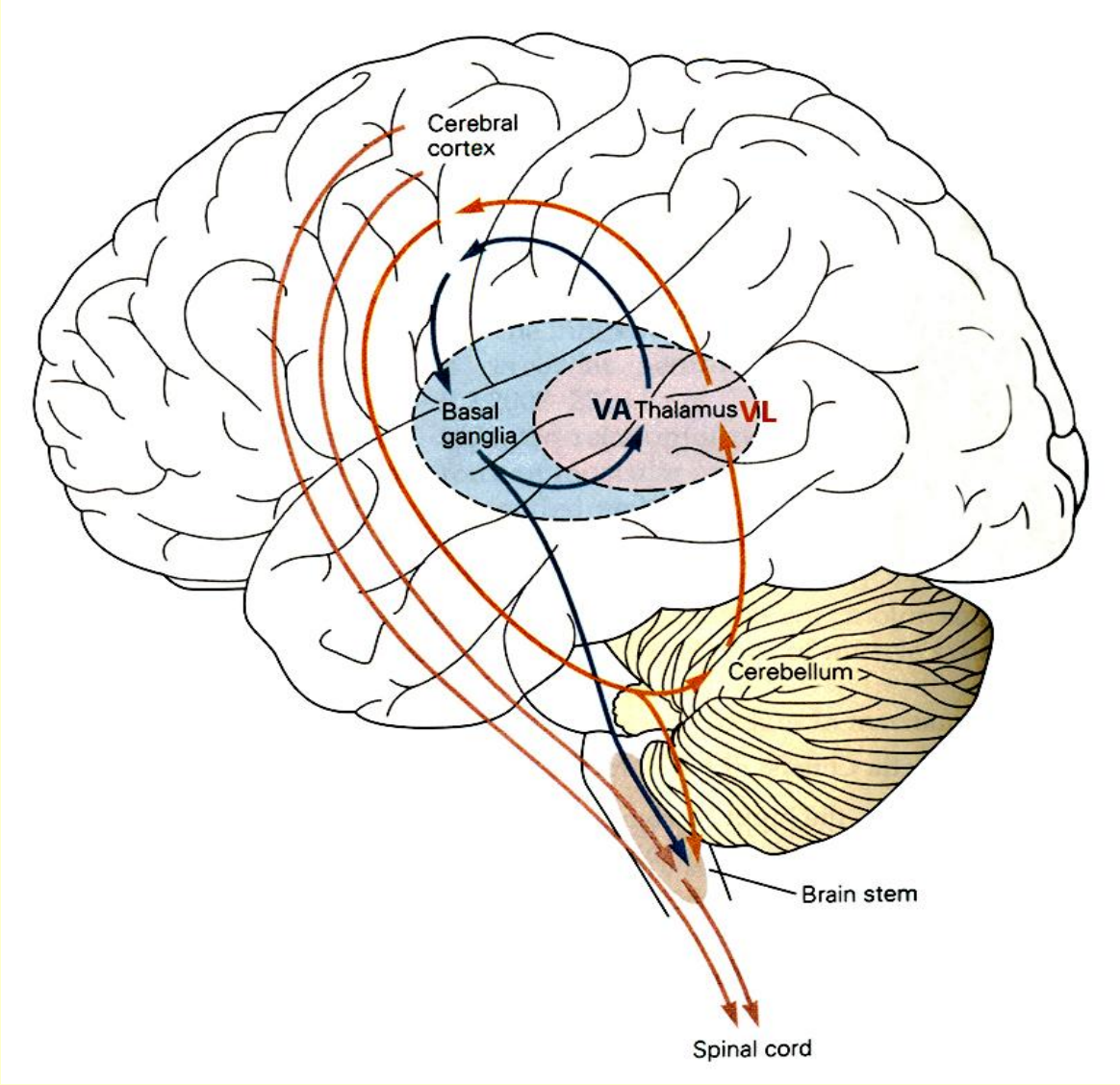
Efferents (projections): pre- and supplementer motor cortex

Ventral lateral nucleus (VL)

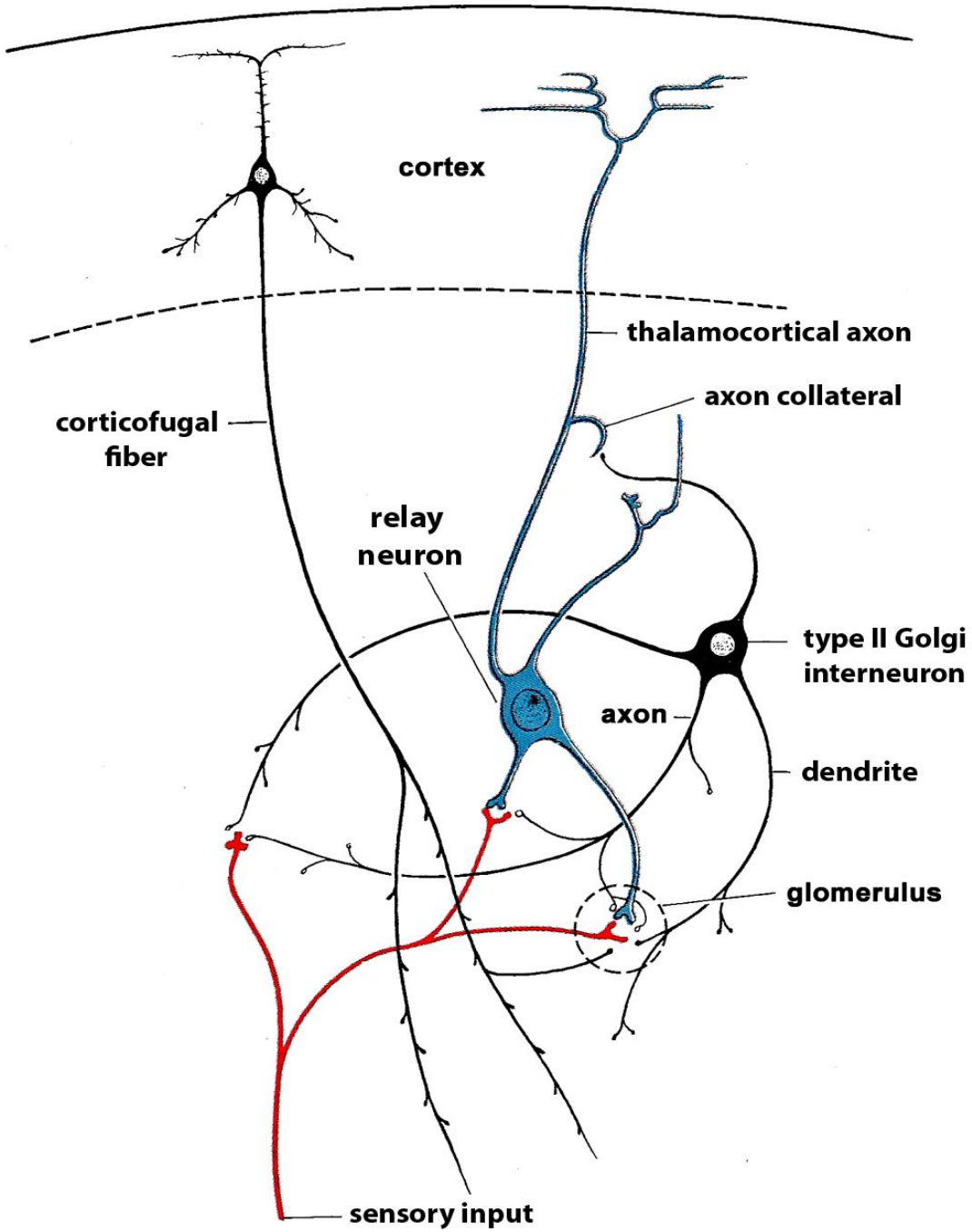
Afferents (inputs): cerebellum (dentate nucleus)

