

Basic Neuroanatomy

Online Tutorial

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Resources

CNS Compendium for medical students (Division of Neuroanatomy)

Frozen brain sections (Division of Clinical Anatomy)

Histological sections (Division of Histology)

Brain Model (3B Scientific)

Embryonic Neuroanatomy

3 vesicle stage (day 25, 4 mm) → 5 vesicle stage (day 42, 12 mm)

Prosencephalon (forebrain)

Mesencephalon (midbrain)

Rhombencephalon (hindbrain)

Medulla spinalis (spinal cord)

Telencephalon

Lateral ventricle
Foramen Monroi

Diencephalon

Mesencephalon
Aquaeduct

Rhombencephalon
Met- and Myelencephalon

Medulla spinalis
Canalis centralis

CN VII/VIII

Isthmus (CN IV)

Flexura cervicalis

Flexura pontina

Medulla spinalis

CN V

Cerebellum

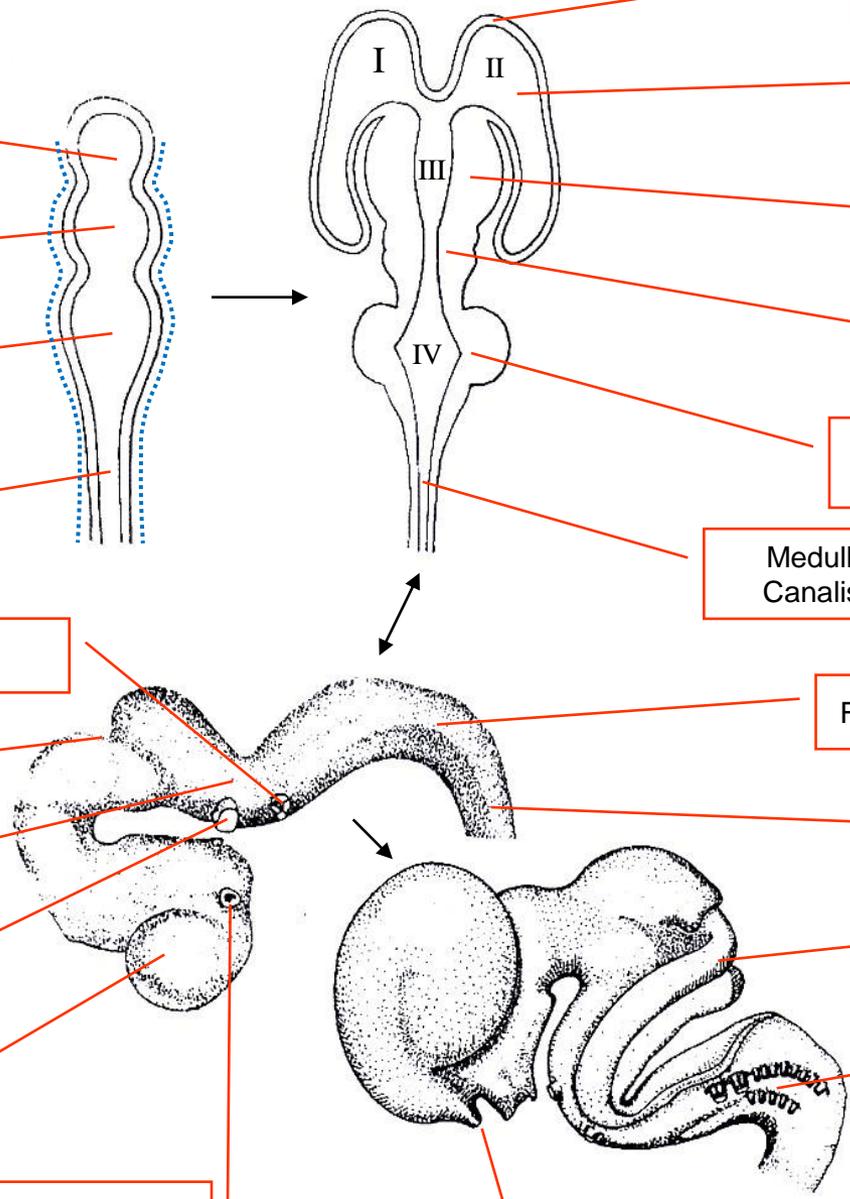
Telencephalic vesicle

CN IX-XII

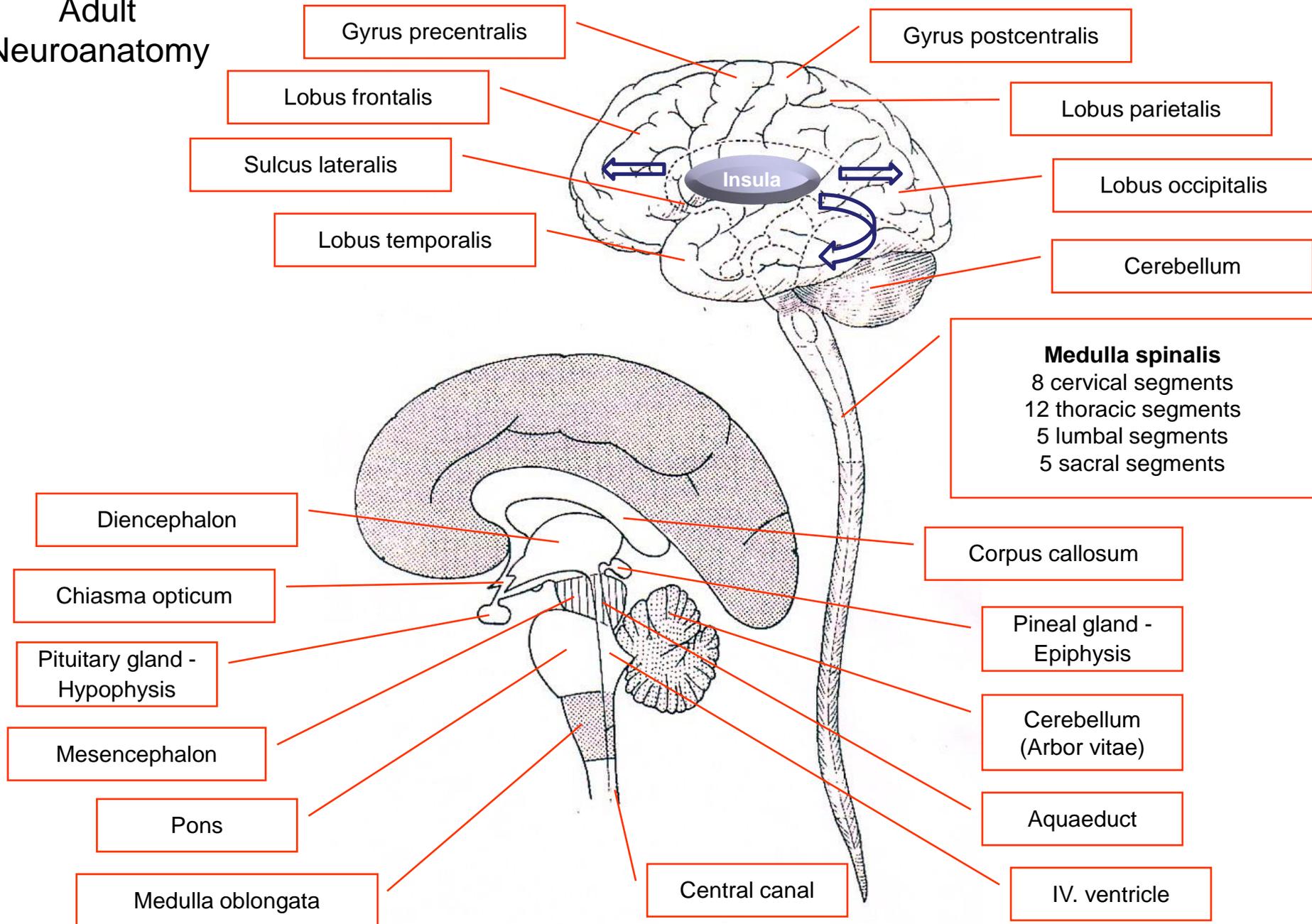
Optic cup

Bulbus olfactorius (CN I)

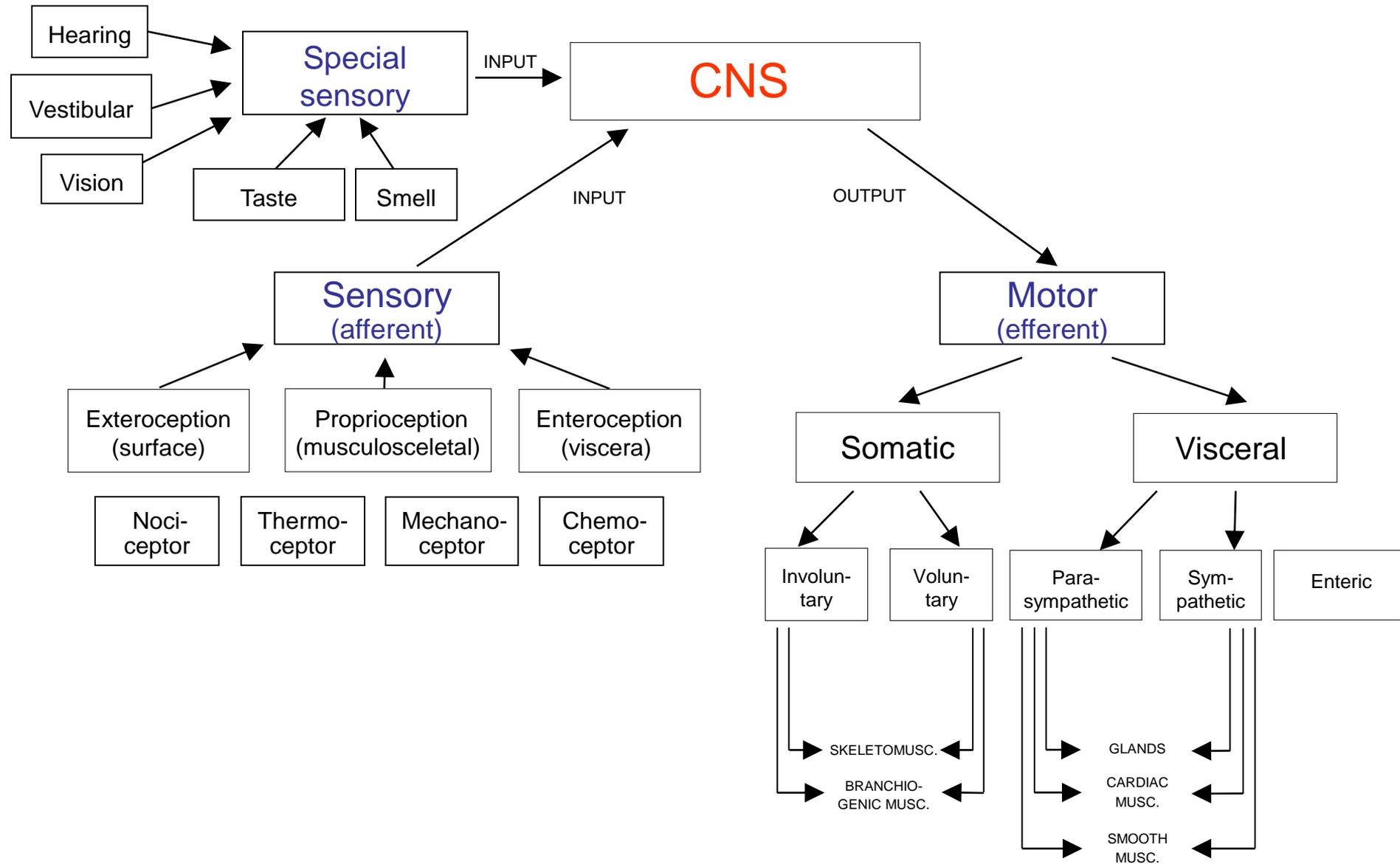
(day 60, 30 mm)



