PREFRONTAL CORTEX/ PREFRONTAL LOBE

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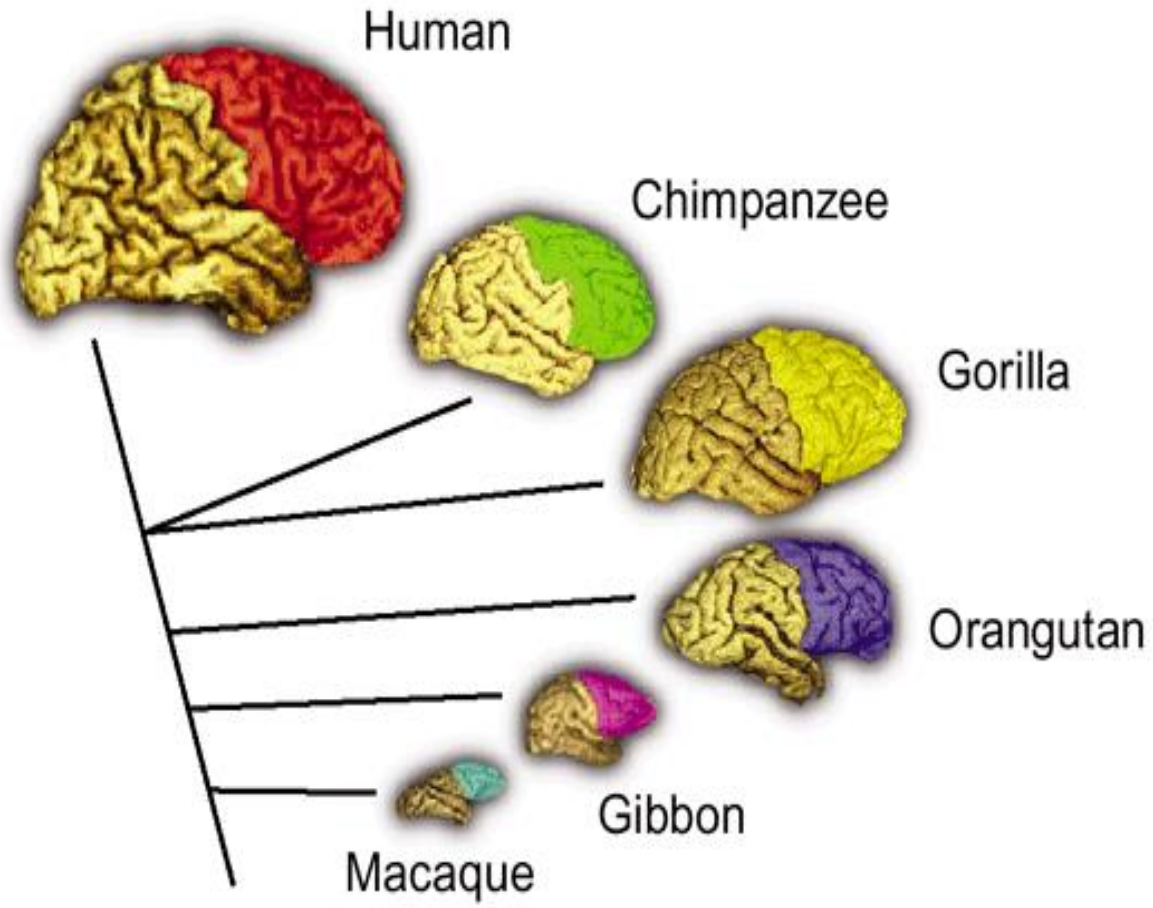
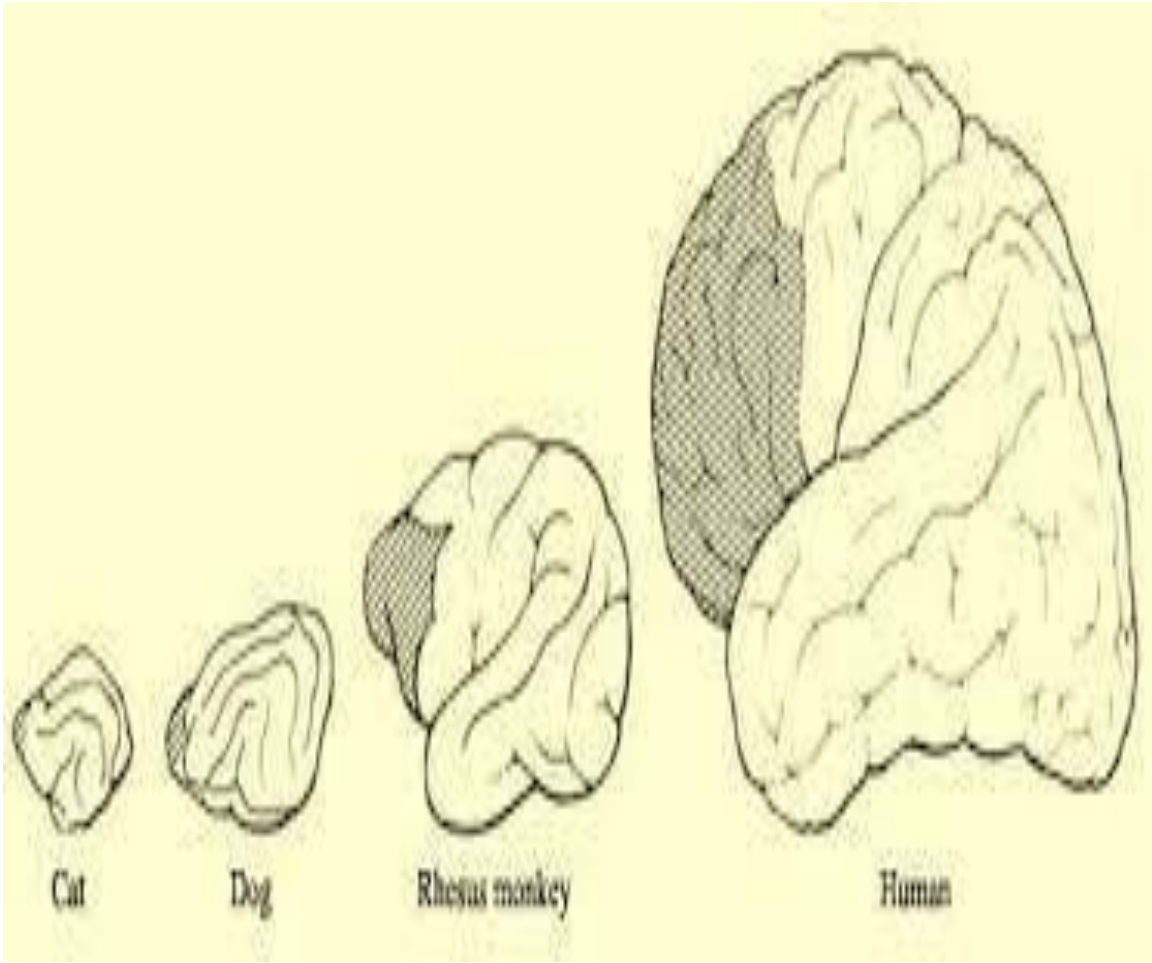
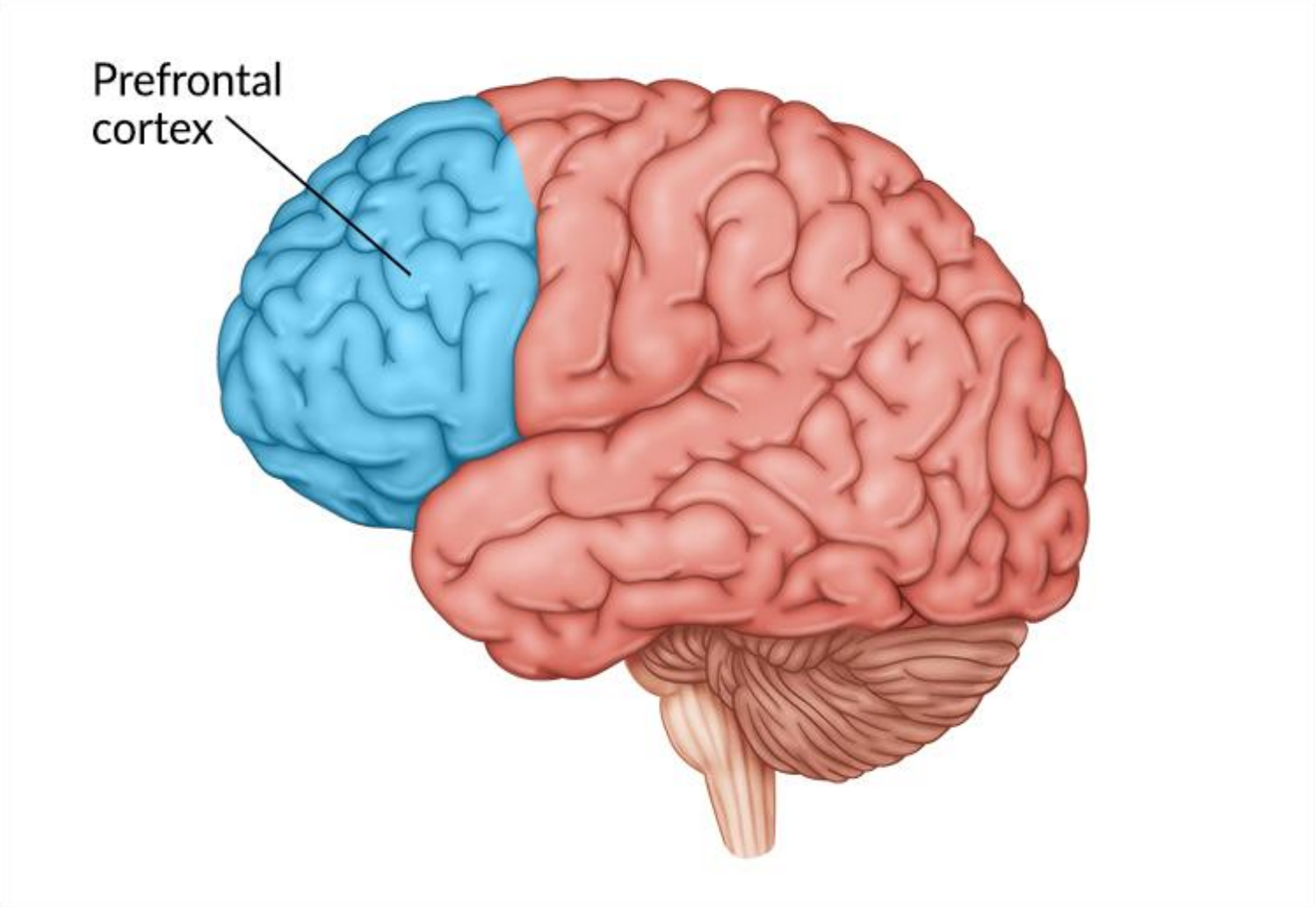
- The prefrontal cortex was thought to be locus of **“higher intellect”** in the human being, due to the great prominence of the human prefrontal areas.
- This area is **better developed in man than in any other species.**