Efferents (projections): primary motor cortex (gyrus precentralis)

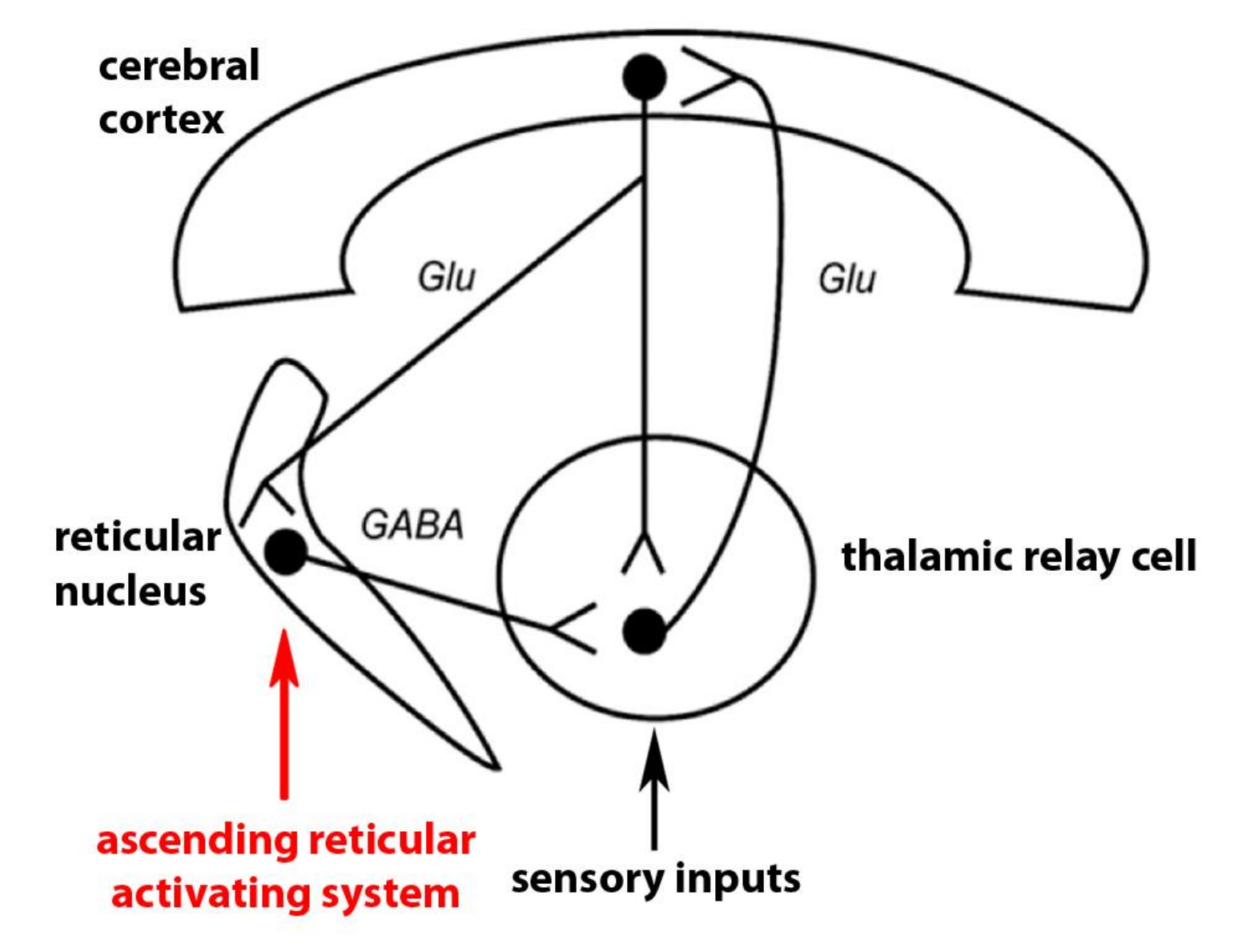
The motor thalamic relay nuclei participate in different motor circuits



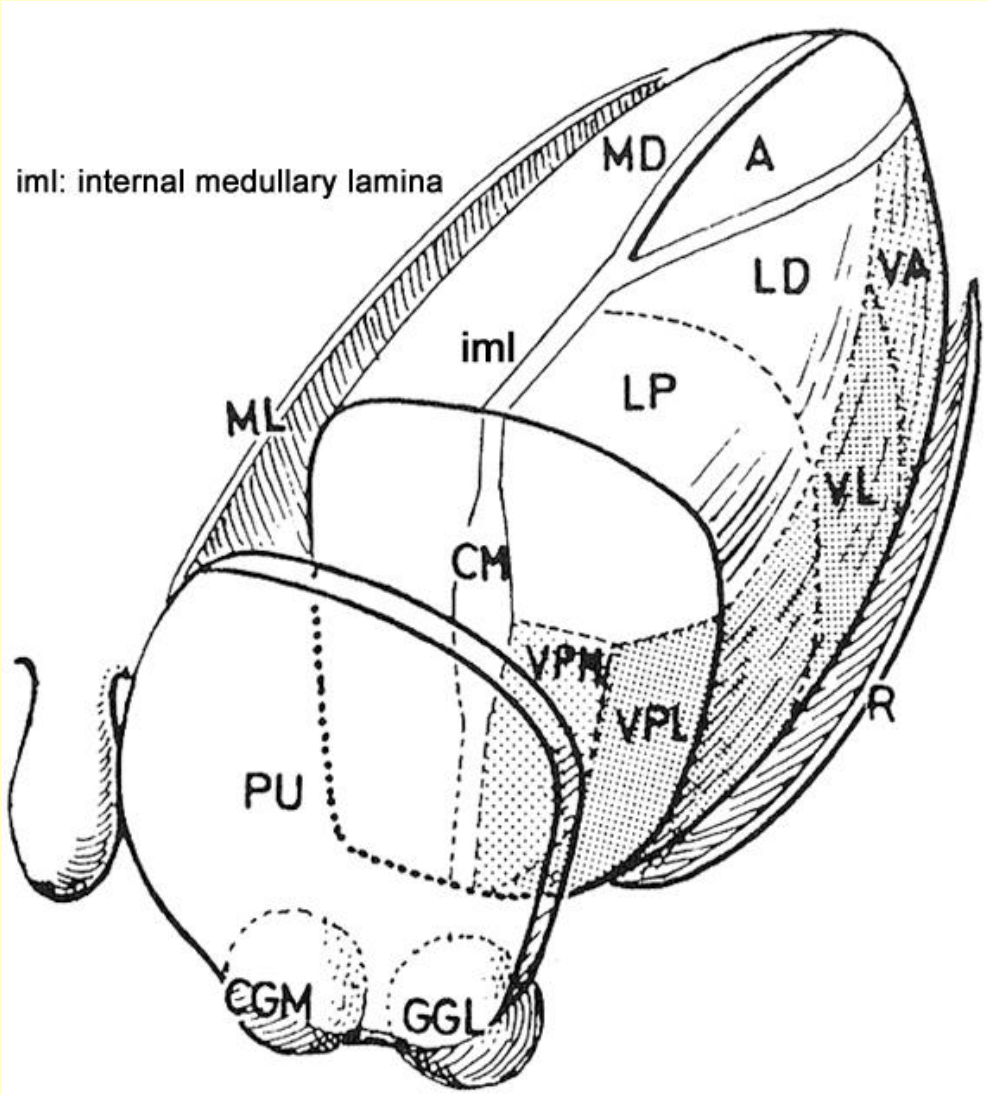
Neuronal circuit of information relay in the specific thalamic nuclei



