

# CNS: THE BRAIN, SPINAL CORD & PNS

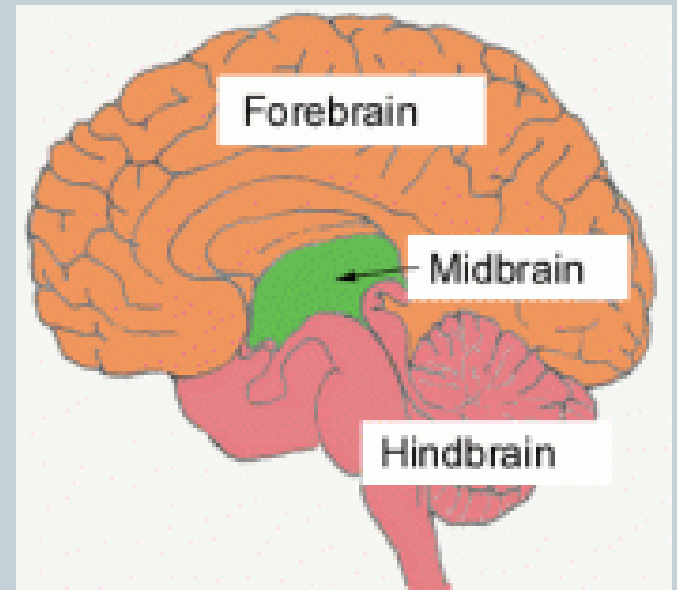


NERVOUS SYSTEM

# The Brain



- Coordinates body activities
- Made up of approximately 100 billion neurons
- Protection: flat bones of cranium, CSF (contained in cavities – ventricles), meninges (same as SC)
- Divided into three major parts →
  - the cerebrum (largest section)
  - the cerebellum
  - the brain stem
    - ✦ Midbrain
    - ✦ Pons
    - ✦ Medulla oblongata

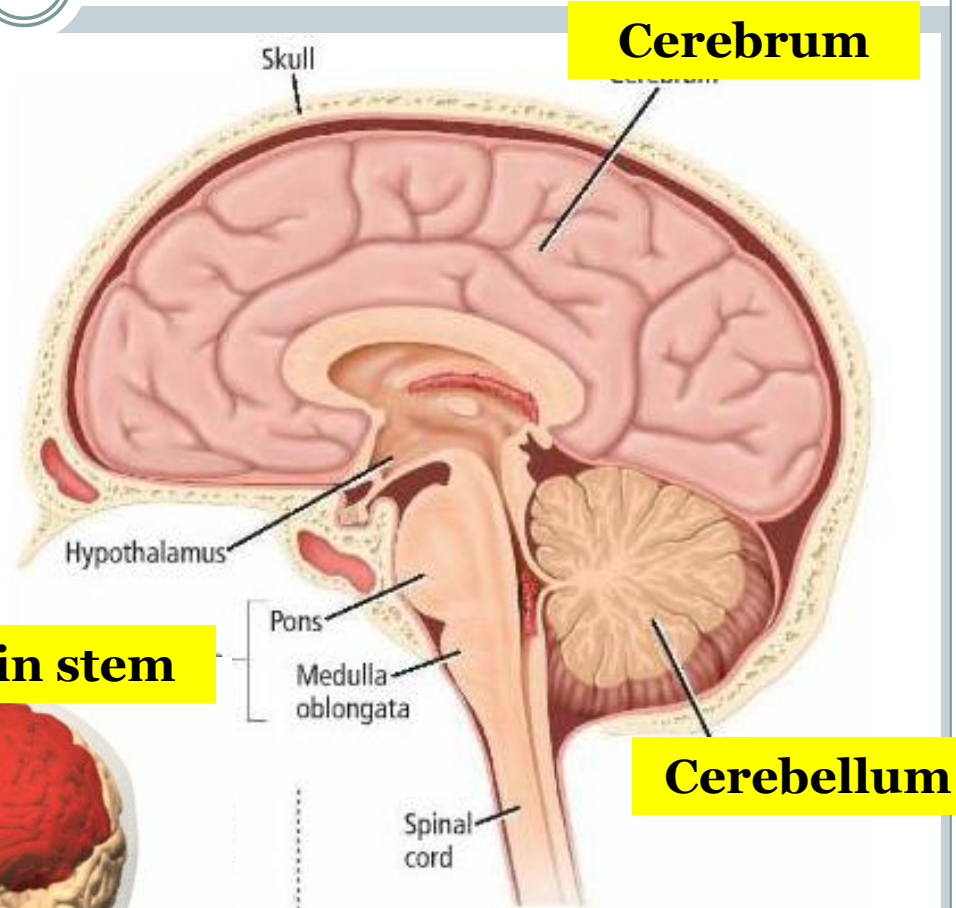
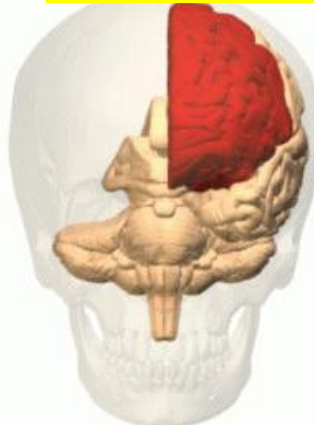


# External features of the Brain



**Brain stem**

**The brain** Over 100 billion neurons in the brain maintain homeostasis and control the body's activities, it is sometimes called the control center of the body.



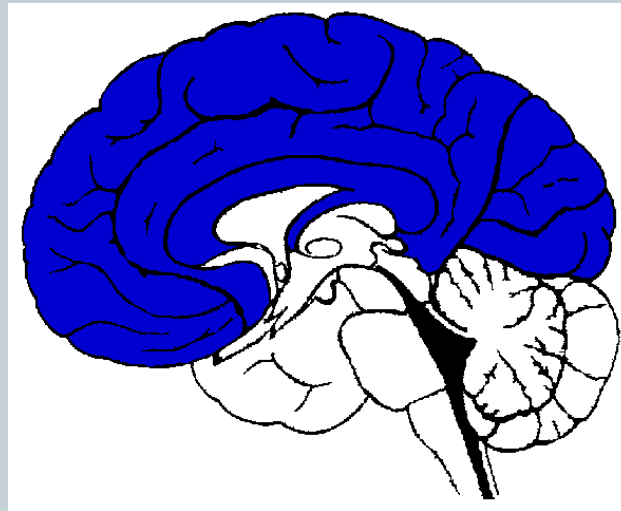
**Cerebrum**

**Cerebellum**

# Cerebrum



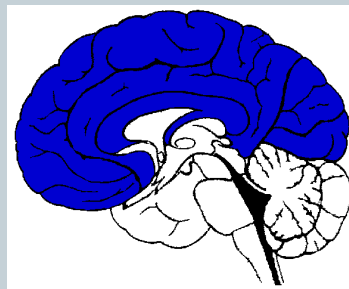
- Largest part of the brain
  - Aka: “Higher Brain”
- Language, learning, memory
- Voluntary body movements controlled