The main difference between the brains of monkeys and of human beings is the size of pre-frontal cortex





- It is also called as **orbito-frontal cortex**
- portion of frontal lobes in front of the motor cortex.



- Situated most anteriorly, in front of area 4,6,8
- It is comprised of Areas 9 to 14, 23,24,29,32,44 to 47

- **Area 9,10,11 & 12:**

  - present in the superior frontal gyrus and extend on to adjacent medial hemisphere

- **Area 13:**

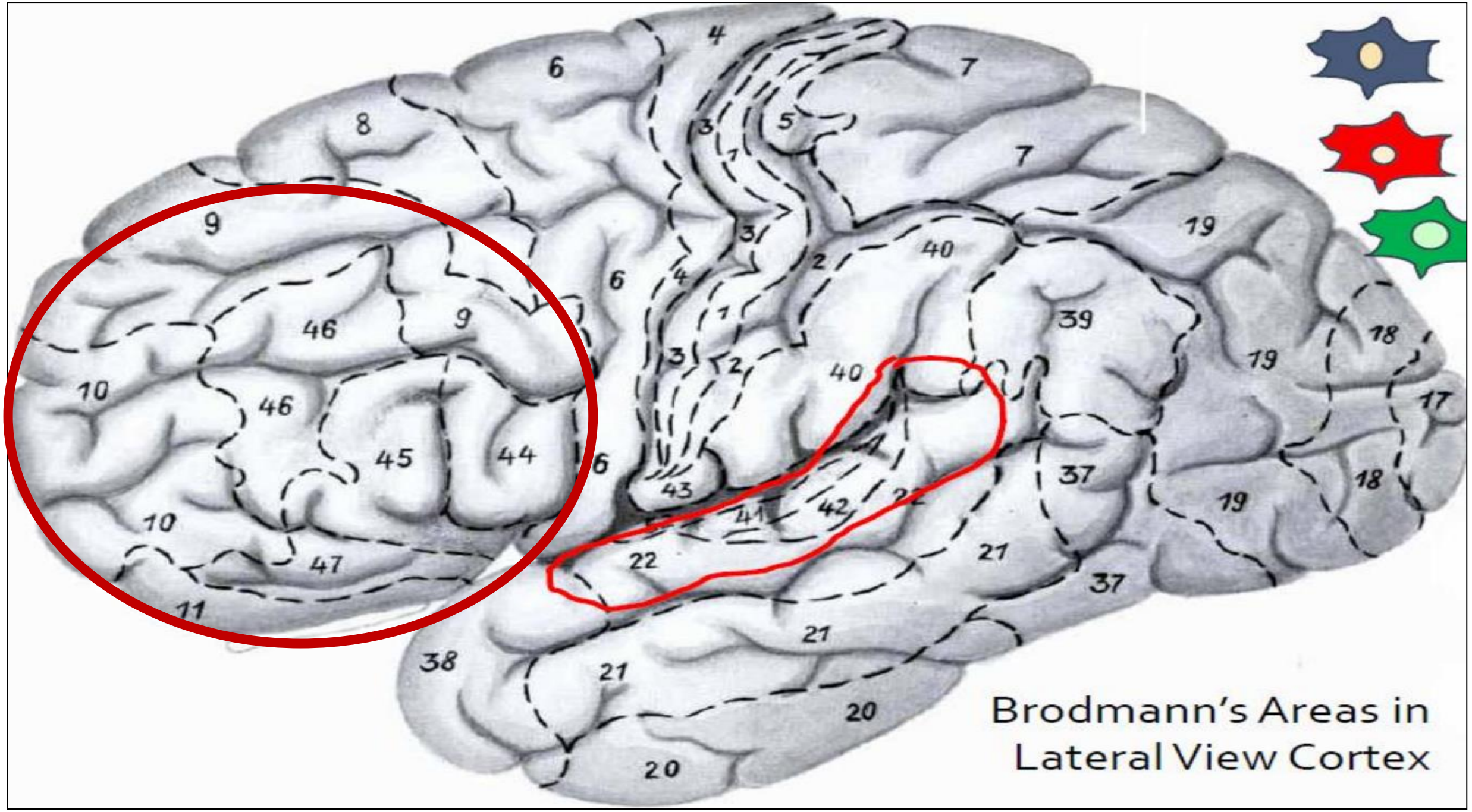
  - located in the orbital part of the inferior surface of frontal lobe

