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**THE LIMBIC SYSTEM** (from a "limbus" (border) around the corpus callosum and **brainstem**) **THE LIMBIC SYSTEM** is principally a SUBCORTICAL (basal forebrain; paleocortical) circuit involving several distinct structures (neuronal pools) BUT also involving a cortical structure (cingulate gyrus) and the HYPOTHALAMUS. The subcortical structures are the SEPTUM ( just under forward end of the corpus callosum), AMYGDALA (in the ventral surface near the temporal lobe), and HIPPOCAMPUS (begins near the amygdala and swerves up into brain). It extends from the orbitofrontal area (ventral surface of the frontal lobes) to the cingulate gyrus (in front of the corpus callosum onto the medial aspect of the cerebral hemisphere). To pass posterior down to the ventromedial part of the temporal lobe to the hippocampal gyrus and pyriform area and uncus.

The Limbic System (especially hypothalamus) is responsible for most homeostatic, vegetative, visceral functions BUT ALSO integrates these functions with certain stimuli that in a way that results in "EMOTIONAL" behavior. (that is, the visceral functions are put in the service of behavioral patterns associated with the appropriate stimuli.) e.g. pleasure, fear, anger, and all their somatic and autonomic (visceral) manifestations.

The **HIPPOCAMPUS** is the main input; the **HYPOTHALAMUS** is the main output.

In mammals it consists of:

- a. **olfactory bulbs**
- b. **septum pellucidum**
- c. **fornix** (fibers that pass from beneath corpus callosum to the mammillary bodies of the hypothalamus)
- d. **cingulum** (cerebral gyrus just above corpus callosum)
- e. **hippocampus** (in floor of lateral ventricle near amygdaloid nucleus)
- f. **mammillary bodies** (mainly olfactory reflexes)
- g. **hypothalamus** (connects to pituitary gland or hypophysis), the main outflow to autonomic system

## LIMBIC FUNCTION:

**Reward/Punishment** (=?= pleasure/pain; =?= approach/withdrawal) Necessary for establishing memory in most cases.

**1. REWARD:** mainly **septal** (along course of medial forebrain bundle) and **hypothalamus** (especially VM nucleus --stim of which causes satiety (lat hypothal stim causes voracity).

**2. PUNISHMENT:** **central gray area** surrounding the aqueduct of Sylvius in the mesencephalon and up to the periventricular structures of **hypothalamus** (espec perifornical nuc -- also assoc with autonomic elements of hunger and blood pressure--stim here and get rage: cat hisses, raises tail, spits, extends claws, growls, piloerects, and dilates pupils) and **thalamus**.

### 3. "RAGE"/EMOTIONAL RESPONSES/SEX:

**"RAGE" EFFECTS:** When the entire cortex of many mammals is removed, it is easy to enrage;

BUT, animals that have most of the cortex removed but the limbic system left unimpaired become placid."

BUT, if a certain part of the limbic system is lesioned in such placid animals (cing OR amyg/hipp/pyriform lobe), they become ferocious

**AMYGDALA** stimulation effects are

- sim to those of HYPOTHAL stim but also include tonic and circling movements and sometimes an "arrest" reaction ("freezing")
- like hypothal aversion/rage and sometimes reward/pleasure
- sex: erection/copulation ejaculation, ovulation, premature labor
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