

# BRAIN

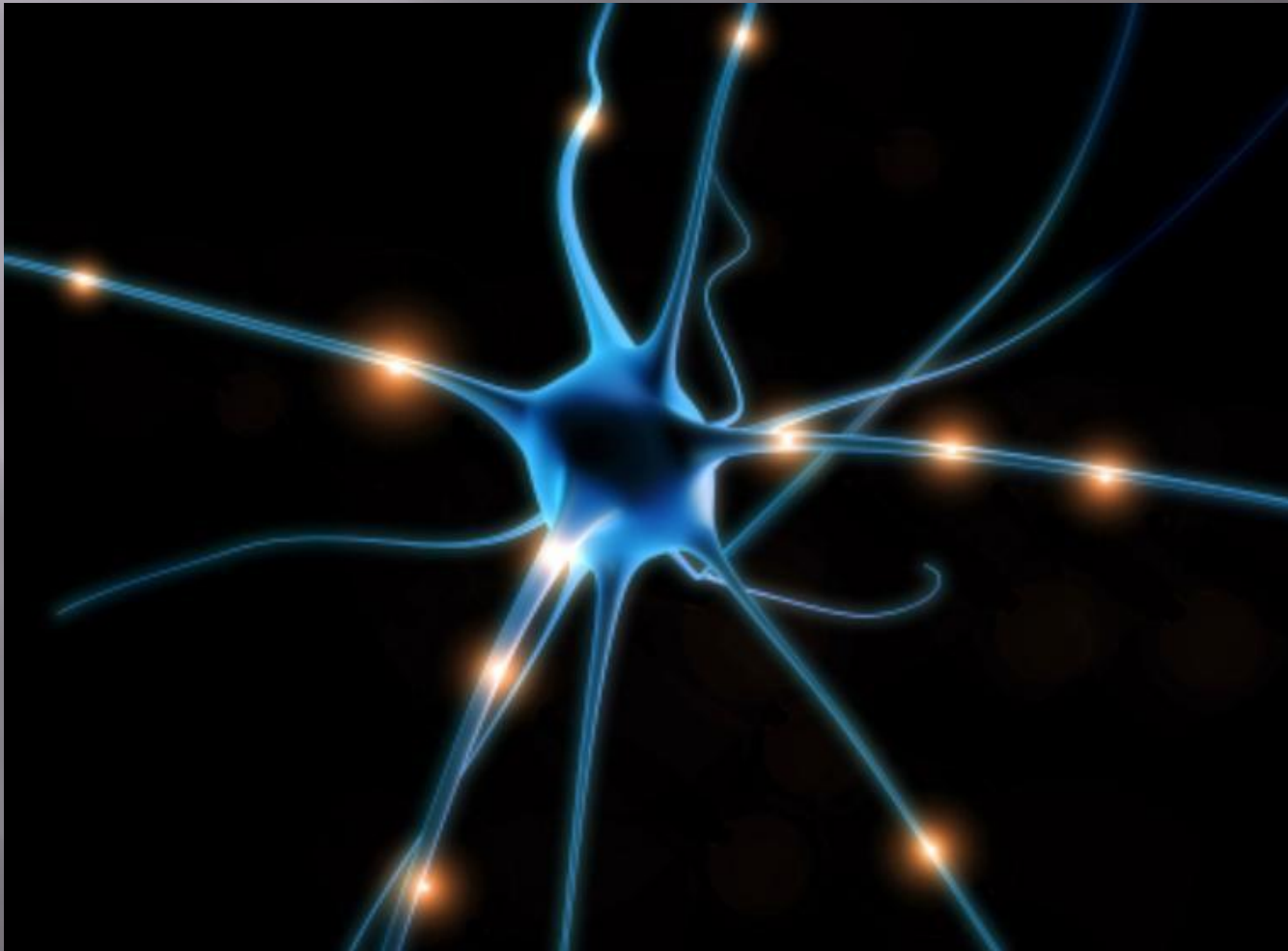


- ▣ The human brain is the central organ of the human nervous system, and with the spinal cord makes up the central nervous system. The brain consists of the cerebrum, the brainstem and the cerebellum. It controls most of the activities of the body, processing, integrating, and coordinating the information it receives from the sense organs, and making decisions as to the instructions sent to the rest of the body.