# Cerebrum



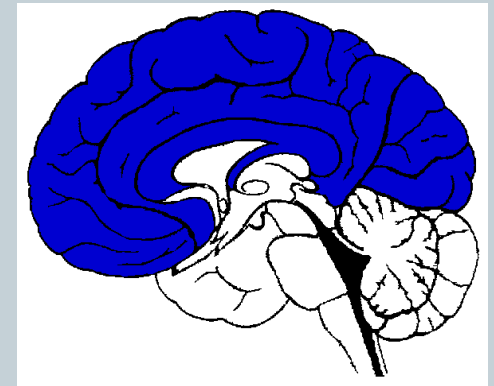
- Divided into: L and R portions → cerebral hemispheres
- Foldings: convolutions – increases surface area
  - Upward: gyri
  - Downward groove: sulci
    - ✦ Deep groove: fissure → longitudinal (R/L) and transverse (lower cerebrum from cerebellum)
- Functional regions: frontal, parietal, occipital, temporal lobes



# Cerebrum



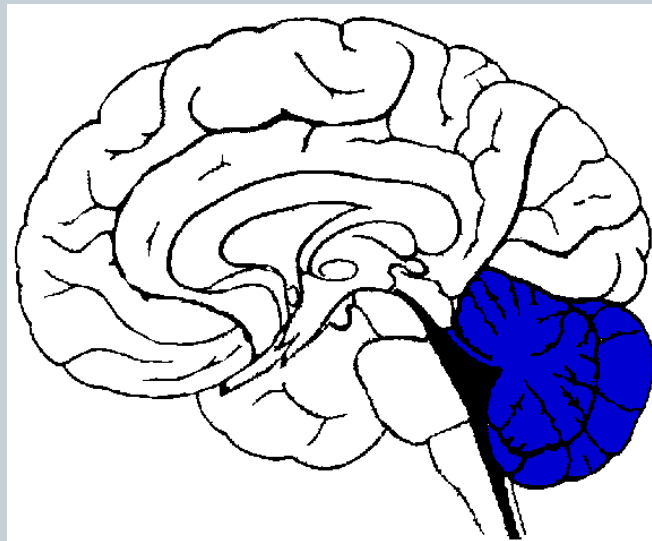
- Frontal and parietal = central sulcus
- Frontal and temporal = lateral sulcus
- Each lobe contains:
  - gray matter → external, “cerebral cortex”
    - ✦ Source of integrative fxns
  - White matter → internal
    - ✦ Masses of gray matter:
      - Basal nuclei (clusters of cell bodies)
        - control unconscious mvmts and motor impulses
    - ✦ Myelinated fibers:
      - Hemi. 2 Hemi. → *corpus callosum*
      - One part of Hemi. To another part of same Hemi.
      - Hemi. To other part of brain



# Cerebellum



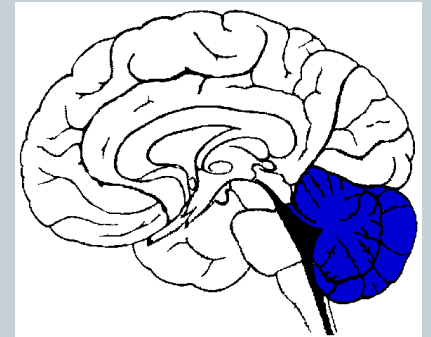
- Means “little brain”
- Interprets stimuli from eyes, ears, muscles
- Responsible for balance and coordination



# Cerebellum



- 2 hemispheres: divided by central vermis
- Convolutions:
  - Upfolds = folia
  - Downfolds = sulci
- White matter with a thin gray exterior (cortex)
  - White = branching tree, “arbor vitae”
- Transverse fissure = separates cerebellum from cerebrum





# Brainstem

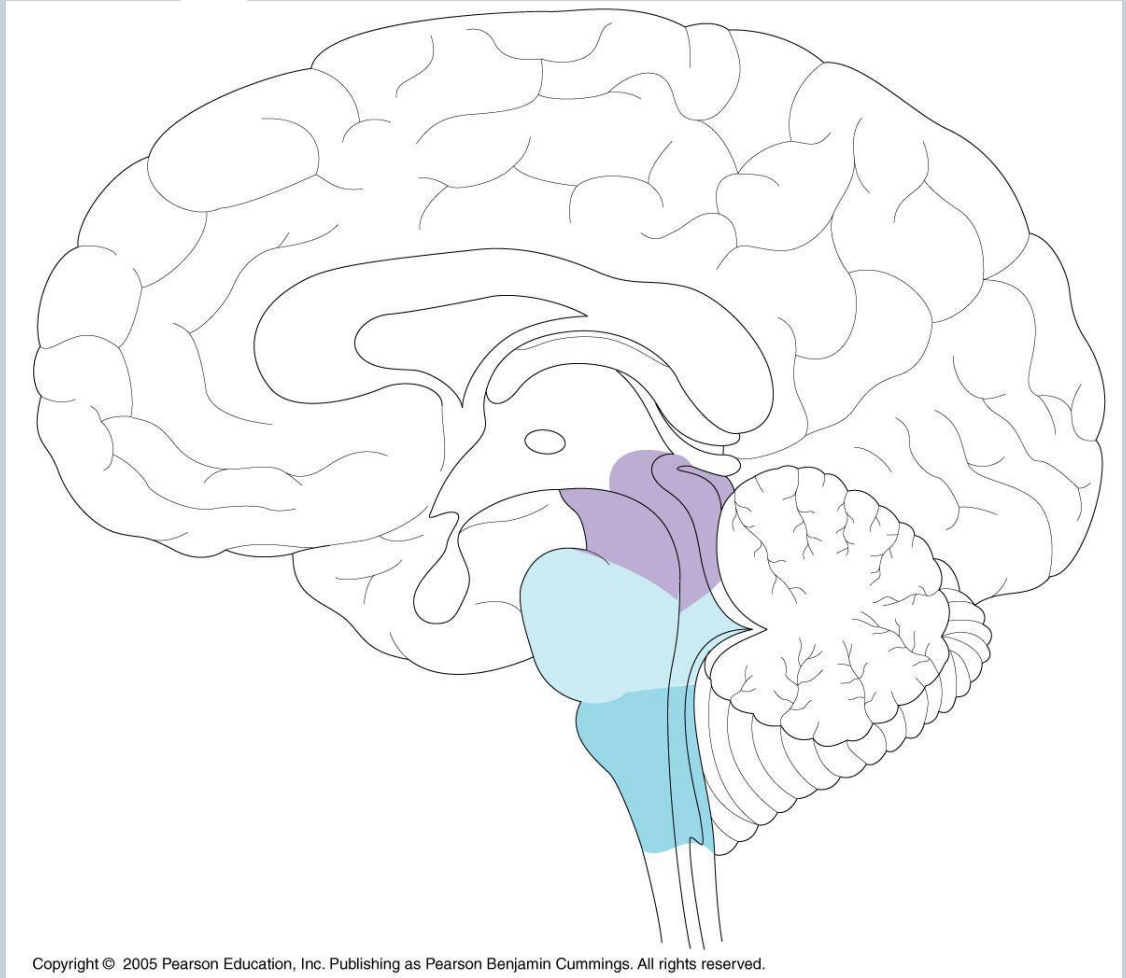


- Extends from base of brain and continues into SC
- Made up of pons and medulla oblongata
- Relays signals btwn brain and SC
  
