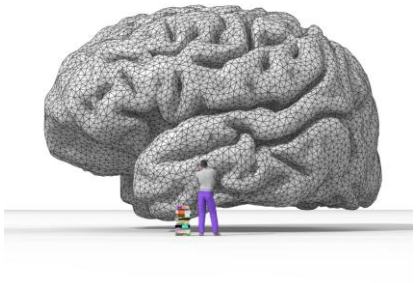
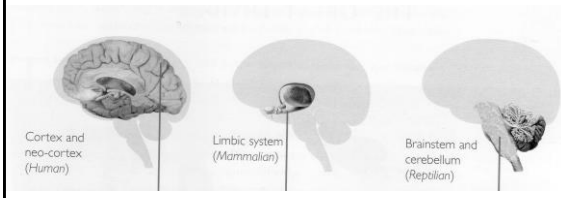


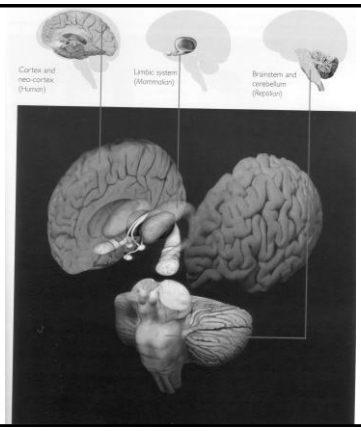
Neurobiology: A brief introduction

Major regions of the brain

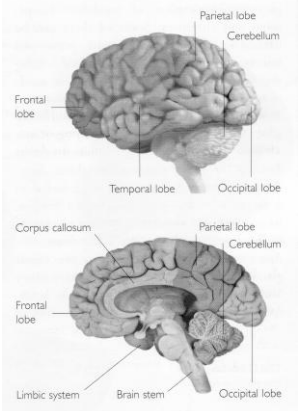


Major regions of the brain

- Brainstem & cerebellum
  - Breathing, eating, coordinating movement
- Limbic system
  - Memory, emotion
  - Hippocampus, amygdala
- Large cortex – primates, humans
  - Thinking, reasoning, planning



- Cortex is the outer part of the brain
- Most recently evolved; greatly enlarged in primates and particularly in man



4 major lobes in the cortex

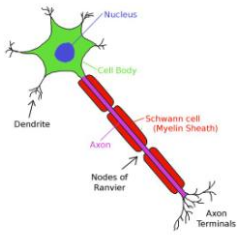
- Frontal lobe
  - Higher cognitive function
  - Planning, judgment
- Parietal
  - Sensation, some motor control
- Temporal
  - Language, learning
- Occipital
  - Visual processing

Neurons

- Neurons are the cells that transmit information rapidly in the body.
- Provide mechanism for faster responses to the environment

Three main parts of neurons

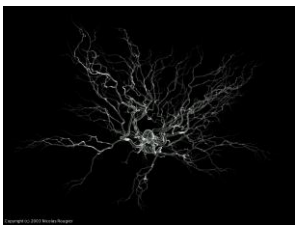
- Dendrites:
  - receive signals
- Cell body:
  - maintains cell
- Axon:
  - sends signals



commons.wikimedia.org/wiki/File:Neuron1.jpg by Nick Gorton

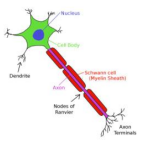
Dendrites

- Input channel to the neuron
- Most neurons have many dendrites (many inputs)



Axons

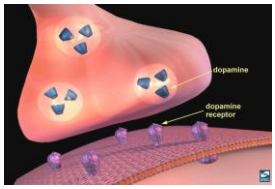
- Output channel from the neuron
- Most neurons have only one axon
- Each axon usually branches many times before it ends, allowing a single neuron to have many terminals.



- The end of the axon, called the axon terminal, is the point at which it communicates with receiving neurons.
- Axons usually connect to a receiving neuron's dendrite, but may also contact a receiving neuron's cell body or its axon.
- The point where the sending and receiving parts of neurons meet is the synapse.

Synapse

- Neurons communicate with each other at synapses using chemical neurotransmitters.

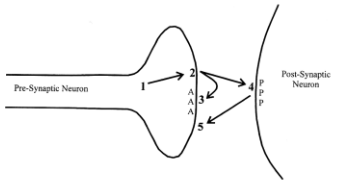


- Information usually flows across the synapse:
  - from the axon terminal (presynaptic)
  - to the receiving neuron (postsynaptic)

How drugs act on synapses

- Neurons communicate with each other at synapses using chemical neurotransmitters.
- This provides the bases for drugs (and poisons) to affect synaptic transmission.
- Drugs with chemical properties similar in some way to those of neurotransmitters can act on synapses to alter behavior and thoughts (psychotropic or psychoactive drugs)

- Drugs that increase synaptic transmission are "agonists".
- Drugs that block or reduce synaptic transmission are "antagonists".



PROCESS	AGONIST	ANTAGONIST
1. synthesis	increase	decrease
2. release	promote	inhibit
3. autoreceptors (A)	block	activate
4. post-synaptic receptors (P)	activate	block
5. deactivation	block reuptake or degredation	

FIGURE 3 Effects of drugs on synaptic processes. Details about each numbered process can be found in the text.

- About 25 neurotransmitters are known in the mammalian brain.
- Most psychoactive drugs act on the synapses of a single neurotransmitter.
- These synapses often occur in different, functionally unrelated parts of the brain, controlling many different behaviors
- The psychological actions of drugs can be quite complex and difficult to predict

To affect the brain, drugs must cross the blood-brain barrier

- Access to the brain from the circulatory system is controlled by the blood-brain barrier (BBB).
- This barrier is made up of a layer of cell surrounding the blood vessels that supply the brain.
- These cells determine the degree to which substances in the blood can enter the brain.

- Fat-soluble substances cross the BBB more easily than water –soluble substances.
- Drugs and hormones with large molecular weights do not easily pass the BBB. May require transporters to get into cells
- Glucose and insulin are actively transported into the brain
- The degree to which drugs cross the BBB is critical to their effects on memory.

Learning and memory

- Most neuroscientists today believe that alterations in synaptic connectivity underlie learning, and that memory is the stabilization and maintenance of these changes over time.