Physiology of Sensory System

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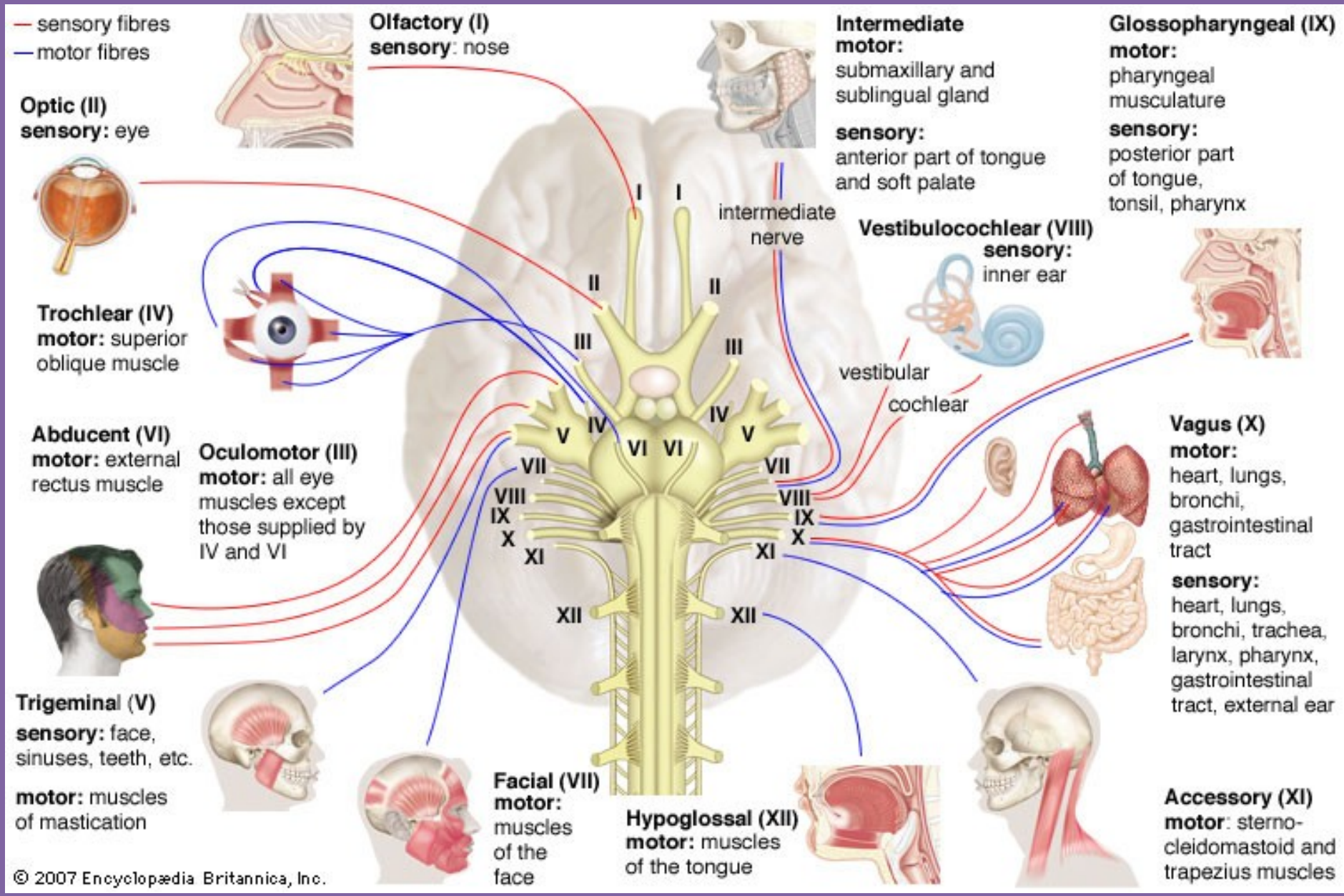
Sensory Organs

Sense	Organ
Touch	Skin (external)
Taste	Tongue
Smell	Nose
Hearing/ Equilibrium	Ears
Sight	Eyes

The Sensory System

- The central nervous system receives information from the internal and external environment via the sensory organs.
- Sensory organs are able to “sense” this information because of specialized receptors.
- When a receptor is triggered, it causes an action potential in the sensory neuron.



Types of Sensory Receptors

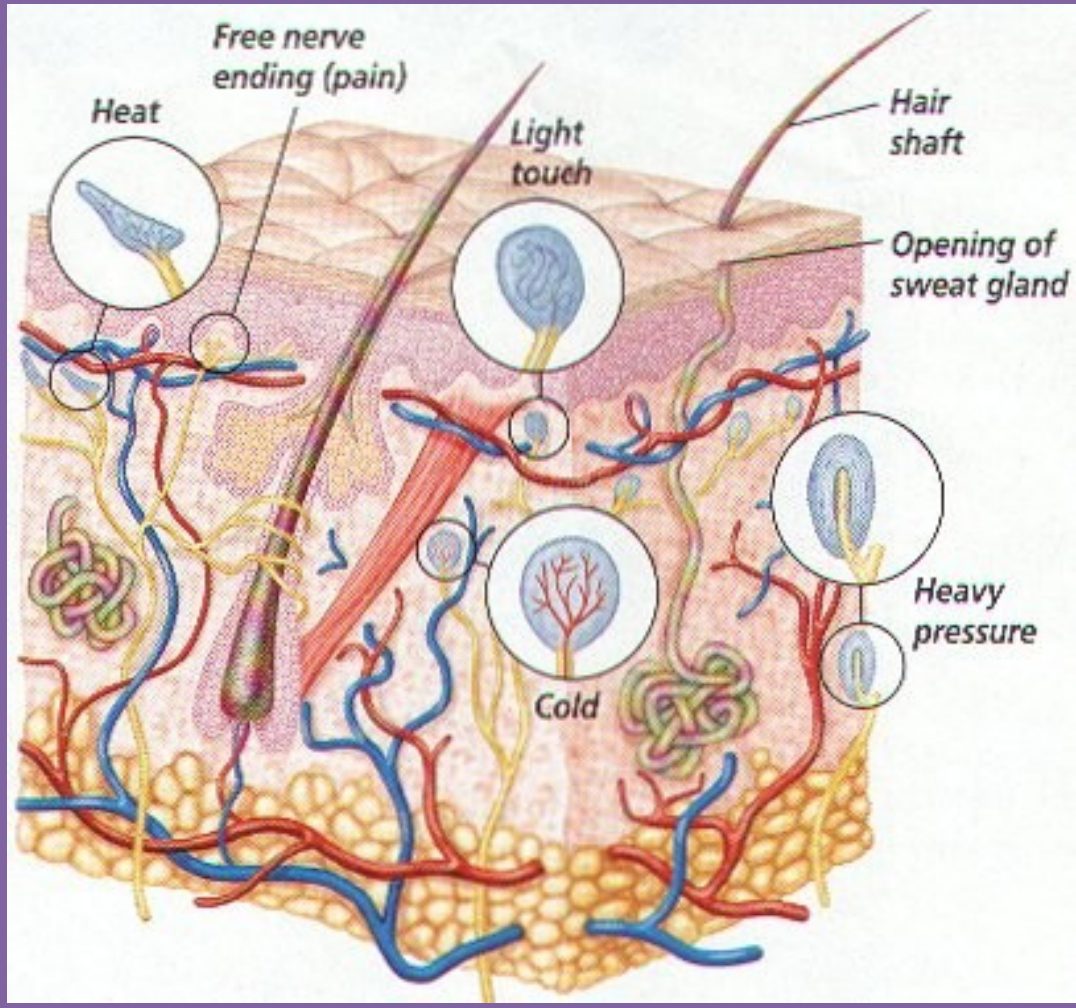
- 1. Mechanoreceptors – stimulated by changes in pressure or movement
  - Found in skin and muscles
- 2. Thermoreceptors – stimulated by changes in temperature
  - Found in skin
- 3. Pain receptors – stimulated by tissue damage
  - Found in skin and viscera