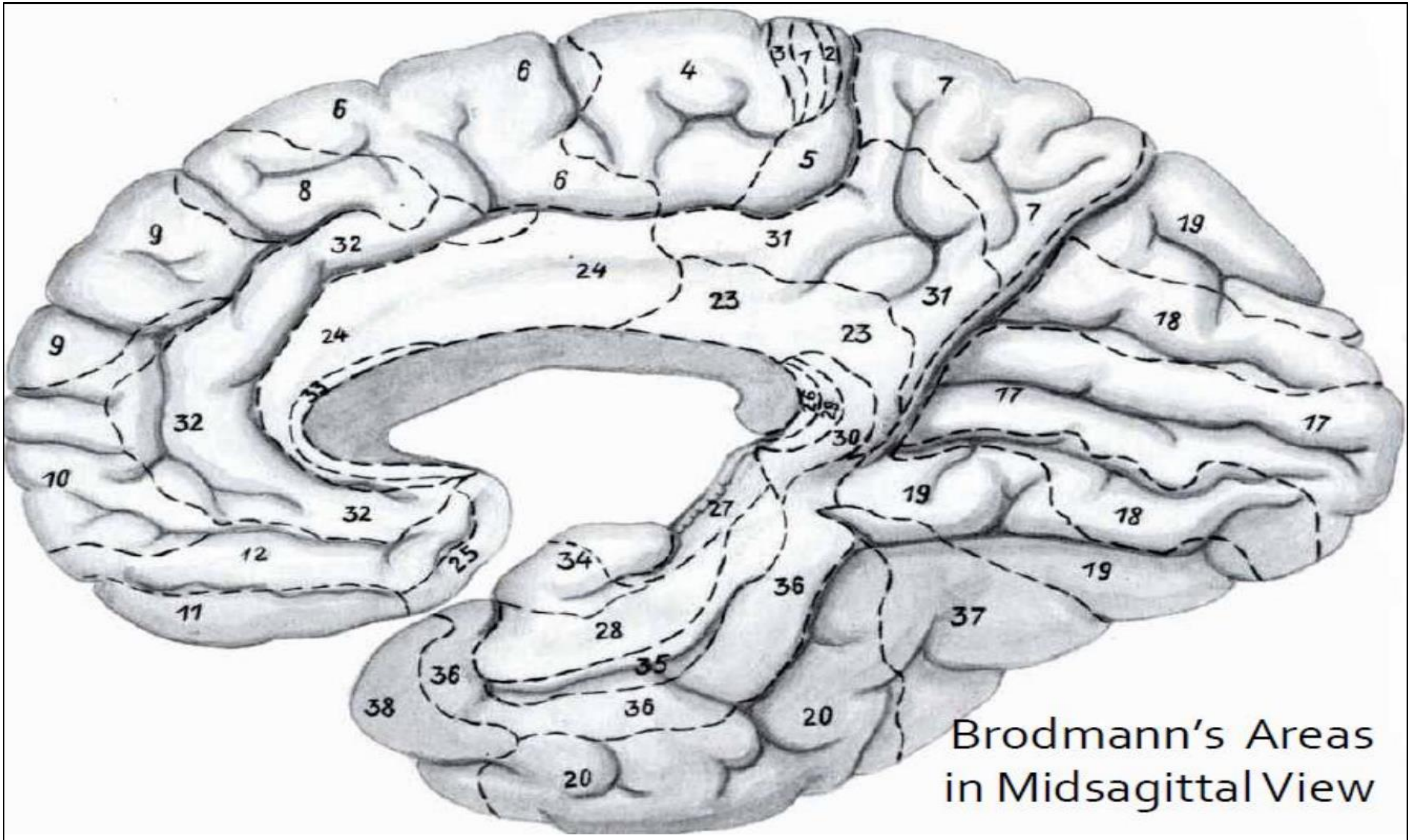
- **Area 24:**

  - present in the pre-callosal part cingulate gyrus on medial surface

- **Area 32:**
  lies in the cingulate gyrus

