SAWA UNIVERSITY

تشريح الشعاعي و الكورس الأول

NORMAL ANATOMY OF THE BRAIN

جامعـــــة ســـــــاوة الاهلية — Sawa University

كليـــة التقنيـــات الصحيـة والطبيـة — College of health and medical techniques

قسم تقنيات الاشعة والسونار — Department of Radiology Tech.

المرحلـــــــــــة الثالثة — Third Stage

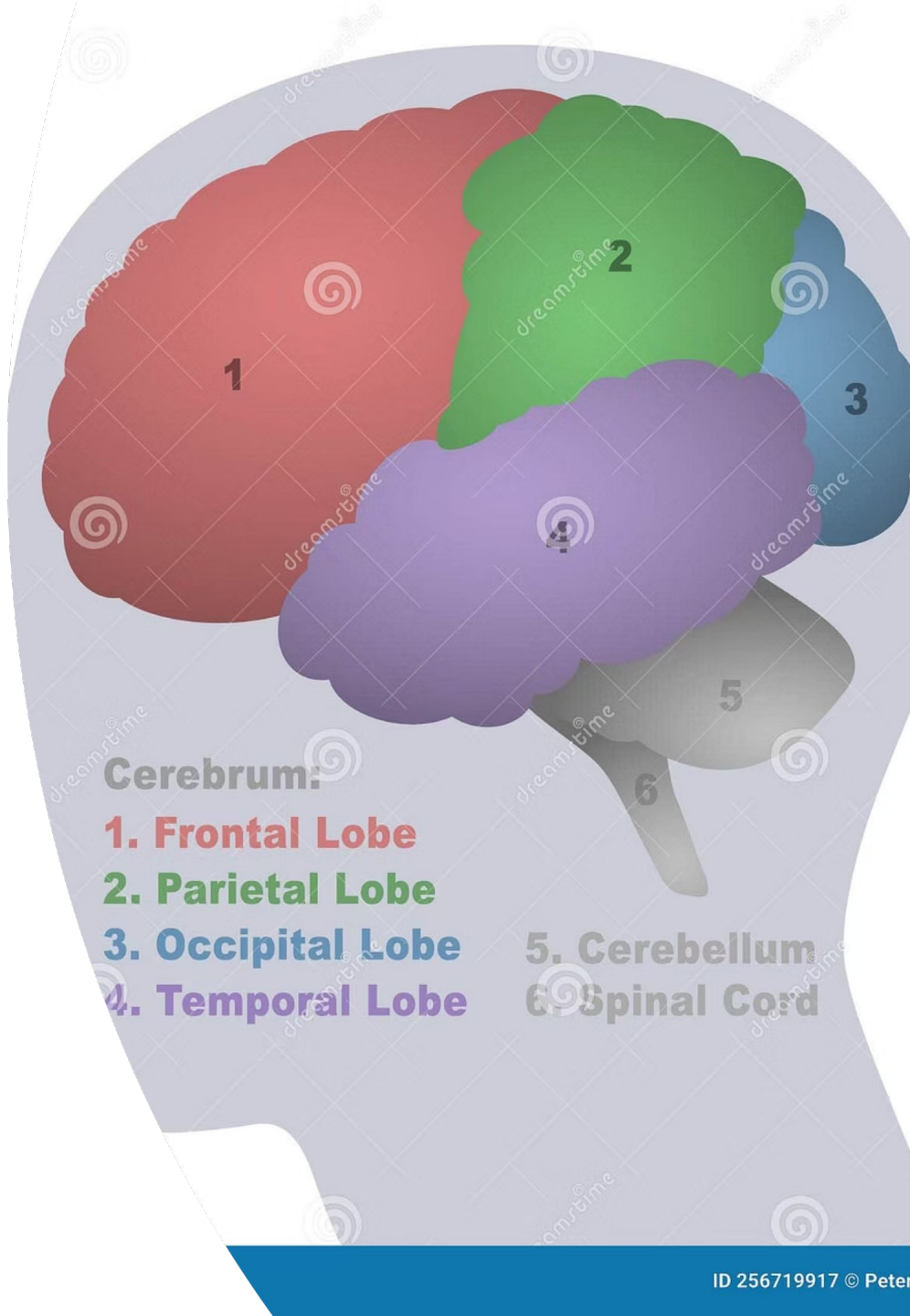
الجانب النظري — Theoretical

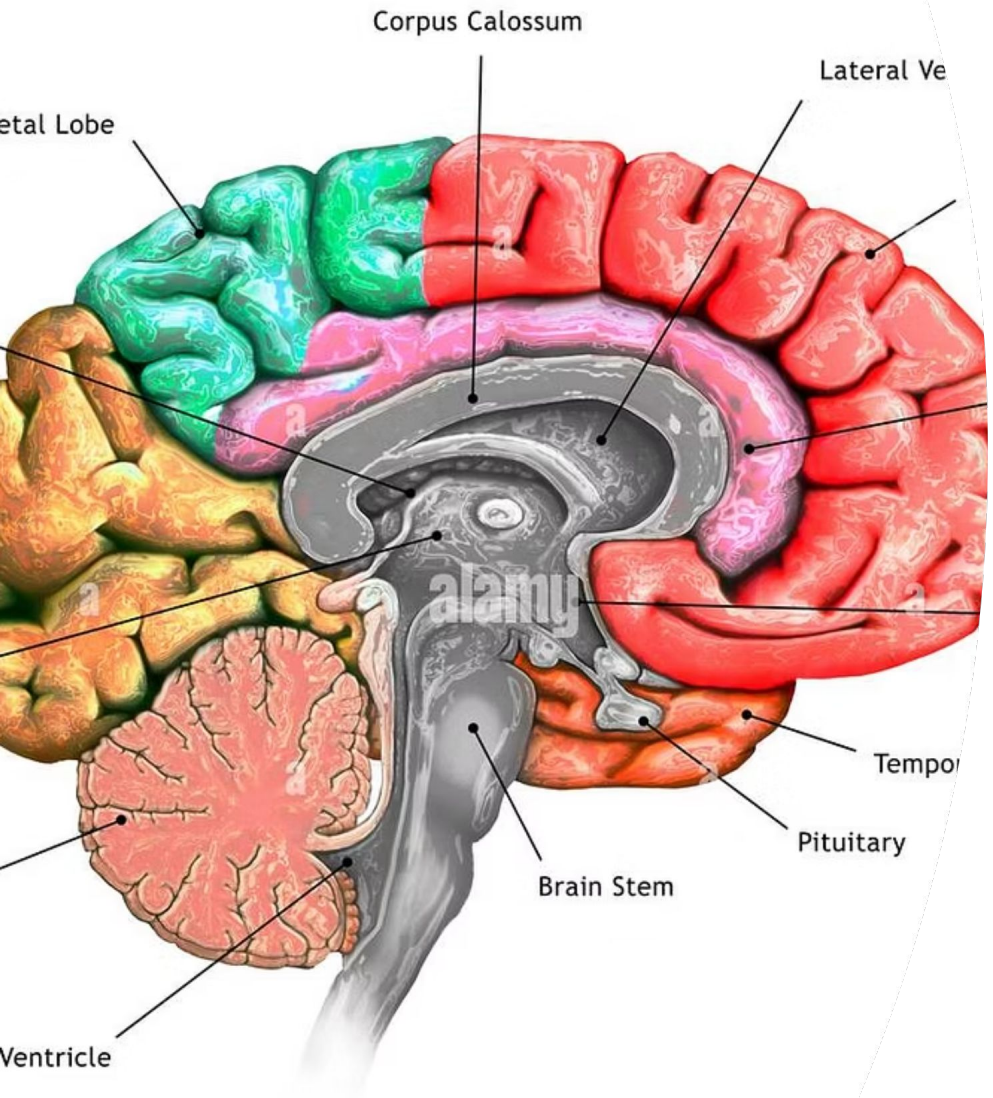
محاضرة رقم 1 — Lecture No. …1.

تدريسي المادة : م.م.ابراهيم فاضل

Normal Anatomy of the Brain: Cerebrum, Cerebral Cortex, and Lobes

A comprehensive exploration of cerebral anatomy and radiological features essential for clinical neuroscience understanding.





Overview of the Cerebrum

