5- Physiology of
Limbic System

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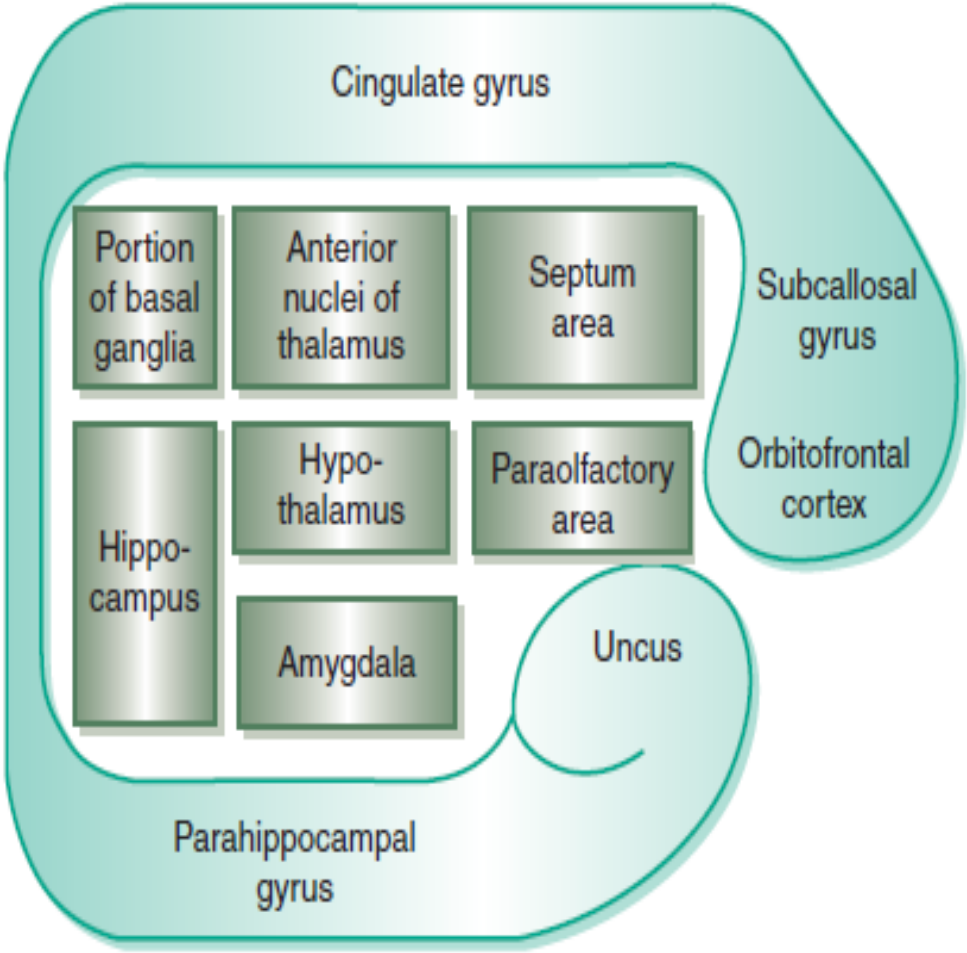
Limbus = Ring = Border =C-Shape

Limbic System

The part of cortical and subcortical structures that form ring around brainstem.



Components

Limbic system

CORTICAL STRUCTURES

Orbito-frontal area

Sub-callosal gyrus

Cingulate gyrus (Maternal)

Para-hippocampal gyrus

Uncus

(learning, psychic & social factors)

Components

Limbic system

Subcortical structures

Hypothalamus ANS,motivation,H2o, feeding, temp

Hippocampus (olfaction, memory & learning)

Amygdala (Emotion, feeding, sexual)

Septum area (Trust & social)

Para-olfactory area

Ant. N. of the thalamus

Portions of the basal ganglia.


Functions
A,B,C,D,E,F,G, H

1-REGULATION OF AUTONOMIC FUNCTIONS

A-Stimulation of anterior & medial hypothalamic nuclei: ⇒ Parasympathetic effects, e.g. bradycardia & hypotension.