Adult Neuroanatomy

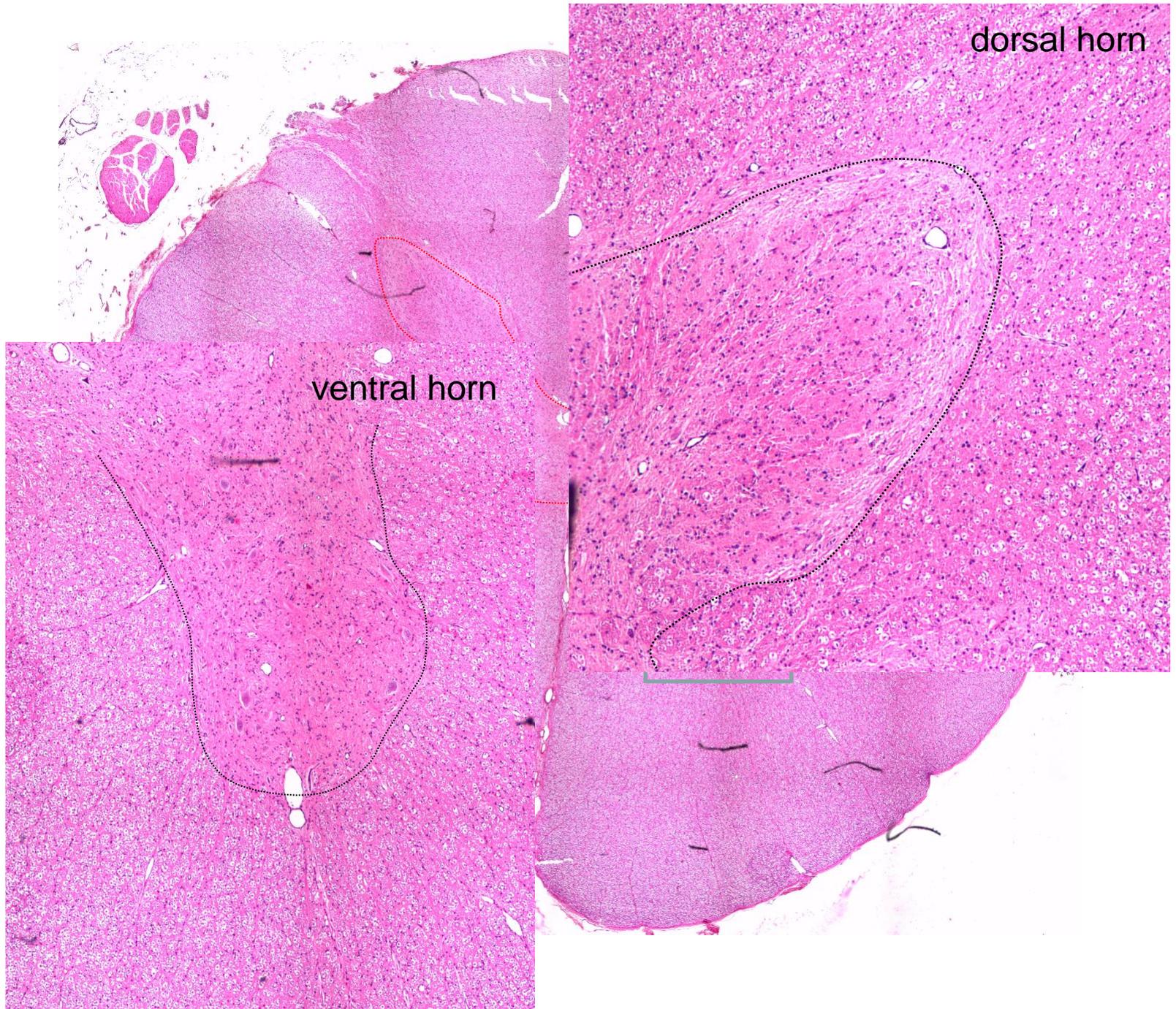


Functional Neuroanatomy



Spinal cord

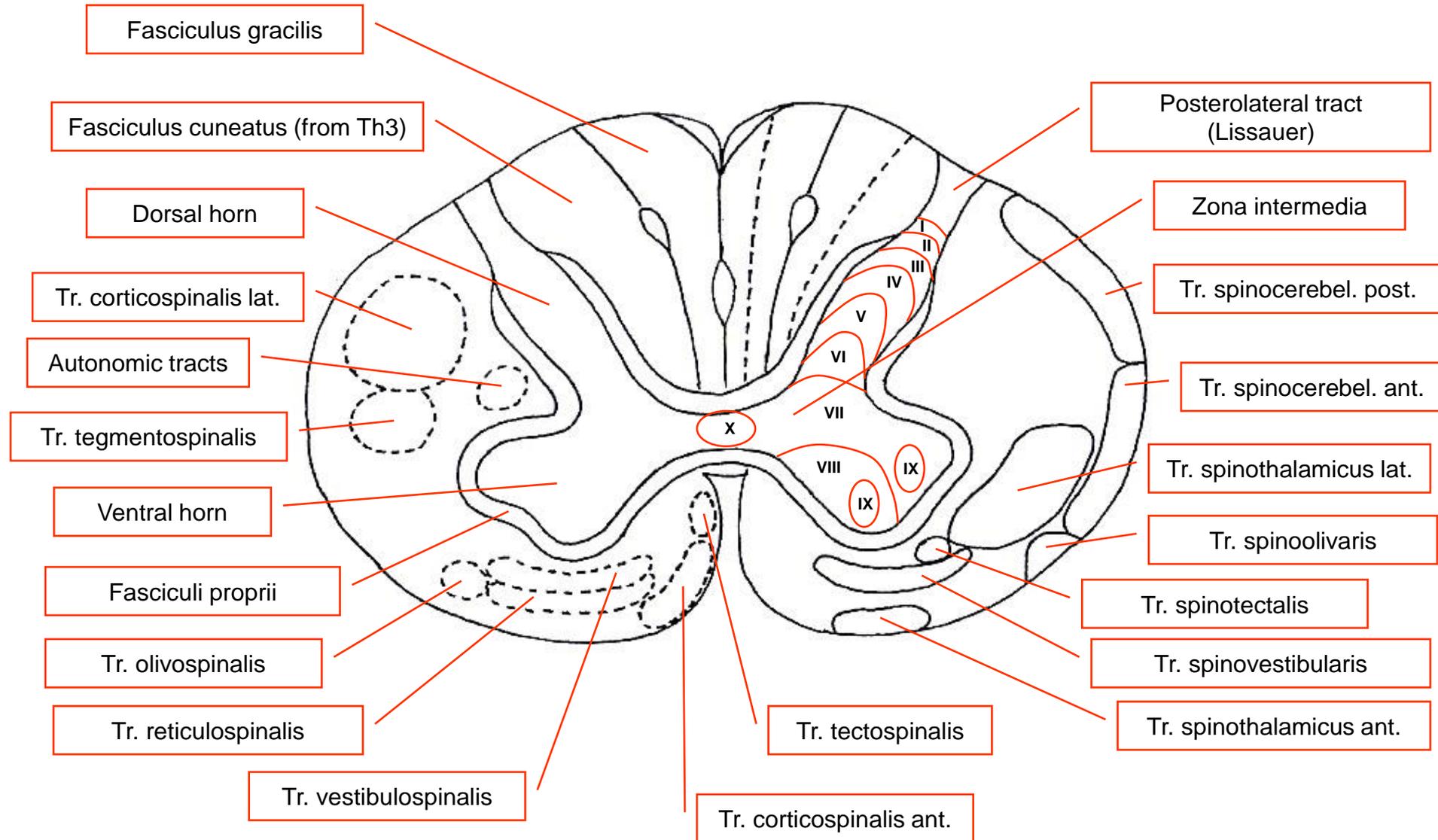
Main motor and sensory systems

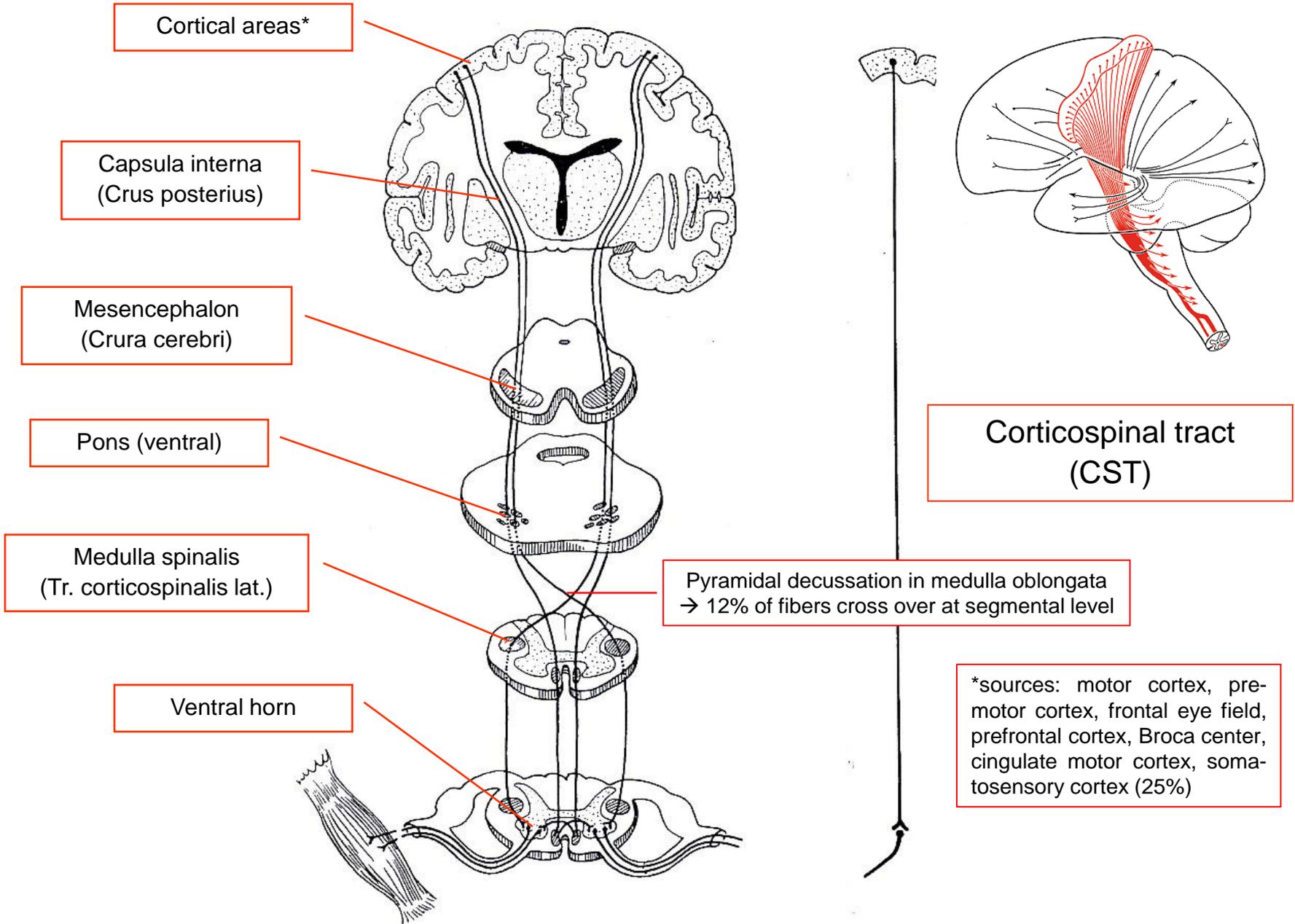


dorsal horn

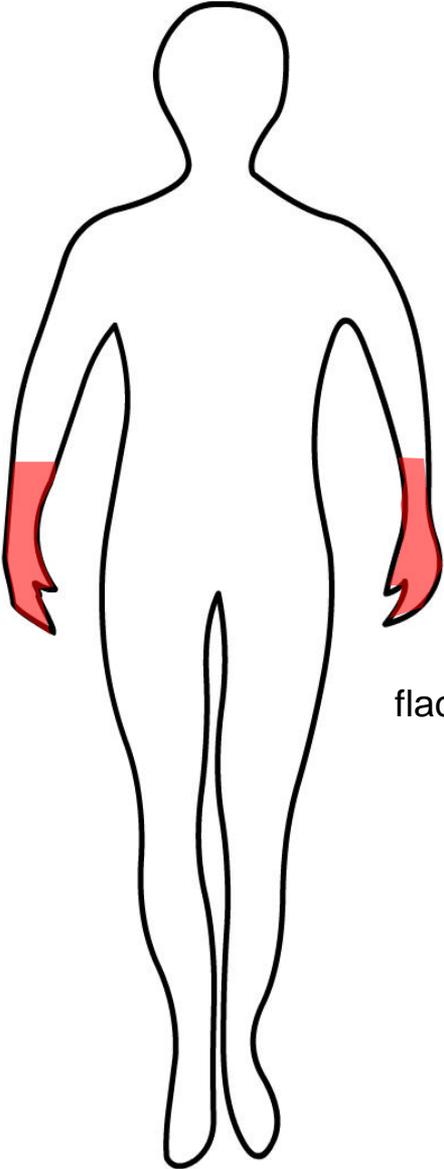
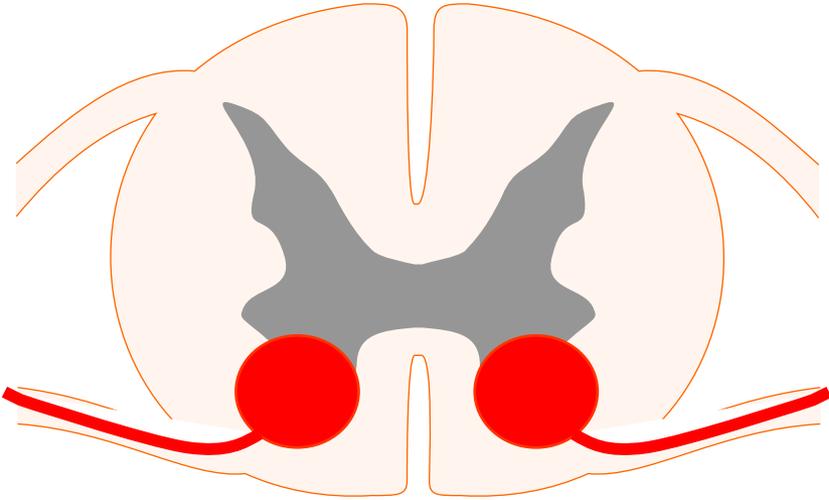
ventral horn

Cervical spinal cord



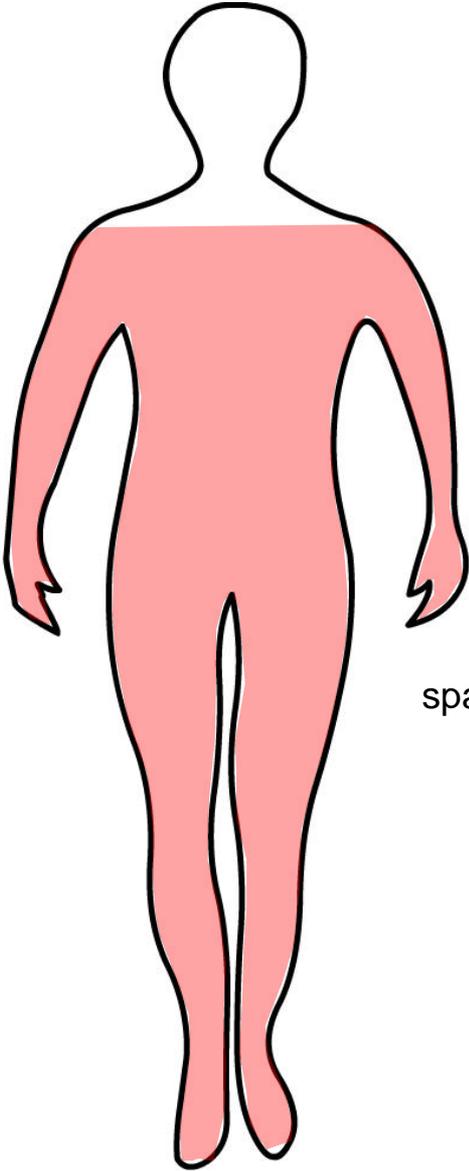