The shape and size of the brain varies greatly between species, and identifying common features is often difficult. Nevertheless, there are a number of principles of brain architecture that apply across a wide range of species. Some aspects of brain structure are common to almost the entire range of animal species; others distinguish "advanced" brains from more primitive ones, or distinguish vertebrates from invertebrates.



The brains of all species are composed primarily of two broad classes of cells: neurons and glial cells.





# Neurons are collecting electrical impulses



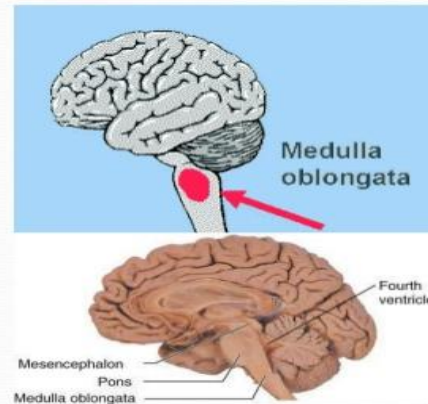
# Glial perform a number of critical functions



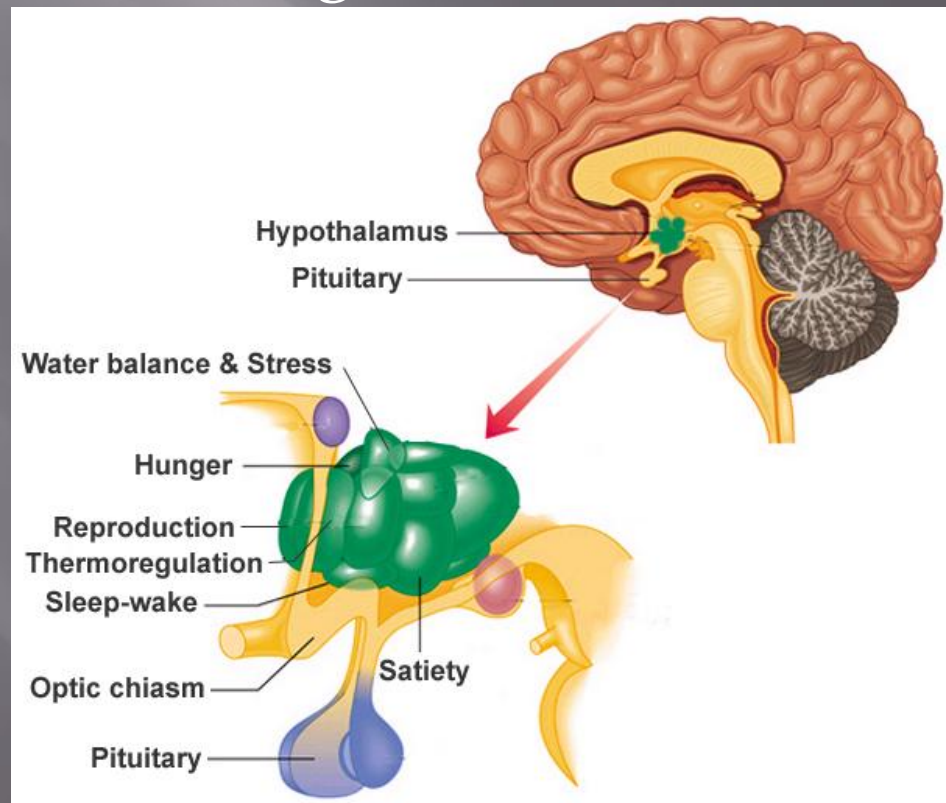
**The medulla, along with the spinal cord, contains many small nuclei involved in a wide variety of sensory and involuntary motor functions such as vomiting, heart rate and digestive processes.**

## Medulla

- Carries out and regulates life sustaining functions such as breathing, swallowing and heart rate
- The medulla is easily the most important part of the brain.
- It's functions are involuntary.
- We would not be able to live without the medulla because of the myriad of crucial tasks it performs including regulating blood pressure and breathing.
- As a part of the brain stem, it also helps transfer neural messages from the brain to the spinal cord.