B-Stimulation of posterior & lateral hypothalamic nuclei:⇒ Sympathetic effects, e.g. tachycardia & hypertension.

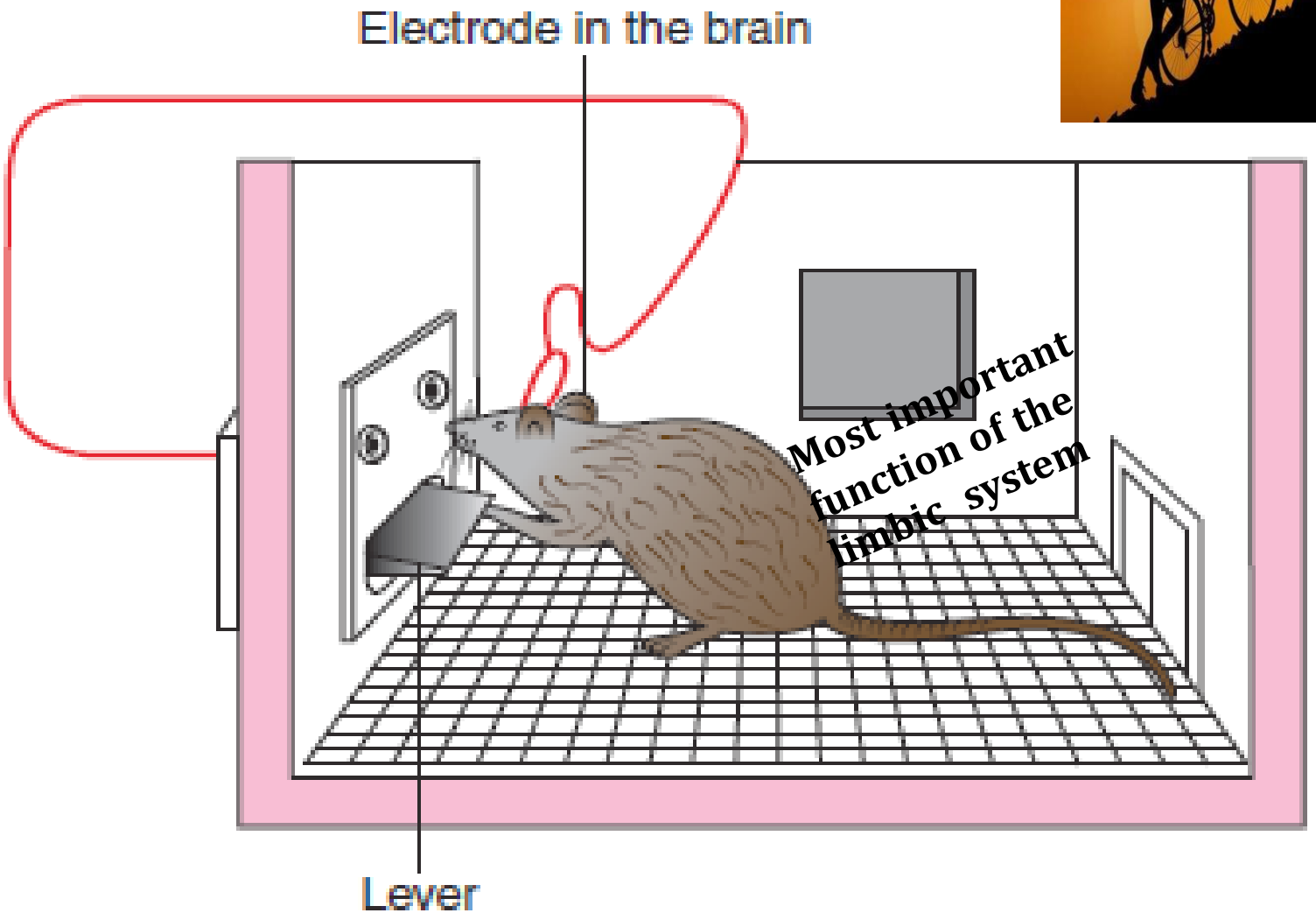
- The limbic system produces the autonomic body response to emotion e.g. changes in blood pressure, heart rate &respiration.

