Introduction to the Nervous System

OR

"Everything You Need to Know About the Brain in One Hour"

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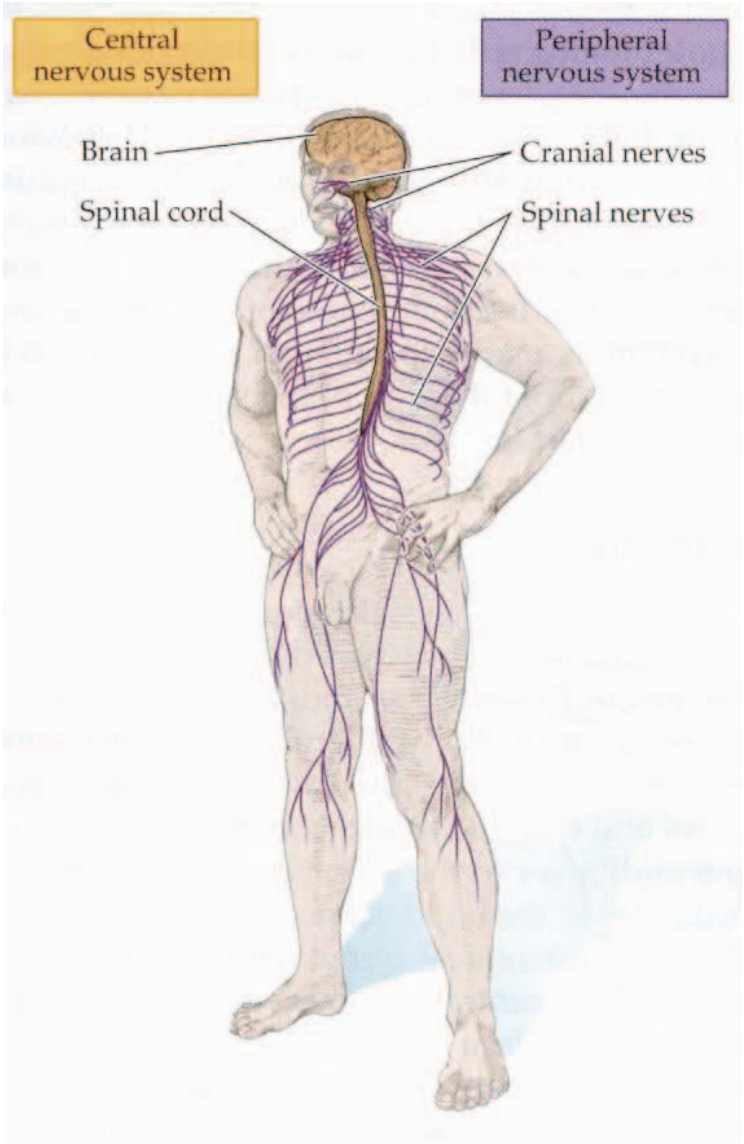
August 2, 2010

Overview of the Nervous System



Central vs. Peripheral

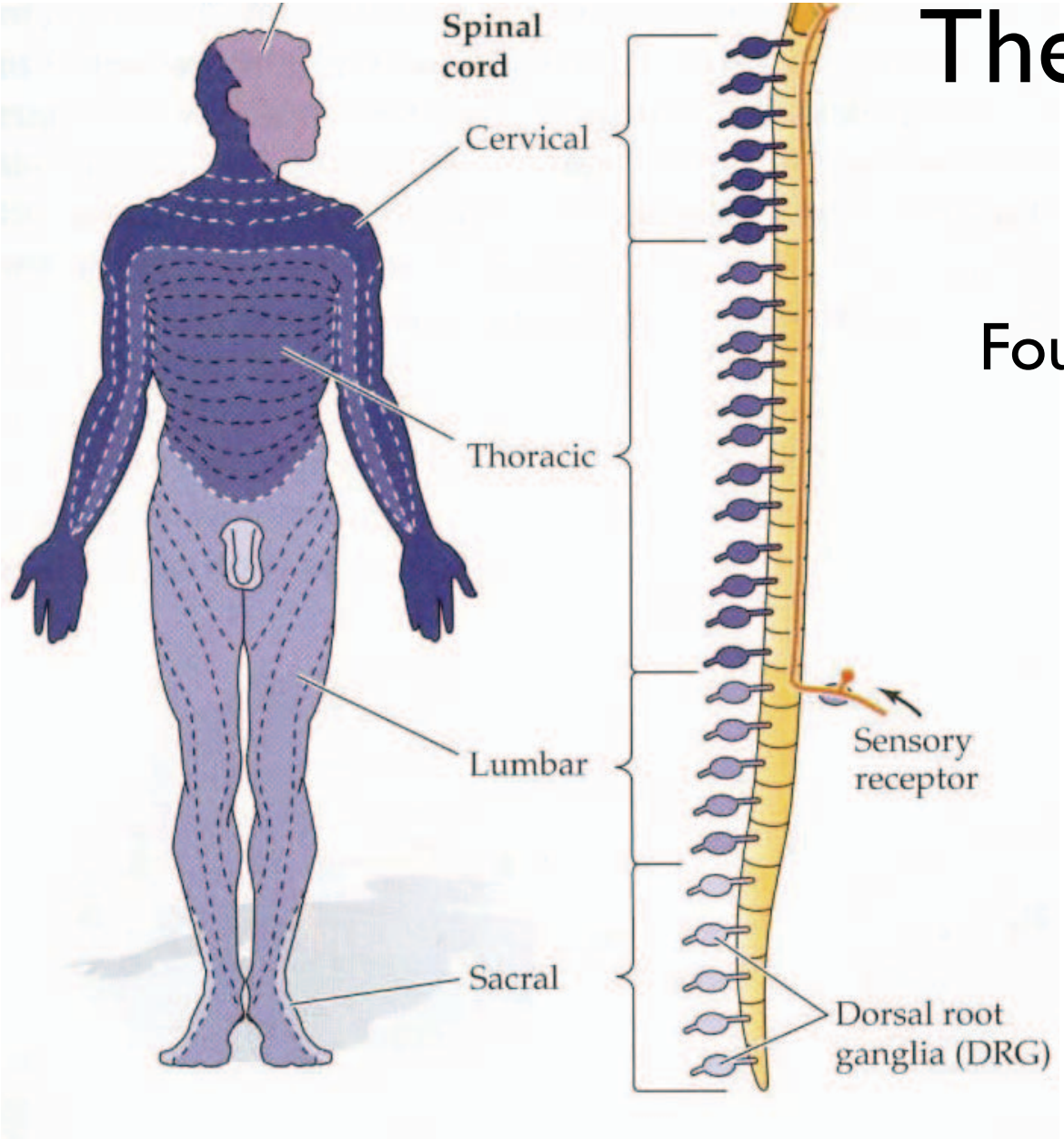
Peripheral:

- somatic (nerves, ganglia)
- autonomic (enteric)

Central:

