

Biopsychology

Nervous System & Brain
Endocrine System

Nervous System

- Divisions of the Nervous System
- Types of Nerves
- Reflexes

Divisions of the Nervous System

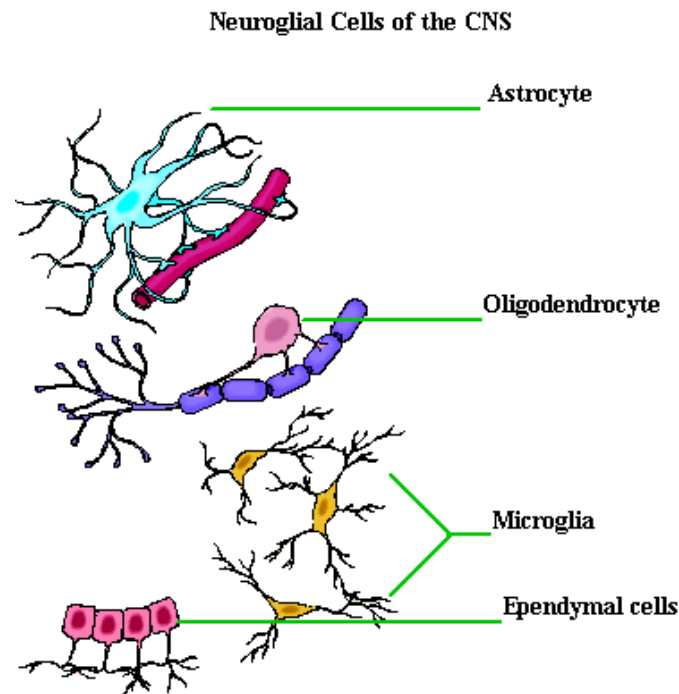
- Central NS: coordinates activity of all parts of the body
 - Brain and Spinal Cord
- Peripheral NS: carries sensory and motor info to and away from the CNS
 - Somatic: stimulate skeletal muscle (voluntary)
 - Autonomic: stimulate smooth and heart muscles (involuntary)
 - Sympathetic: pumps you up; “flight or flight”
 - Parasympathetic: calms you down; “rest & digest”

Types of Nerves

- Afferent Neurons/Sensory Nerves
 - Take info from the sensory receptors *to CNS*
- Efferent Neurons/Motor Nerves
 - Take info *from CNS* to muscles and glands
- Interneurons/Association Neurons
 - Neurons within the CNS
 - Middlemen between Afferent & Efferent
- Remember “SAME”

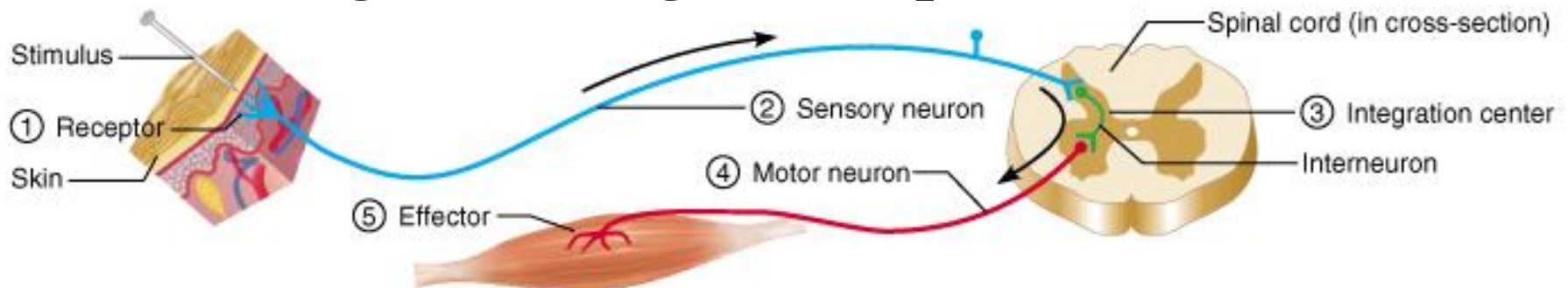
Types of Nerves

- **Neurons vs. Glial Cells**
 - Neurons send electrochemical messages
 - Glial cells support and nourish neurons



Reflexes

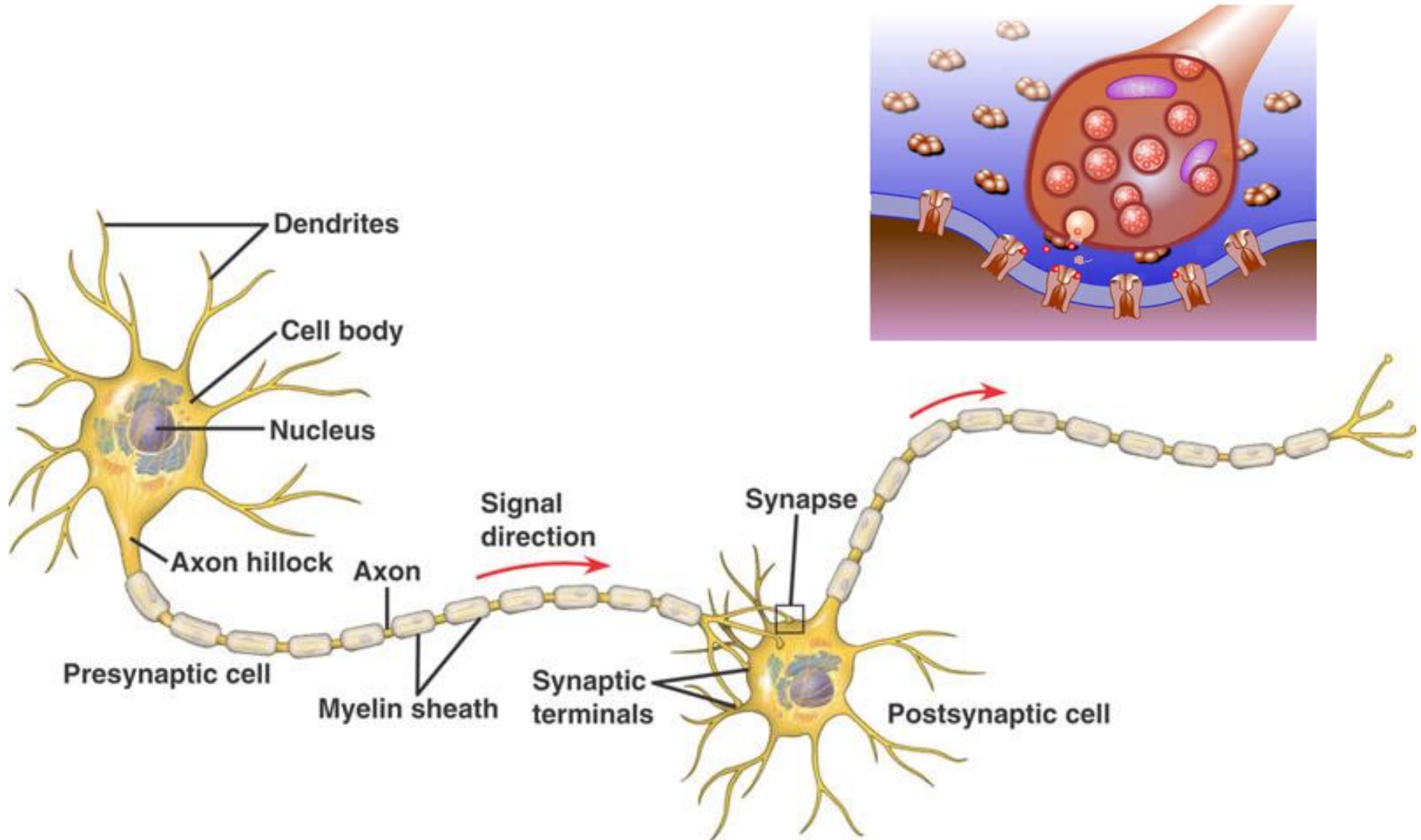
- Normal nervous system transmissions
 - Afferent → Spinal Cord → Brain → Spinal Cord → Efferent
- Reflexes
 - Afferent → Interneurons in Spinal Cord → Efferent
 - Brain gets message after spinal cord acts



The Neuron

- Structure of the Neuron
- Neurotransmitters
- Synaptic Transmission

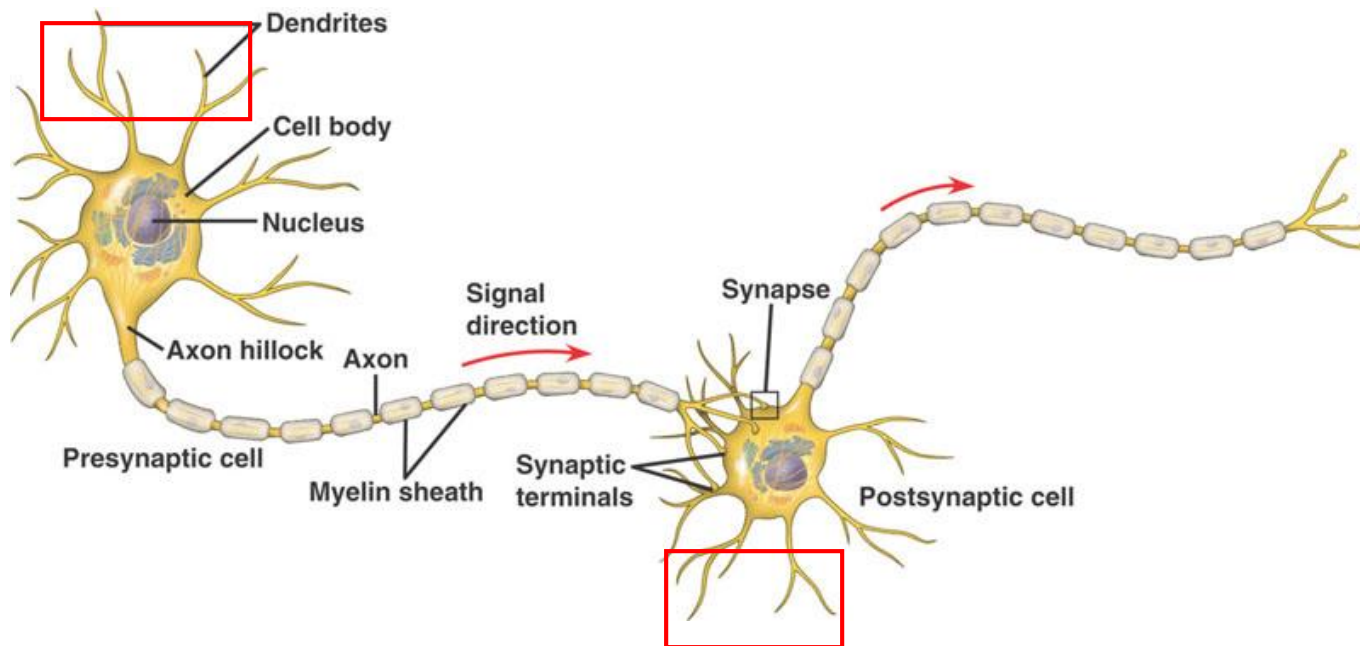
Structure of the Neuron



Structure of the Neuron

- **Dendrites**

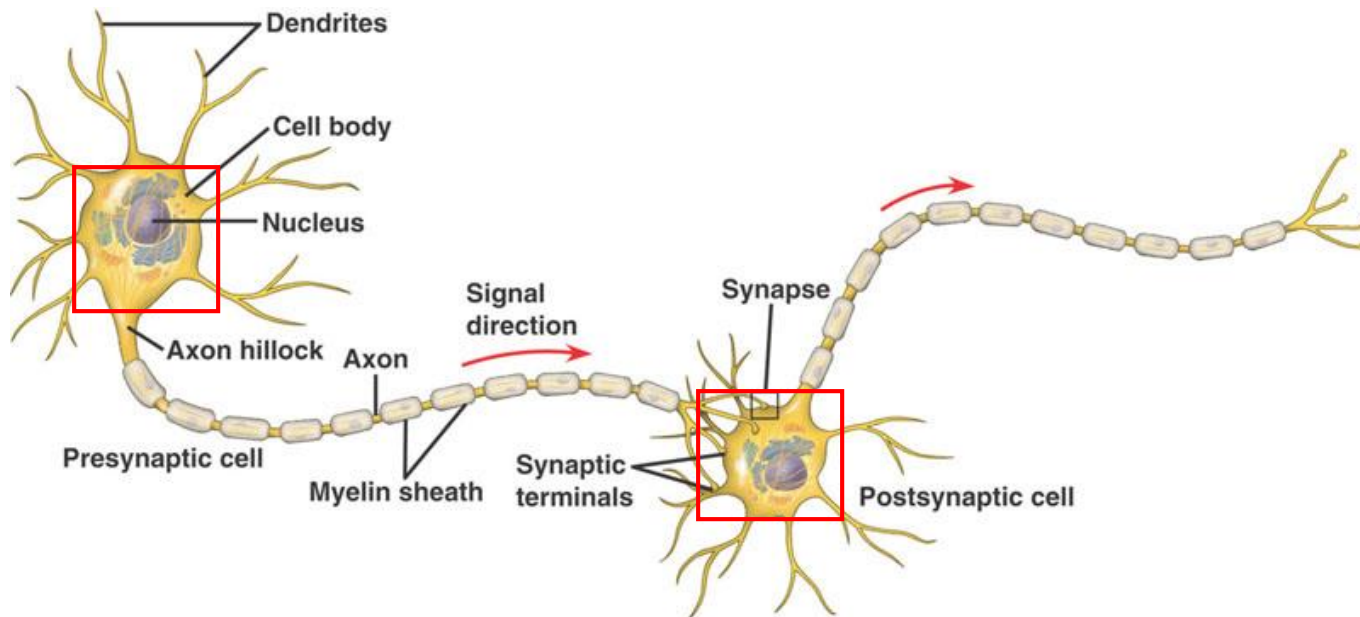
- Contain receptor sites which receive neurotransmitters from the presynaptic neuron