- **Area 44 to 47:**
  lie in the inferior frontal gyrus


Brodmann's Areas in
Lateral View Cortex

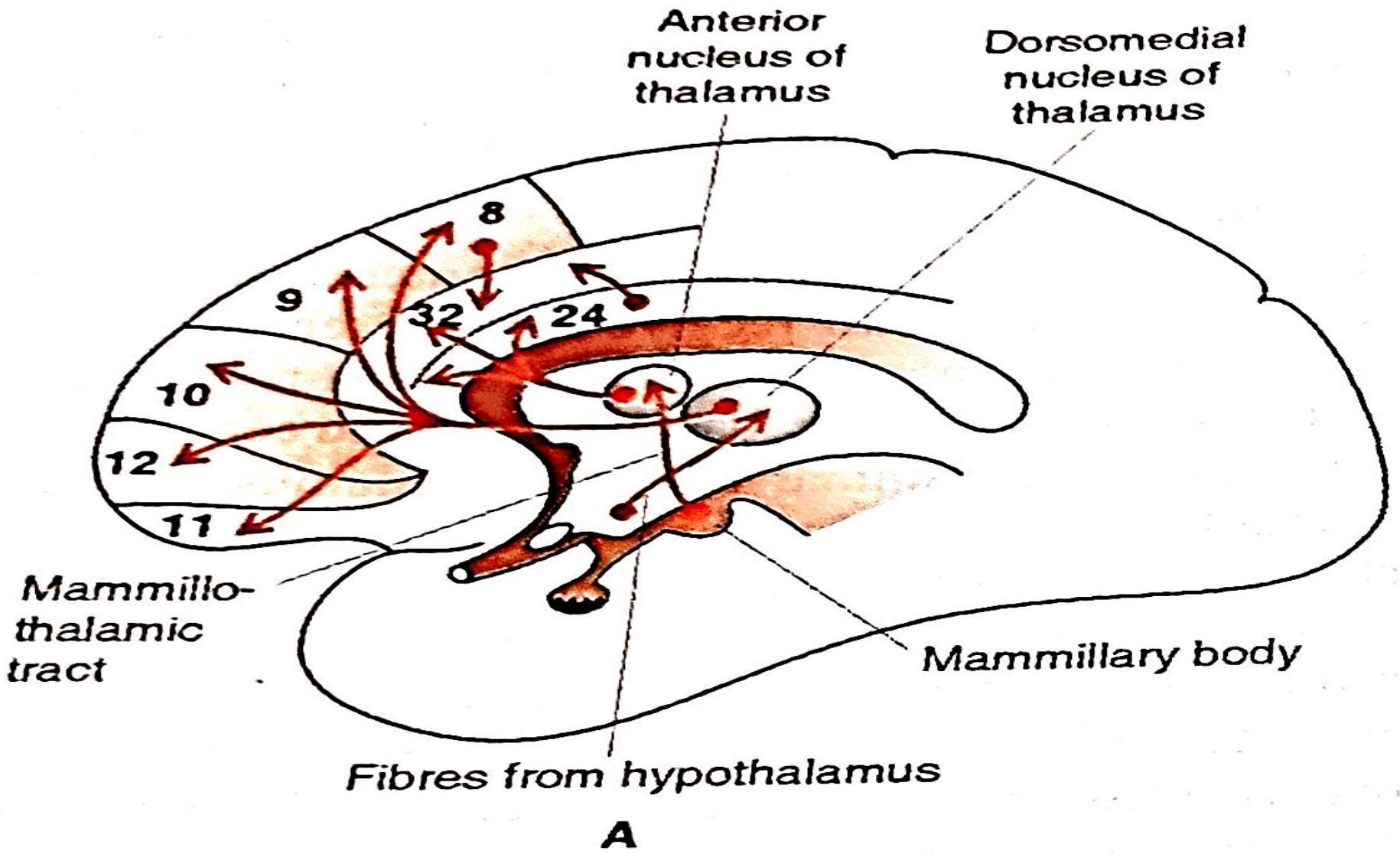


Brodmann's Areas
in Midsagittal View