2-REGULATION OF BEHAVIOR

A- Motivation:

MOST IMPORTANT

FUNCTION OF THE LIMBIC SYSTEM



2-REGULATION OF BEHAVIOR

A- Motivation:

A. Reward (satisfaction) center: in ventromedial nucleus of the hypothalamus.

B. Punishment (aversion or avoidance) center: posterior and lateral nuclei. Electrical stimulation of these nuclei in animals leads to pain, fear, defense, escape reactions and other elements of punishment.

---IMPORTANCE: emotion, learning & memory

2-REGULATION OF BEHAVIOR

B- sexual behavior :

The limbic system is responsible for the drive & behavior that accompany the sexual act. Amygdala + hypothalamus

MODIFICATION of instinctive reflexes.

This modification is achieved by learning, psychic & social factors through the influence of **cortical part of limbic system.**

- A decorticate female animal will have regular oestrous cycle provided the hypothalamus is intact.

2-REGULATION OF BEHAVIOR

C- Role in Maternal behavior :

Maternal behavior =

Cingulate gyrus

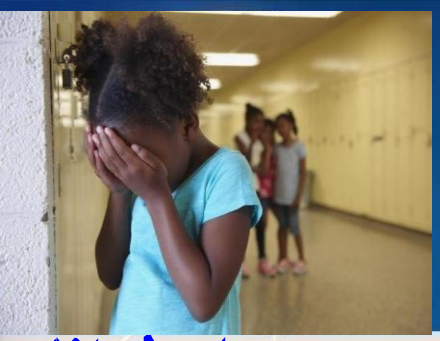
[3] Regulation and Generation of Circadian Rhythm (*circa* = about + *dia*=day):

Hypothalamus has major role in the circadian fluctuations in various physiological activities through the suprachiasmatic nuclei that receive information about the light-dark cycle from the optic tract.

[4] Regulation of Drinking and Water Balance:

A-Water Intake: Stimulation of the thirst center in the lateral hypothalamus

B-Water Loss: The hypothalamus controls the release of ADH which increases the permeability of the distal & collecting tubules $\Rightarrow$ helps water reabsorption & decreases water loss.



5-Control of Emotions:

MOST IMPORTANT

FUNCTION OF THE LIMBIC SYSTEM

Amygdala

5-Control of Emotions:

Fear is produced by stimulation of amygdaloid nucleus **(fear center).** Fear disappears after bilateral **amygdalectomy** e.g. Monkey approach snakes without fear.

5-Control of Emotions:

Rage: It is produced by stimulation of lateral hypothalamus **(rage area).**

-This area is tonically inhibited by the ventromedial nucleus **(placidity area),** septum & the neocortex.

♣ ***Sham rage reaction:*** *(extreme aggression with minor stimuli)* produced by stimulation of amygdaloid nuclei or lesion of ventromedial nucleus of hypothalamus, septum or neocortex.

Fear and Rage

Placidity: *(calmness with little or no response to provocation)*

Produced by stimulation of ventromedial nucleus of hypothalamus or bilateral damage of amygdala

–*Normally there is balance between the rage and placidity.*

6-Regulation of Food Intake

Appestat Centre

A-Feeding Centre: Present in the lateral hypothalamus.

Normally, it is always active.Its stimulation ⇒ eating behavior.

Its damage ⇒ anorexia "loss of appetite".

B-Satiety Centre: Present in the ventromedial nucleus.

Its stimulation ⇒ cessation of eating.

Its damage ⇒ hyperphagia & obesity.

- **Amygdala** is important in choice of food and the mechanical actions of eating e.g. chewing, deglutition & licking. **Cortical areas of limbic system** play role in animal searching for food when it is hungry.

7- Regulation of Get Sleep !!!

Stimulation of anterior hypothalamus ⇒ ***sleep***.

Stimulation of posterior hypothalamus (mamillary body) ⇒ ***arousal***.

8- Regulation of heat (Body Temperature)

Heat Gain Centre: Present in the posterior nuclei.