Structure of the Neuron

- **Soma**

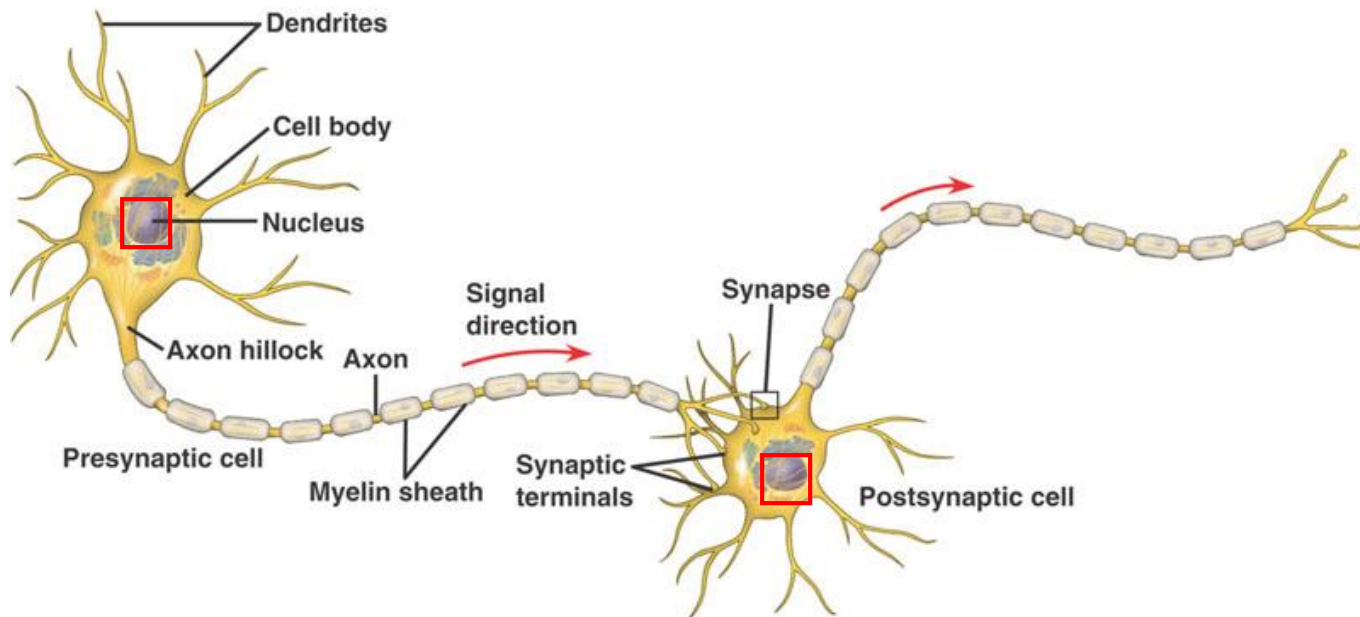
- aka cell body; contains cytoplasm; nucleus



Structure of the Neuron

- **Nucleus**

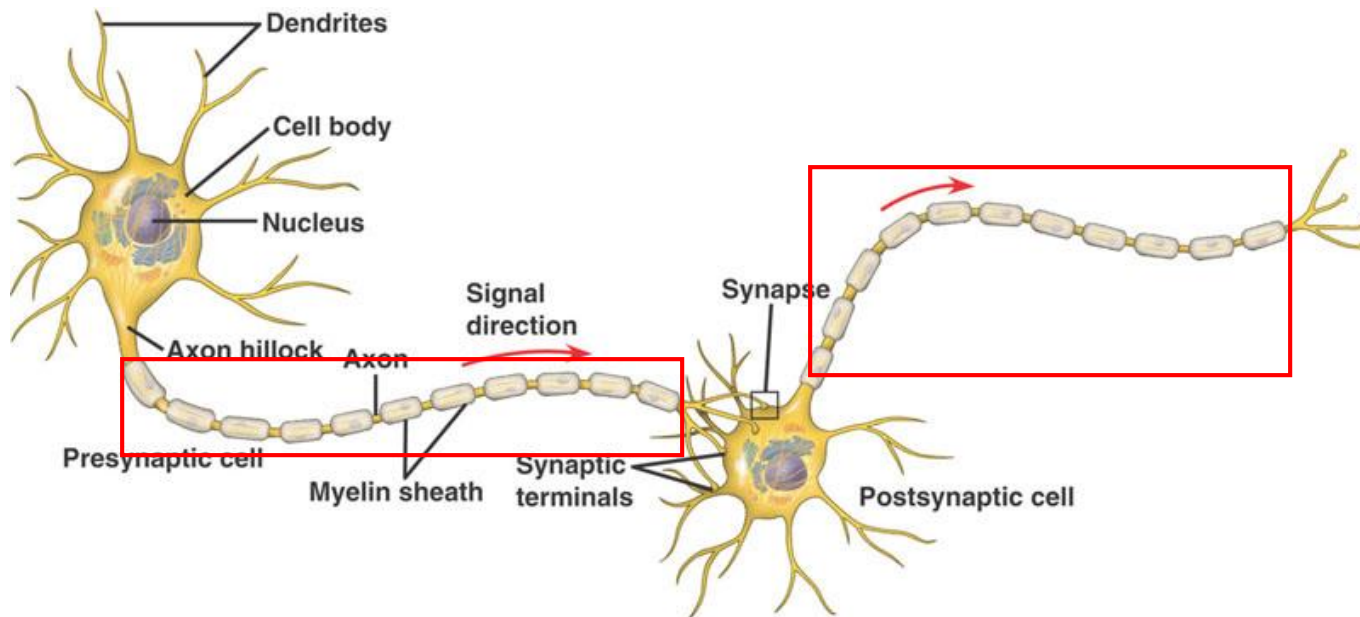
- directs production of neurotransmitters;
contains DNA



Structure of the Neuron

- **Axon**

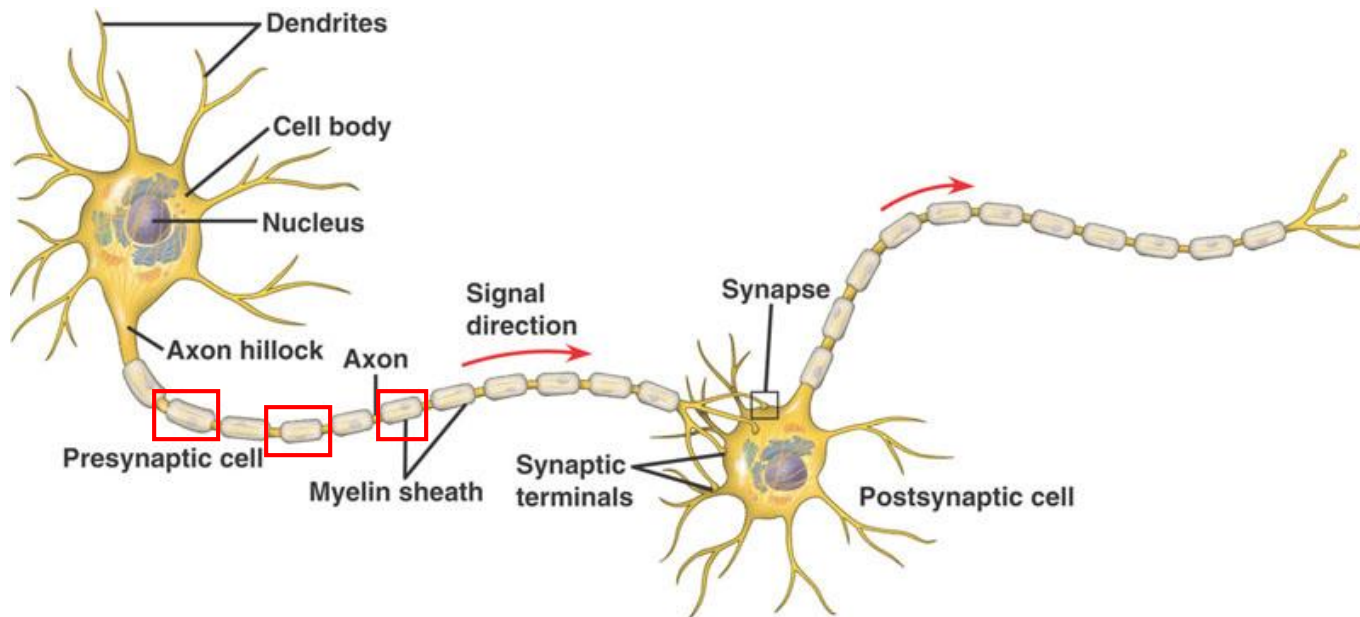
- what the neuron impulse travels down once threshold has been reached



Structure of the Neuron

- **Myelin Sheath**

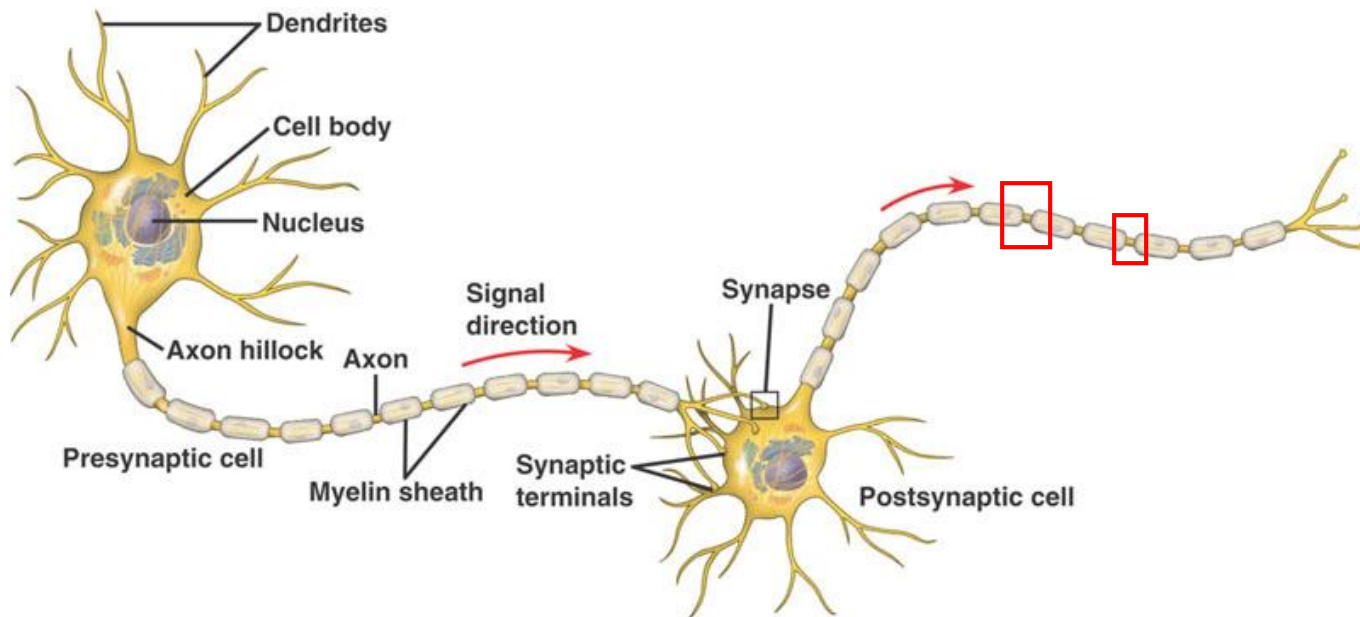
- fatty tissue which insulates the axon; speeds up the neural impulse; made by glial cells



Structure of the Neuron

- **Nodes of Ranvier**

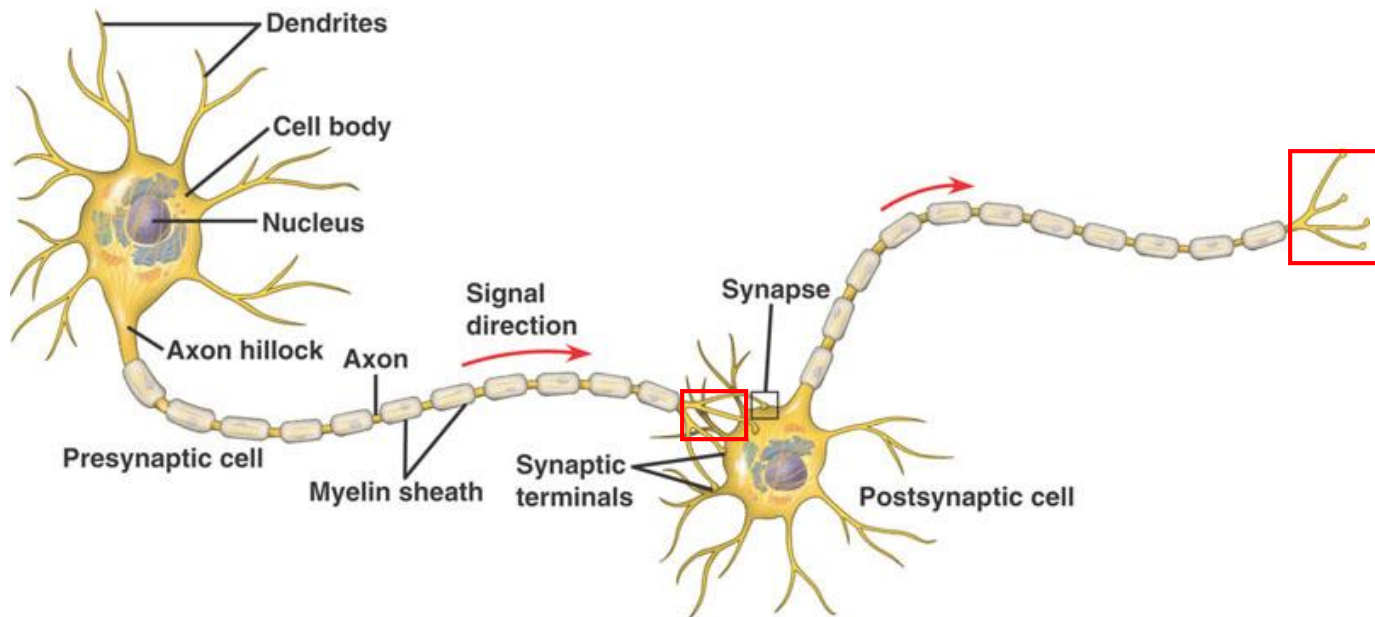
- the spaces on the axon which are not covered by myelin; where ion flow occurs for depolarization



