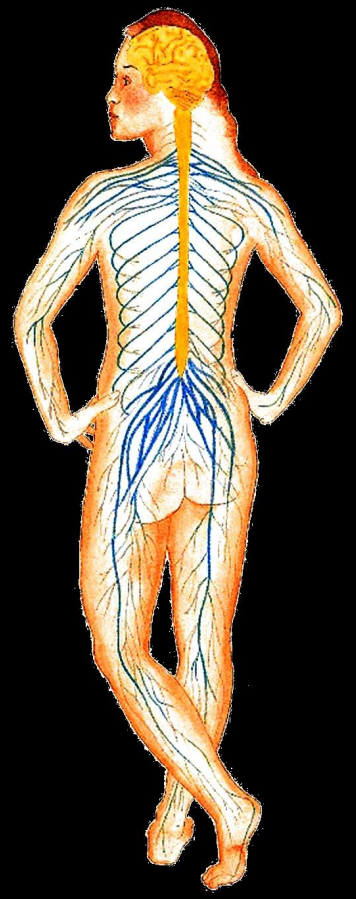
The Nervous System

- Major division - Central vs. Peripheral
- Central or CNS- brain and spinal cord
- Peripheral- nerves connecting CNS to muscles and organs

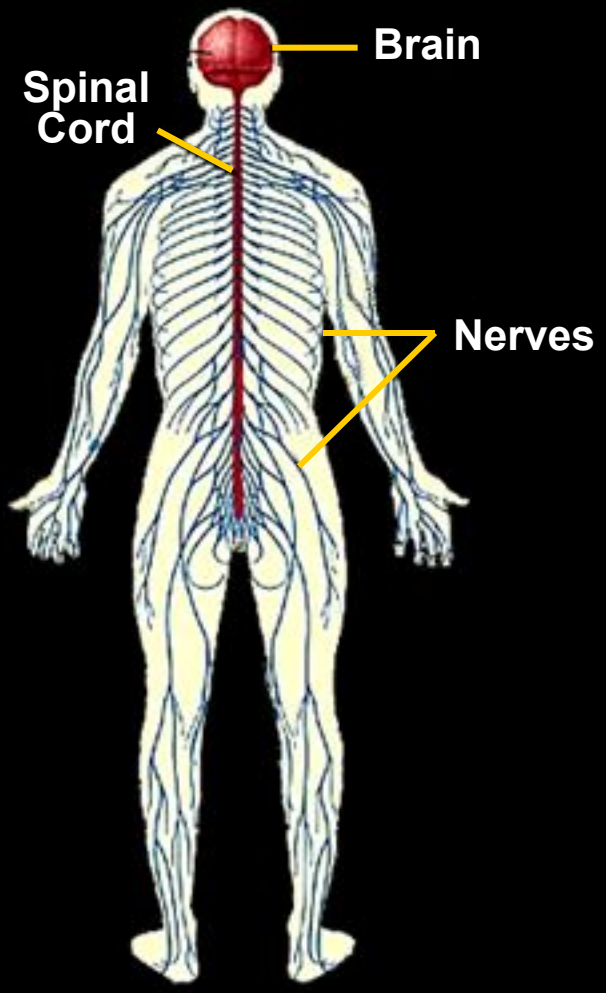


Central Nervous System

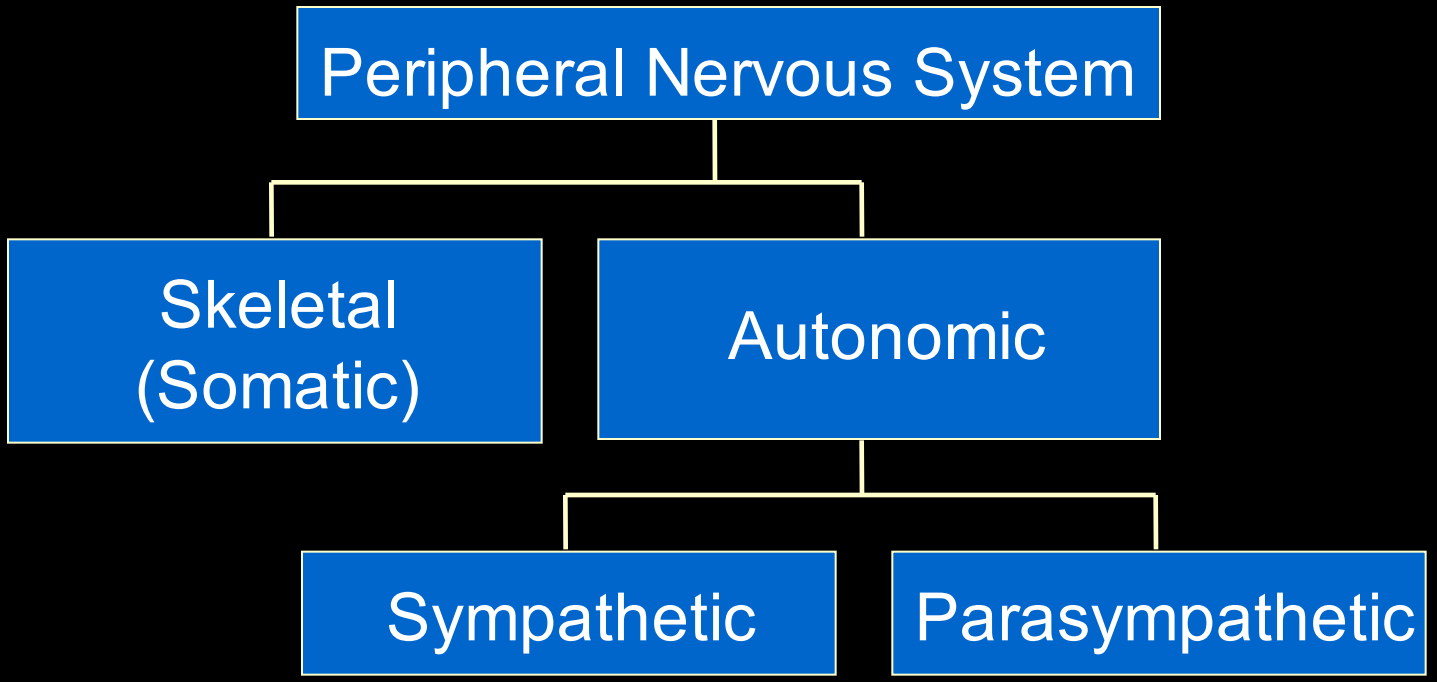
Peripheral Nervous System

Peripheral Nervous System

- 3 kinds of neurons connect CNS to the body
  - sensory
  - motor
  - interneurons
- Motor - CNS to muscles and organs
- Sensory - sensory receptors to CNS
- Interneurons: Connections Within CNS

