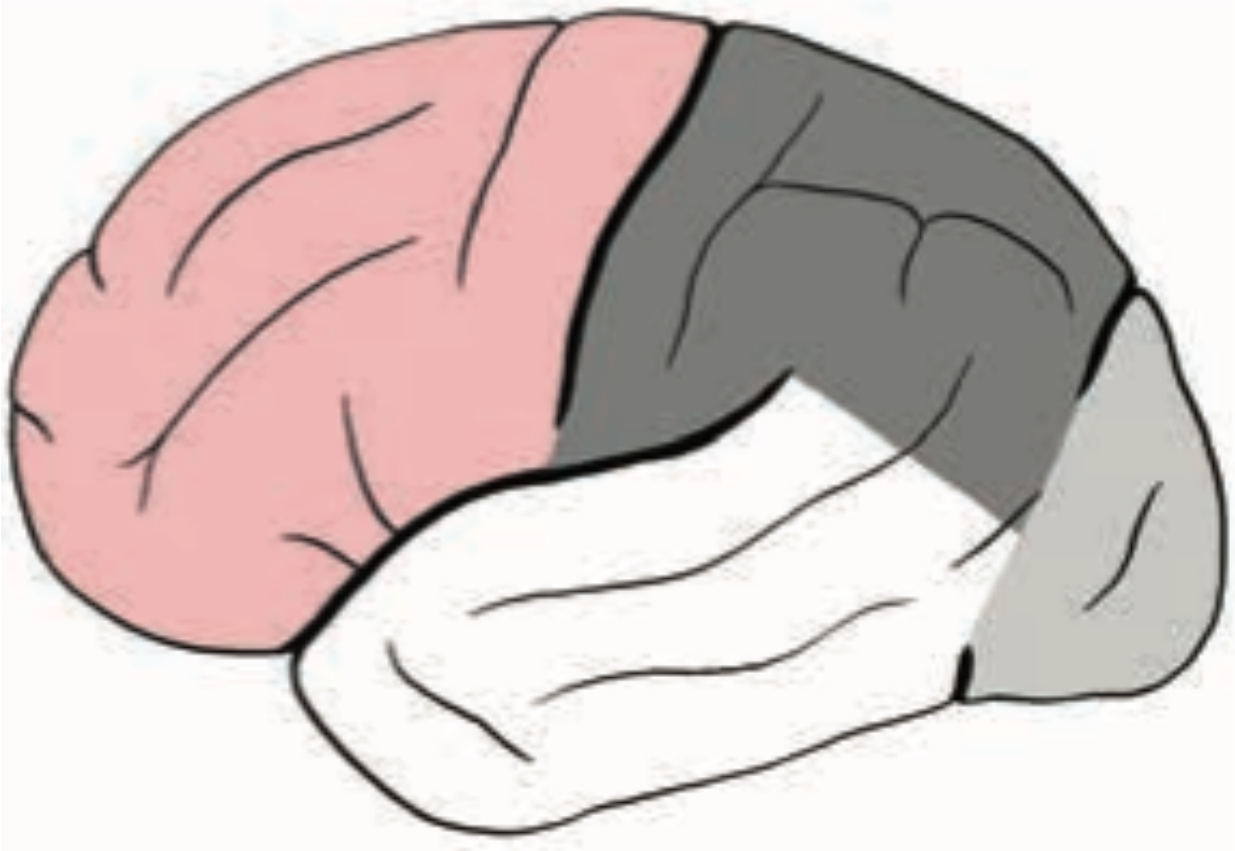
Neuroanatomy – hemispheres, grey matter

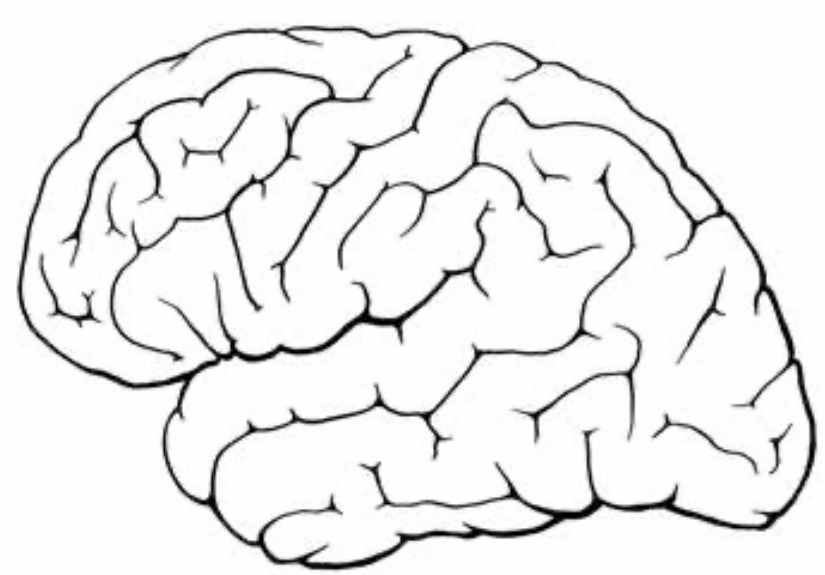
Lobi, sulci, gyri

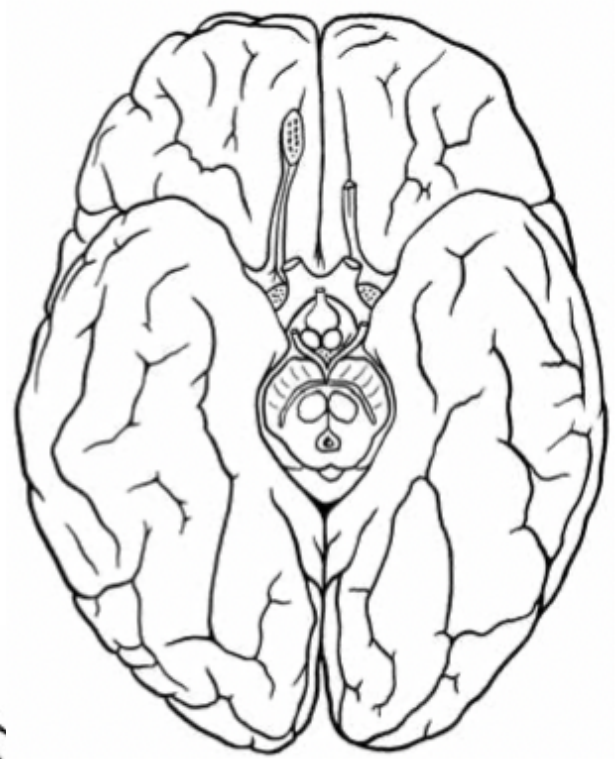
- **Lobus - lobi**
  - **Divided by**
- **Sulci**
- ***Sulcus centralis (Rolandi)***
- *Lobus frontalis / lobus parietalis*
- ***Sulcus lateralis (Sylvii)***
- *Lobus temporalis / lobus temporalis + parietalis*
- ***Sulcus parietooccipitalis***
- *Lobus parietalis – lobus occipitalis*
- ***Incissura praeoccipitalis***
- *Lobus temporalis / lobus occipitalis*

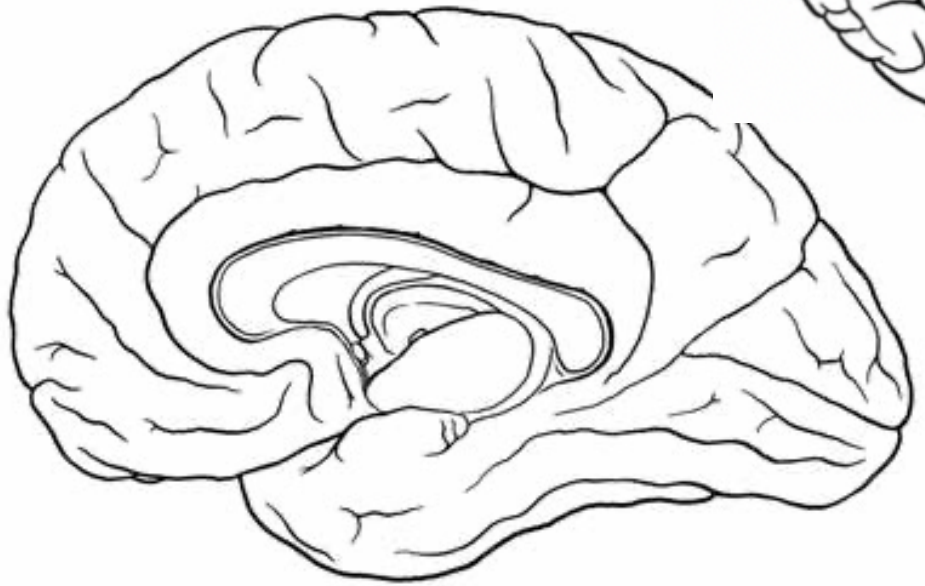


Cortex cerebri

- **Allocortex**
  - **Paleopallium = paleocortex (1%)**
  - **Olfactory region**
  - **Archipallium = archicortex (3,5%)**
  - **Three layers**
- **Isocortex**
  - **neocortex = neopallium (95,5%)**
  - **Six layers with differnt participation**
- **Mesocortex**
  - **Reduction of some layers**
  - **Between allocortex and isocortex**
  - **Peripaleocortex**
  - *insula*
  - **Periachicortex**
  - *Entorhinal area – medial uncus gyri hippocampalis*
  - *Praesubiculum - medial surface gyrus parahippocampalis*



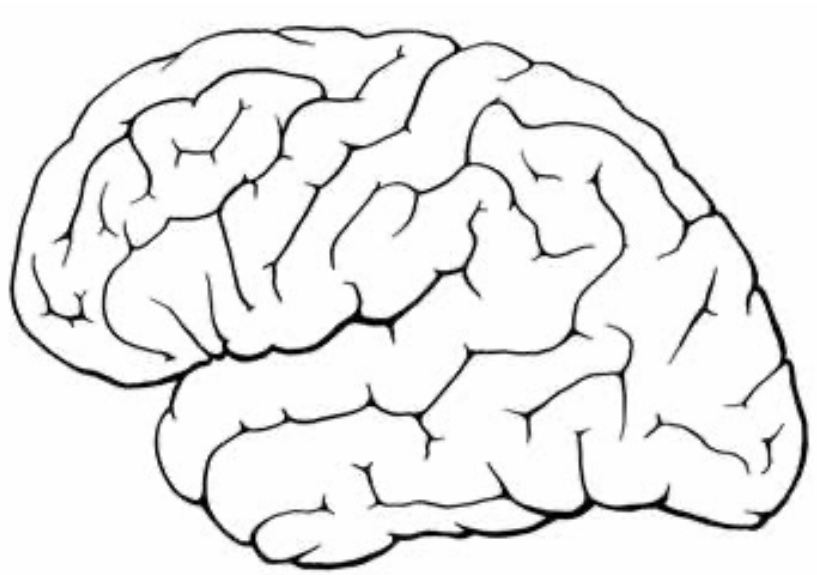


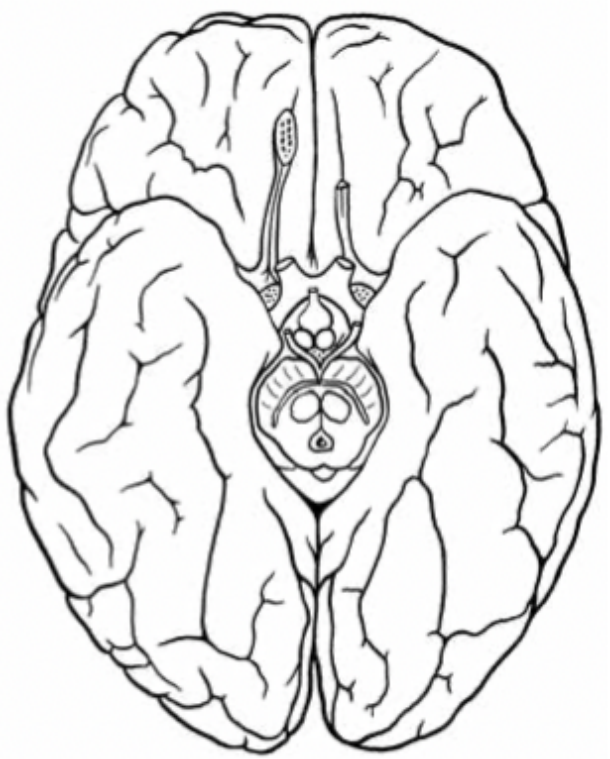


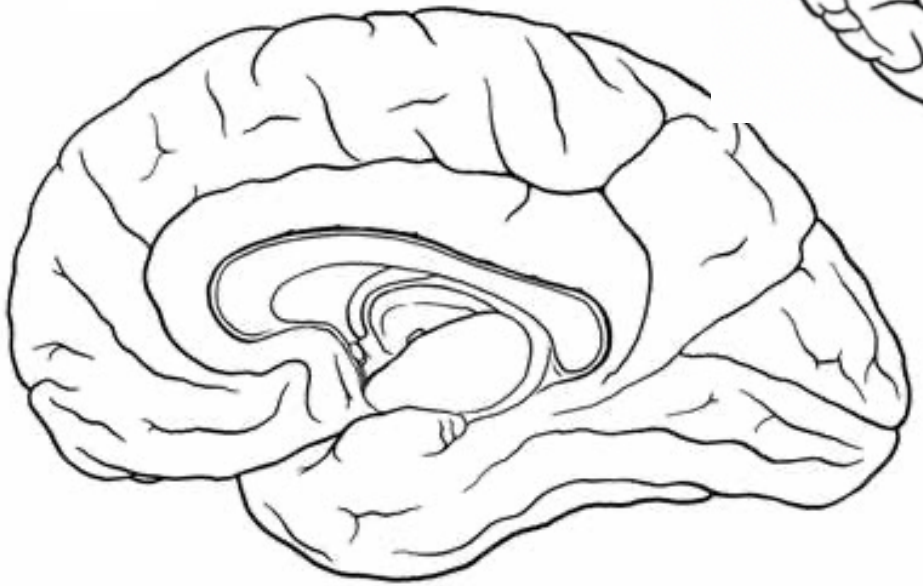
Archicortex

- Subiculum
- Gyrus dentatus
- Hippocampus
- Rudiments
  - Induseum grisseum
  - Striae longitudinales
- Hippocampal fromation

- Fornix
  - Crura fornicis
  - Commisura fornicis
  - Corpus fornicis
  - Columnae fornicis
    - between collumnae fornicis and corpus callosum
    - septum pellucidum