Types of Sensory Receptors (continued)

- 4. Chemoreceptors – stimulated by changes in chemical concentration of substances
  - Used for taste and smell
- 5. Photoreceptors – stimulated by light
  - Found only in the eye

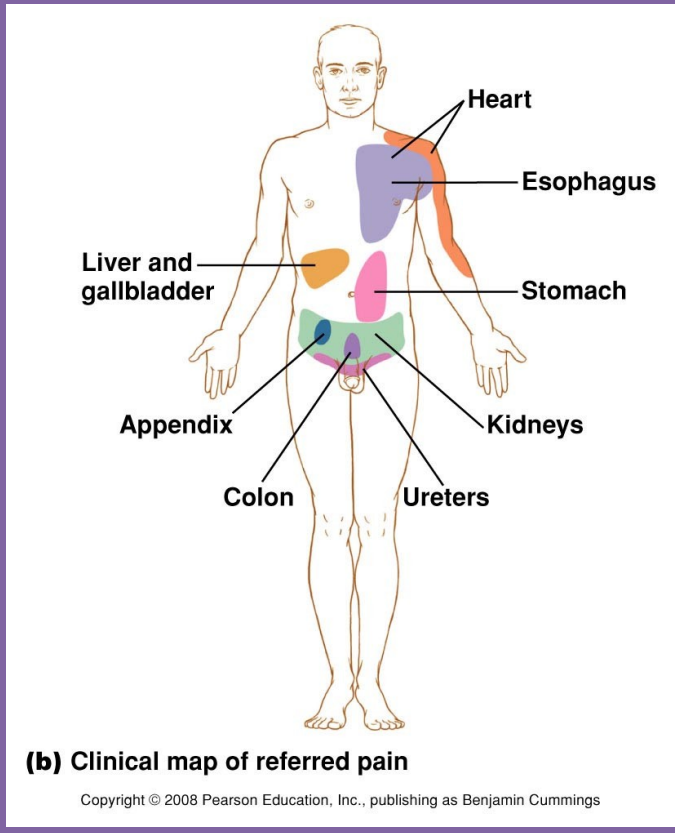
Sense of Touch

- Mechanoreceptors in the skin and viscera detect varying degrees of pressure.
- Free nerve endings have pain receptors and thermoreceptors.



Sense of Touch – Pain

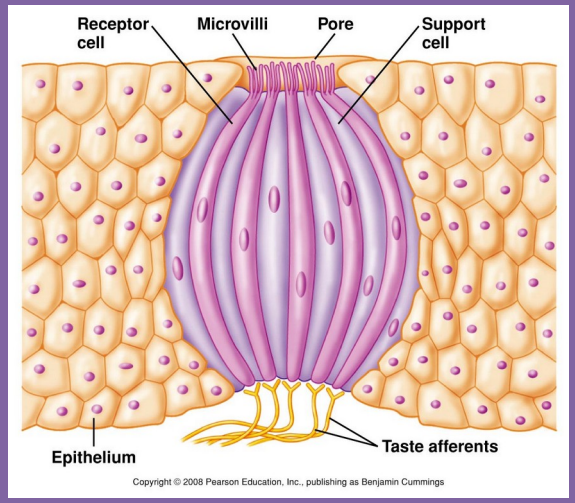
- Pain is caused by chemicals released by inflamed tissues.
  - Aspirin and ibuprofen reduce pain by blocking synthesis of these chemicals
- Referred pain – inside the body's organs, pain is often felt in another area.
  - Ex: Pain from the heart is felt in the left shoulder and arm

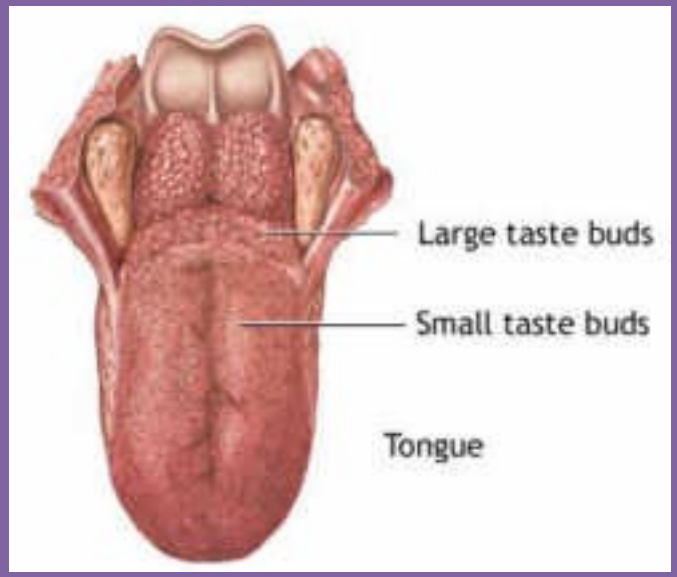


(b) Clinical map of referred pain

Senses of Taste & Smell

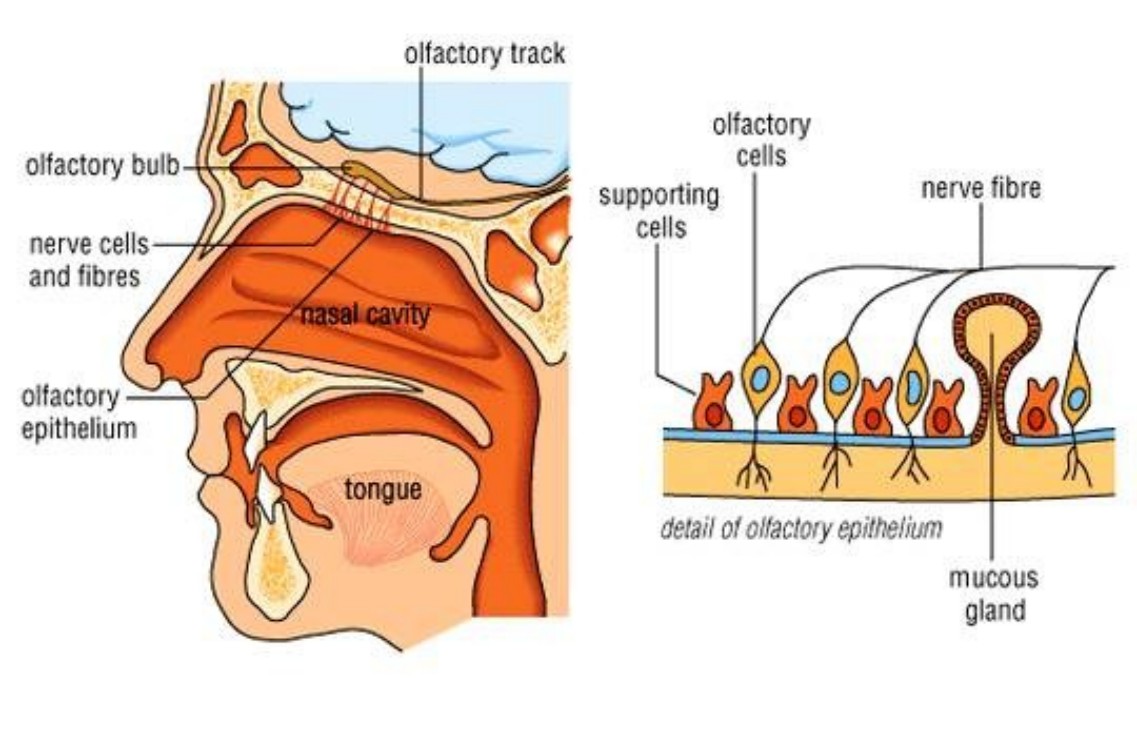
- Taste and smell are "chemical senses"
- Taste – tastebuds containing chemoreceptors are found in the epithelium of the tongue
- Papillae (bumps) on the tongue contain many receptors
- Receptors can distinguish between sweet, sour, salty, and bitter tastes.





