

# Module 2: Structural Anatomy of the Human Brain

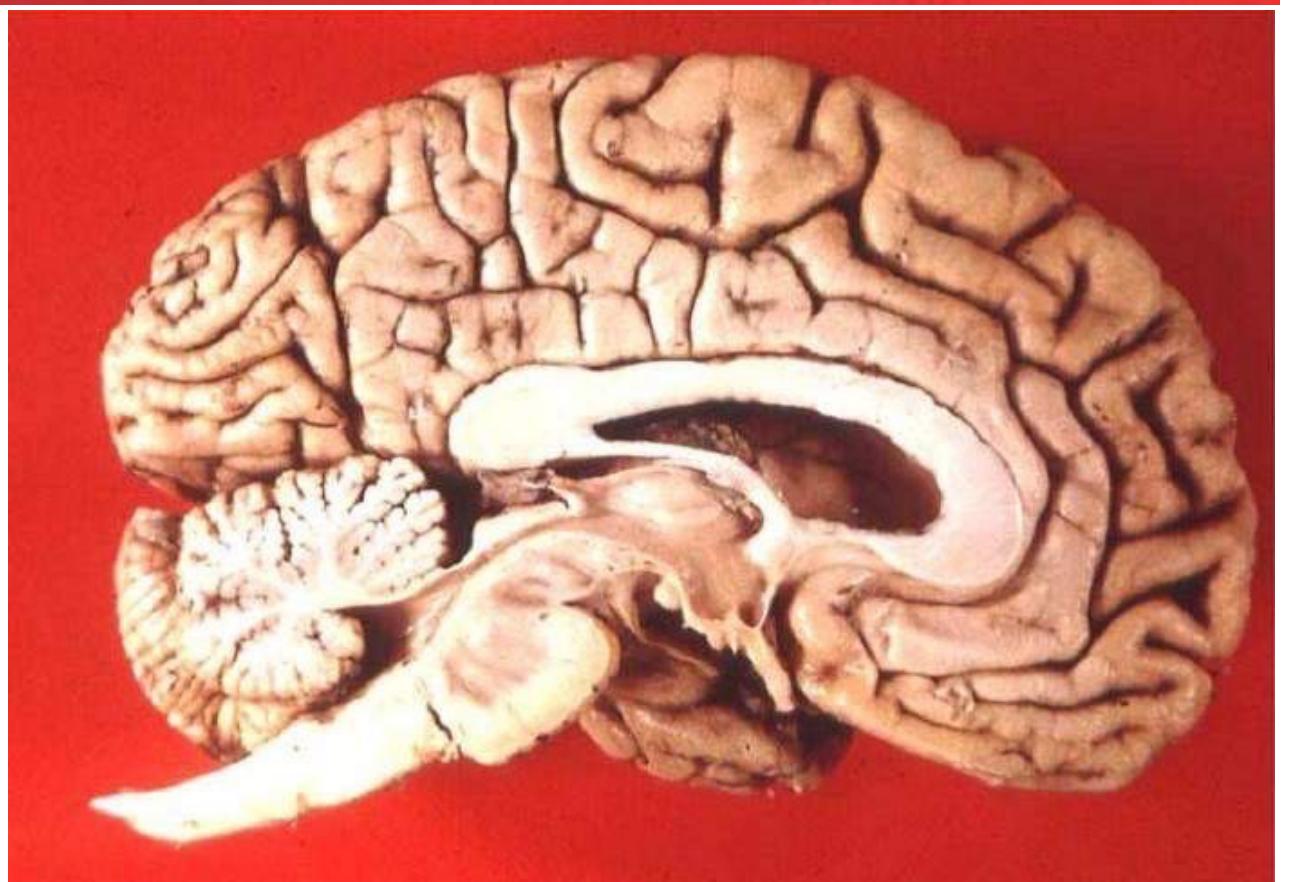
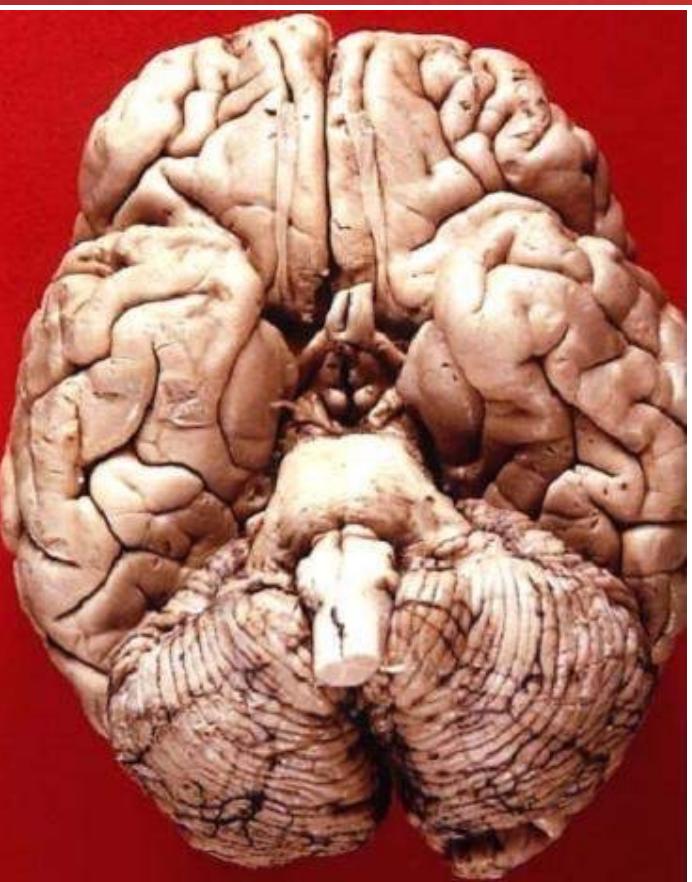
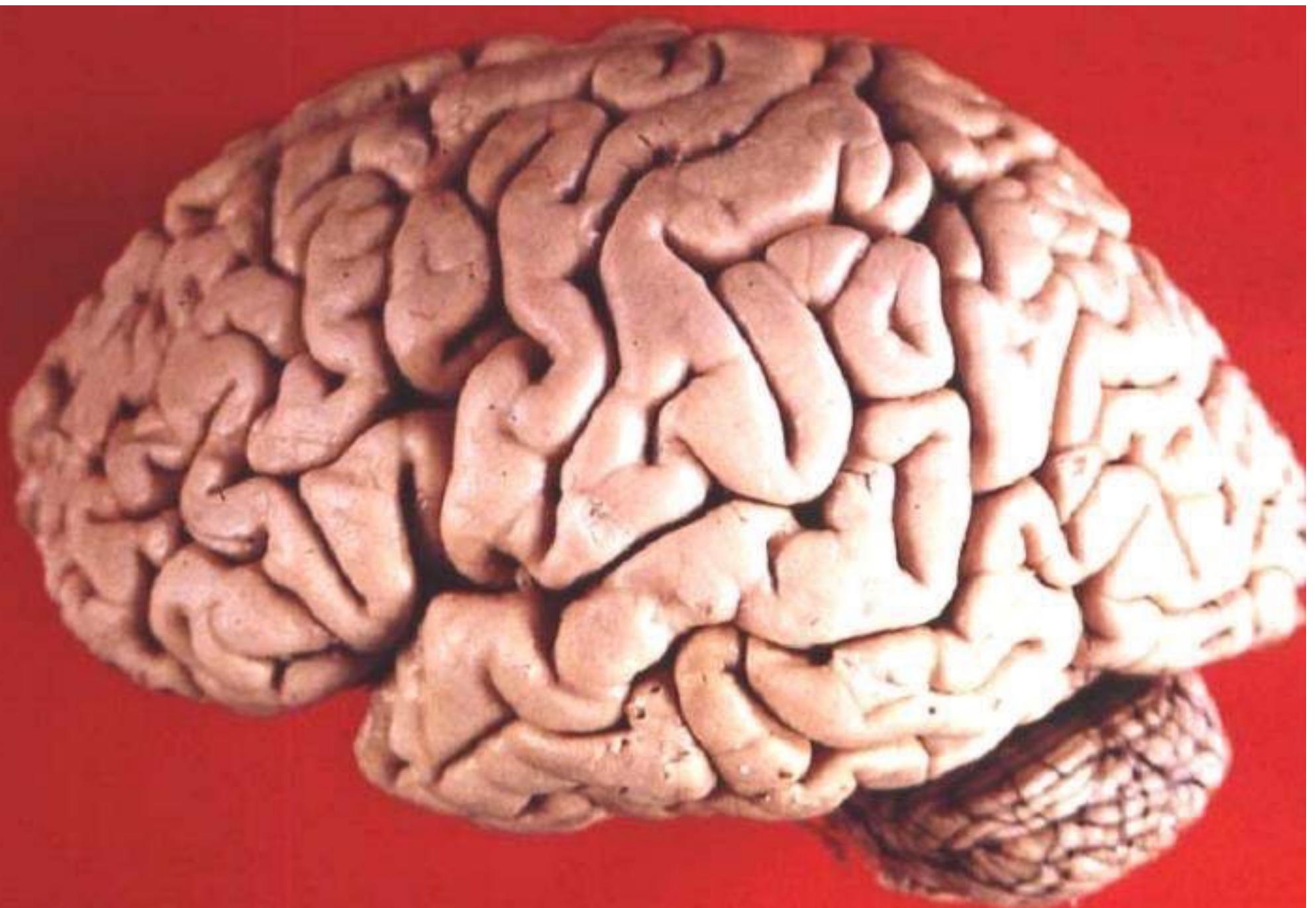
**Arnold Bakker**