Largest Brain Component

The cerebrum comprises approximately 85% of total brain weight, divided into two distinct hemispheres connected by the corpus callosum.

Command Center

Controls voluntary movements, sensory perception, cognition, language, memory, and all higher-order brain functions that define human consciousness.

Cerebral Cortex: The Brain's Outer Layer

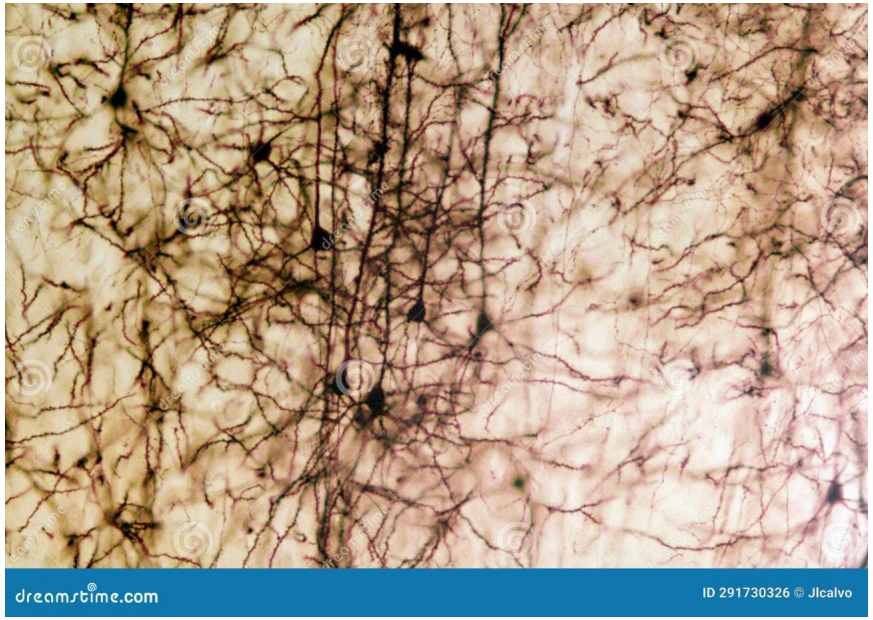
Structural Complexity

Composed of grey matter containing billions of neurons organized in six distinct layers, each with specialized functions and connections.

Functional Significance

Responsible for consciousness, abstract thought, memory consolidation, language processing, and complex sensory integration.