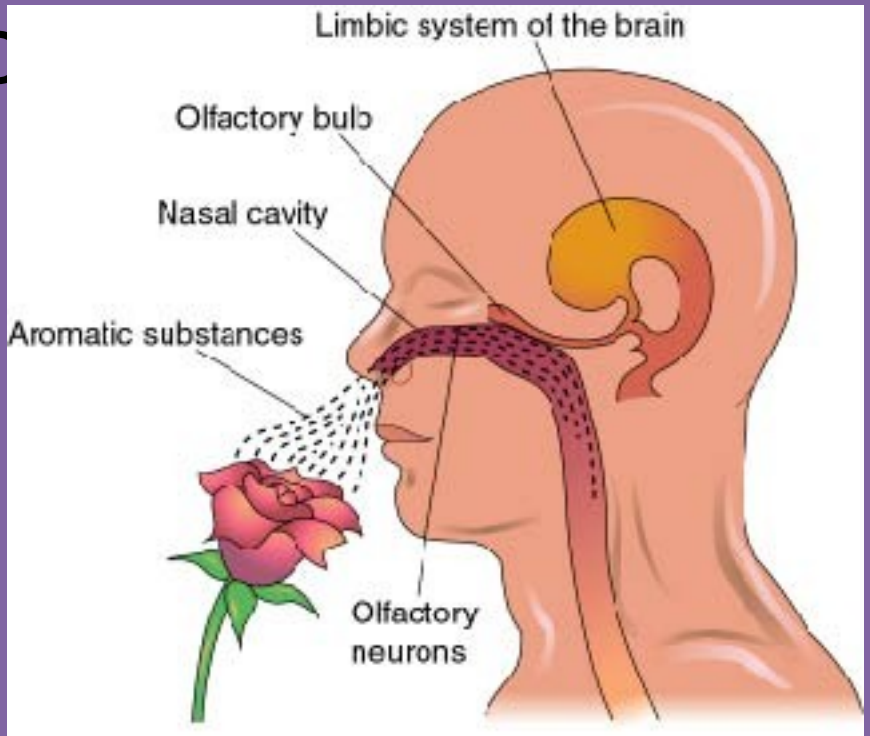
Senses of Taste & Smell

- Smell – within the nasal cavity, chemoreceptors in the olfactory bulb are stimulated by odor molec



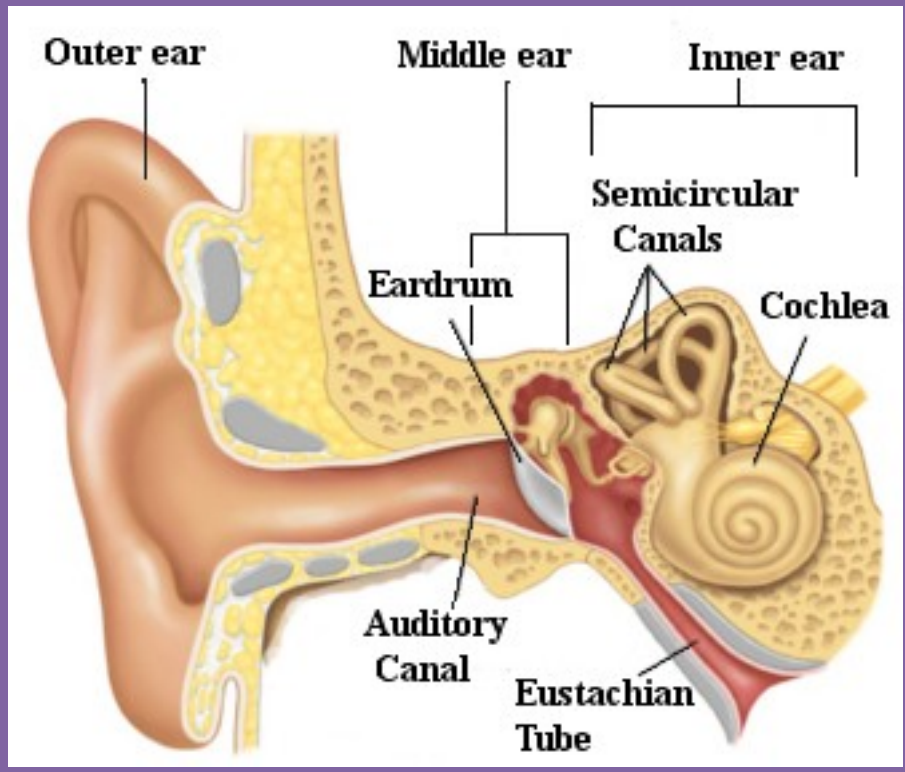
Senses of Taste & Smell

- Smells have been shown to be linked to memories because the olfactory bulb is linked to the limbic system c



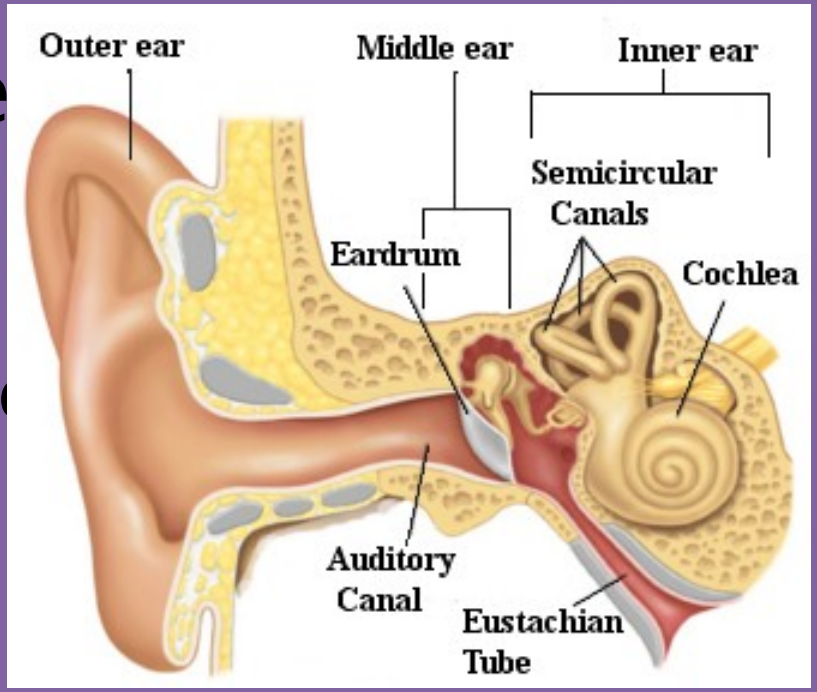
Sense of Hearing

- Anatomy of the Ear
  - 1. Outer Ear – includes:
    - pinna (external ear)
    - auditory canal