- spinal cord
- brain

The Spinal Cord

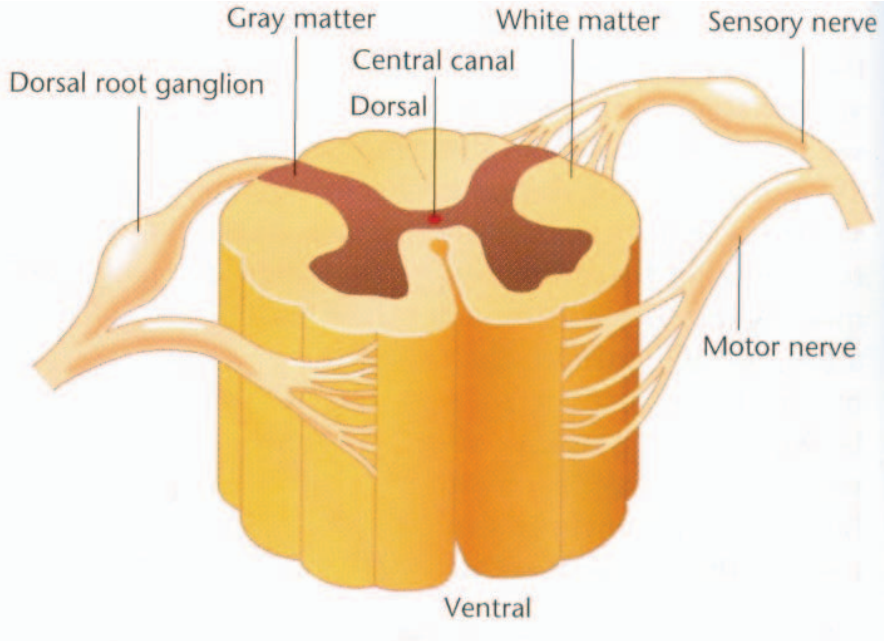


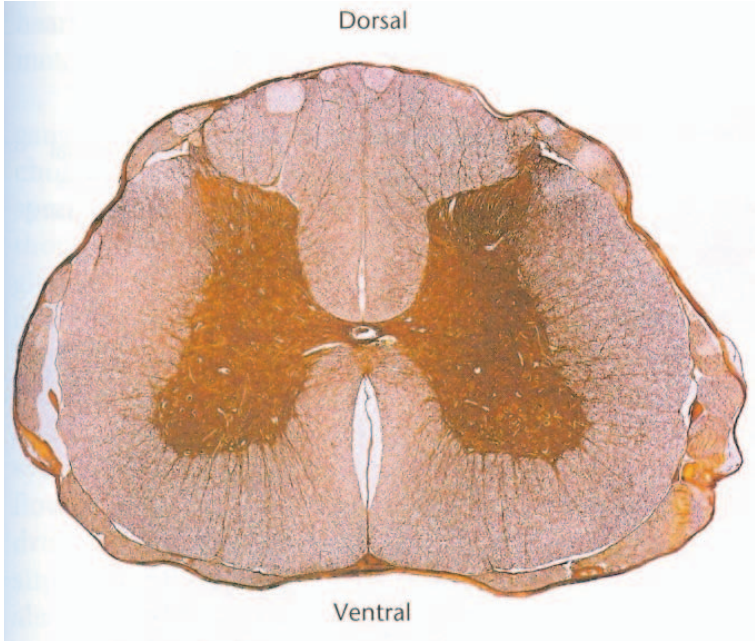
Four Main Divisions

Local Circuits in the Spinal Cord

Dorsal roots: sensory
Ventral roots: motor

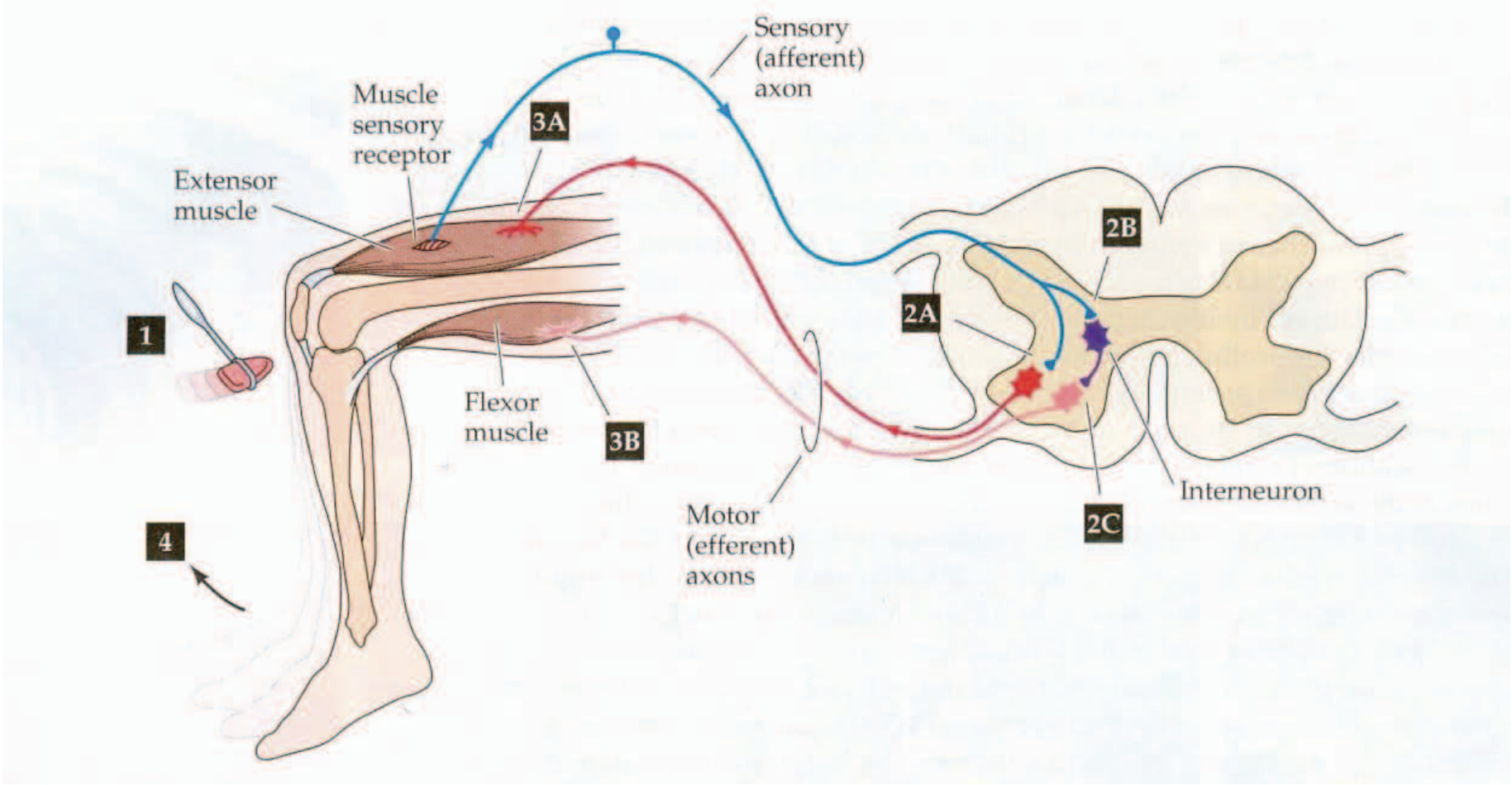
Grey matter: cell bodies
White matter: fibers