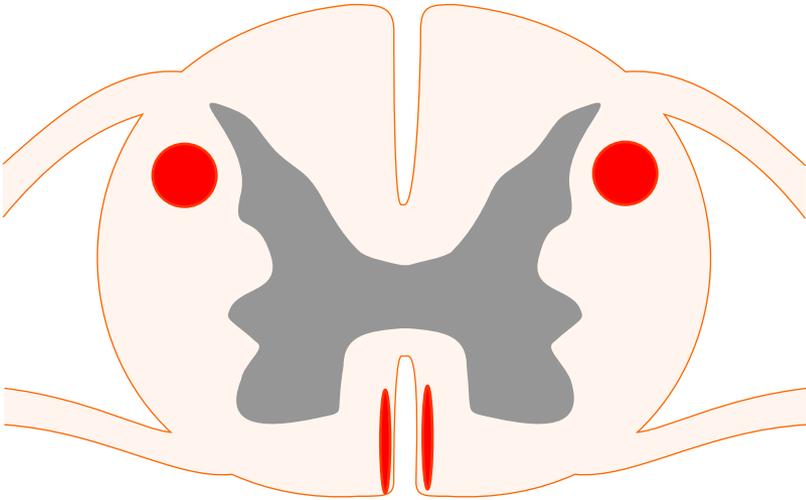


Ventral horn lesion – C7/8



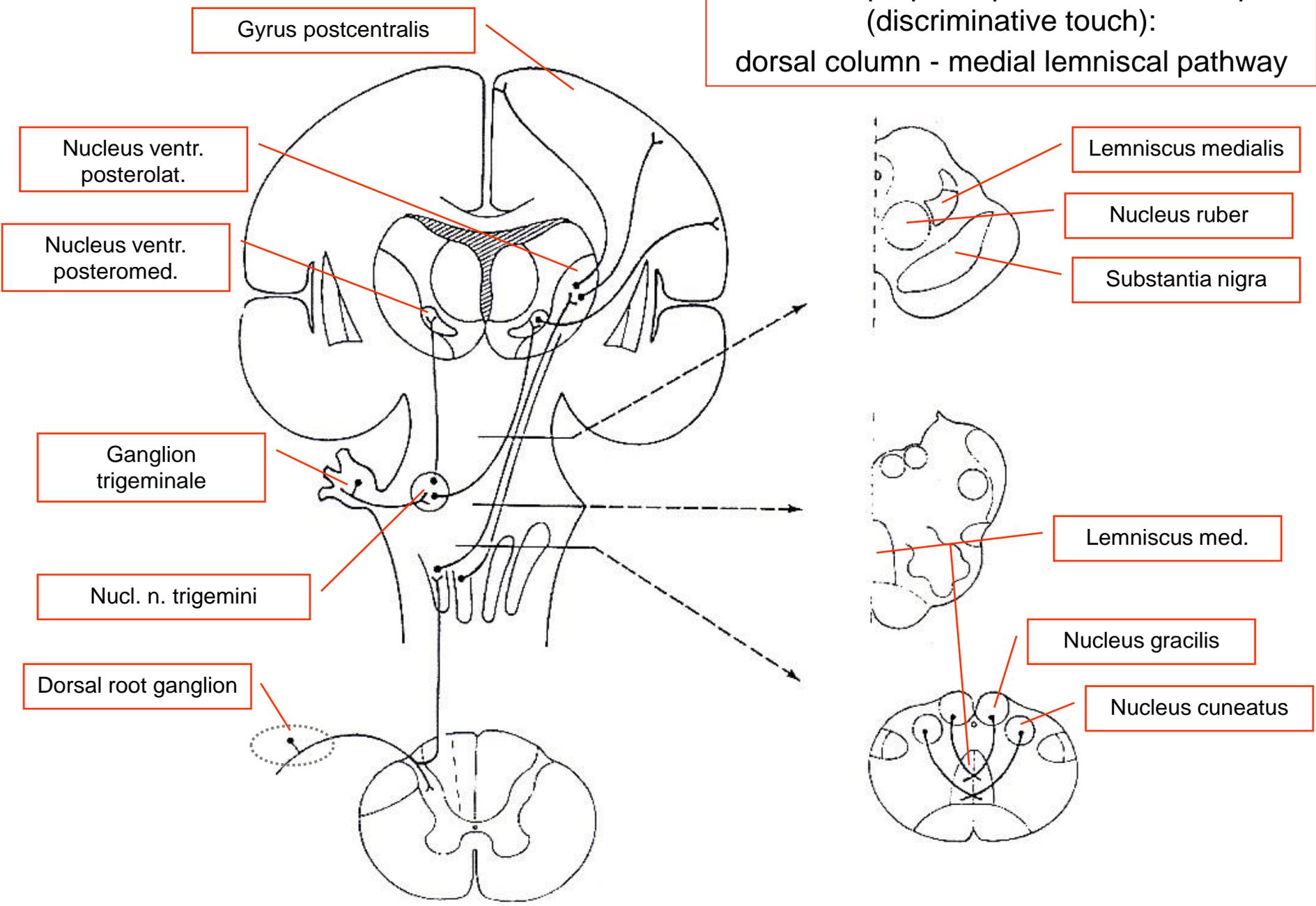
flaccid paralysis

Corticospinal tract lesion

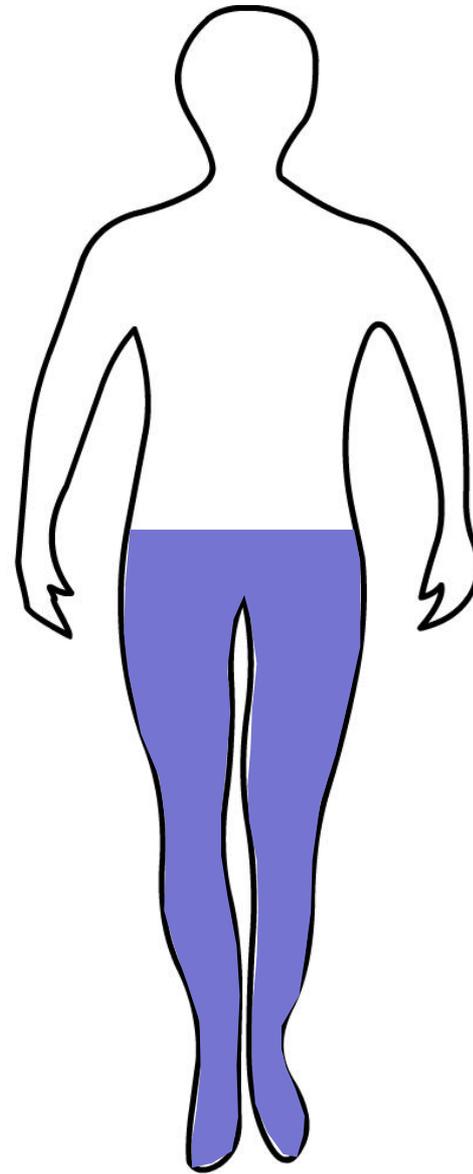
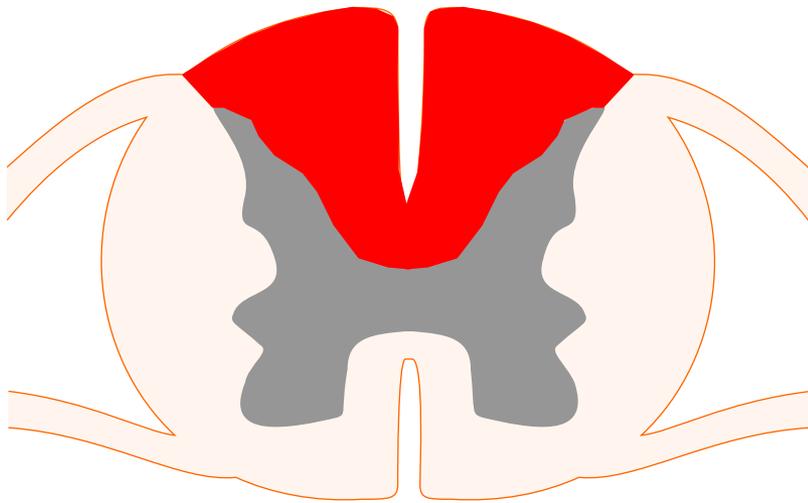


spastic paralysis

Conscious proprioception and exteroception (discriminative touch):
dorsal column - medial lemniscal pathway