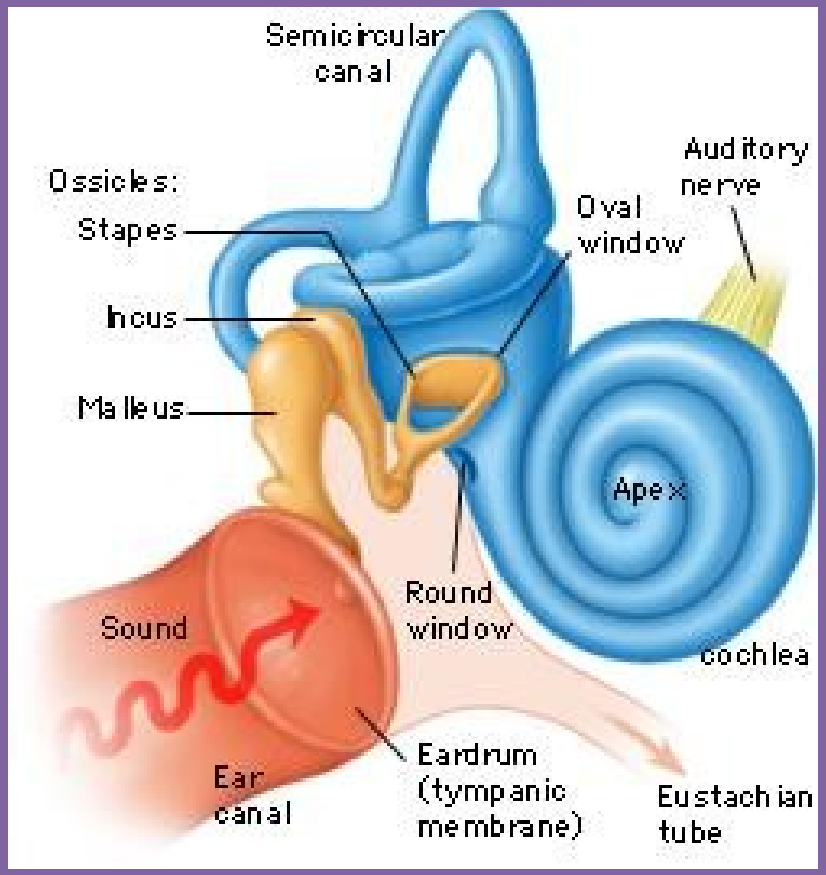
Sense of Hearing

- Anatomy of the Ear
  - 2. Middle Ear- include
    - Eardrum (tympanic membrane)
    - Ossicles – 3 small bon
      - 1) Malleus (hammer)
      - 2) Incus (anvil)
      - 3) Stapes (stirrup)
    - Eustachian tube – equalization of air pressure (“pops” ear)



Sense of Hearing

- Anatomy of the Ear
  - 3. Inner Ear – includes:
    - Semicircular canals – involved with equilibrium
    - Cochlea – snail-shaped structure involved with hearing

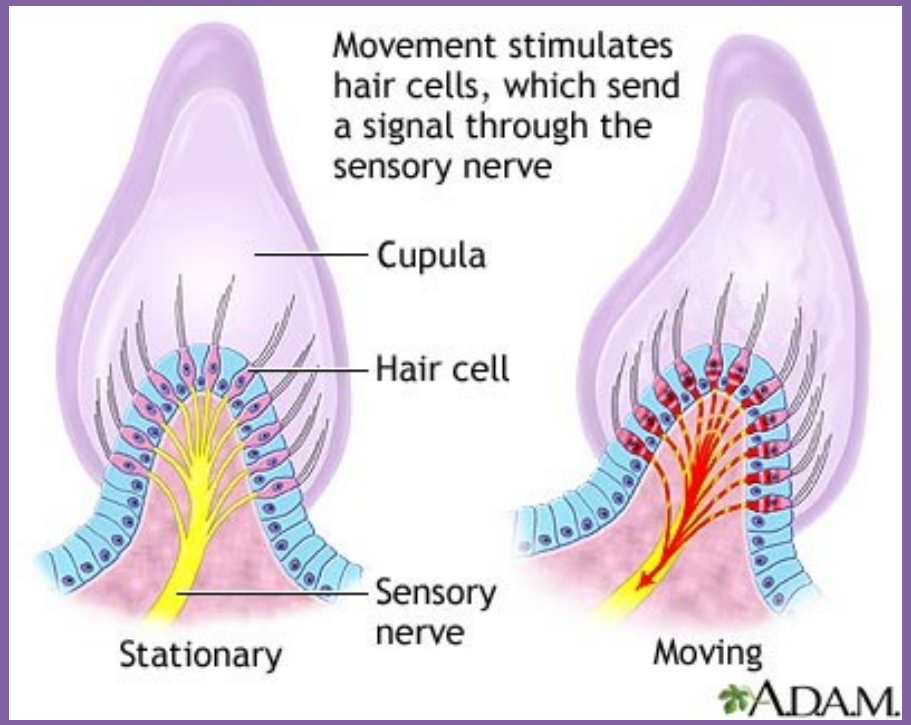


Sense of Hearing

- How we Hear
  - 1. Sound waves travel through the auditory canal to the eardrum.
  - 2. The sound waves cause the eardrum to vibrate.
  - 3. The vibration causes the malleus (hammer) to hit the incus (anvil) and then the stapes (stirrup).
  - 4. The vibration passes to the fluid in the cochlea of the inner ear.
  - 5. Each part of the spiral cochlea is sensitive to different frequencies of sound.
  - 6. The auditory nerve takes impulses to the brain.

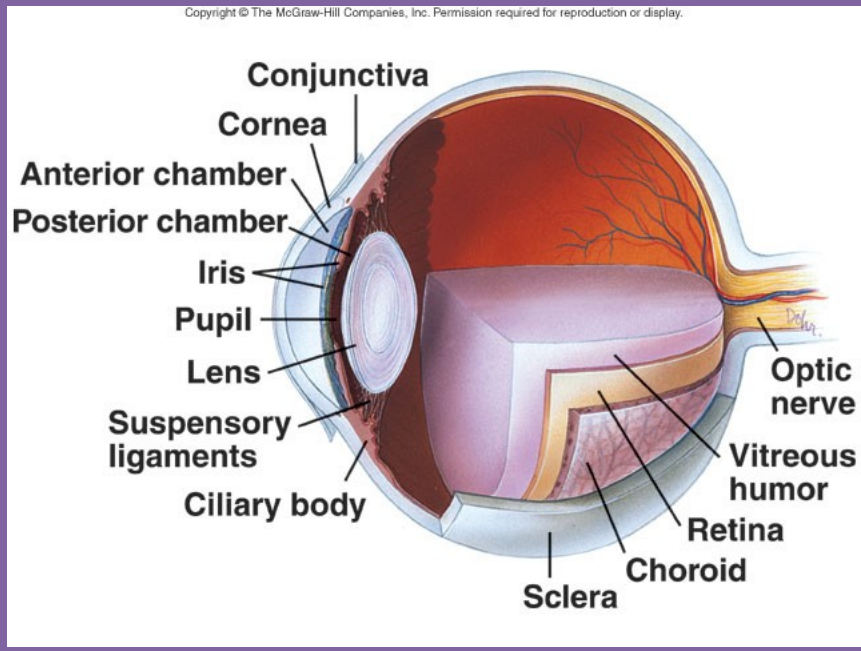
Sense of Hearing

- Equilibrium
  - Mechanoreceptors in the semicircular canals detect rotation and movement of the head
  - Little hair cells send information to the brain to cause appropriate motor output so as to correct position when it is unbalanced.
  - Vertigo (dizziness)



