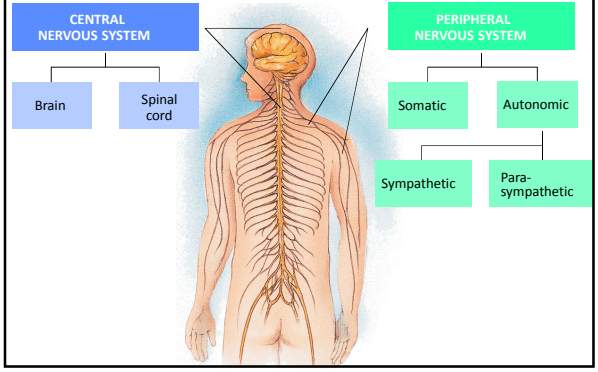
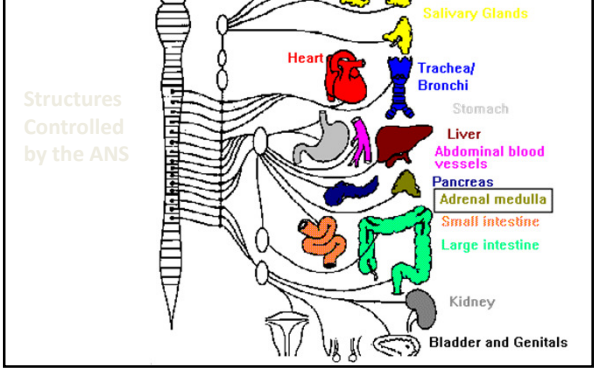
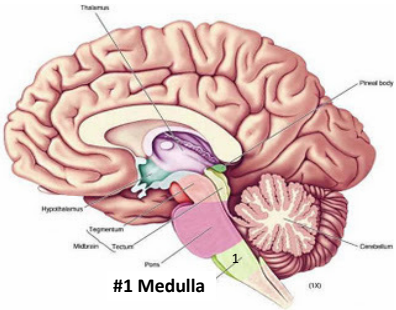
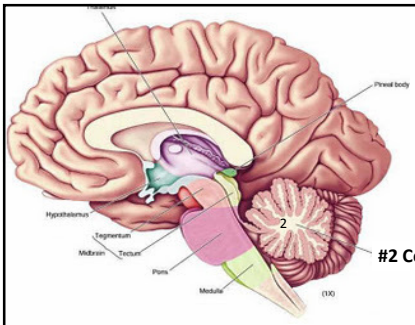






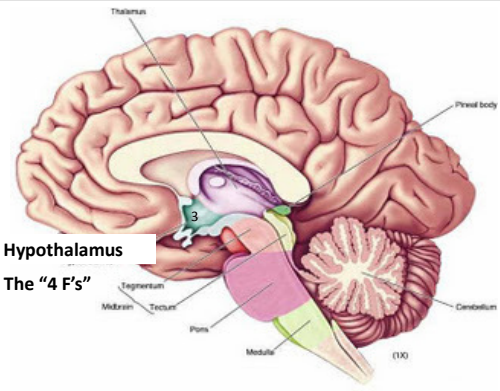
#1 Medulla

Life-sustaining and life-protecting reflexes. Overdose deaths usually due to drug action in the medulla, interfering with regulation of breathing or cardiovascular function.



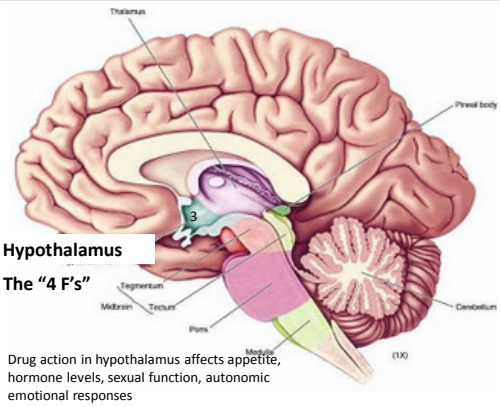
#2 Cerebellum

Motor coordination and balance. Drug action on cerebellum may cause slurring, stumbling, loss of balance.