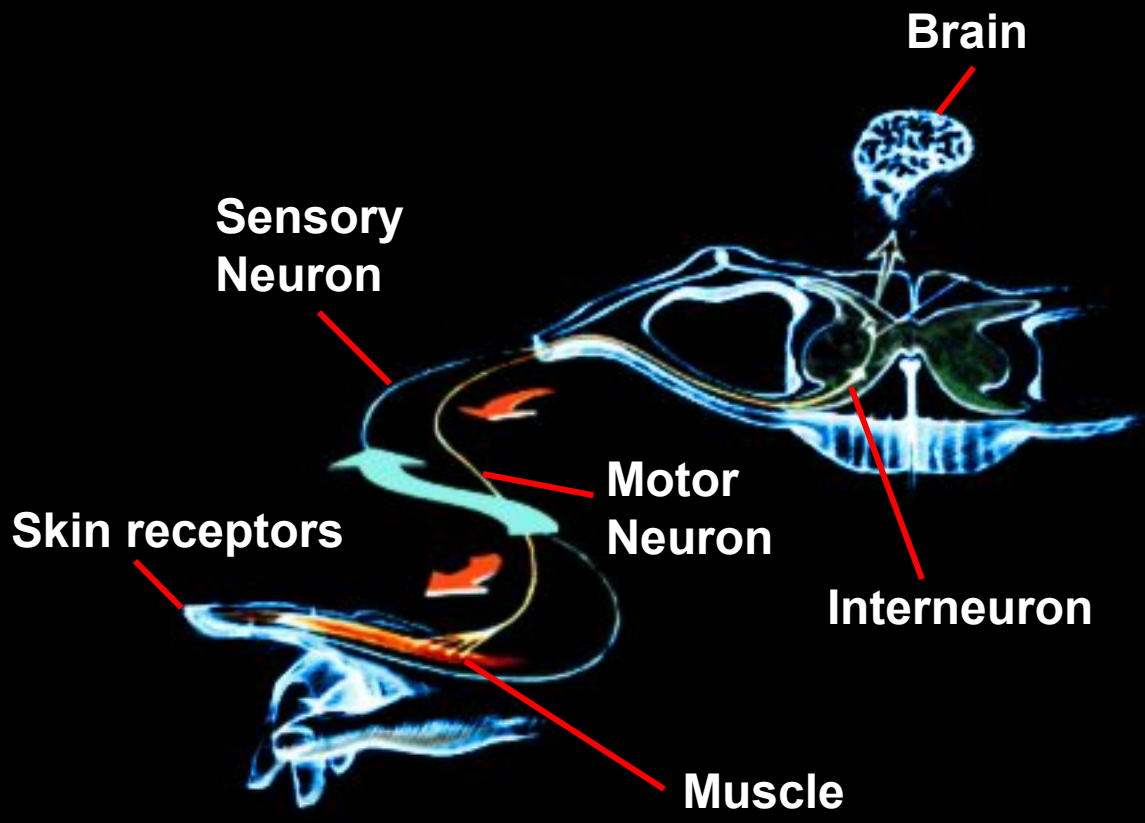


Peripheral Nervous System



Somatic System

- Nerves to/from spinal cord
  - control muscle movements
  - somatosensory inputs
- Both Voluntary and reflex movements
- Skeletal Reflexes
  - simplest is spinal reflex arc

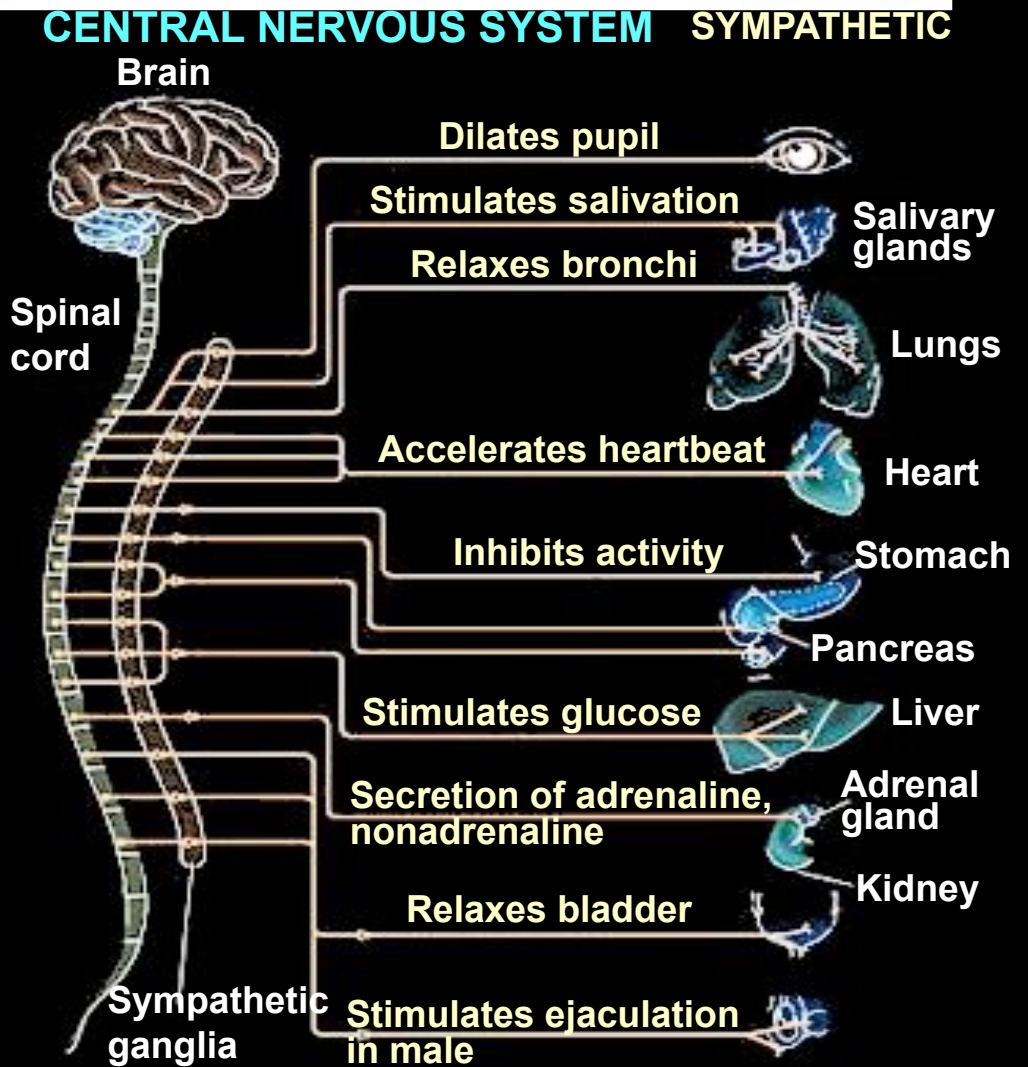


Autonomic System

- Two divisions:
  - sympathetic
  - Parasympatheitic
- Control involuntary functions
  - heartbeat
  - blood pressure
  - respiration
  - perspiration
  - digestion
- Can be influenced by thought and emotion