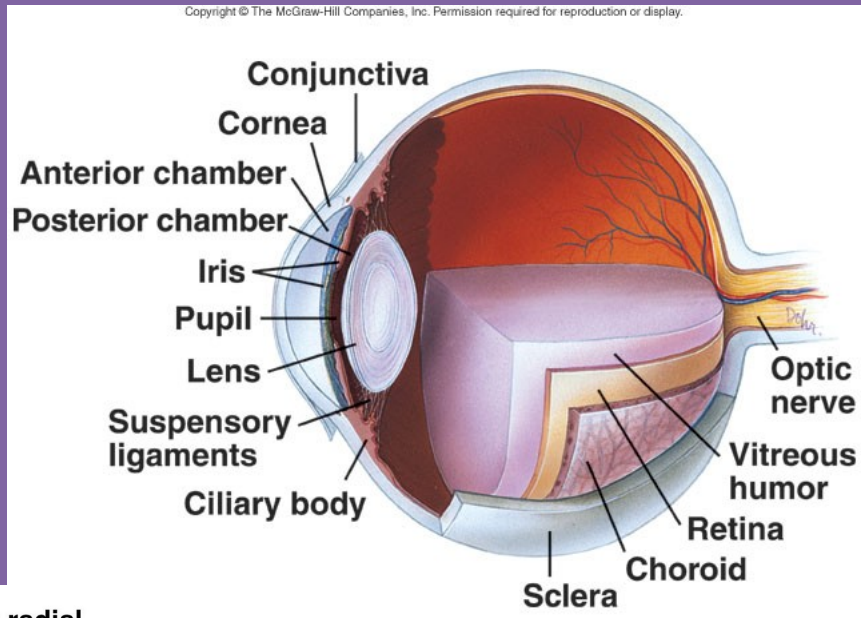
Sense of Sight

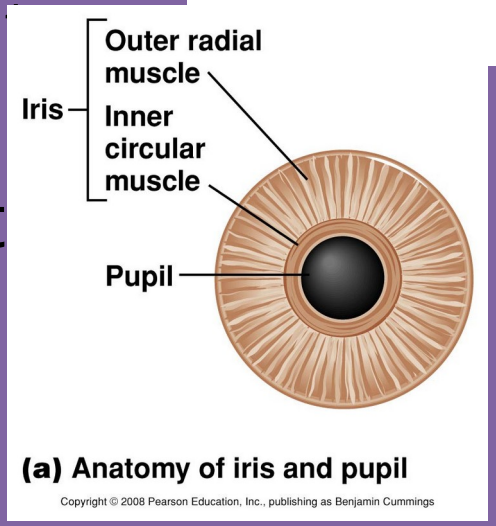
- Anatomy of the Eye
  - Sclera – protection (white of eye)
  - Cornea – refracts light
  - Vitreous humor – maintains eyeball shape
  - Retina
    - Rods – black & white vision
    - Cones – color vision
  - Optic nerve – sends impulses to brain

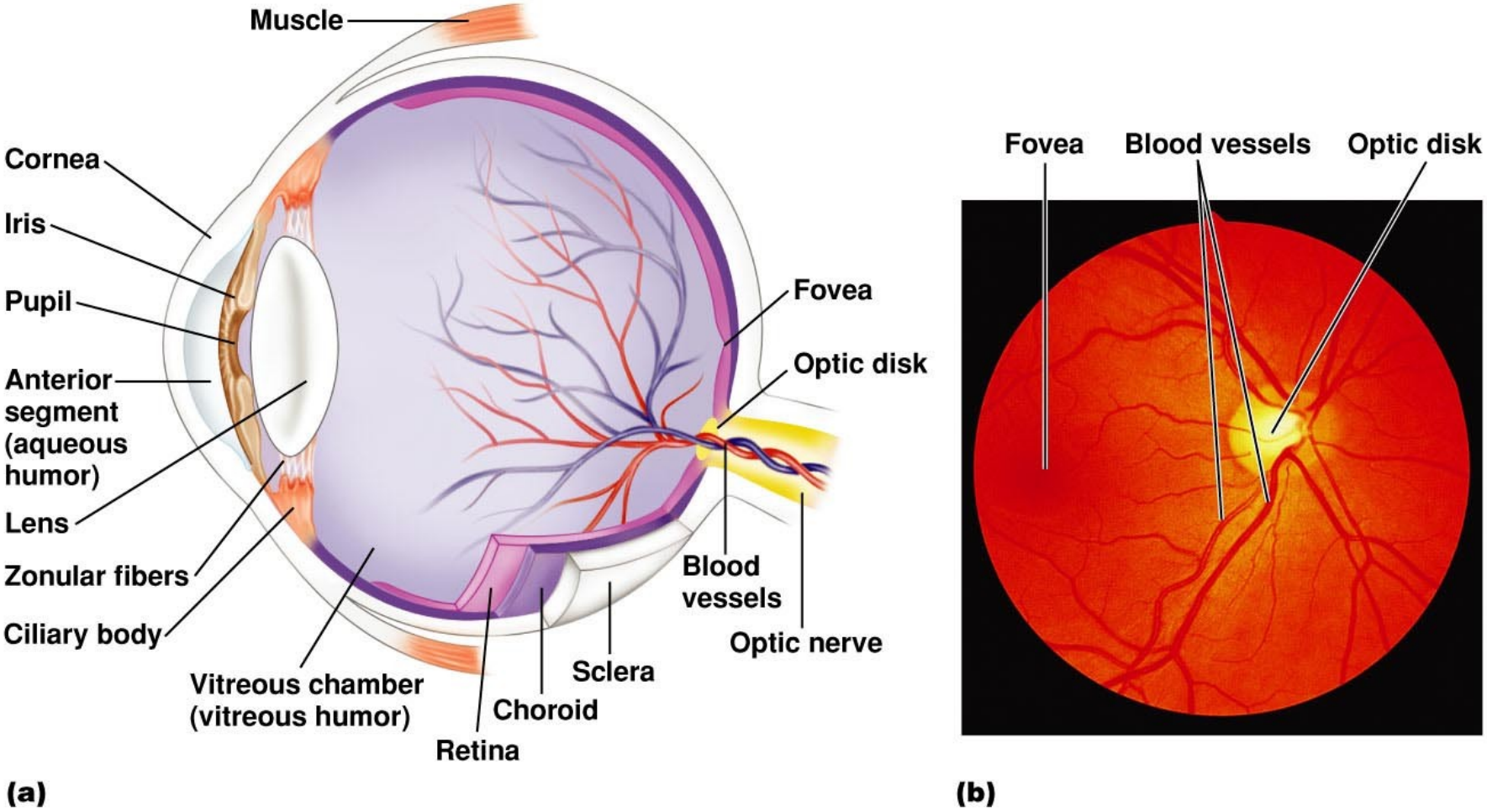


Sense of Sight

- Anatomy of the Eye
  - Lens – focuses light
  - Cilliary body – holds lens in place, accommodation
  - Iris – regulates ligh entrance (muscle)
  - Pupil – admits light