- Layer I: Molecular layer with dendrites
- Layers II-III: Association and commissural connections
- Layer IV: Primary sensory input
- Layers V-VI: Output to subcortical structures



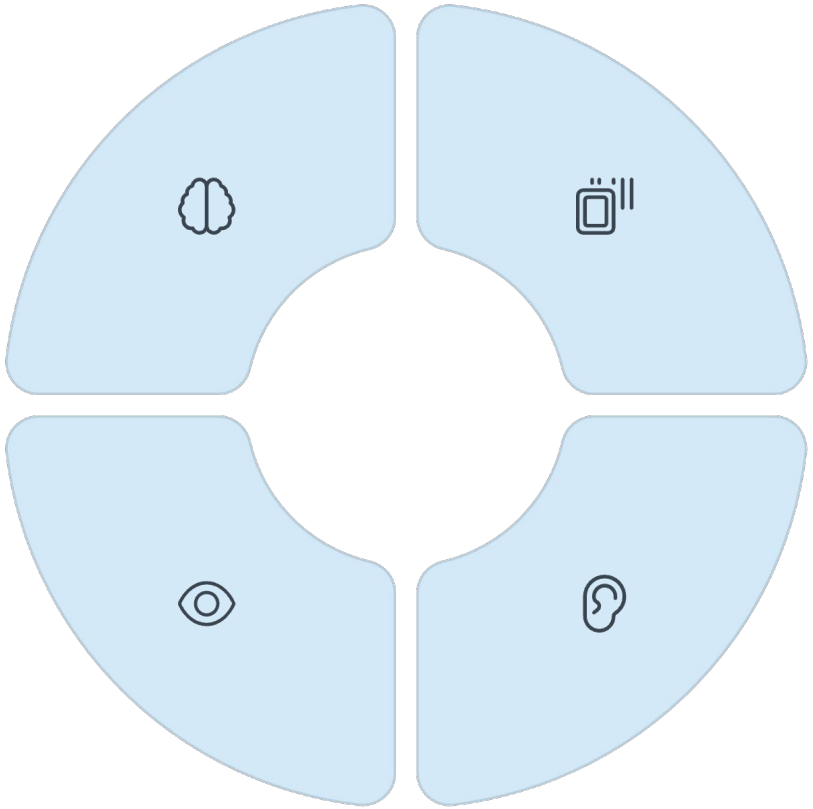
Brain Lobes: Functional Divisions

Frontal Lobe

Executive functions, motor control, personality

Occipital Lobe

Visual processing and recognition



Parietal Lobe

Sensory processing, spatial awareness

Temporal Lobe

Auditory processing, memory, language

Each lobe has specialized functions that work together to create integrated brain function and human behavior.

- Voluntary Muscle Mvt.
- Premotor/S.M.C (MAC)
  - Planning/Coordination of Movement
- Frontal Eye Field
  - Voluntary Rapid Eye Mvt.

Frontal Lobe: The Executive Center

Executive Functions

Planning, decision-making, judgment, impulse control, working memory, and abstract reasoning capabilities.

Motor Control

Primary motor cortex located on the precentral gyrus controls voluntary movements throughout the body via the corticospinal tract.

Broca's Area

Located in the left frontal lobe, responsible for speech production and language expression in most individuals.

Parietal Lobe: Sensory Integration Hub

Somatosensory Processing

Processes touch, temperature, pain, pressure, and proprioception through the primary somatosensory cortex.

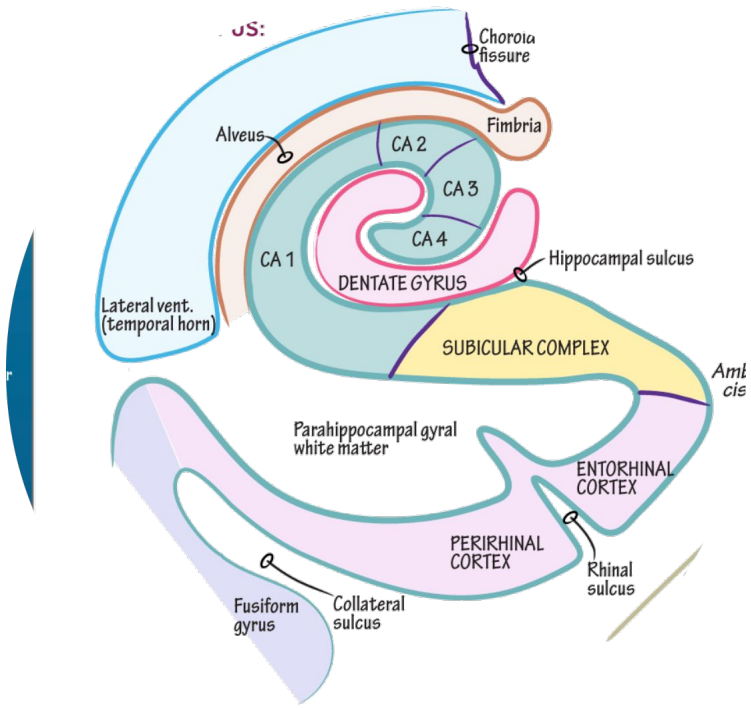
Spatial Awareness

Integrates sensory information to create spatial maps and body awareness, crucial for navigation and coordination.