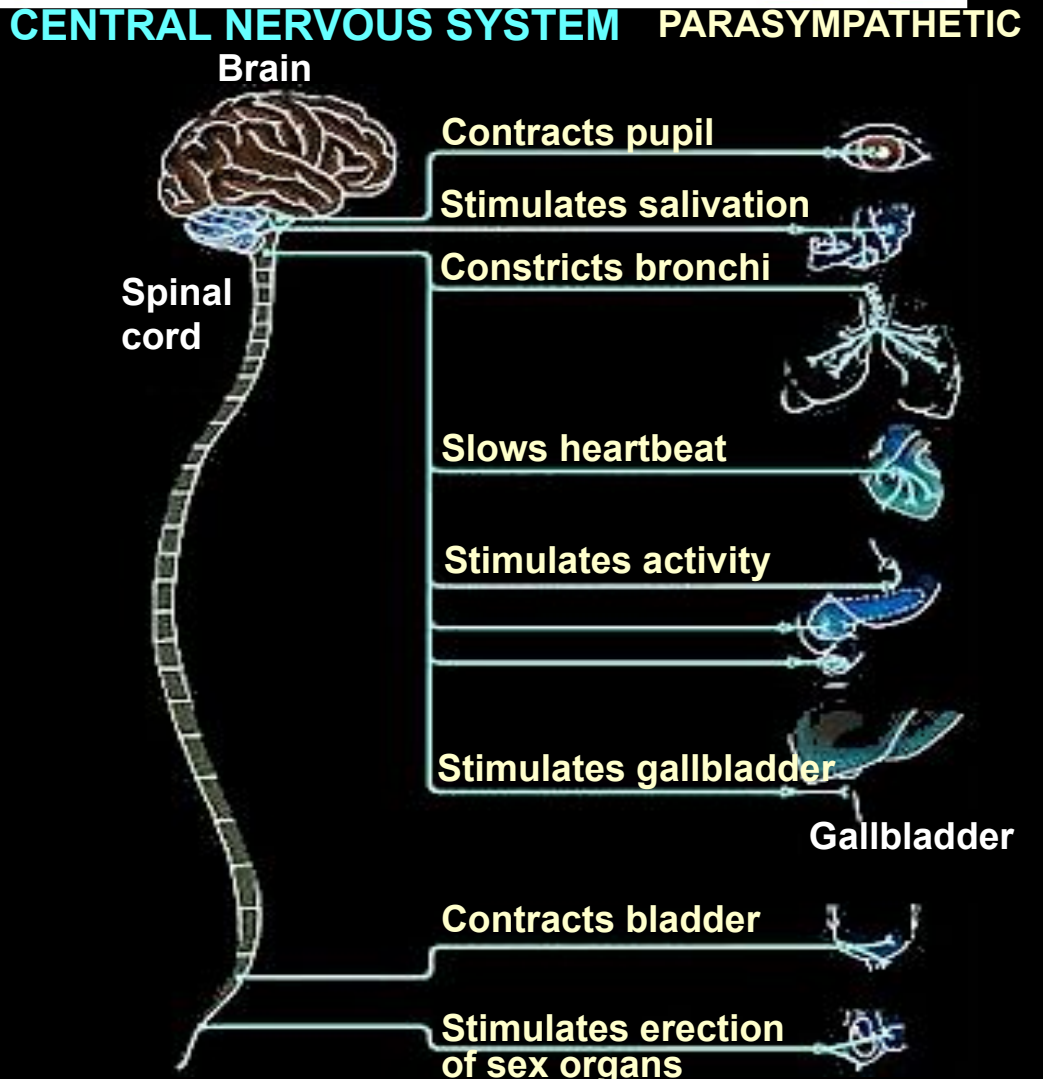
Sympathetic

- “ Fight or flight” response
- Release adrenaline and noradrenaline
- Increases heart rate and blood pressure
- Increases blood flow to skeletal muscles
- Inhibits digestive functions



Parasympathetic

- “ Rest and digest ” system
- Calms body to conserve and maintain energy
- Lowers heartbeat, breathing rate, blood pressure



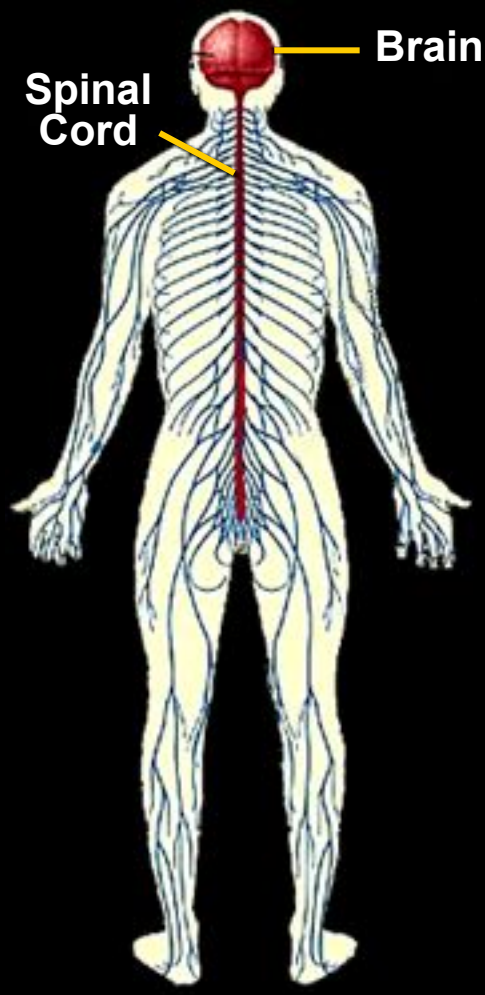
Summary of autonomic differences

Autonomic nervous system controls physiological arousal

Sympathetic division (arousing)		Parasympathetic division (calming)
Pupils dilate	EYES	Pupils contract
Decreases	SALVATION	Increases
Perspires	SKIN	Dries
Increases	RESPERATION	Decreases
Accelerates	HEART	Slows
Inhibits	DIGESTION	Activates
Secrete stress hormones	ADRENAL GLANDS	Decrease secretion of stress hormones