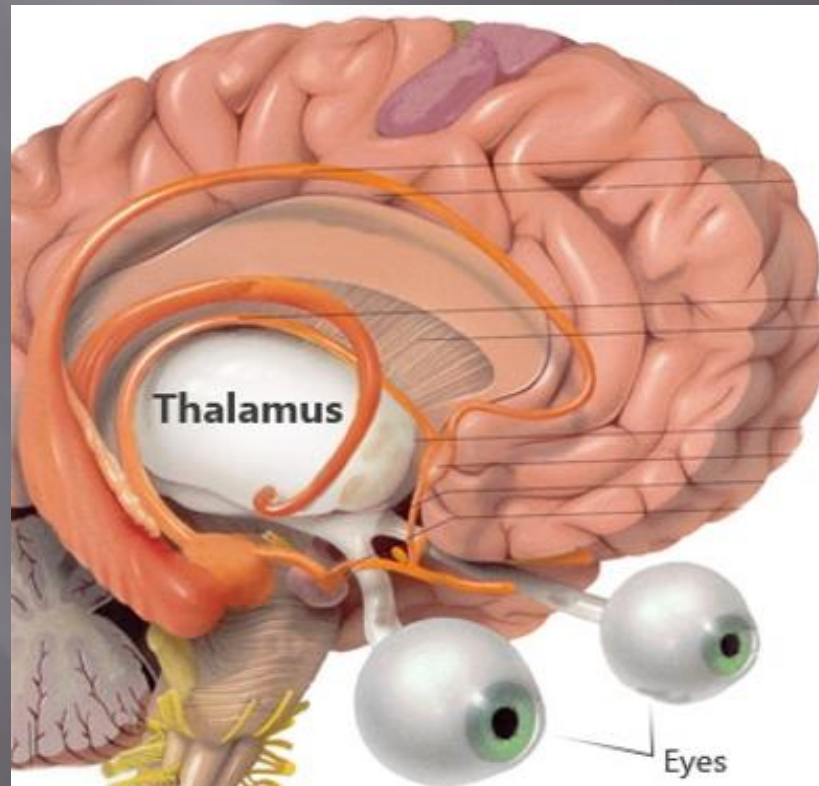


- The **hypothalamus** is a small region at the base of the forebrain, whose complexity and importance belies its size. It is composed of numerous small nuclei, each with distinct connections and neurochemistry. The hypothalamus is engaged in additional involuntary or partially voluntary acts such as sleep and wake cycles, eating and drinking, and the release of some hormones





- ▣ The **thalamus** is a collection of nuclei with diverse functions: some are involved in relaying information to and from the cerebral hemispheres, while others are involved in motivation. The subthalamic area (**zona incerta**) seems to contain action-generating systems for several types of "consummatory" behaviors such as eating, drinking, defecation, and copulation.



- The **cerebellum** modulates the outputs of other brain systems, whether motor related or thought related, to make them certain and precise. Removal of the cerebellum does not prevent an animal from doing anything in particular, but it makes actions hesitant and clumsy