#3 Hypothalamus

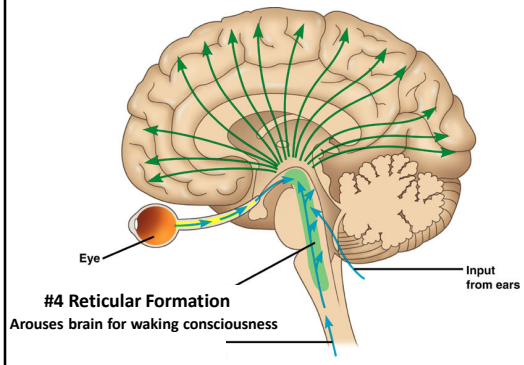
The "4 F's"



#3 Hypothalamus

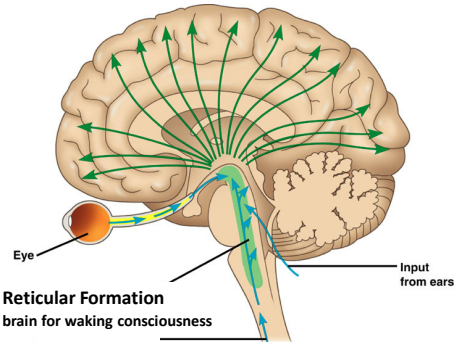
The "4 F's"

Drug action in hypothalamus affects appetite, hormone levels, sexual function, autonomic emotional responses



#4 Reticular Formation
Arouses brain for waking consciousness

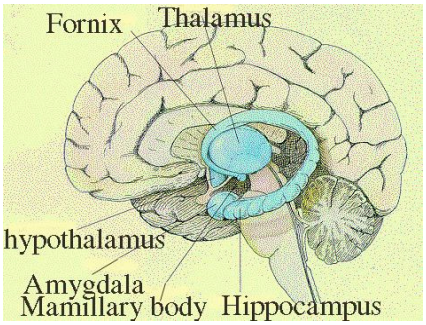
A.k.a. **"Reticular activating system"**



#4 Reticular Formation
Arouses brain for waking consciousness

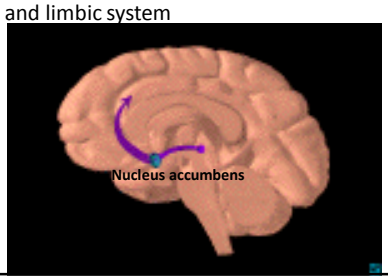
Drug stimulation here may prevent sleep . Drug interference here can cause loss of consciousness.

#5 The Limbic System - Emotion Control System



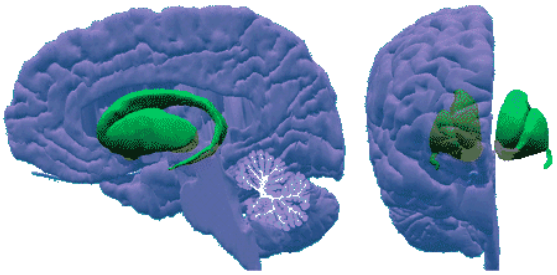
6 Dopamine Pleasure/Reward System (aka mesolimbic pathway)

- Bundle of dopamine (DA) neurons from midbrain thru hypothalamus & nucleus accumbens, then on to cortex and limbic system



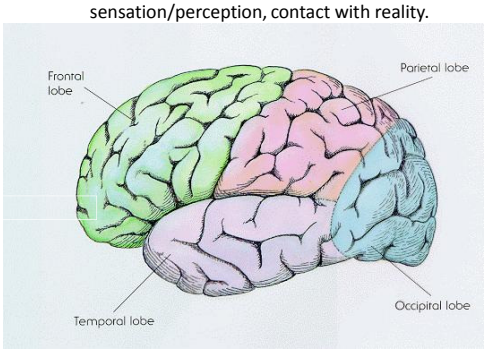
#7 Basal Ganglia or Extrapyramidal Motor System