State-dependent modes of relay cell function



Midline and intralaminar nuclei of the thalamus



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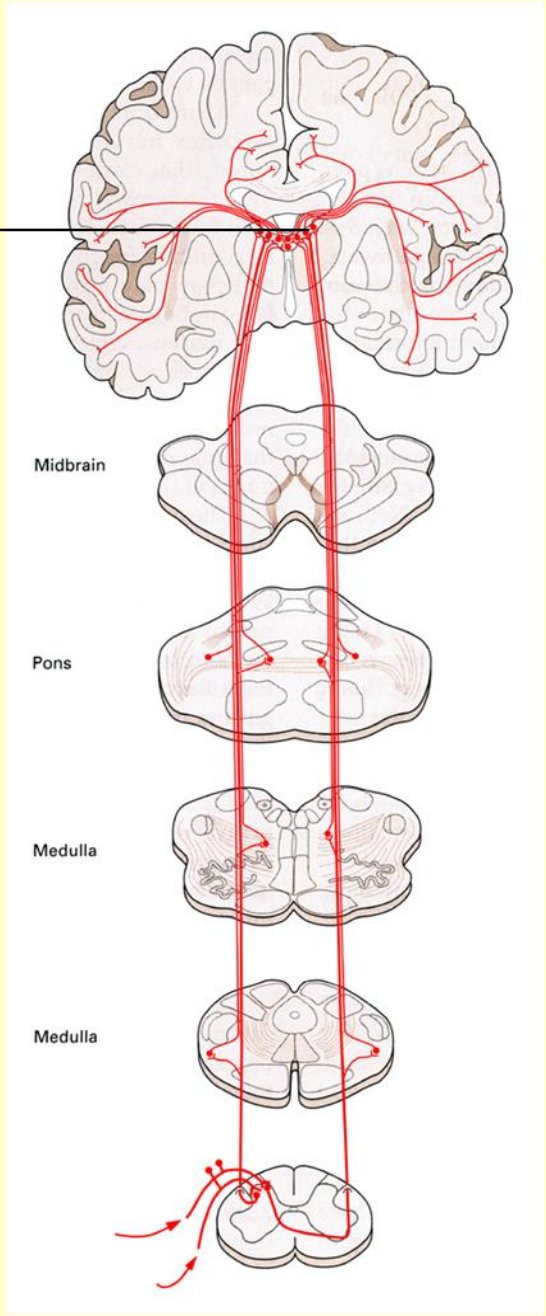
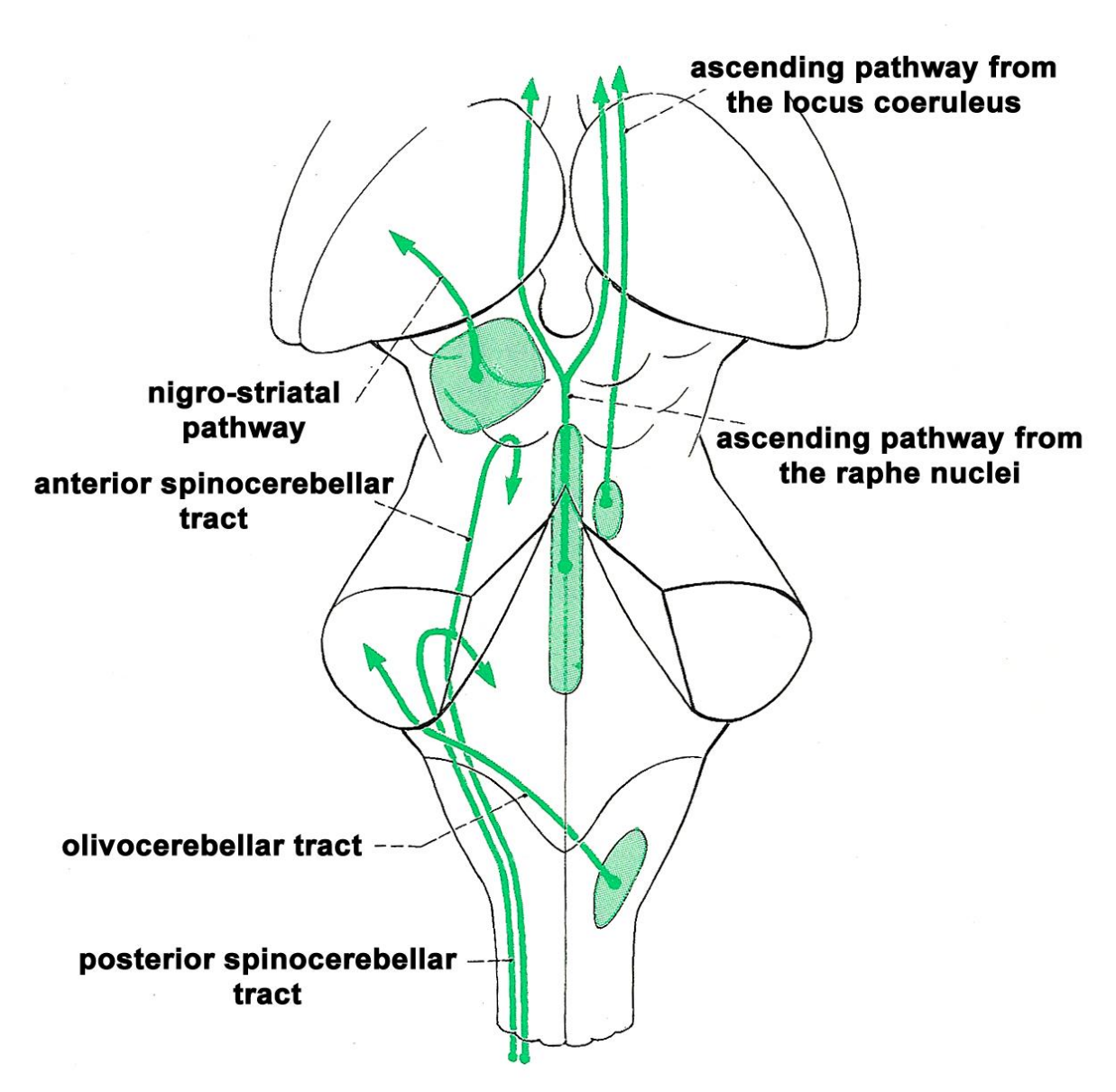
Major inputs and projections of midline and intralaminar thalamic nuclei



Spino-reticulo-thalamic tract

– part of the „ascending reticular activating system”, a regulator of cortical alertness