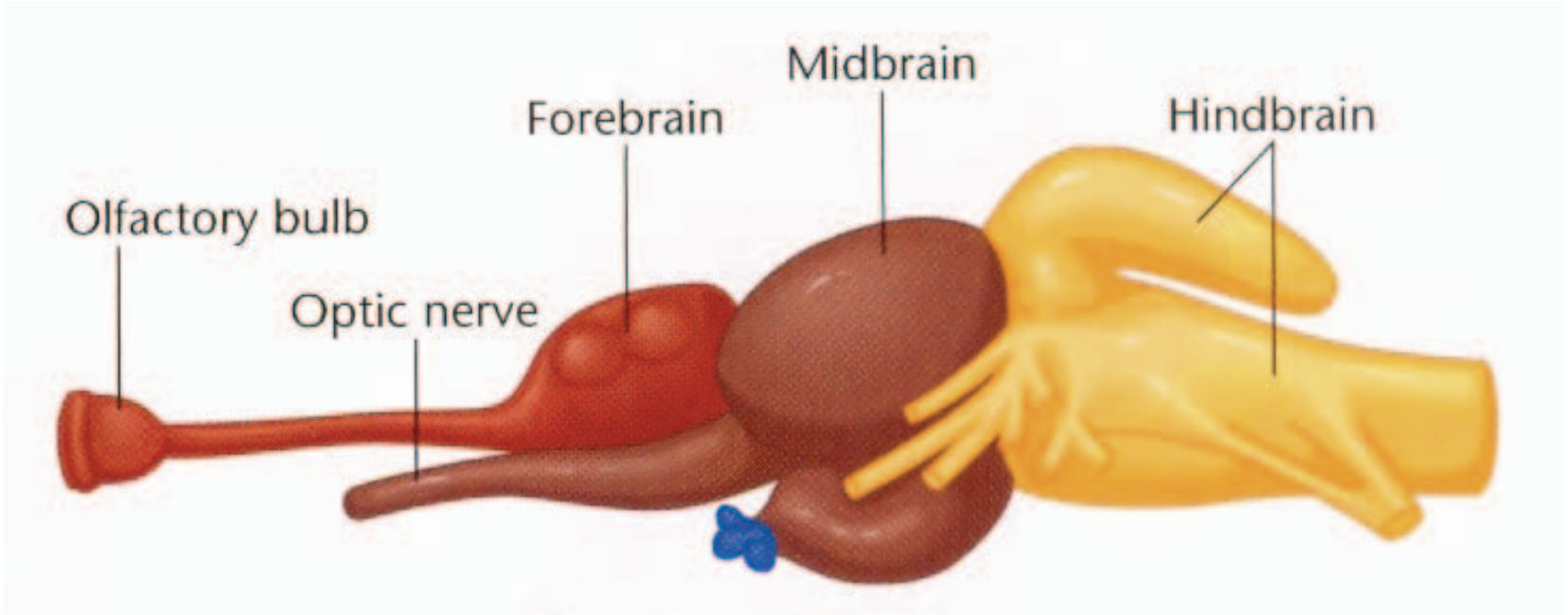
Local Operations in the Spinal Cord

- Reflexes
- Central pattern generators

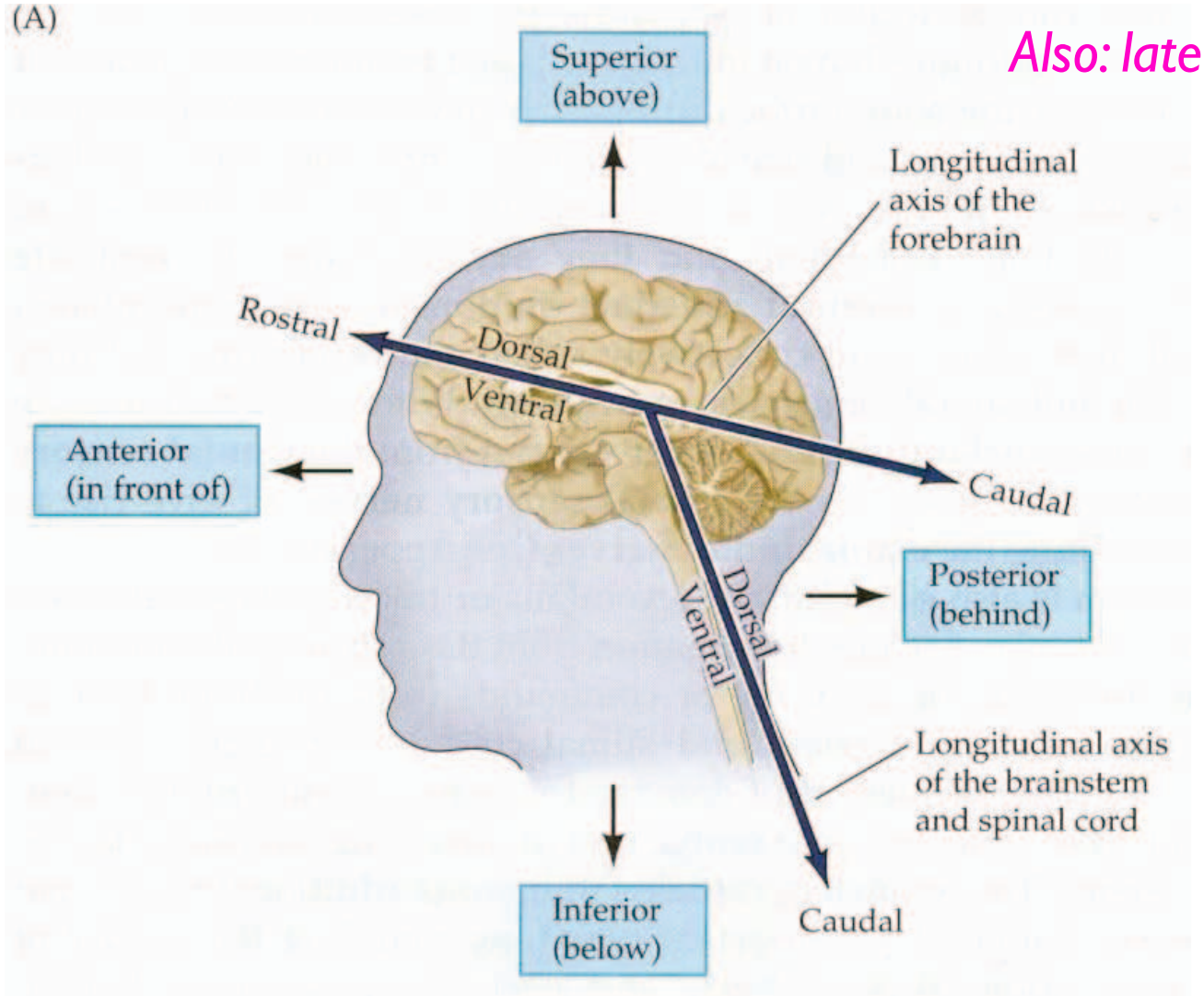


Basic Divisions of the Brain

- Hindbrain, Midbrain, Forebrain

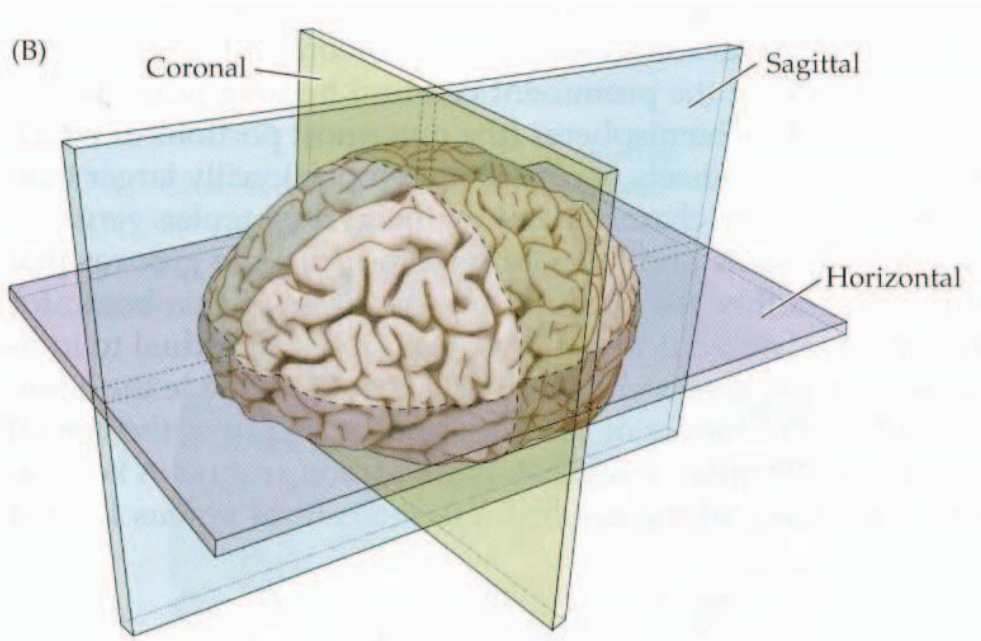


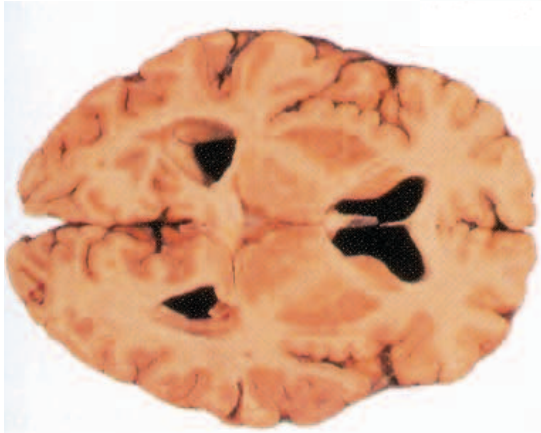
Anatomical Terms: Directions in the Brain