Structure of the Neuron

- **Axon Terminal/Terminal Button**

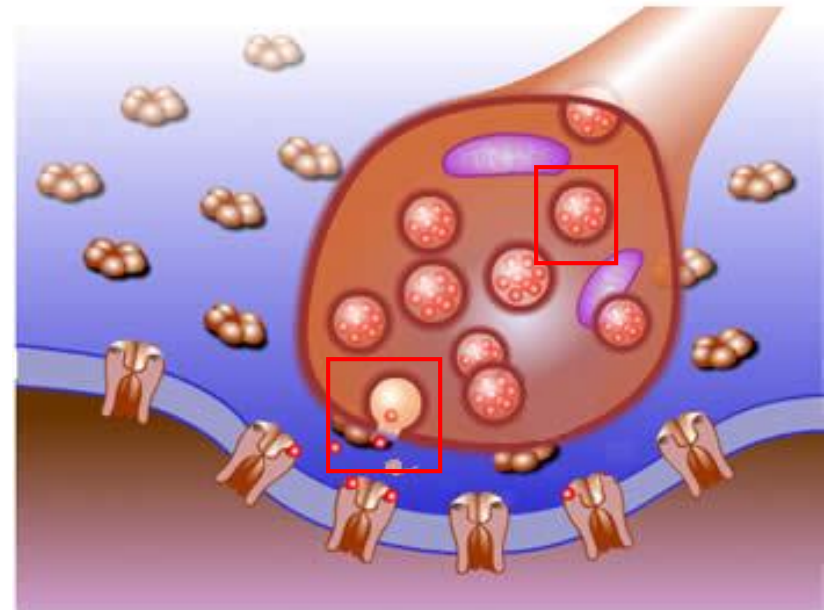
- contains neurotransmitters which are released after depolarization and neural impulse



Structure of the Neuron

- **Vesicles**

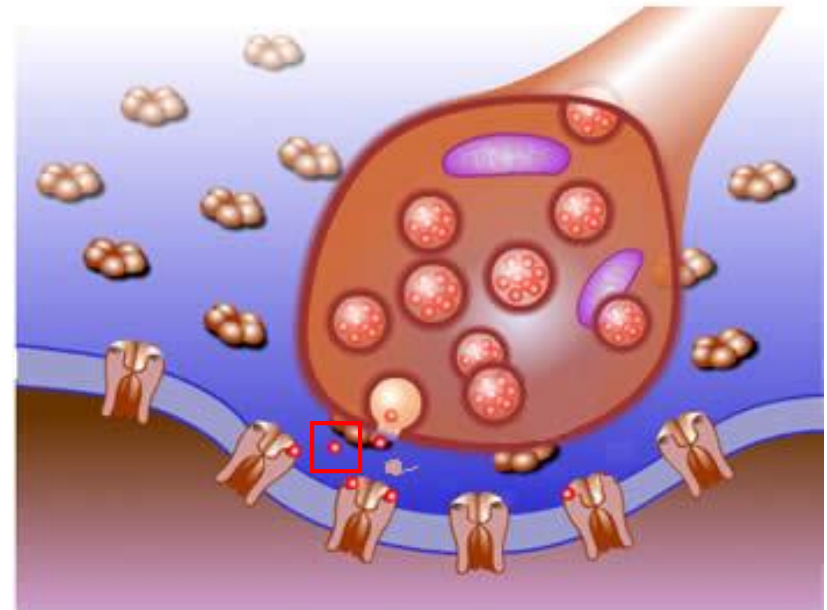
- contained within the axon terminals, these contain neurotransmitters, they surface and release neurotransmitters after depolarization



Structure of the Neuron

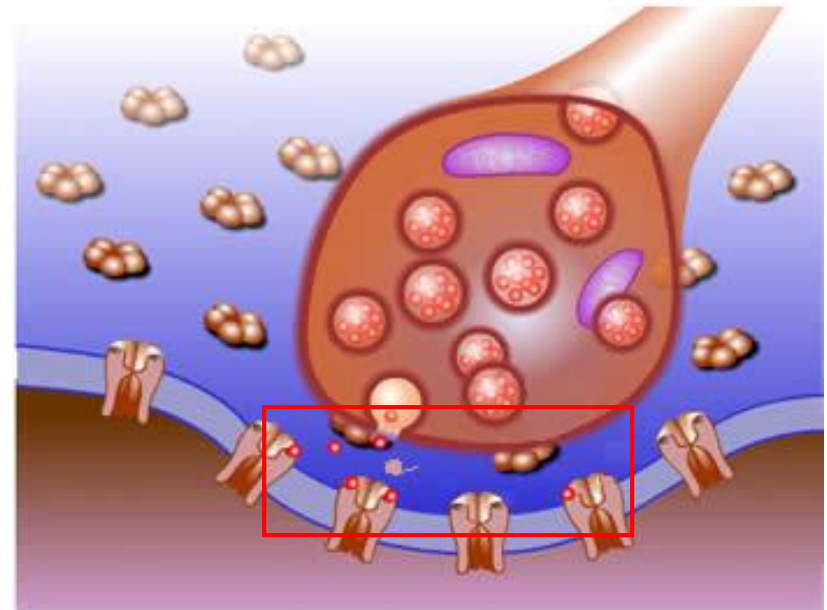
- **Neurotransmitters**

- contained in the vesicles, and are released into the synapse to stimulate their respective receptor sites on the postsynaptic neuron



Structure of the Neuron

- **Synapse**
 - fluid-filled gap between terminal buttons of the presynaptic neuron and the dendrites of the postsynaptic neuron

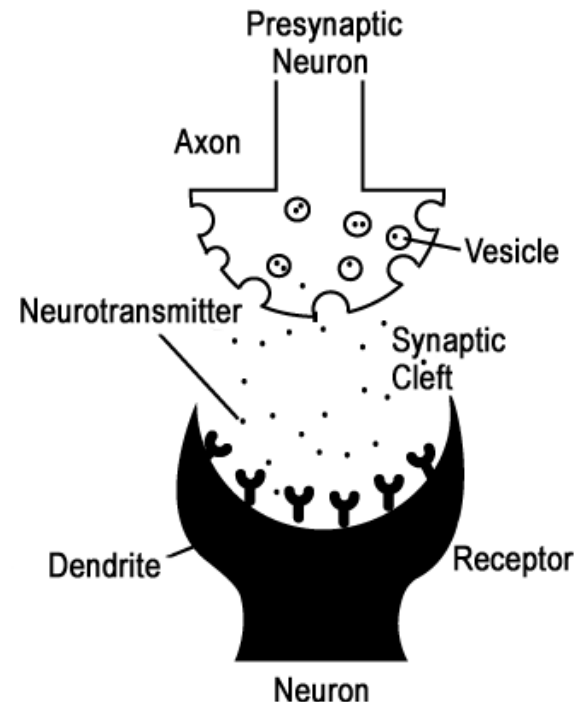


Neurotransmitters

- **Excitatory vs. Inhibitory**

- Excitatory: makes receiving neuron **MORE** likely to meet threshold and have an action potential

- Inhibitory: makes receiving neuron **LESS** likely to meet threshold and have an action potential



Neurotransmitters

- **Serotonin**
 - Sleep and dreaming
 - Mood
 - Appetite
 - Sexual behavior
 - Related to Depression (too little)



Neurotransmitters

- **Acetylcholine (ACh)**
 - Learning
 - Memory
 - Voluntary motor activity
 - Related to Alzheimer's Disease (too little)



Neurotransmitters

- **Dopamine**

- Involuntary motor activity
- Reward pathway
- Motivation
- Cognition
- Related to Schizophrenia (too much) and Parkinson's Disease (too little)



Neurotransmitters

- **Gamma-Aminobutyric Acid (GABA)**
 - The primary inhibitory neurotransmitter in the body
 - Related to anxiety and mood disorders (to little)



Neurotransmitters

- **Endorphins**
 - Body's natural painkiller
 - Pleasure
 - Lowered levels result from opiate use



Neurotransmitters

- **Glutamate**

- The primary excitatory neurotransmitter in the body
- Learning
- Memory



Neurotransmitters

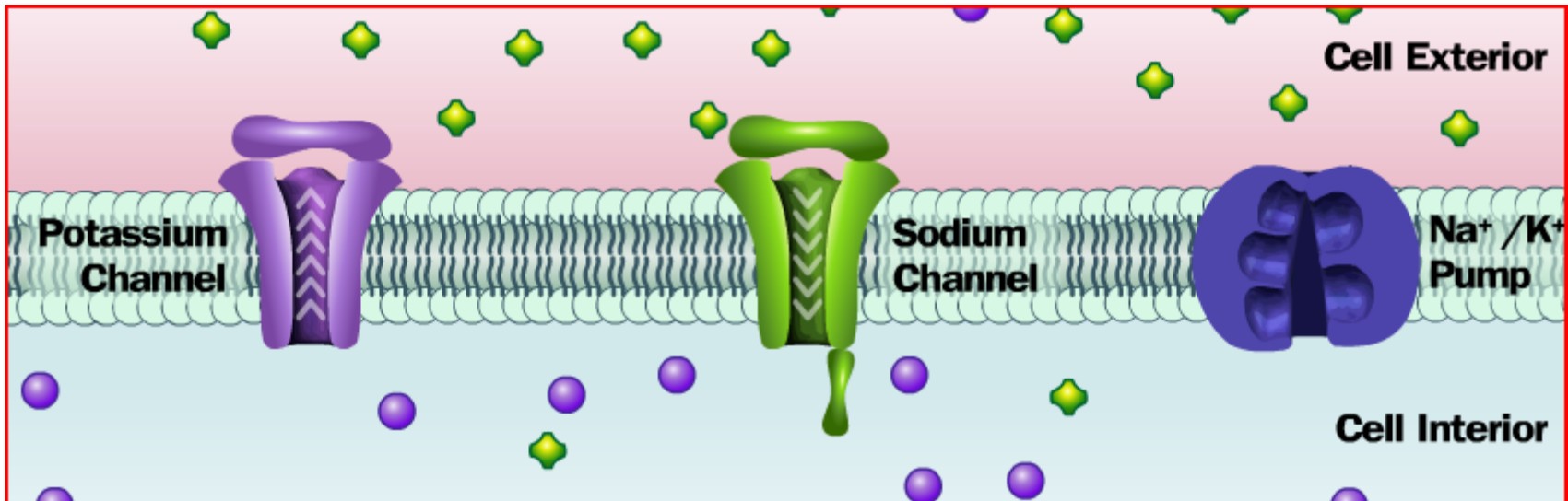
- **Noradrenaline**
 - Aka: Norepinephrine
 - Stress Response
 - Blood pressure
 - Heart rate
 - Also a hormone



Synaptic Transmission

- **Resting Potential**

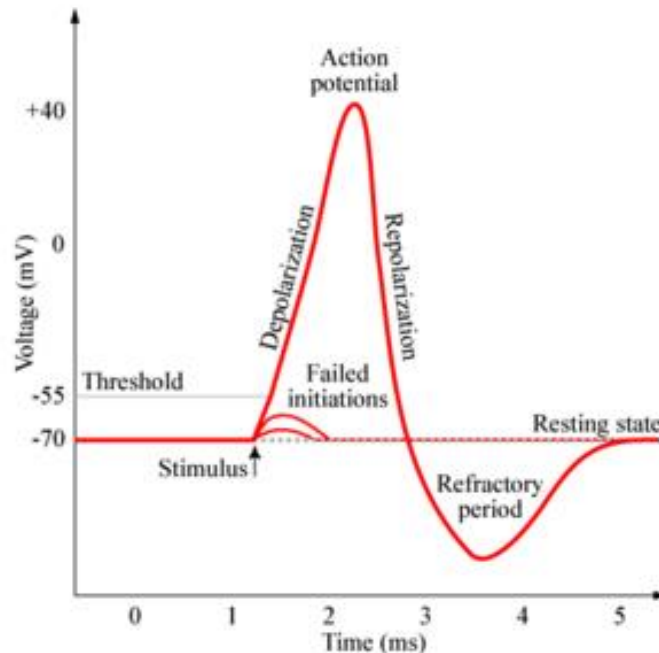
- possible for the neuron to fire; axon has negative charge inside and outside is more positive; K^+ are on the inside of the axon, Na^+ is on the outside



Synaptic Transmission

- **Action Potential**

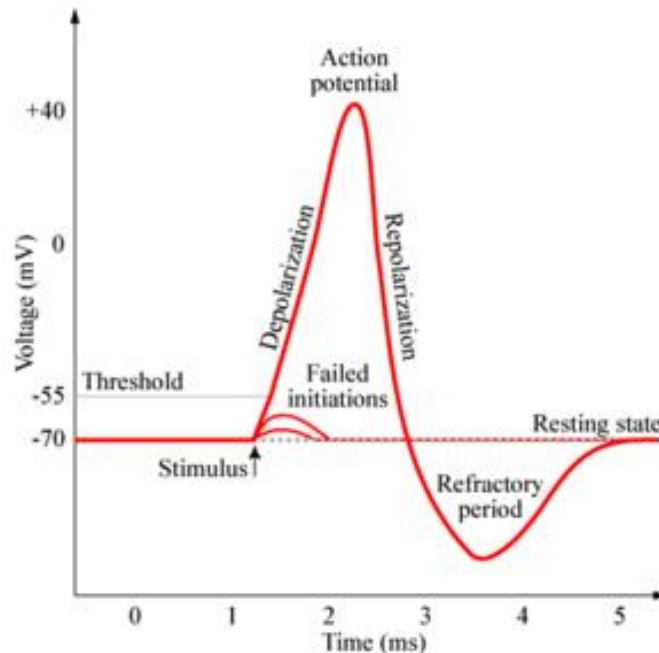
- change in potential across the neuron's membrane; the electrical impulse; depolarization of ions down the axon