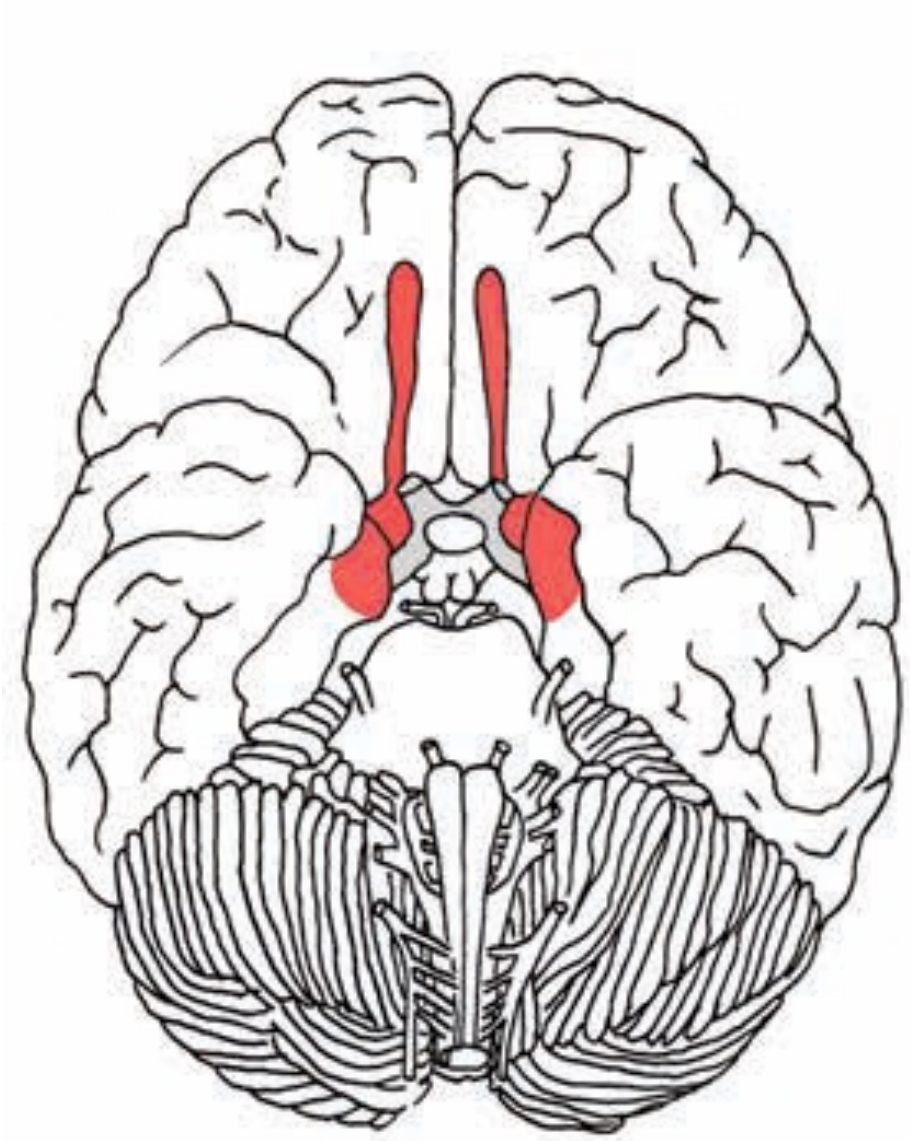






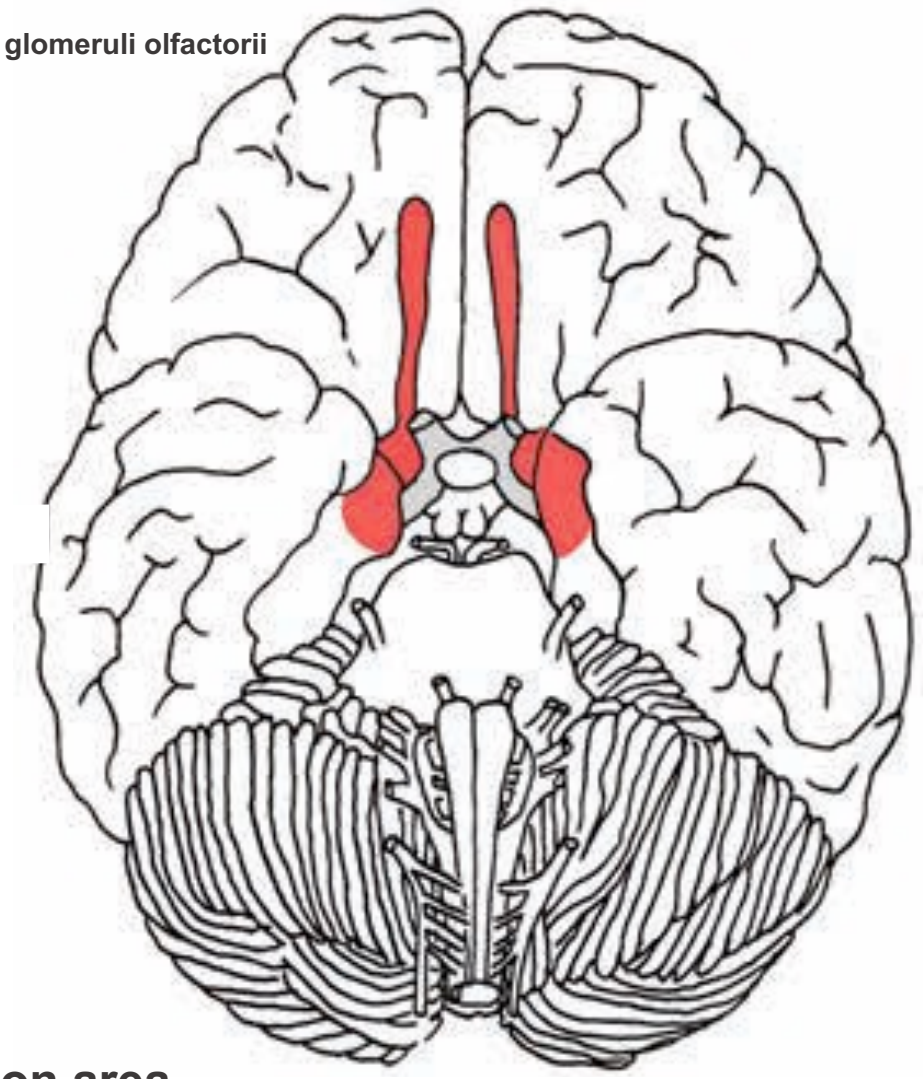
Paleocortex

- **Region between**
  - stria olfactoria lateralis
  - Medial surface of uncus gyri hippocampalis
  - Neghboring to entorhinal mesocortical region
- **layers**
  - 1. lamina plexiformis
    - Fibers, minimum of neurones
    - Efferent connection of bulbus olfactorius
  - 2. lamina pyramidalis
    - Dendrites in the firs layer
    - Glutamatergic pytamidal neurones
    - Diffused inhibitory neurones
  - 3. lamina multiformis
    - Differnt shapes of neurons
    - Contains also GABAergic interneurons



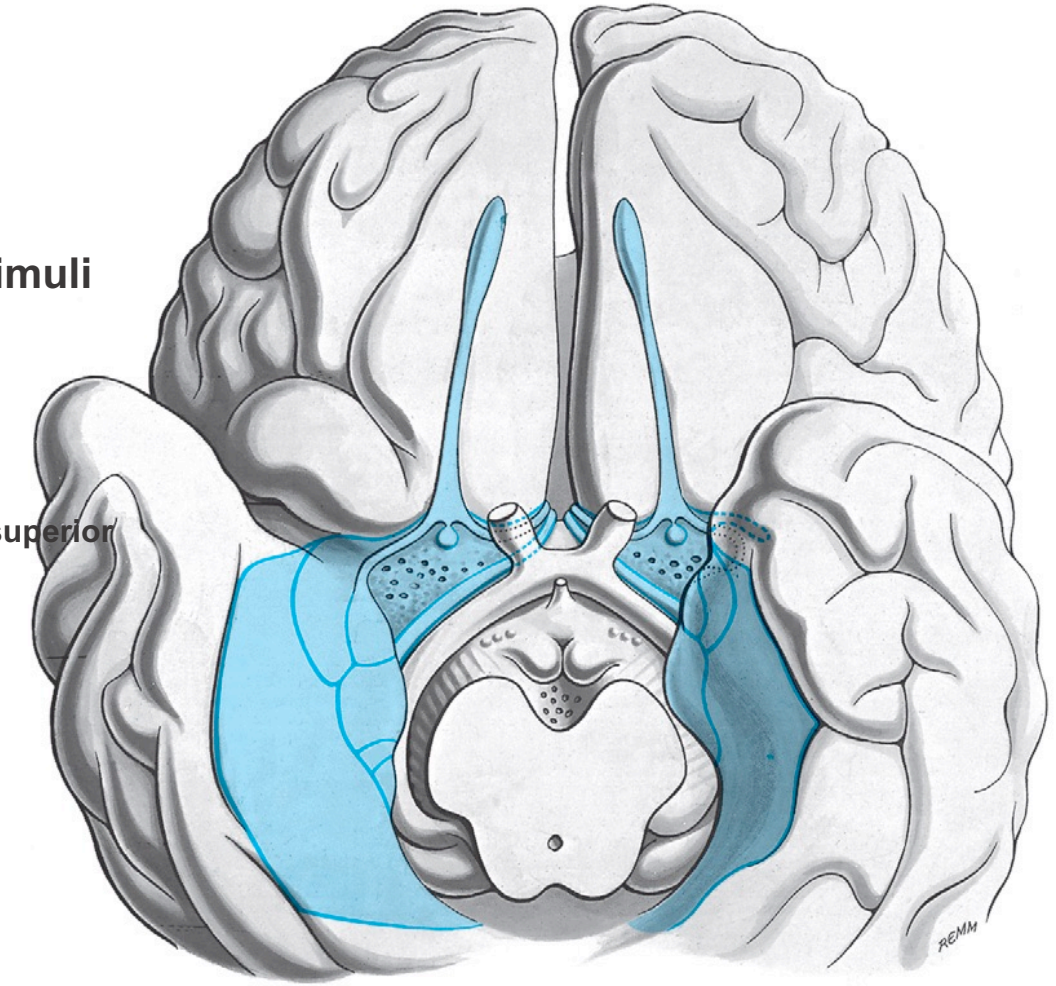
Olfactory brain - rhinencephalon

- Bulbus olfactorius
  - Synaptic complex of special sensoric cells and mitral cells in olf. bulbs- glomeruli olfactorii
  - Endings of olfactory region fibers and from septum verum
- Tractus olfactorius
  - Substantia perforata anterior
- stria olfactoria lateralis
  - Leads to uncus gyri hippocampalis
  - To primary olfactory region
- stria olfactoria medialis
- Rhinencefalon – only where olfactory pathway
  - twoneuronal
  - Sensoric cells . Nasal mucosa
  - Mitral cells – bulbus olfactorius
- Olfactory cortical area
- Paleocortex - all
  - frontal – lateral from stria olfactoria lateralis
  - Temporal upper surface odf – uncus gyri hippocampalis
- Anterior part of entorhinal region
- Medial and cortical nukleus of amygdala
- Primary olfactory area only bulbus
- rest of rhinencefalon – a som signs of association area



Olfactory brain - rhinencephalon

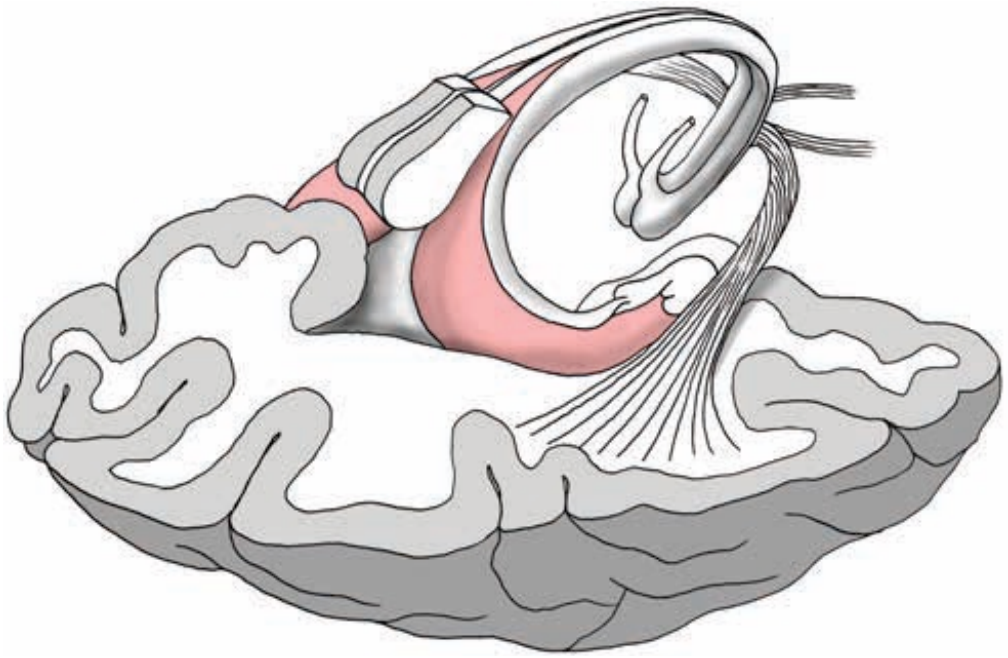
- Afferent connections
  - Axons of mitaral cells in bulbus olfactorius
- Efferent connections
- cortical – entorhinal area
  - To hippocampal formation – archicortex of limbic cortex
  - Anterior part of olfactory cortex activated by the positive stimuli
- subcortical
  - Amygdala – activated by negative stimuli
  - Thalamus – nc. mediodorsalis
    - Orbitofrontal cortex – association cortex in insuly and gyrus temporalis superior
    - Emmltions and behaviour
  - Hypothalamus – area hypothalamica lateralis
    - Vegetative and brainsem functions
- Association connection
  - With rest of paleokortex
- Commisural connections
  - Left/right connection of paleocortex
  - Crossed projection to olfactory bulb

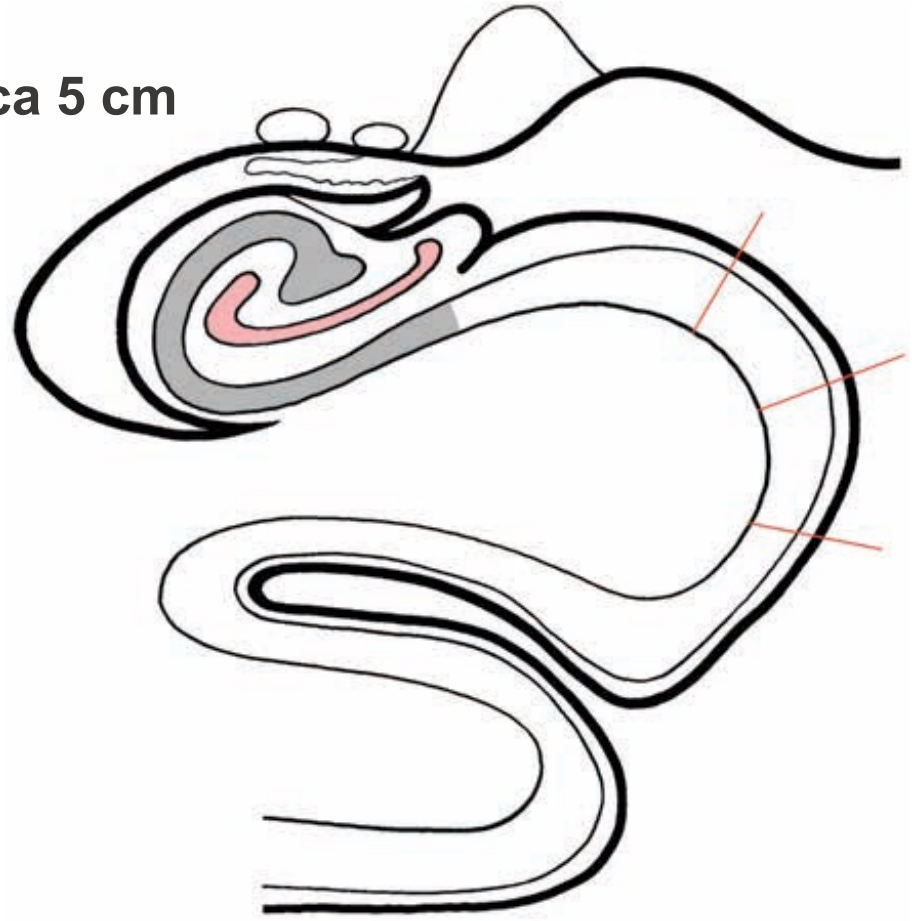


Archaecortex

- In fissura chorioidea at the base of temporal horn of lateral ventrikle
- Thre layers
- Three bands of gaey matter – hippocampal formation