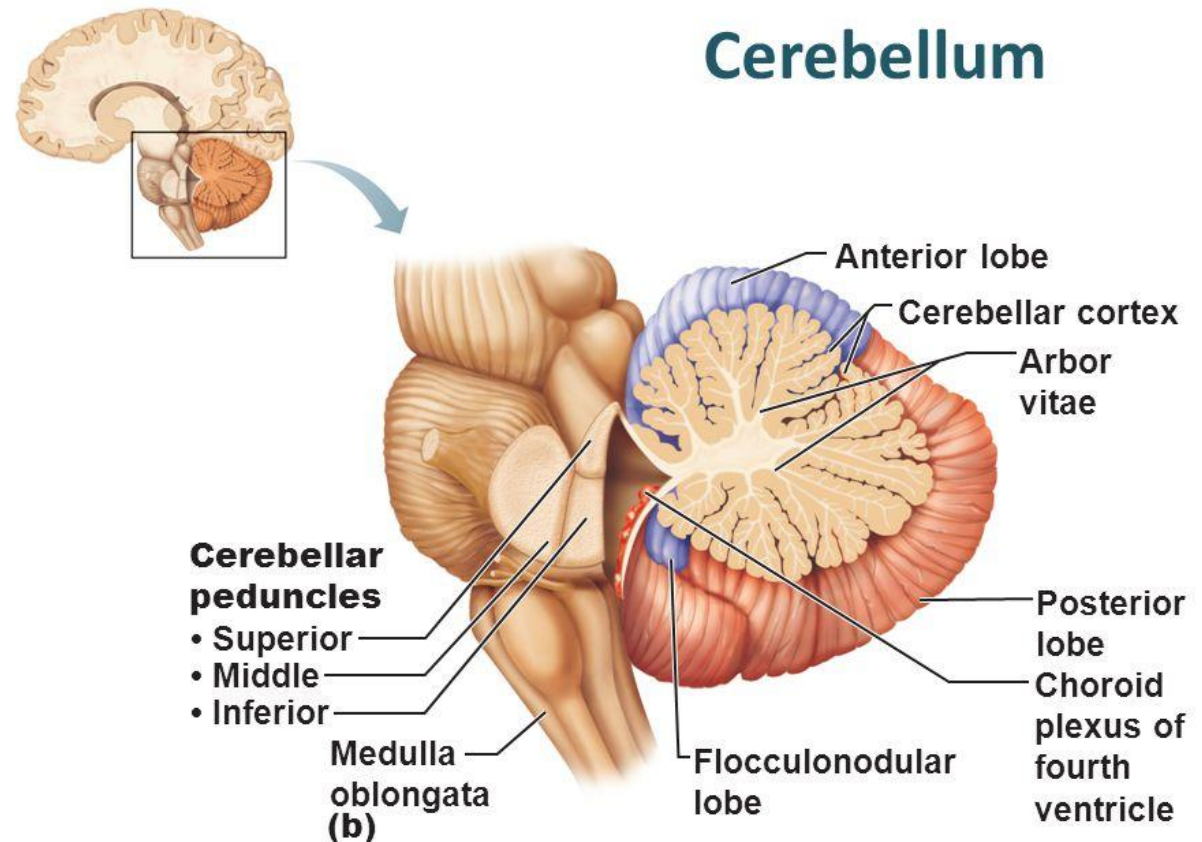