Department of Psychiatry and Behavioral Sciences  
Division of Psychiatric Neuroimaging  
Johns Hopkins University School of Medicine

# Structural Anatomy

The brain consists mostly of two categories of highly specialized cells:

- Neurons: highly specialized and interconnected cellular unit of the brain
- Glia: non-neuronal supportive cellular elements

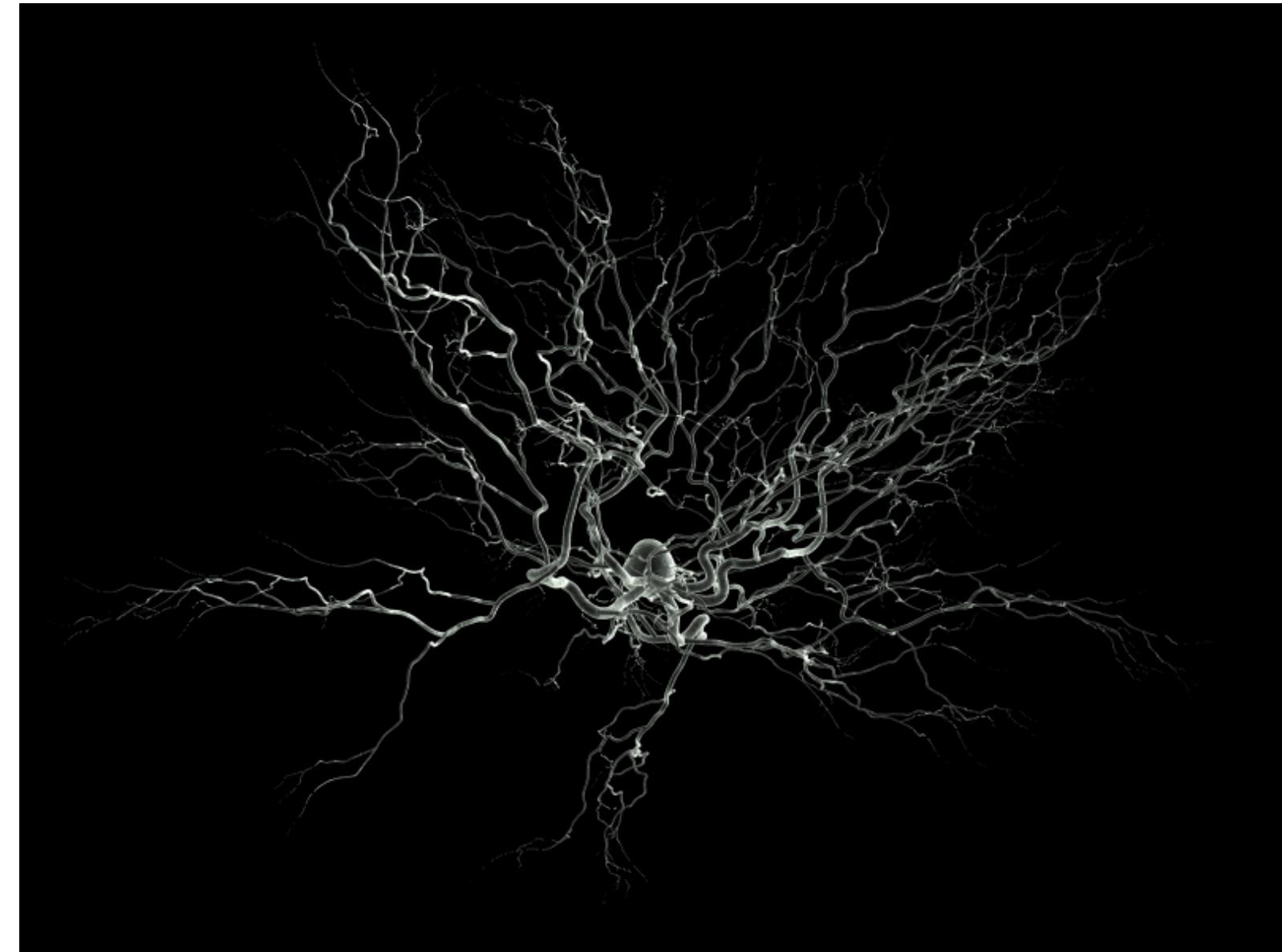


# Structural Anatomy

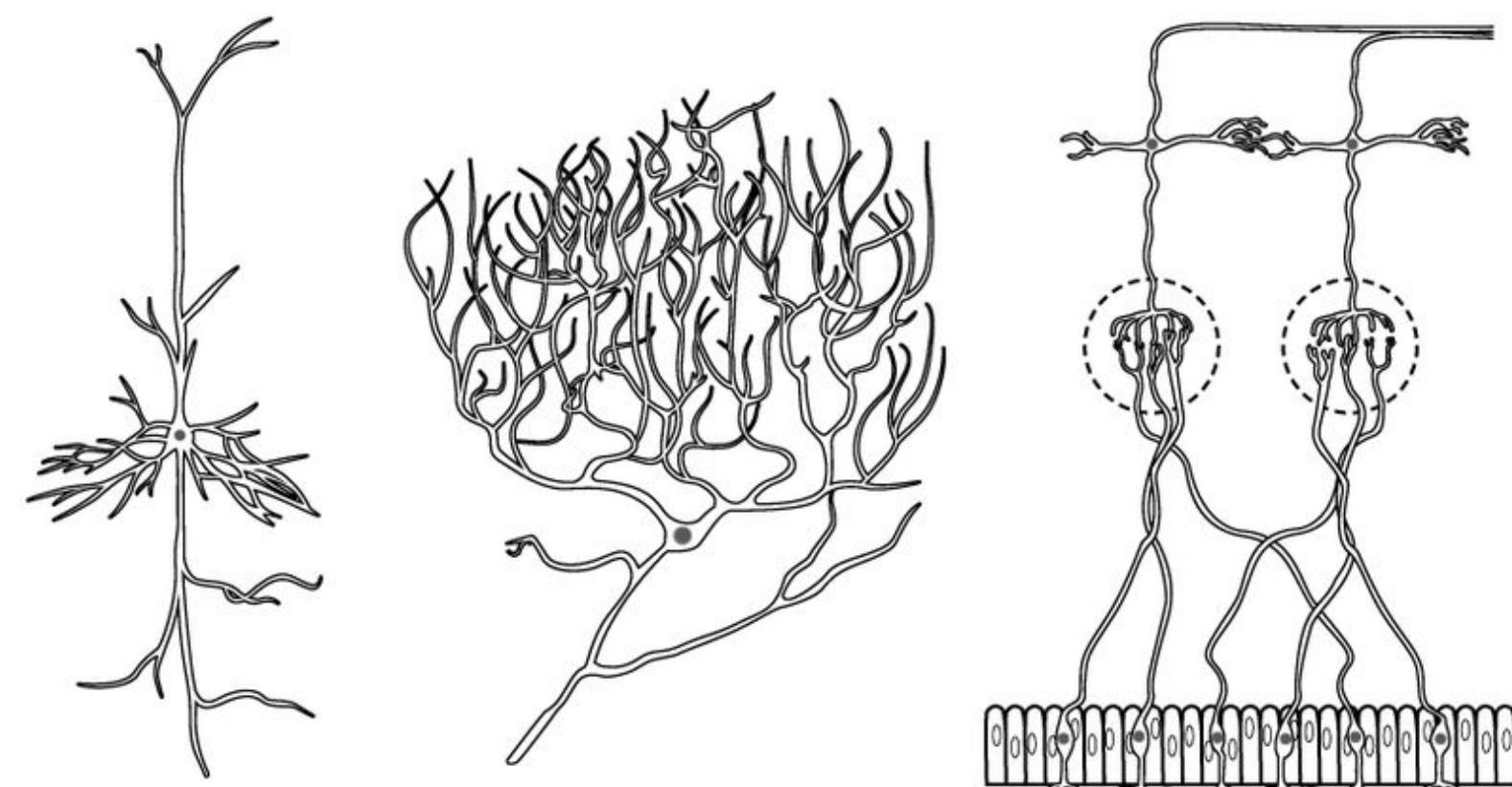
Neurons form the fundamental processing unit of the brain