Also: lateral vs. medial

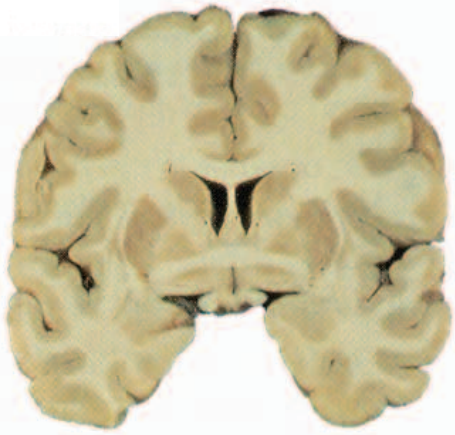
Anatomical Terms: Sections of the Brain





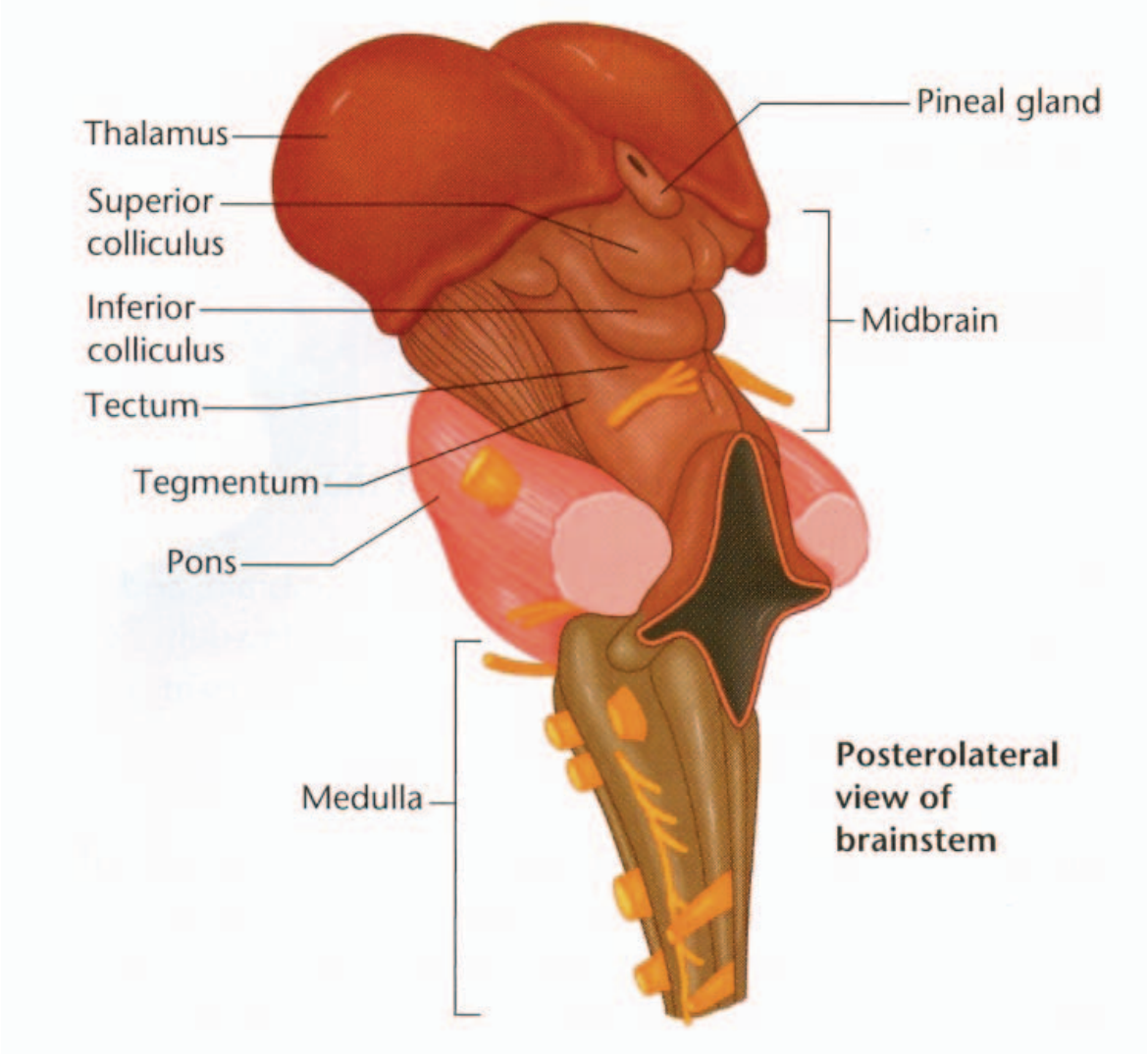
Horizontal plane

Sagittal plane



Coronal plane

Key Part #1: Brainstem

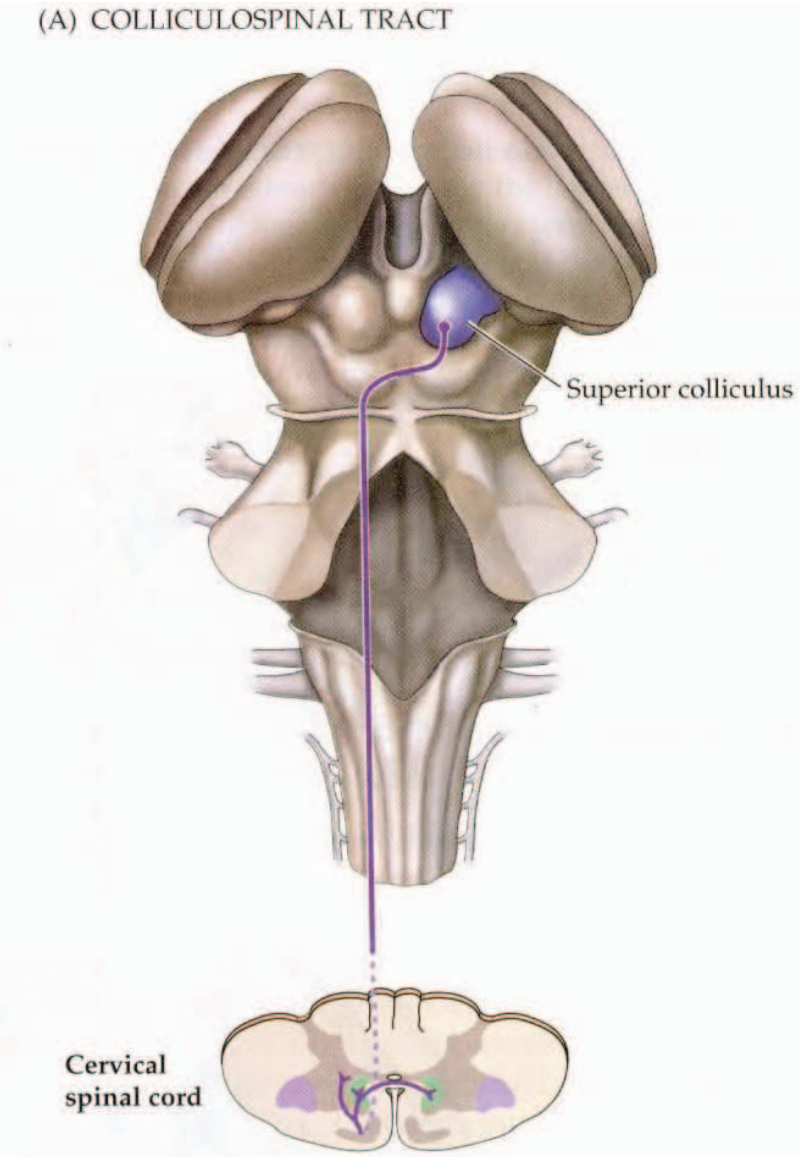


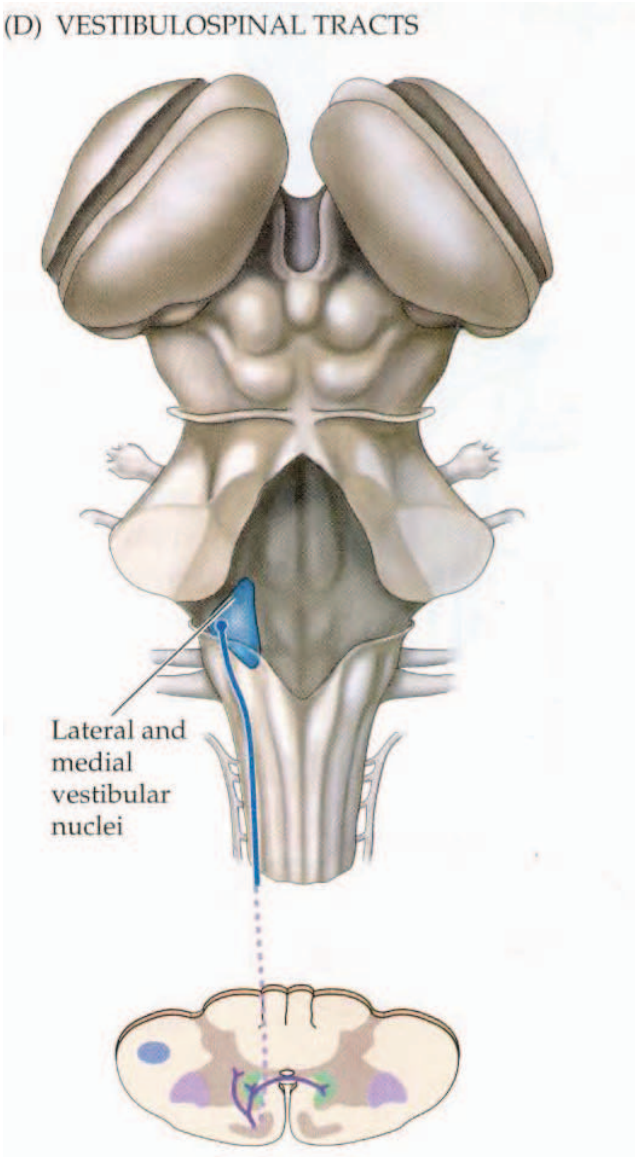
Definition:
Hind + Mid – Cerebellum

Local Circuits:
- dedicated
- automatic
- "early"

Examples:
- pre-Bötzinger complex
- superior colliculus

Brain Stem Pathways





Key Part #2: Thalamus

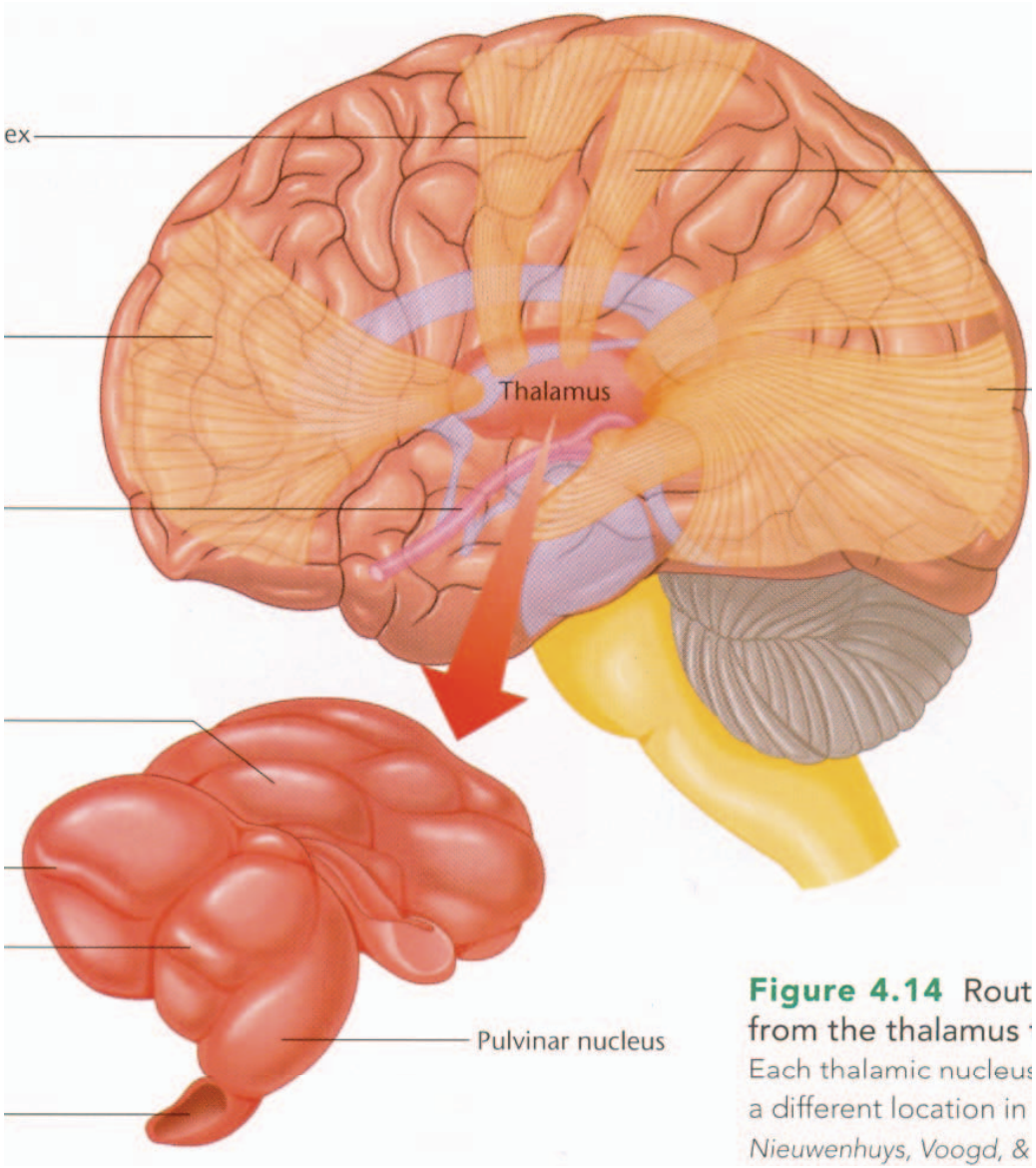
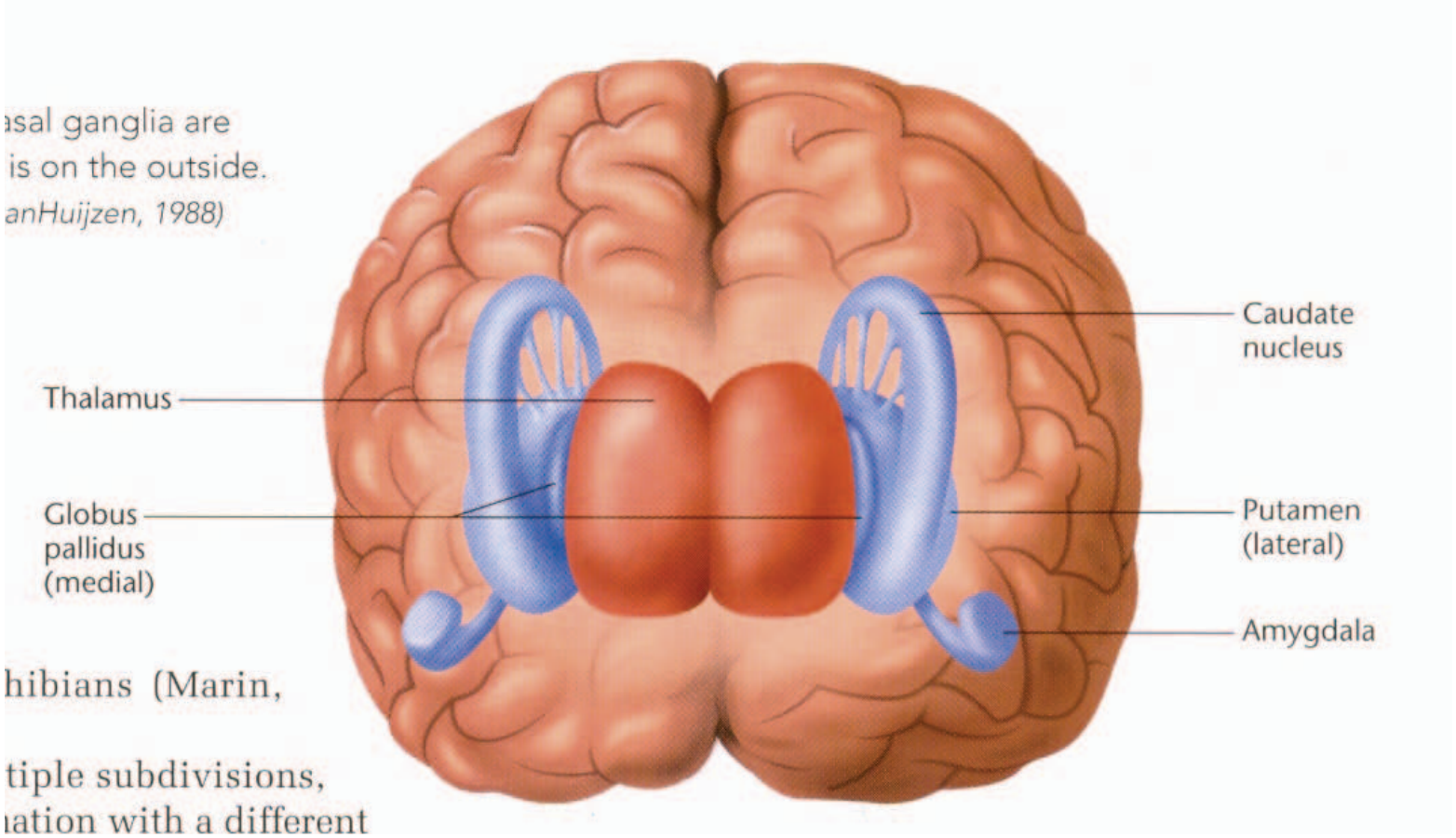