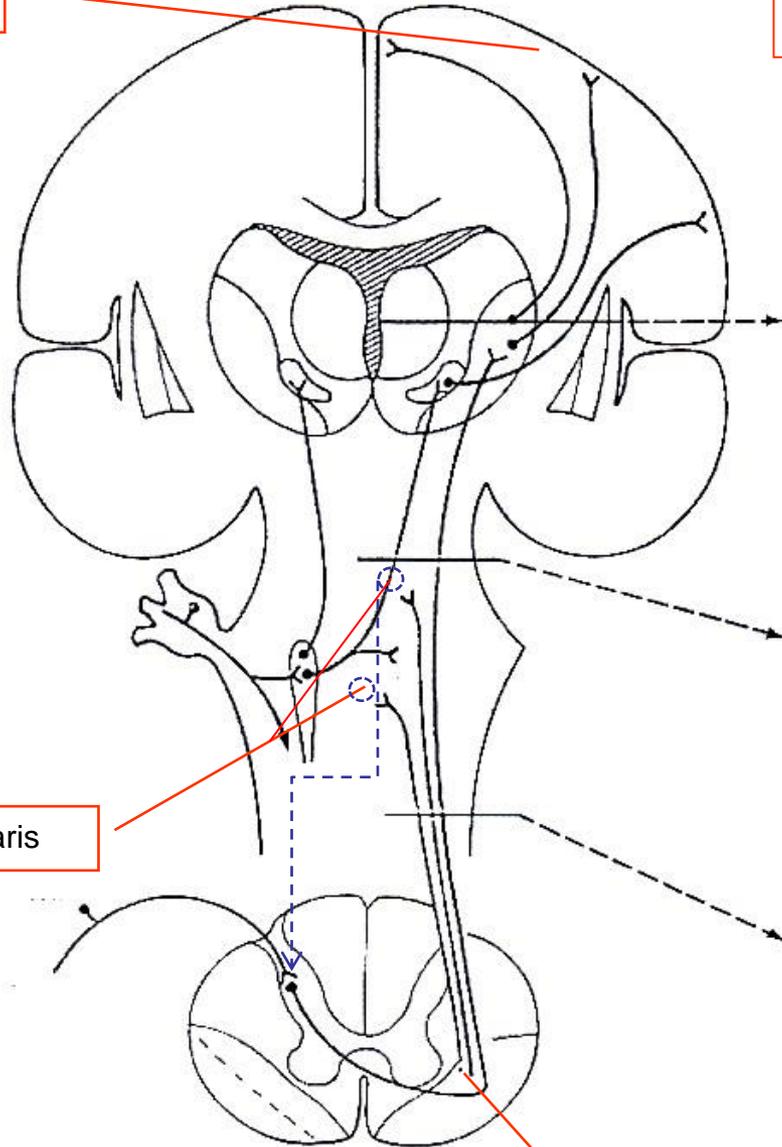
Dorsal column syndrome (Th10)



hypesthesia
sensory ataxia

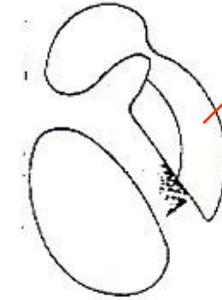
Gyrus postcentralis

Exteroception (pain, temperature):
spinothalamic pathway

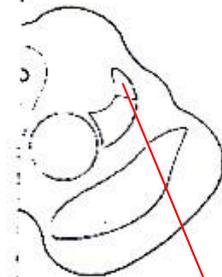


Formatio reticularis

Tractus spinothalamicus lateralis (LSTT)

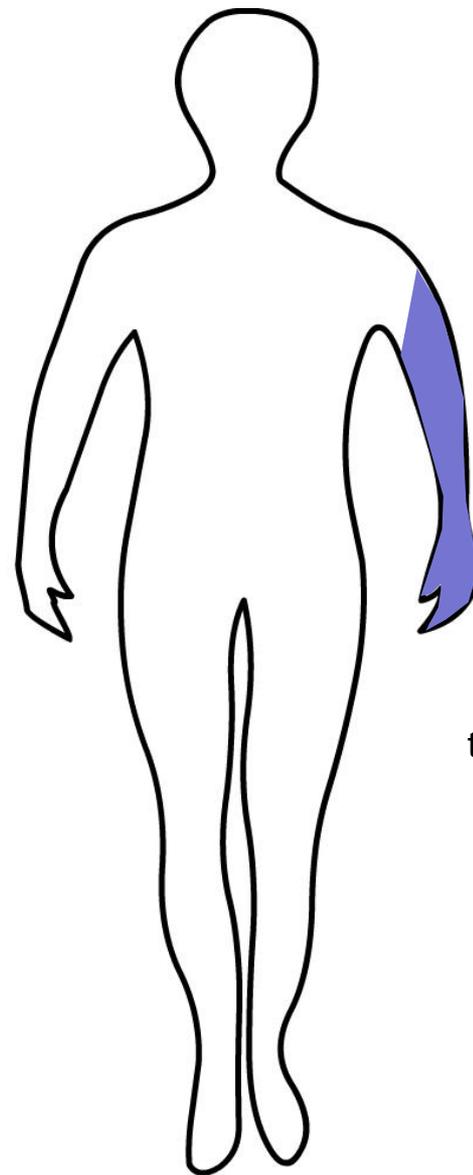
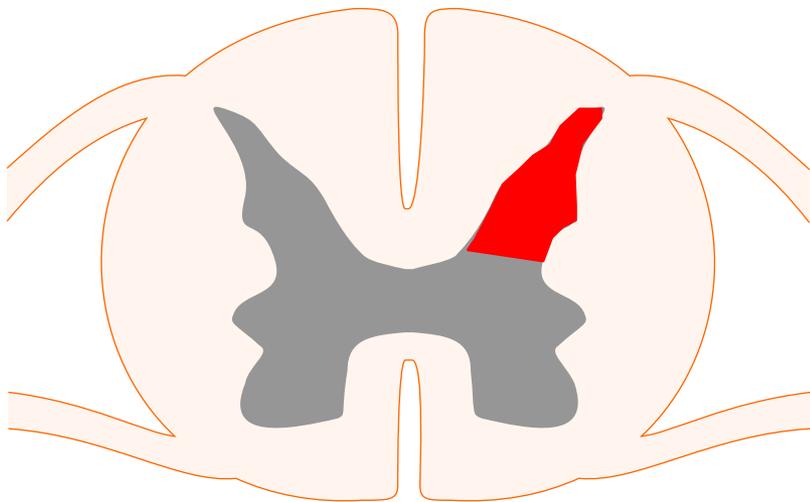


Thalamus (VPLN)

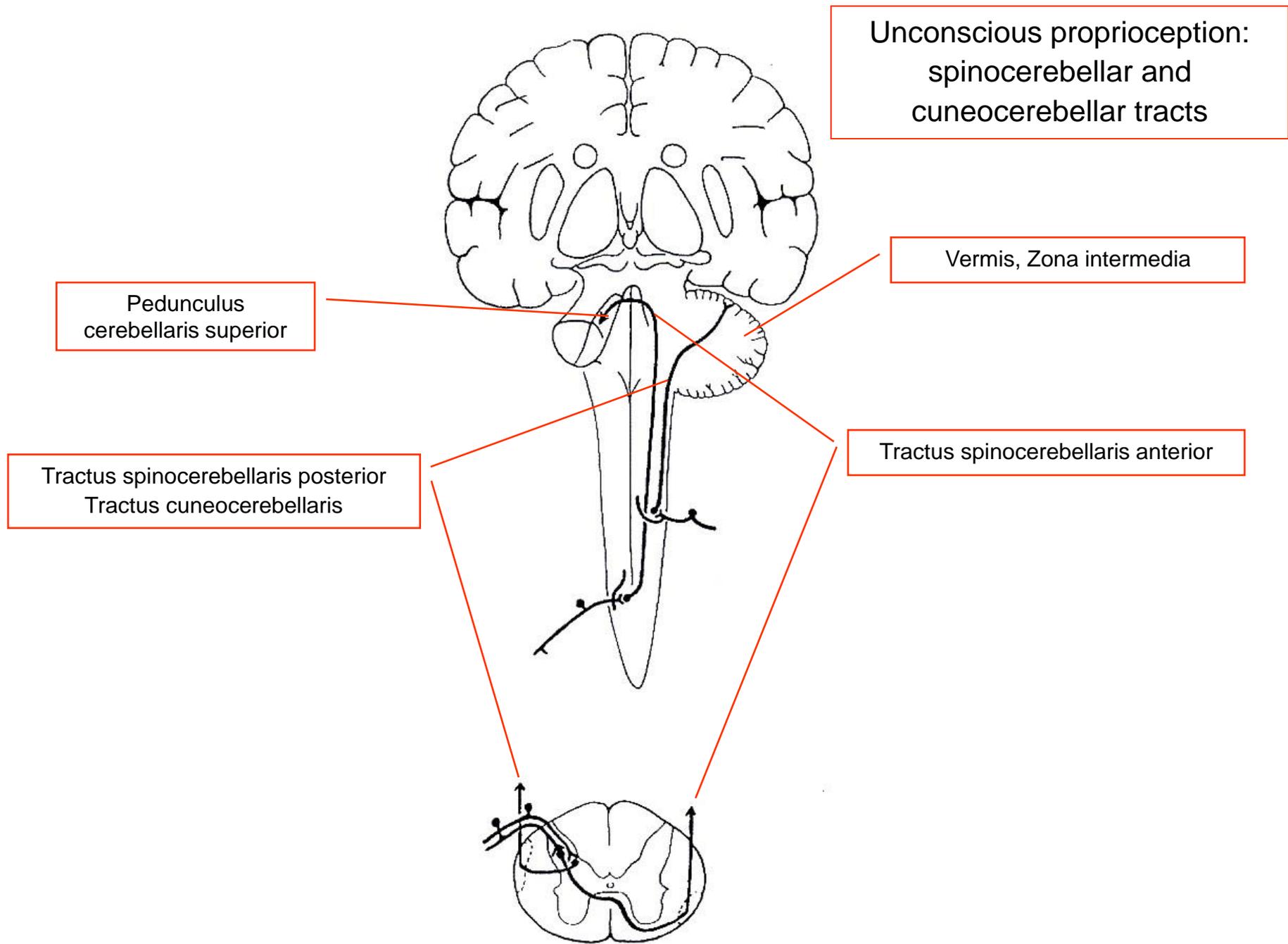


Spinal lemniscus

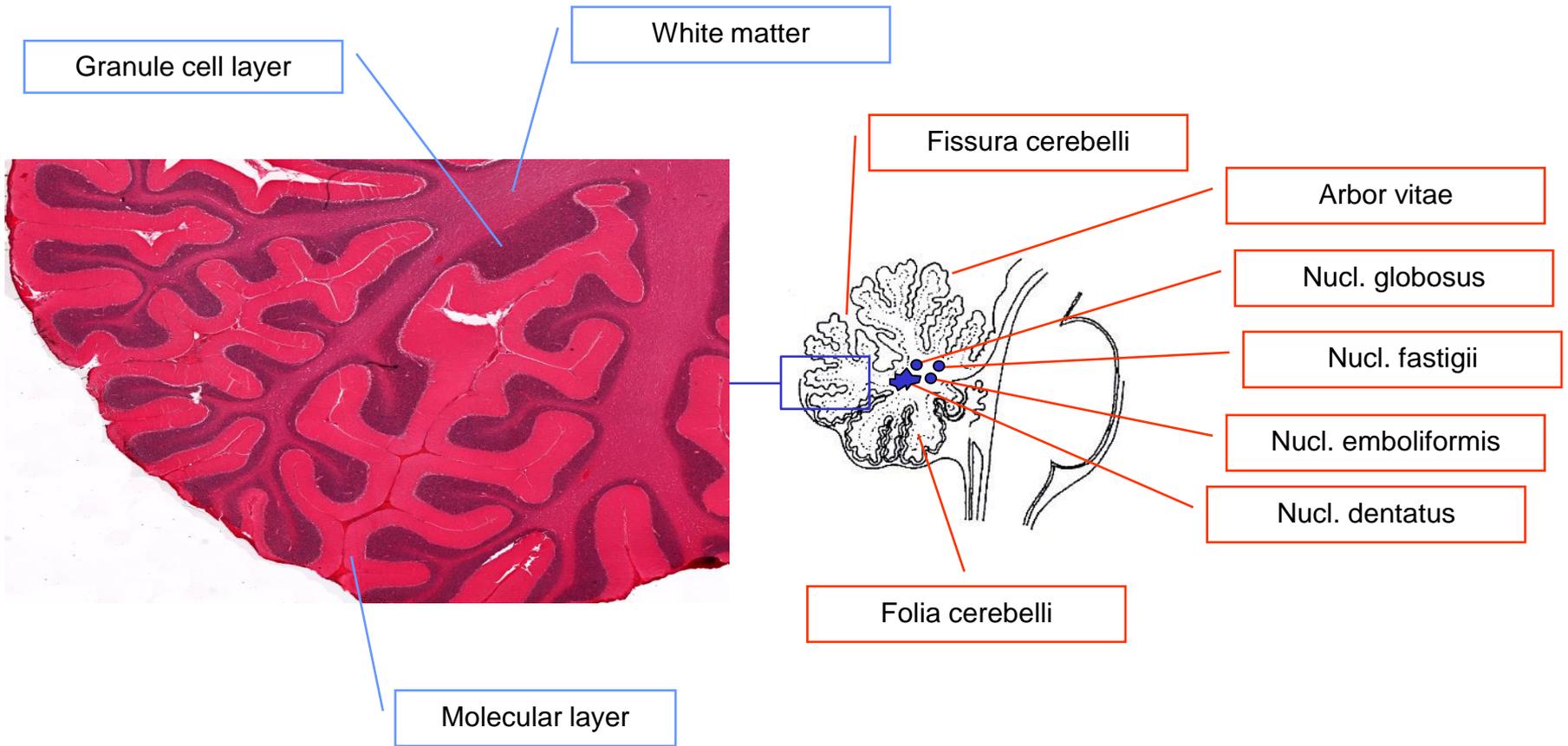
Dorsal horn syndrome (C5-C8)