Postcentral Gyrus

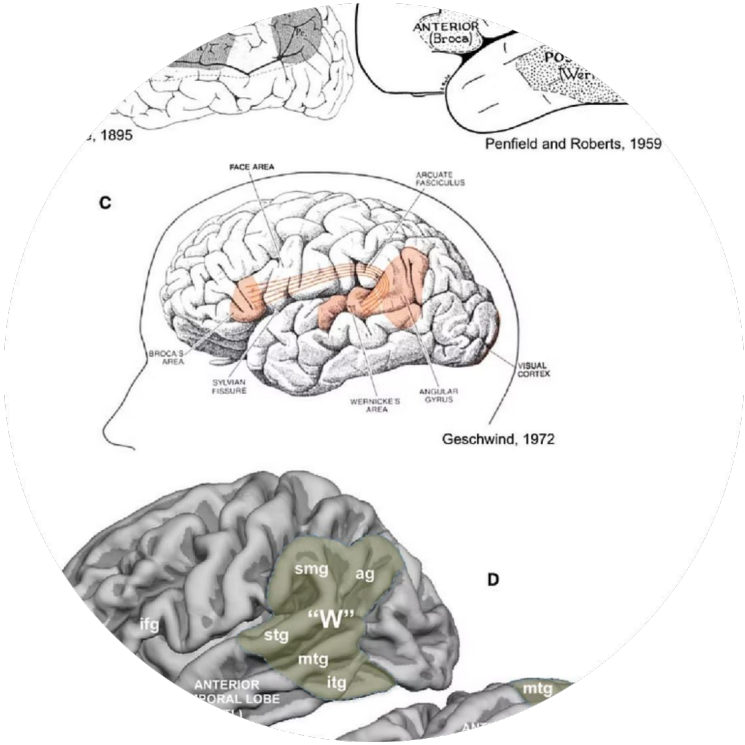
Contains the somatosensory homunculus, representing body parts proportional to their sensory innervation density.

Temporal Lobe: Memory and Language Center



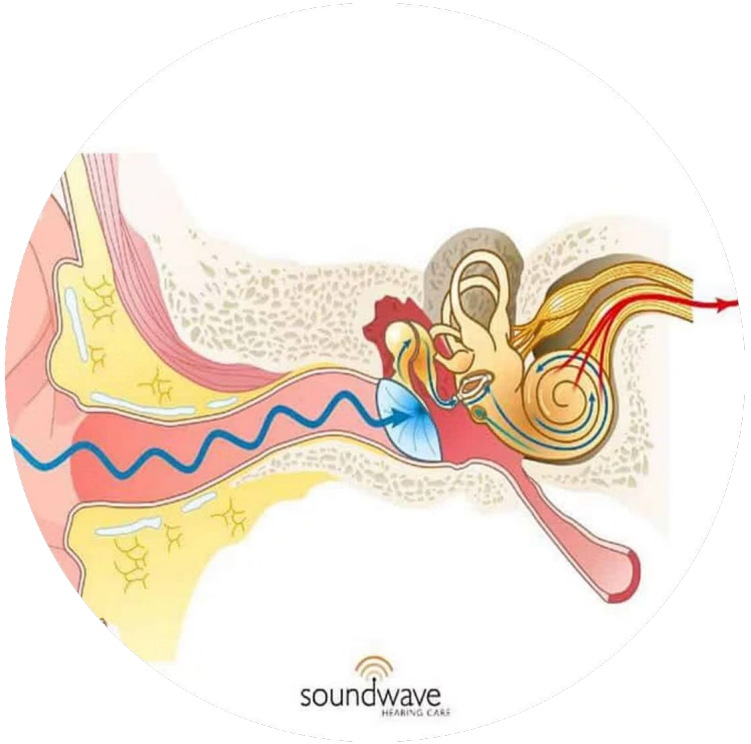
Hippocampus

Critical for memory formation, consolidation, and spatial navigation. Essential for converting short-term to long-term memories.



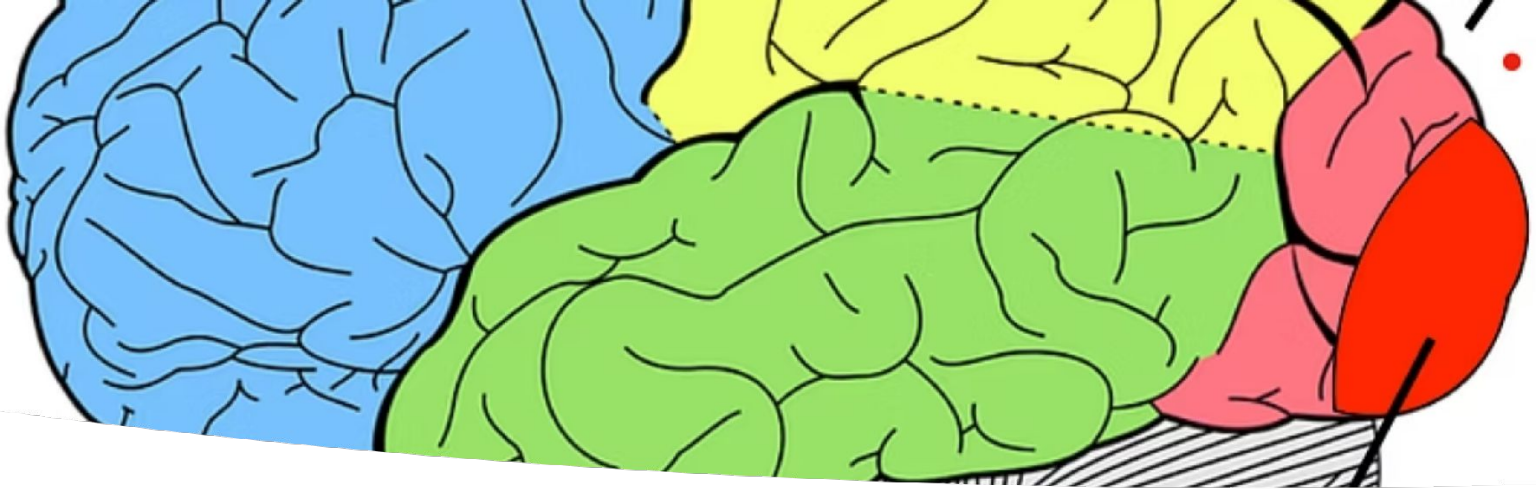
Wernicke's Area

Located in the superior temporal gyrus, responsible for language comprehension and semantic processing.