- Initiating voluntary movements & keeping undesired movements in check

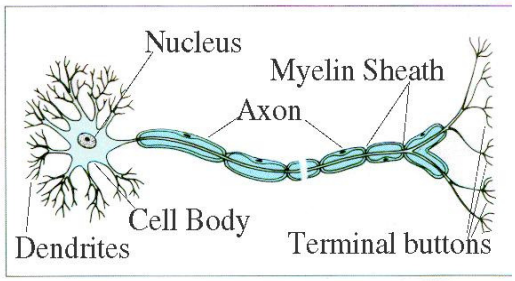


#8 Cortex

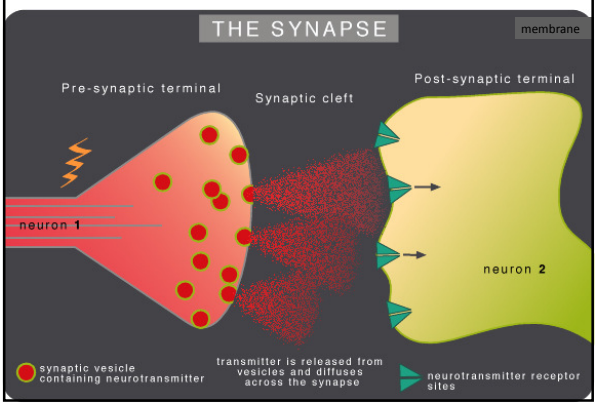
Drug action here affects judgment & reasoning, self-control, sensation/perception, contact with reality.

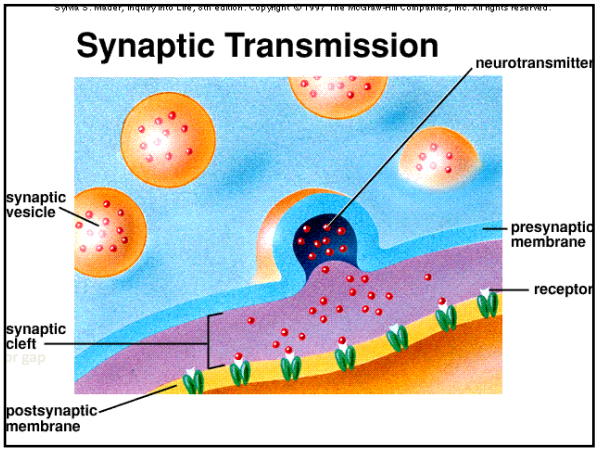


Neuron



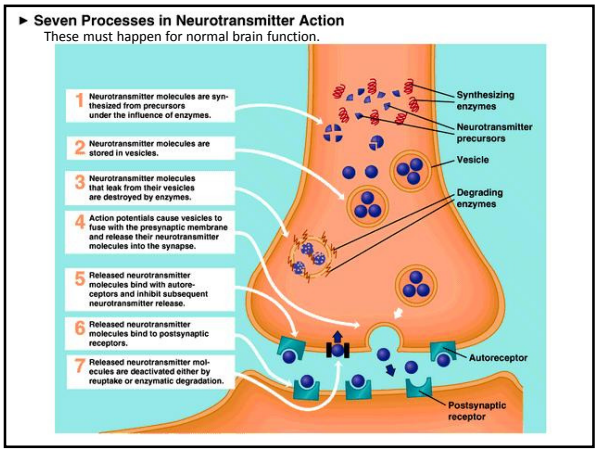
Function depends on electrical messages *within* the neuron (the "nerve impulse" or "action potential" and chemical messages *between* cells .





Cleaning Up Neurotransmitter

- Transmitter must be removed from synapse after its release & activation of receptors.
- Most neurotransmitters are recycled thru a process called "**reuptake**" – transported back into axon ending to be used again
- Less often an enzyme breaks down transmitter into inactive components.
- Clean up is critical to normal nervous system function.



- The "Big Seven"

(Best Known Neurotransmitters That our Psychoactive Drugs Will Influence)

- Acetylcholine (ACh)
- Norepinephrine (NE)
- Dopamine DA)
- Serotonin or 5-Hydroxytryptamine (5HT)
- GABA
- Endorphin
- Glutamate
- http://www.uni.edu/walsh/neurotransmitters.html

•Acetylcholine (ACh)

- neurons using ACh =“cholinergic neurons”
- Where do you find them?
  - Nerves to skeletal muscle
  - Parasympathetic N.S.
  - Learning and memory areas of brain
- some drugs (Cognex (tacrine), Aricept, Reminyl) increase Ach actions
- others (“anticholinergics”) block its action

•Norepinephrine (NE)

- Where do you find NE neurons?
  - **Sympathetic N.S.**
  - **Brain areas involved in appetite, arousal, mood**
- Some drugs activate NE receptors (“sympathomimetics”)
- others block NE receptors (e.g. “beta-blockers”)