Figure 4.14 Rout
from the thalamus
Each thalamic nucleus
a different location in
Nieuwenhuys, Voogd, &

- Sensory gateway to the brain
- Reciprocal circuits with cortex
- Role in sleep

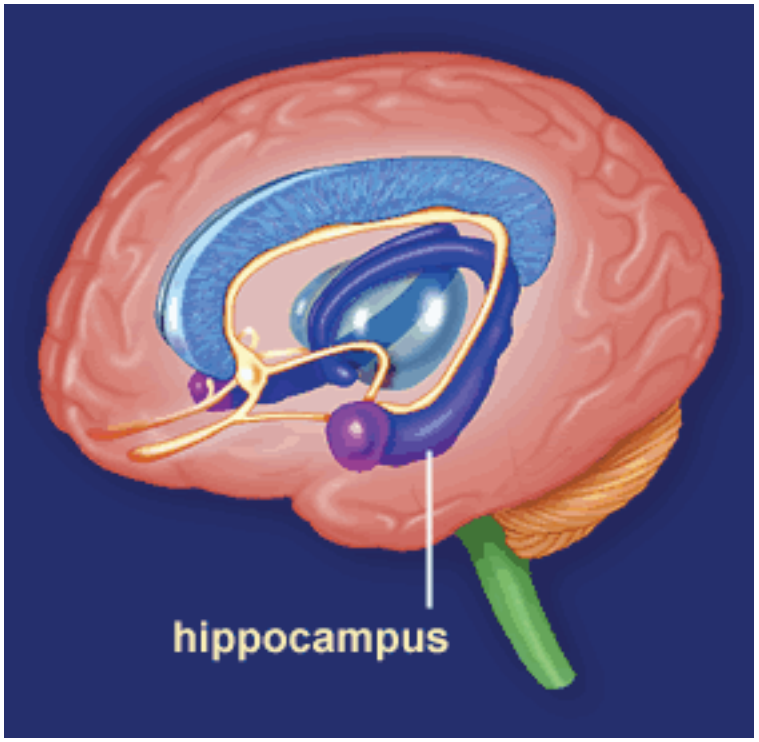
Key Part #3: Basal Ganglia

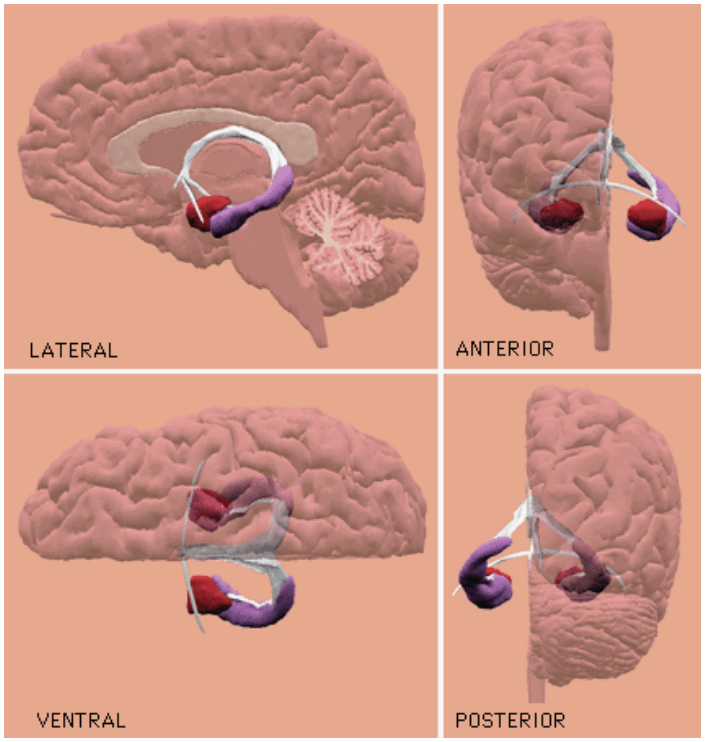
- Underneath the cortex
- Three Divisions: caudate, putamen, globus pallidus
- Involved in gating voluntary movement