Auditory Cortex

Primary auditory processing center located in Heschl's gyrus, analyzing sound frequency, pitch, and volume.



Occipital Lobe: Visual Processing Center

> The occipital lobe transforms electrical signals from the retina into the rich visual experience that defines our perception of the world.

01

Primary Visual Cortex (V1)

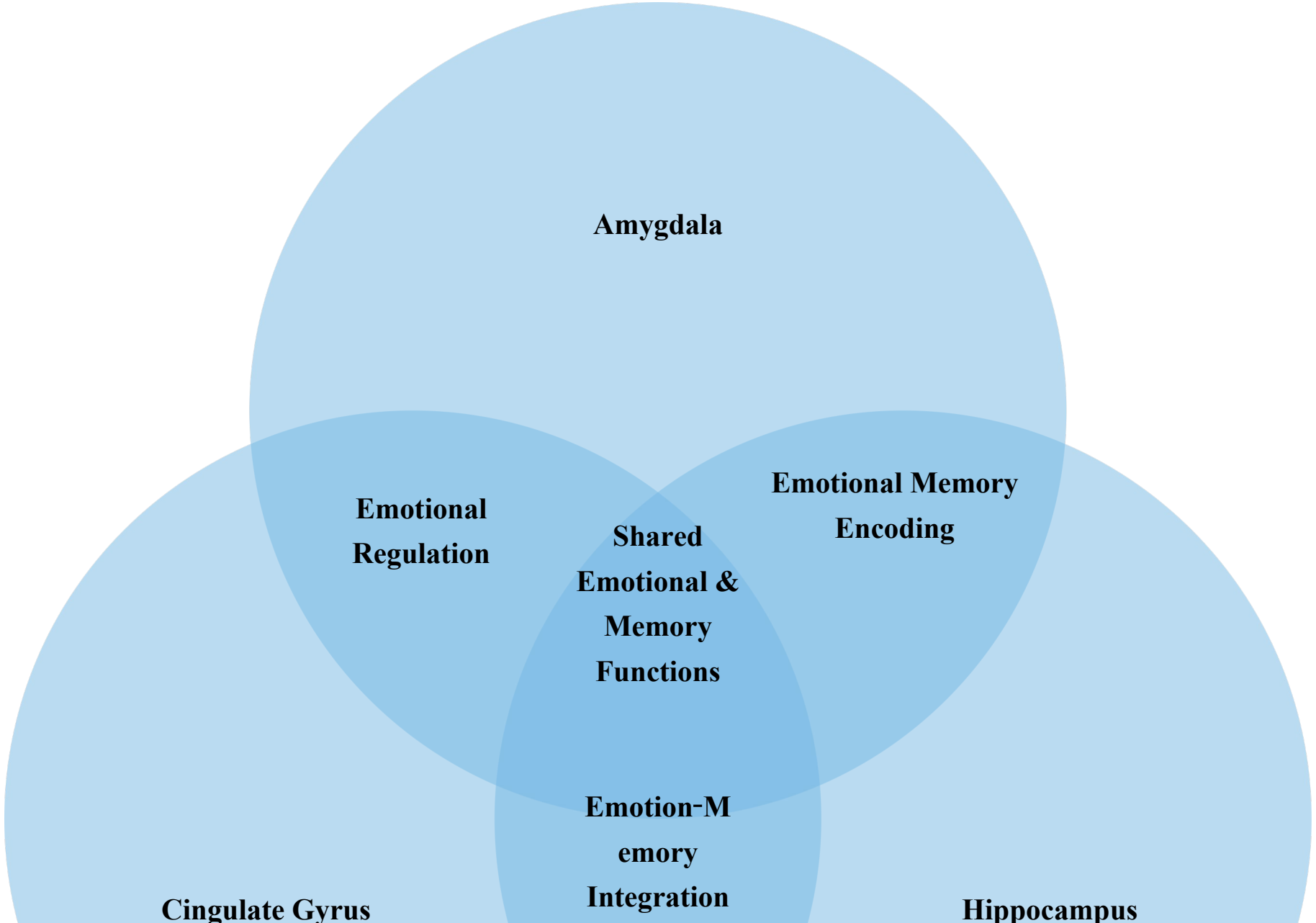
Located around the calcarine fissure, processes basic visual features like edges, orientation, and movement.

02

Visual Association Areas

Secondary visual areas (V2-V5) integrate complex visual information for object recognition and spatial processing.