Synaptic Transmission

- **Threshold**

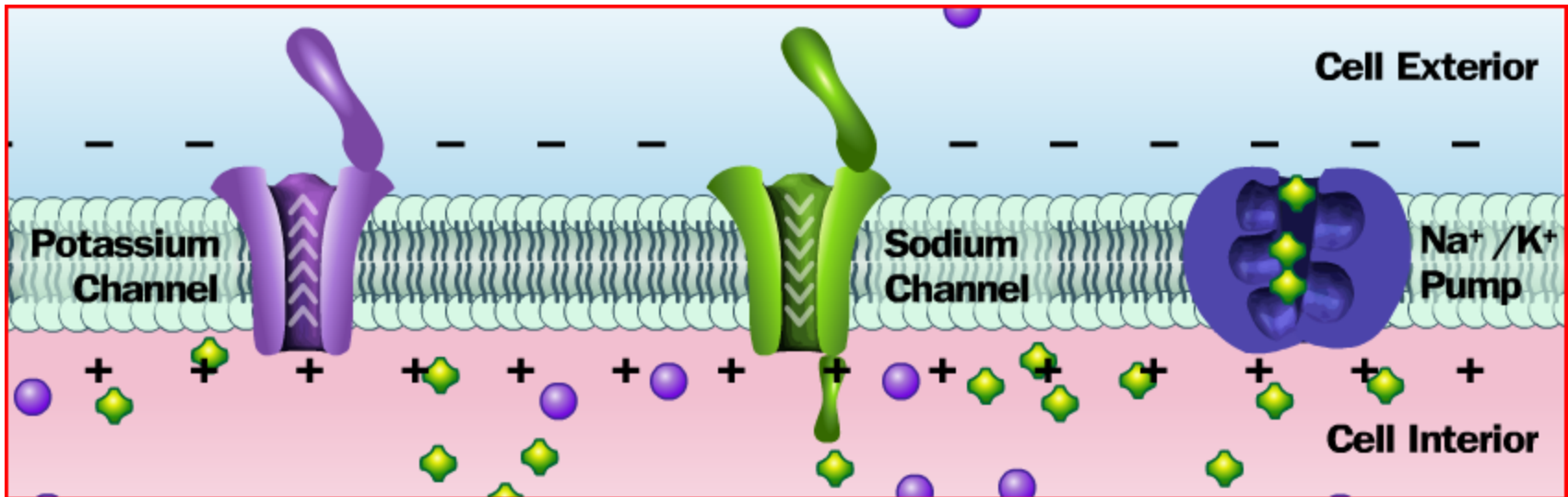
- minimum stimulation required to trigger a neural impulse



Synaptic Transmission

- **Depolarization**

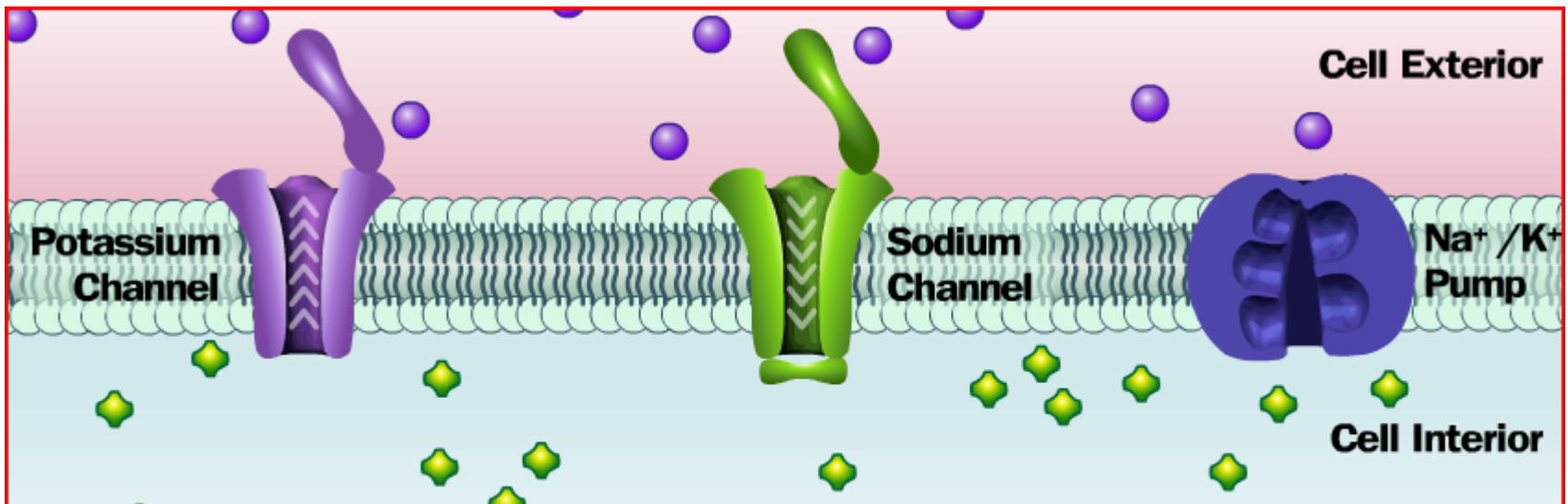
- Na^+ ions rush into the cell, changing the polarity on each side of the membrane, occurs on Nodes of Ranvier



Synaptic Transmission

- **Repolarization**

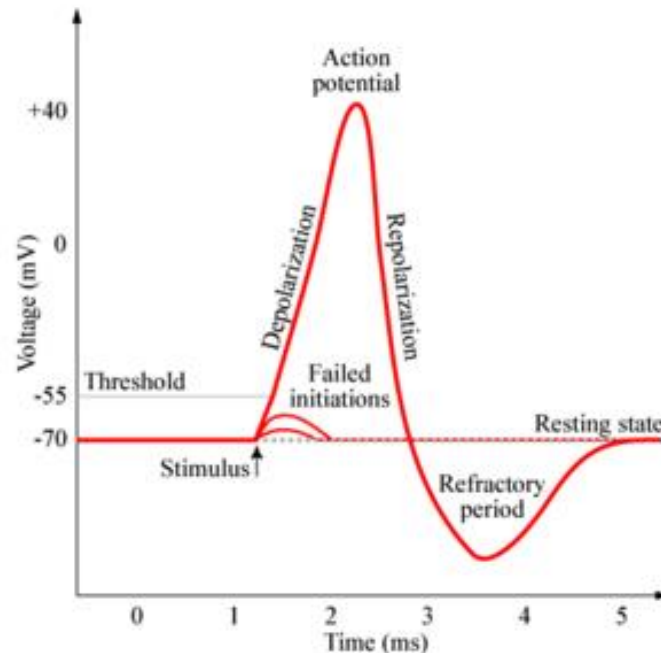
- after Na^+ ions have rushed into the cell, K^+ ions rush out of the cell to restore the balance and the original polarity



Synaptic Transmission

- **Refractory Period**

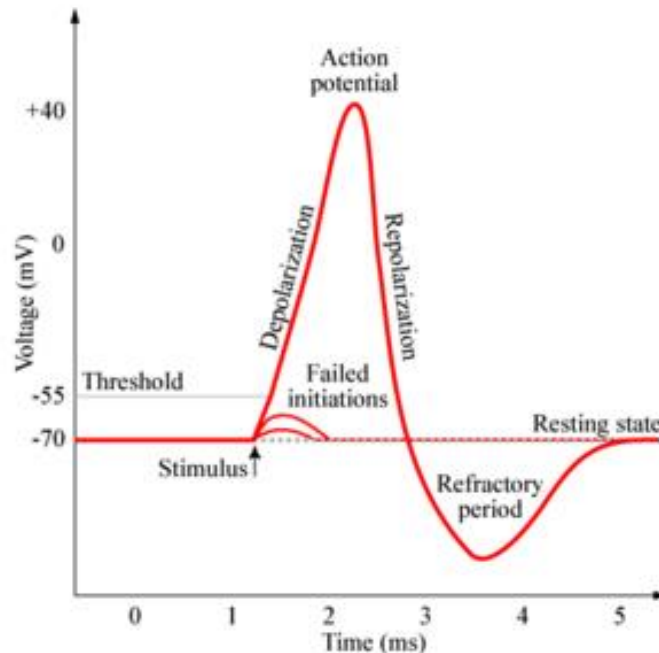
- period in which the cell cannot fire while the Na^+ ions and the K^+ ions return to their original locations via Na^+/K^+ pumps



Synaptic Transmission

- **Hyperpolarization**

- when axon is repolarizing, more K^+ ions leave the cell, causing the cell to become MORE negative than before it started



Synaptic Transmission

- **All-or-None Principle**
 - a neuron will fire with its full intensity or not at all

Synaptic Transmission

- **Electrochemical Reaction**
 - Electrical *within* the neuron (impulse)
 - Chemical *between* the neurons (neurotransmitters)

The Brain

- Examining the Brain
- Structures of the Brain
- Hemispheric Specialization

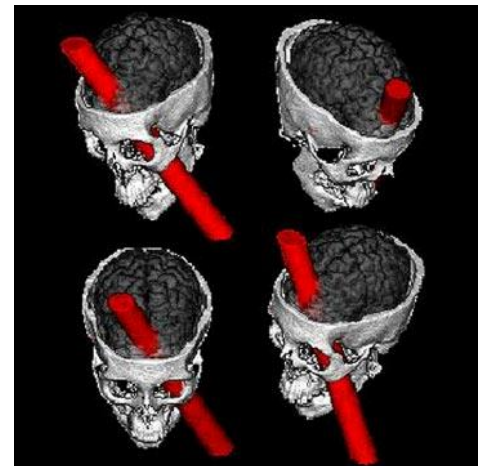
Studying the Brain

- **Accidents & Case Studies**

- When people acquire some sort of brain damage, psychologists learn about the functions of the brain

- Famous Example: Phineas Gage

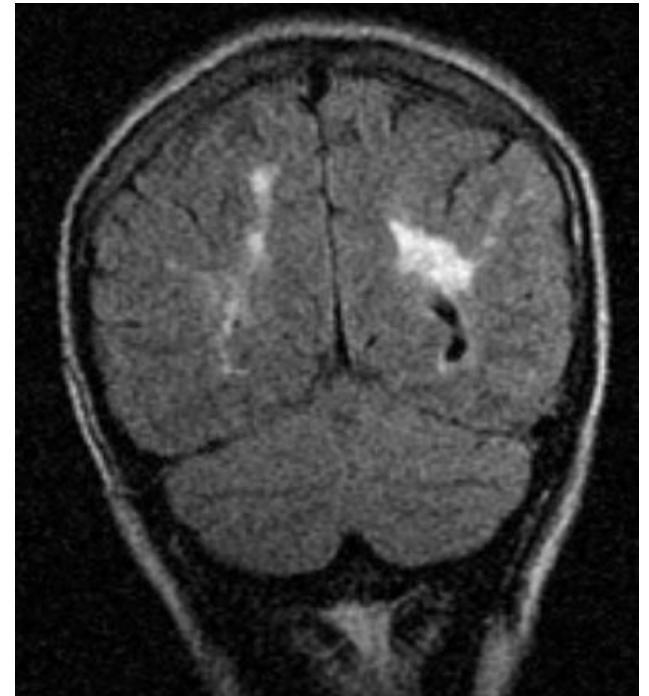
- Tamping rod flew through his frontal lobe
- Frontal lobe research was furthered because of this new information



Studying the Brain

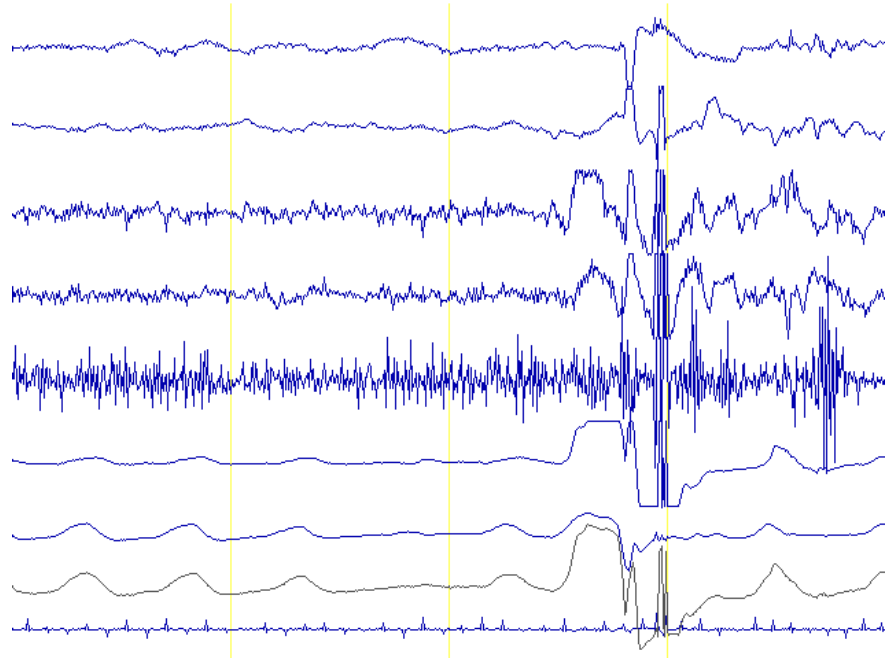
- **Lesions**

- Destruction of brain tissue lets us know the function of that part of the brain
- Accidental or purposeful



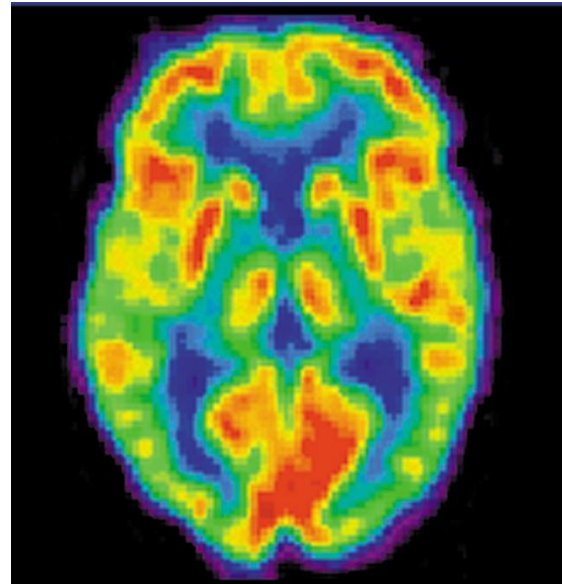
Studying the Brain

- **Electroencephalography (EEG)**
 - creates image of brain wave activity by eliciting evoked potentials
 - Function only