Key Part #4: Hippocampus

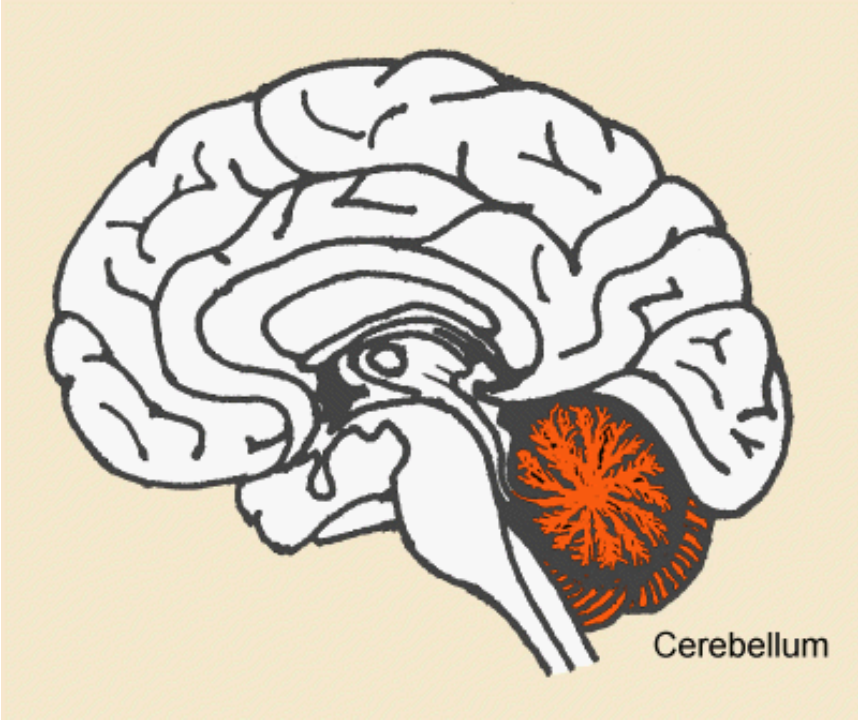
- Formation of long-term memory

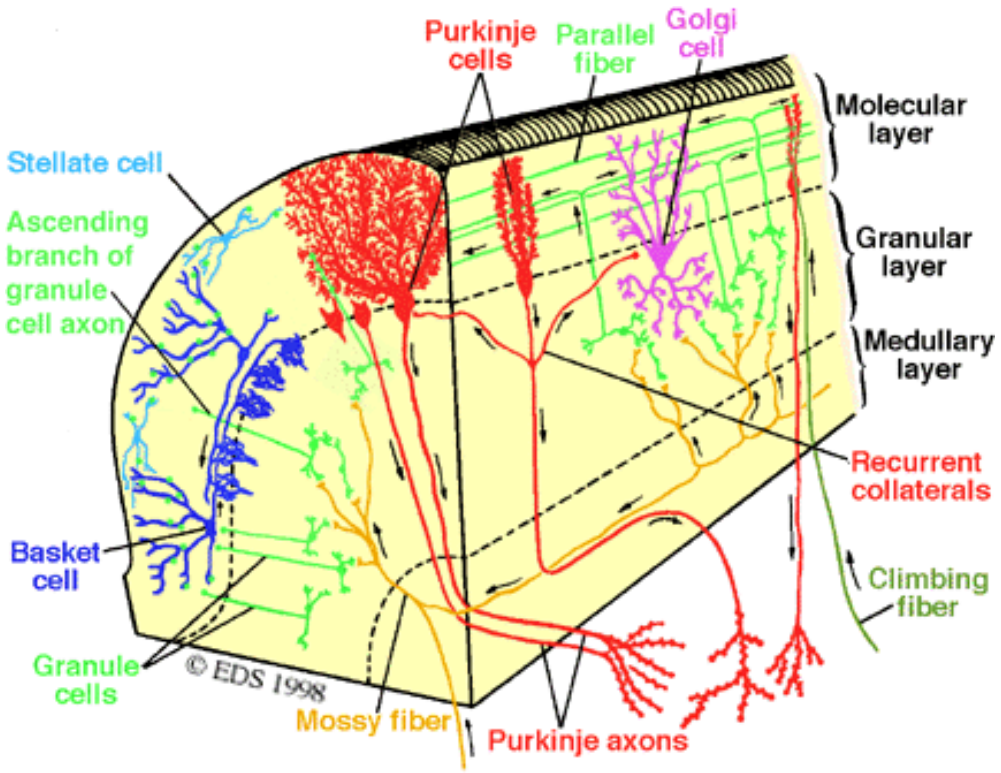




Key Part #5: Cerebellum

- Fine motor control

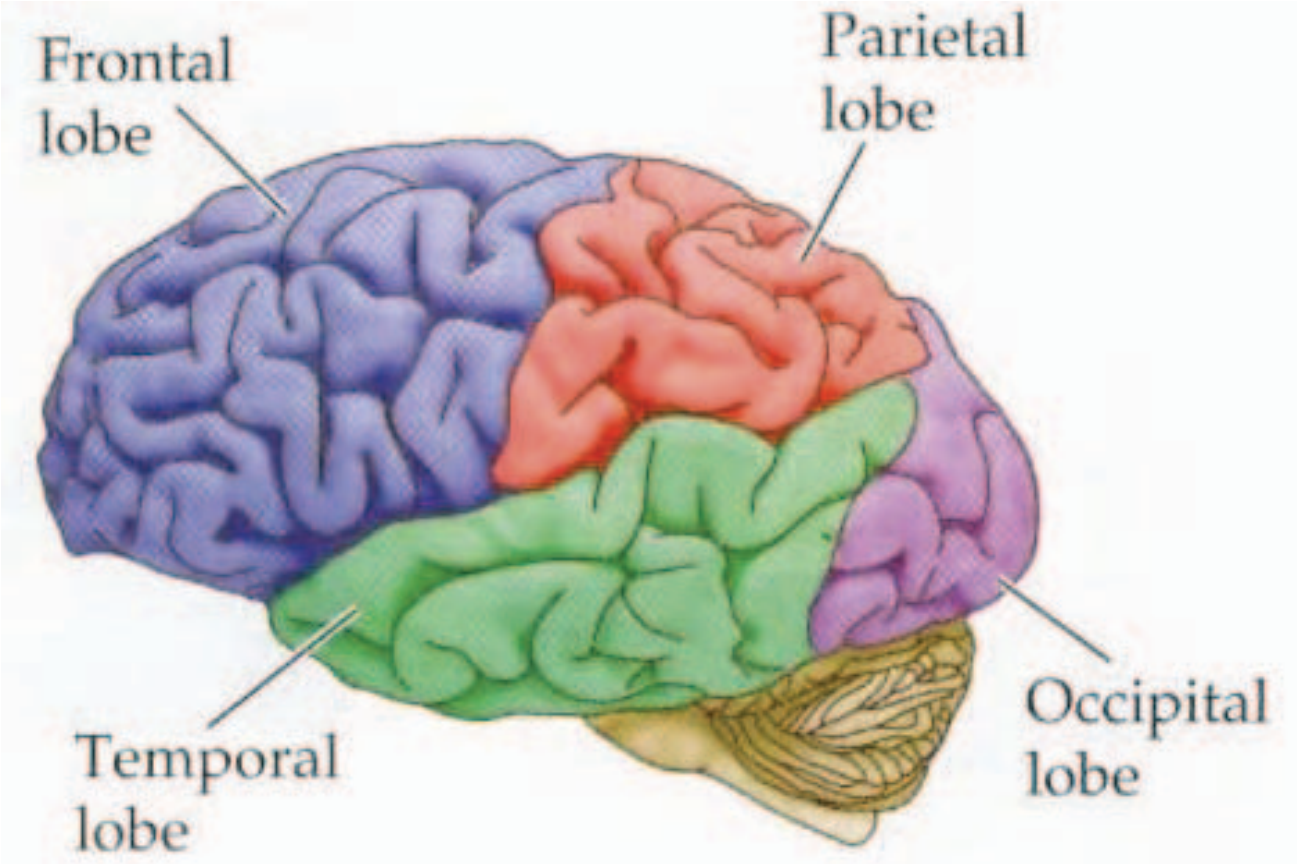




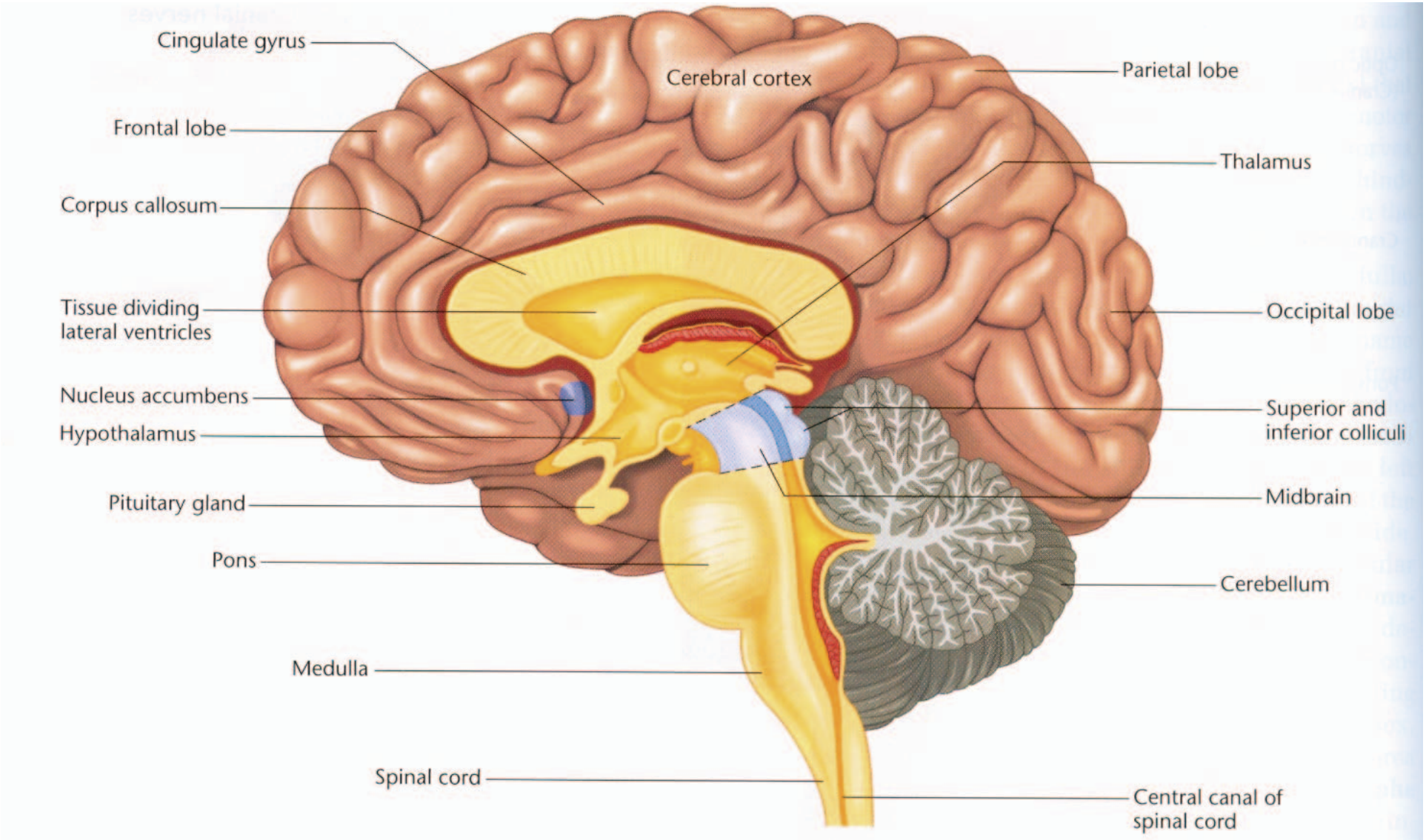
Key Part #6: Cerebral Cortex

- Four main lobes

Sulcus vs. gyrus



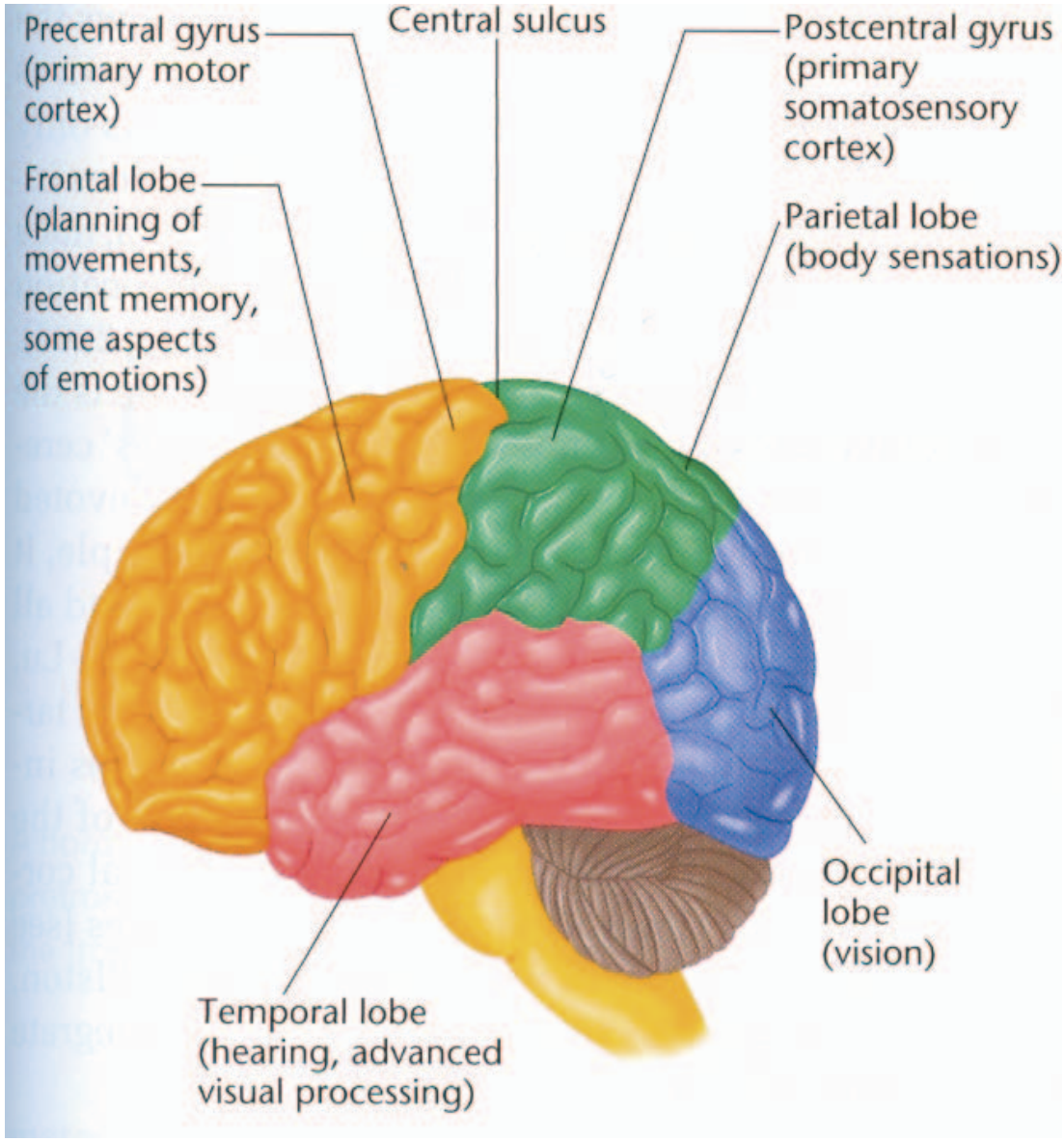
Overview


Cingulate gyrus
Cerebral cortex
Parietal lobe
Frontal lobe
Thalamus
Corpus callosum
Tissue dividing lateral ventricles
Occipital lobe
Nucleus accumbens
Superior and inferior colliculi
Hypothalamus
Pituitary gland
Midbrain
Pons
Cerebellum
Medulla
Spinal cord
Central canal of spinal cord