Limbic System: Emotion and Memory Network



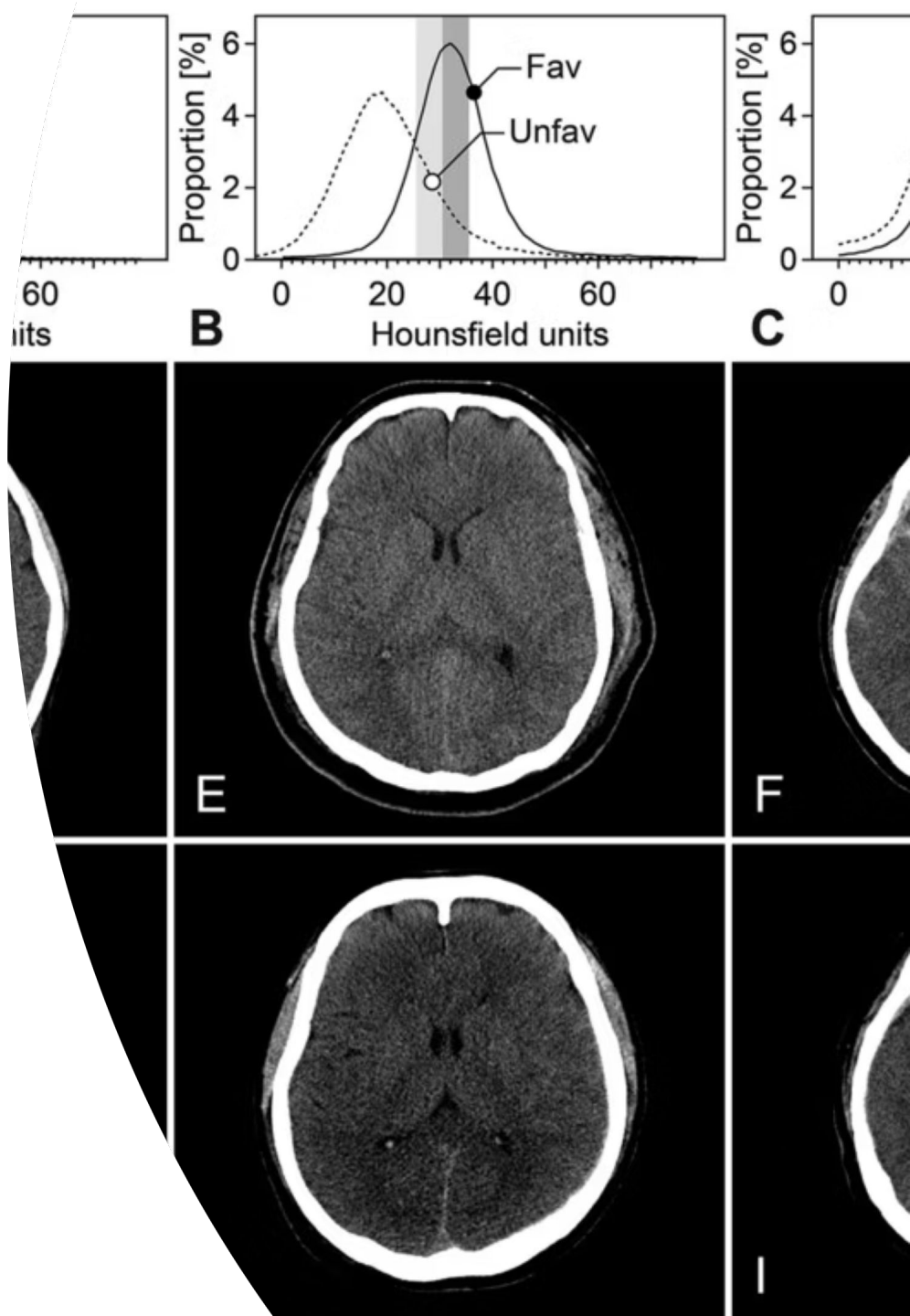
Radiological Features: CT and MRI Basics

CT Imaging Principles

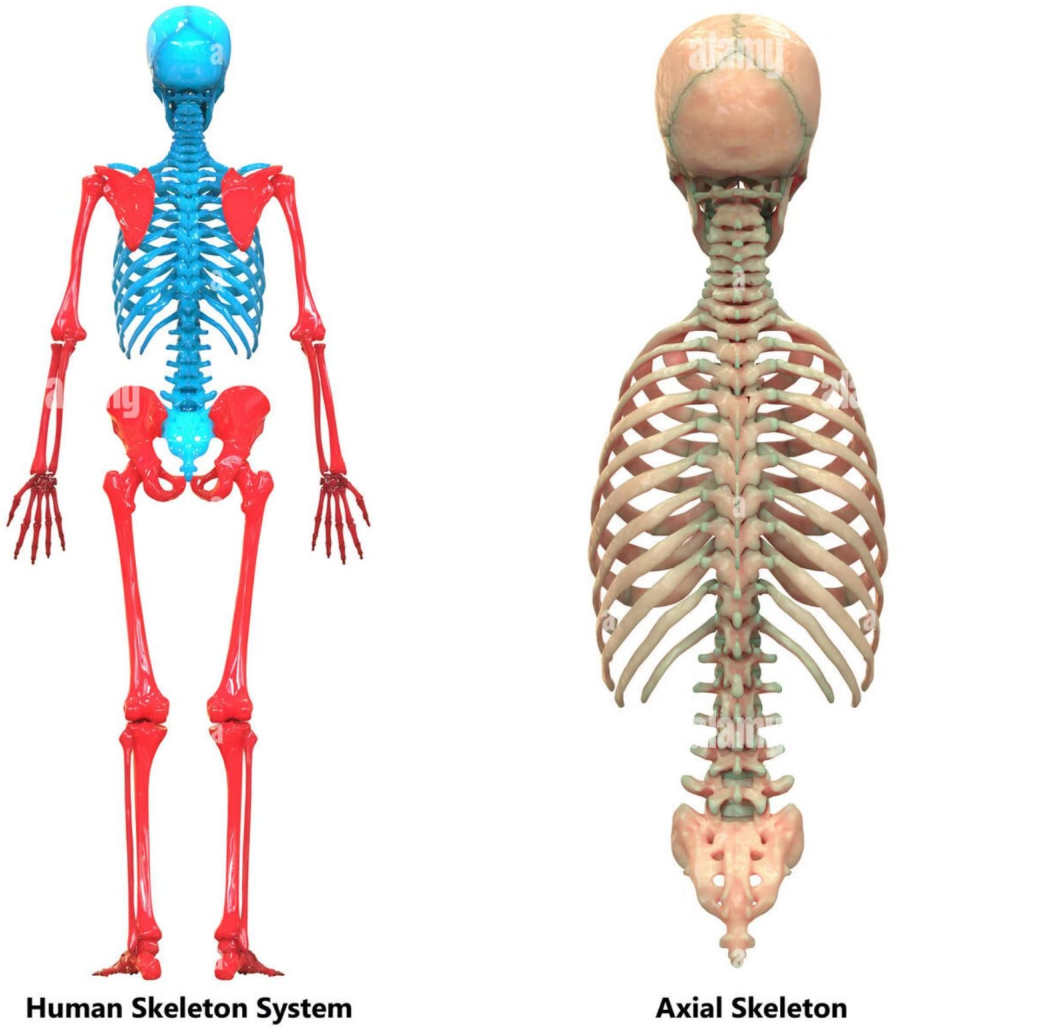
Grey matter appears hyperdense (lighter) due to higher cell density, while white matter appears hypodense (darker) on computed tomography.