- Pons → top region ; controls breathing rate
- Medulla → connects to SC; controls BP, heart rate, breathing rate

# What does the light blue shaded organ refer to?



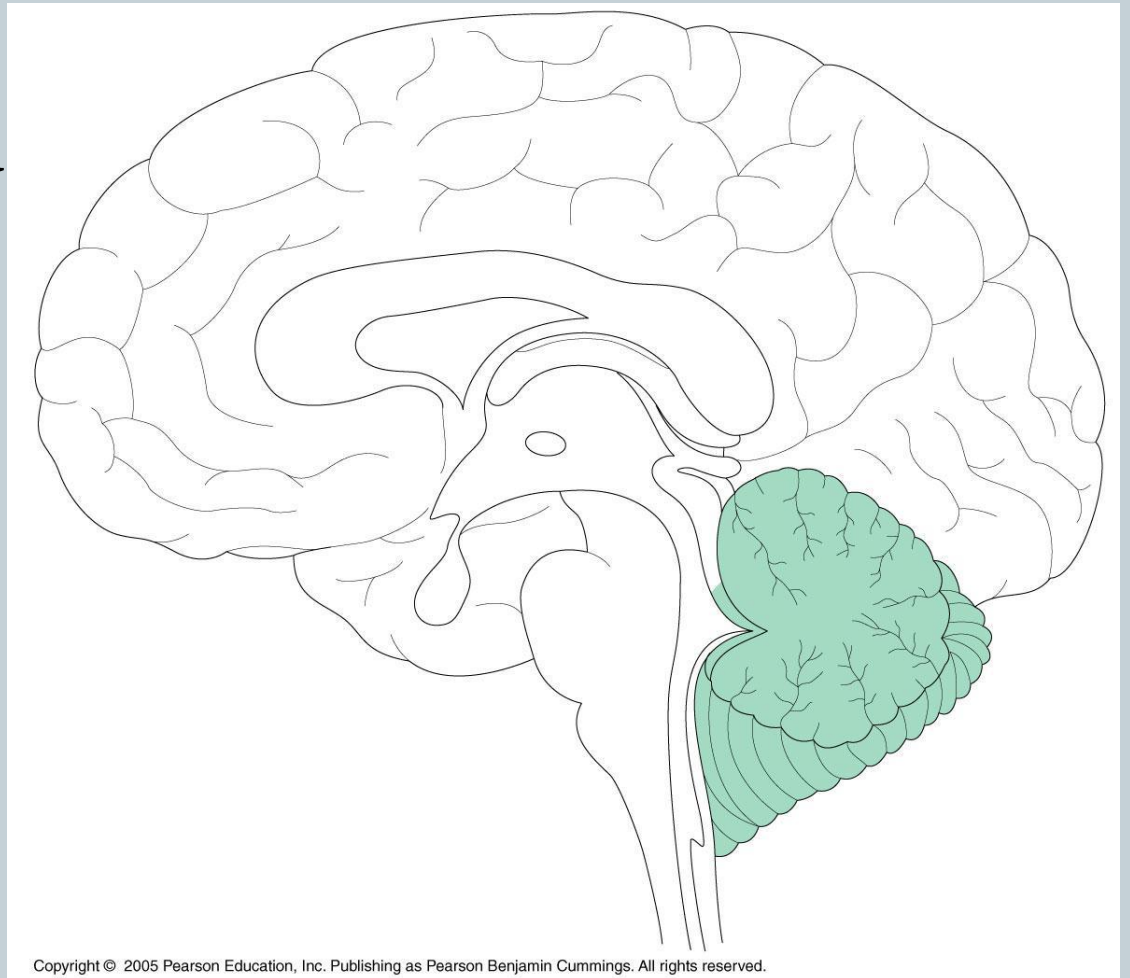
- Cerebrum
- Medulla oblongata
- Pons
- Spinal cord
- cerebellum