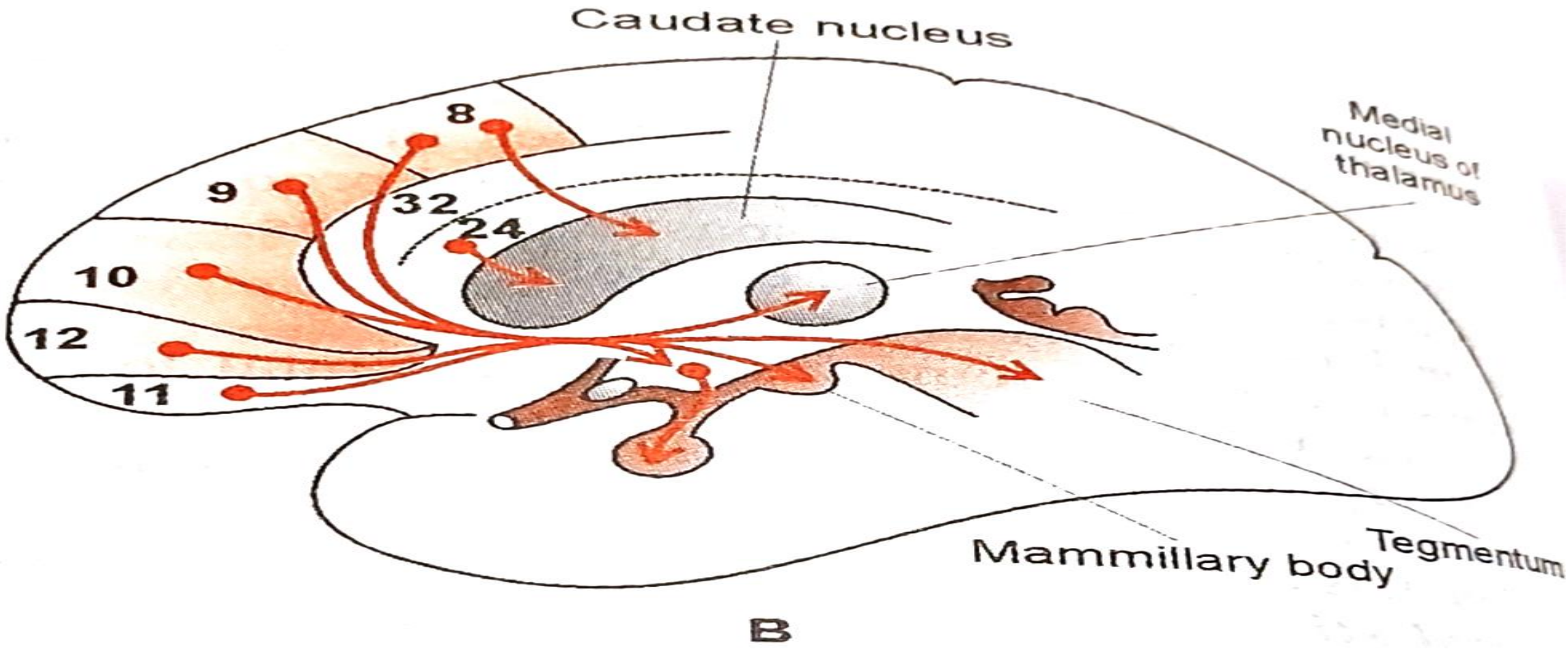
Connections of Pre-frontal cortex

- It has to and fro connections with thalamus, hypothalamus and many regions of the cerebral cortex