Neurons have many different:

- Types
- Properties
- Shapes
- Functions



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(a) Pyramidal cell of the cerebral cortex

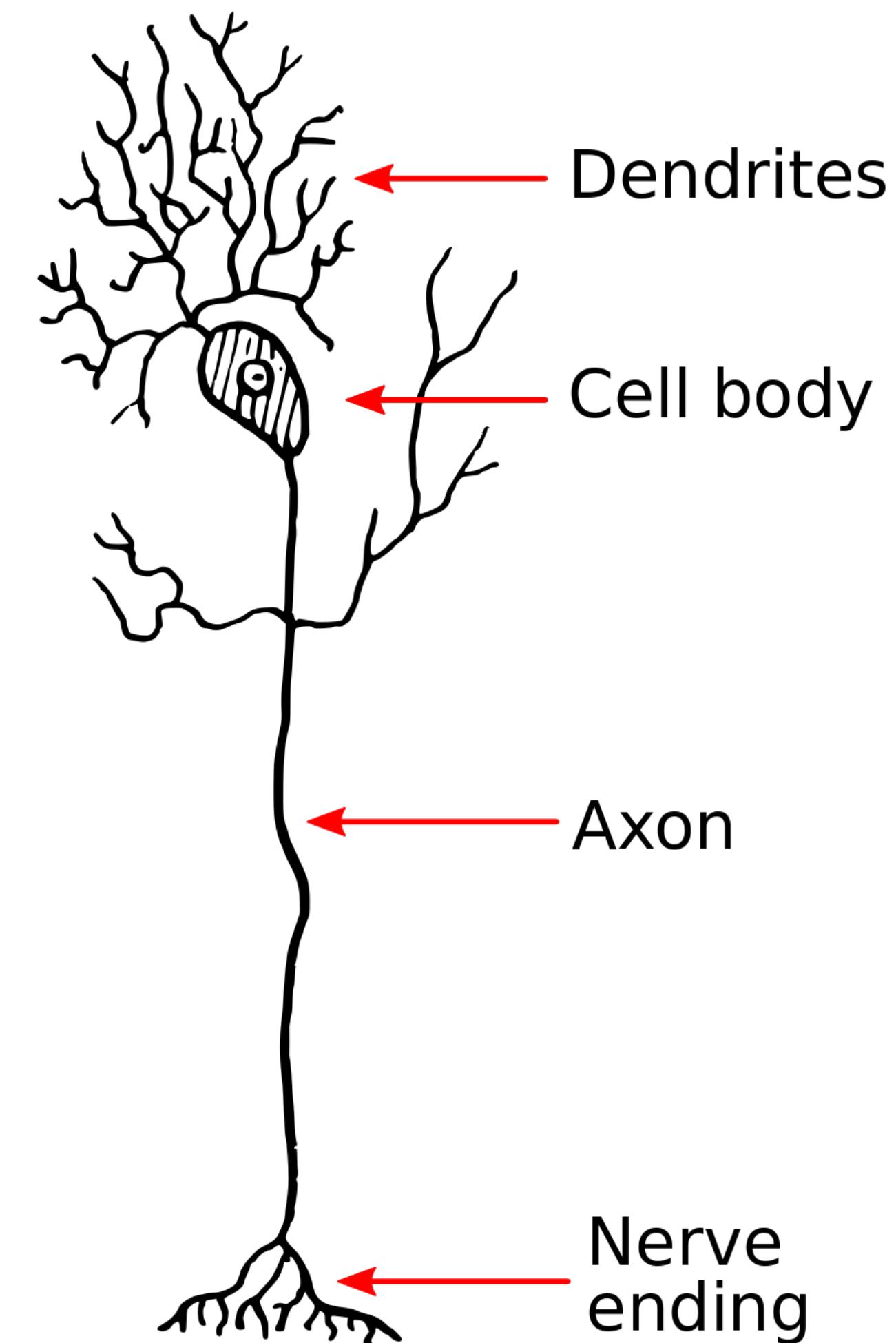
(b) Purkinje cell of the cerebellar cortex

(c) Olfactory cells in the olfactory epithelium and olfactory bulbs

# Structural Anatomy

Most neurons have several basic elements:

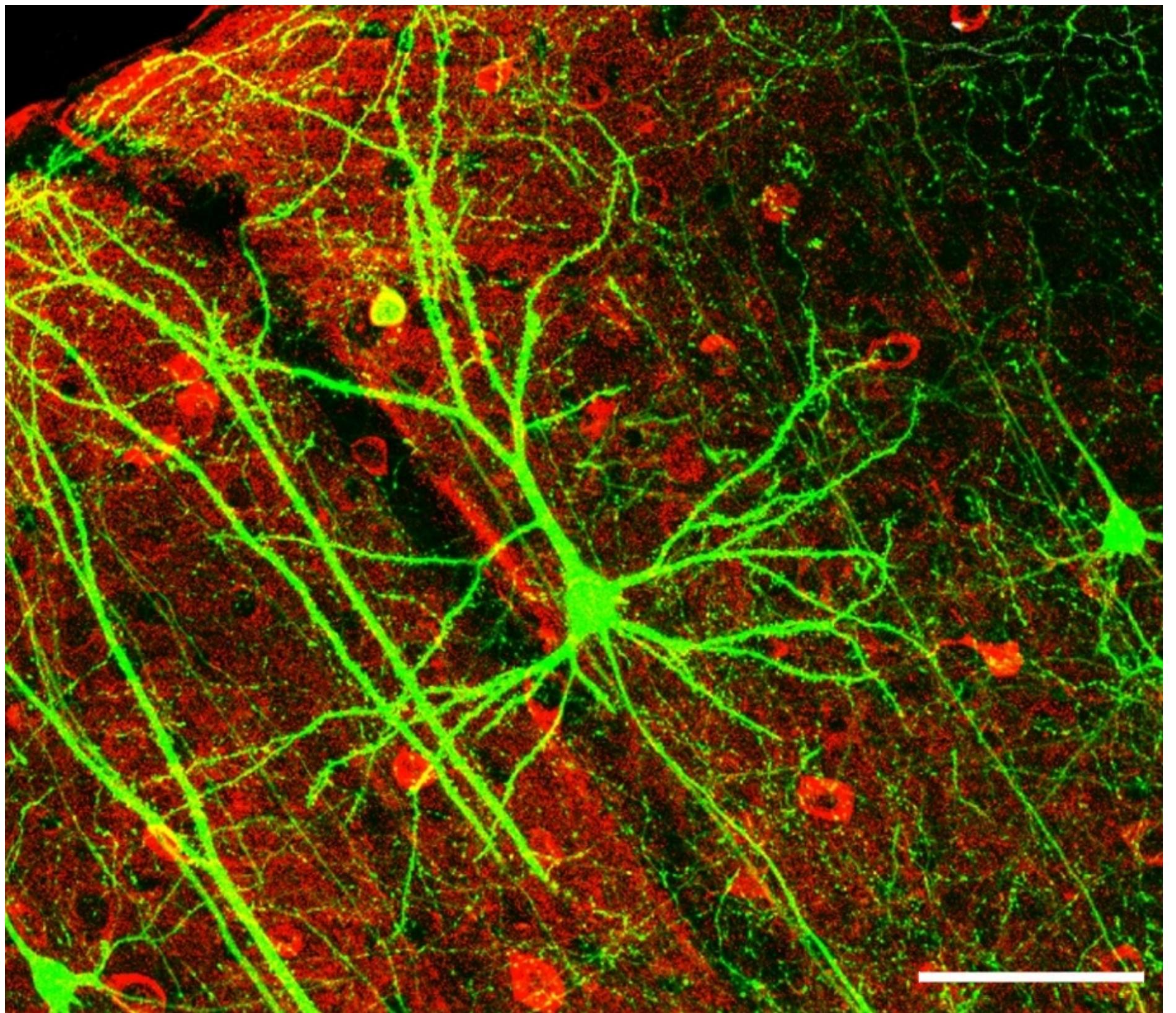
- Axon
- Cell body
- Dendrites
- Axon terminals