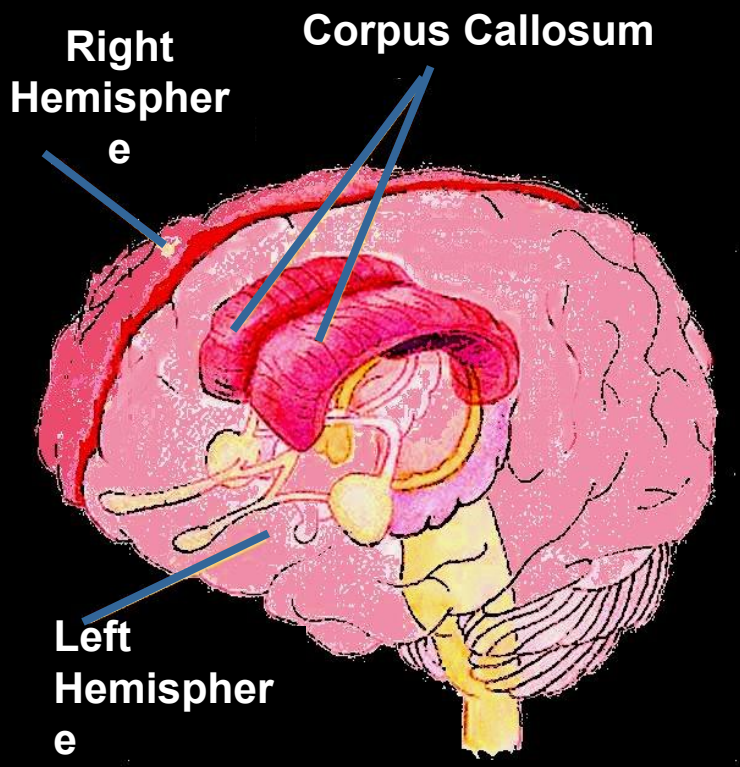
Central Nervous System

- **Brain and Spinal Cord**

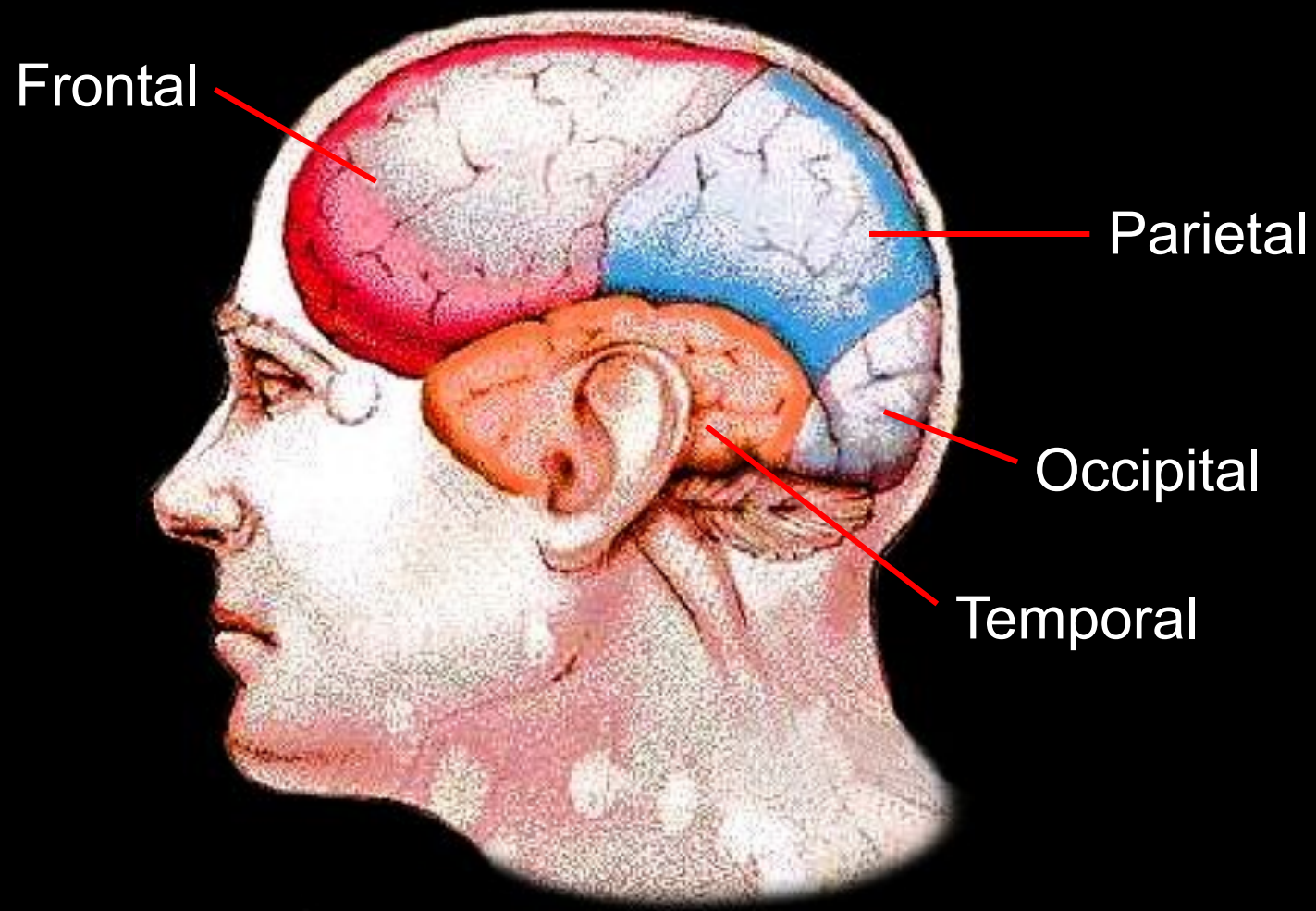


Brain has 2 Hemispheres

- Left & Right sides are separate
- Corpus Callosum : major pathway between hemispheres
- Some functions are ‘lateralized’
  - language on left
  - math, music on right
- Lateralization is never 100%

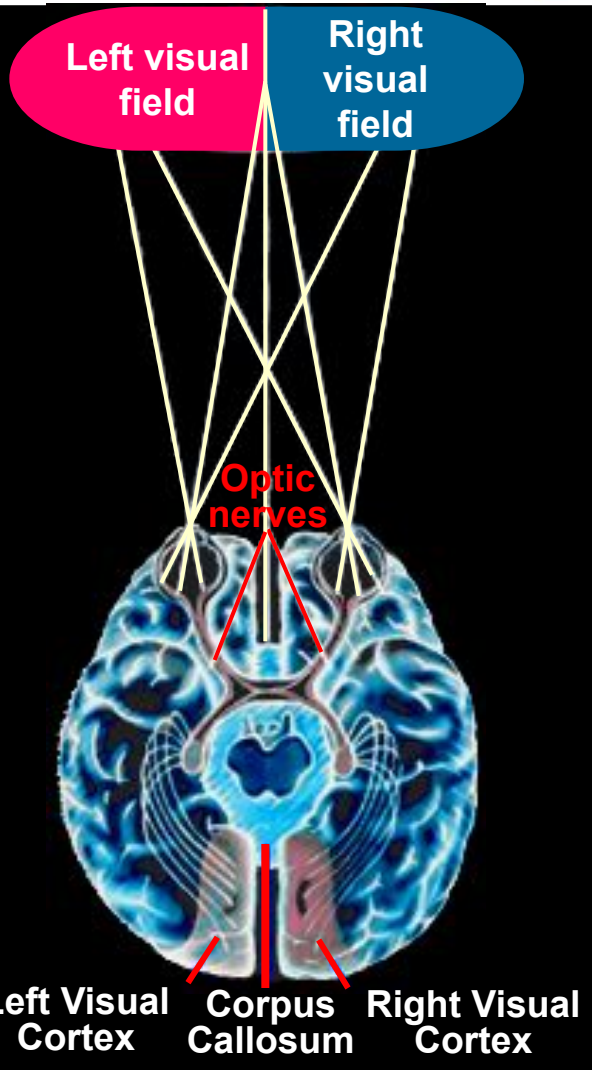


Each hemisphere is divided into 4 lobes



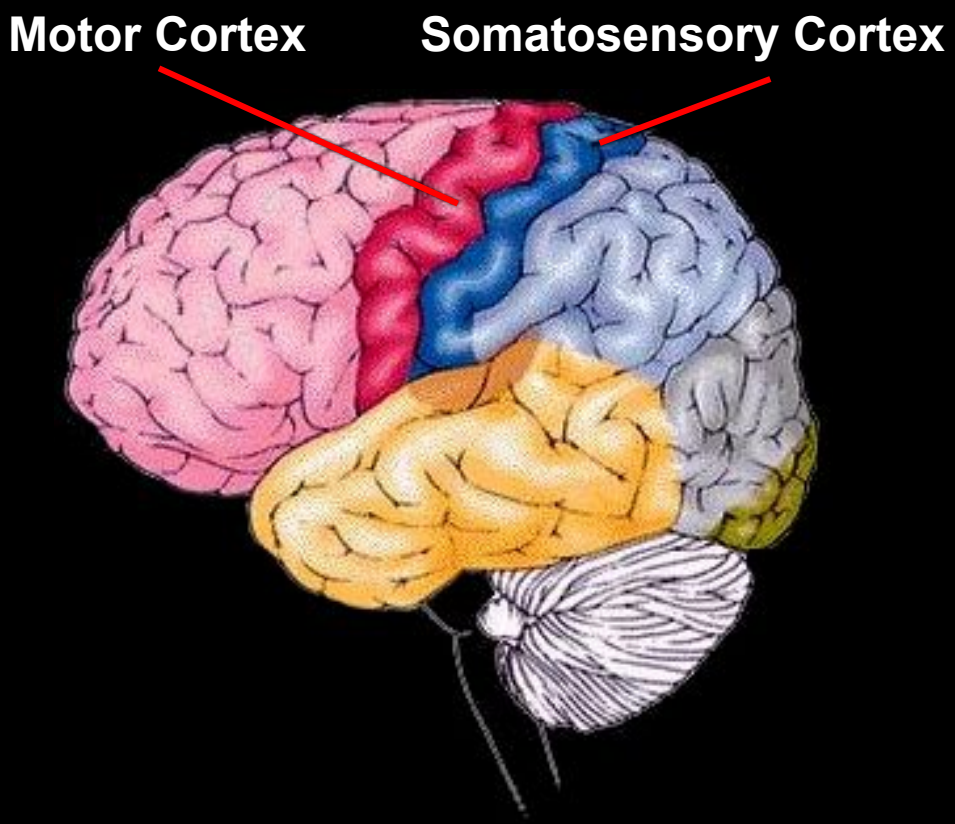
Sensory Information sent to opposite hemisphere

- Principle is Contralateral Organization
- Sensory data crosses over in pathways leading to the cortex
- Visual Crossover
  - left visual field to right hemisphere
  - right field to left
- Other senses similar



Contralateral Motor Control

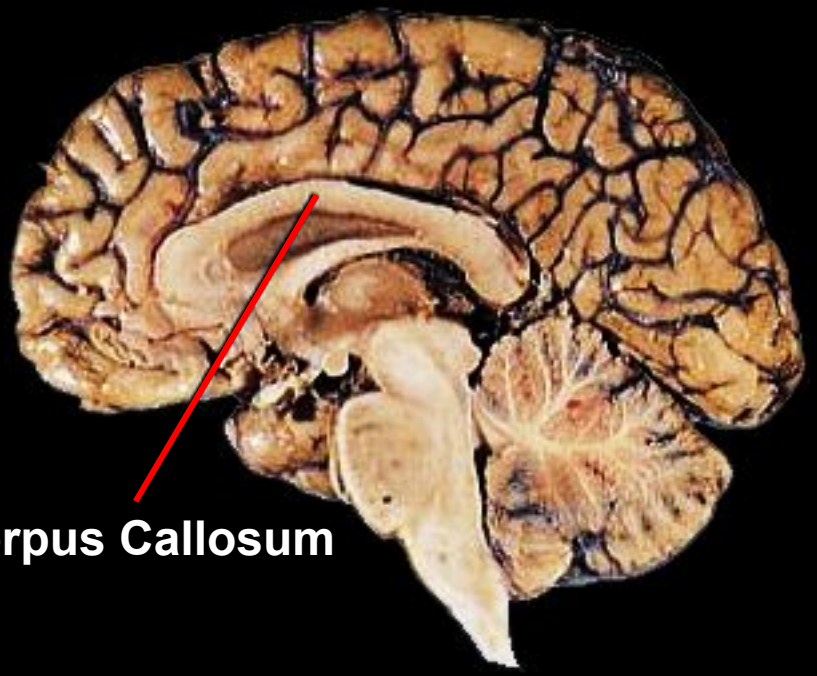
- Movements controled by motor area
- Right hemisphere controls left side of body
- Left hemisphere controls right side
- Motor nerves cross sides in spinal cord