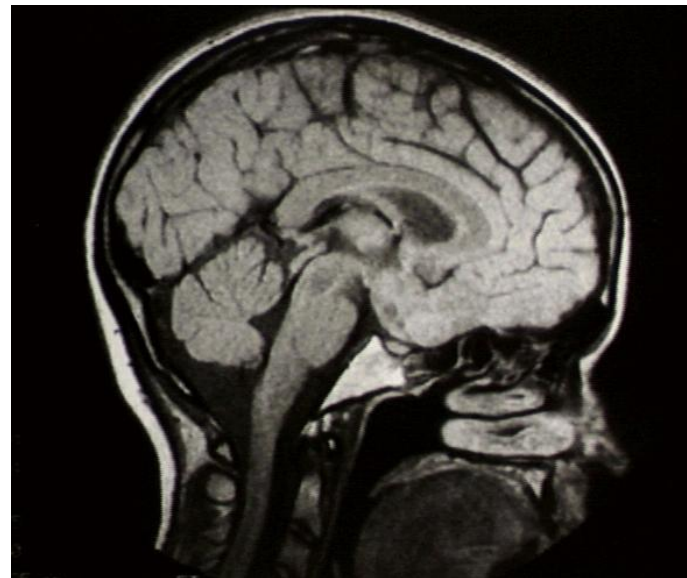
Studying the Brain

- **Positron Emission Tomography (PET)**
 - creates image which looks at glucose usage in the brain after injection of radioactive form of glucose
 - Function only



Studying the Brain

- **Computerized Axial Tomography (CAT/ CT)**
 - provides image of brain structure including soft tissue and bones; specialized type of x-ray
 - Structure only



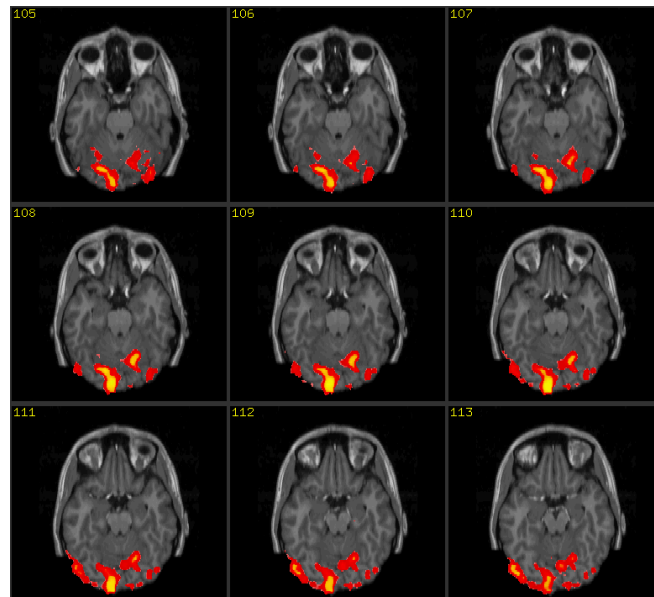
Examining the Brain

- **Magnetic Resonance Imaging (MRI)**
 - uses magnetic fields in order to examine structure of brain tissues
 - Structure only



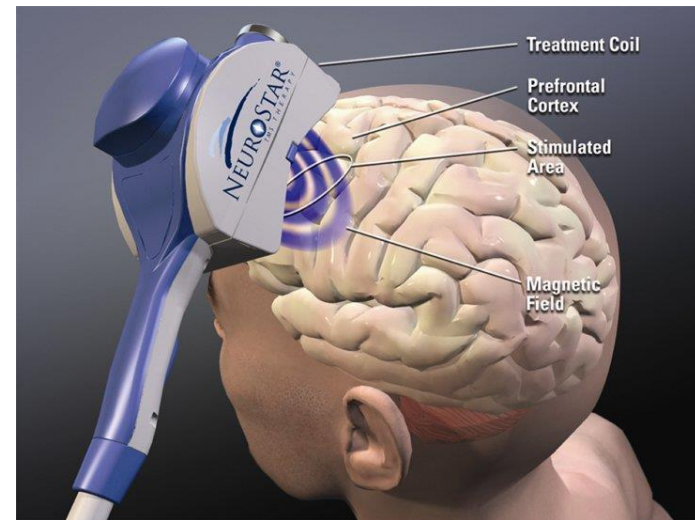
Examining the Brain

- **Functional Magnetic Resonance Imaging (fMRI)**
 - brain imaging technique which provides information about both structure and function



Examining the Brain

- **Transcranial Magnetic Stimulation (TMS)**
 - Stimulation of areas of the brain using magnetic field to influence activity of neurons (to depolarize or hyperpolarize)



Structures of the Brain

- **Hindbrain**

- Brainstem

- Medulla

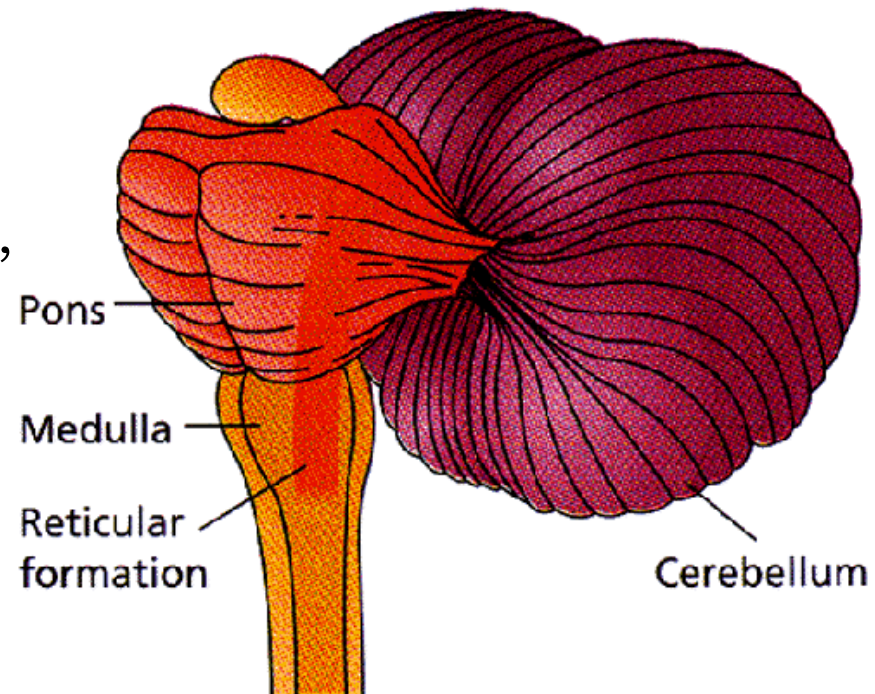
- in charge of respiration, blood pressure, heart rate

- Pons

- helps relay sensory info., has a role in controlling arousal and dreaming

- Reticular Formation

- controls awareness and arousal

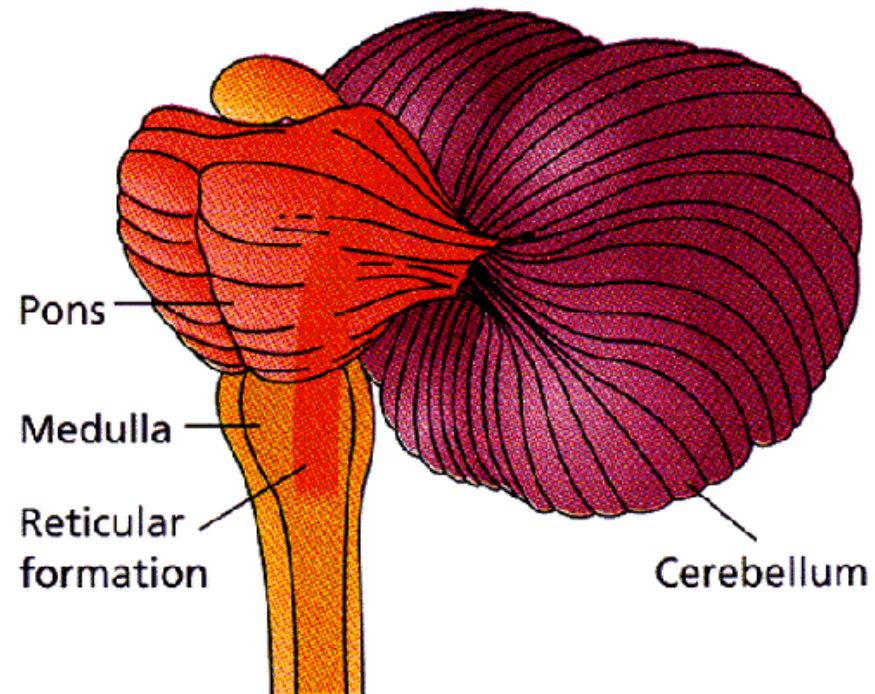


Structures of the Brain

- **Hindbrain**

- Cerebellum

- coordinates motor control and maintains balance and posture

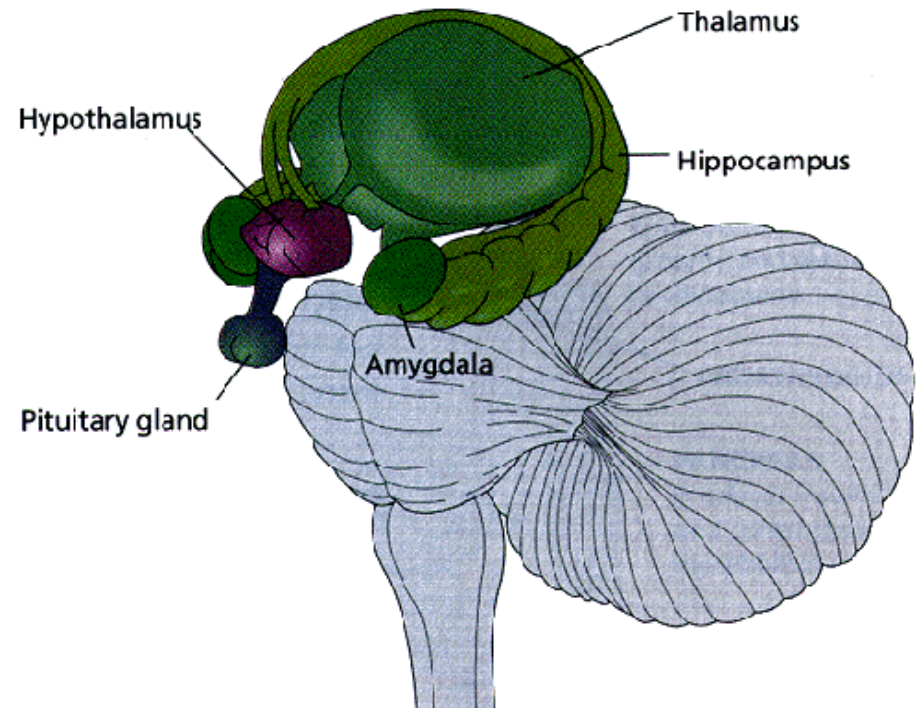


Structures of the Brain

- **Forebrain**

- Thalamus

- sensory switchboard of the brain for all senses except olfaction



Structures of the Brain

- **Forebrain**

- Limbic System

- Hippocampus

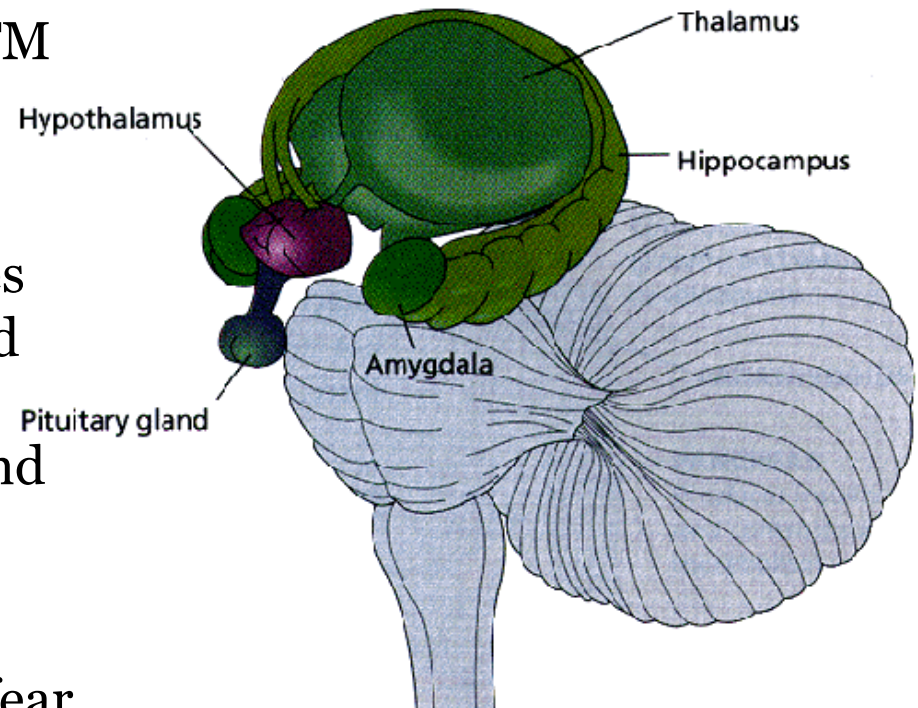
- converts info from STM to LTM

- Hypothalamus

- homeostasis, regulates hunger and thirst, and sexual behavior, controls pituitary gland

- Amygdala

- role in emotions, especially anger and fear



Structures of the Brain

- **Forebrain**

- Cerebral Cortex - Association Areas

- Frontal Lobe

- personality, problem-solving, initiation, judgment, impulse & emotion control, speech (L)

- Temporal Lobe

- auditory perception, memory, facial recognition (R), language comprehension (L)