# What does the green shaded organ refer to?







- Cerebrum
- Medulla oblongata
- Pons
- Spinal cord
- cerebellum



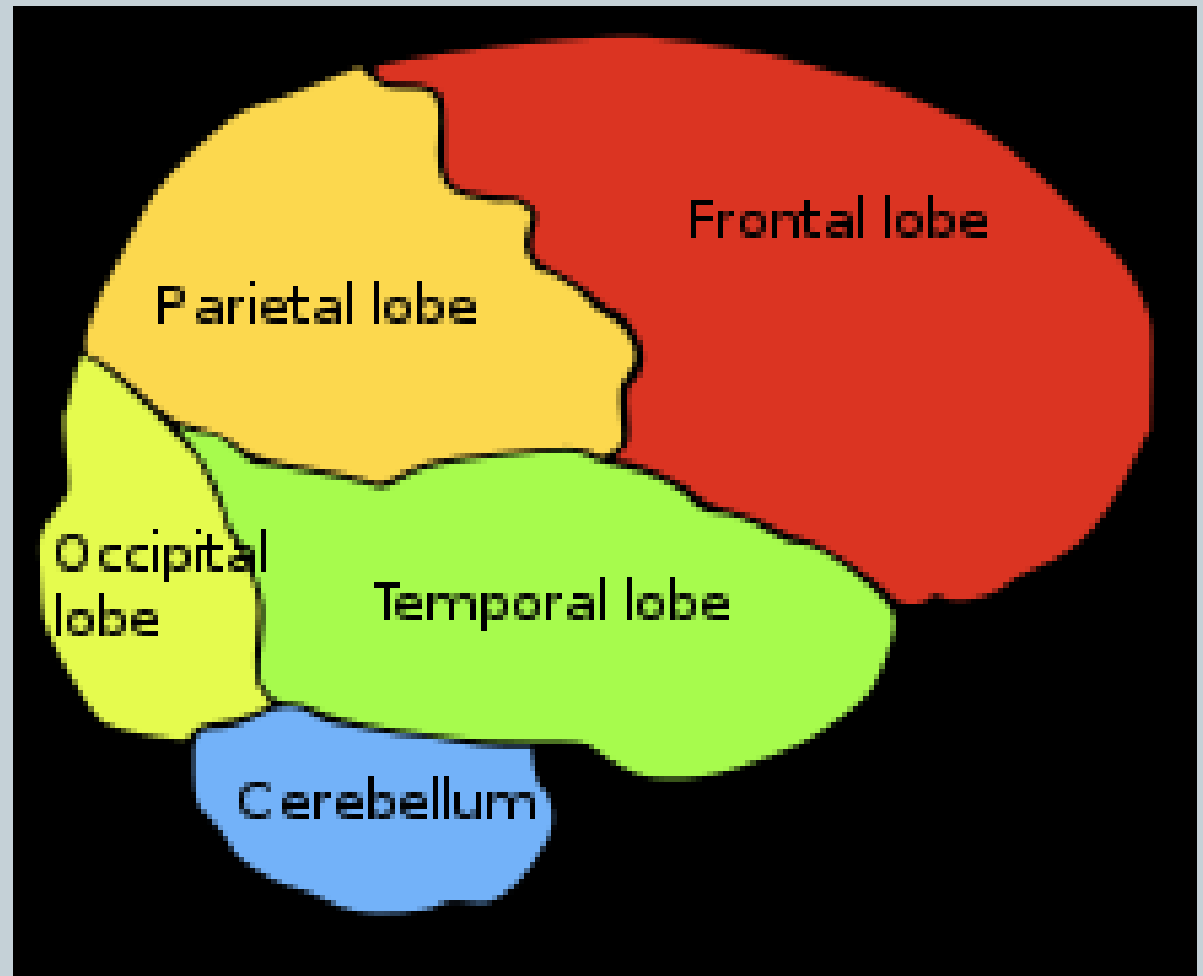


### Four lobes

-  Occipital lobe
-  Parietal lobe
-  Frontal lobe
-  Temporal lobe

### And others

-  Cerebellum
-  Medulla



# The Brain and its functions

Based on Diagrams from  
Head injury - A Practical Guide By Trevor Powel

**Executive functions,**  
thinking, planning,  
organising & problem  
solving. Emotions &  
behavioural control,  
personality (frontal  
lobe)

**Movement**  
(motor cortex)

**Sensation**  
(sensory cortex)

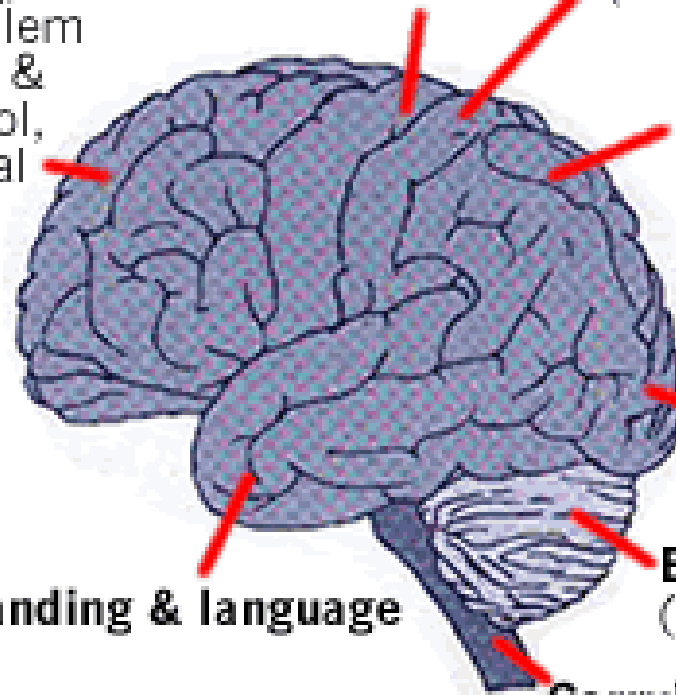
**Perception,** making  
sense of the world,  
arithmetic, spelling  
(parietal lobe)

**Vision**  
(occipital lobe)

**Balance**  
(cerebellum)

**Memory, understanding & language**  
(temporal lobe)

**Carrying messages**  
(spinal cord)



# Peripheral Nervous System

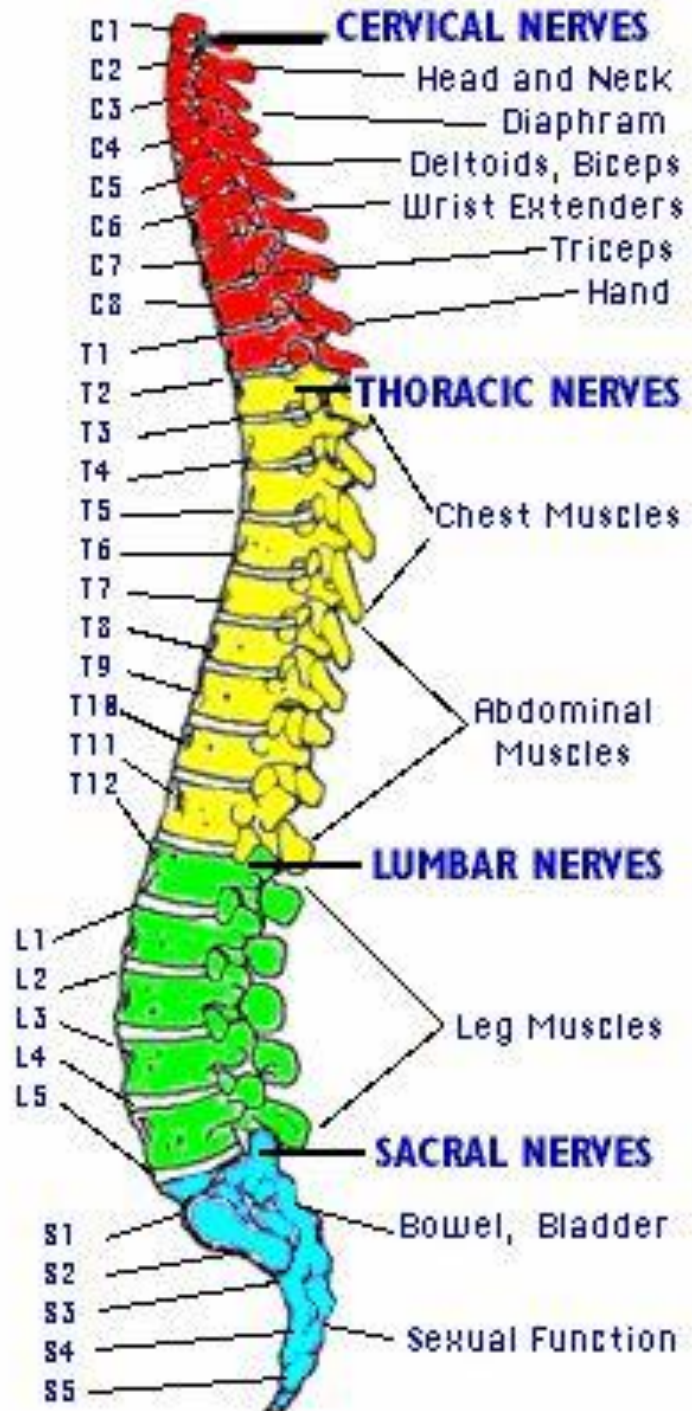


- Connects body to brain & spinal cord
- Cranial nerves
  - Attach to brain
  - 12 pairs
  - Head and neck
  - Named with roman numerals such as I, II, III, IV, etc.
  - Sensory, motor, mixed (toward/away CNS)
- Spinal nerves
  - Attached to SC
  - 31 pairs
  - Neck, trunk, limbs
  - C, T, L, S, C
  - Bundles of sensory and motor neurons held together by connective tissue