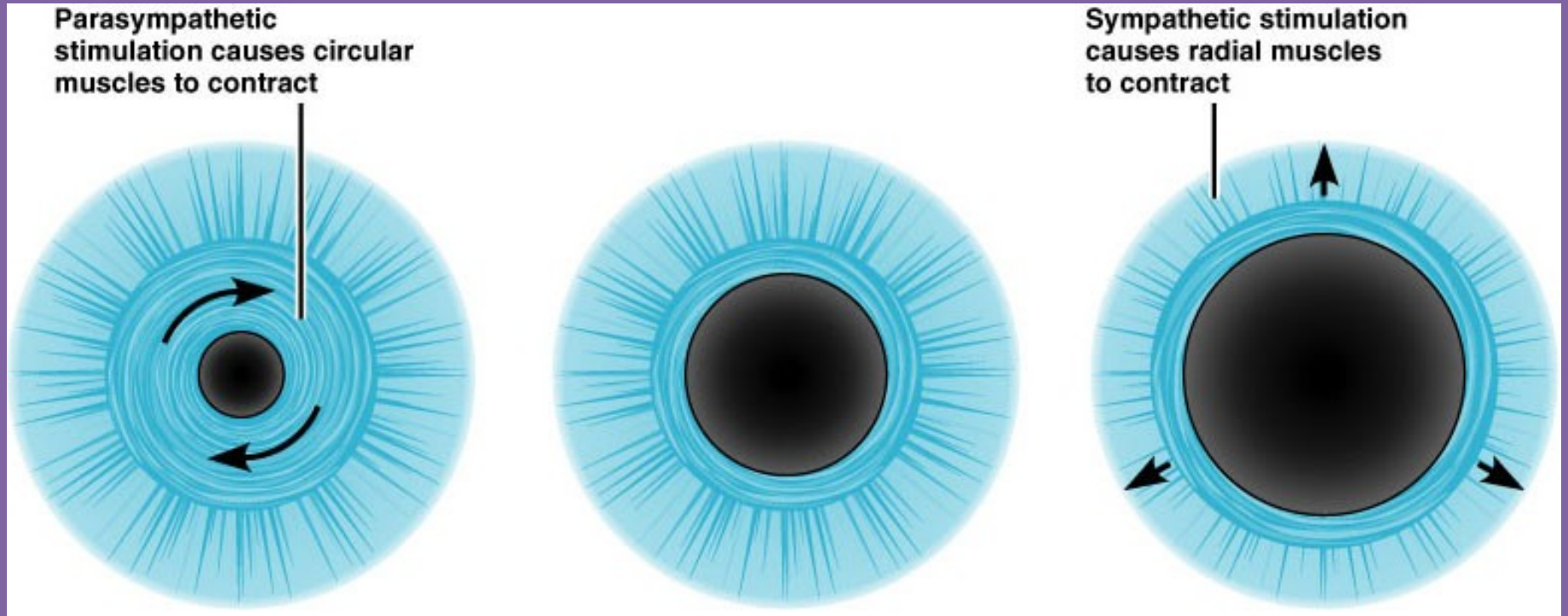






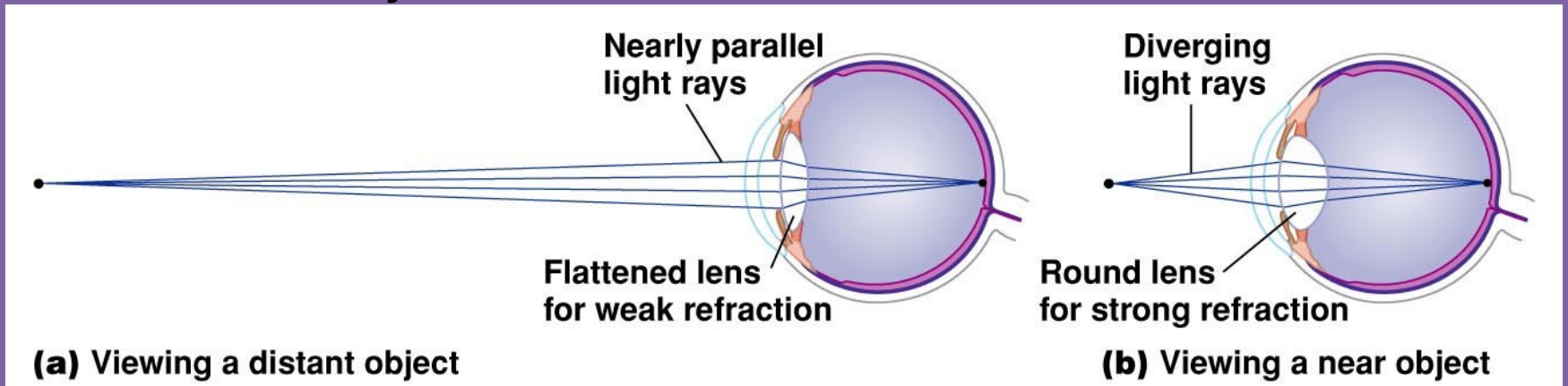
Sense of Sight

- How we see
  - 1. Light enters through the pupil.
    - The iris can contract or dilate to allow different amounts of light into the eye.



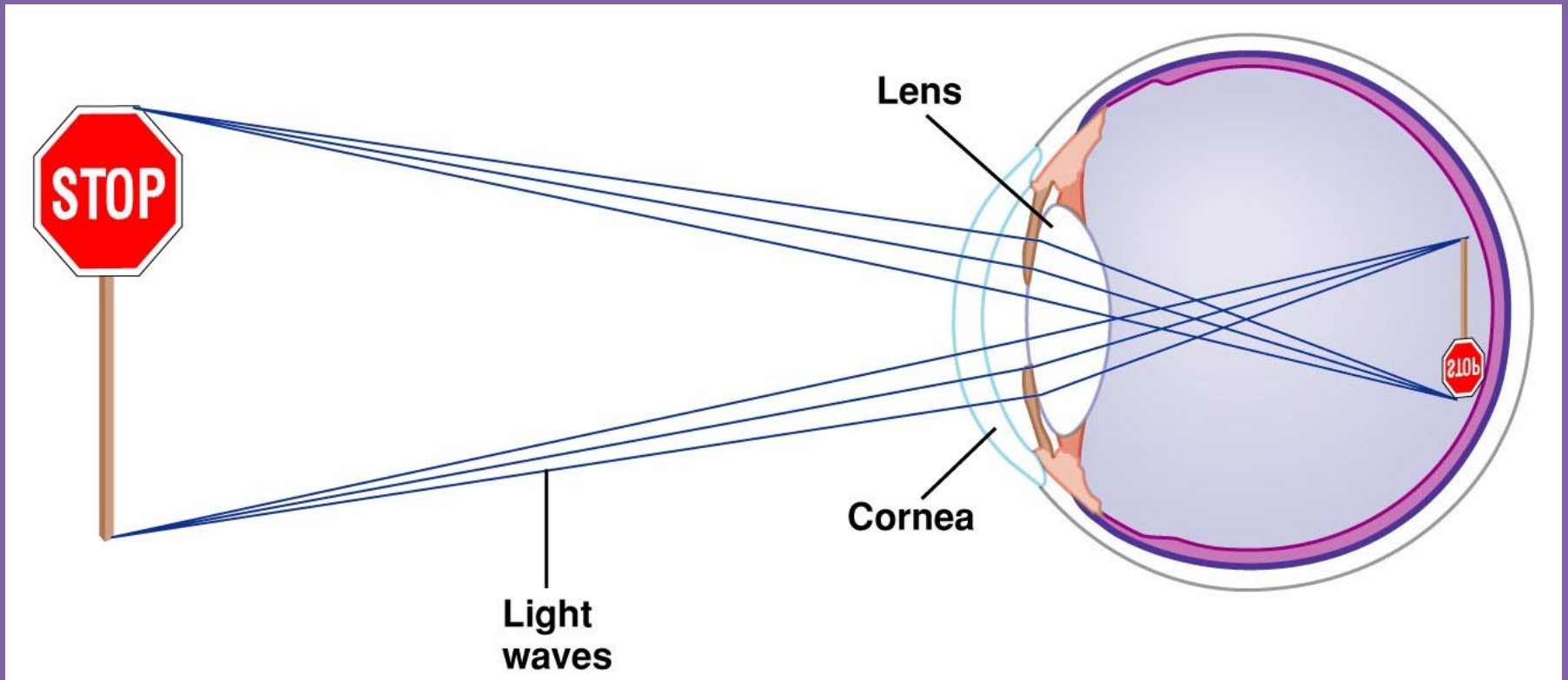
Sense of Sight

- How we see
  - 2. Light passes through the lens and vitreous humor to the back of the eye, the retina.
    - The lens can change shape to focus light through accommodation.
      - Object is far → the lens flattens