analgesia
thermanaesthesia



Brain Model



Caput nucl. caudati

Pedunculi cerebri

Capsula interna
crus anterius

Nucl. ruber

Putamen

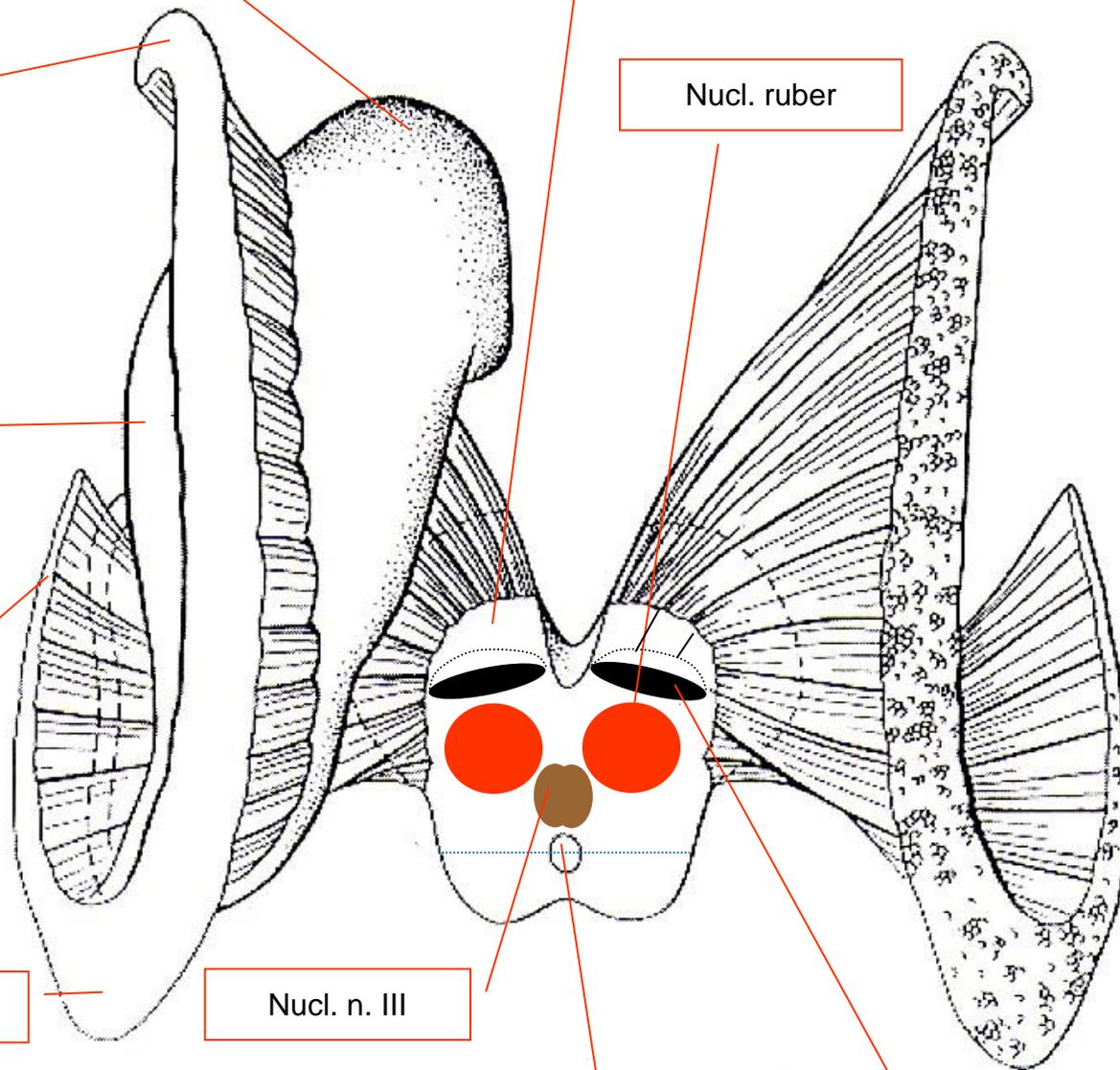
Pars sublenticiformis

Pars retrolenticiformis

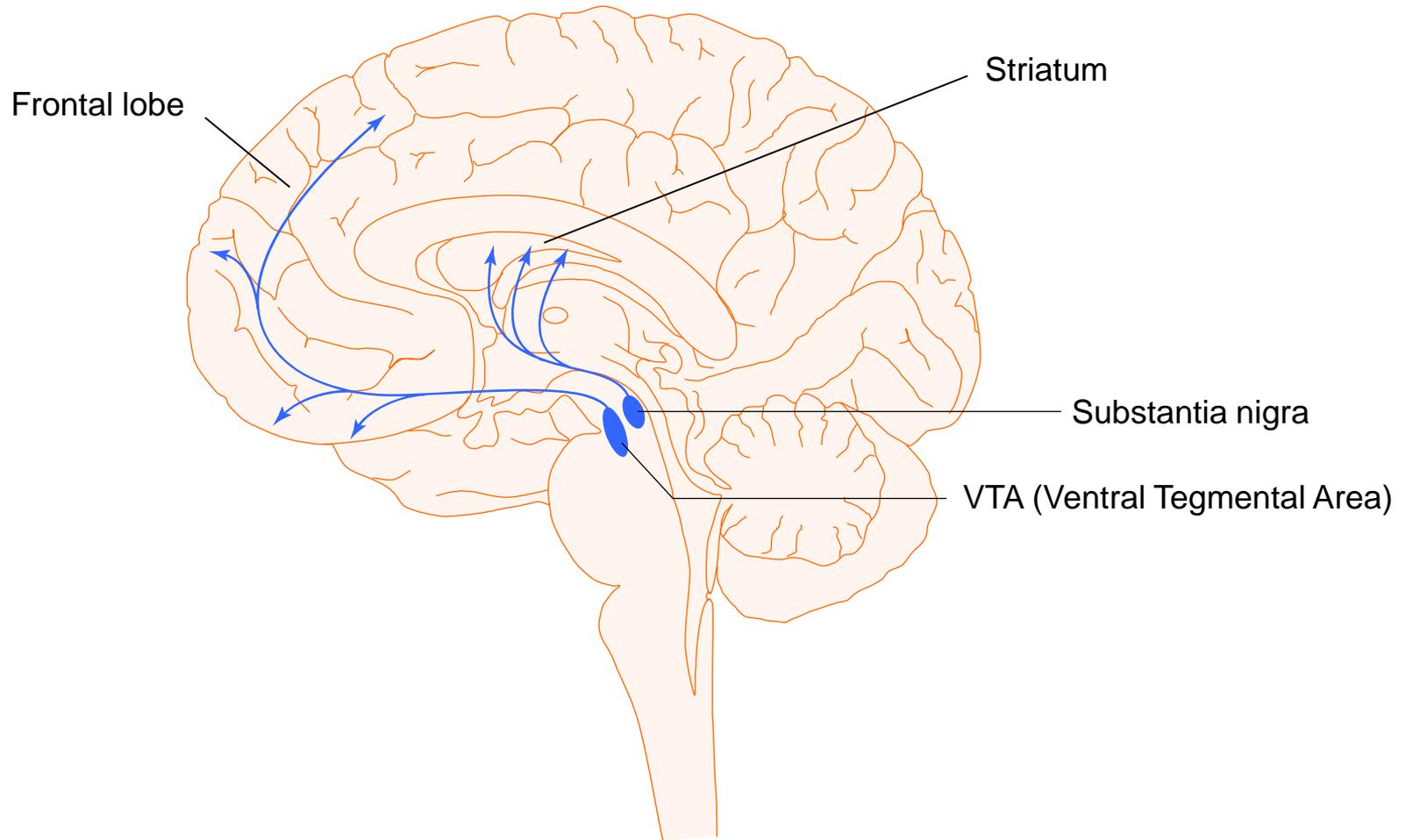
Nucl. n. III

Aquaeduct

Substantia nigra
pars compacta



Dopamine



week 8

Epithalamus
Epiphysis and
Commissura posterior

Thalamus dorsalis
Specific and unspecific nuclei,
Metathalamus (Corpora geniculata)