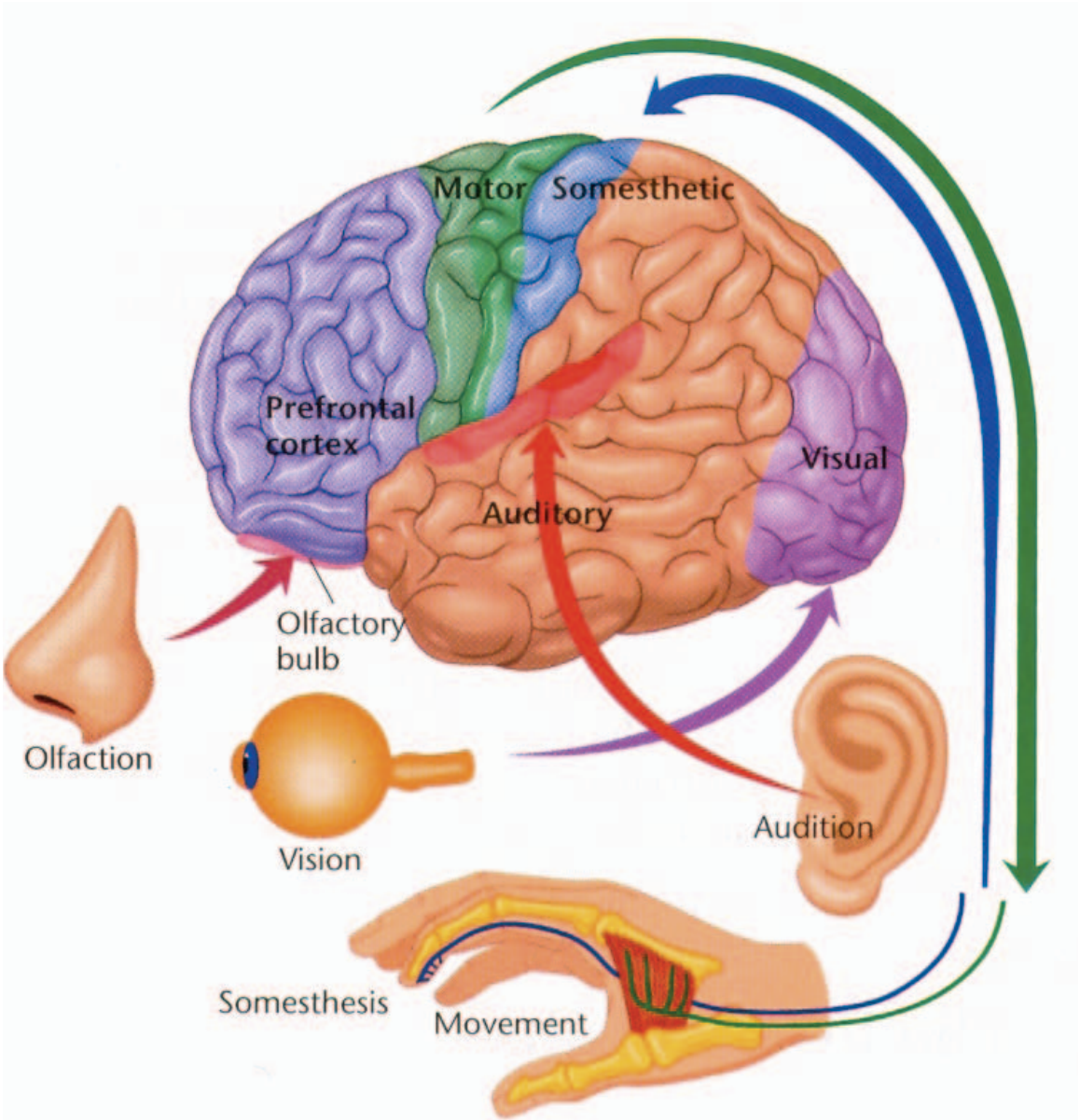
Slicing it a Different Way

- Brainstem = hindbrain + midbrain – cerebellum
- Limbic System = hippocampus + amygdala + cingualte cortex + others
- Forebrain = diencephelon + telencephelon
- Diencephelon = thalamus + hypothalamus
- Telencephelon = cortex + hippocampus + basal ganglia