MRI Sequence Variations

T1-weighted, T2-weighted, and FLAIR sequences provide different tissue contrasts, highlighting pathological changes and anatomical details.



CT Appearance of Brain Lobes



Anatomical Landmarks

- **Central sulcus:** Separates frontal and parietal lobes
- **Sylvian fissure:** Divides temporal from frontal/parietal
- **Parieto-occipital sulcus:** Boundary between parietal and occipital

Spatial Orientation

Frontal lobes anteriorly, parietal superiorly, temporal laterally, and occipital lobes located posteriorly in standard axial views.

MRI Features: Advanced Tissue Contrast

FLAIR Sequences

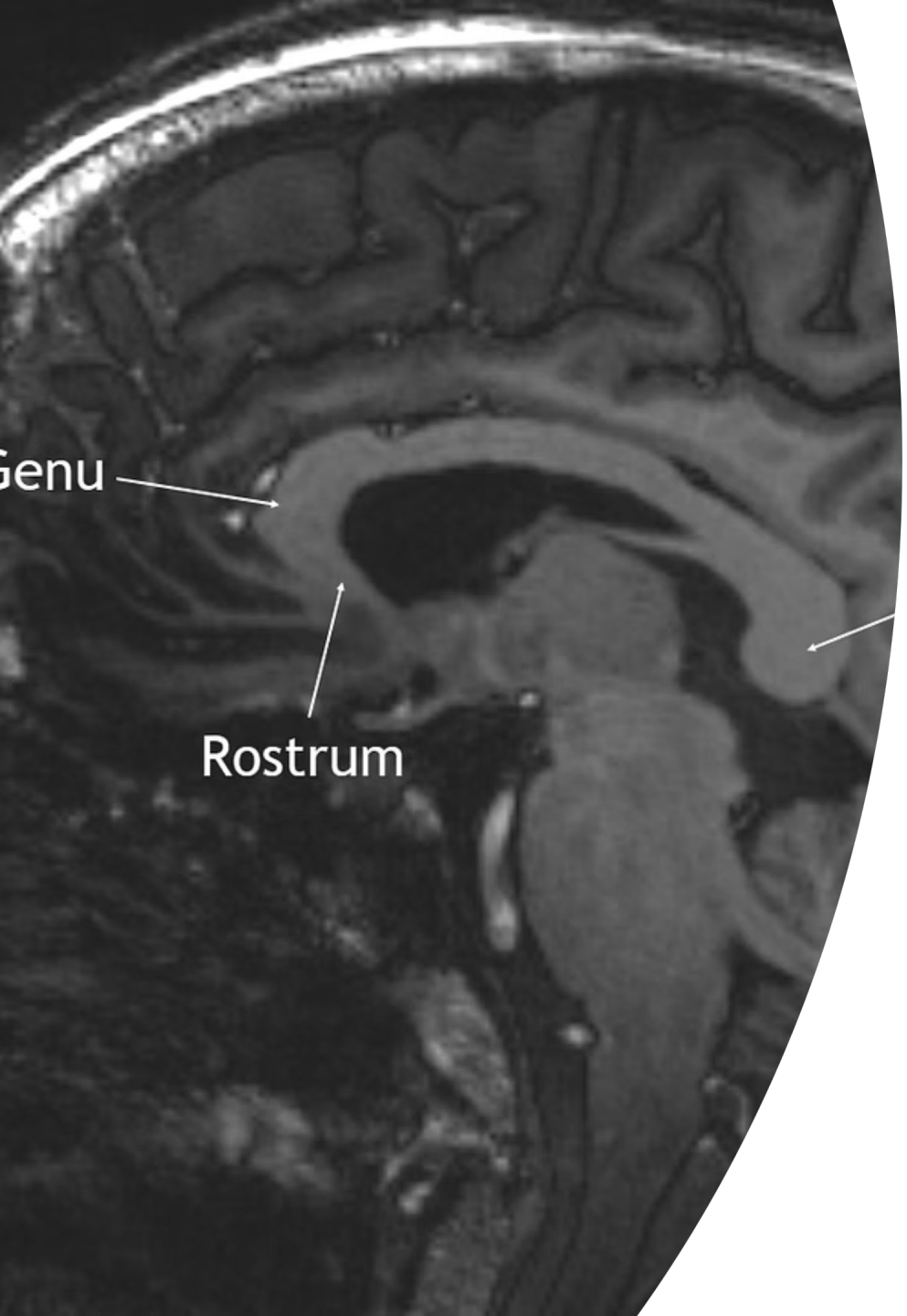
Fluid-Attenuated Inversion Recovery images highlight cortical grey matter and suppress CSF signal, revealing subtle pathological changes.