Ascending pathways without relay in the thalamus



The hypothalamus

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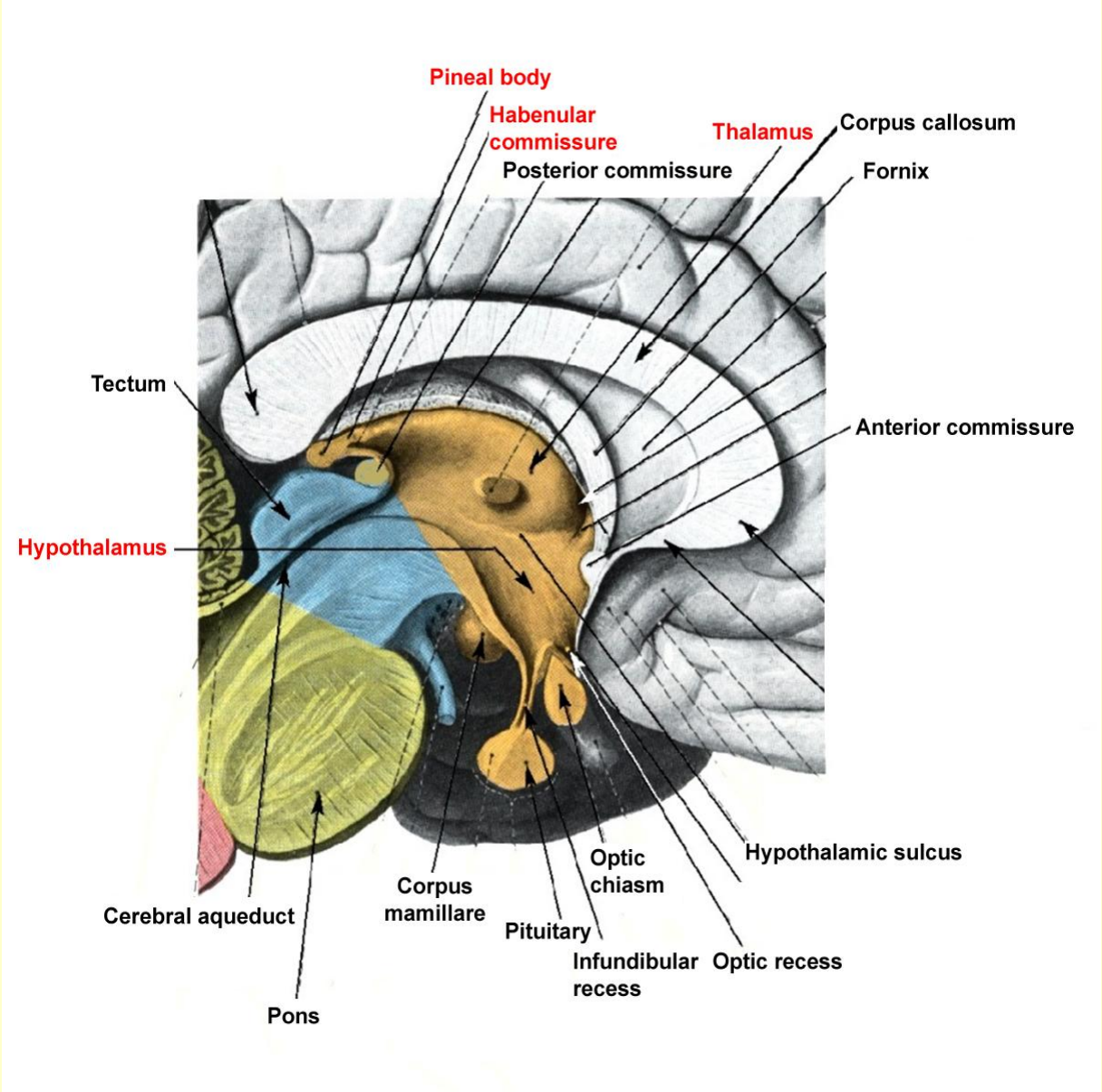
- **Epithalamus**
  - Pineal body
  - Habenula
  - Trigonum habenulae
  - Habenular nuclei
  - Stria medullaris
  - Habenular commissure
- **Metathalamus**
  - Medial geniculate body
  - Lateral geniculate body
- **Subthalamus**
  - Subthalamic nucleus
  - Zona incerta
  - H fields of Forel
- **Hypothalamus**



Structure and major functions of the thalamus and hypothalamus are profoundly different

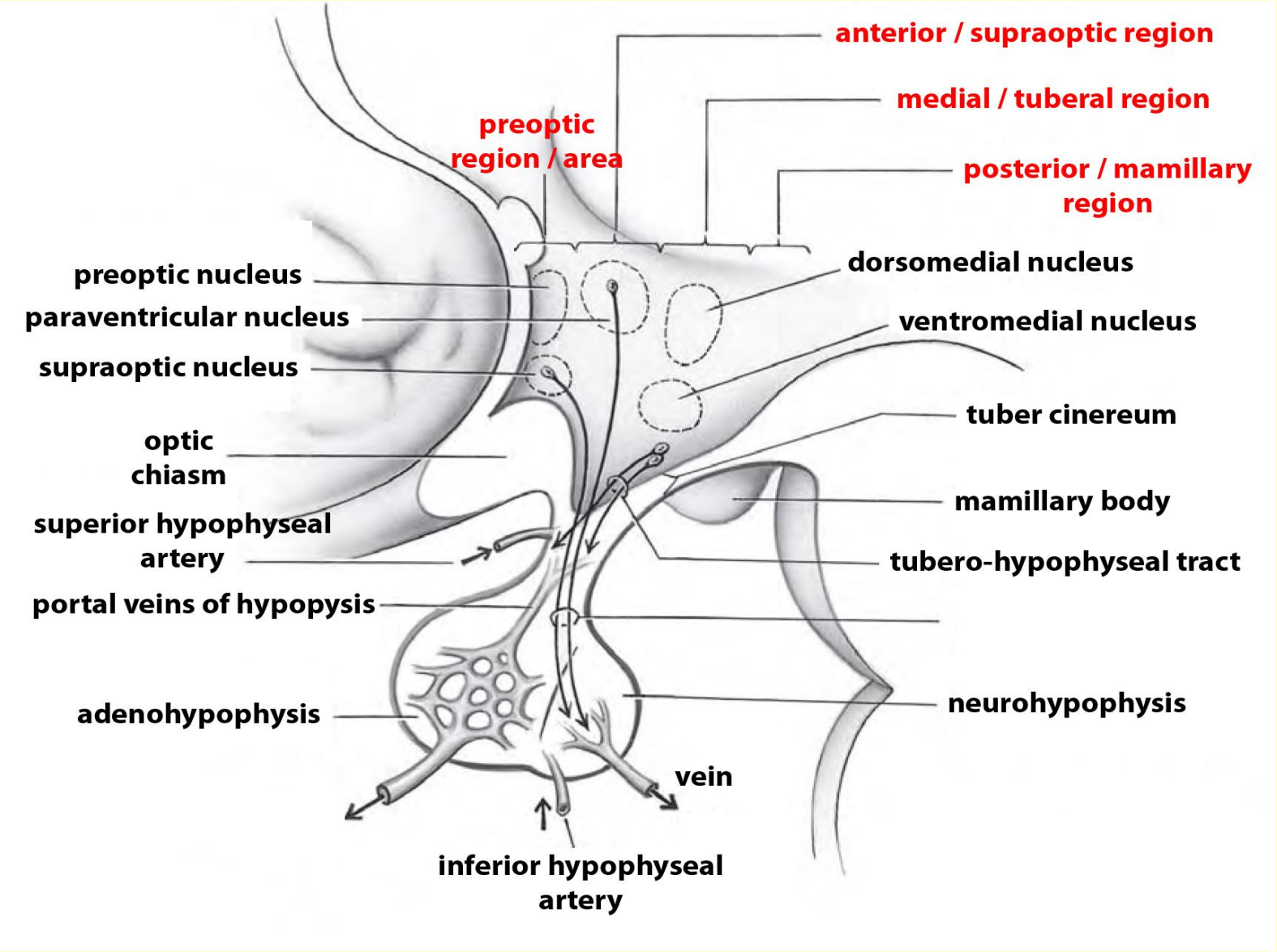
Thalamus:

- well delineated nuclei
- relay and modulation of cortical inputs

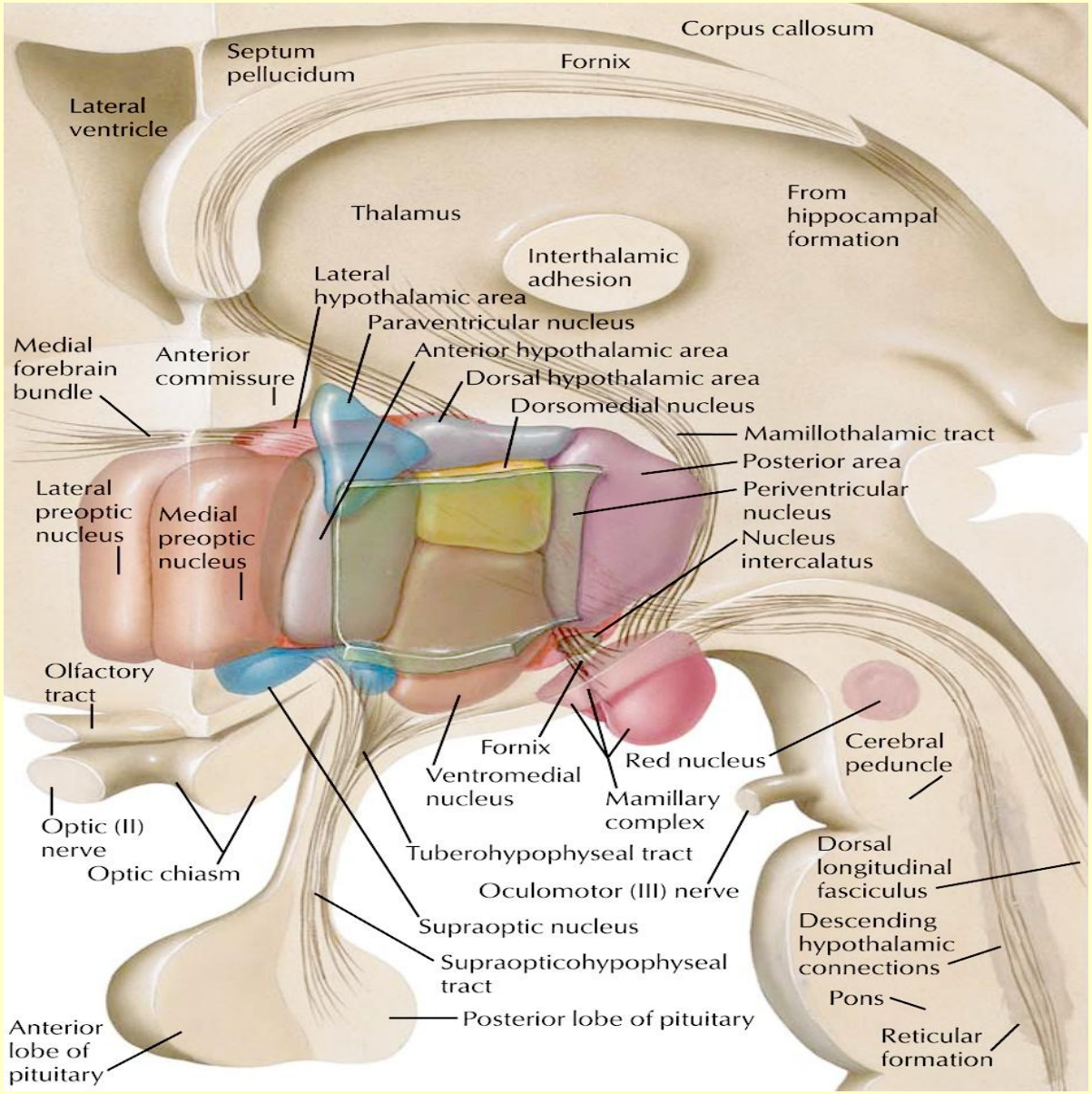
Hypothalamus:

- neurons with different functions are intermingled, not well separated
- homeostatic regulations that do not require cortical processing

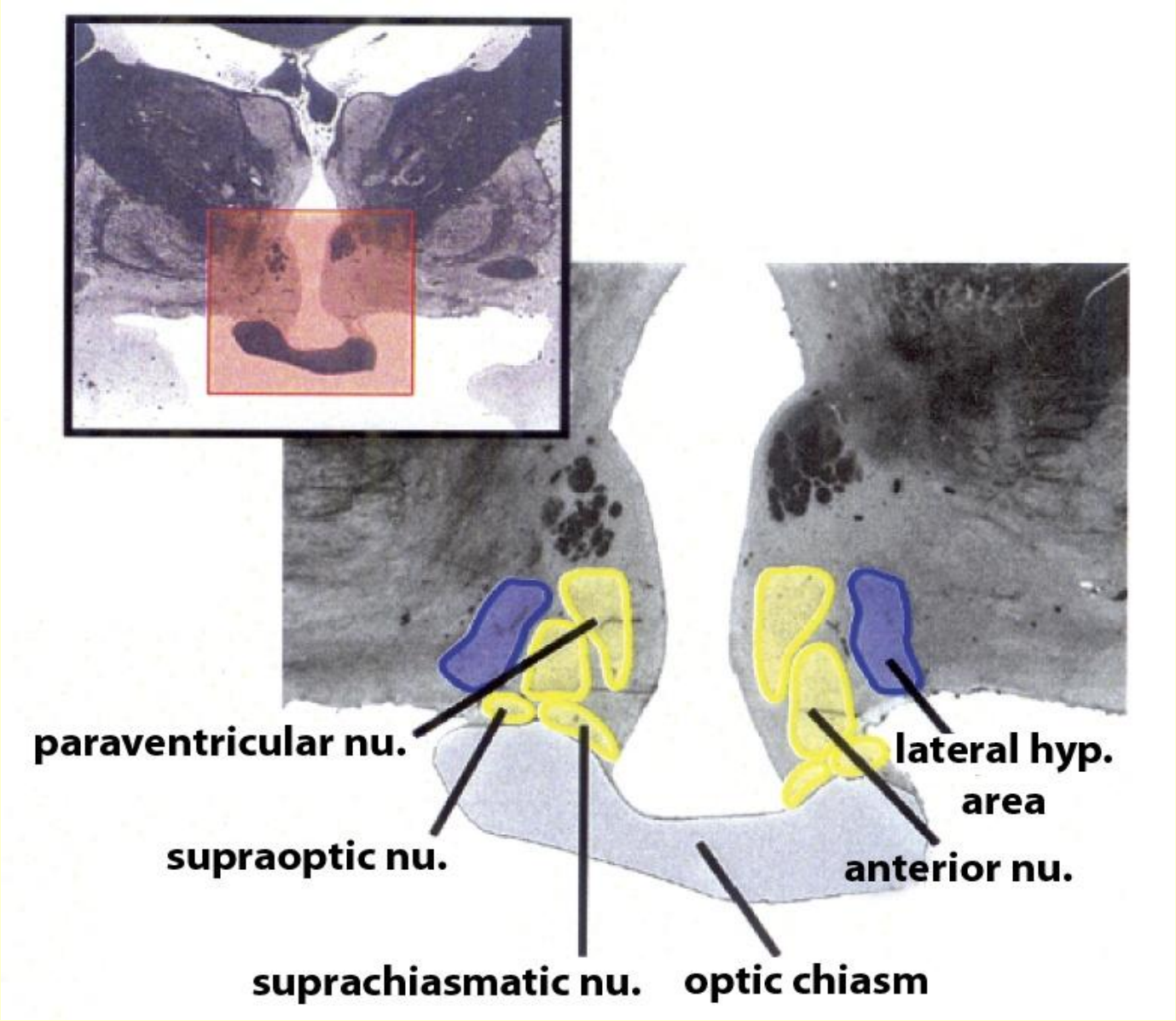
Antero-posterior regions of the hypothalamus