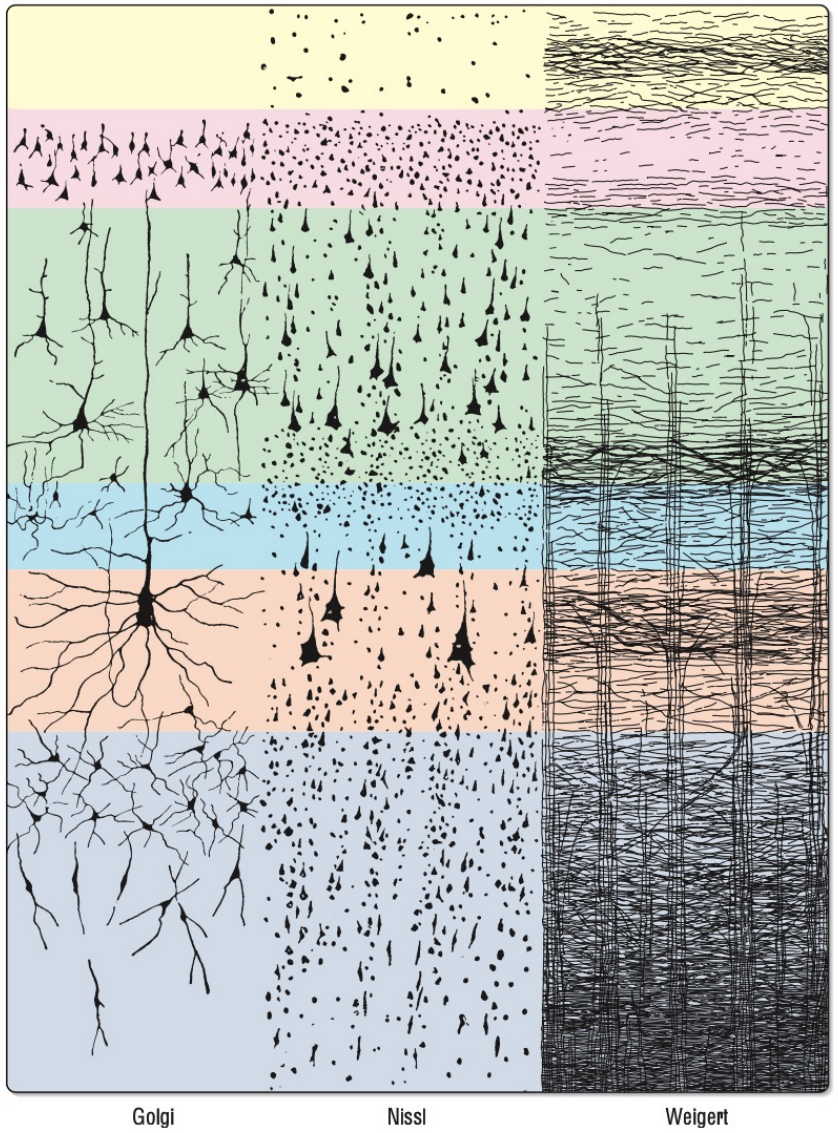
- **Subiculum – uper surface of parahippocampal gyrus**
- **Hippocampus – bank facing into lateral ventrikle – cca 5 cm**
- **Gyrus dentatus – medial to hippocampus**





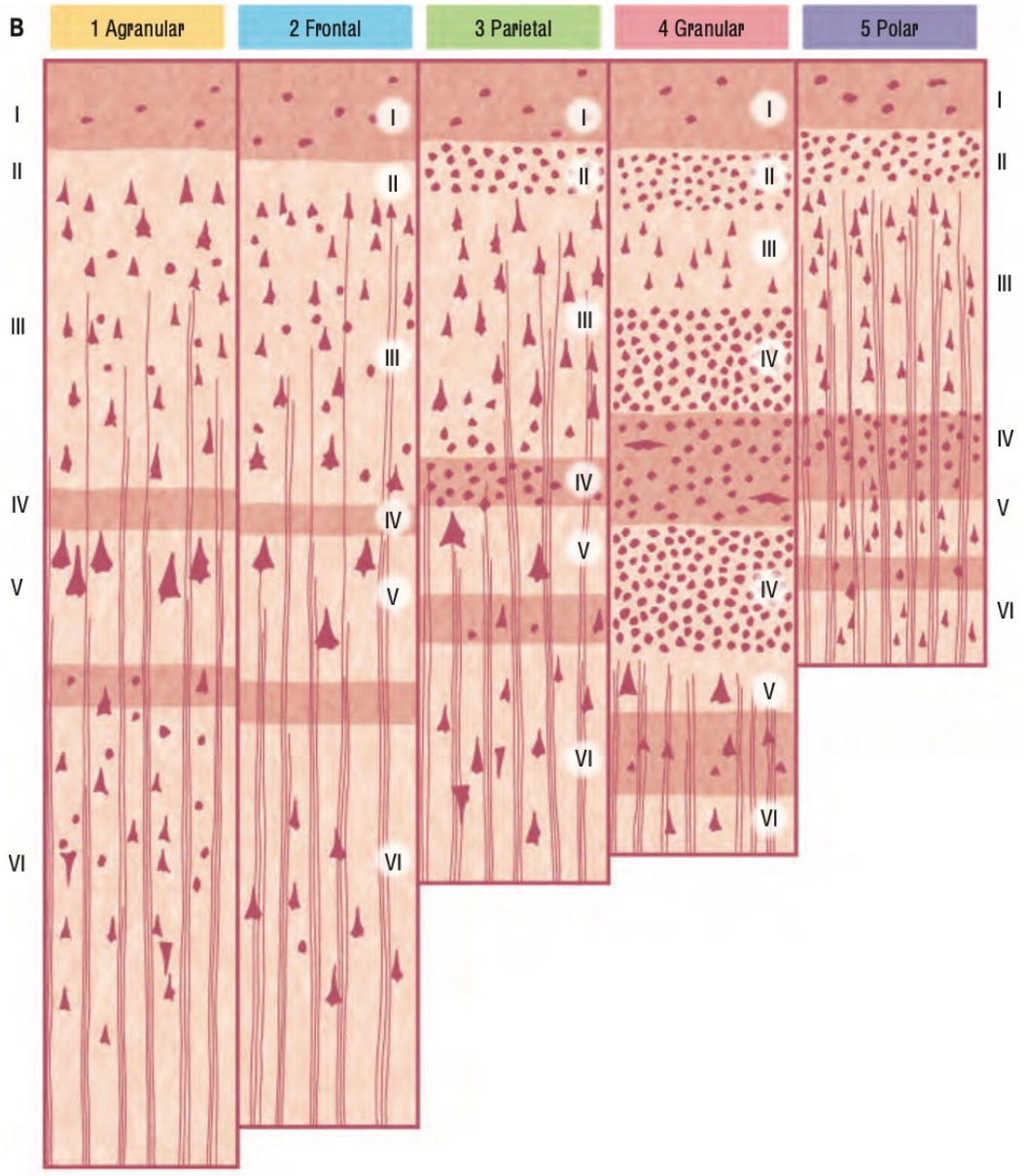
Isocortex

- I. lamina molecularis
  - Horizontal neurons, apical dendrites of pyramidal cells
  - Minimla number of neurons, reach of neurglia and fibers
  - Superficial part. Reach of astrocytes – membrana limitans gliae superficialis
  - Covered by basal membrane and on it lies pia mater
- II. lamina granularis externa
  - Stellar neurons and small pyramidal cells
  - Paralel fibers - association
- III. lamina pyramidalis externa
  - smaller pyramidal cells – apical dendrites to lamina I. , than horizontal dendrites
  - Stellar and Martinotti cells - commisural functions
- IV. lamina granularis interna
  - overwwlming stellar neurones
  - Endings of thalmaic fibers
  - Minimla in motorcortex, extended in sensoric
  - Layer of myelinized fibers in horizontal orientation – stria Baillargeri externa
- V. lamina pyramidalis interna (ganglionaris)
  - Large pyramidal cells – 100um – Betz pyramids – axons lead to subcortical centers
  - Apical dendrites reach I. lamina
  - The deep part contains stria Baillargeri interna
- V. lamina multiformis
  - Fusiform, Matinotti, stellar neurons

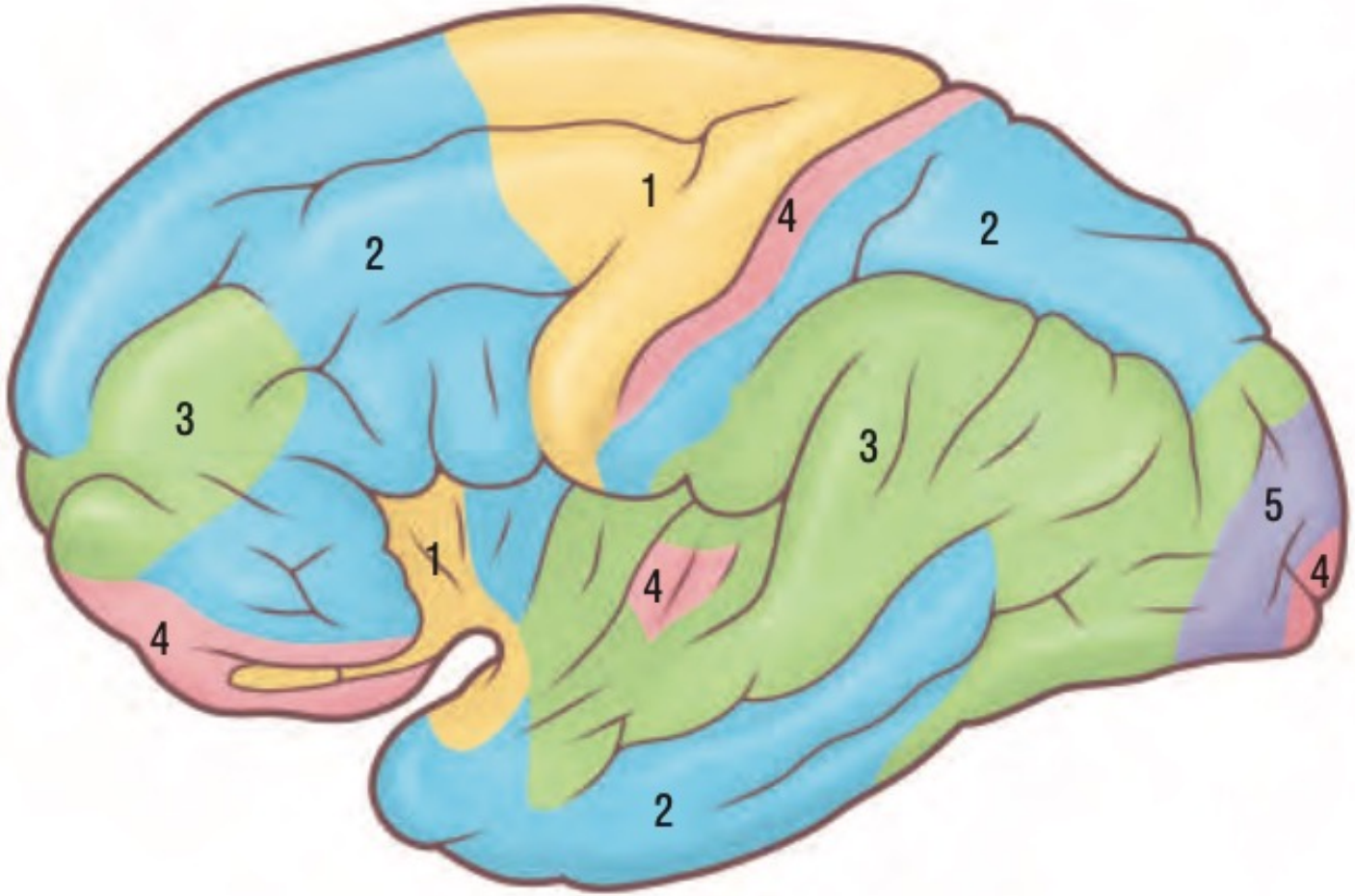


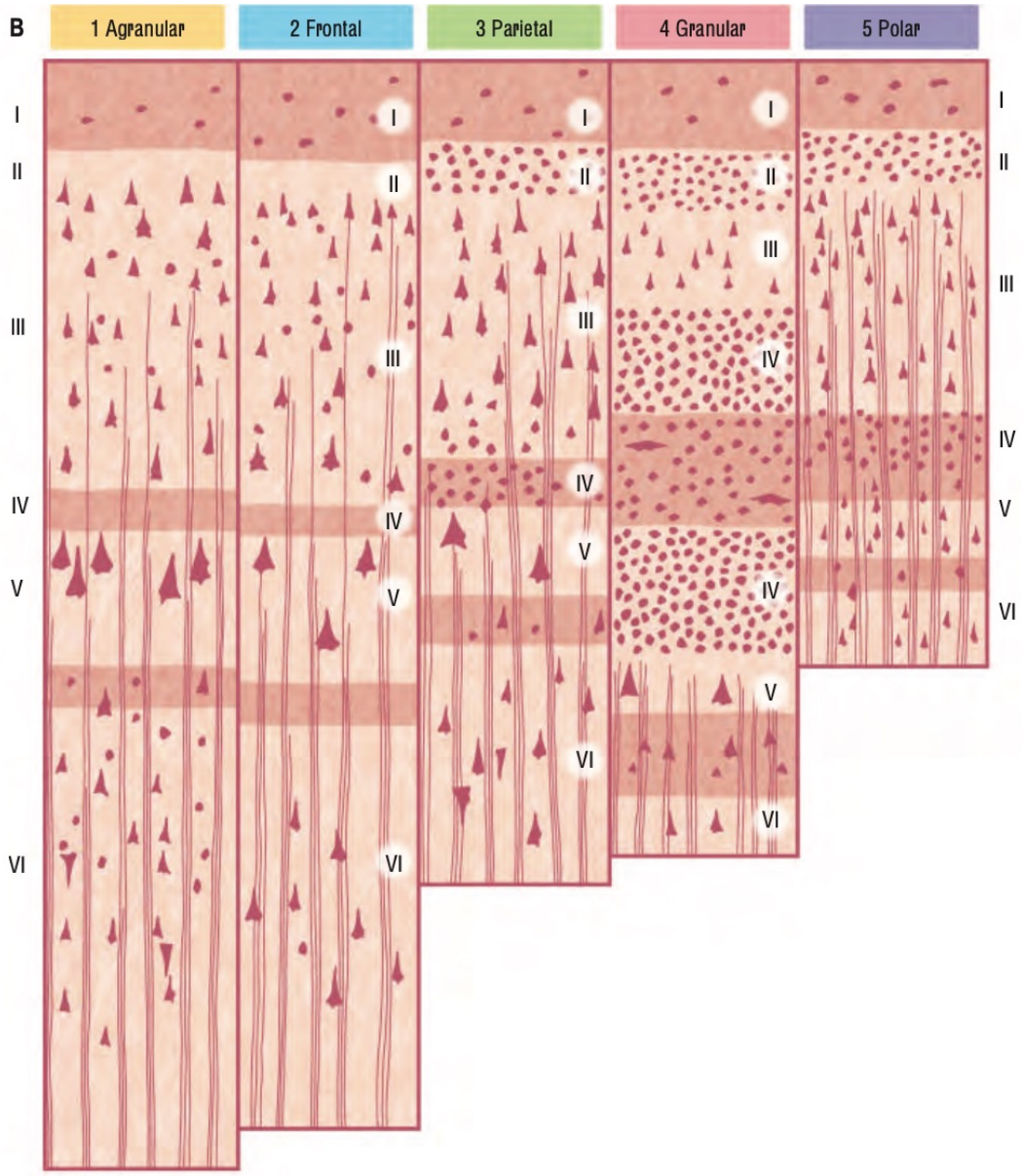
Cytoarchitectonic - differences

- **Homotypical cortex**
  - *Al layers distinguished well*
- **Heterotypical cortex**
  - *Some layers are suppressed, other oversized*
- **Agranular cortex**
  - *Motor cortex*
  - *Dominating layers III. + V.*
  - *Dominated by pyramidal cells*
  - *Important reduction of stellar cells*
- **Granular cortex**
  - *sensoric*
  - *Dodominating layers II. + IV.*
  - *Mainly stellar neurons*