Functional Divisions of the Cortex

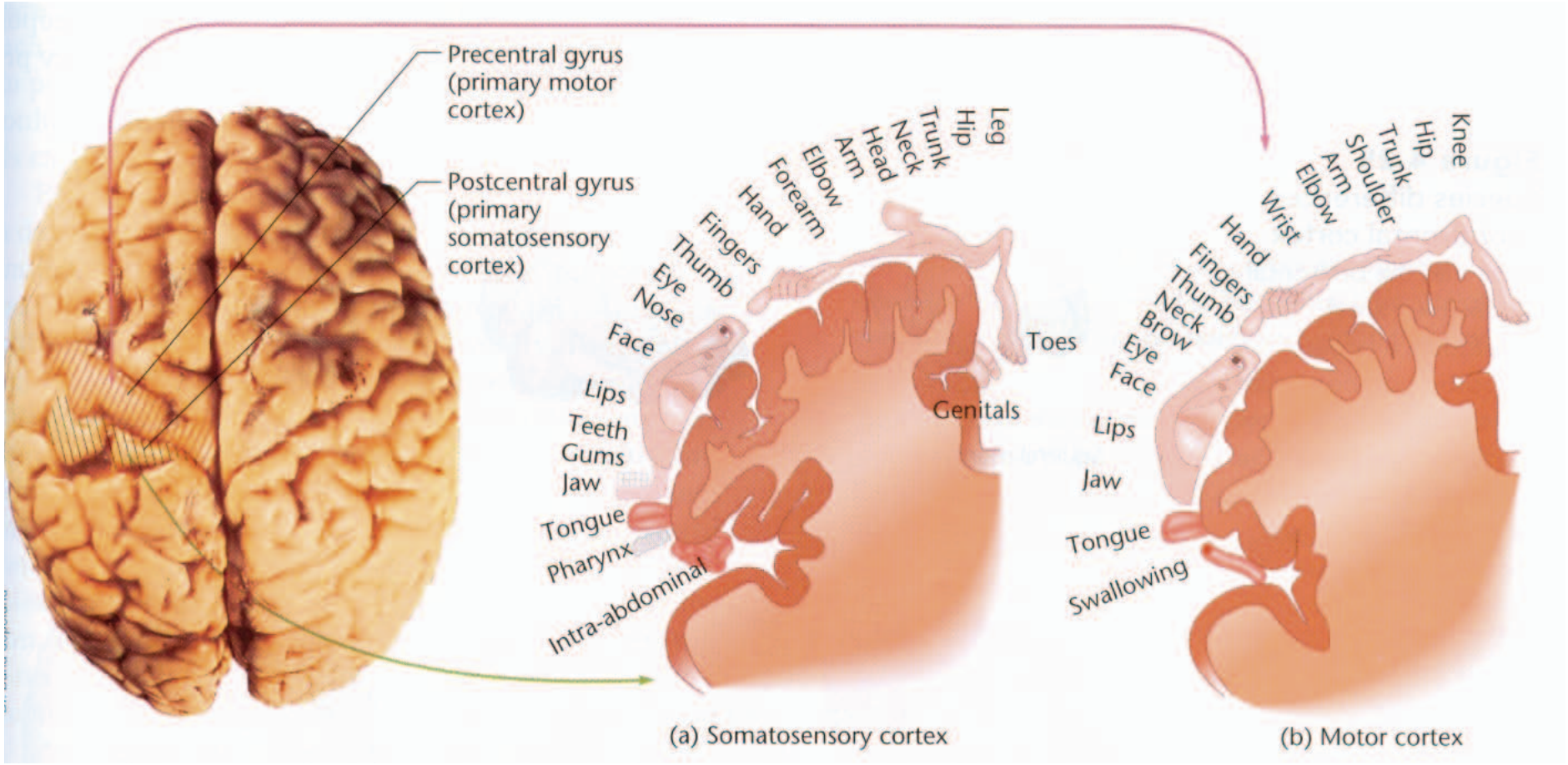


Organization of Sensory Information



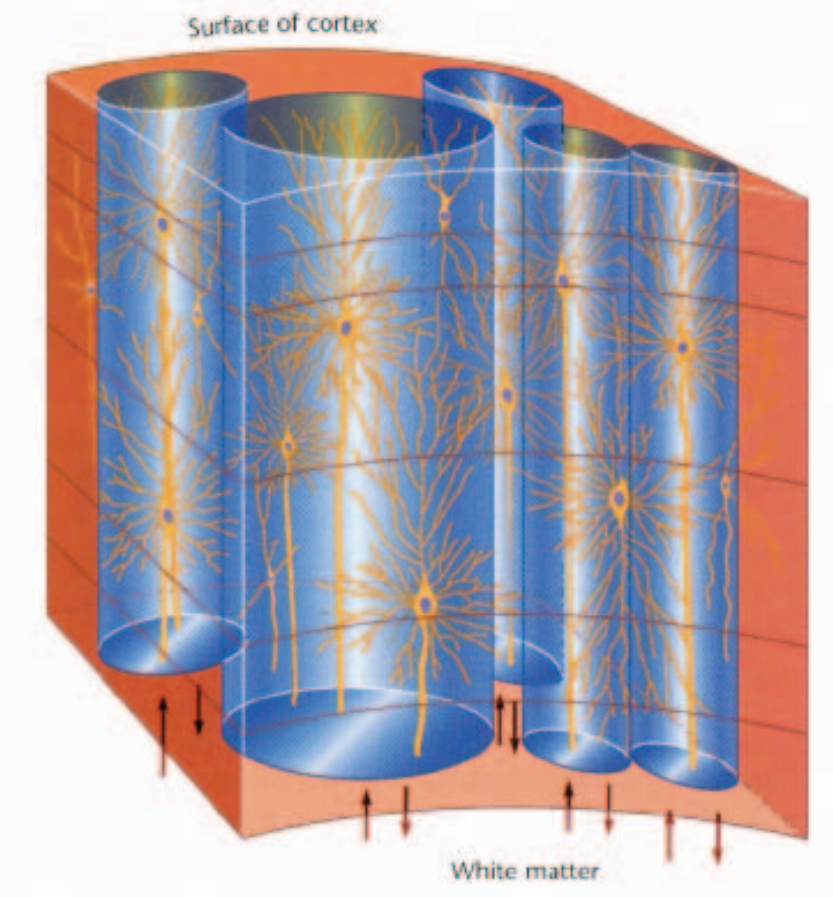
A Map of the Body

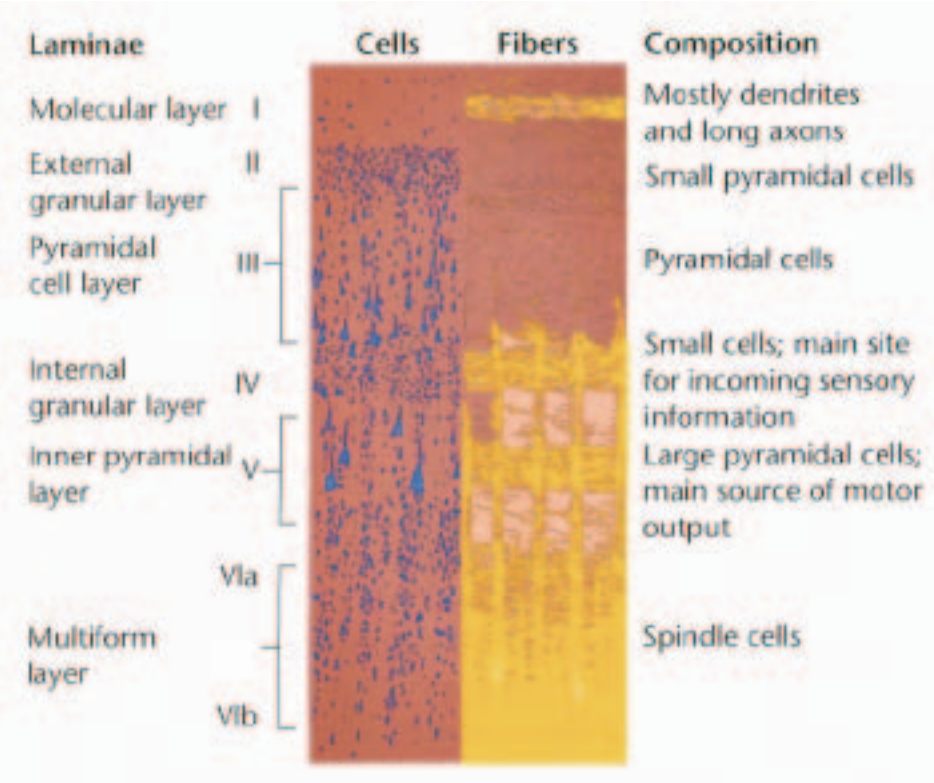
- Penfield's sensory/motor homunculus



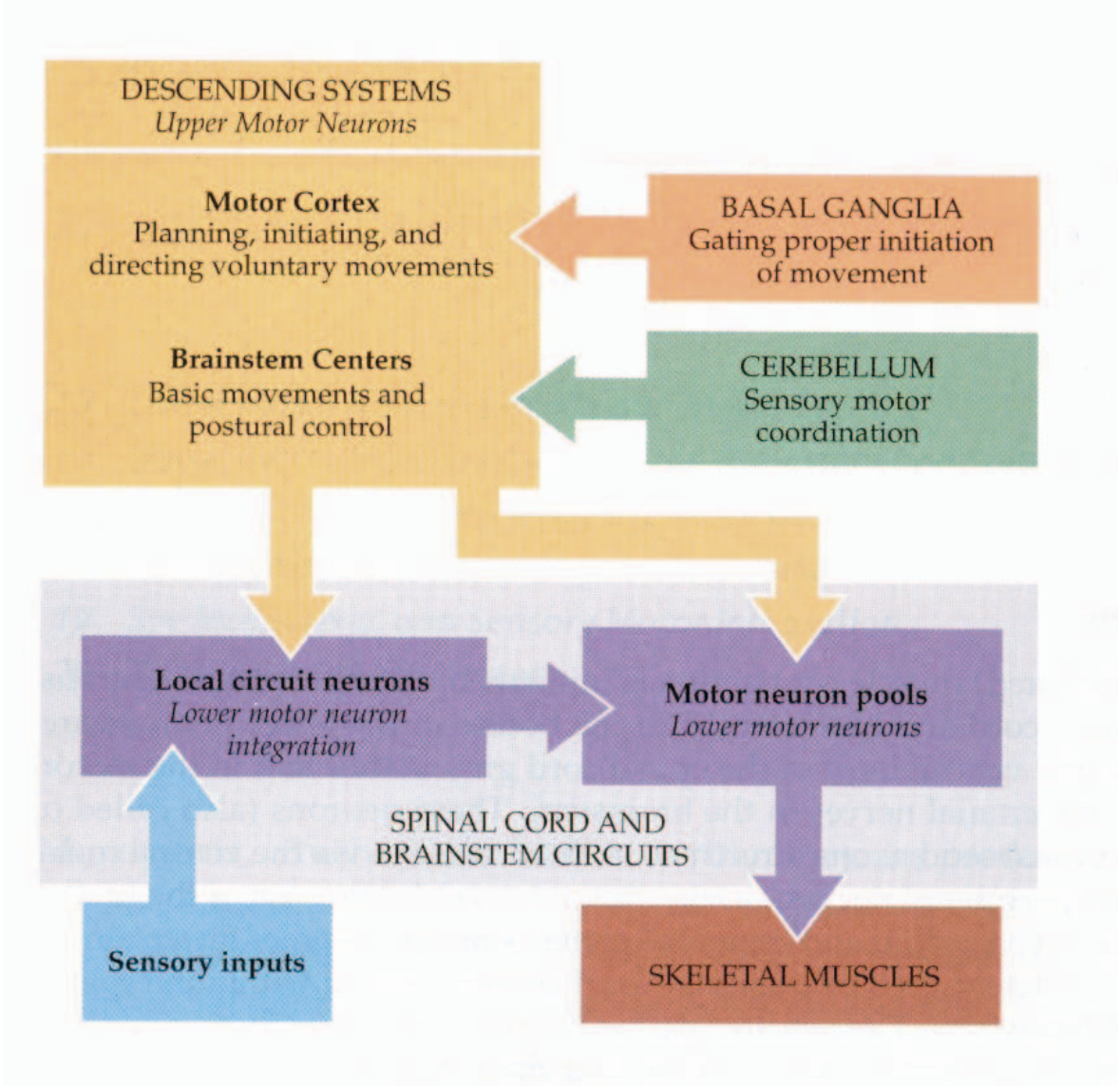
Microcircuits of the Cortex

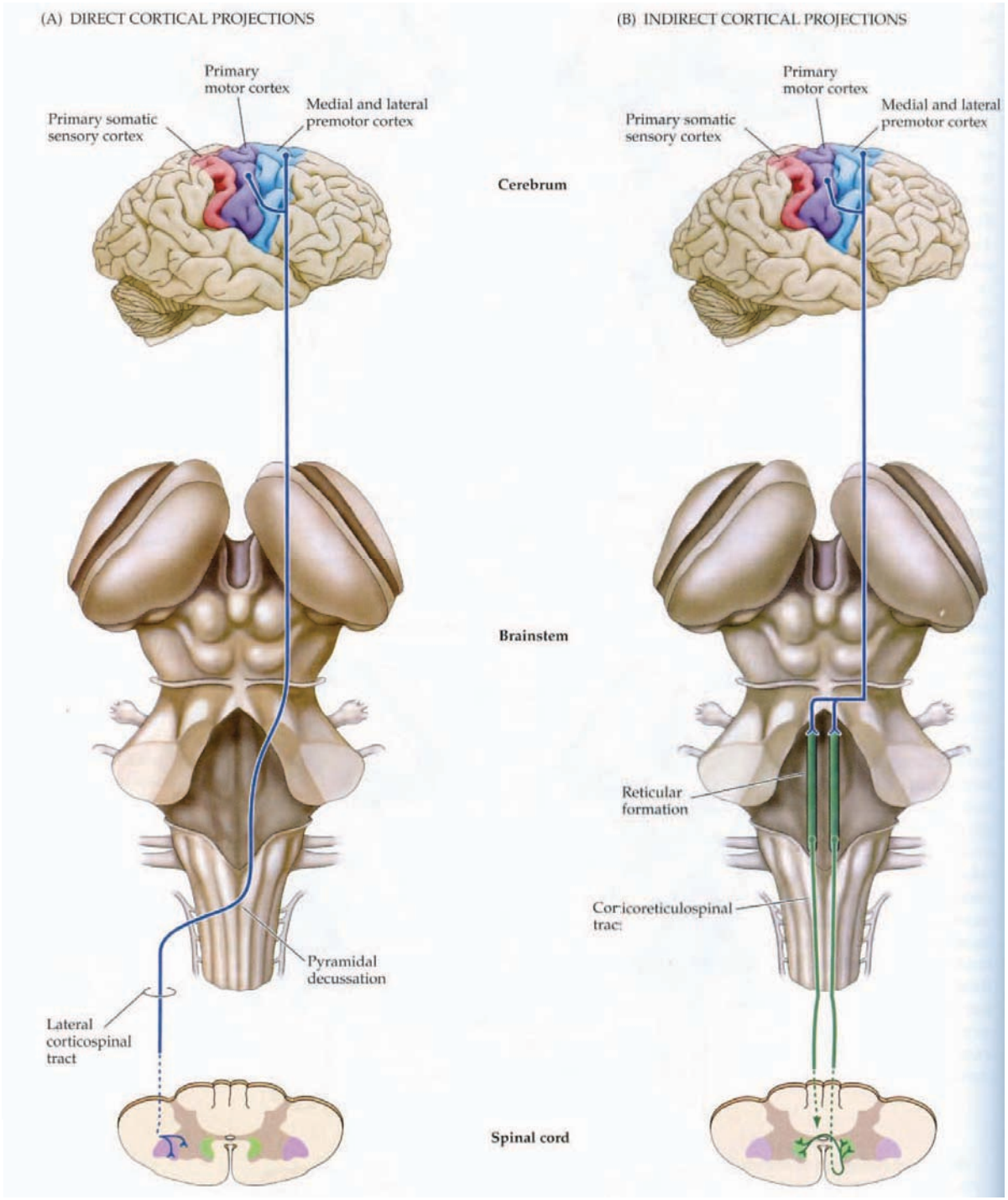
- Columns and laminar organization





Organization of Movement




(A) DIRECT CORTICAL PROJECTIONS
(B) INDIRECT CORTICAL PROJECTIONS
Primary motor cortex
Medial and lateral premotor cortex
Primary somatic sensory cortex
Cerebrum
Brainstem
Spinal cord
Reticular formation
Corticoreticulospinal tract
Pyramidal decussation
Lateral corticospinal tract

THE END