Medio-lateral zones of the hypothalamus



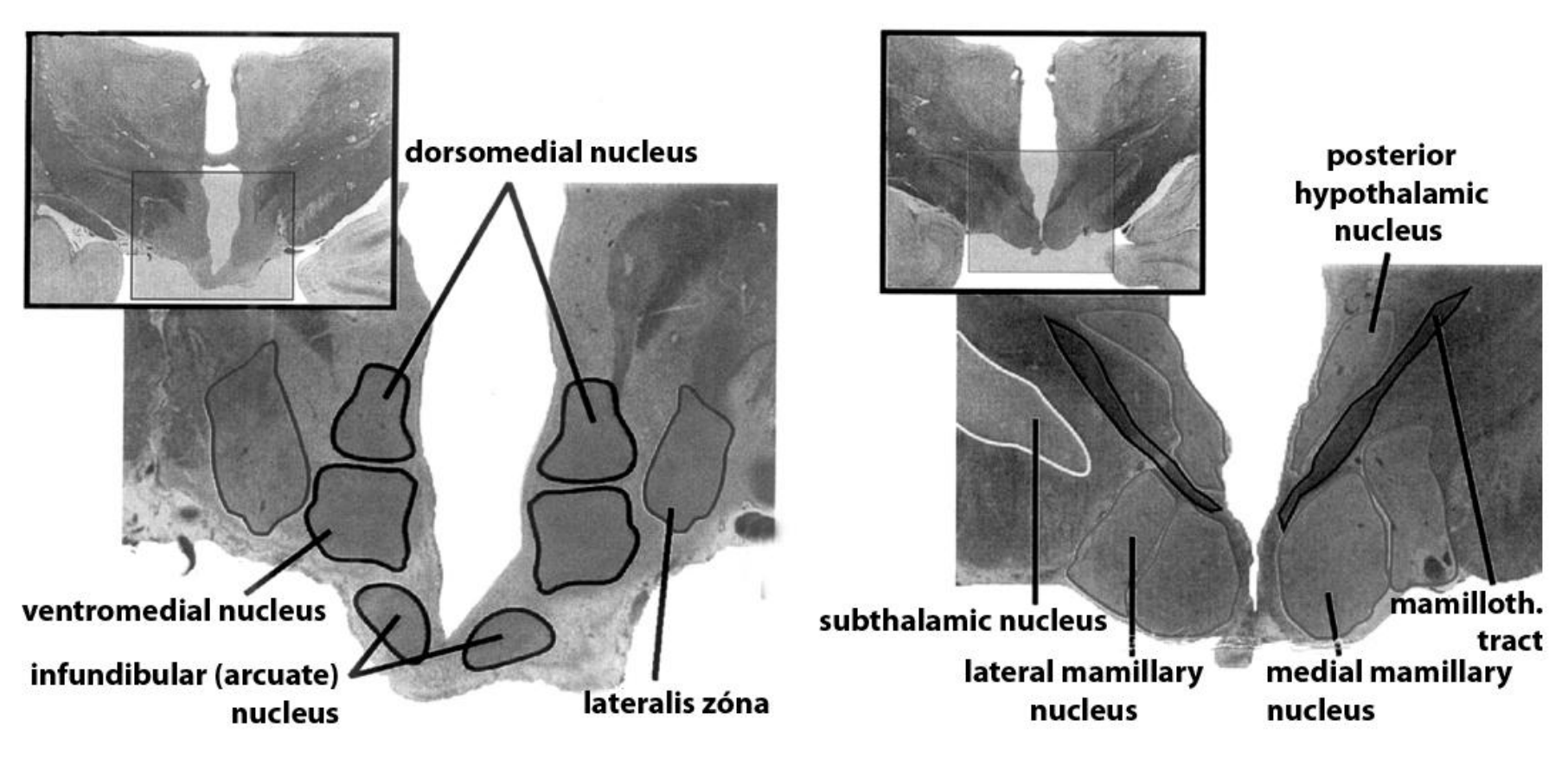
Anterior hypothalamic region



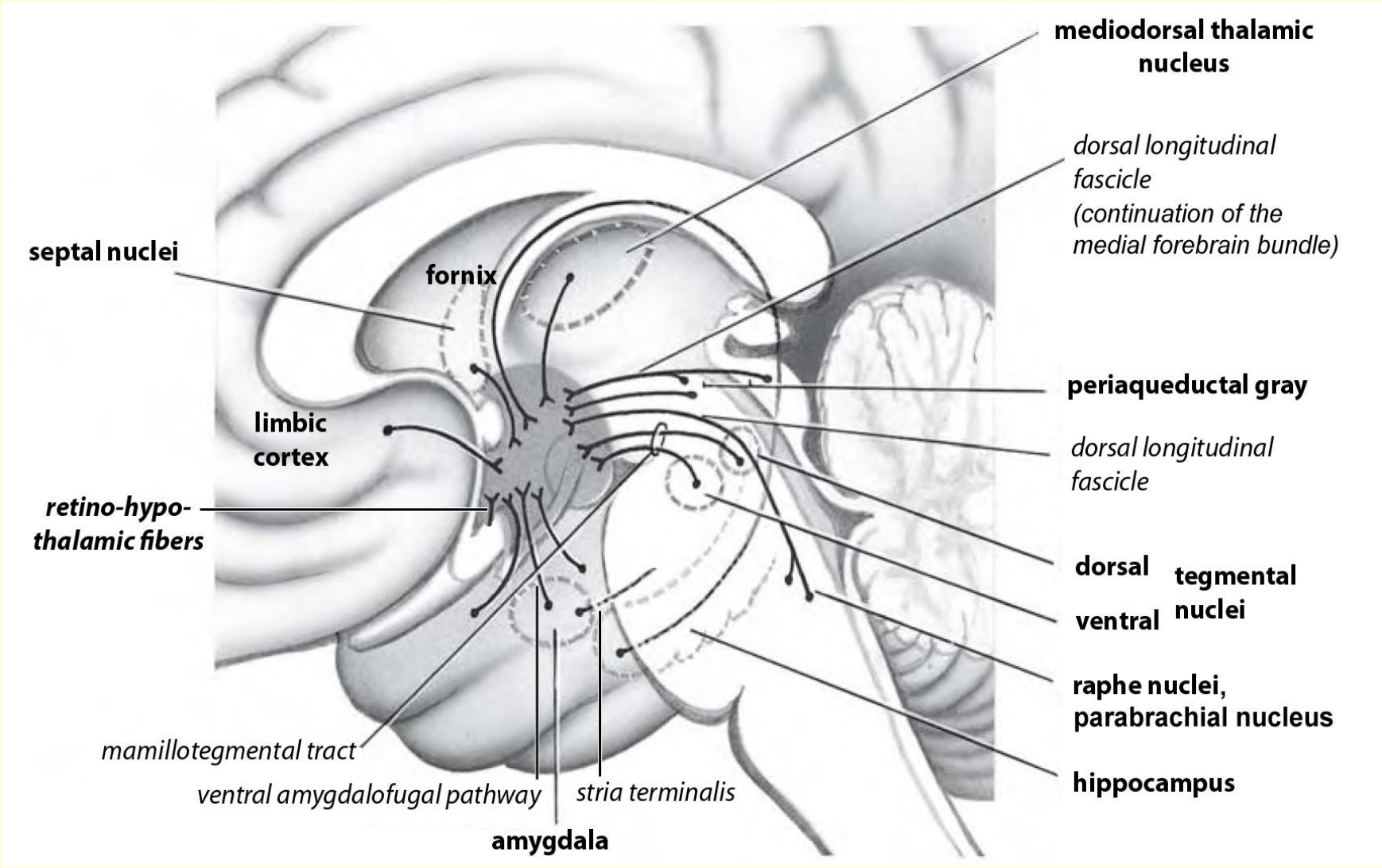
Tuberal and posterior hypothalamic regions