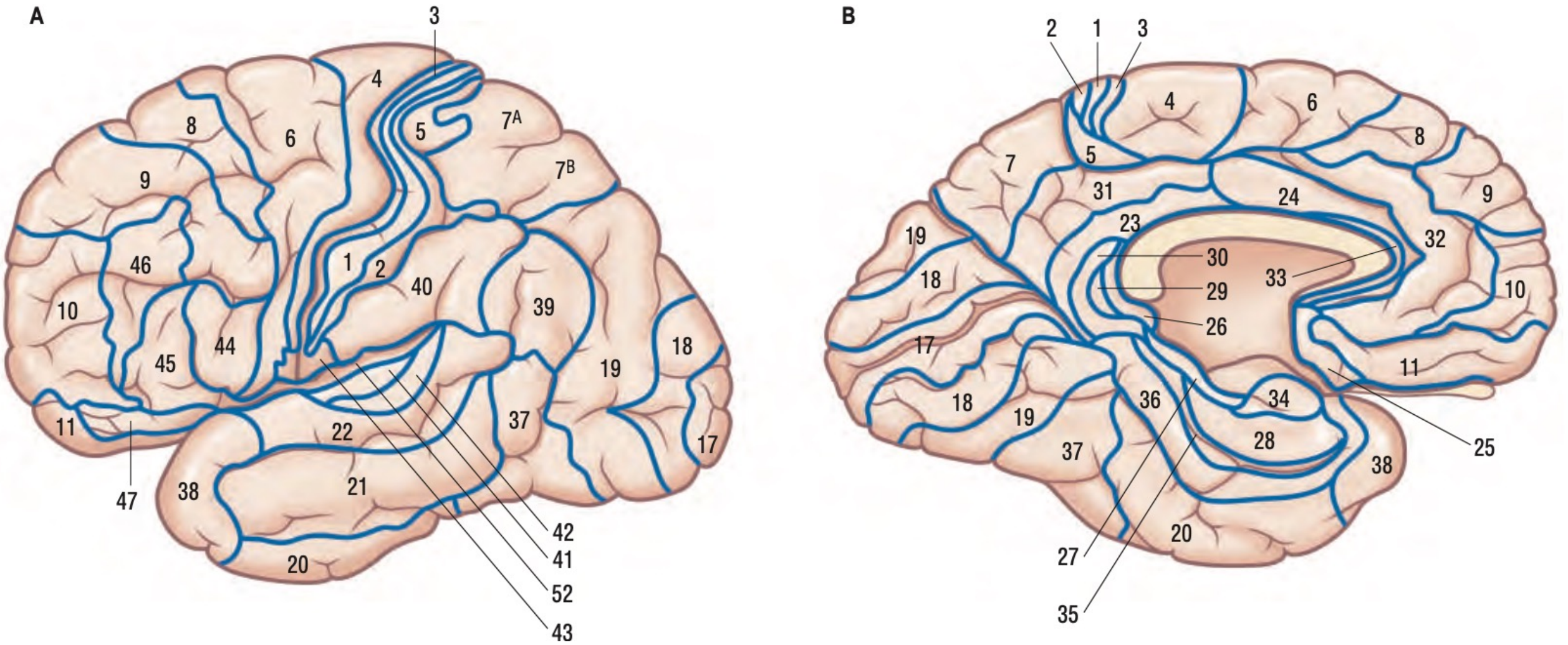


Cytoarchitectonic

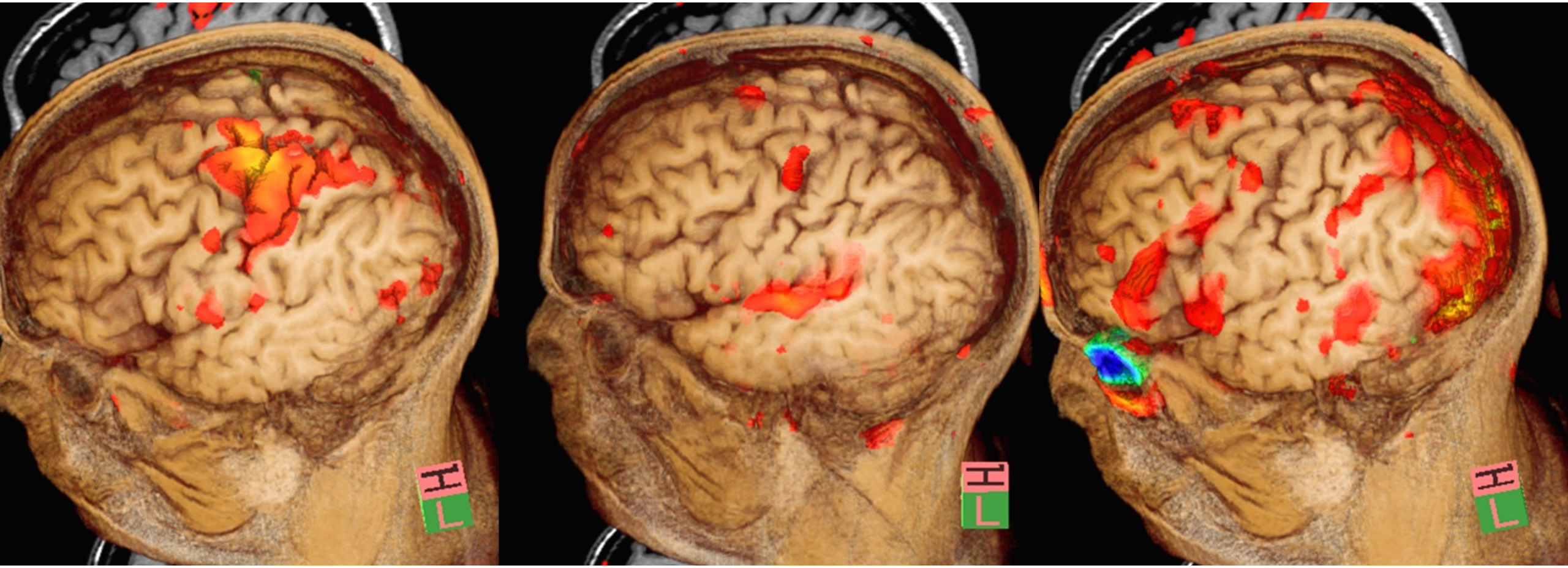




Brodman areas



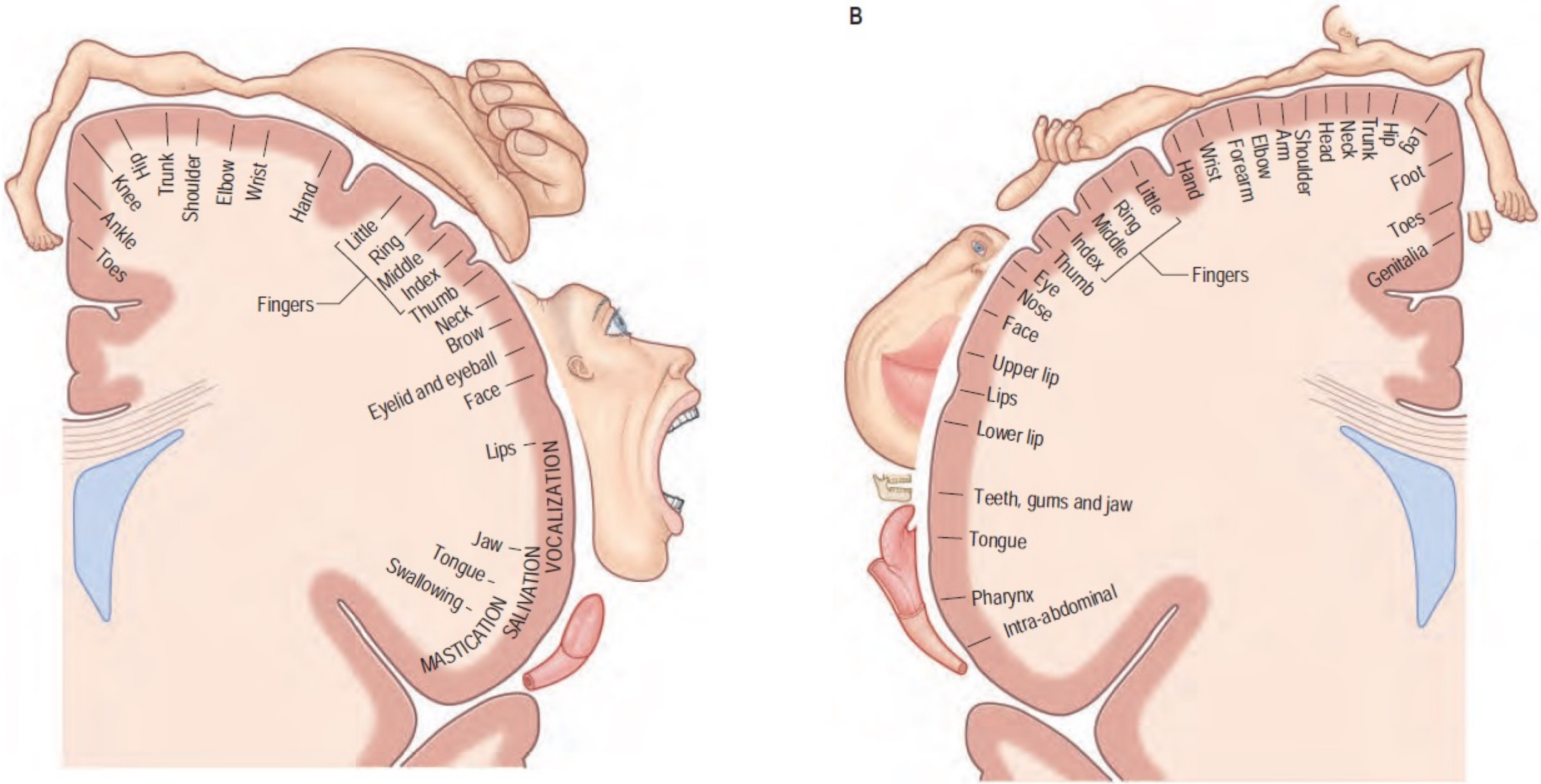
Functional magnetic resonance

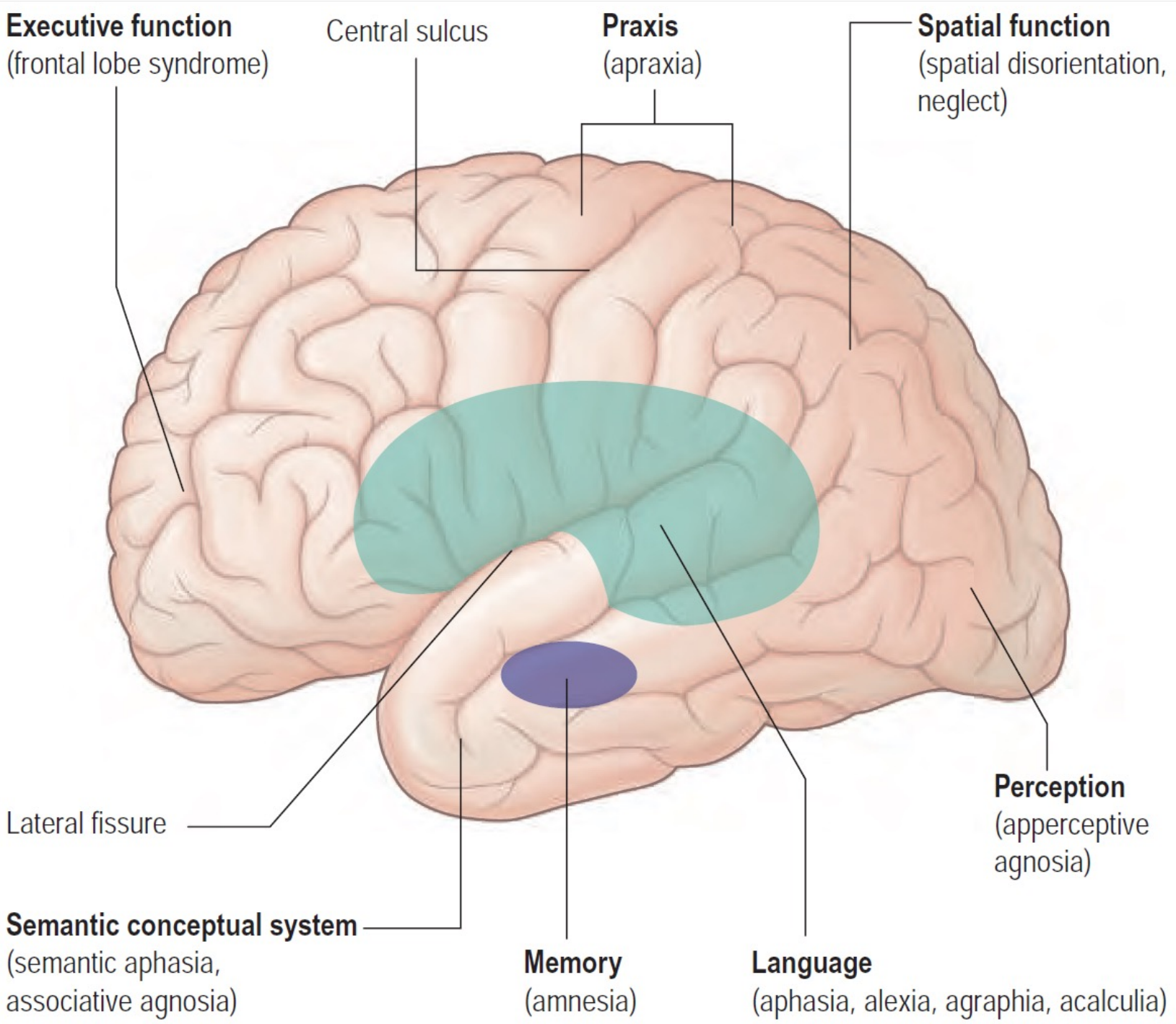


fingertapping

ZZ top listening

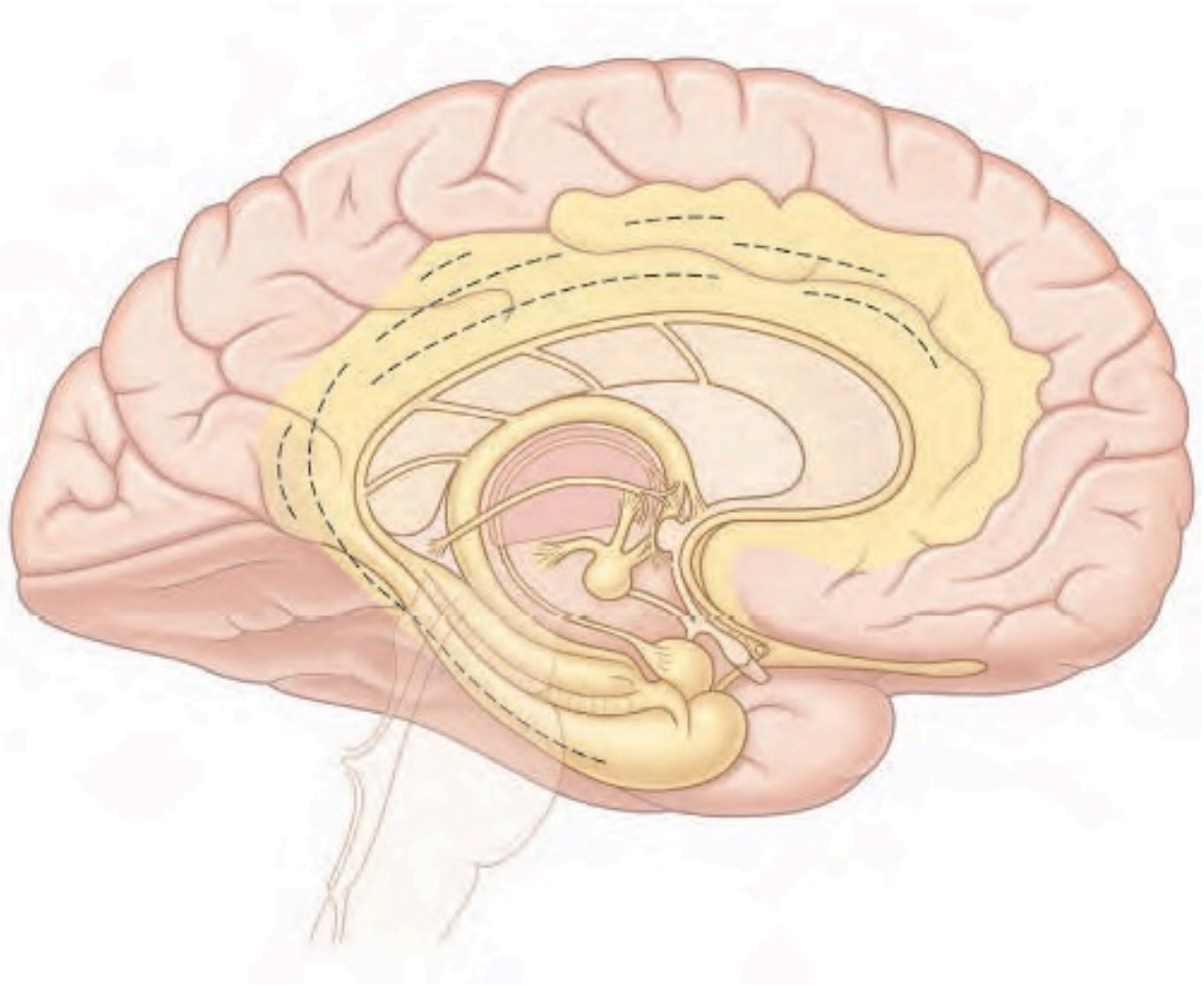
Image naming


Toes
Ankle
Knee
Hip
Trunk
Shoulder
Elbow
Wrist
Hand
Fingers
Little
Ring
Middle
Index
Thumb
Neck
Brow
Eyelid and eyeball
Face
Lips
Jaw
Tongue
Swallowing
MASTICATION
SALIVATION
VOCALIZATION
B
Toes
Genitalia
Foot
Leg
Hip
Trunk
Neck
Head
Shoulder
Arm
Elbow
Forearm
Wrist
Hand
Fingers
Little
Ring
Middle
Index
Thumb
Eye
Nose
Face
Upper lip
Lips
Lower lip
Teeth, gums and jaw
Tongue
Pharynx
Intra-abdominal