# Structural Anatomy

## Axon:

- Varying length and complexity
- Transmits electrical signal form the cell body to the axon terminals towards target neurons



# Structural Anatomy

## Cell body:

- Contains the nucleus of the cell which contains the DNA
- Contains specialized organelles such as mitochondria, Golgi apparatus, ribosomes and polysomes that provide energy and synthesizes proteins that facilitate generation and propagation of the electrical signal



# Structural Anatomy

## Dendrites:

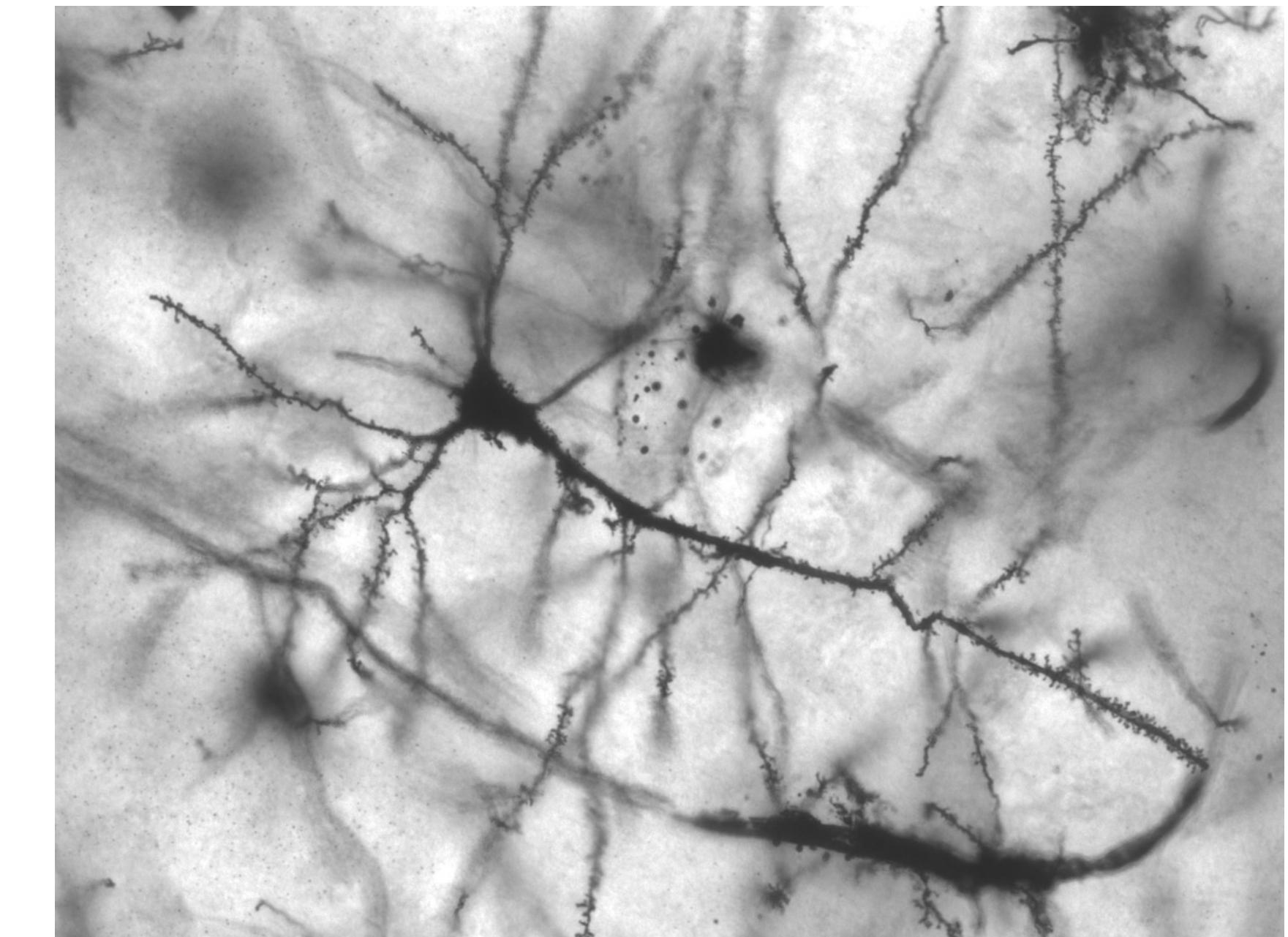
- Extend from the cell body
- Forms the receiving contact from other neurons
- Can branch in complex patterns
- Contains dendritic spines



# Structural Anatomy

## Axon terminals:

- Also known as presynaptic terminal
- Very fine branches that form communication sites with other neurons
- Most end on the adjoining neuron's dendrites
- Some end on the adjoining neuron's cell body