Afferent connections to the prefrontal cortex



Efferent connections to the prefrontal cortex



- The functions thought to be performed by prefrontal cortex are as follows:
- Role in thought process
- Site of working memory and intellectual functions

Functions of Prefrontal cortex

1. Centre for planned actions:

- Prefrontal-association areas in close association with motor cortex to plan **complex patterns and the sequence of motor movements**.
- The prefrontal cortex receives much pre-analyzed sensory information, especially information on the spatial coordinates of the body that is necessary for **planning effective movements.**

- Much of the output from the prefrontal area into the motor control system passes through the **caudate portion of the basal ganglia-thalamic feedback circuit** **for motor planning, which provides many of the sequential and parallel components of movement stimulation**.

Functions of Prefrontal cortex

2. Centre for higher functions:

- This forms the Centre for higher functions like **emotions, learning, memory and social behavior.**

- Responsible for various autonomic changes during emotional conditions due to its connections to the hypothalamus and brain stem.

- The prefrontal association area is also essential to carrying **out "thought" processes in the mind.**
- capable of processing non-motor and motor information from widespread areas of the brain and therefore to achieve **non motor types of thinking, as well as motor types.**
- prefrontal association area is important for **elaboration of thoughts**
- to store on a short-term basis **"working memories"** that are used to combine new thoughts while they are entering the brain.

Functions of Prefrontal cortex

3. Seat of intelligence:

- Short-term memories are registered in prefrontal cortex.
- It can keep track of many bits of information and also has the ability to recall this information bit by bit for subsequent thoughts.
- **It is therefore called the seat of intelligence or an organ of mind.**

Functions of Prefrontal cortex

4. Control of intellectual activities:

The prefrontal cortex has the following intellectual abilities:

- It allows us to **prognosticate(predict the future**).
- It allows us **to plan the future.**

- It allows the person to concentrate on the central theme of thought
- It helps in depth and abstractness of thought, and thereby in elaboration of thought.
- It allows to delay action in response to incoming sensory signals so that sensory information can be weighed until the best response is obtained.
- It allows to consider the consequence of motor actions before their performance

- It plays a role in solving complicated mathematical, legal and philosophical problems.
- It allows to correct avenues of information in diagnosis of rare disease,
- It allows to control one's activity according to the moral laws.

Functions of the prefrontal cortex

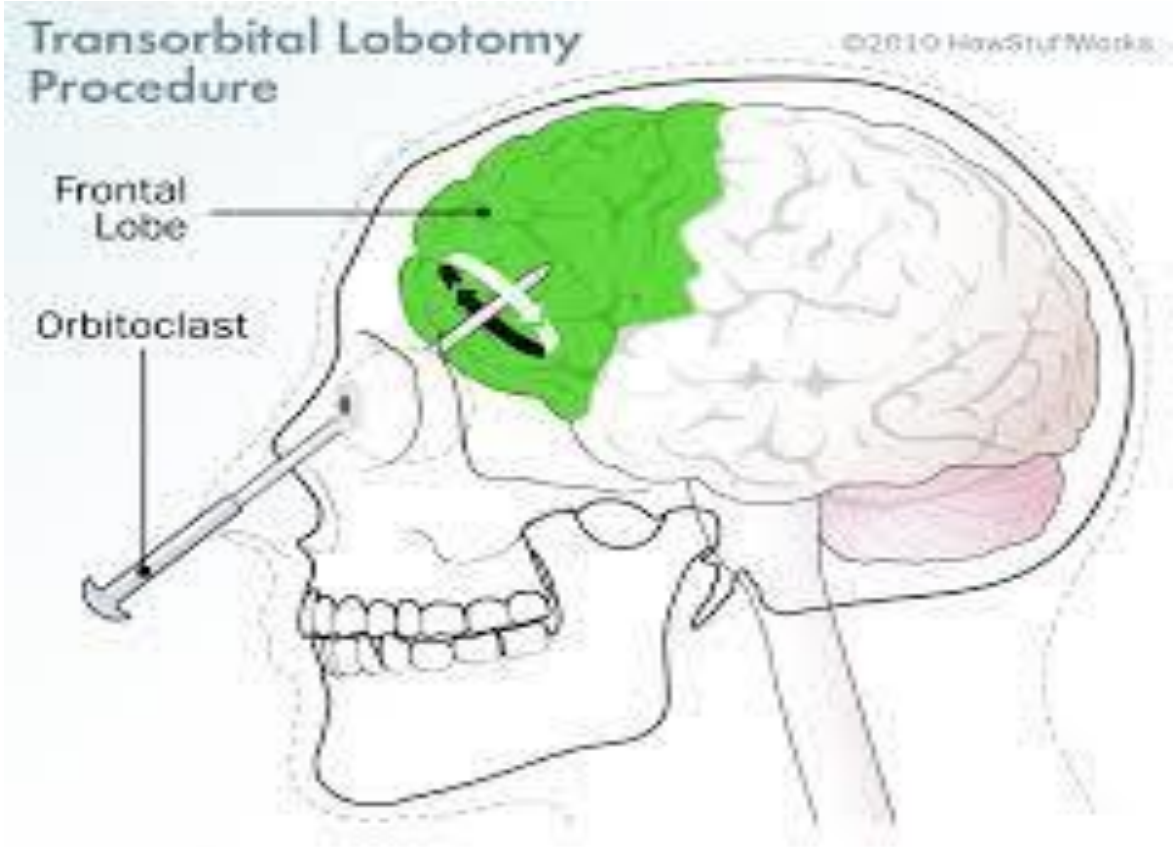
- Control of higher intellectual activities
- Control of personality
- Control of behavior and social consciousness