Corpus Callosum

- Major (but not only) pathway between sides
- Connects comparable structures on each side
- Permits data received on one side to be processed in both hemispheres
- Aids motor coordination of left and right side

Medial surface of right hemisphere

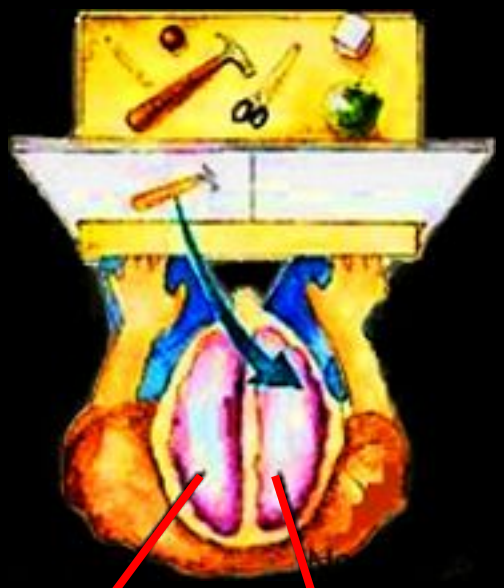


Corpus Callosum

- What happens when the corpus callosum is cut?
- Sensory inputs are still crossed
- Motor outputs are still crossed
- Hemispheres can’t exchange data

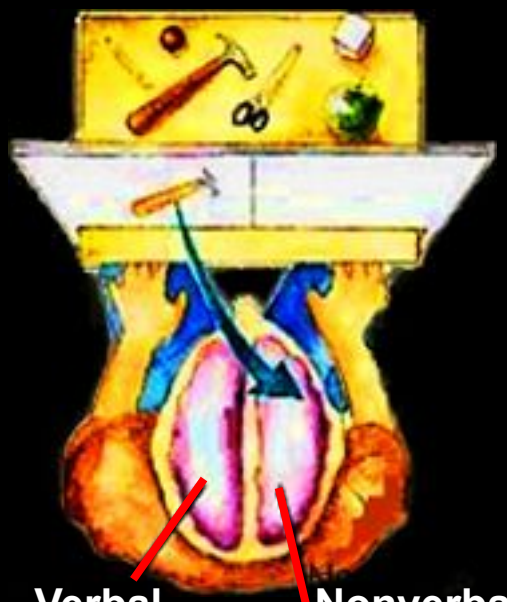
The ‘Split Brain’ studies

- Surgery for epilepsy : cut the corpus callosum
- Roger Sperry, 1960’s
- Special apparatus
  - picture input to just one side of brain
  - screen blocks objects on table from view

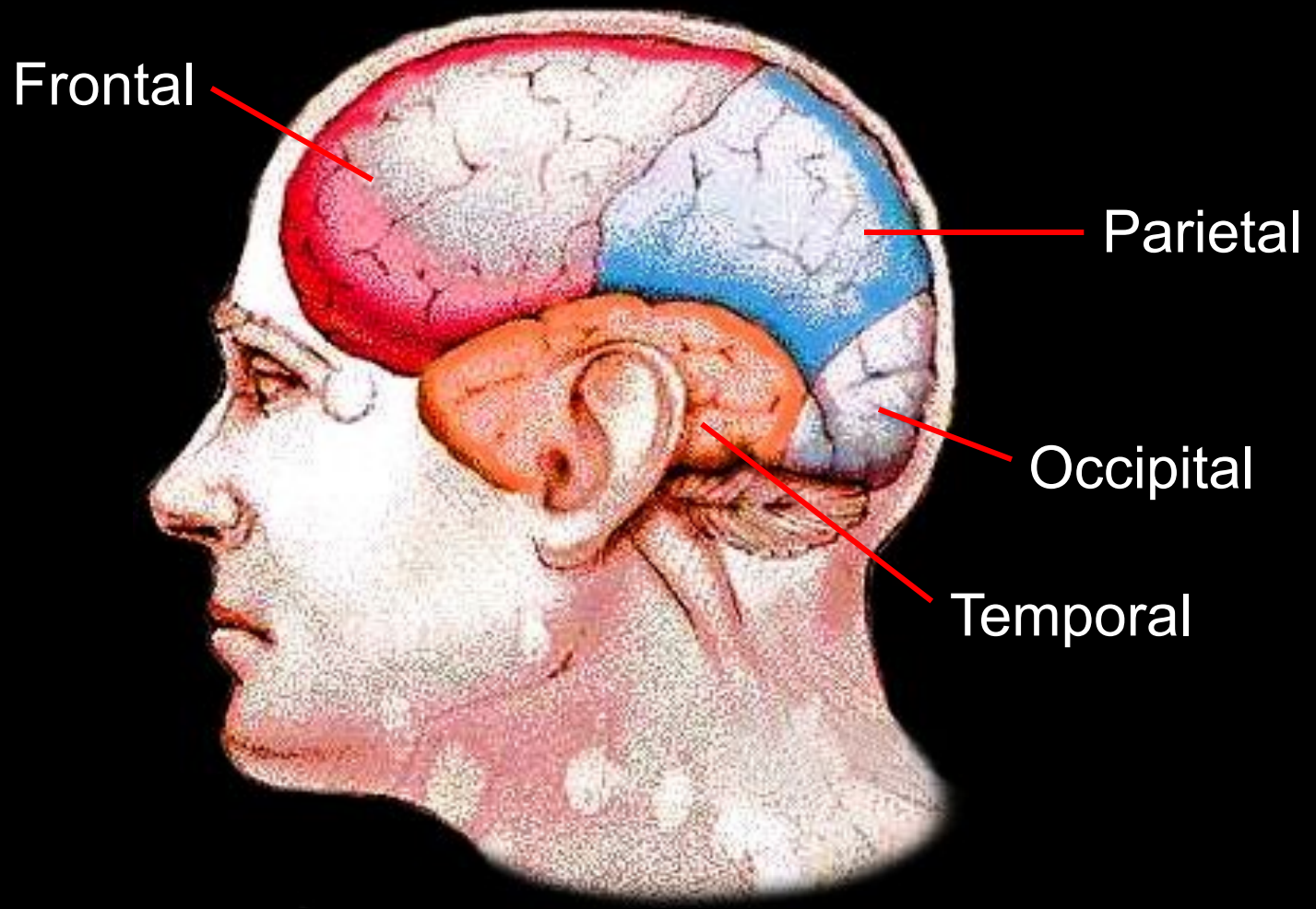


The ‘Split Brain’ studies

- Picture to right brain
  - can’t name the object
  - left hand can identify by touch
- Picture to left brain
  - can name the object
  - left hand cannot identify by touch