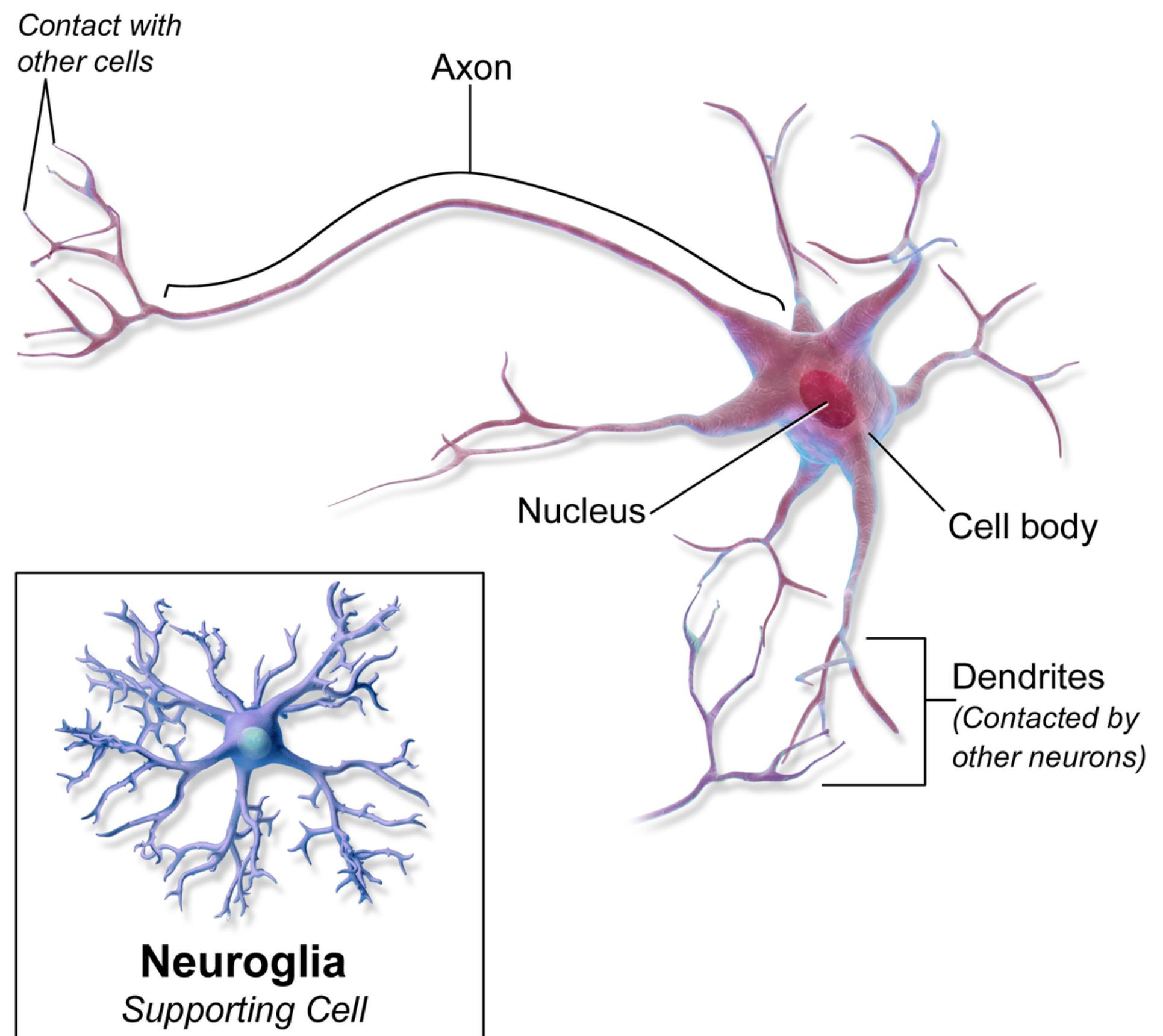


# Structural Anatomy

Glia forms the fundamental support or scaffolding for the brain

Glia form the majority of cells in the central nervous system and have many different roles:

- Forms connective tissue
- Serves metabolic support roles
- Removal of excessive neuronal secretions
- Produces myelin which insulates axons



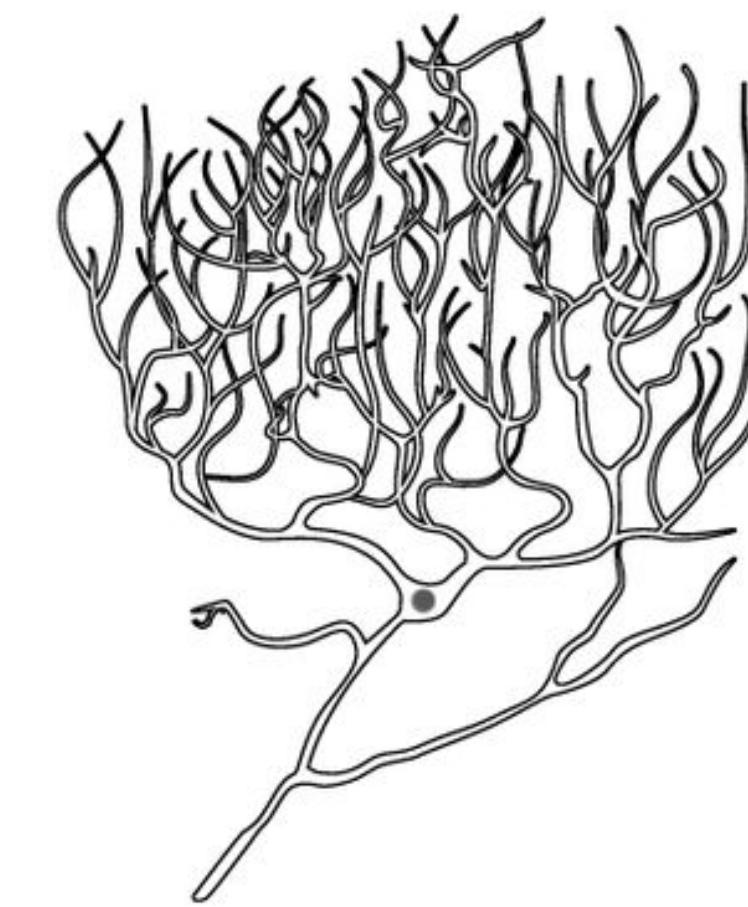
# Structural Anatomy

Large groups of similar and spatially organized neurons form the basis of dissociable brain structures and networks by:

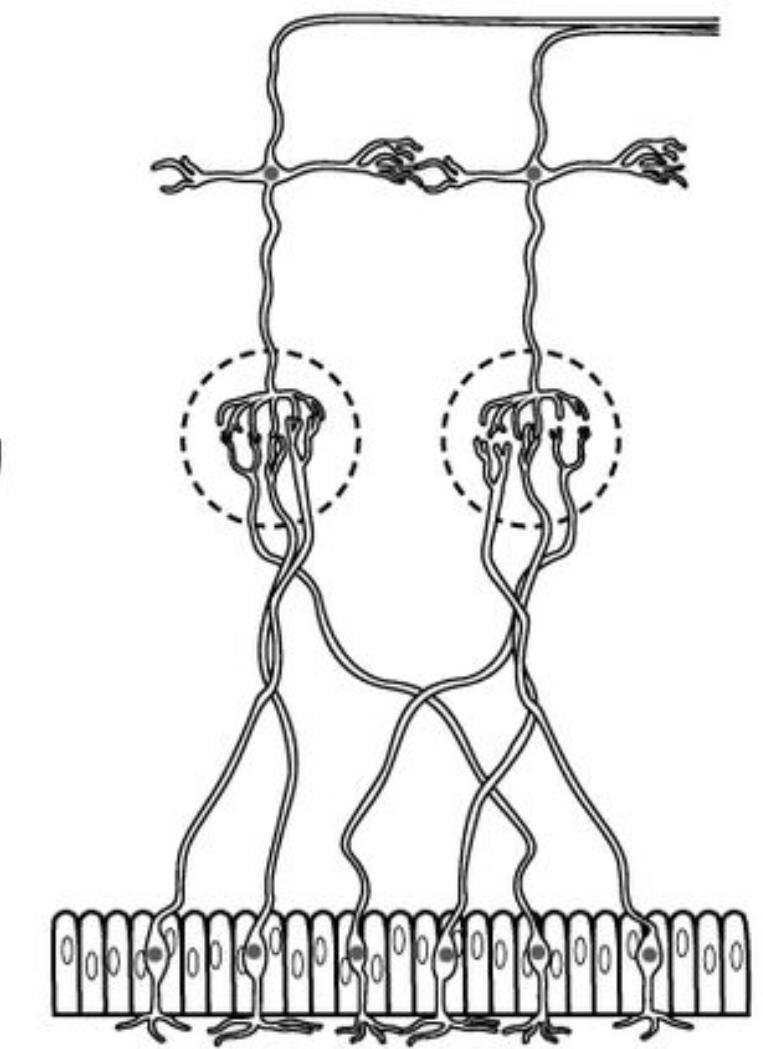
- Cytoarchitectural organization
- Dissociable brain structures
- Dissociable brain networks