Frontal lobe: Applied Aspects

- **Frontal lobe syndrome:**
  refers to symptom complex occurring due to injury or ablation of prefrontal cortex
- **Prefrontal leucotomy** i.e cutting the connection between the thalamus and prefrontal lobe also results in frontal lobe syndrome.
- **Bilateral frontal lobectomy(extirpation)**

Prefrontal lobotomy

- To treat Psychiatric condition



igure 29. Case 128. May 6, 1942, be-
ore lobotomy. "God, I'm getting ready
o blow up."

Figure 34. Case 128. September, 194
Employed and going to night school.

Studies in patients with prefrontal lobotomy showed the following mental changes:

1. The patients lost their ability to solve complex problems.
2. They became unable to string together sequential tasks to reach complex goals.
3. They became unable to learn to do several parallel tasks at the same time.
4. Their level of aggressiveness was decreased, sometimes markedly, and, in general, they lost ambition.

5. Their social responses were often inappropriate for the occasion, often including loss of morals and little reticence in relation to sexual activity and excretion.
6. The patients could still talk and comprehend language, but they were unable to carry through any long trains of thought, and their moods changed rapidly from sweetness to rage to exhilaration to madness.
7. The patients could also still perform most of the usual patterns of motor function that they had performed throughout life, but often without purpose.

Effect of lesion of prefrontal cortex

- **Prefrontal Syndrome or frontal lobe syndrome:**

- unplanned and useless motor activities
- lack of concentration & easy distraction within minutes
- patients don’t follow moral & ethical laws of hygiene, excretion, sex
- increase in threshold for pain
- Disorientation
- Tremors
- Hyperphagia
- Loss of affection for family, friends society

Phineas Gage---JUST OUT OF CURIOSITY

- He died on May 21, 1860, of an epileptic seizure that was almost certainly related to his brain injury.
- Gage's skull, and the tamping iron that passed through it, are on display at the Warren Anatomical Museum in Boston, Mass.
- https://youtu.be/ytBIa7xy2gI: CAN WATCH ON YOUTUBE

How to Strengthen Your Prefrontal Cortex

- It is possible to strengthen your prefrontal cortex with some exercises that target specific functions of your brain, such as:
- **Games:**
  - Word games, memory games, and puzzles are effective ways to strengthen your prefrontal cortex.
  - These exercises can encourage neuroplasticity, which is our brain's ability to create and reinforce essential interconnections.

- **Learning:**

 - Learning something new, like a language, instrument, or other skill, is even more effective than word games at enhancing your prefrontal cortex.

- Learning pushes your brain out of its comfort zone and forces it to adapt to understand and piece together the new information.

- **Cooking:**

Cooking is an activity that utilizes multiple areas of your brain, including various senses.

Cooking requires hand-eye coordination, concentration, multitasking, planning, and working memory to execute a recipe correctly, which can help strengthen these skills over time.

- **Math:**

- Solving math problems with increasing difficulty can help train your brain
- Math problems push your brain to use logic, analytical skills, and trial and error to arrive at correct conclusions.