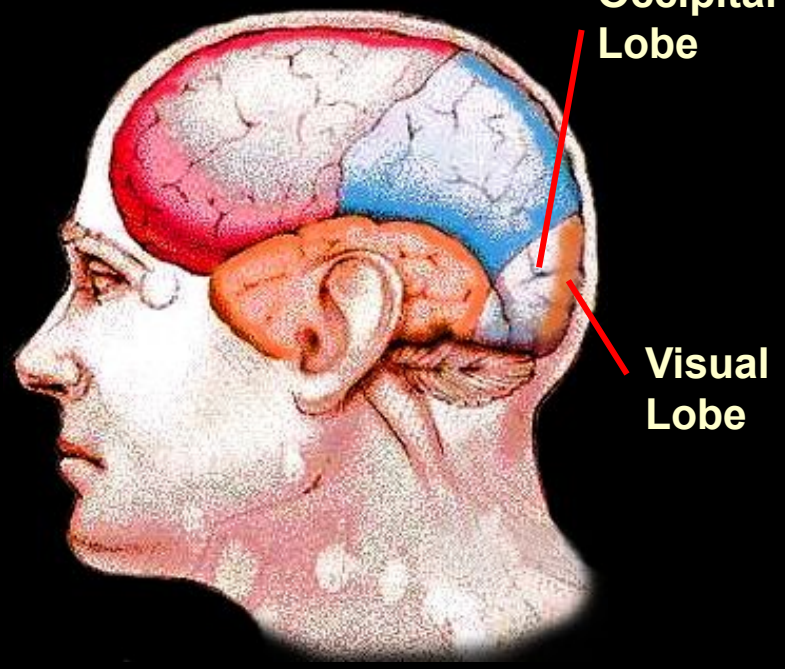


Localization of function



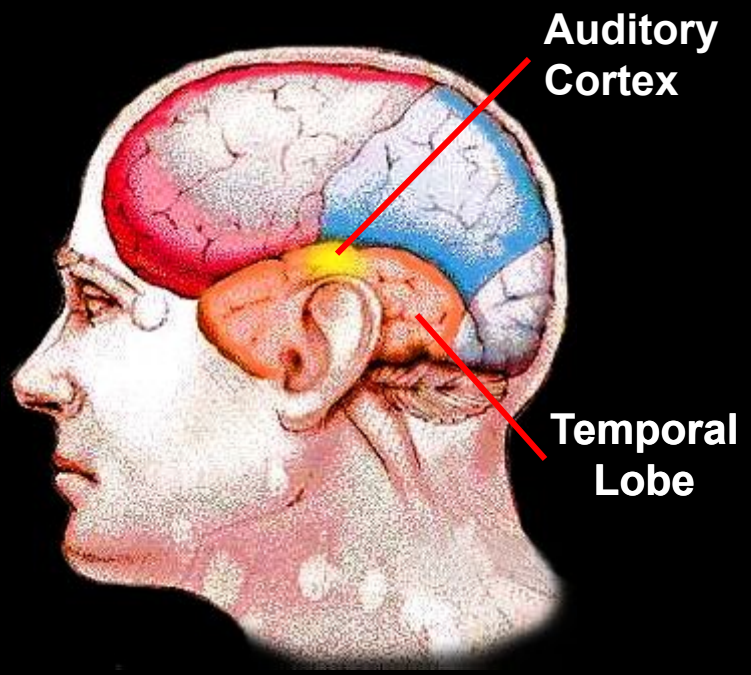
Occipital Lobe

- Input from Optic nerve
- Contains primary visual cortex
  - most is on surface inside central fissure
- Outputs to parietal and temporal lobes



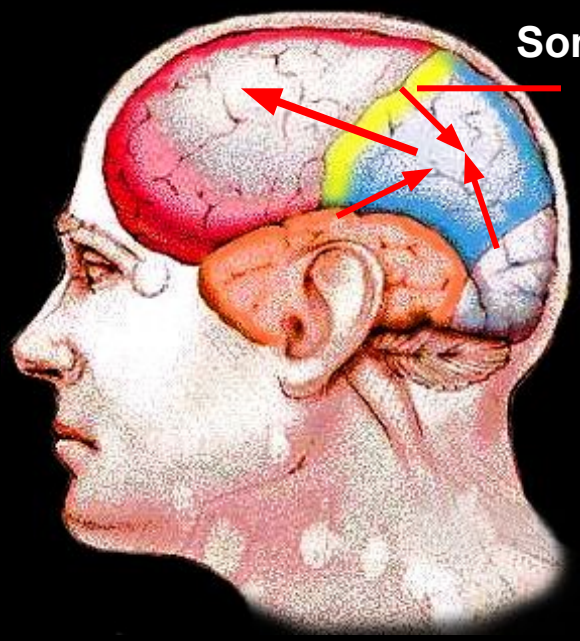
Temporal Lobe

- Contains primary auditory cortex
  - Inputs are auditory, visual patterns
    - speech recognition
    - face recognition
    - word recognition
    - memory formation
  - Outputs to limbic System, basal Ganglia, and brainstem



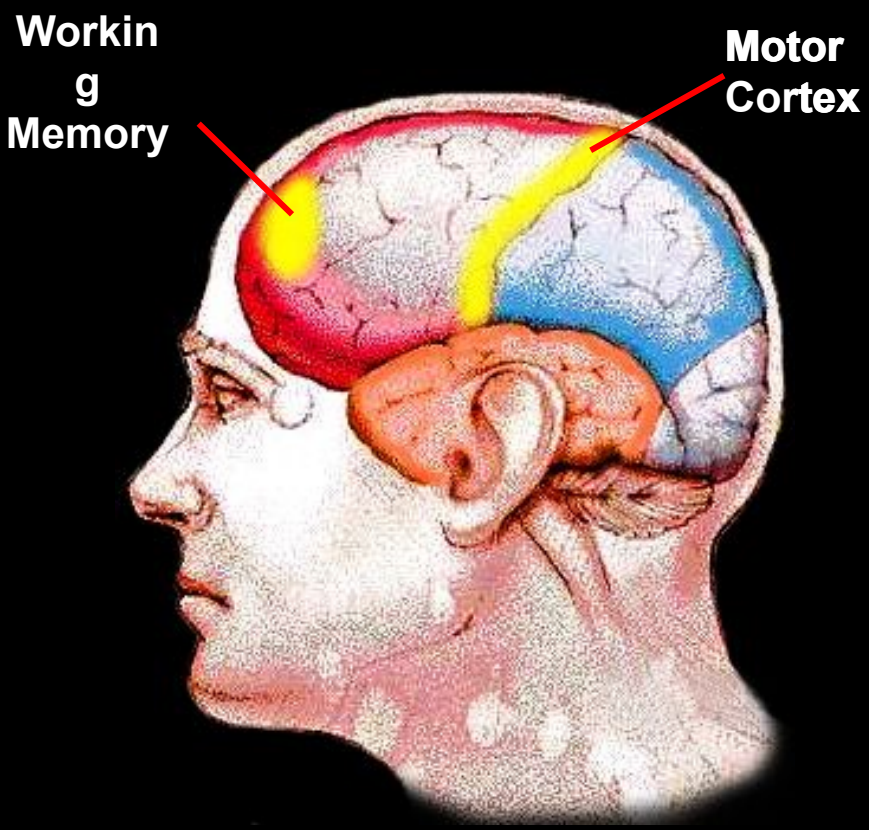
Parietal Lobe

- Inputs from multiple senses
  - contains primary somatosensory cortex
  - borders visual & auditory cortex
- Outputs to Frontal lobe
  - hand-eye coordination
  - eye movements
  - attention



Frontal Lobe

- Contains primary motor cortex
- No direct sensory input
- Important planning and sequencing areas
- Broca's area for speech
- Prefrontal area for working memory

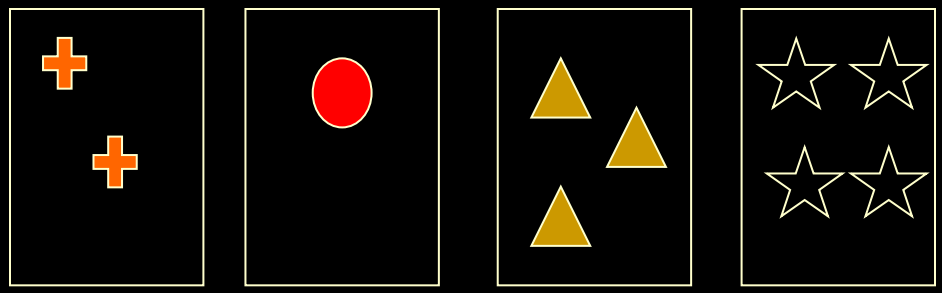


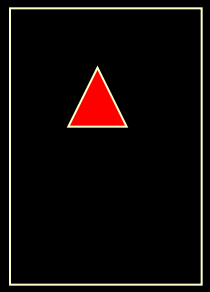
Frontal Lobe Disorders

- Broca's area
  - productive aphasia
- Prefrontal area
  - lose track of ongoing context
  - fail to inhibit inappropriate responses
- Often measured with the Wisconsin Card Sorting Task