(a) Pyramidal cell of the cerebral cortex



(b) Purkinje cell of the cerebellar cortex

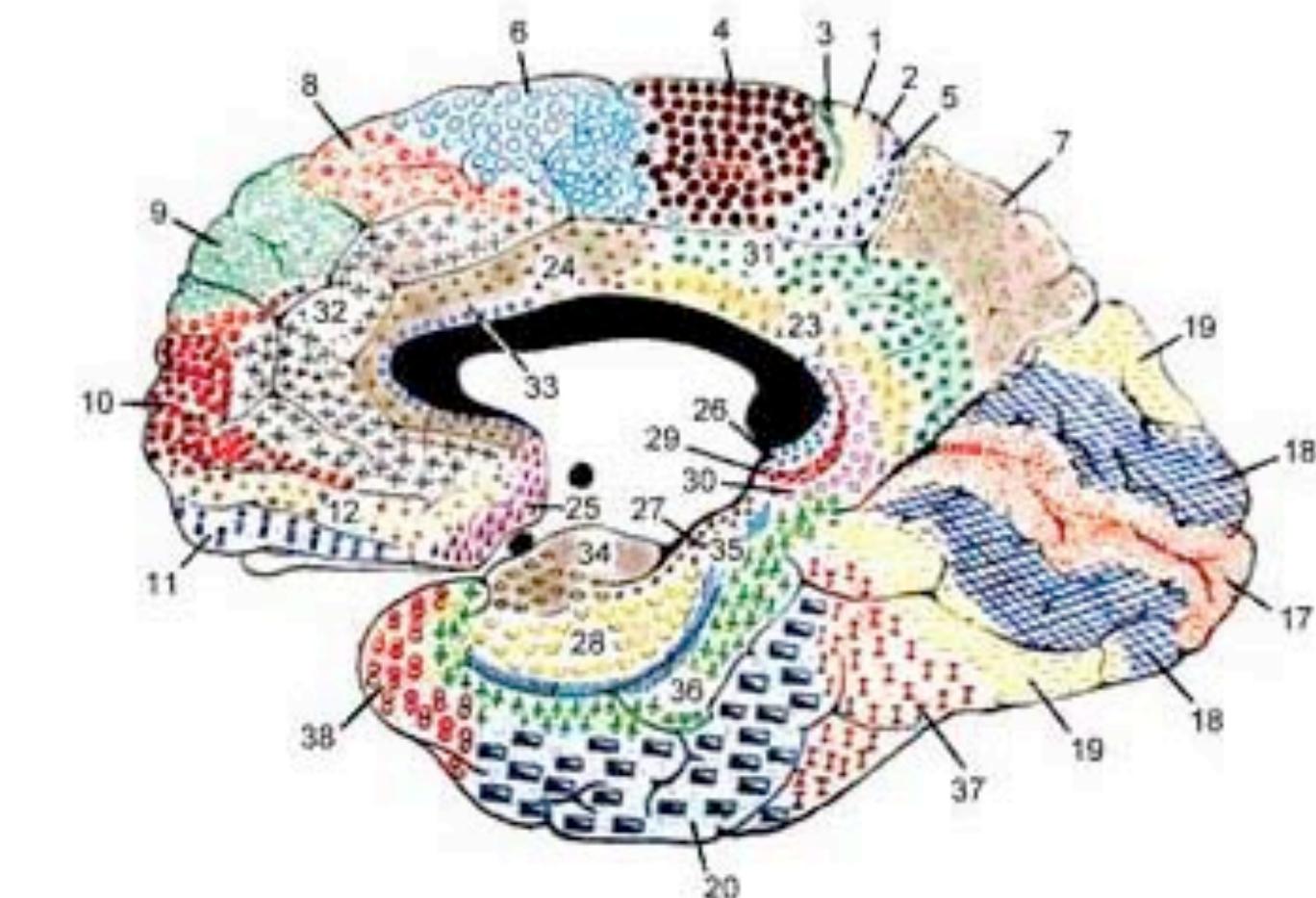
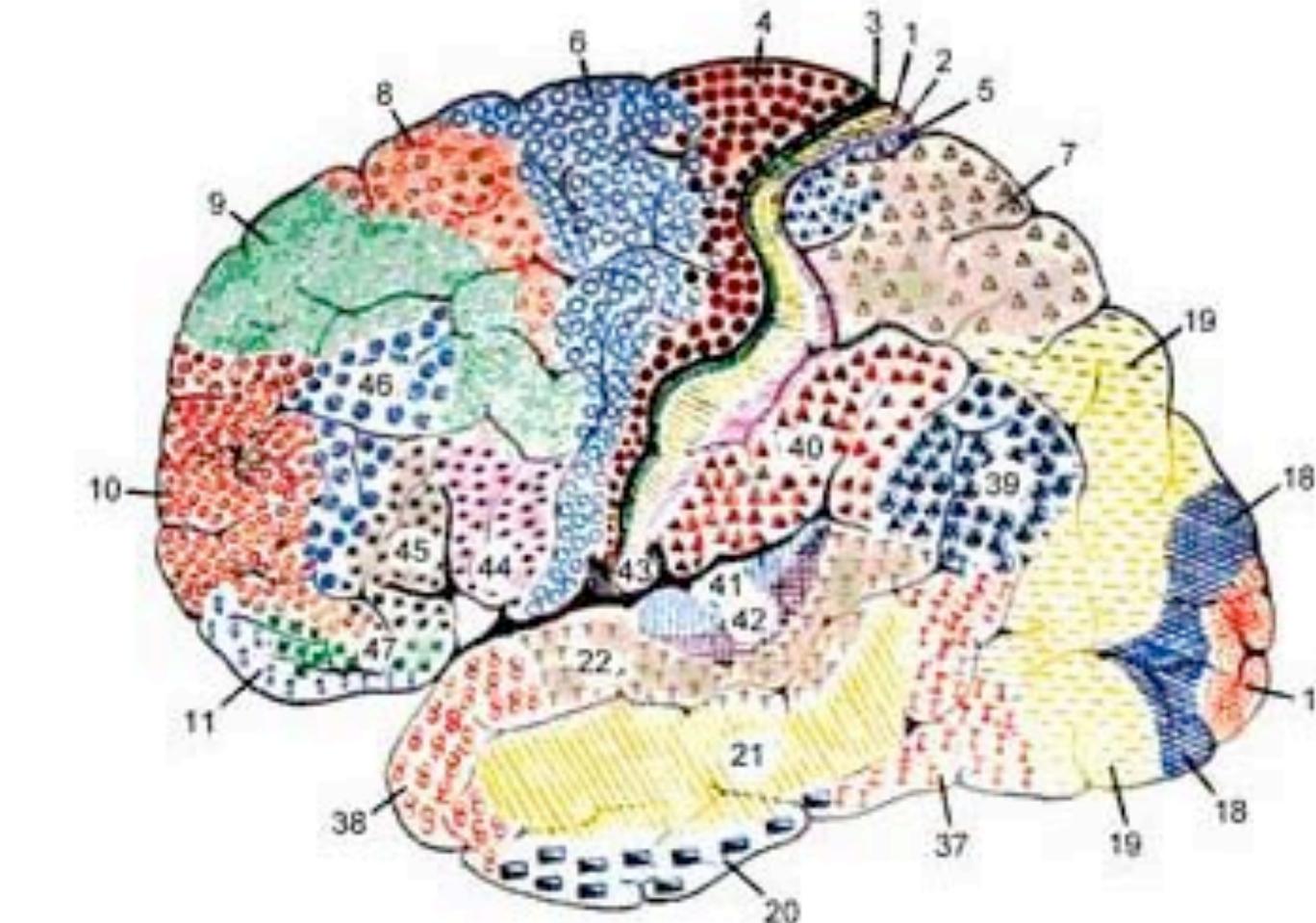


(c) Olfactory cells in the olfactory epithelium and olfactory bulbs

# Structural Anatomy

Cytoarchitectural organization:

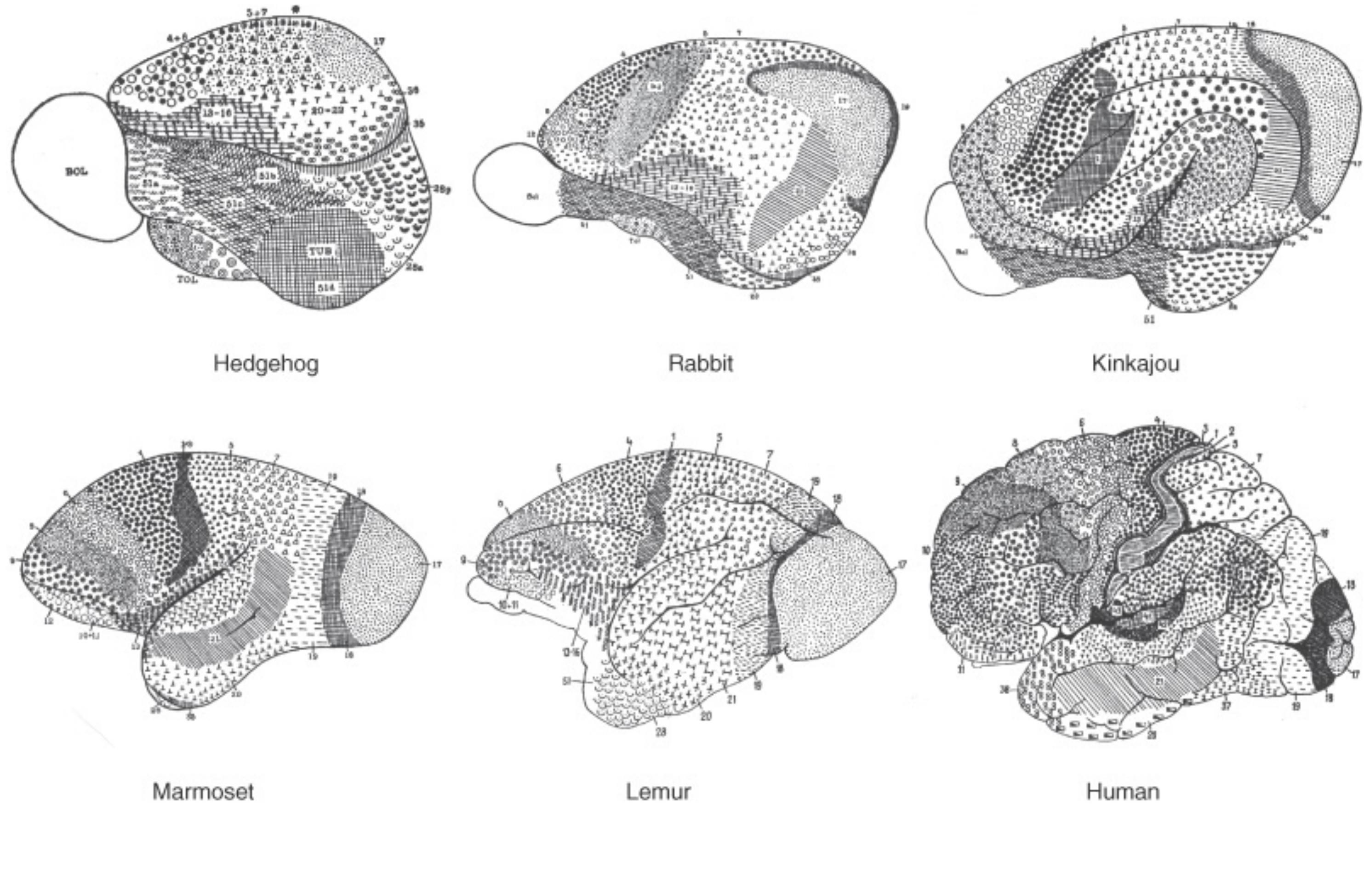
- Structural organization of the brain based on cellular composition
- German anatomist Korbinian Brodmann published a cytoarchitectural map of the human brain in 1909
- Brodmann areas are still commonly used to report the location of neuroimaging findings



# Structural Anatomy

Cytoarchitectural organization:

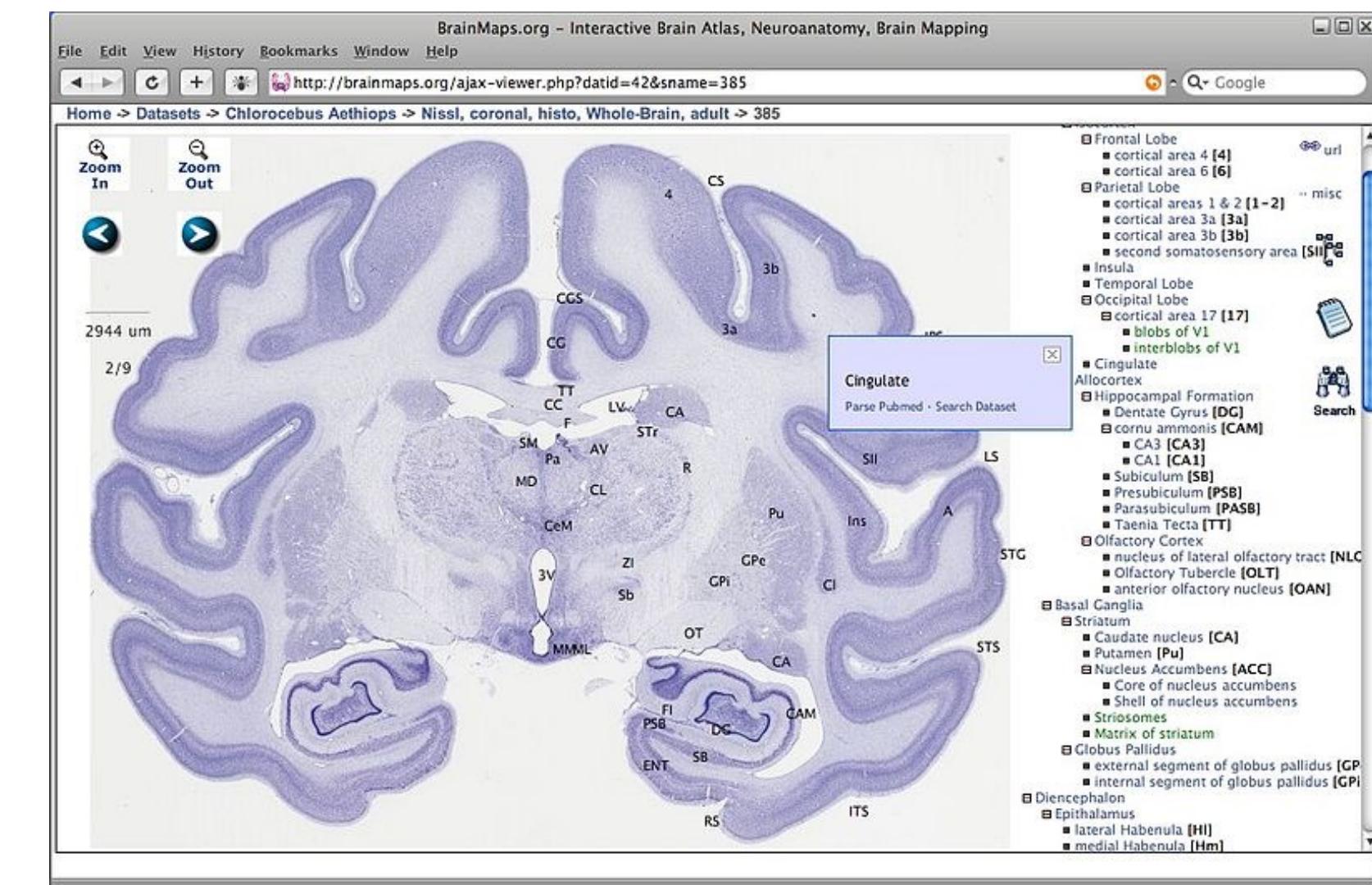
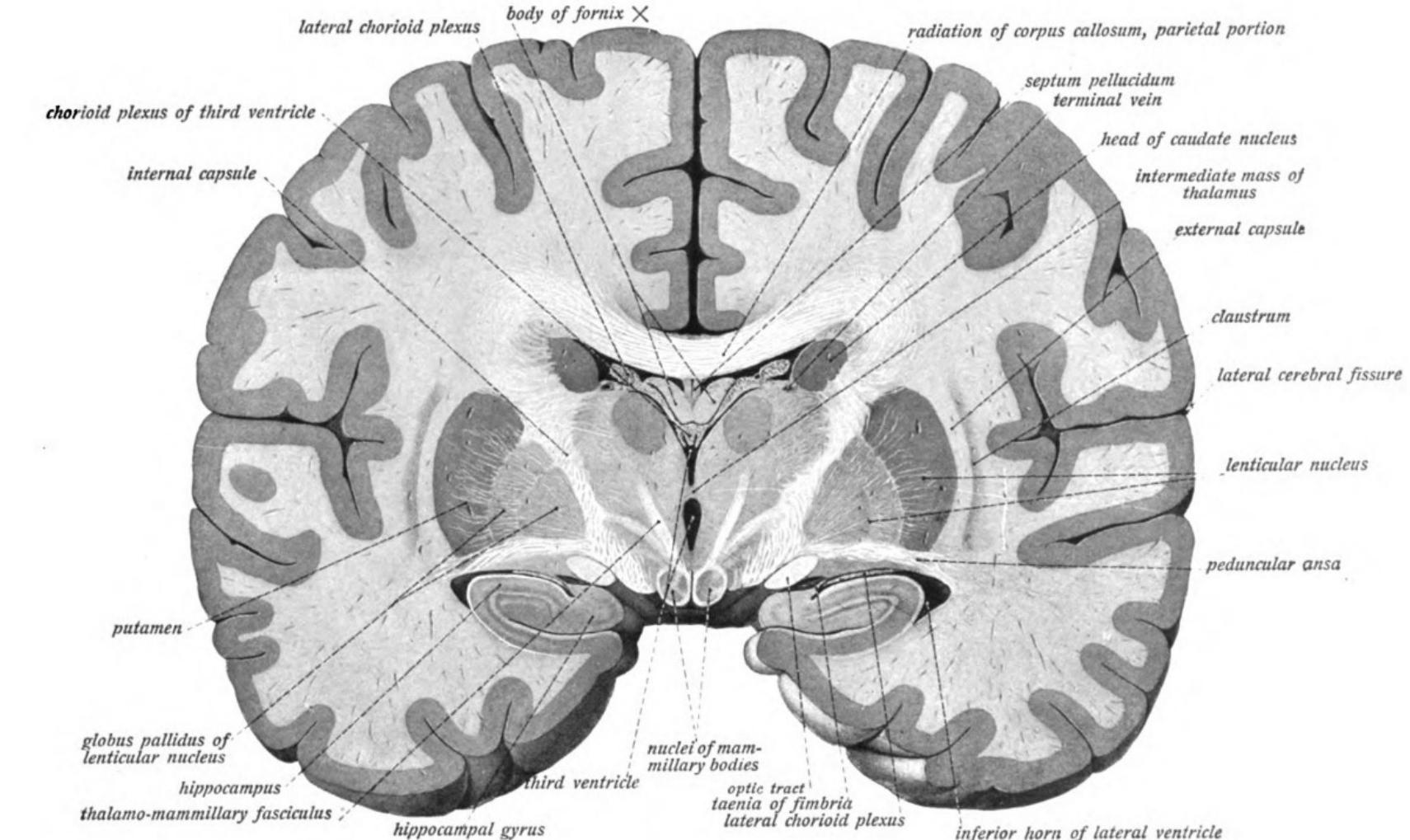
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# Structural Anatomy