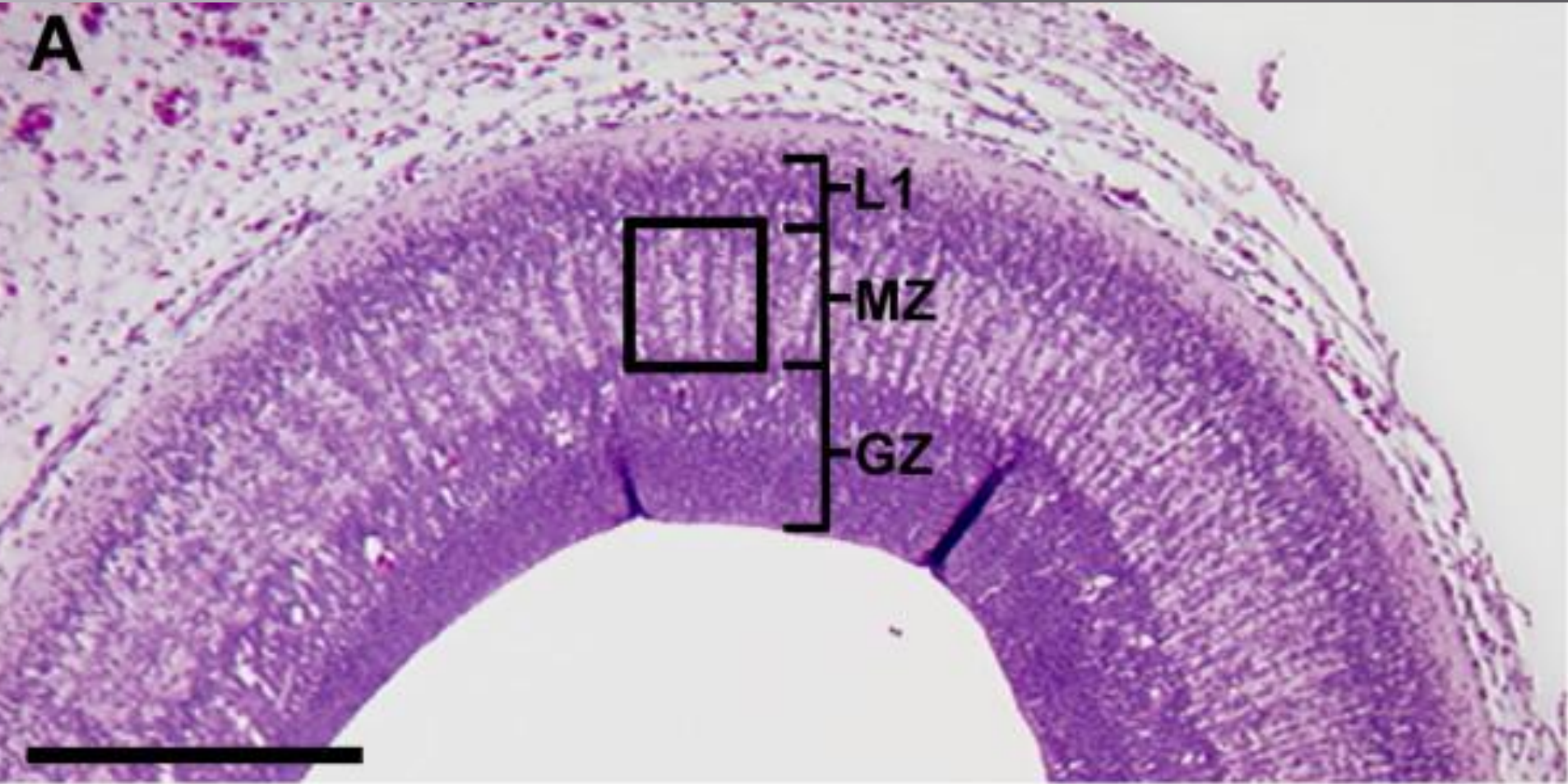