Wisconsin Card Sorting Task

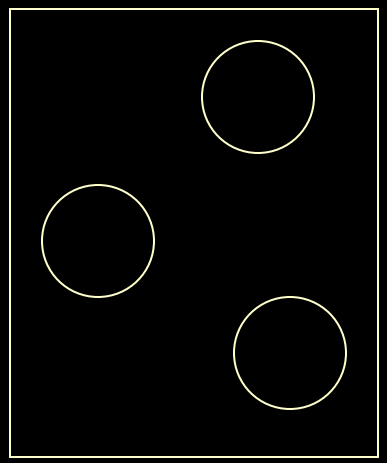
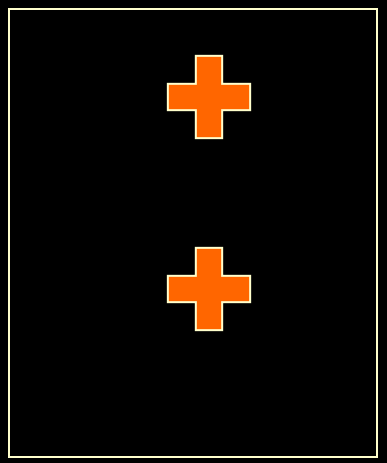
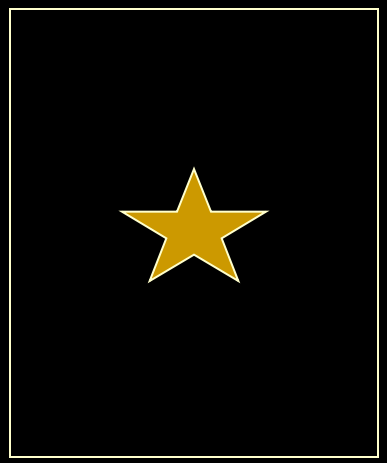
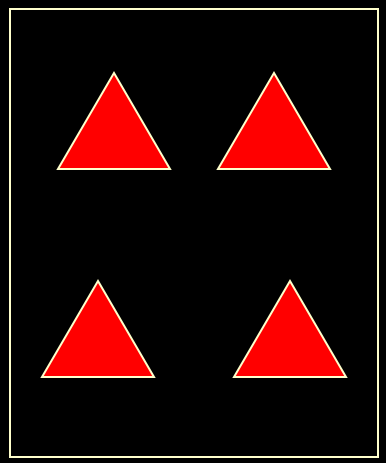
- Row of 4 example cards set out
- Patient is given a deck of 64 different cards
- Told to place each card under the one it best matches
- Told correct or incorrect after each card
- Must deduce what the underlying rule is.



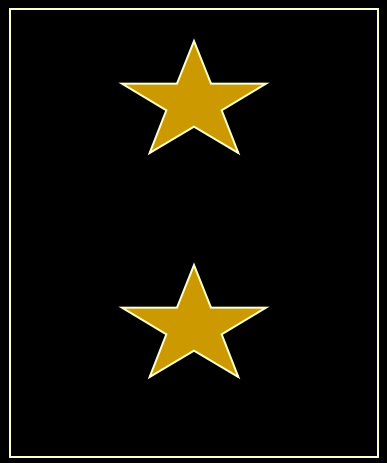


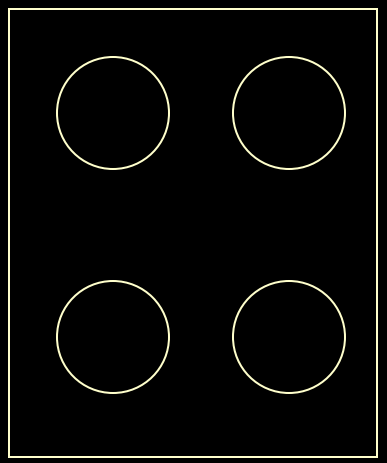
Correct!

