Neural Communication

Biological Psychology = aspect of psychology concerned with physical ways neurons cooperate to compose mental processes

- Names:
  - Behavioral Neuroscientists
  - Neuropsychologists
  - Behavior Geneticists
  - Physiological Psychologists
  - Biopsychologists

Phrenology

- The study of the shape of skull and the making of inferences based off of that shape
  - Bumps on head indicate abilities or traits
- Developed by Franz Gall

The Neuron

Anatomy:

- Soma = body of the cell
  - Receives action potentials from dendrites
- Dendrites = branching bodies that connect to other dendrites or axon terminals
  - Receive action potentials via **neurotransmitters**
- Axon = long, thin barrel with myelin sheath that uses electrotonic potential to relay signals from soma to axon terminals
  - Covered with myelin sheath to split transmission into brief, fast electrotonic potentials and connecting action potentials to keep voltage high
- Myelin sheath = waxy layer composed of **Schwann Cells**
  - Serves to insulate stretches of the axon so that electrotonic potential can happen, speeding up transmisison
- *Nodes of Ranvier* = gaps inbetween the myelin sheathing that allows an action potential to happen, keeping the voltage within the cell high enough to ensure the signal isn't lost

- Synapse
  - The area where two neurons come near to each other
  - Cite of neurotransmitter release and intake

Action Potential Process

- Begin at resting potential(-70mV inside neuron)
- Stimulus opens Na+ channels and tons of sodium ions flow in
  - **Polarization**
- After a threshold is reached, K+ gates open, letting K+ out. Voltage drops as a result
  - **Depolorization**
- After a while, Sodium-Potassium pumps begin to create the gradient
  - **Repolarization**

Drugs that Target Neurotransmitters

- Action potential at dendrite is stimulated by neurotransmitter, typically
- Drugs can fit in those receptors
- **Antagonist**
  - The drug fits, but poorly; as a result, the *real* neurotransmitter can't fit
  - **Inhibits** the targetted neurotransmitter
- **Agonist**
  - The drug fits *really* well and simulates the neurotransmitter
  - **Excites** the neurotransmitter or increases activity

Neurotransmitters

- Dopamine
  - Used in movement, attention, and learning
  - Schizophrenia thought to be related to dopamine imbalance
  - Thought to be a surplus of dopamine
  - Parkinson's disease thought to be related to loss of dopamine-releasing neurons
  - Symptoms:
    - Movements are difficult to control
    - Shaking while at rest
    - Stooping posture or rigidity

    * Unbalance
  - Treatments
    * L-dopa = agonist that immitates dopamine
    * Fetal tissue transplants
    * Adrenal gland transplants
    * Electrical stimulation of thalamus = stops shaking
  - Part of "reward system" or limbic system
- Serotonin
  - Regulates sleeping patterns
  - Thought to be related to depression
  - Especially low-serotonin
  - High-serotonin is thought to cause mania
  - *Prozac* excites serotonin
    * **SSRI** = Selective Serotonin Reuptake Inhibitor
    * Examples: Welbutrin, Zoloft, Celexa
- Acetylcholine
  - First neurotransmitter we discovered
  - Abbreviated "ACh"
  - Used in motor neurons–stimulates muscles to contract
  - Used in learning, memory, and muscle contraction
  - Nicotine is an agonist for Norepinephrine and ACh
  - Thought to be related to Alzheiumer's Disease
  - Decay of memory, reasoning, and lanugage
- Endorphins
  - Regulates pain/pleasure
  - Pain is a stimulus for release
  - Agonists
  - Morphine
  - Codeine
  - Explains "runners high"
- Norepinephrine
  - Excitatory neurotransmitter that causes "fight or flight" response
  - Also related to depression
  - Used in physical arousal, learning, and memory
- GABA
  - Inhibitory
  - Thought to be related to Huntington's disease = death of neurons in *stratium* that make use of GABA
  - Jerky movements
  - Cognitive deterioration

- Glutamate
  - Very prevelant
  - Excitatory neurotransmitter
  - Excess glutamate and lack of GABA is associated with epilepsy

Neurons can be Excitatory or Inhibitory

- Excitatory = stimulates post-synaptic neuron to carry an action potential
- Inhibitory = Causes post-synaptic neuron to be less likely to start an action potential
  - GABA

Summary

- Stages
  - Relieved Dolby Rescued Harry = mneumonic for remembering stages of action potential
  - **R**elieved = **R**esting
  - **D**olby = **D**epolorization
  - **R**escued = **R**epolorization
  - **H**arry = **H**
- Ions
  - SIPO = mneumonic for remembering ions
  - **S**odium **I**n, **P**otassium **O**ut
- Agonists vs Antagonists
  - Agonists = mimic effect of neurotransmitter
  - Nicotine, Morphine
  - Antagonists = block or inhibit effect of neurotransmitter

The Nervous System

- Nerves = small strands of neurons that act as highways for action potentials
  - Serve to connect brain to peripheral sensory organs
- Nervous System = the organ system the body employs to communicate between organs
  - Composition
  - Nerve Cells
  - **Peripheral Nervous System(PNS)** = nerve framework that connects brain to peripheral sense organs
  - **Central Nervous System(CNS)** = the brain and spinal chord

Model of Nervous System

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- Peripheral Nervous System
    * Autonomic Nervous System
        + Controls unconscious actions of organs
        + Sympathetic Nervous System = arousal
        + Parasympathetic Nervous System = calming effect
            + *Think of a parachute--slows you down*
    * Skeletal/Somatic Nervous System
        + Controls voluntary movement of skeletal muscle
- Central Nervous System
    * Brain
    * Spinal Chord
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Types of Neurons

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- Sensory Neurons
    * Serve as medium through which sensory information travels to brain
    * Sense Organs -> Brain
        + Uses **affarent neurons**
    * Brain -> Sense Organs
        + Uses **efferent neurons**
    * Mneumonic = SAME
        + **S**ensory **A**ffarent **M**otor **E**fferent
- Interneurons = linking neurons that connect other systems together
    * Only found in brain and spinal chord
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Reflexes

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- **Reflex** = a simple action undertaken via the **reflex arc**
- **Reflex Arc** = a pathway of nerves through which a reflex happens
    * Generally goes from sensory organ -> affarent neurons -> interneurons -> spinal chord
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Neural Networks

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- Neural Networks = a web of inter-connected neurons that cooperate to process information
- Through experience and feedback, neural networks are modified
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Lesions

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- Lesions = destruction of tissue cause either naturally or by purpose
- Walter Freeman = got Nobel Prize for procedure wherein he quickly caused damage to a part
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Brain Scan

- Electroencephalogram(EEG)
    * Places 8 electrodes around the brain and records electric brain activity
- Computed Tomography Scan(CAT Scan)
    * X-ray photoraphs taken from different angles
    * A computer generates a composite image
- Positron Emission Tomography Scan(PET Scan)
    * A radioactive form of glucose is ingested and sensors detect where glucose goes
- Magnetic Resonance Imaging Scan(MRI Scan)
    * Large electromagnets and radio waves make water in the brain orient itself in line wit
    * Can generate very high-detail images