Its stimulation, as during exposure to cold

⇒V.C. and shivering.

Heat Loss Centre: Present in the anterior nuclei.

Its stimulation, as during exposure to heat

⇒ V.D. and sweating.

9- Other functions

A-Olfaction: (Rinoencphalon) The Hippocampus form part of the olfactory center & concerned with the emotional response to olfactory stimuli.

B-Transformation from short term to long term memory= Hippocampus

c- Learning = Hippocampus

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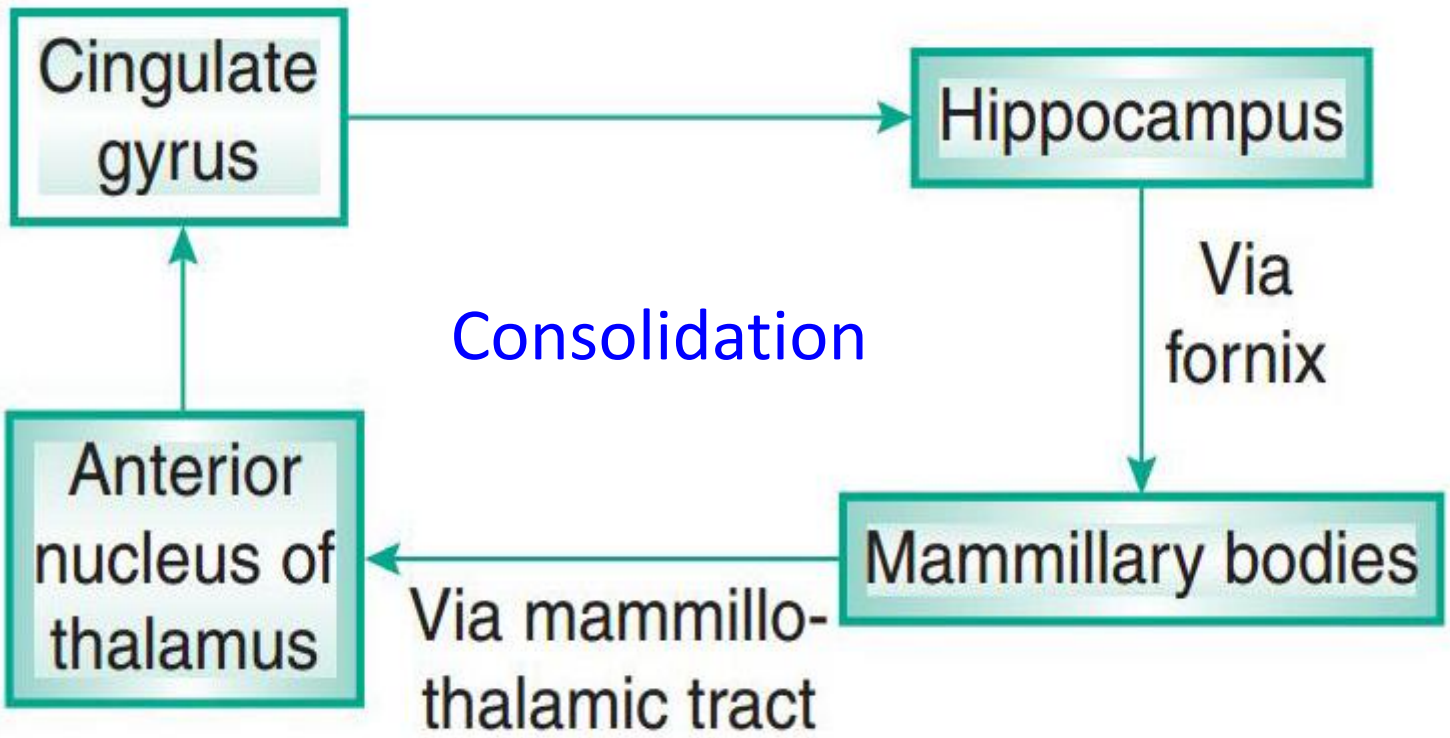
c- Learning = Hippocampus



Papez Circuit


Thank you