Multi-planar Imaging

Axial, coronal, and sagittal planes provide comprehensive visualization of lobes and deep structures in three dimensions.

White Matter Tracts

Diffusion tensor imaging reveals white matter fiber organization and connectivity between different brain regions.



Key Radiological Landmarks

1

Corpus Callosum

Major white matter commissure connecting cerebral hemispheres, visible as a bright structure on T1-weighted MRI.

2

Ventricular System

CSF-filled cavities including lateral, third, and fourth ventricles, appearing hypodense on CT and hyperintense on T2 MRI.

3

Basal Ganglia

Deep grey matter nuclei including caudate, putamen, and globus pallidus, essential for motor control and cognition.

Clinical Relevance: Diagnostic Applications

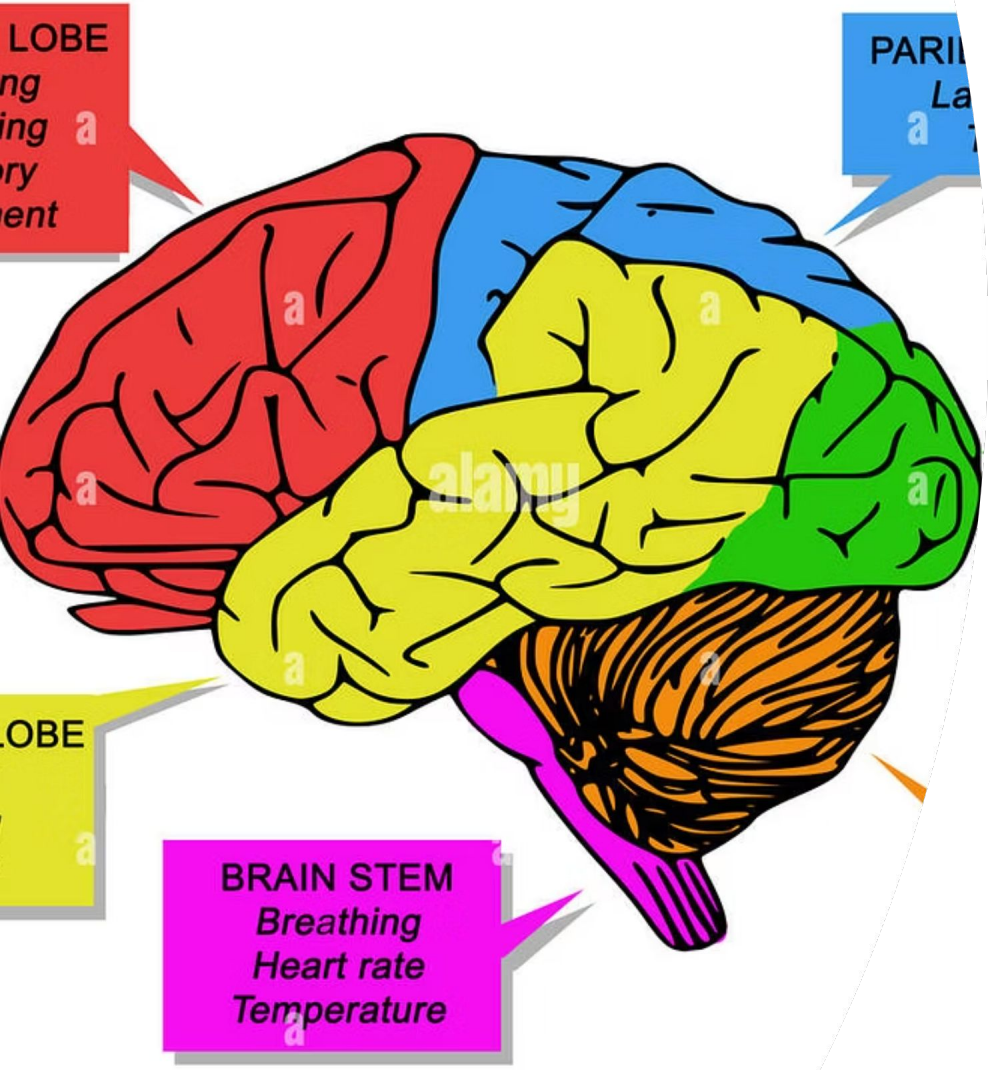
Lesion Localization

Accurate anatomical knowledge enables precise localization of pathological changes, correlating symptoms with specific brain regions.

Diagnostic Applications

- Stroke localization and treatment planning
- Tumor staging and surgical approach
- Traumatic brain injury assessment
- Neurodegenerative disease monitoring
- Epilepsy focus identification

Radiological imaging serves as the foundation for modern neurological diagnosis and treatment planning.



Key Takeaways

1

Anatomical Foundation

The cerebrum's lobes and cortex form the structural and functional foundation of human cognition, behavior, and consciousness.

2

Imaging Excellence

Advanced radiological techniques provide unprecedented insights into normal brain anatomy and pathological processes.

3

Clinical Integration

Mastery of both anatomical knowledge and imaging interpretation is essential for excellence in clinical neuroscience practice.

QUIZ

Any questions?