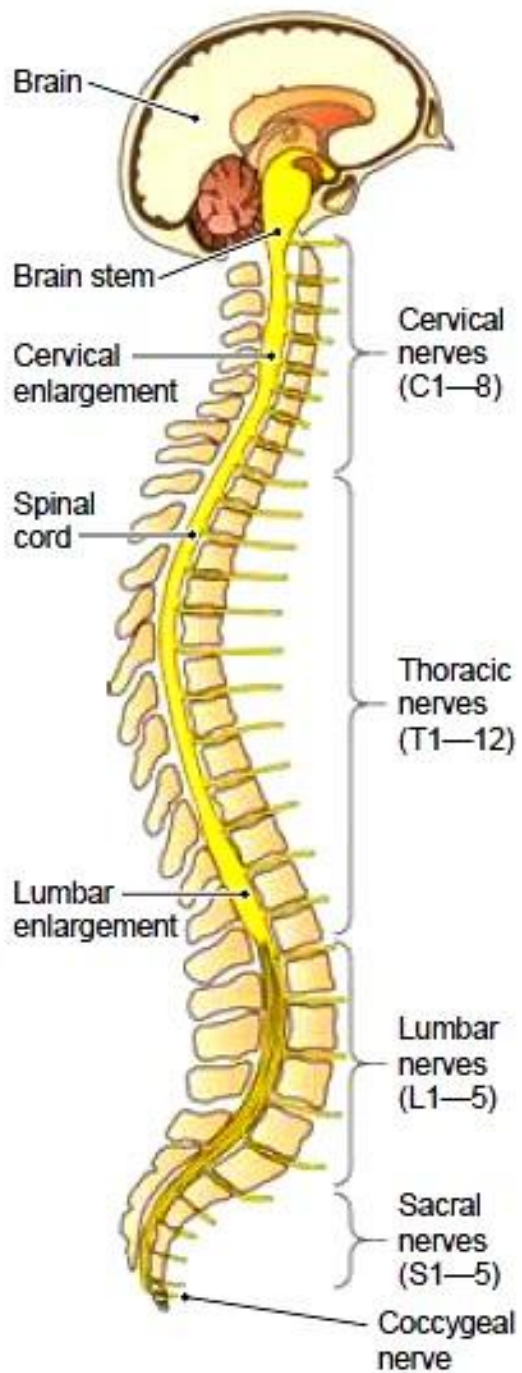
# Spinal Nerves



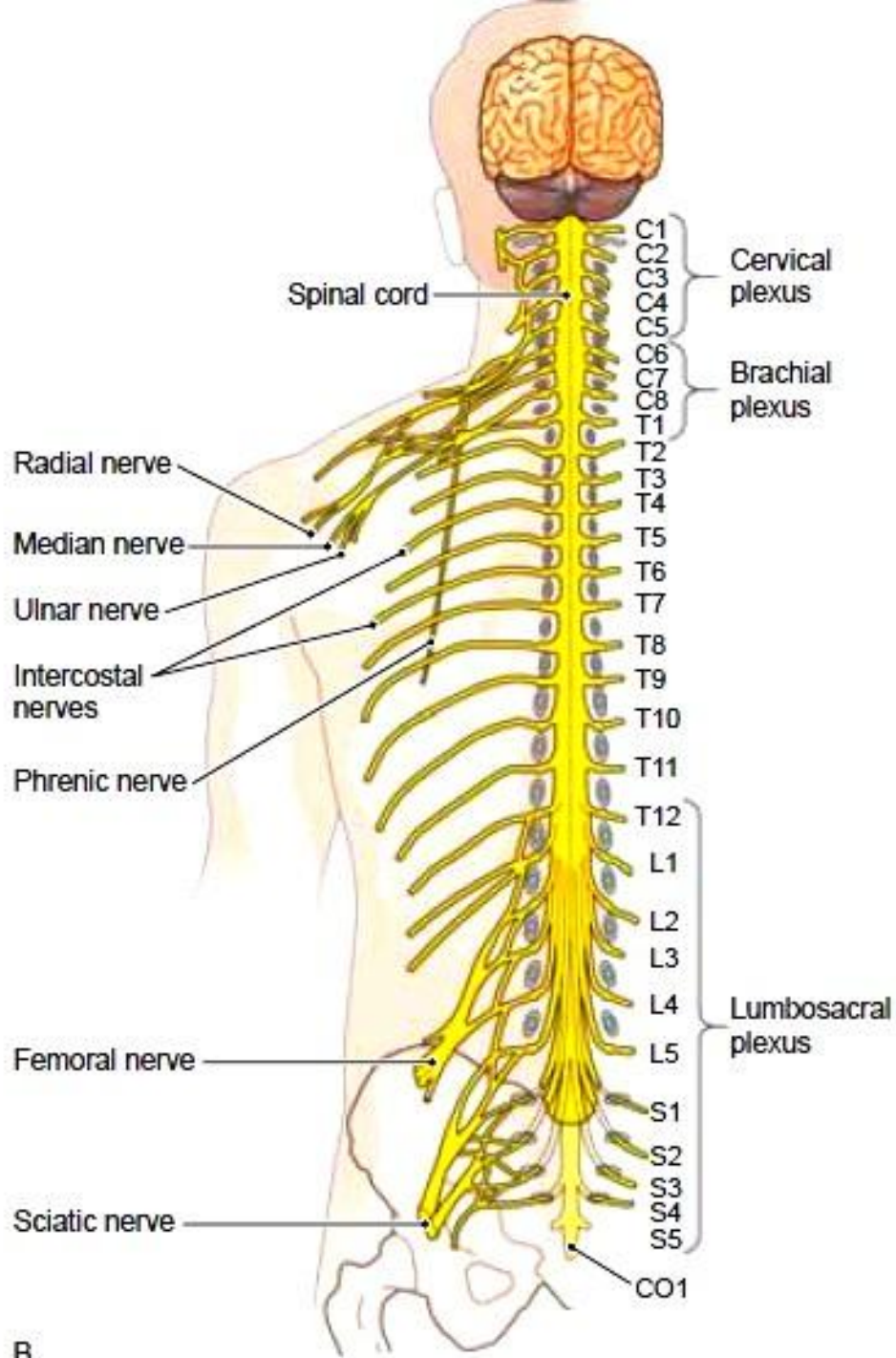
- root = fibers between cord and nerve
  - Sensory = dorsal
  - Motor = ventral
- rami = smaller nerve branches
  - Dorsal (posterior) = muscles and skin of back
  - Ventral (anterior) = trunk and limbs \*larger
- plexus = complex , branching networks off of rami