- Parietal Lobe

- spatial processing (R), math (L), sensory organization

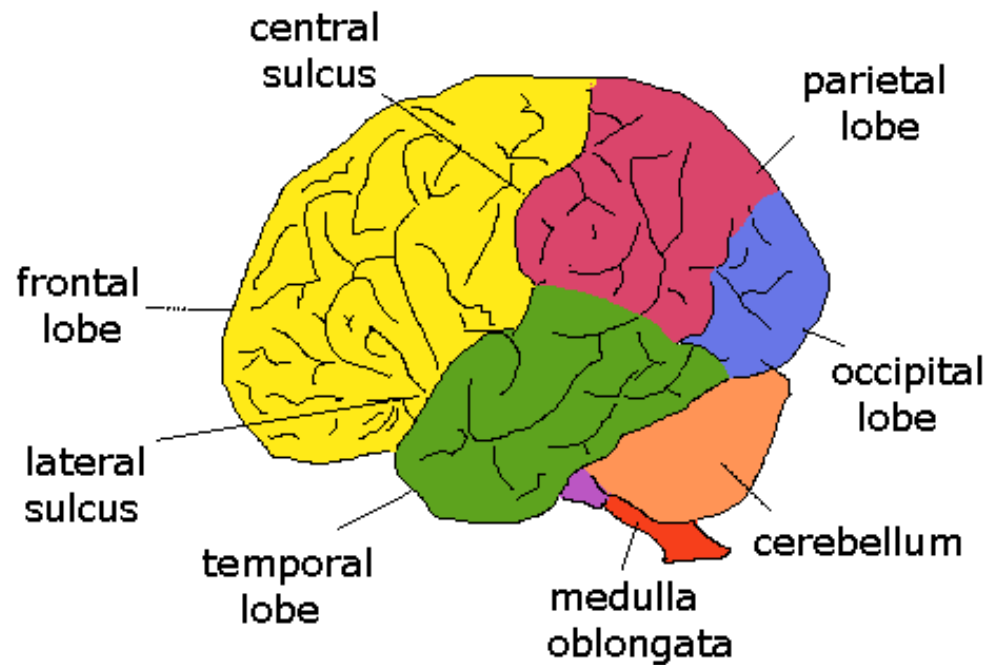
- Occipital Lobe

- visual perception

Structures of the Brain

- **Forebrain**

- Cerebral Cortex - Association Areas



exterior of the cerebrum from the left side

Structures of the Brain

- **Forebrain**

- Cerebral Cortex - Sensorimotor Areas

- Motor Cortex

- controls voluntary movement (frontal)

- Somatosensory Cortex

- skin sense, tactile sensation (parietal)

- Visual Cortex

- visual processing (occipital)

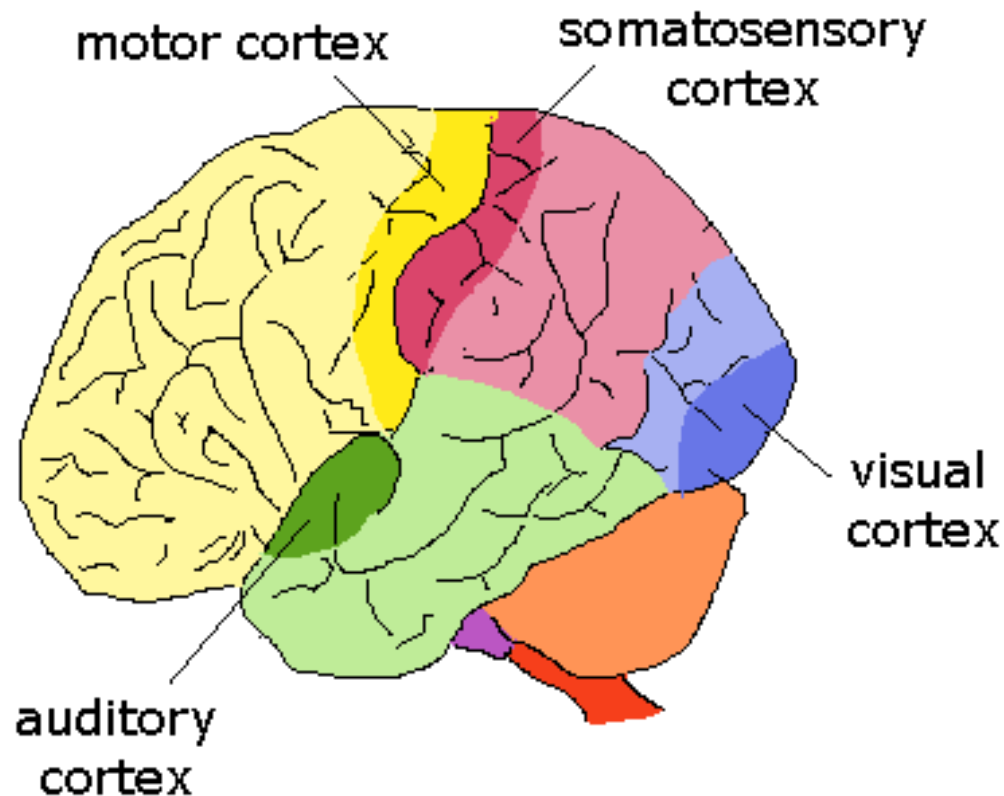
- Auditory Cortex

- Auditory processing (temporal)

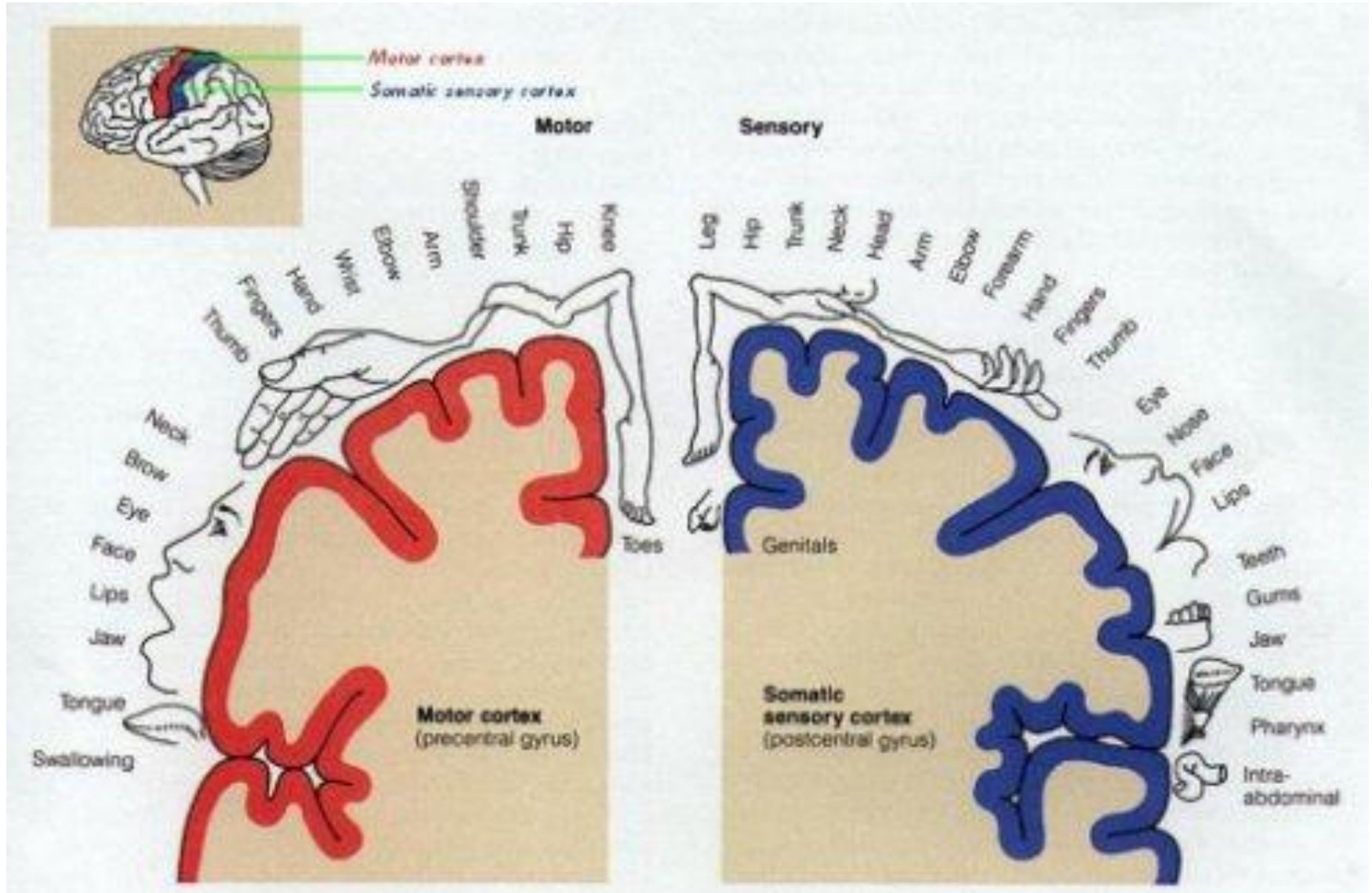
Structures of the Brain

- **Forebrain**

- Cerebral Cortex - Sensorimotor Areas



Structures of the Brain



Structures of the Brain

- **Forebrain**

- Cerebral Cortex – Language Areas

- Broca's Area

- part of the frontal lobe on left side; controls the ability to form words

- Wernicke's Area

- part of the temporal lobe on left side; controls the ability to comprehend language

- Angular Gyrus

- related to reading, turns visual symbols to auditory code

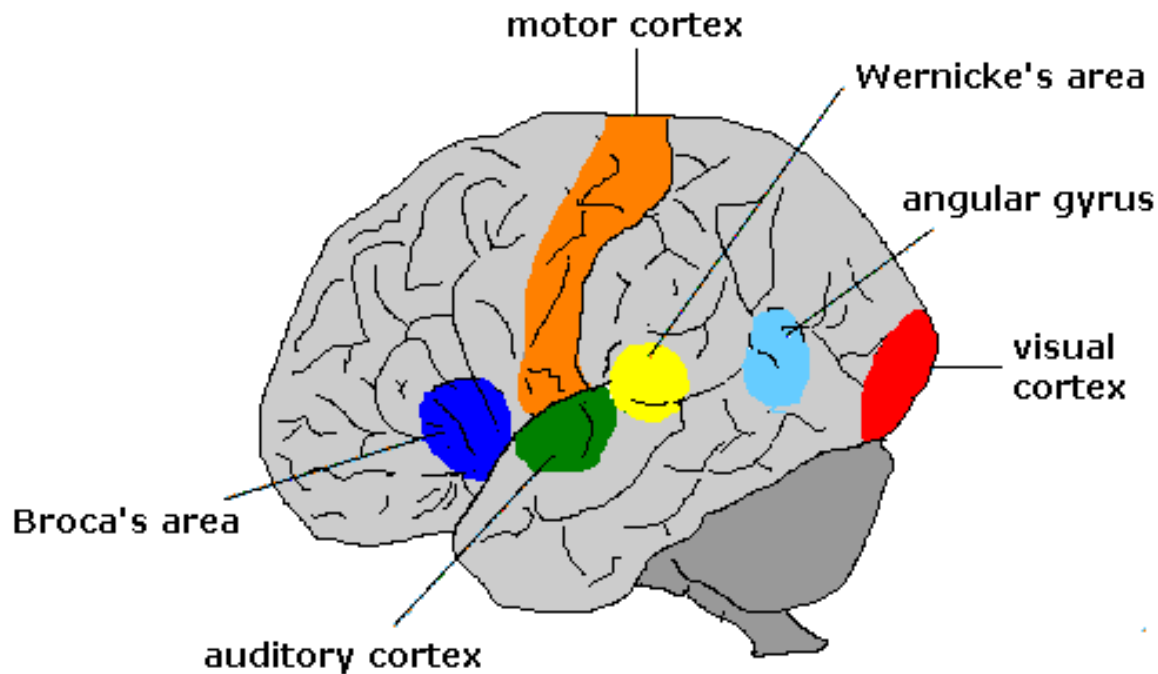
- Aphasia

- damage to area responsible for language

Structures of the Brain

- **Forebrain**

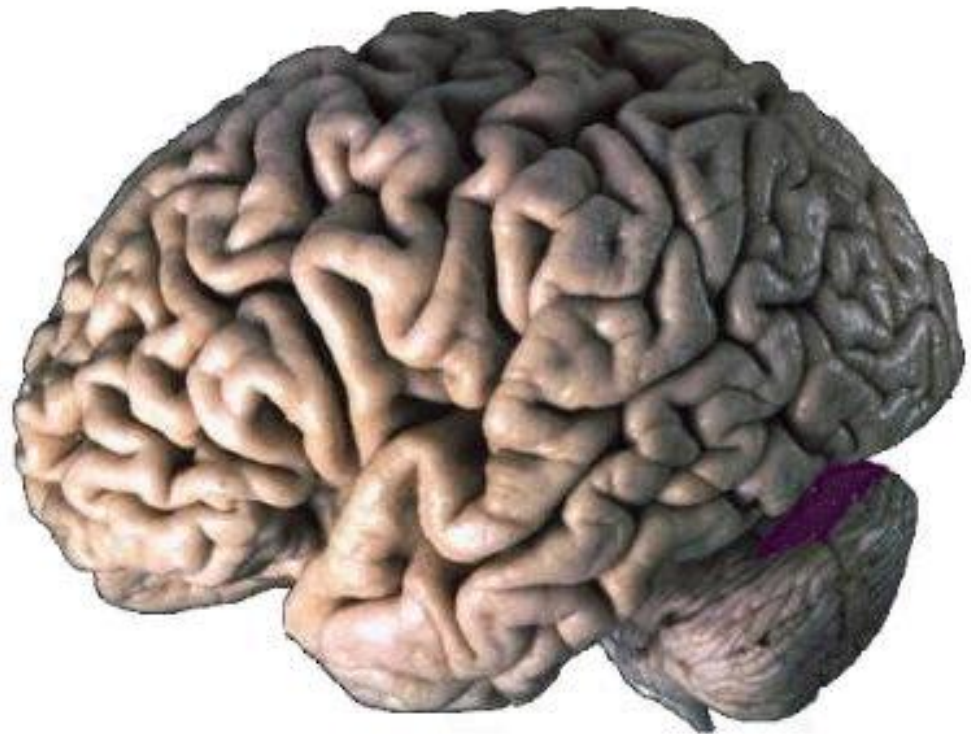
- Cerebral Cortex – Language Areas



Speech Areas

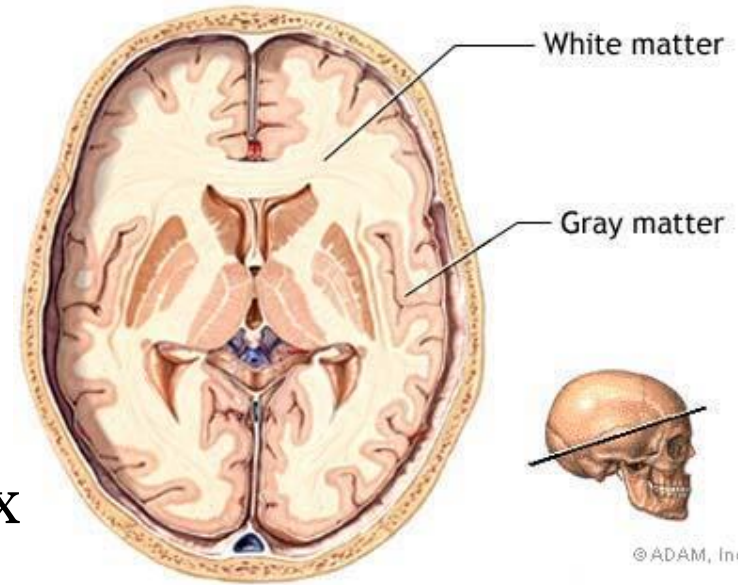
Structures of the Brain

- **Gyri vs. Sulci**
 - Gyrus
 - peak in cerebral cortex
 - Sulcus
 - valley of cerebral cortex
 - Wrinkles provide more surface area for cerebral cortex