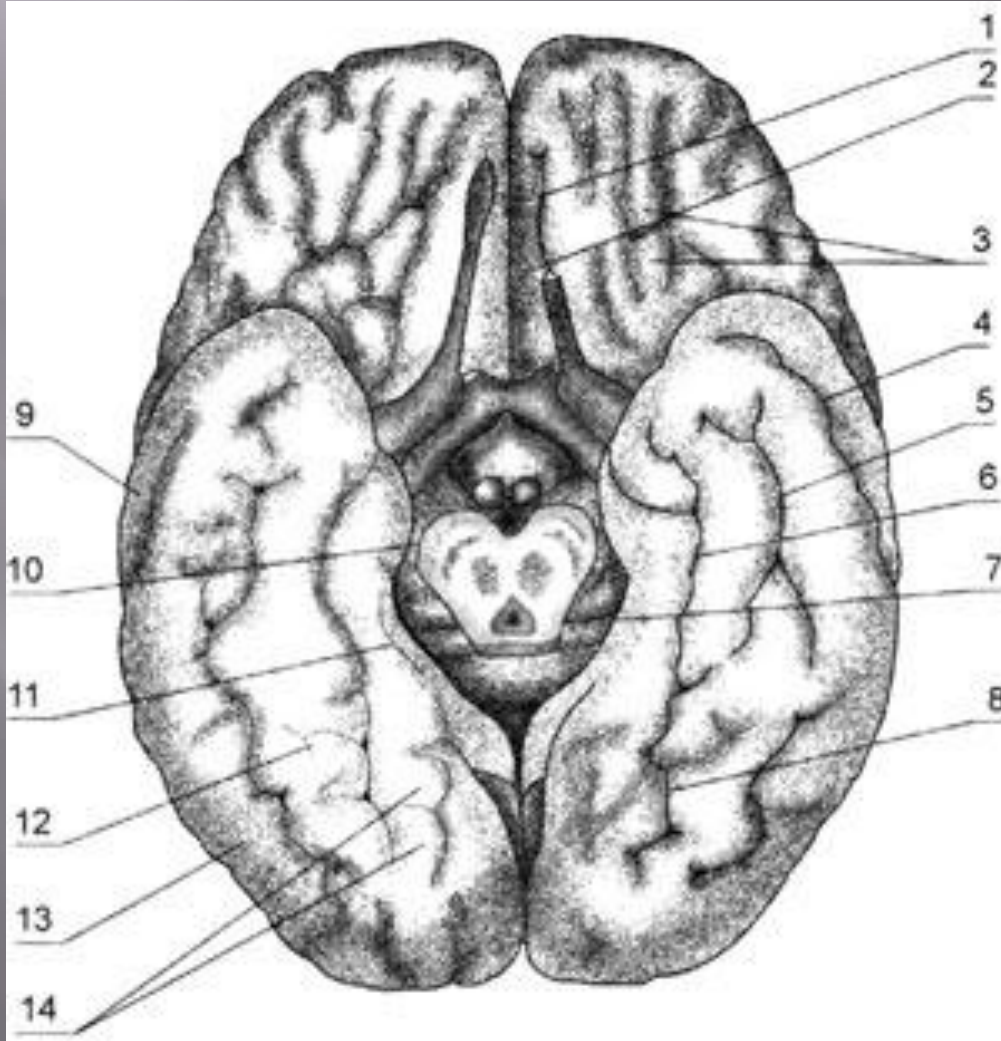
Figure 12.17b

- ▣ The optic tectum allows actions to be directed toward points in space, most commonly in response to visual input