•Dopamine (DA)

- Very closely related to NE (“catecholamines”) and both NE & DA loosely related to serotonin (“monoamines”)
- Where is it found?
  - **basal ganglia (motor control)**
  - **limbic system (emotion, mood and “reward”)**
  - **frontal cortex (judgment & reasoning)**
  - **hypothalamus link to pituitary gland (hormone control)**
- some drugs increase DA (l-dopa)
- others block DA (antipsychotics)

•Serotonin or 5 Hydroxytryptamine (5HT)

- found in
  - **sleep & pain suppression areas of brain,**
  - **in limbic system (mood)**
  - **in sensory processing areas**
- several drugs increase 5HT (antidepressants)
- 5HT blockers are used to decrease nausea (e.g. Zofran)

•GABA

- best known inhibitory transmitter
- widely distributed in CNS
- seems necessary to keep neuron activity “in check” - without enough of it you might suffer from excessive neural activity causing anxiety or epilepsy
- several drugs increase the effects of GABA (benzodiazepines, alcohol)

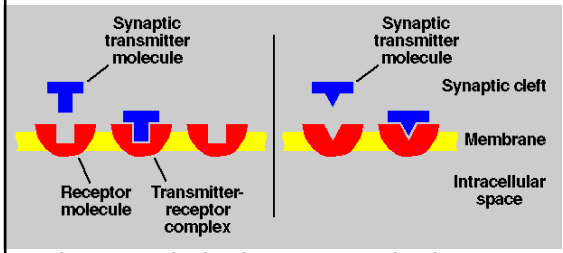
Glutamate

- Amino acid which acts as an excitatory transmitter almost everywhere in the CNS
- PCP blocks some glutamate receptors

•Endorphins

- Peptide family of transmitters which decrease pain perception and elevate mood
- Narcotic analgesic drugs act on endorphin receptors

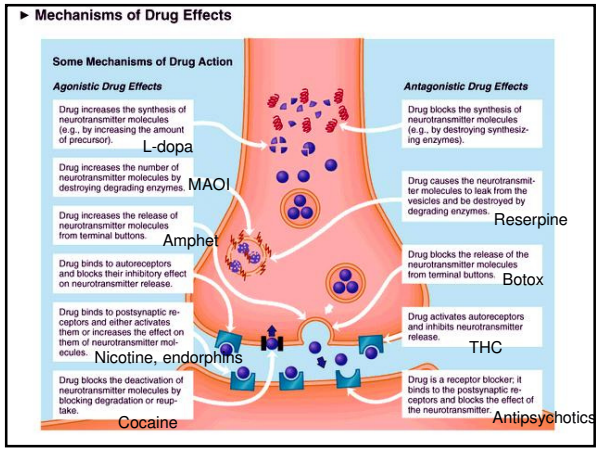
Post-SynapticReceptor Specificity



- **Each transmitter binds only to its receptors, but there are multiple types of receptors for each.**
- **Drugs may increase or decrease the synaptic action of neurotransmitters. Drugs may affect only certain types of a transmitter's receptors.**

•Ways Drugs May Affect Neurons

- Drugs may affect any of the normal neuron processes
  - Production of transmitter
  - Storage of transmitter in vesicles
  - Release of transmitter
  - Binding & action of transmitter at receptor sites
  - Elimination of transmitter by reuptake or enzymatic breakdown
- Drugs exert these actions by binding to proteins involved in these functions.
- The study of how drugs exert their effects on cells is "pharmacodynamics"



•Drugs & Receptor Sites

- AGONIST: A drug that triggers or increases the usual synaptic effects of a transmitter
  - E.g. A drug which fits post-synaptic receptor sites and MIMICS action of transmitter
- ANTAGONIST: A drug prevents or decreases the usual synaptic effects of a transmitter
  - E.g. A drug which fits receptor site but **does not** trigger a response. This drug is a BLOCKER.

•Drug Actions

- AGONIST examples:
- Narcotic pain relievers fit and activate opiate receptors **mimicking** the action of normal endorphin.
- Nicotine fits into & stimulates ACh receptor sites, arousing the cortex like ACh

- ANTAGONIST examples:
- Haldol **blocks** DA receptors in schizos
- Naloxone **blocks** opiate receptors
- Atropine & curare (discussed earlier) block different types of ACh receptors