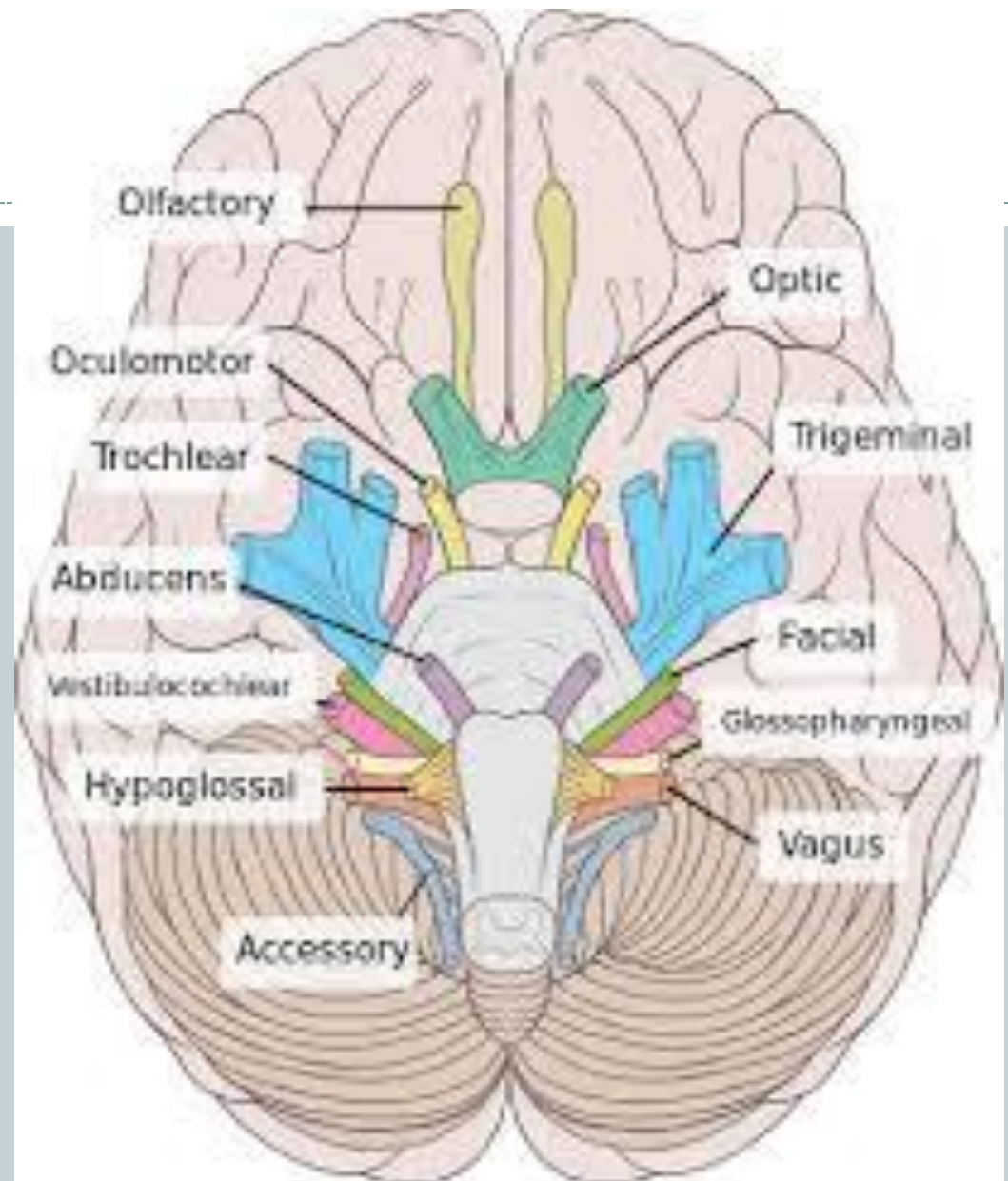


A



B

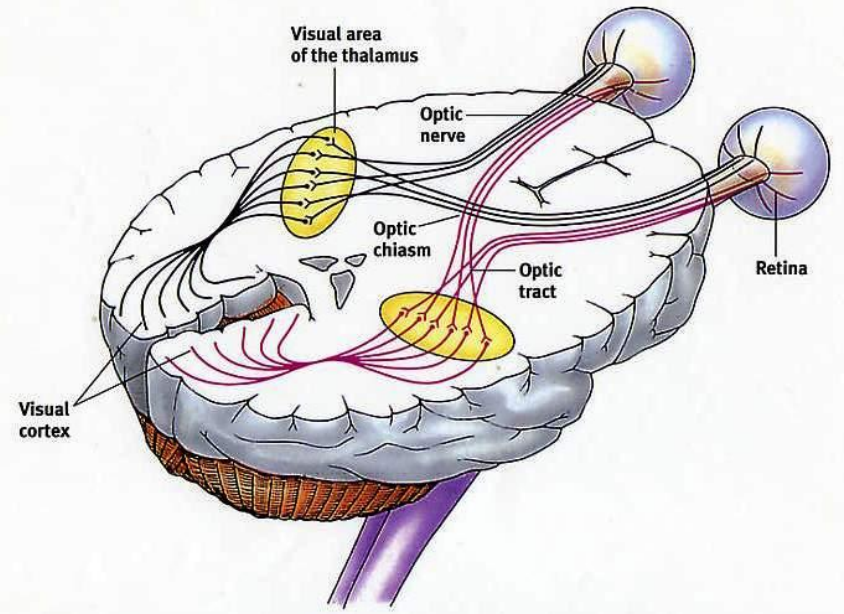
# Cranial Nerves



See handout to fill  
in function for each  
cranial nerve

# Impulse to the Brain (for eye sight...)

- **Optic nerve**
  - Impulse leaves eye
- **Optic chiasma**
  - Where impulses cross (X)
- **Optic tract**
  - Leads from chiasma to...
- **Thalamus**
  - Relay switch for sensory impulses
- **Occipital lobe of cerebral cortex**
  - Interprets signal
  - Larger and right side up (and not reversed)



# The EYE



- Eye diagram: (10) terms to be used for labeling
  - 1. Blind spot
  - 2. Choroid
  - 3. Cornea
  - 4. Iris
  - 5. Lens
  - 6. Optic nerve
  - 7. Pupil
  - 8. Retina
  - 9. Sclera
  - 10. Suspensory ligaments