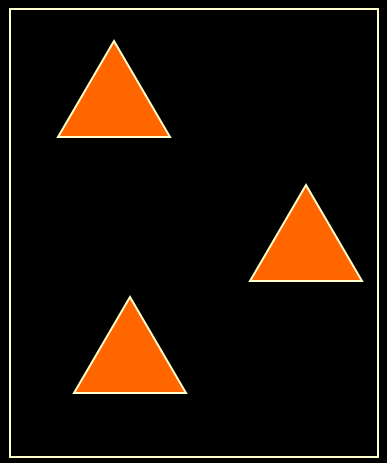
Wisconsin Card Sorting Task

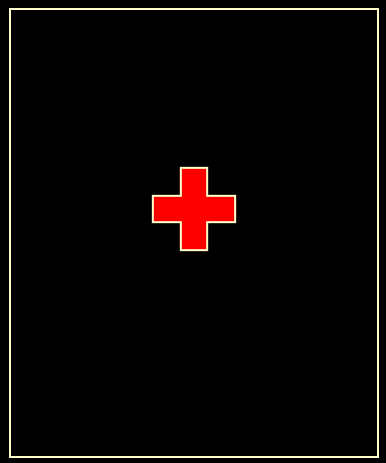





Wisconsin Card Sorting Task

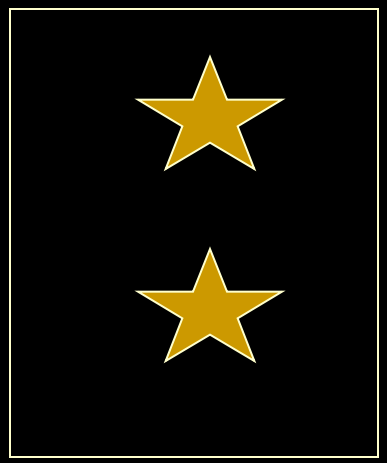


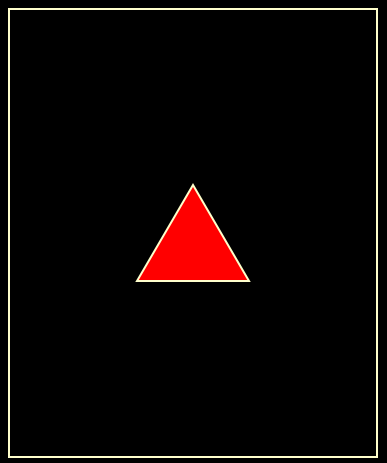


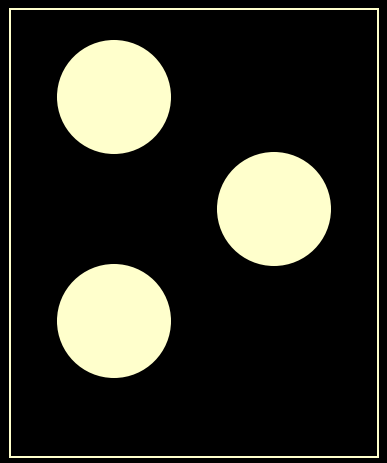


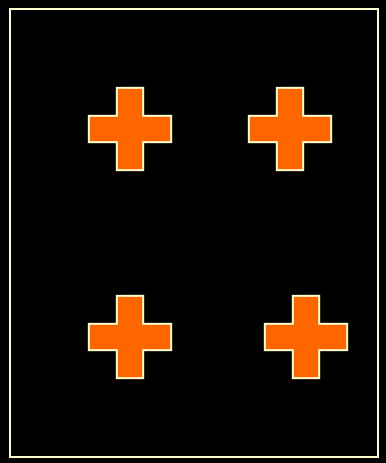


Wisconsin Card Sorting Task

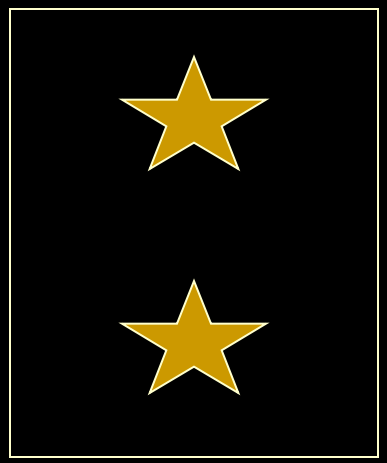


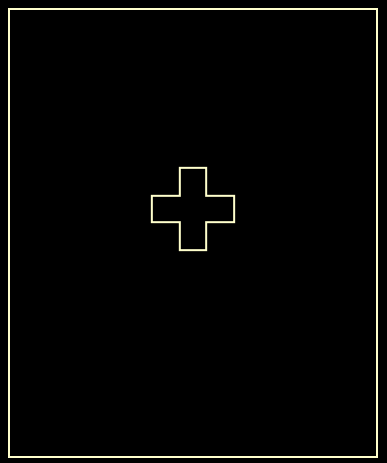


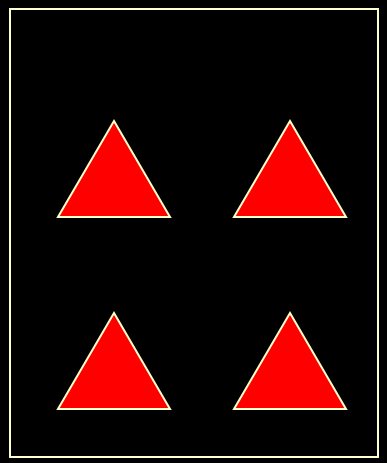


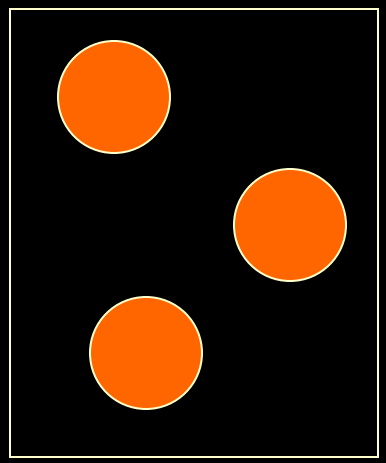


Wisconsin Card Sorting Task









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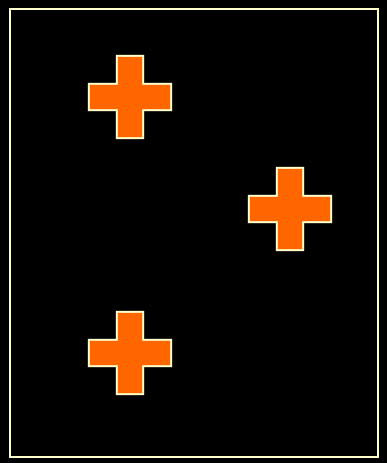

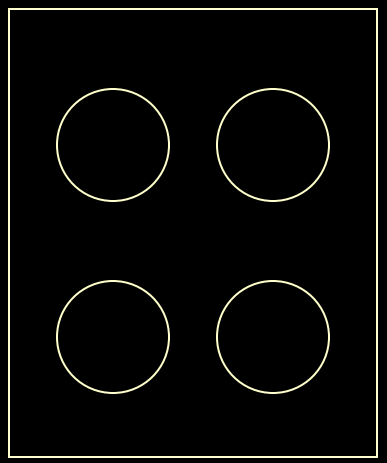

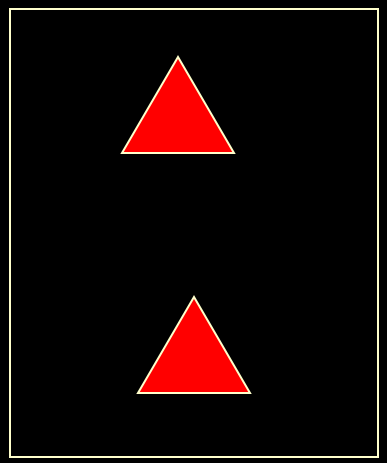

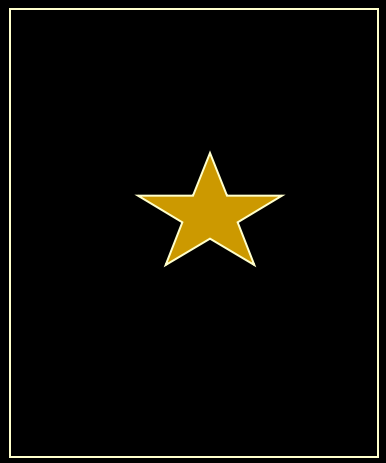

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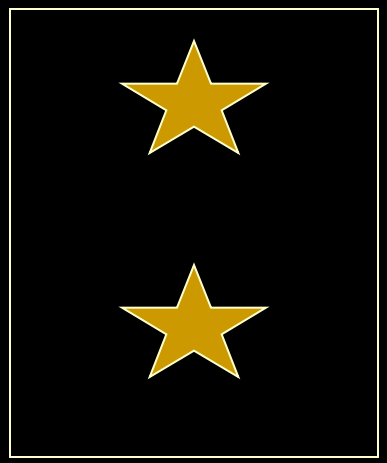
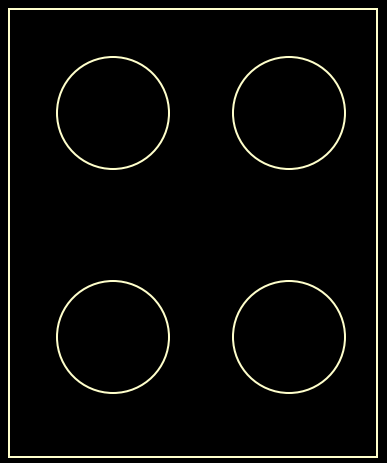
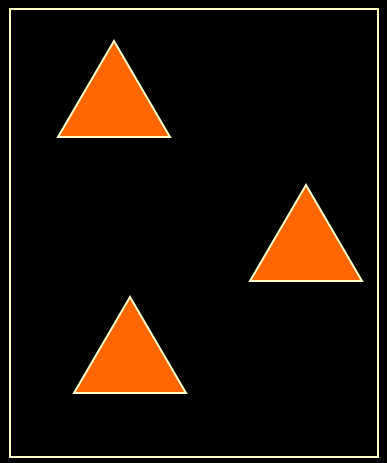
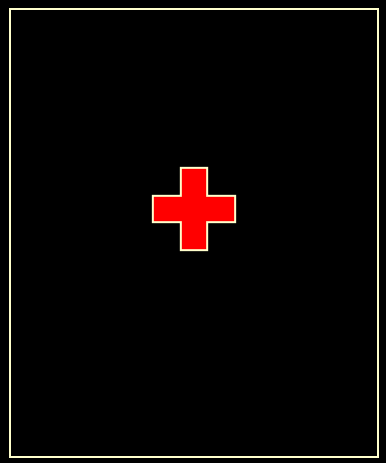


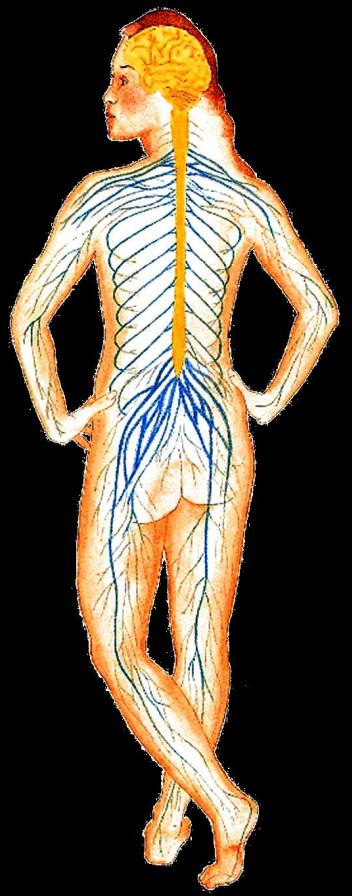






The Nervous System: Summary

- Major structures of the nervous
  - CNS, Somatic, Autonomic
  - Two hemispheres & 4 lobes
- Organization
  - contralateral input & output
  - primary sensory areas
  - motor areas
  - Commissure
- Localization of functions



Central Nervous System

Peripheral Nervous System