Subthalamus
Globus pallidus
Nucl. subthalamicus

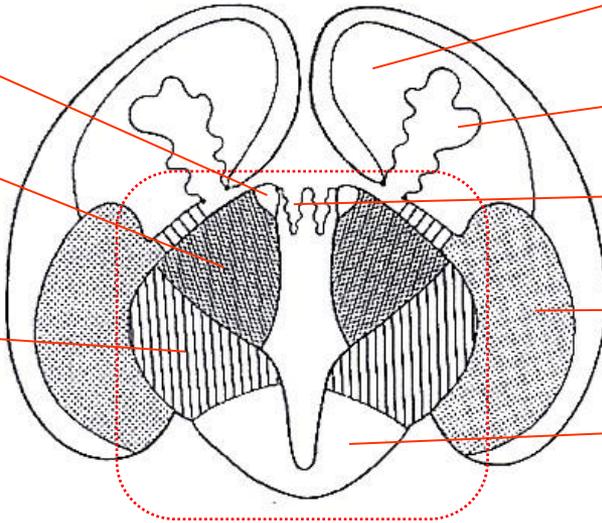
Nucleus caudatus

Thalamus dorsalis

Putamen

Globus pallidus

Tractus opticus



Lateral ventricle

Plexus of lateral ventricle

Plexus of III. ventricle

Ganglionic eminence

Hypothalamus
Hypophysis
Corpora mamillaria

adult

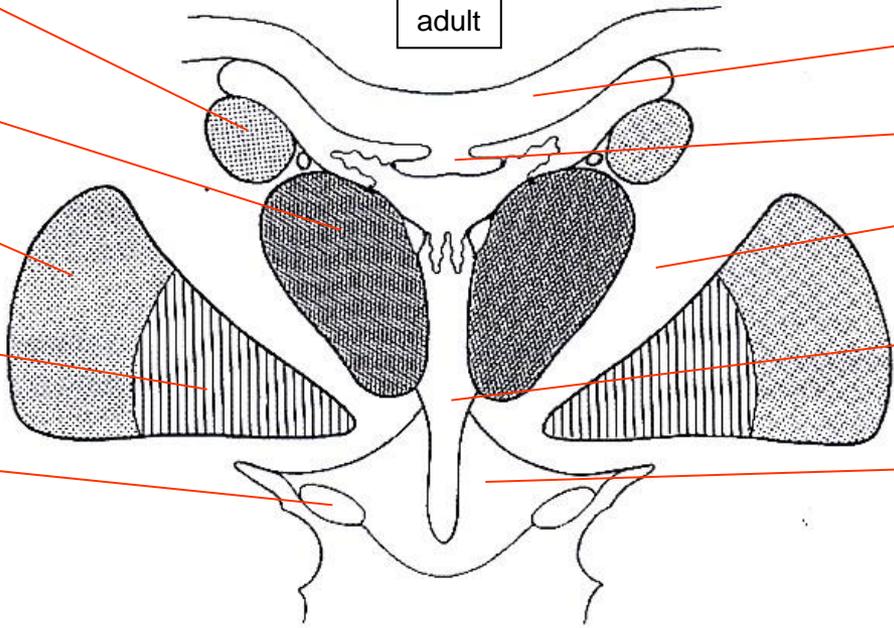
Corpus callosum

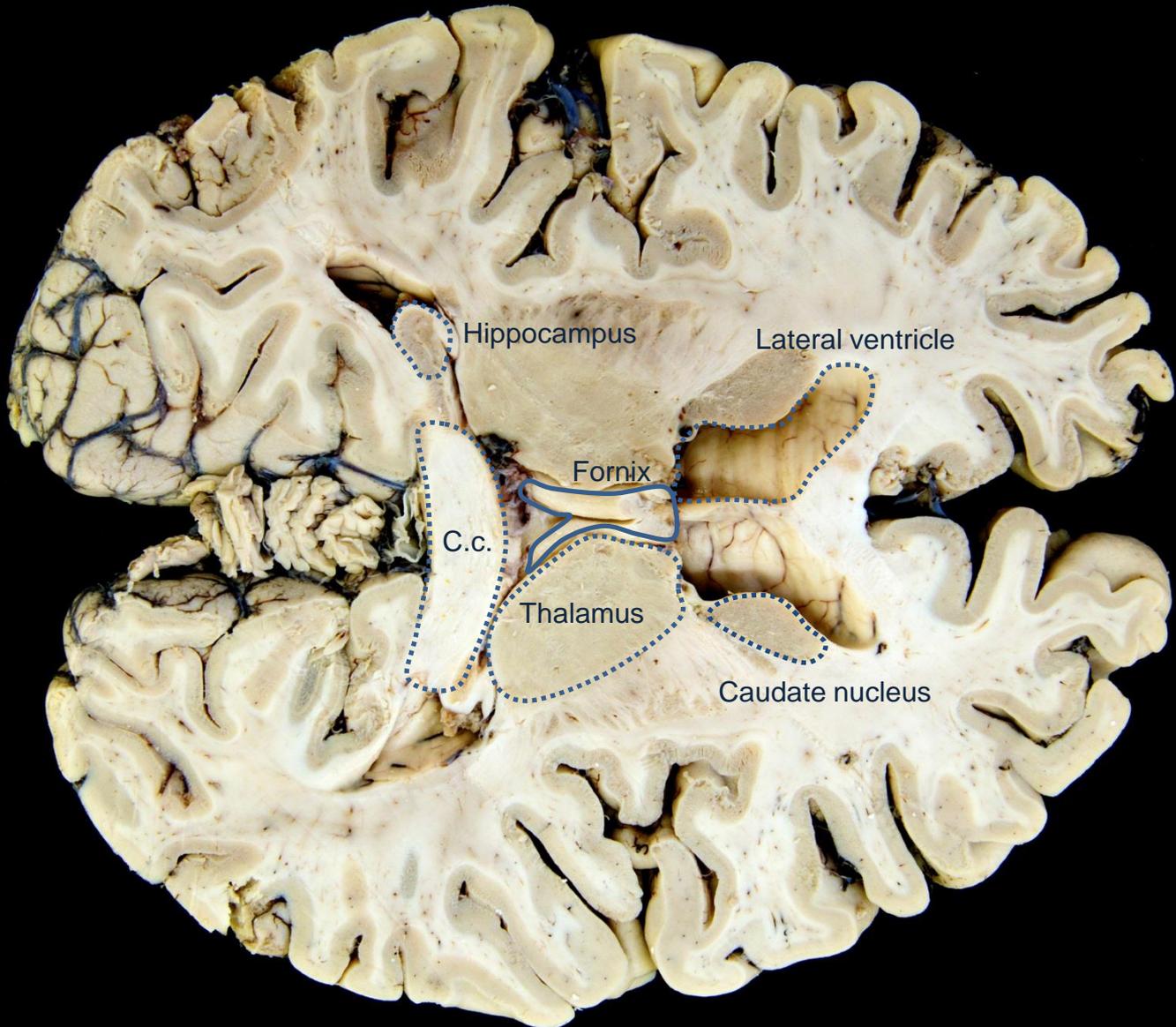
Fornix

Capsula interna

III. ventricle

Hypothalamus





Hippocampus

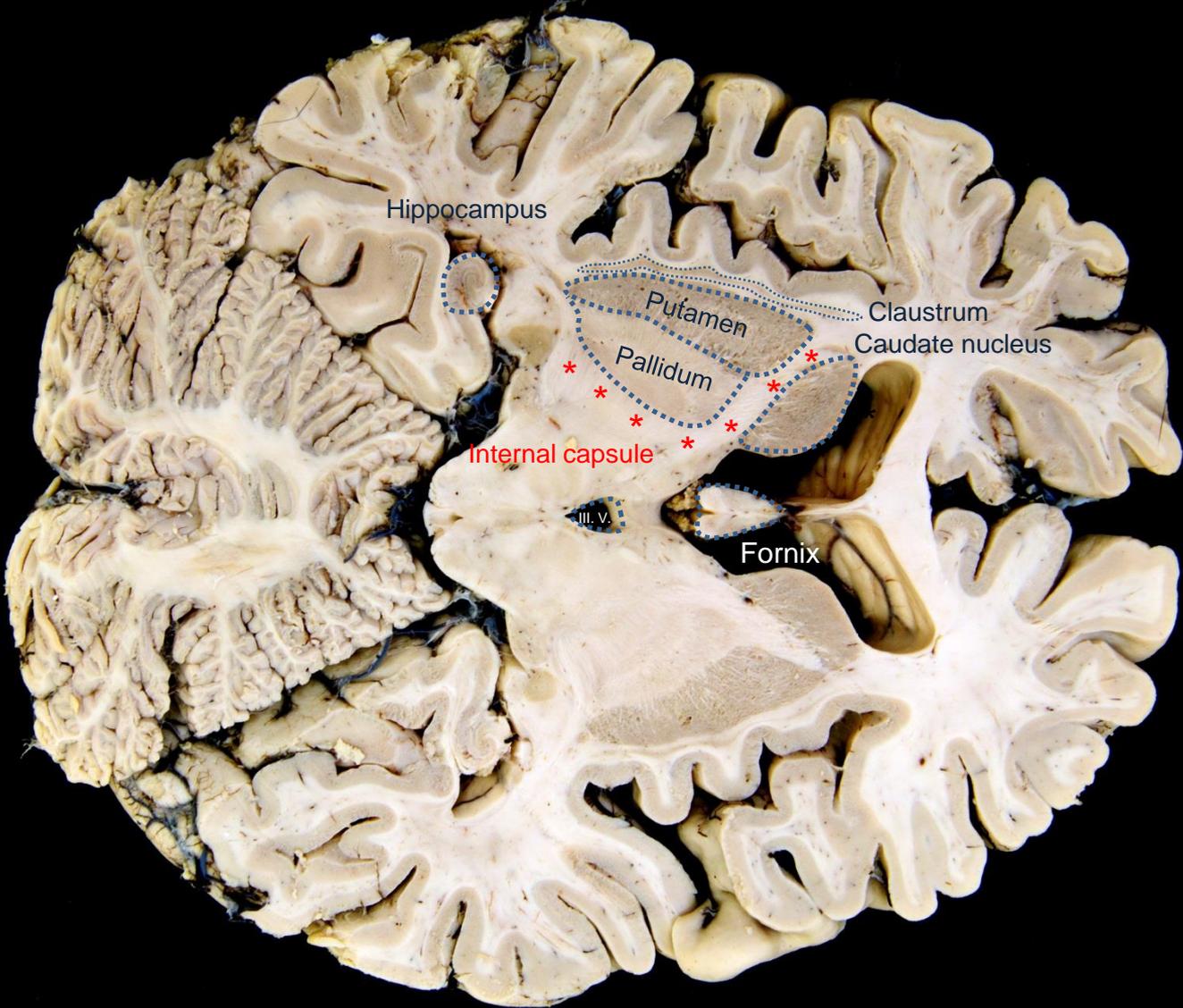
Lateral ventricle

Fornix

C.c.