## Dissociable Brain Structures:

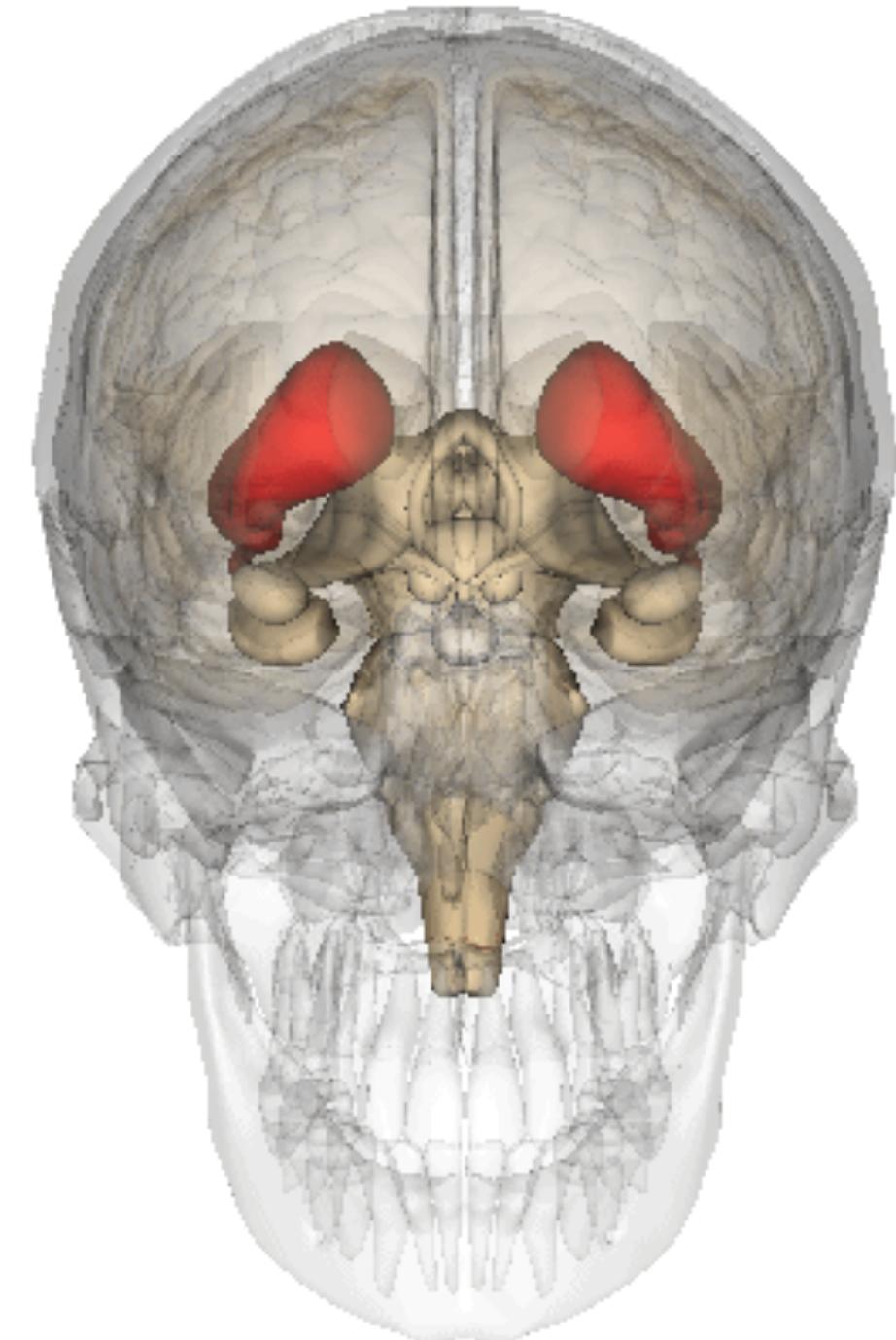
- Many structures in the brain have been carefully defined based on cell type and anatomical boundaries and named
- Numerous highly detailed brain atlases available



# Structural Anatomy

## Dissociable Brain Networks:

- Groups of structures form brain networks based on connections between them
- Examples are the striatum which includes the nucleus accumbens, caudate nucleus and putamen and the medial temporal lobe network which includes the hippocampus, entorhinal and perirhinal cortex.



# Structural Anatomy

Rudimentary anatomical classification of the brain in 6 lobes:

- Frontal Lobe
- Parietal Lobe
- Occipital Lobe
- Temporal Lobe
- Limbic Lobe
- Insular cortex