Tuberal hypothalamic region

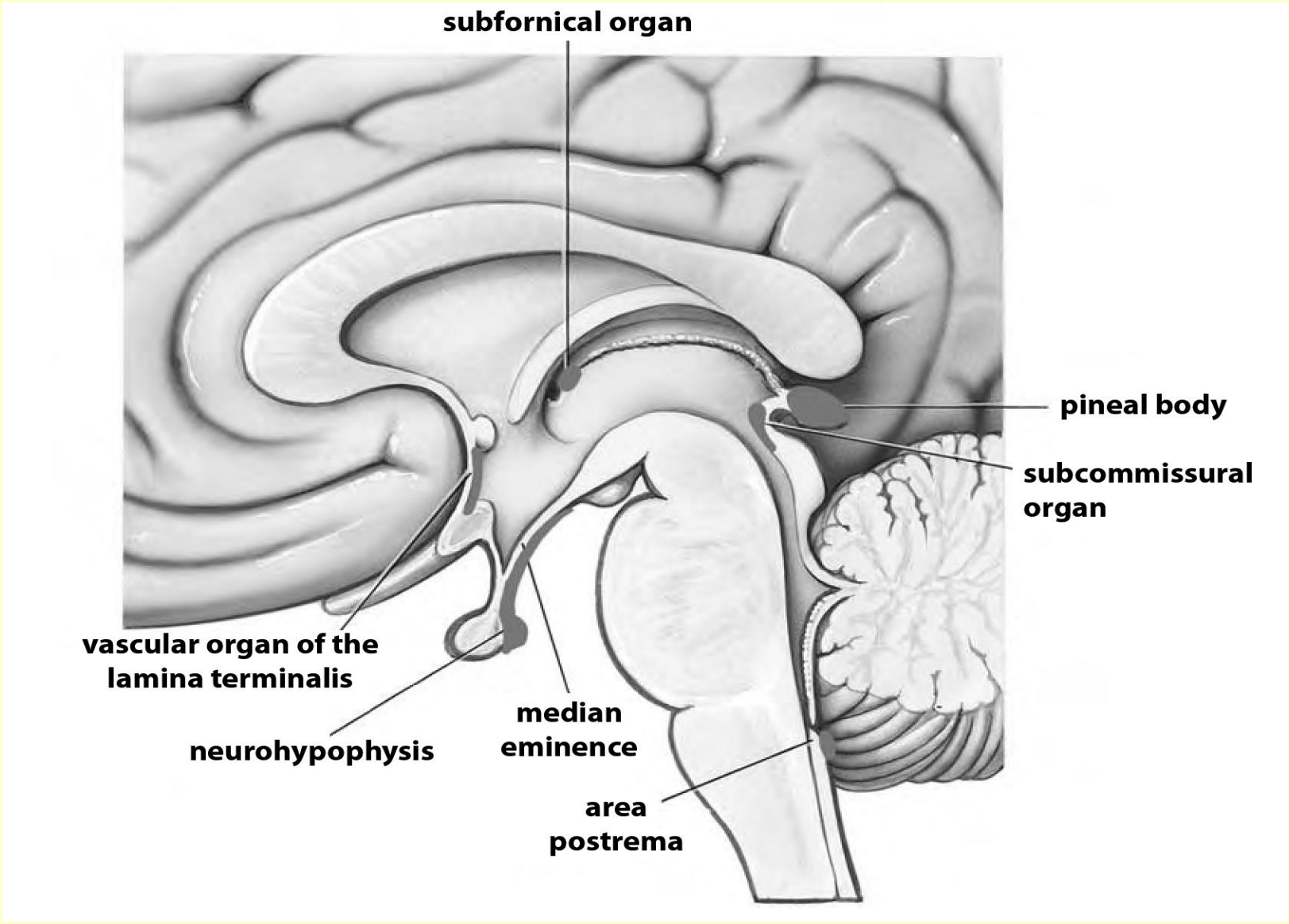
Posterior hypothalamic region



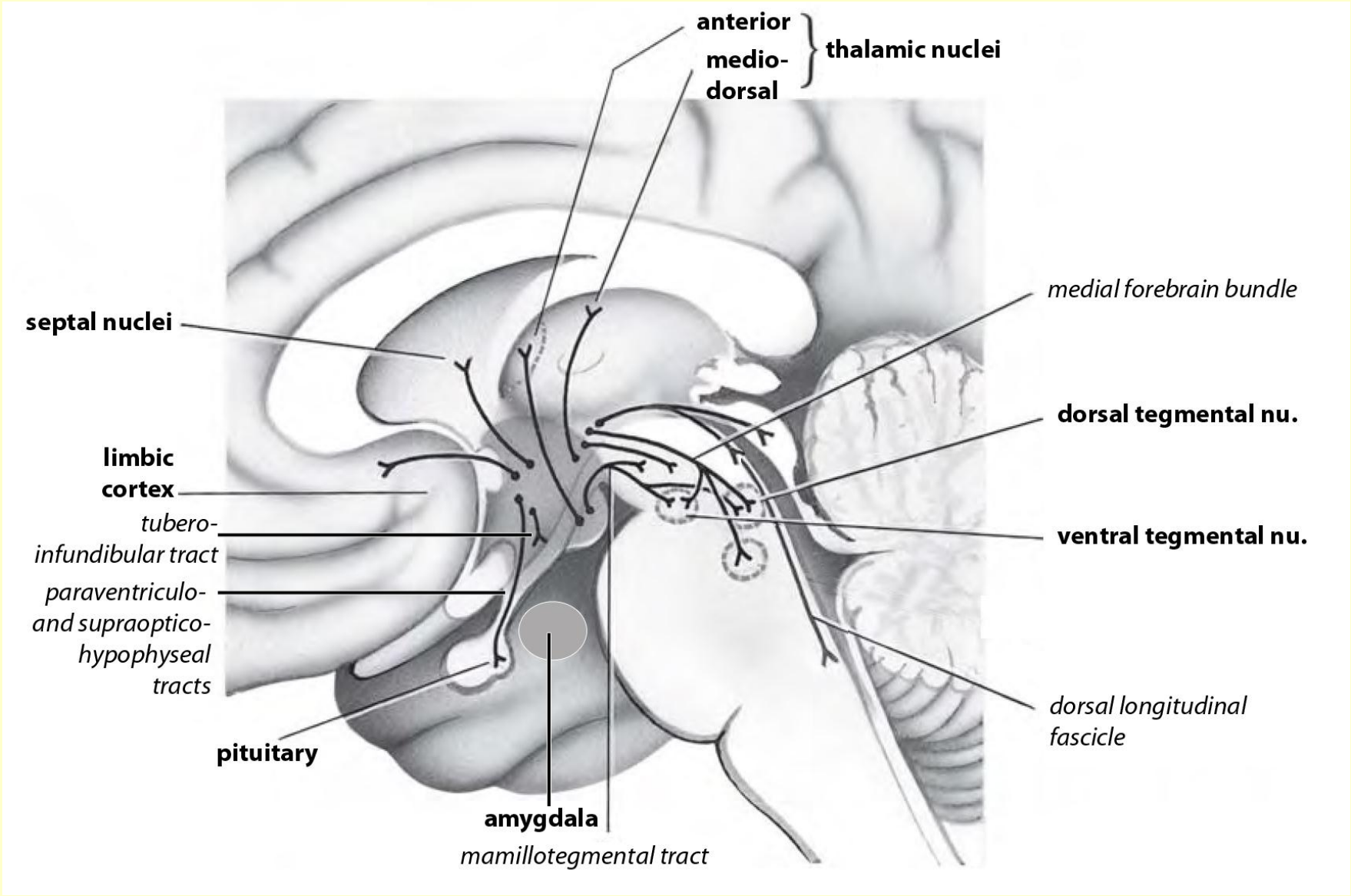
Neuronal inputs to the hypothalamus



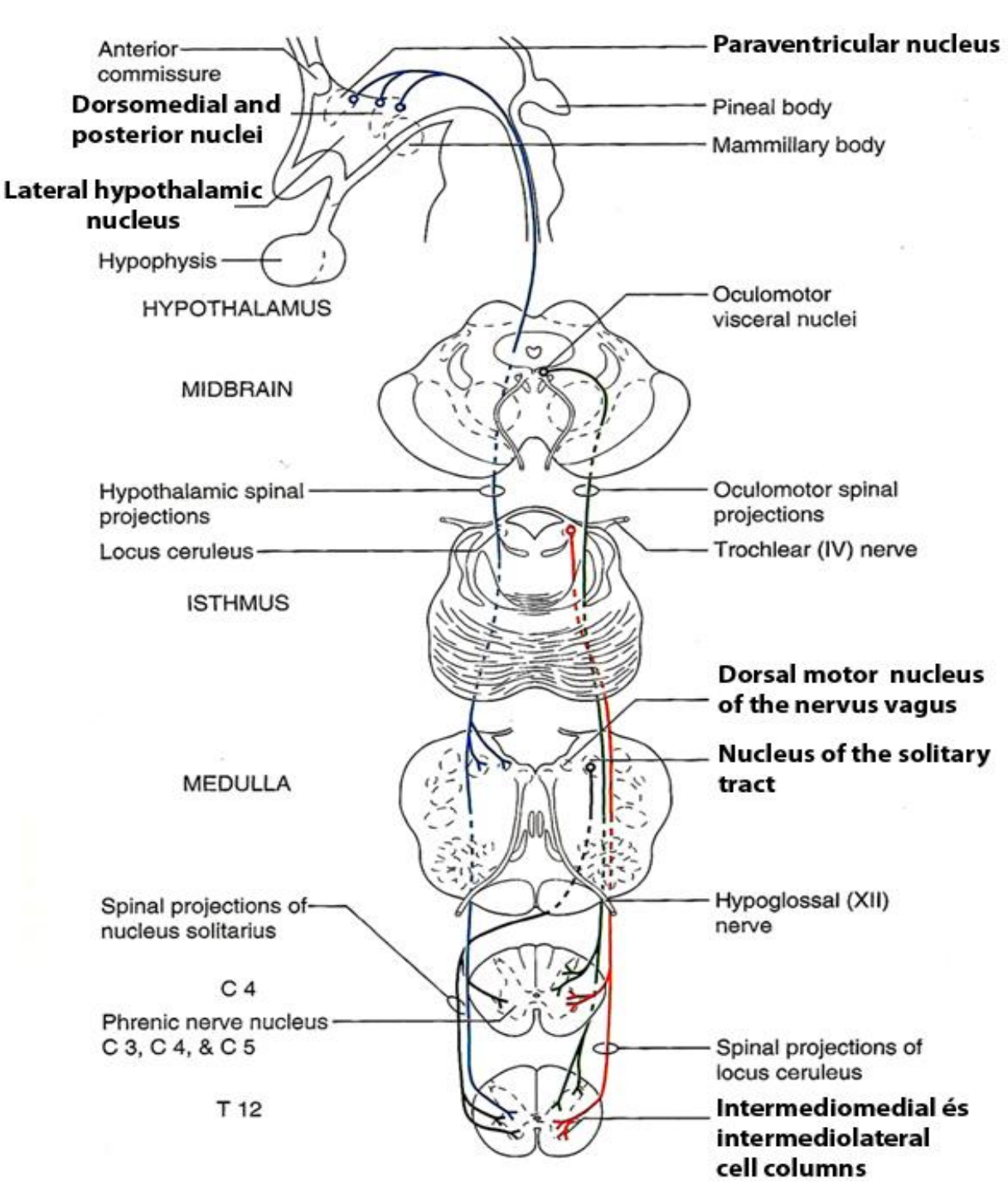
Circumventricular organs – humoral inputs



Extrahypothalamic projections of hypothalamic nuclei



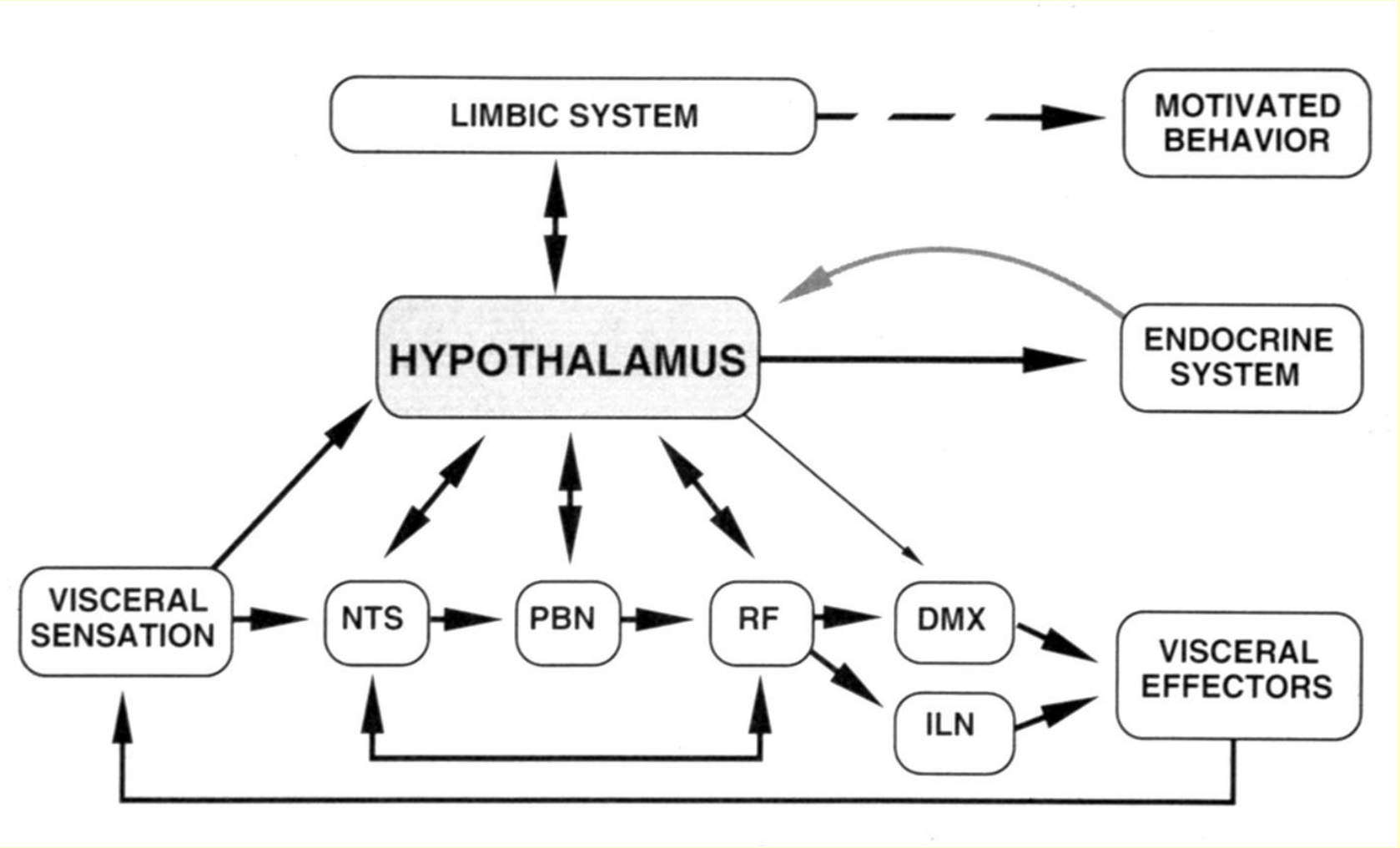
Hypothalamo-spinal tract and other descending pathways regulating vegetative functions



Regulatory functions of hypothalamic nuclei

- Vegetative regulations
- Neuroendocrine regulations
- Salt and water balance
- Food intake and body weight
- Temperature
- Circadian rhythms
- Sleep
- Reproduction

Neural elements of homeostatic regulations



NTS: nucleus of the solitary tract, PBN: parabrachial nucleus, RF: reticular formation, DMX: dorsal motor vagus nucleus, ILN: intermediolateral column (nucleus) of the spinal cord

Thank you for your attention!