Thalamus

Caudate nucleus



Hippocampus

Putamen

Pallidum

Internal capsule

III. V.

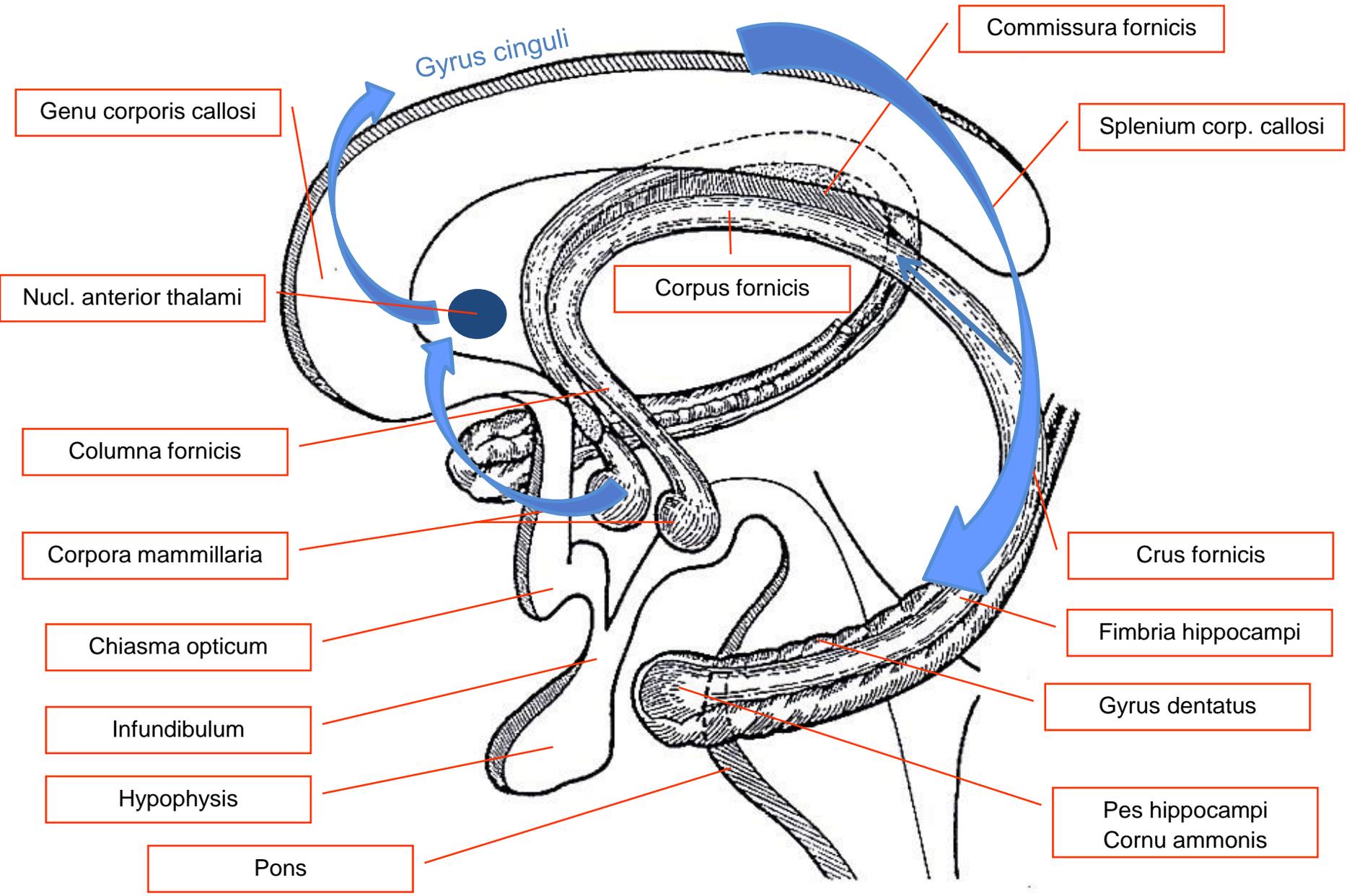
Fornix

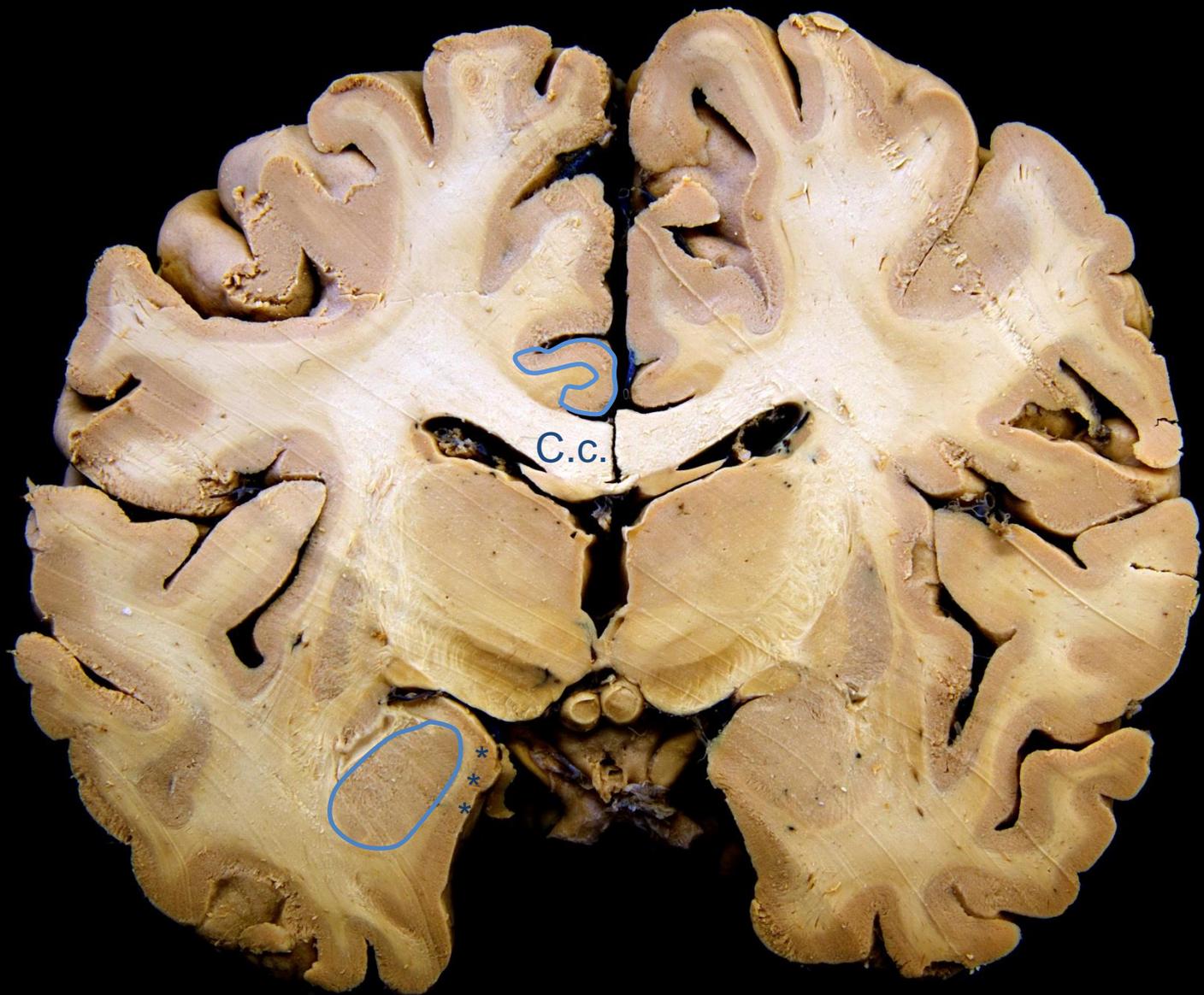
Clastrum

Caudate nucleus

Archi- and Paleocortex - 'Limbic System'

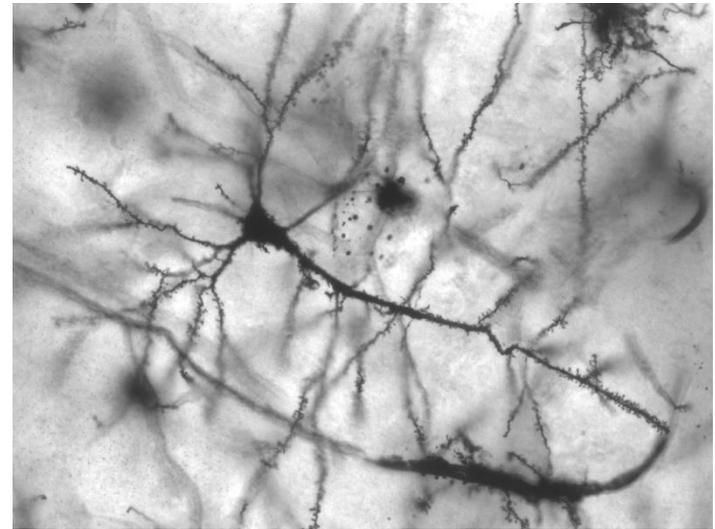
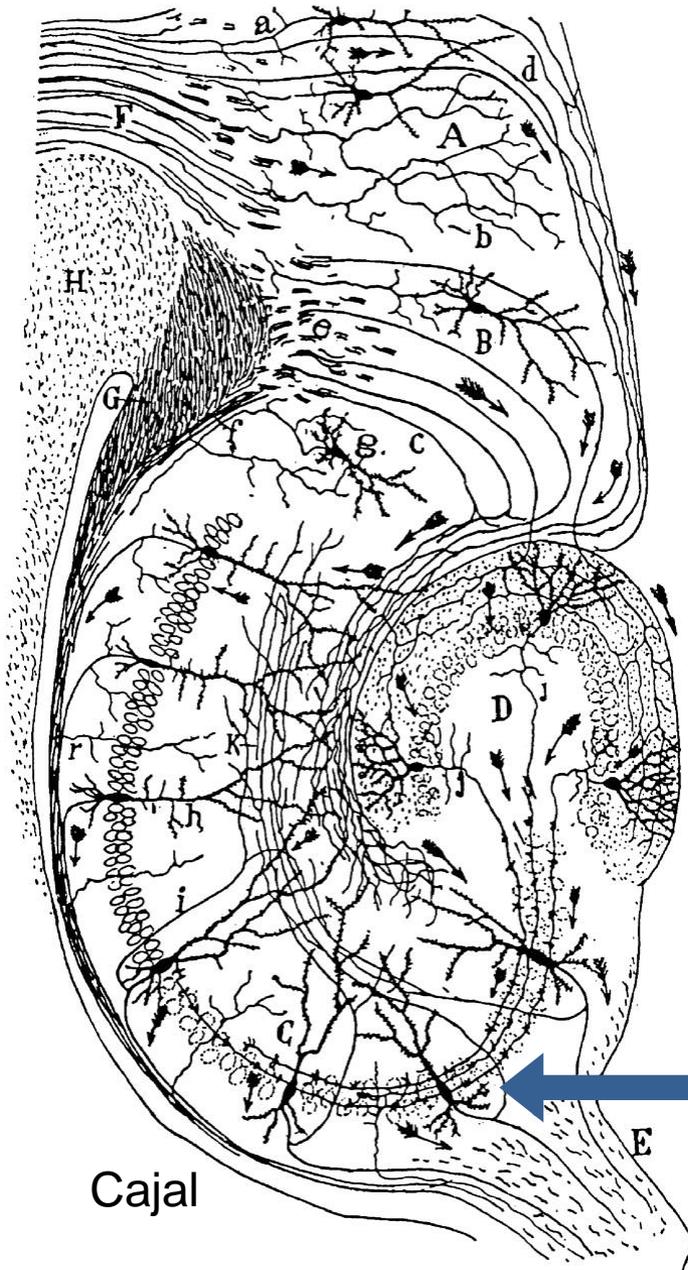
Limbic structures





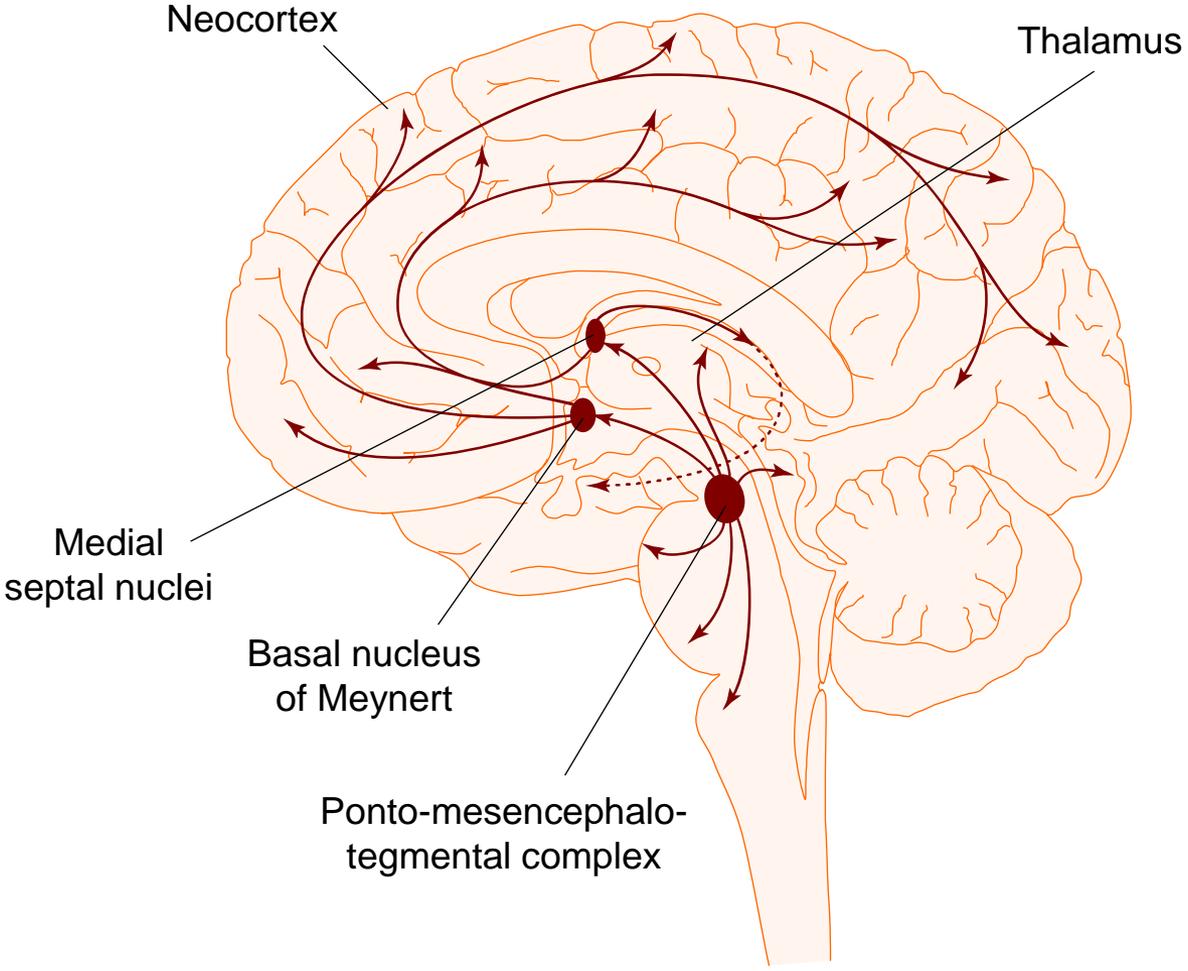
C.c.