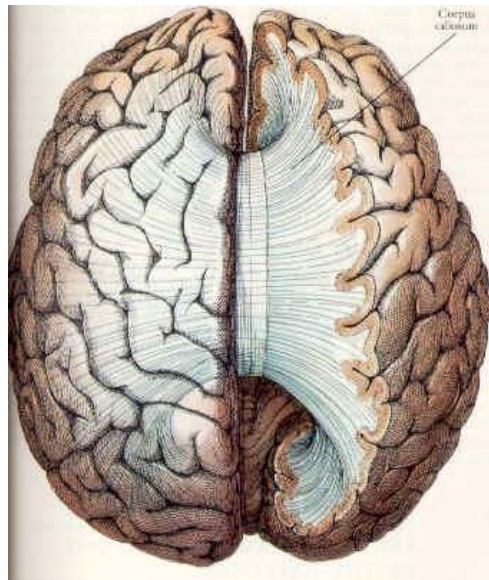
Structures of the Brain

- **White vs. Grey Matter**
 - White Matter
 - neural tissue containing mostly myelinated axons
 - relays info. to cerebral cortex
 - Grey Matter
 - closely packed neuron cell bodies on the surface of the brain



The Brain

- **Corpus Callosum**
 - White matter structure which connects left and right hemispheres
 - Allows communication between hemispheres



Hemispheric Specialization

- Longitudinal Fissure
 - separates left and right hemispheres
- Contralaterality
 - one side of brain controls the other side of the brain

Hemispheric Specialization

- **Left vs. Right Brain**

- Left

- analytical, speech (frontal), language comprehension (temporal), sequential, logical, interprets what is in right visual field (occipital), controls right side of body

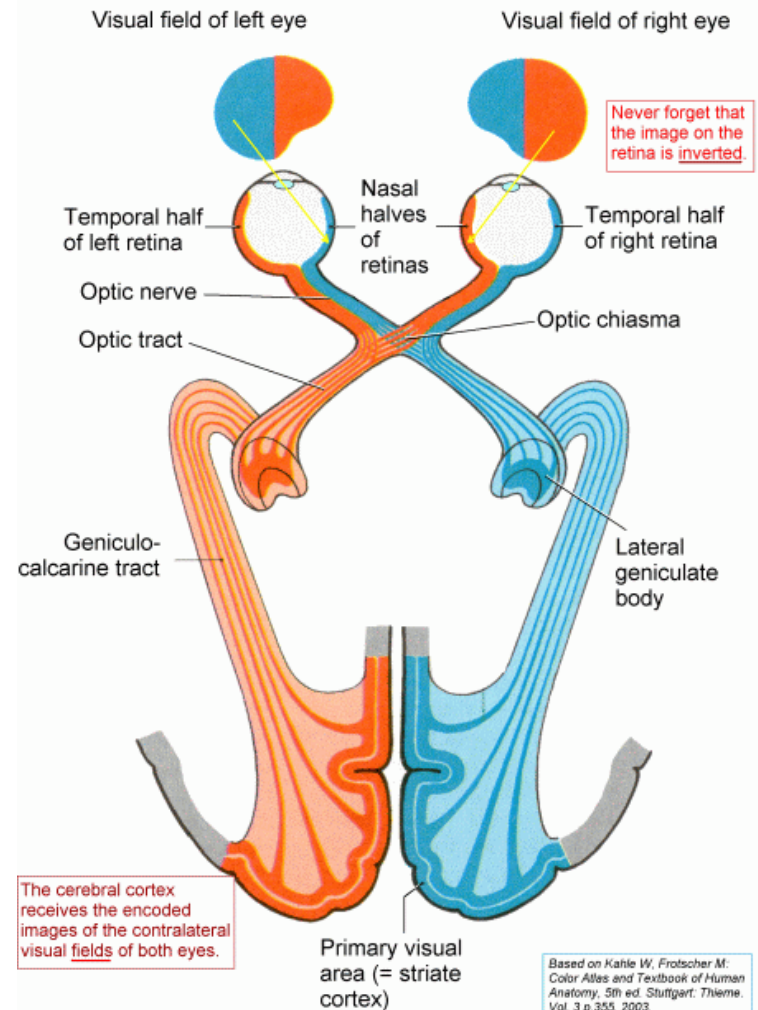
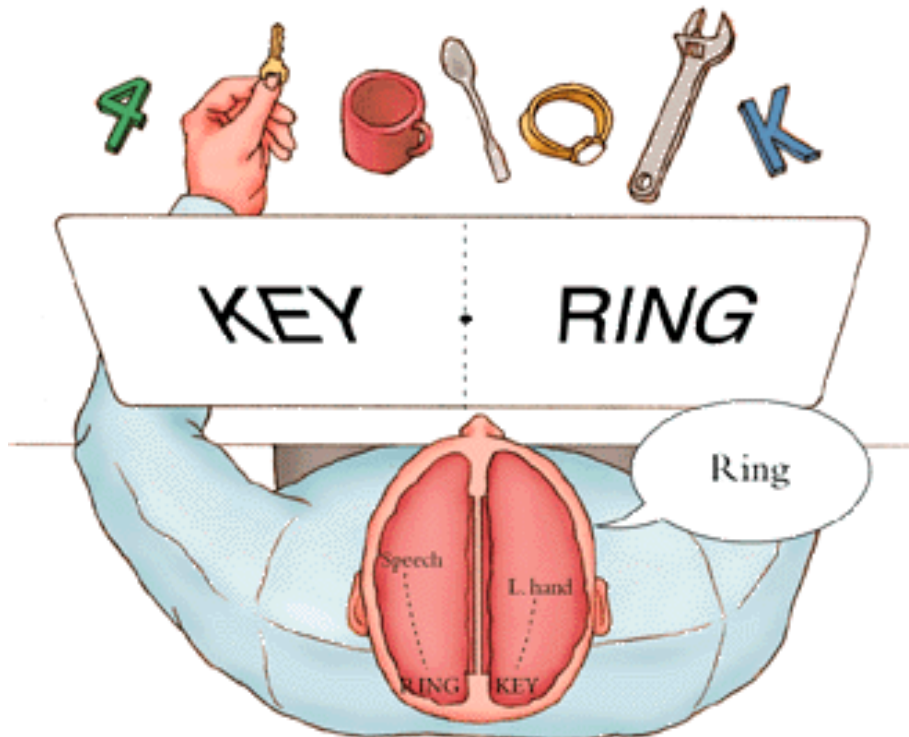
- Right

- intuitive, holistic, language emphasis, facial recognition (temporal), spatial interpretation (Parietal), creativity, art, music appreciation, interprets what is in left visual field (occipital), controls left side of body

Hemispheric Specialization

- **Split Brain Research**

- Michael Gazzaniga & Roger Sperry's Research



The Brain

- **Brain Plasticity**

- Ability for brain to make up for damage by having neurons of brain take on functions of damaged areas
- Age-dependent (doesn't occur as well in older brains)

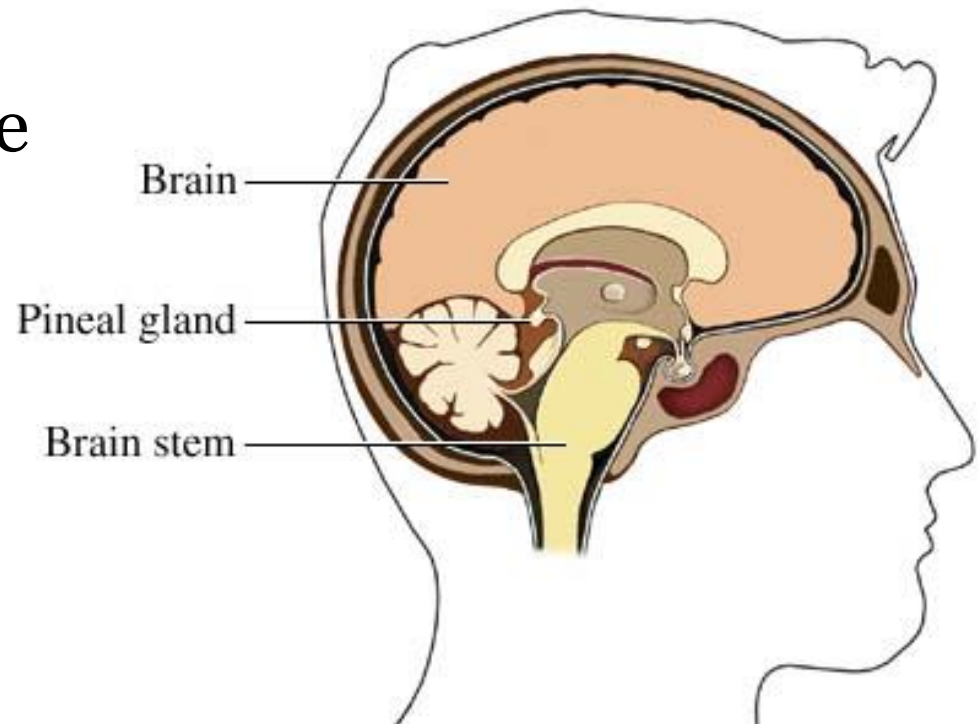
Endocrine System

- Glands
- Hormones

Glands

- **Pineal Gland**

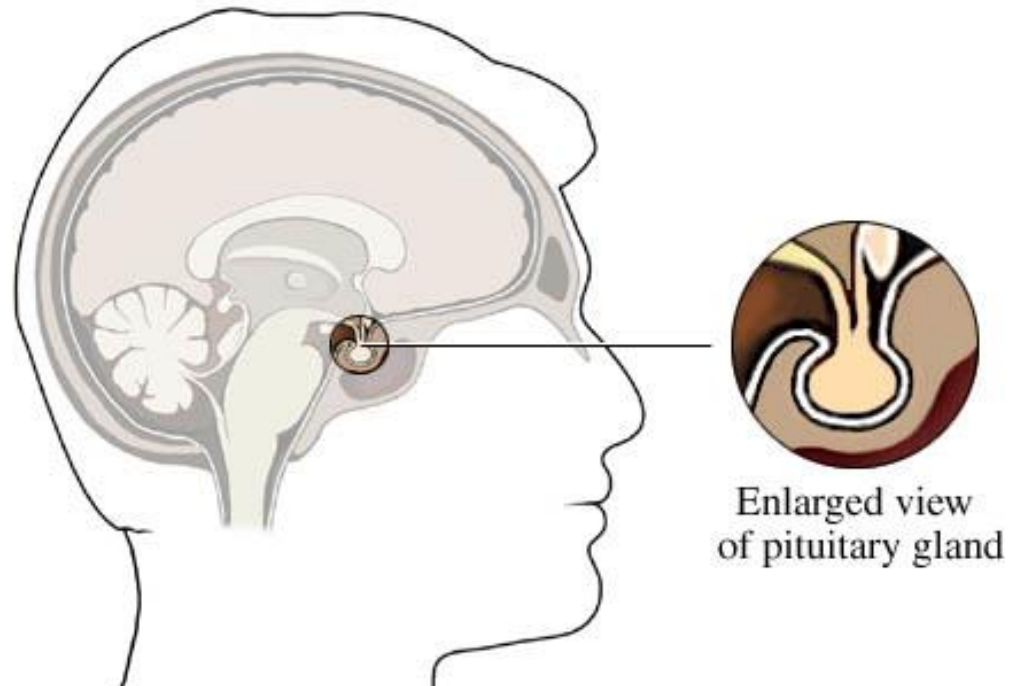
- Produces melatonin (according to lightness or darkness of environment)
- Helps modulate sleep/wake cycle



Glands

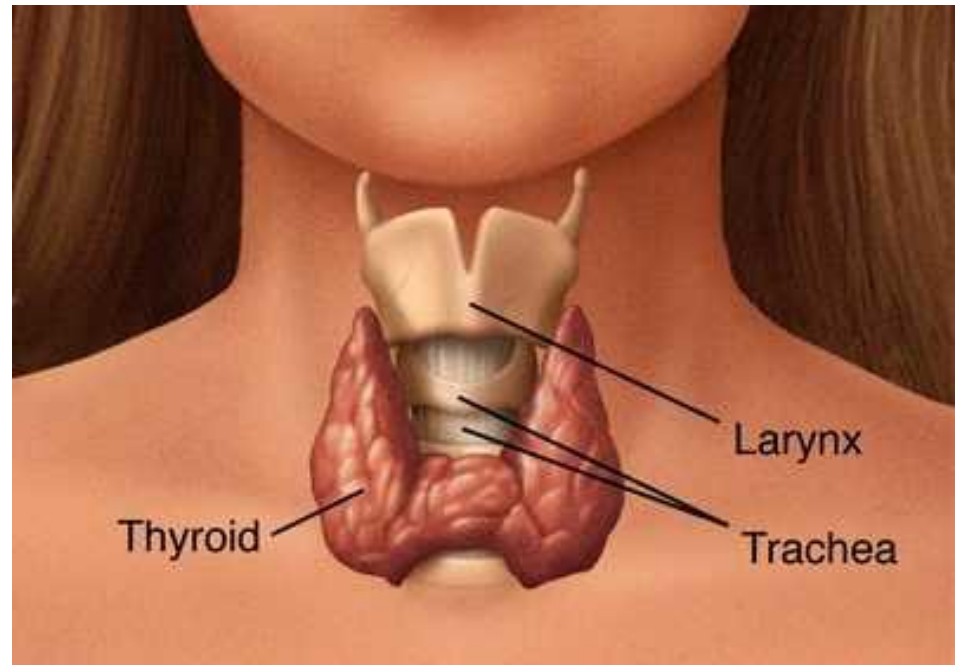
- **Pituitary Gland**

- Produces Human Growth Hormone (HGH)
- Regulates homeostasis
- Regulates sexual development & functioning
- Contributes to physical growth
- Regulates water in the body