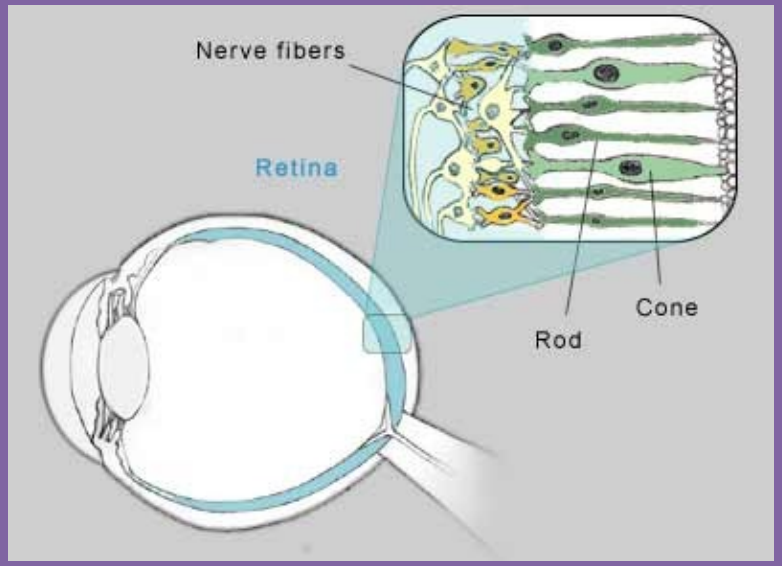
Sense of Sight

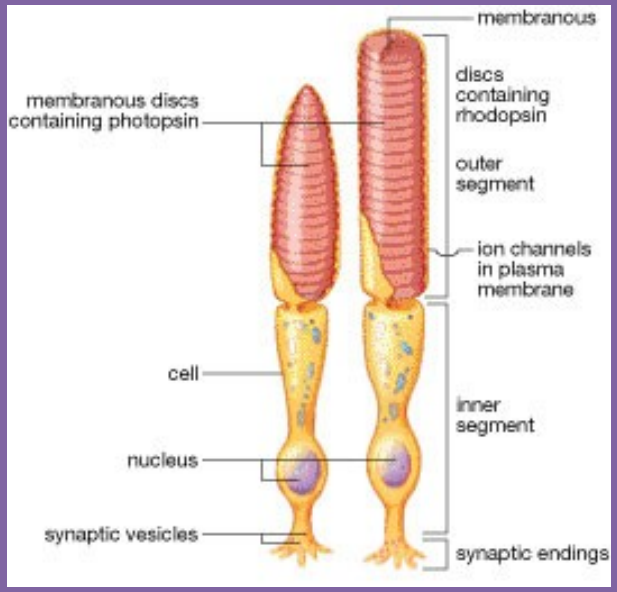
- How we see
  - The image projected from the lens on the back of the eye is upside down.



Sense of Sight

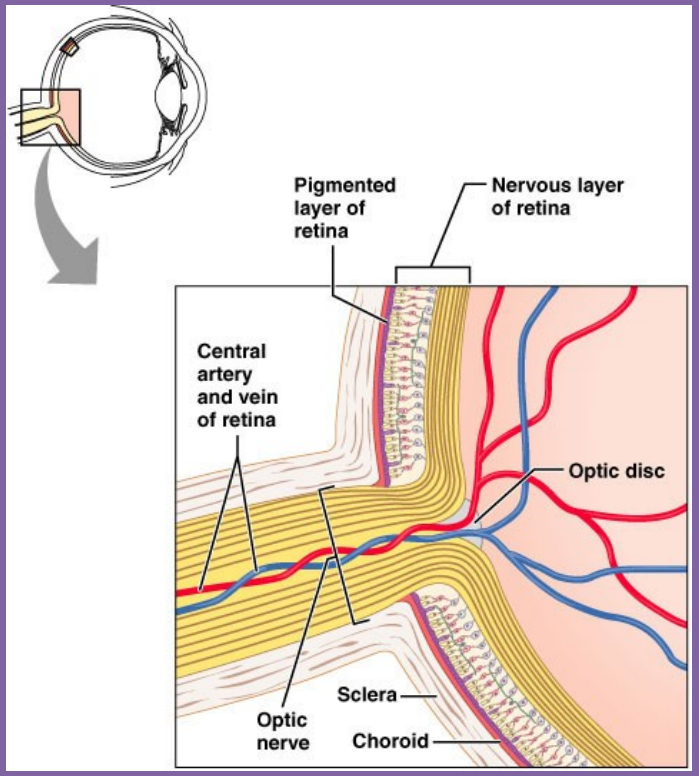
- How we see
  - 3. The retina has photoreceptor cells that detect light and send impulses to the brain.
    - Rods – black and white vision
      - sensitive to light; night vision
    - Cones – color vision & detail
      - Sensitive to bright light
      - Blue, green, and red pigment cones detect different wavelengths of light





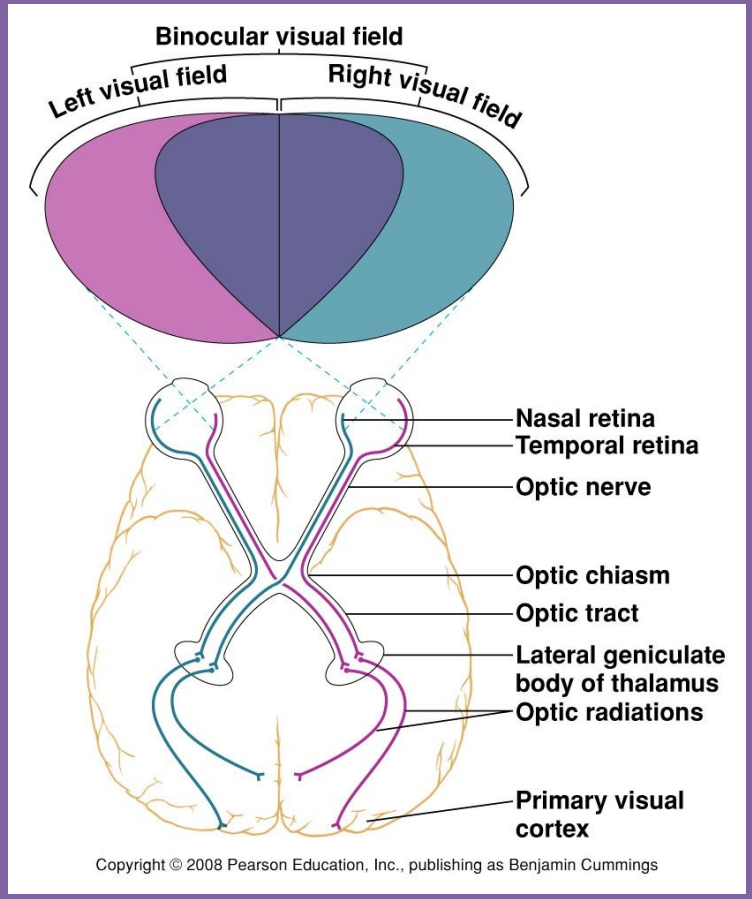
Sense of Sight

- How we see
  - 4. Impulses from the rods and cones in the retina are sent to the optic nerve
    - This spot on the retina has not rods or cones and creates a blind spot.