# The EYE

**\*\*refracts (bends) light\*\***

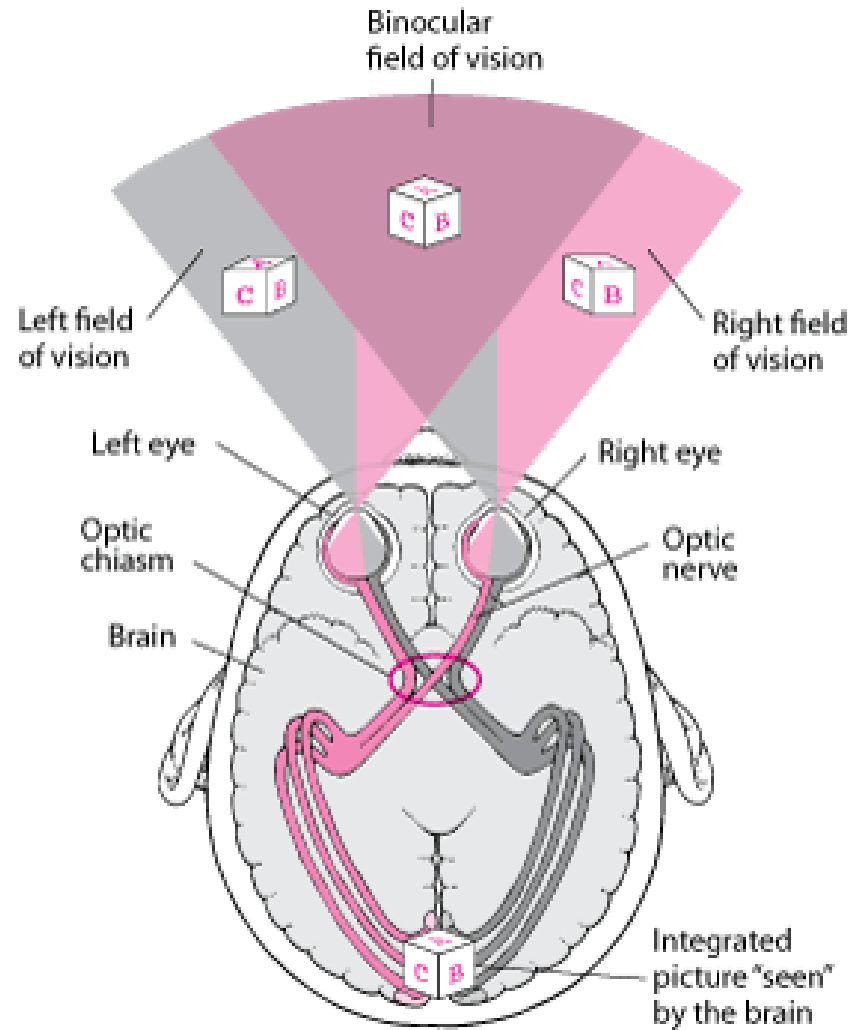
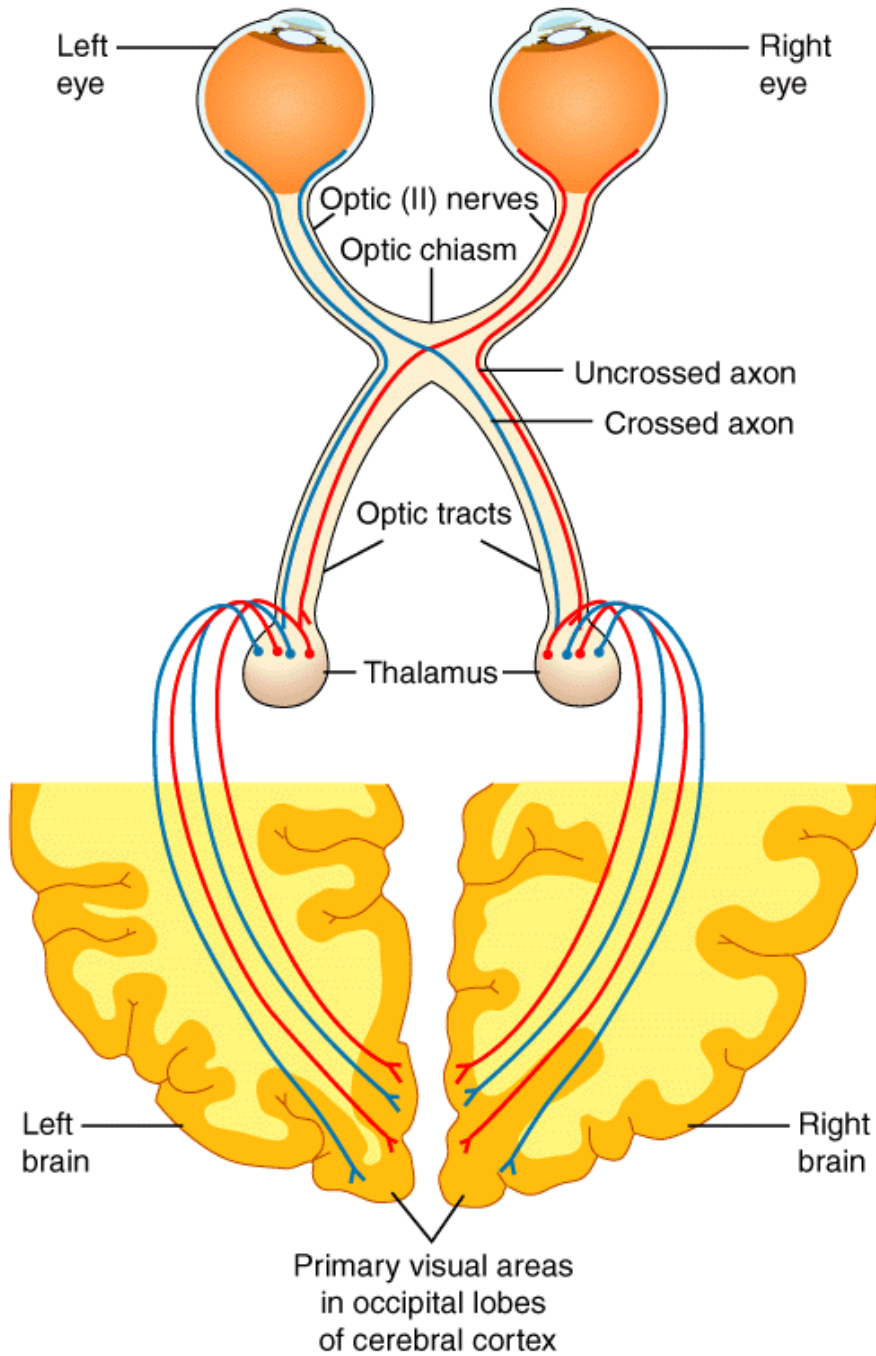