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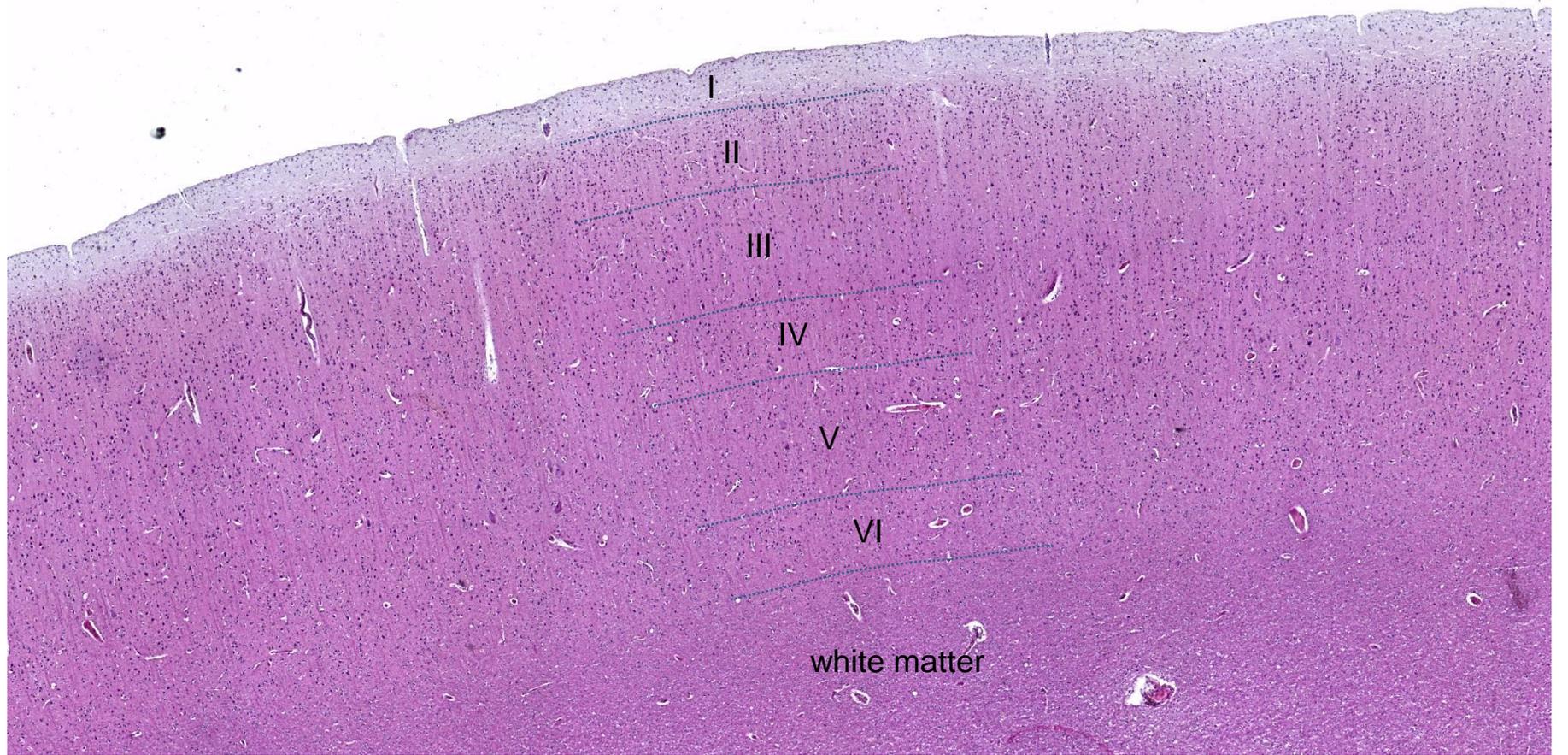


Cajal

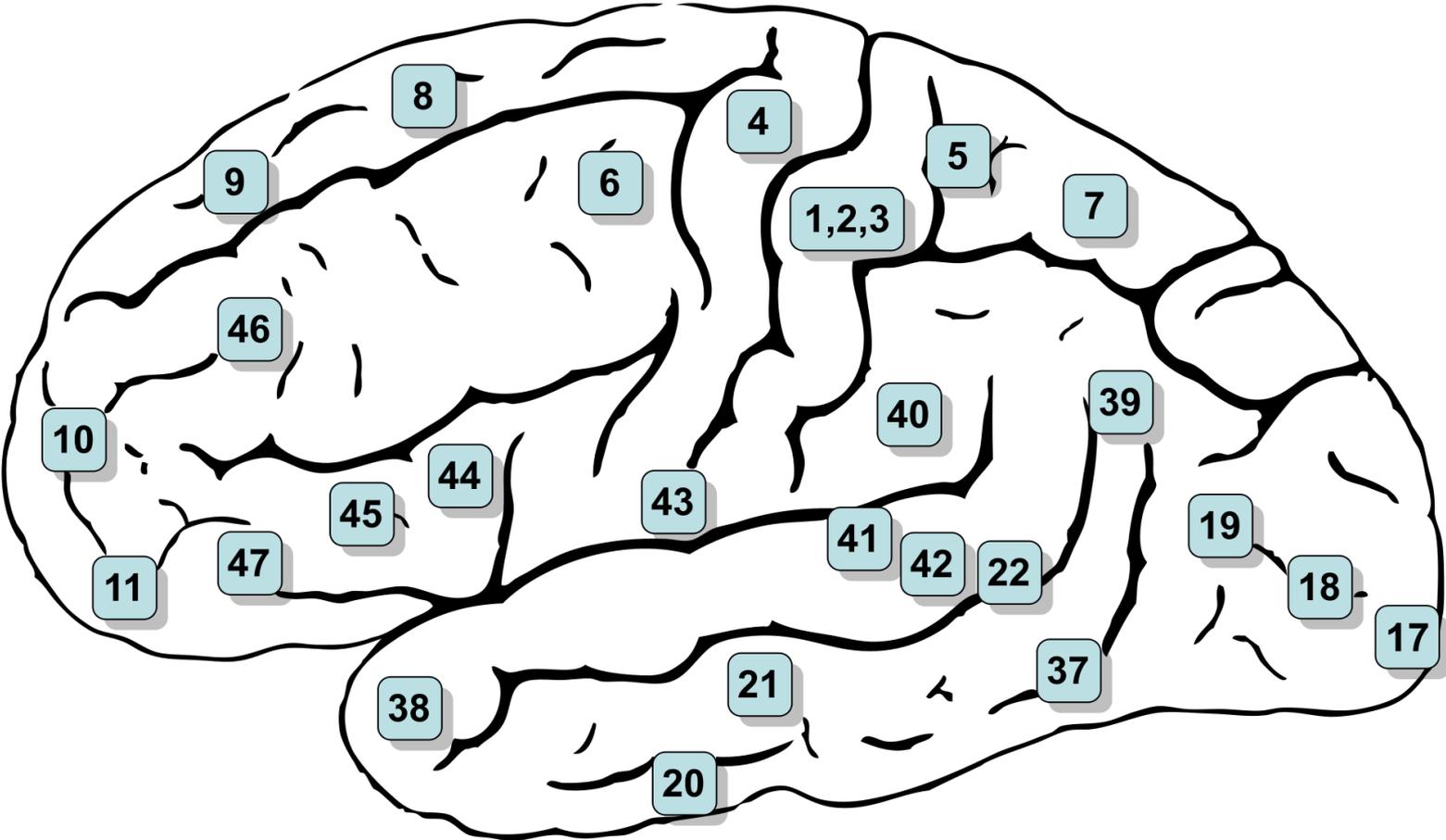
Acetylcholine

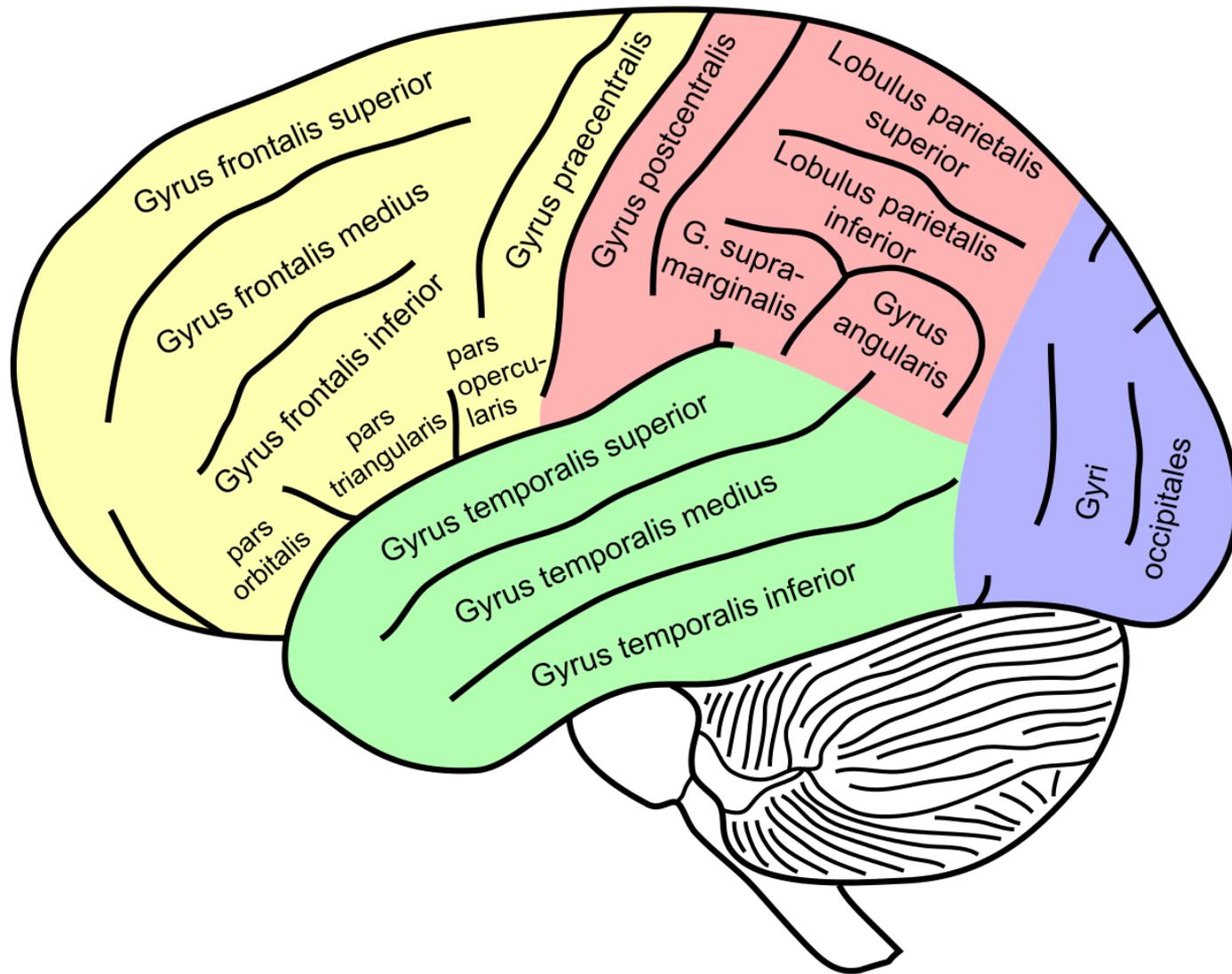


Neocortex cerebri



Brodmann Areas





Quantitative neuroanatomy of the neocortex - comparative aspects

- 50,000–100,000 neurons under 1 mm² cortical surface (primates have higher numbers in the visual cortex)
- Cortical thickness varies (2–4 mm) and is highest in humans
- 100,000,000 cortical minicolumns with up to 110 neurons each
- Cortical neurons packed at high density: ~100,000/mm³ (mouse), humans (24,000/mm³), rats (55,000/mm³), and only 6,000/mm³ in elephants

Terrestrial brain	Elephant	Human	Rat
Brain weight (g)	<u>4800</u>	1300	2
Neocortex (mm ²)	<u>630,000</u>	250,000	600
Neuron density (/mm ³)	6000	24,000	<u>55,000</u>
Neuron number	11 billion	<u>20 billion</u>	0.02 billion

- Each neuron contacts 500 other neurons on average; synaptic density remarkably similar at around 1 billion synapses per mm³; 80% of cortical neurons are excitatory and 20% are inhibitory; average number of synapses per neuron = 8000
- Dependent on cortical thickness axonal length is appr. 4 km/mm³ and dendritic length is appr. 0.4 km/mm³

Thank you for your attention!