Executive function
(frontal lobe syndrome)
Central sulcus
Praxis
(apraxia)
Spatial function
(spatial disorientation, neglect)
Lateral fissure
Perception
(apperceptive agnosia)
Semantic conceptual system
(semantic aphasia, associative agnosia)
Memory
(amnesia)
Language
(aphasia, alexia, agraphia, acalculia)

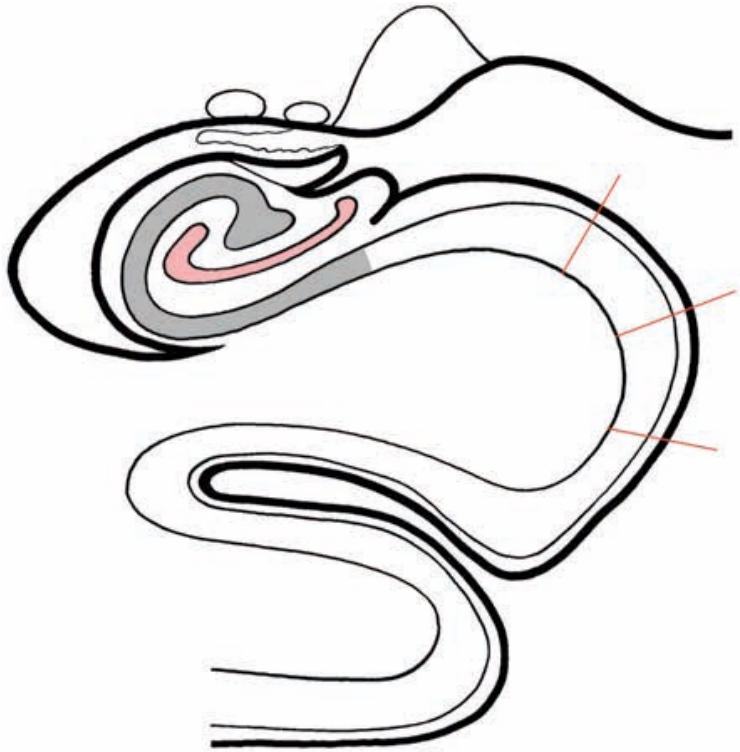
Lobus limbicus

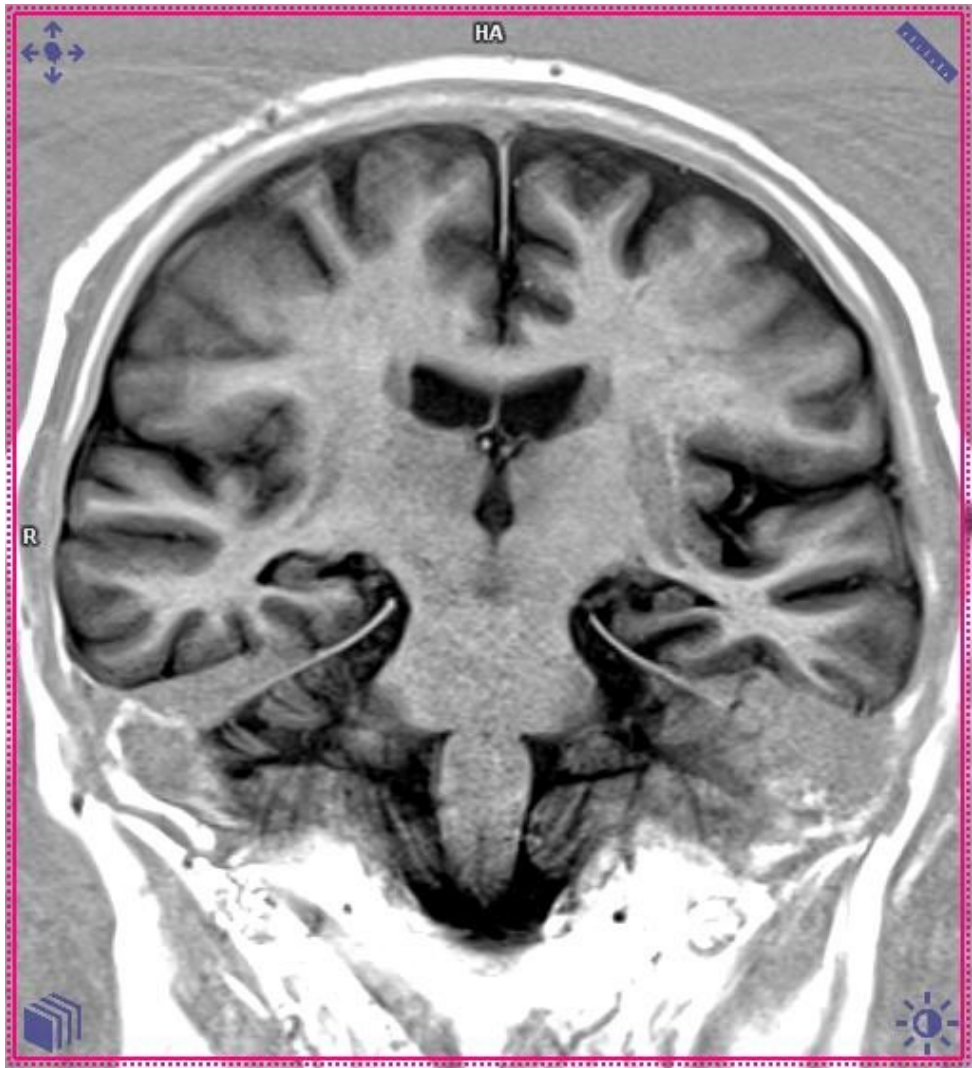
- Gyrus cinguli
- Gyrus parahipocampalis
- Uncus gyri parahipocampalis
- Sulcus hipocampi – oddělení od dienecefala
- Subiculum – horní část g. parahipocampalis
- Gyrus dentatus
- Taenia Giacomini
- Fimbria hipocampi – initiation of fornix
- Tela chorioidea ventriculi lateralis
- To lateral ventrikle bulges hipocampus
- anteriorly pes hipocampi



Subiculum

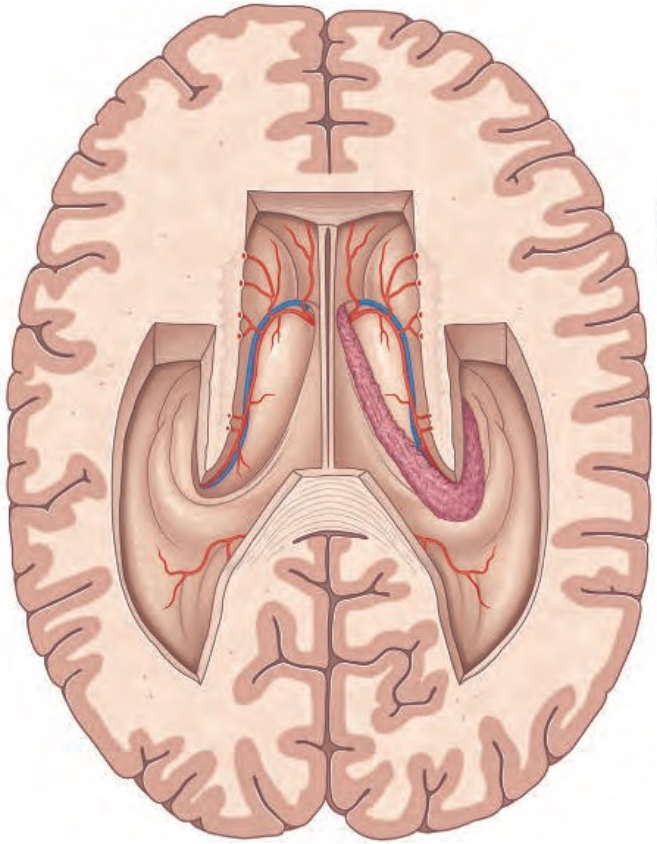
- Upper surface of gyrus hippocampi (parahippocampalis)
- Laterally continues to hipocampus
- Layers
- Surface - stratum moleculare
- Superficial pyramidal layer
- Deeper pyramidallayer
- Neghboring to mesocortex
  - Entorhinal area
  - Praesubiculum

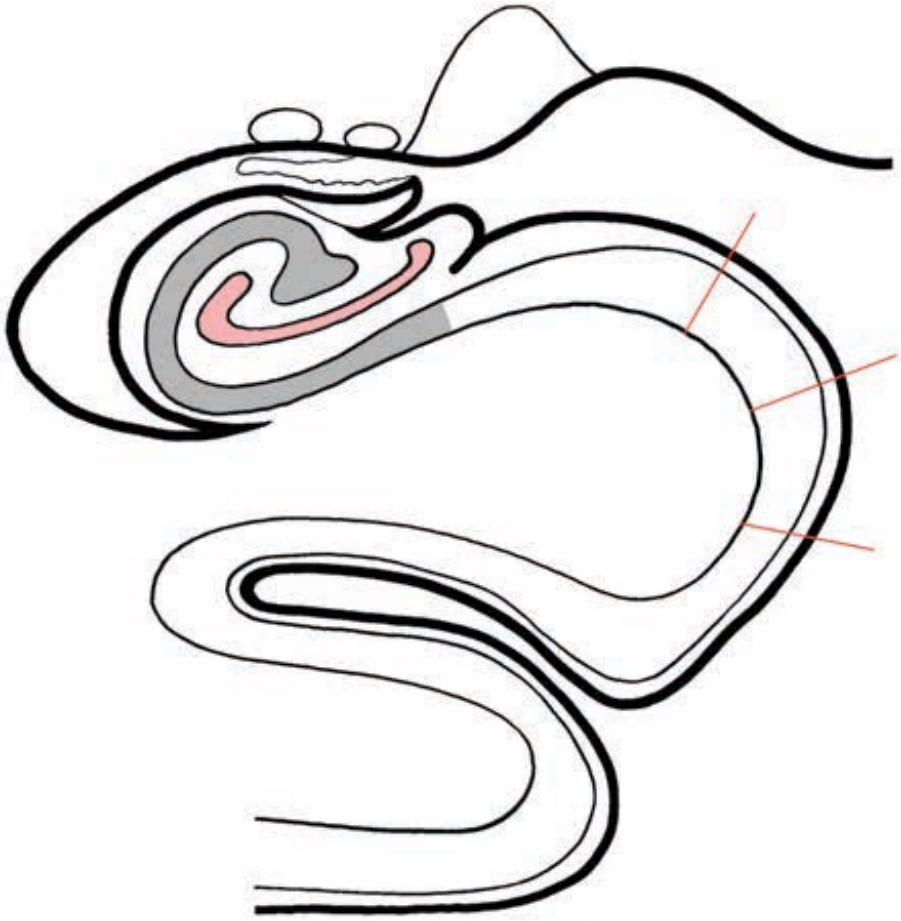




Hippocampus

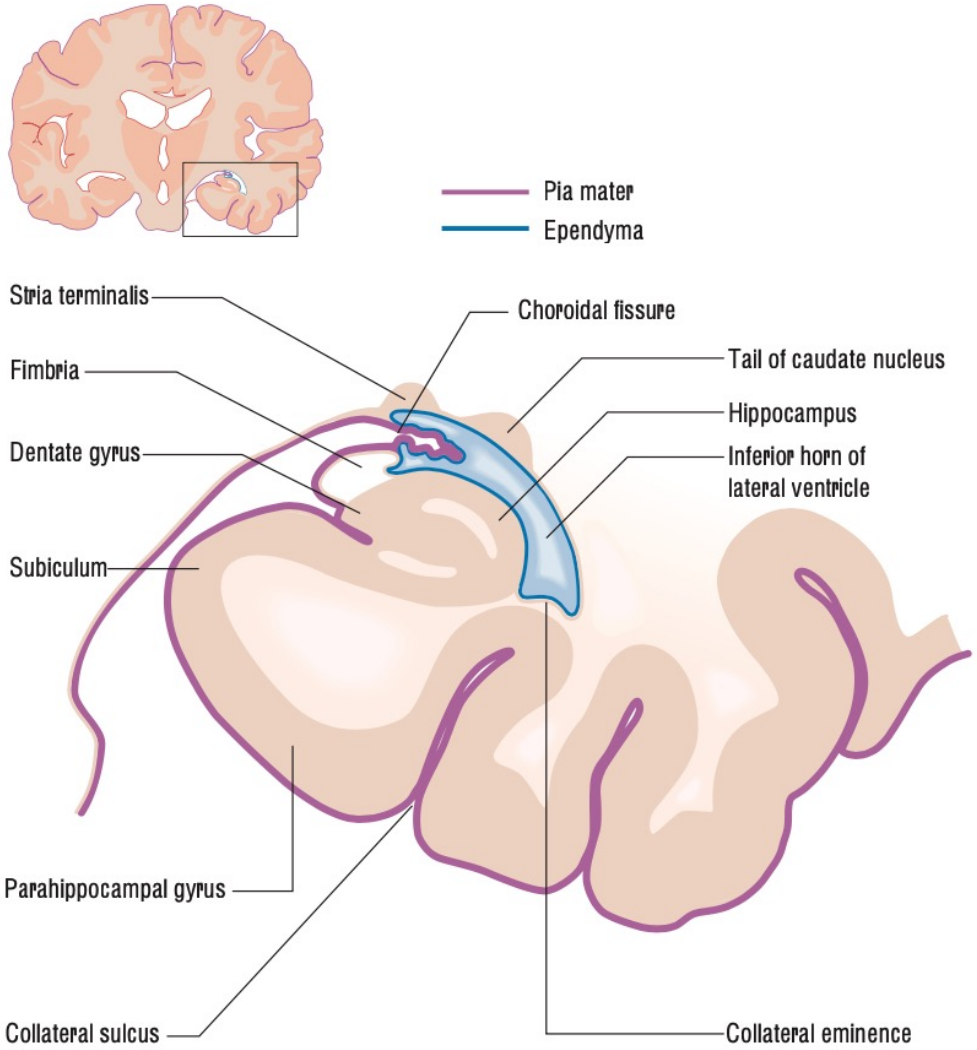
- Hippocampus (cornu Ammonis)
- Anteriorly widens to pes hippocampi (foot)
- Upper ridge – fimbria fornicis – continues like fornix
- surface of hippocampus – ependyma
- Subependymal layer - alveus
  - Fibers converging to fimbria
- Foru fields of hippocampus
- CA1-4
- layers
  - Stratum oriens
    - Small number of neurons
  - Stratum pyramidale
    - Pyramidal projection neurons
  - Stratum radiatum
    - Small number of interneurons