Glands

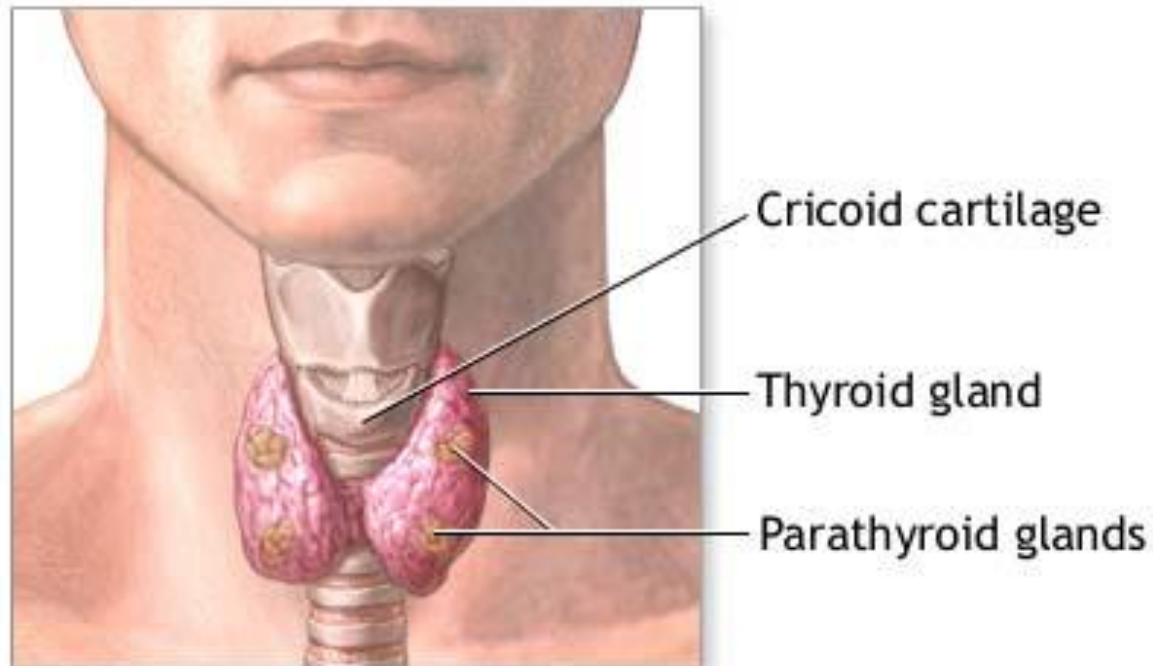
- **Thyroid Gland**
 - Produces Thyroxine
 - Controls metabolism



Glands

- **Parathyroid Glands**

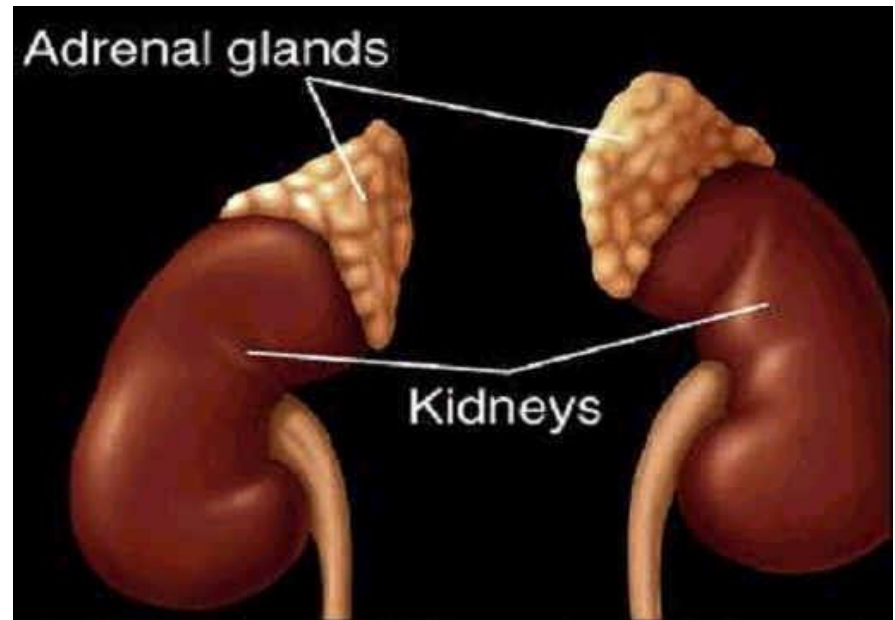
- Regulate calcium levels in the body
(remember, calcium is necessary for neurons to fire)



Glands

- **Adrenal Glands**

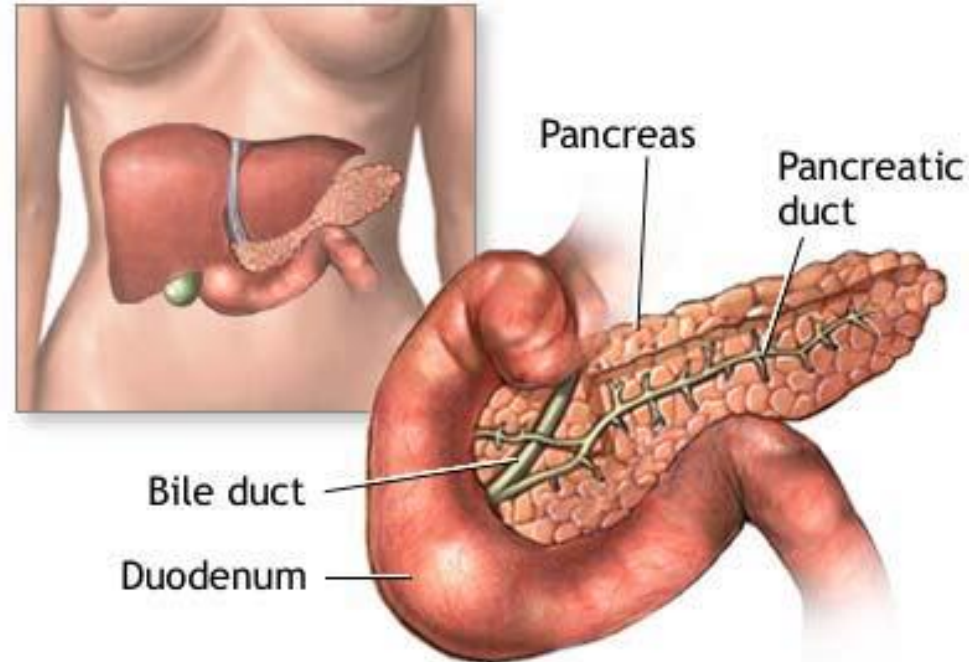
- Produce noradrenaline, adrenaline and cortisol
- Regulate responses to stress and “fight or flight”



Glands

- **Pancreas**

- Produces insulin and glucagon
- Regulates blood glucose level
- Aids in digestion



Glands

- **Ovaries**

- Produce estrogen and progesterone
- Produce ova (eggs) for reproduction
- In charge of the production of secondary sex characteristics (i.e. breasts, hips)
- The female counterpart of the testes (male gonads)

Glands

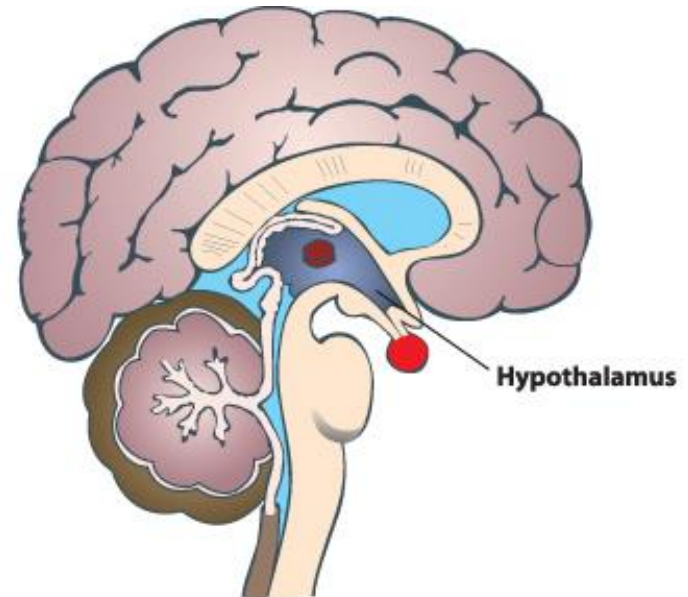
- **Testes**

- Produce testosterone
- Produce sperm for reproduction
- In charge of the production of secondary sex characteristics (i.e. facial hair, deep voice)
- The male counterpart of the ovaries (female gonads)

Glands

- **Hypothalamus**

- Controls pituitary gland
- Secretes hormones related to hunger
- Link between the endocrine & nervous systems



Hormones

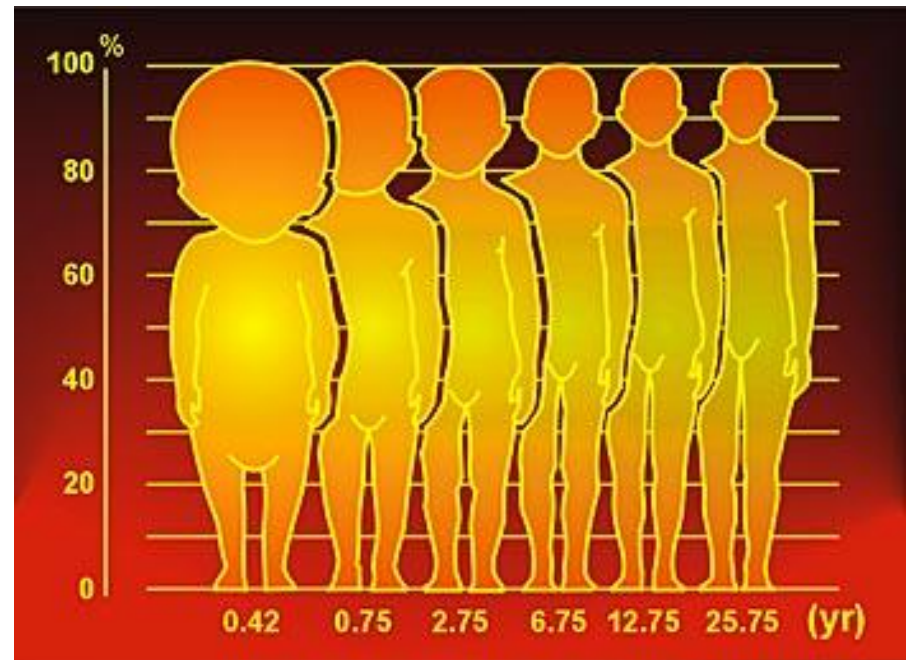
- **Melatonin**

- Produced by the pineal gland
- Helps control sleep/wake cycle
- Production is inhibited by light and facilitated by dark



Hormones

- **Human Growth Hormone (HGH)**
 - Produced by the pituitary gland
 - Stimulates growth and cell reproduction



Hormones

- **Adrenaline**

- Aka epinephrine
- Produced by the adrenal glands
- Plays role in stress reactions & “fight or flight”
- Pumps body up (Sympathetic NS activity)



Hormones

- **Noradrenaline**

- Aka norepinephrine
- Produced by the adrenal glands
- Plays role in stress reactions & “fight or flight”
- Pumps body up (Sympathetic NS activity)
- Also a neurotransmitter



Hormones

- **Cortisol**

- Produced by the adrenals
- Released in stressful situations
- Involved in “fight or flight” response



Hormones

- **Insulin**

- Produced in the pancreas
- Regulates glucose metabolism and blood glucose levels
- Released when blood glucose is elevated, decreases glucose level



Hormones

- **Glucagon**

- Produced in the pancreas
- Released when blood glucose is low, increases glucose level



Hormones

- **Estrogen**
 - Produced by ovaries
 - Primary female sex hormone
 - Aids in sexual development and functioning



Hormones

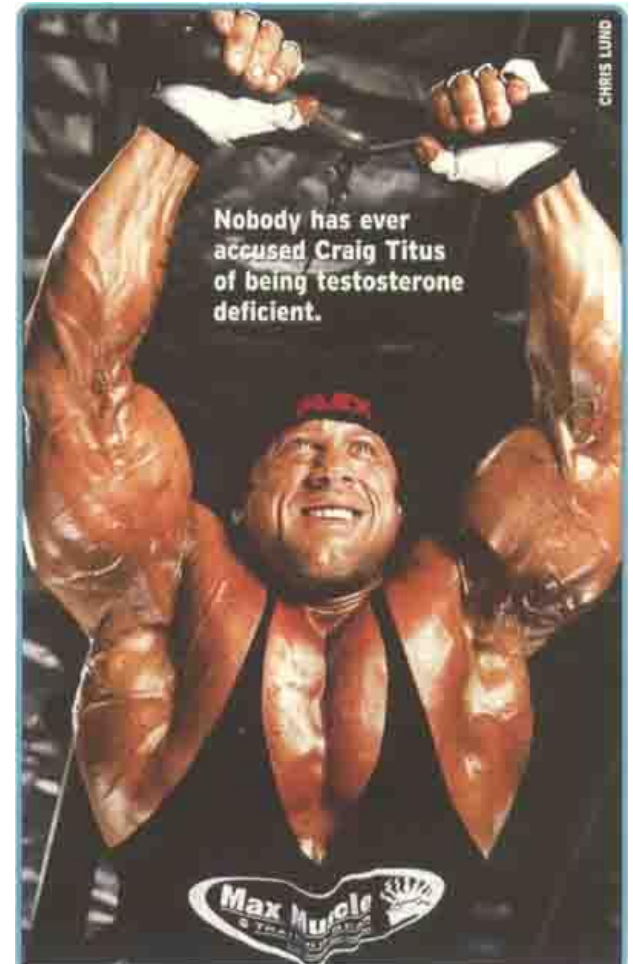
- **Progesterone**

- Produced by ovaries
- Involved with menstrual cycle and pregnancy



Hormones

- **Testosterone**
 - Produced by the testes
 - Primary male sex hormone
 - Aids in sexual development and functioning
 - Linked to aggression



Hormones

- **Thyroxine**
 - Produced in thyroid
 - Controls rate of bodily metabolic processes