- Cornea → static, transparent, “window of eye”
- Aqueous humor → watery fluid btwn cornea and iris
  - Minor shape, nourishes b/c fluid is recycled
- pupil → hole in center of iris, light passes through
  - Size changes w/amount of light available
- lens → changes amount of refraction
  - Accommodation – concave/convex – lens changes shape to focus light on the retina in one spot
- vitreous humor → thick, jelly-like fluid in posterior cavity that supports eye shape, holds retina in place, not recycled
- Retina → like a wet piece of tissue paper
  - Change in light = impulses
  - Image on retina = smaller, upside down, backwards
  - Photoreceptors
    - ✦ Rods (black and white)
    - ✦ Cones (color)

# VISION



- ROYGBIV – reflected wavelength of light is what is perceived by the viewer
- Photoreceptors
  - Rods → for dim light (black and white)
    - ✦ Ex: owls, dogs, cats
  - Cones → color
    - ✦ Ex: humans
- 3 types of cones →
  - Erythrolabe
  - Chlorolabe
  - Cyanolabe

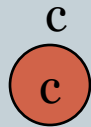


# Vision



**Sex** – linked recessive (**usually affects men – from mom**)

normal =



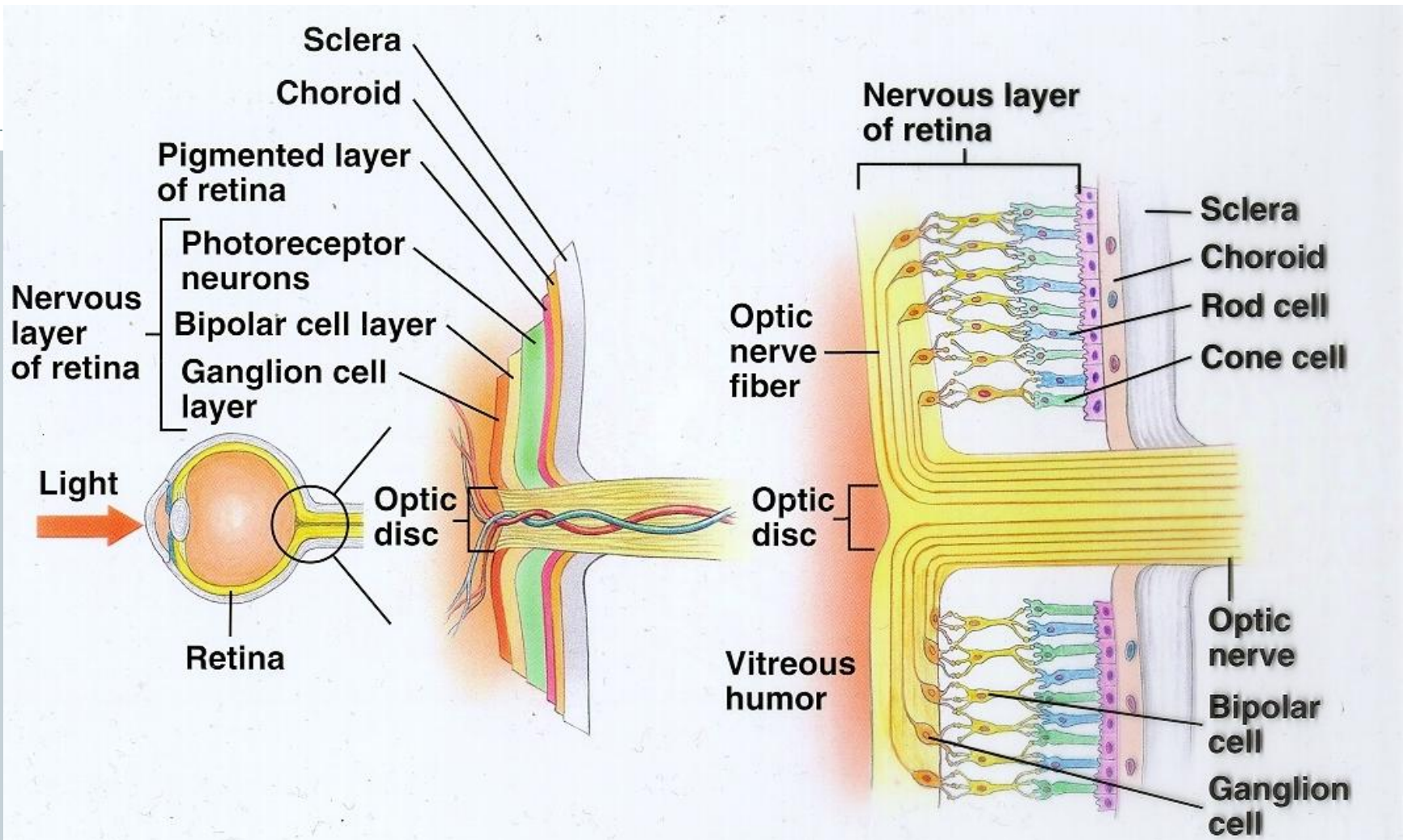
colorblind =



# Vision



- Normal vision (macula)
  - “blind spot” – optic disc/ optic nerve
- Nearsightedness (myopia)
  - Focuses before the retina
- Farsighted (hyperopia)
  - Focuses after the retina
- Astigmatism
  - Unequal curvature from lens and cornea
  - Blurred vision near and far



# Summary of: Peripheral Nervous System



- Two divisions
  - Somatic
  - Autonomic
    - ✦ Sympathetic
    - ✦ Parasympathetic

# Peripheral Nervous System → AUTONOMIC



- Effect of autonomic impulses (smooth muscle, cardiac muscle, glands) either stimulates or inhibits activity
  - Due to release of two different NT
    - Sympathetic: release norepinephrine → adrenergic fibers
      - ✦ Processes that require energy
      - ✦ Increase HR, inc. glucose levels in blood, channel blood flow, inhibit digestive contractions
    - Parasympathetic: release acetylcholine (ACh) → cholinergic fibers
      - ✦ Conservation of energy
      - ✦ Stimulate smooth muscles in digestive tract to digest/store food
- “rest-repose”

# Central Nervous System

Brain

## Parasympathetic Division

Constricts pupil

Stimulates tear glands

Strong stimulation of salivary flow

Inhibits heart, dilates arterioles

Constricts bronchi

Stimulates stomach motility and secretion, stimulates pancreas

Stimulates intestinal motility

Contracts bladder

Stimulates erection

## Sympathetic Division

Dilates pupil

No effect on tear glands

Weak stimulation of salivary flow

Accelerates heart, constricts arterioles

Dilates bronchi

Inhibits stomach motility and secretion, inhibits pancreas and adrenals

Inhibits intestinal motility

Relaxes bladder

Stimulates ejaculation

from Cranial nerves

from Sacral nerves

from thoracic and lumbar nerves