Gyrus dentatus

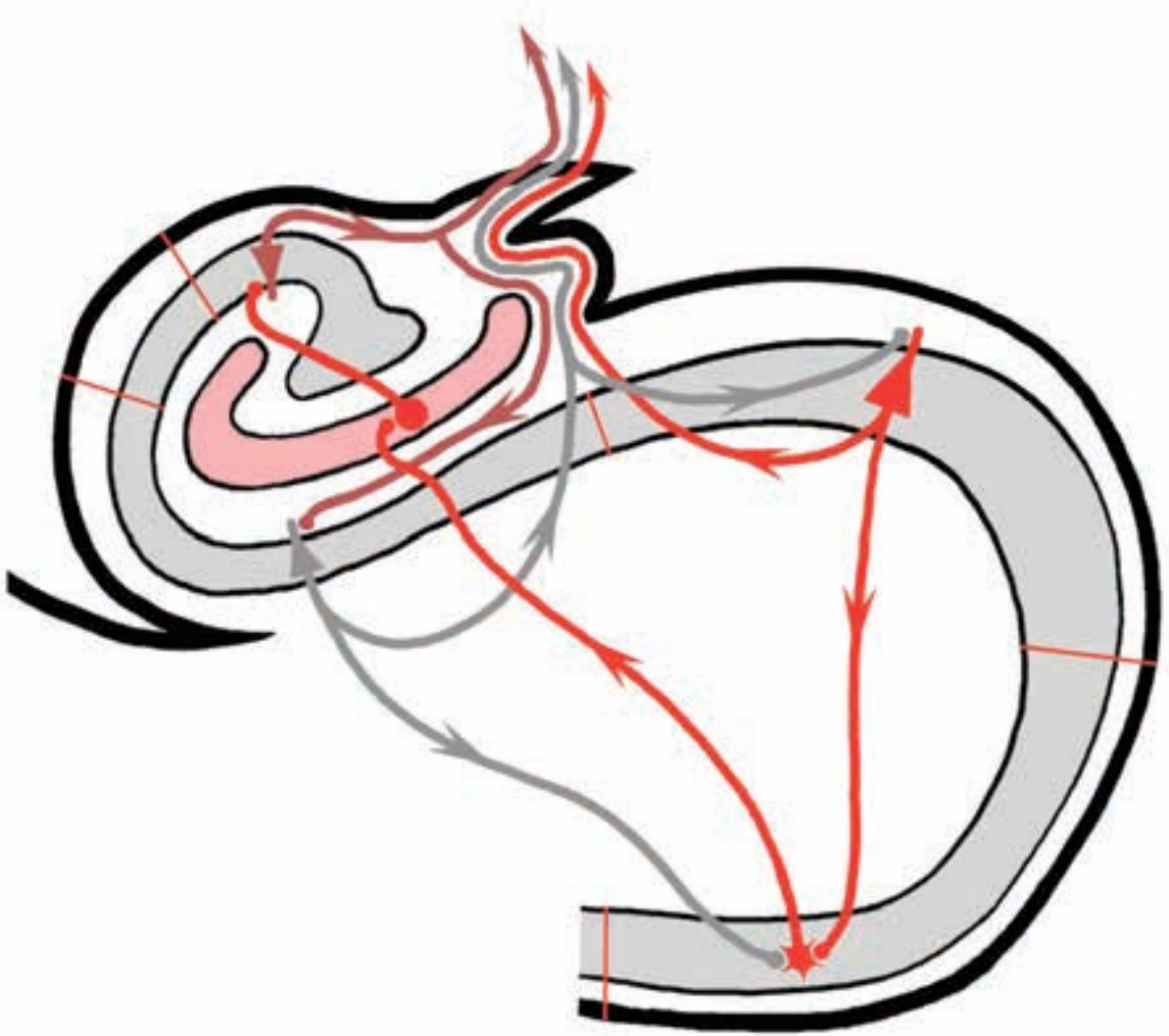
- **Dentate surface**
  - Medially to hippocampus
  - Dorsally falttennig nad shrinkening
  - Giancomini belt to splenium corp. callosi
- **Stratum moleculare**
  - Rareky settled by interneurons
- **Stratum granulare**
  - High density of granular (stellar) cells
- **Stratum multiforme**
  - interneurons
- rudiments
- Upper surface of CORPUS CALLOSUM
- INDUSEUM GRISSEUM + STRIAE LONGITUDINALES



Internal relay of hipocampal formation

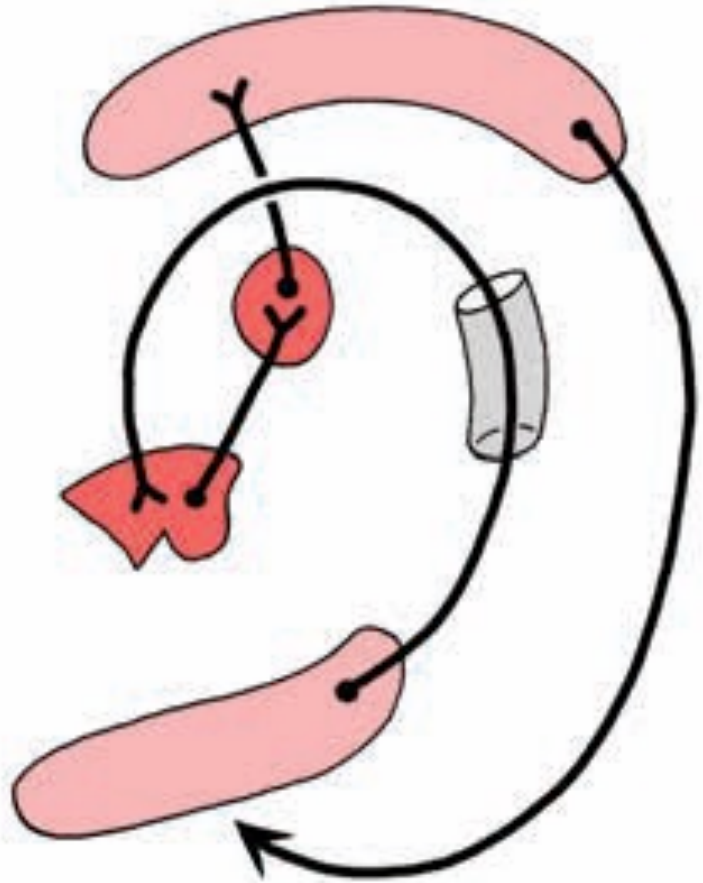
- Andersen circle
- Entorhinal cortex
- Gyrus dentatus
- CA3 hippocampus
- CA1 hippocampus
- Subiculum
- Entorhinalcortex

- Glutamate
  - Outer output – fimbria fornicis



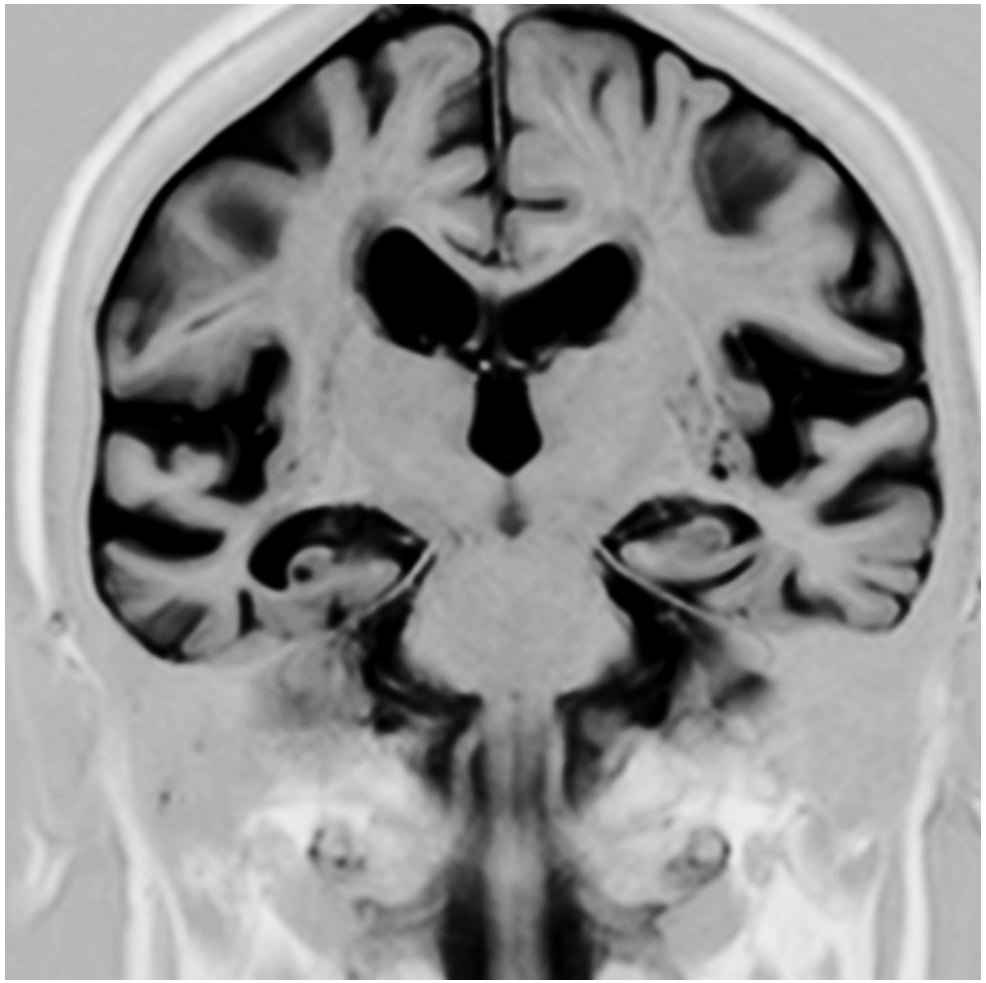
Papez circle

- Hipocampal formation
- Fornix
- Hypothalamus – corpora mamilaria
- Tractus mamilothalamicus
- Nuclei anteriores thalami
- Thalamokortikální projekce
- Gyrus cinguli
- Cingulum (asociační vlákna)
- Gyrus parahippocampalis
- Entorhinal area
- Hippocampal formation



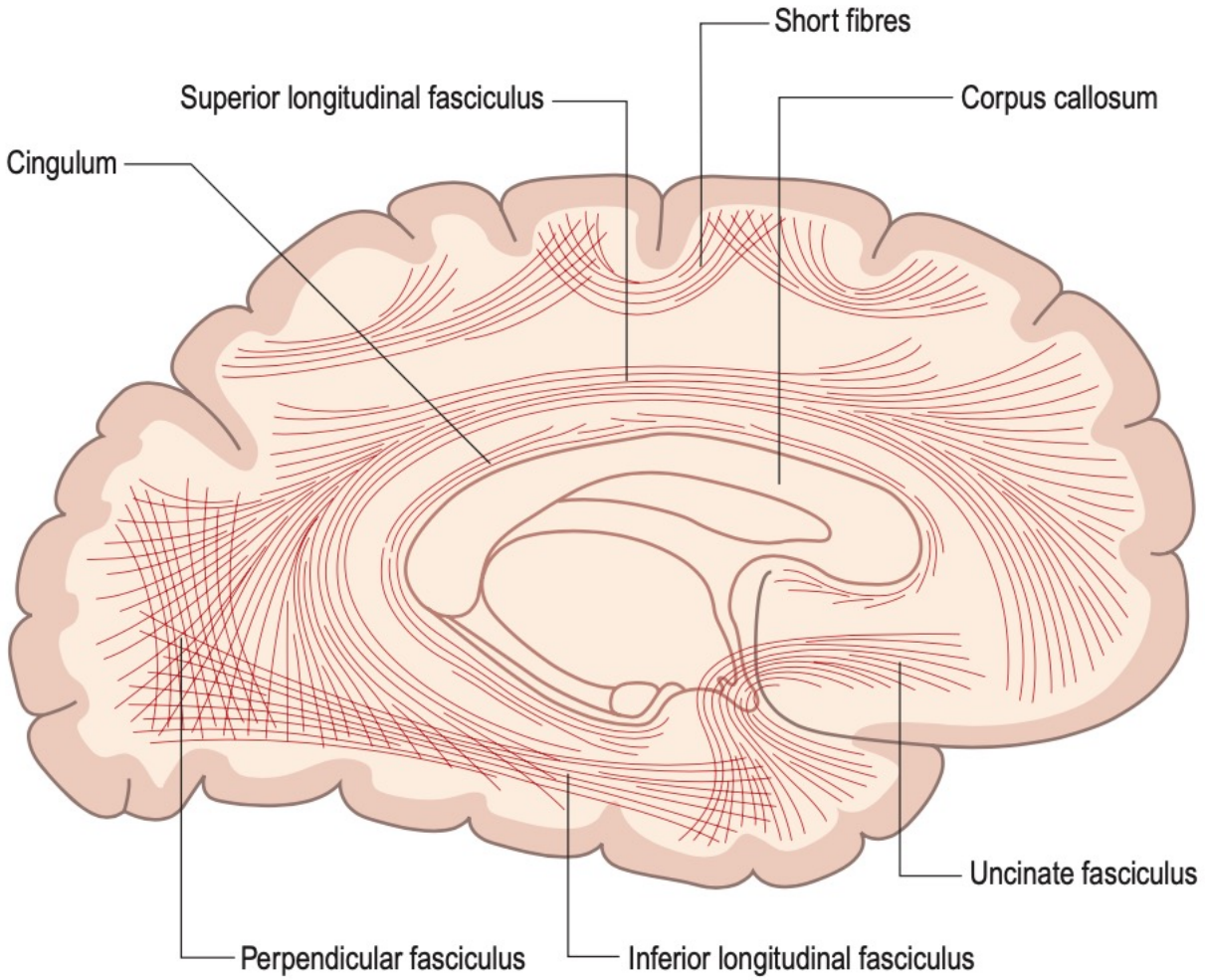
Hippocampal formation

- function
  - Informtion transfer to diencefalon and septum verum
  - Vice versa from hippokampus to neokortex
  - Consolidation of memory trace
  - Transformation of shortterm and midterm memory to longterm
- Mechanism of function - longterm potentiation
- Impaired hippocampal formation
  - Impaired short-term memory
  - Also the related cortical areas
    - A lso ways of information transfer
  - entorhinal area and gyrus parahipocampalis
- Alzheimer disease
- Korsakoff syndrome
- Epileptic foci – temporal mesial sclerosis
- Spatial congnition



Substantia alba – - white matter

- Almost nerve fibers
- Axones
- White matter organization
- Related to communication
- Association fibers
- Comissural fibers
- Projection fibers
- Bound to – fasciculi

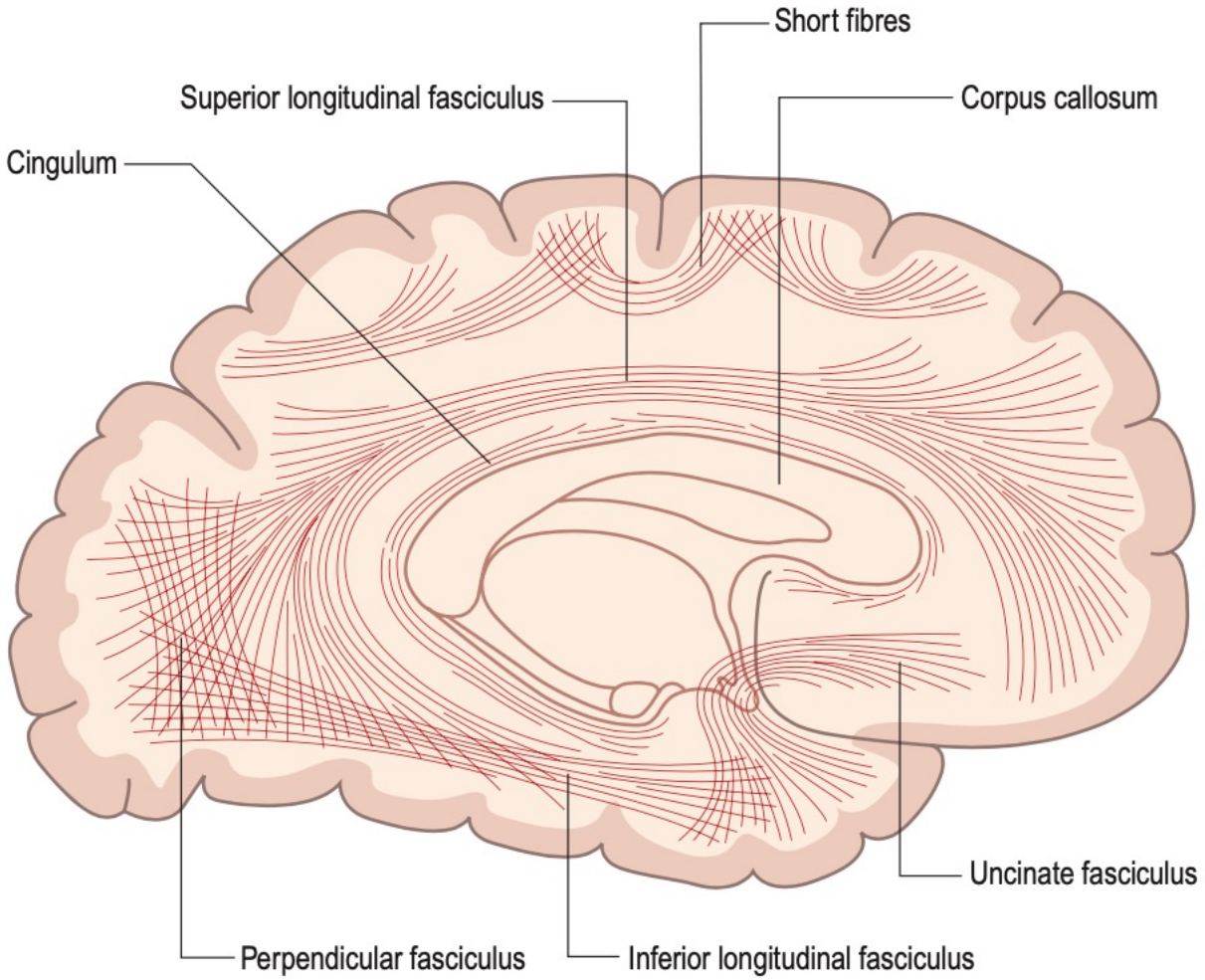


- Imaging of the white matter
- Magnetick resonance imaging
- Diffusion imaging – 3D traktography
-