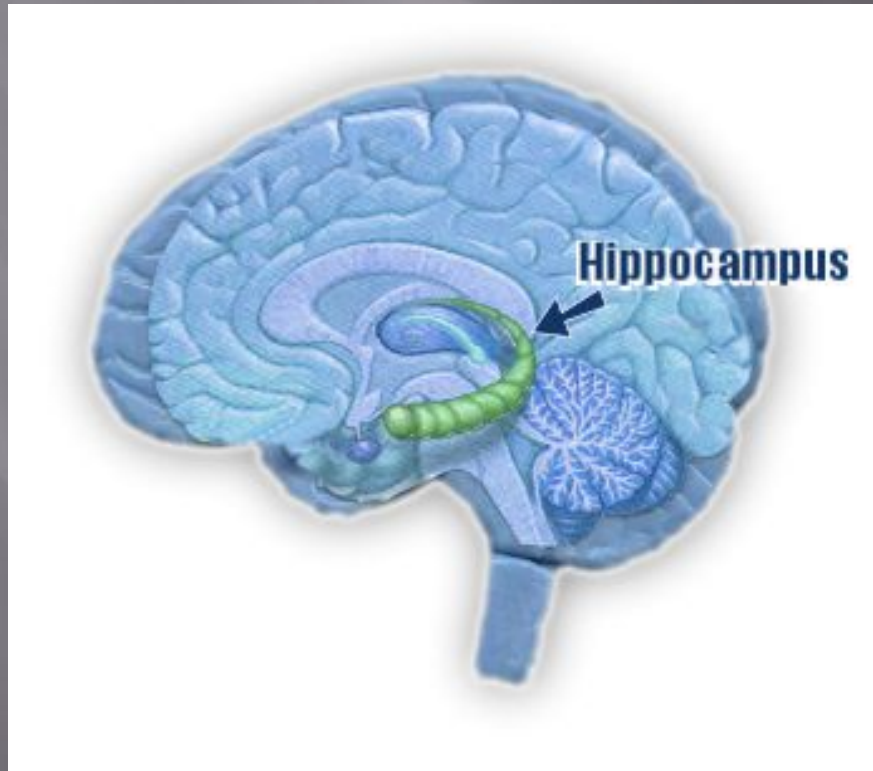


- ▣ The pallium is a layer of gray matter that lies on the surface of the forebrain and is the most complex and most recent evolutionary development of the brain as an organ.

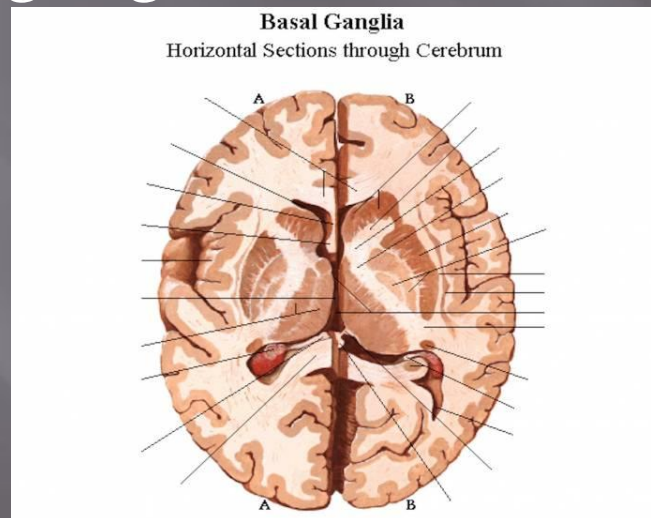




- ▣ The hippocampus, strictly speaking, is found only in mammals. However, the area it derives from, the medial pallium, has counterparts in all vertebrates. There is evidence that this part of the brain is involved in complex events such as spatial memory and navigation in fishes, birds, reptiles, and mammals. ↓

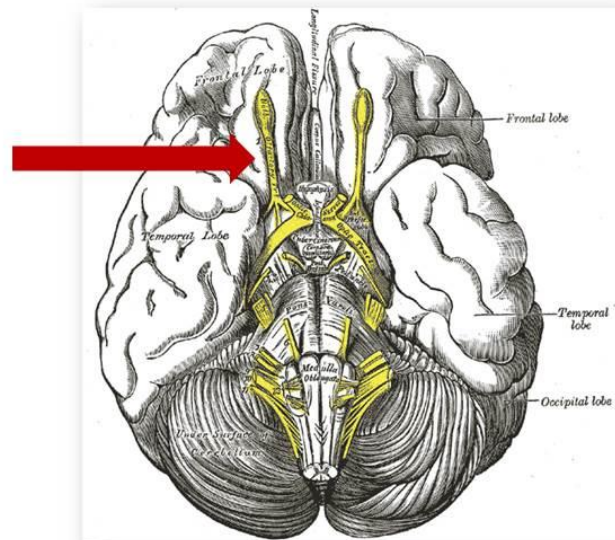


- The basal ganglia are a group of interconnected structures in the forebrain. The primary function of the basal ganglia appears to be action selection: they send inhibitory signals to all parts of the brain that can generate motor behaviors, and in the right circumstances can release the inhibition, so that the action-generating systems are able to execute their actions. Reward and punishment exert their most important neural effects by altering connections within the basal ganglia



- ▣ The **olfactory bulb** is a special structure that processes olfactory sensory signals and sends its output to the olfactory part of the pallium. It is a major brain component in many vertebrates, but is greatly reduced in humans and other primates (whose senses are dominated by information acquired by sight rather than smell)

## Olfactory Bulb



From the 20<sup>th</sup> Edition of Gray's Anatomy, 1918