Association connections

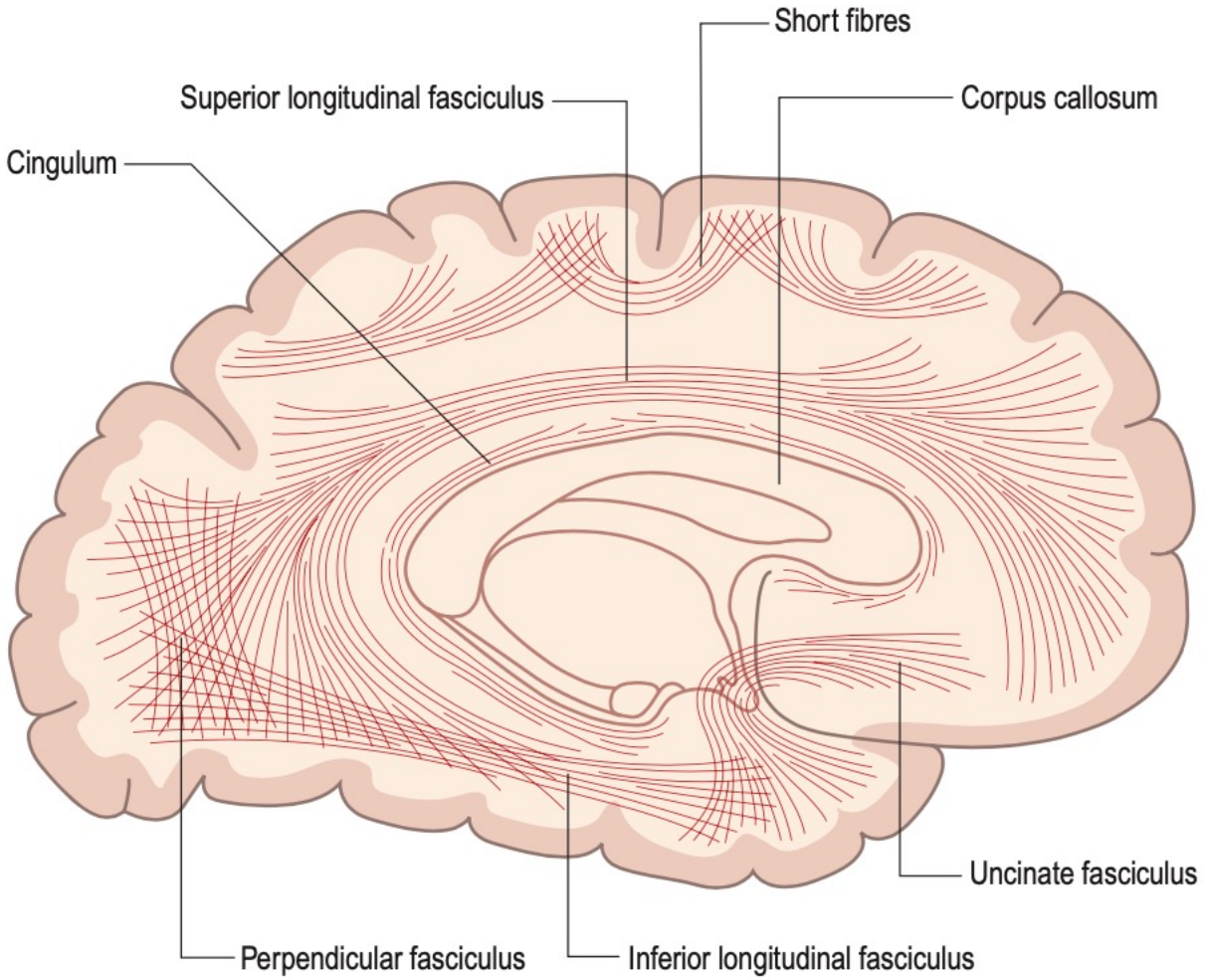
- **"U-shape"**
  - **short connection**
  - **Neighbouring gyri**

- **Fasciculus longitudinalis superior**
- *Frontoparietal segment – horizontal*
  - **Visual perception**
  - **Semantics**
  - ***Distinguishing of faces***
- *Temporoparietal segment – vertical*
- *Temporofrontal segment – arcuate*



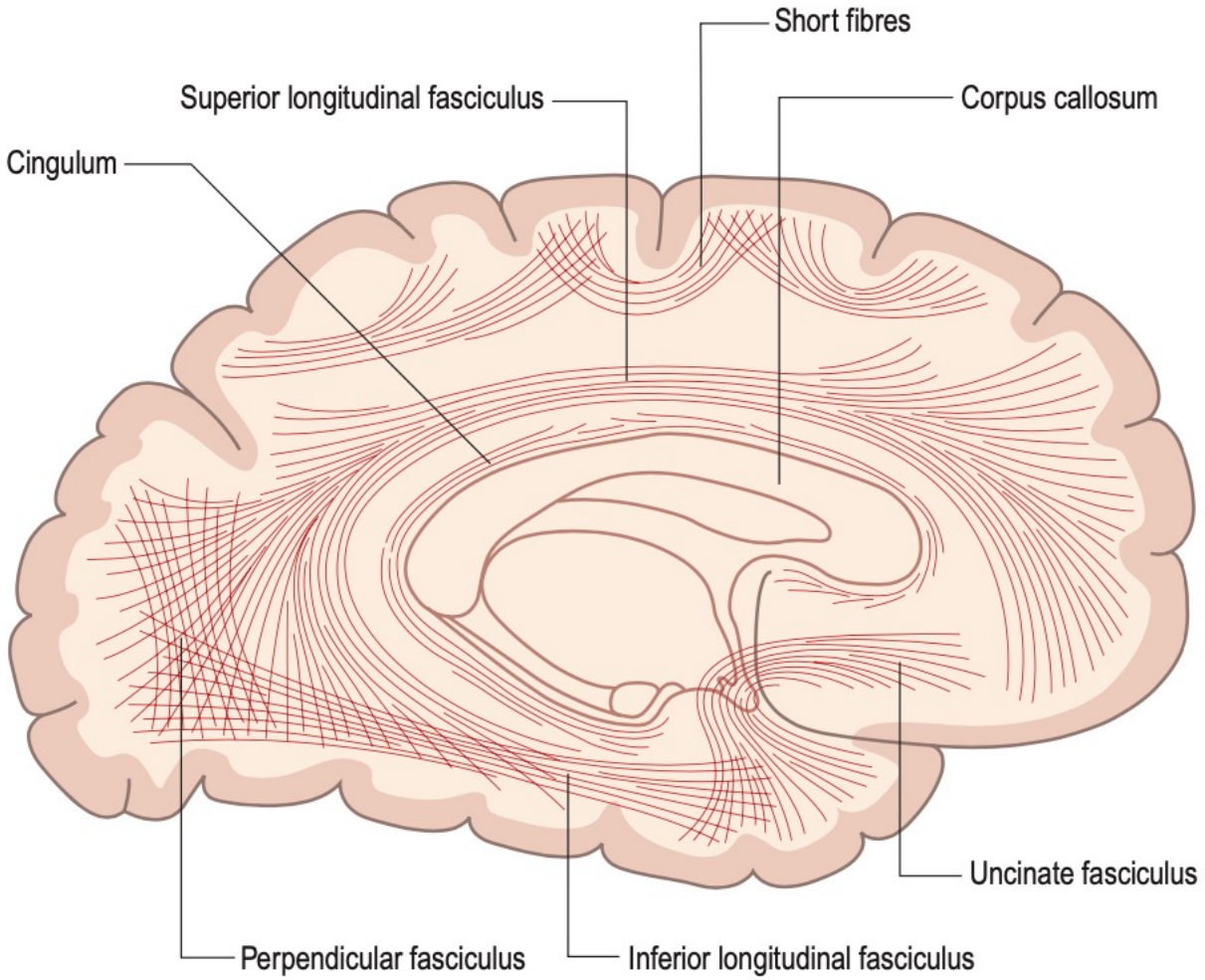
Association connection

- **Fasciculus longitudinalis inferior**
  - Temporopolar region
  - Occipital lobe
- Inside gyrus fusiformis
- Connections of direct pathways
  - Anterior parts of frontal gyri
  - Gyrus parahippocampalis
  - Gyrus fusiformis
  - Amygdala
- Indirect pathways



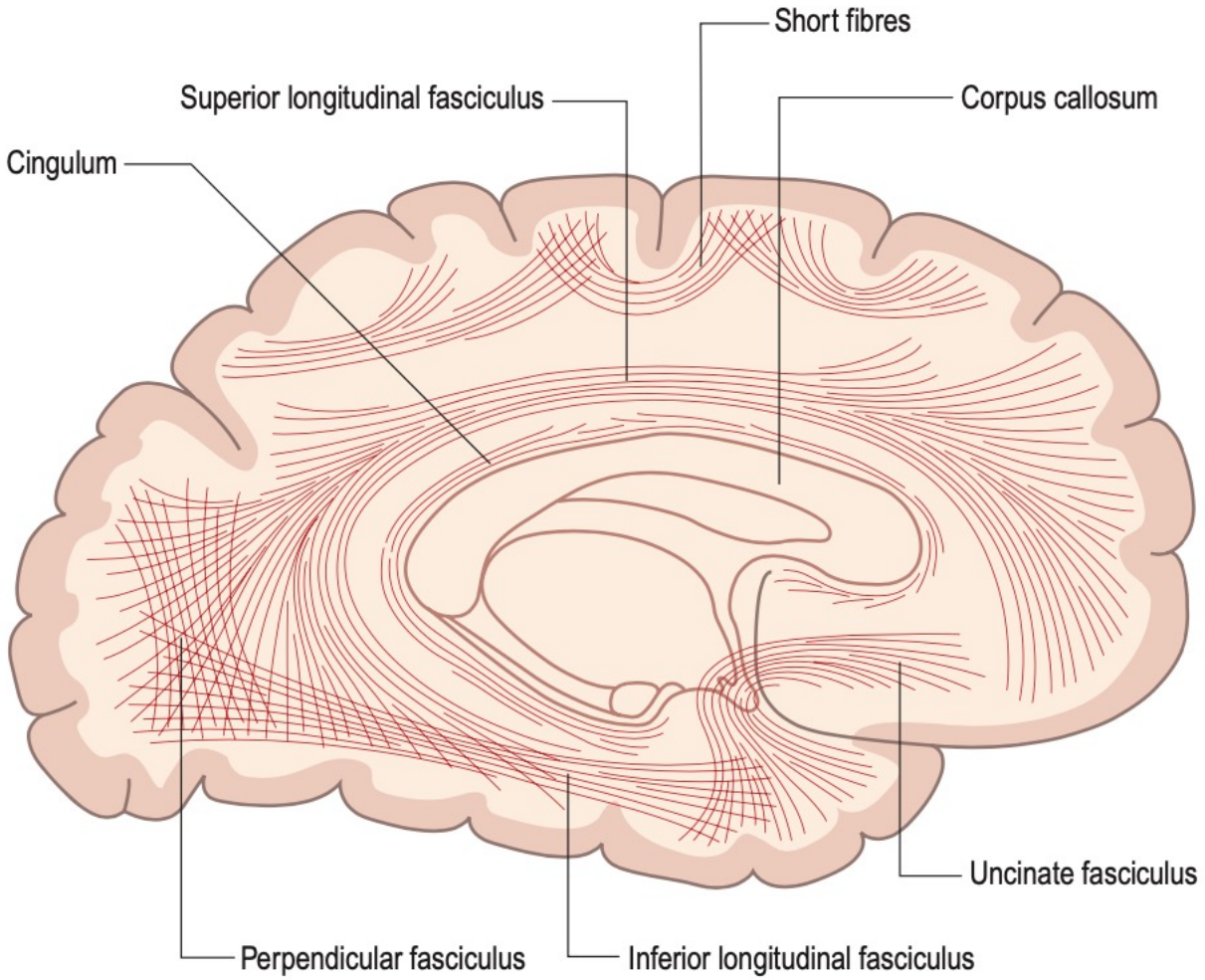
Association connections

- **Fasciculus uncinatus**
  - **Hook-like**
  - **Anteromedial lobus temporalis**
  - **Orbitofrontal region**
- *Mixed fibers*
  - *capsula externa*
  - *capsula extrema*



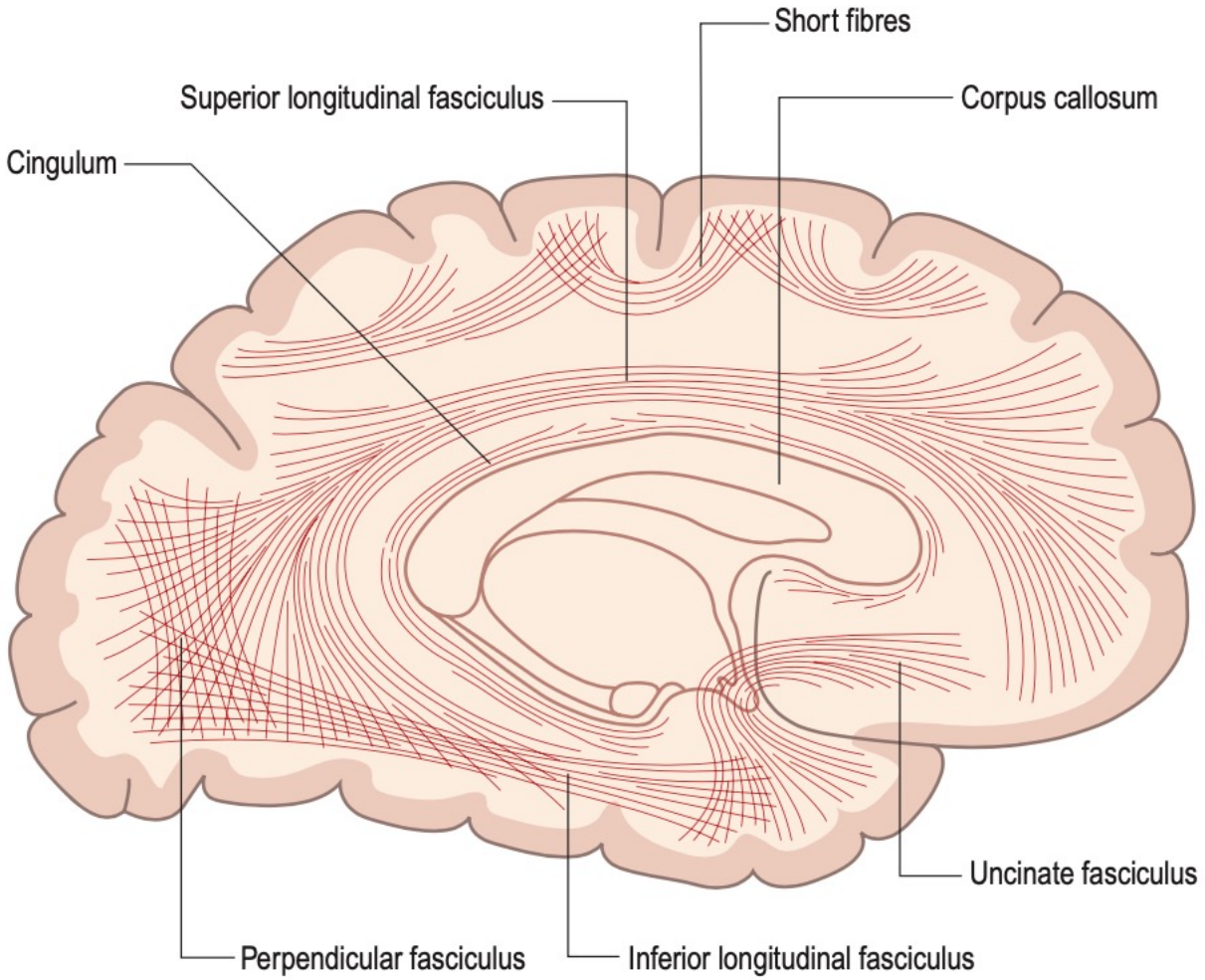
Cingulum

- inside
- gyrus cinguli
- gyrus parahippocampalis
  - Different length of fibers
  - The longestgyrus temporalis anterior
  - To orbitofrontal cortex
  - Gets fibes
  - *Anterior thalamic nuclei*
  - *Upper frontal gyrus*
  - *Paracentral lobulus*
  - *precuneus*
  - ends
  - Entorhinal cortex
  - presubiculum



Temporoparietal fibre intersection area

- Crossing of milions of fibers
- Deep inside below
- Gyrus angularis
- Posterior part
- Supramarginal gyrus
- Upper, medial and inferior temporal gyrus

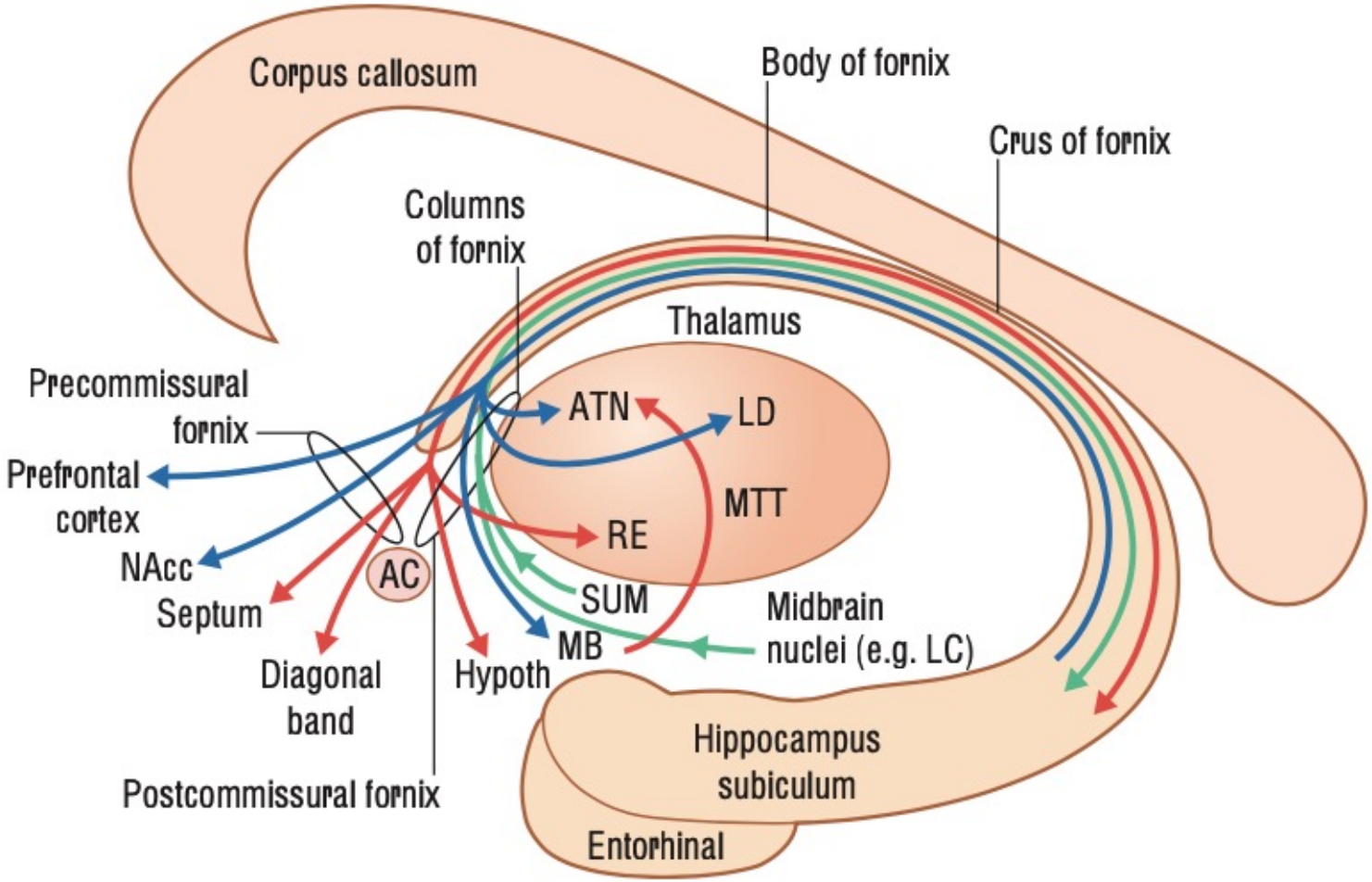


Fornix

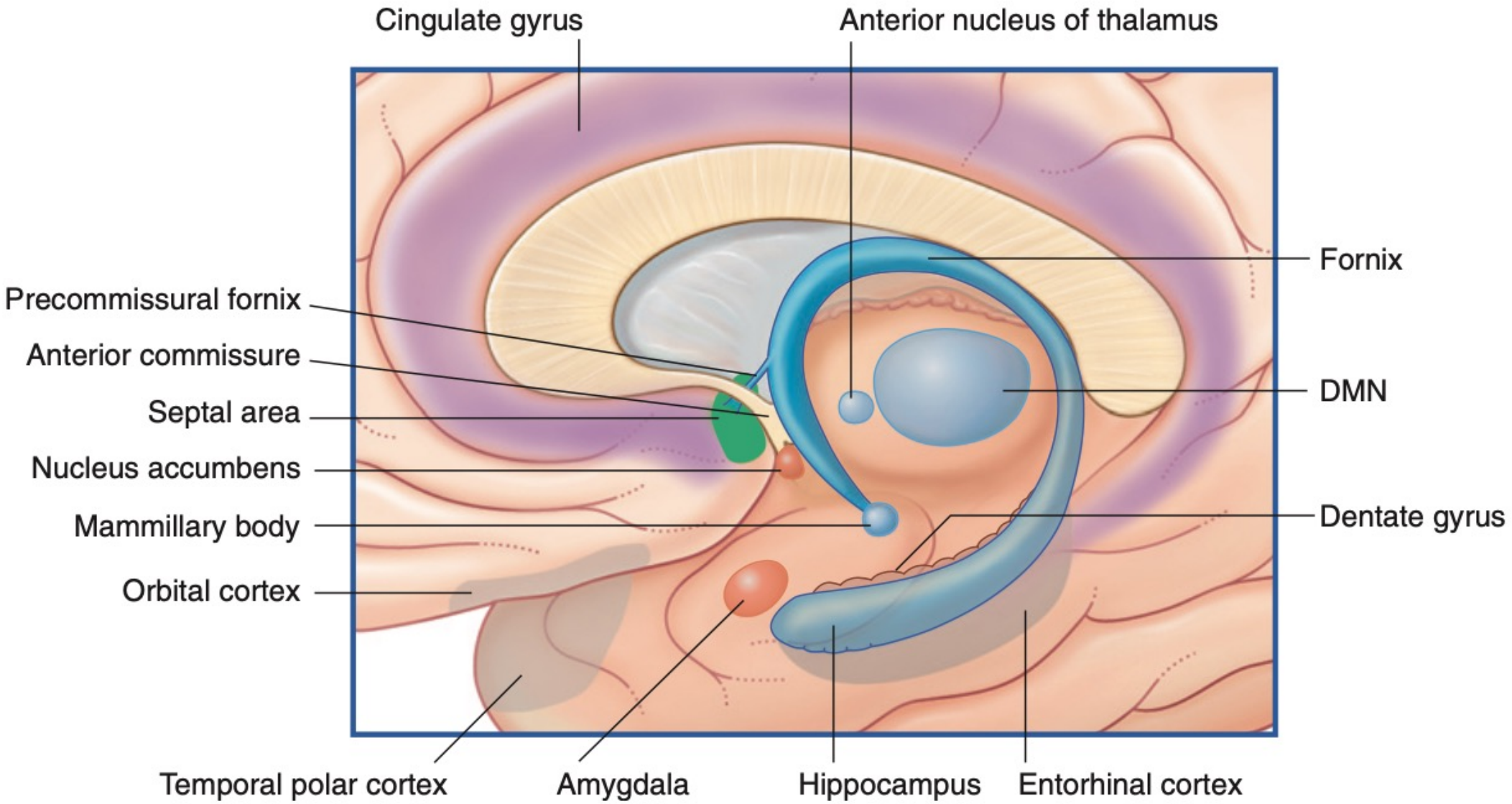
- Connection of
- Nuclei thalami anteriores
- Corpora mamilaria
- Ventrální striatum
- Prefronální kortex

- Reciprocity of connection
  - septum verum
  - nucleus reuniens
  - rapheální jádra retikulární formace
  - locus coeruleus

- Shear injuries



Fornix


Cingulate gyrus
Anterior nucleus of thalamus
Fornix
Precommissural fornix
Anterior commissure
DMN
Septal area
Nucleus accumbens
Dentate gyrus
Mammillary body
Orbital cortex
Temporal polar cortex
Amygdala
Hippocampus
Entorhinal cortex

Commisural fibers

- **Corpus callosum**
  - The largest
- **Commisura anterior**
- **Commisura hippocampalis**
  - Commisura fornicis
  - between crura fornicics
- **Commisura posterior**
  - below
- **Commisura habenularum**
  - connects epithalamus

Corpus callosum

- 150 – 200 millions of fibers
- Contralateral anatomical related structures
- Function-related connections
- **Rostrum**
- **Genu**
- **Truncus**
- **Splenium**
  -
- ***Radiation into the semioval centre***
  - *from truncus crossing corona radiata*
- ***Forceps minor – from genu***
- ***Forceps major – from splenium***

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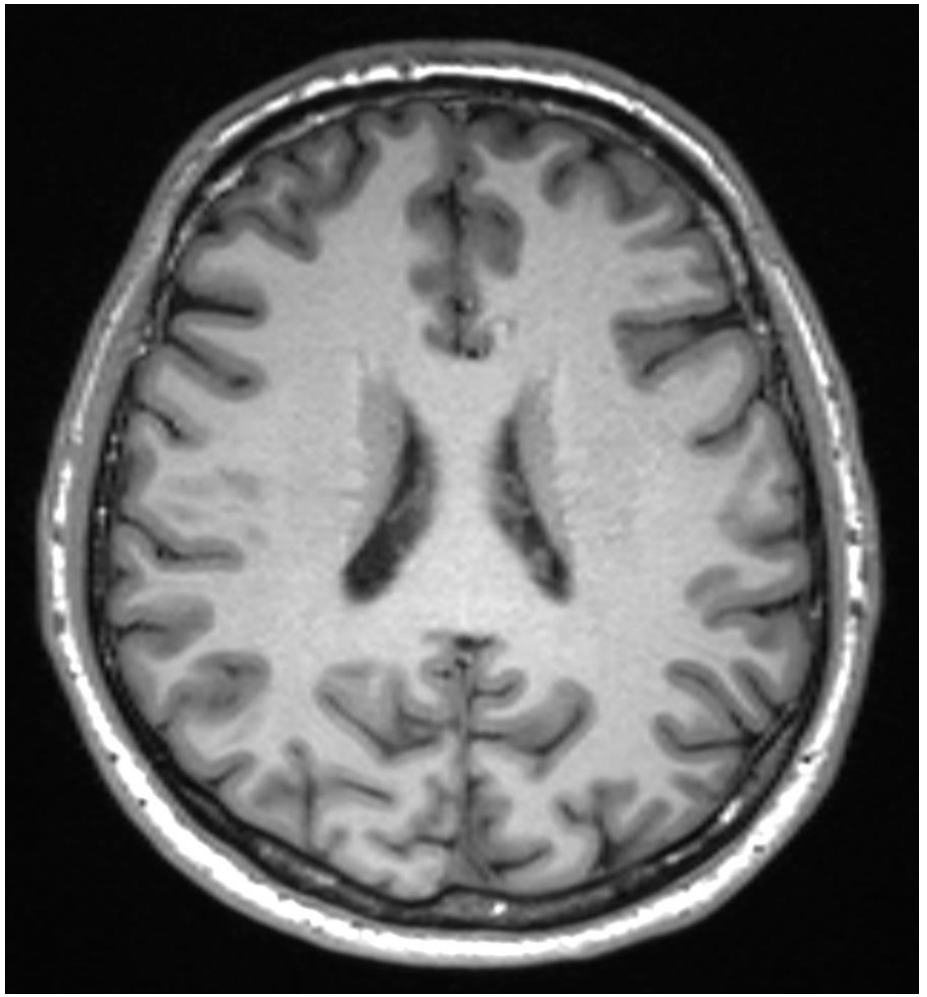


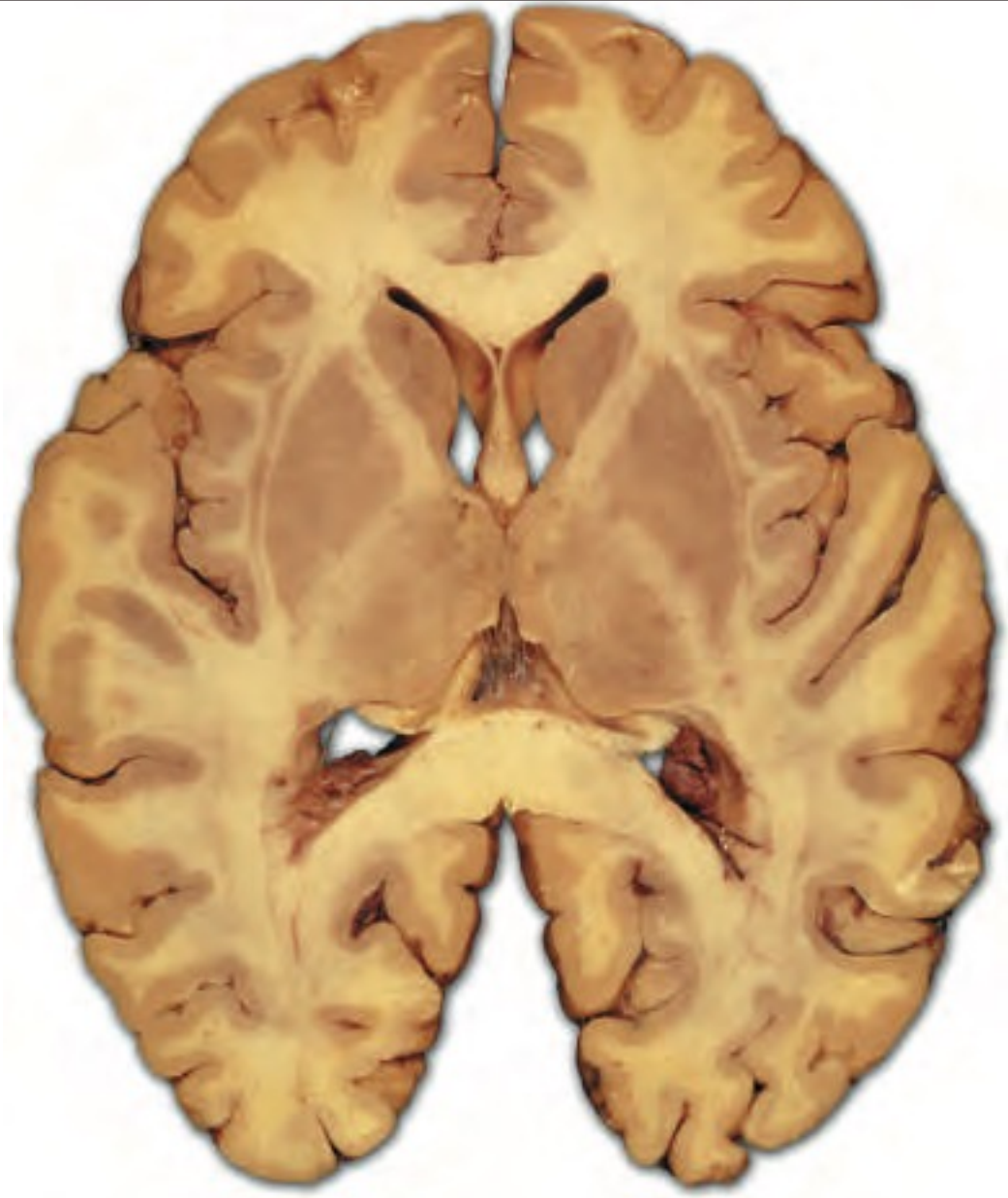
Commisura anterior

- *Connects olfactory cortex*
- *Parahippokampal cortex*
- *Amygdaloid complexes*
- *Nucleus accumbens*

- **4 mm in diameter**
- **3,5 milions of myelinized fibers**
- **supraoptic recessus of III. ventricle**
- **In the front of columnae fornicis**
- **Posterolateral bundle**
- **Anterior part**

Projection fibers

- **Capsula interna**
  - **Genu**
  - **Anterior arm** putamen and caput nuclei caudati
  - **Posterior arm** – putamen and thalamus
  - **Retrolenticular part** – dorsálně za putaminem
  - **Sublenticular part** – below putamen
- **Radiatio capsulae internae**



Capsula interna