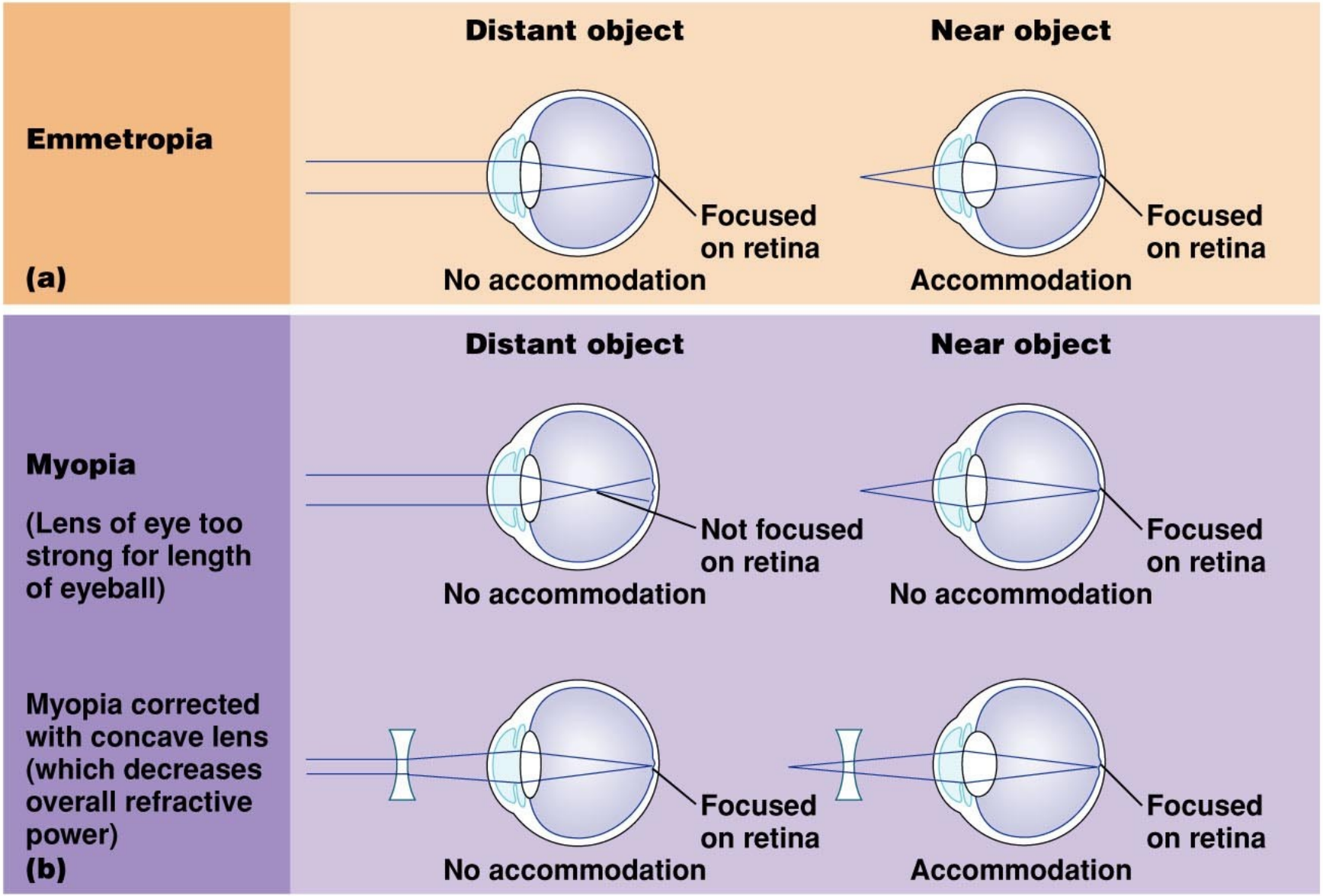
Sense of Sight

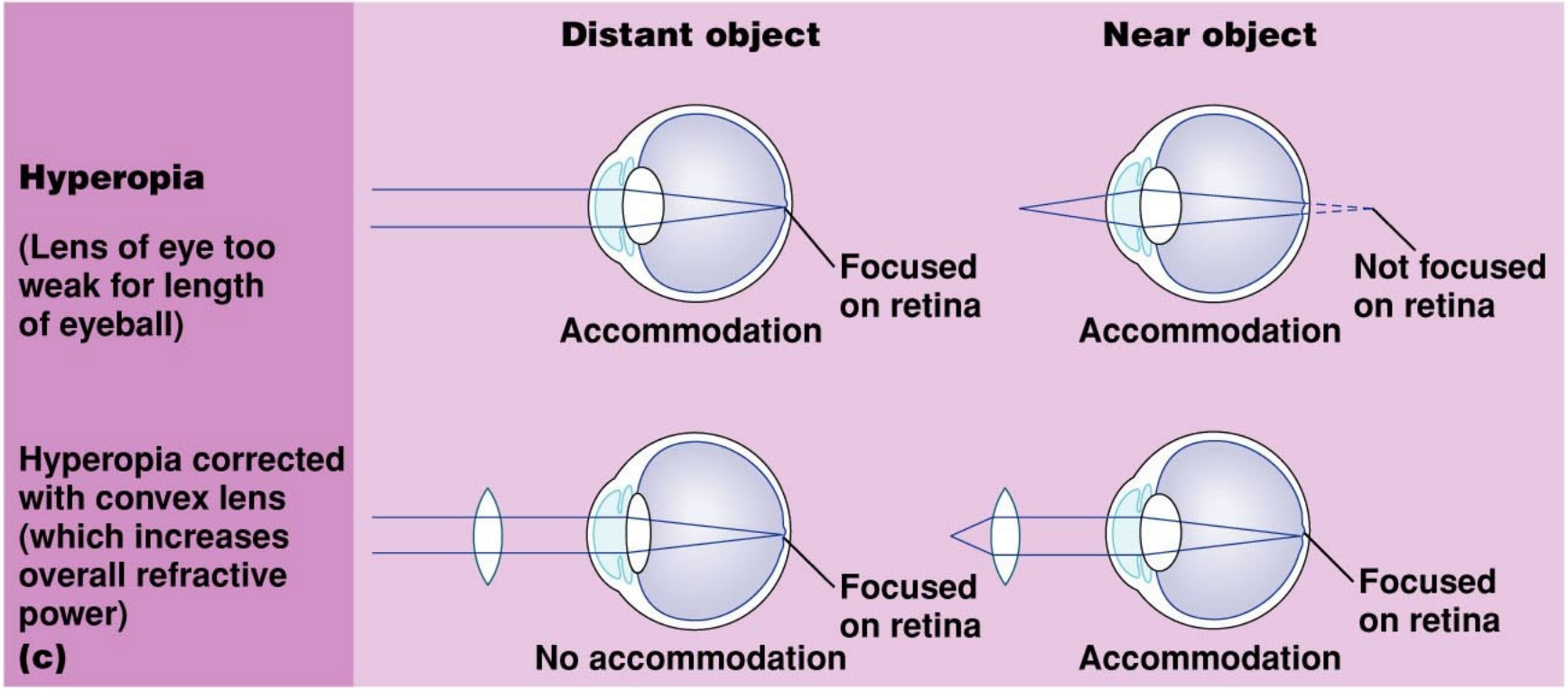
- How we see
  - 5. The optic nerves from each eye cross at the optic chiasm.
    - Input from the right eye goes to the left occipital lobe
    - Input from the left eye goes to the right occipital lobe
  - 6. Visual integration centers in the occipital lobe process visual input.



Vision Disorders

- Farsightedness: trouble seeing close-up
  - eye too short and/or lens too weak
  - light focuses behind retina
  - correct with “convex” lens to add power
- Nearsightedness: trouble seeing far away
  - eye is too long and/or lens is too powerful
  - light focuses in front of retina
  - correct with “concave” lens to reduce power





- Presbyopia: Oldsightedness
  - The crystalline lens tends to harden with age
  - The near point of distinct vision moves further and further away from the eye with age.

Astigmatism

- Abnormal curvature of the cornea
- Light from vertical and horizontal direction do not focuses in the same point
- Cor
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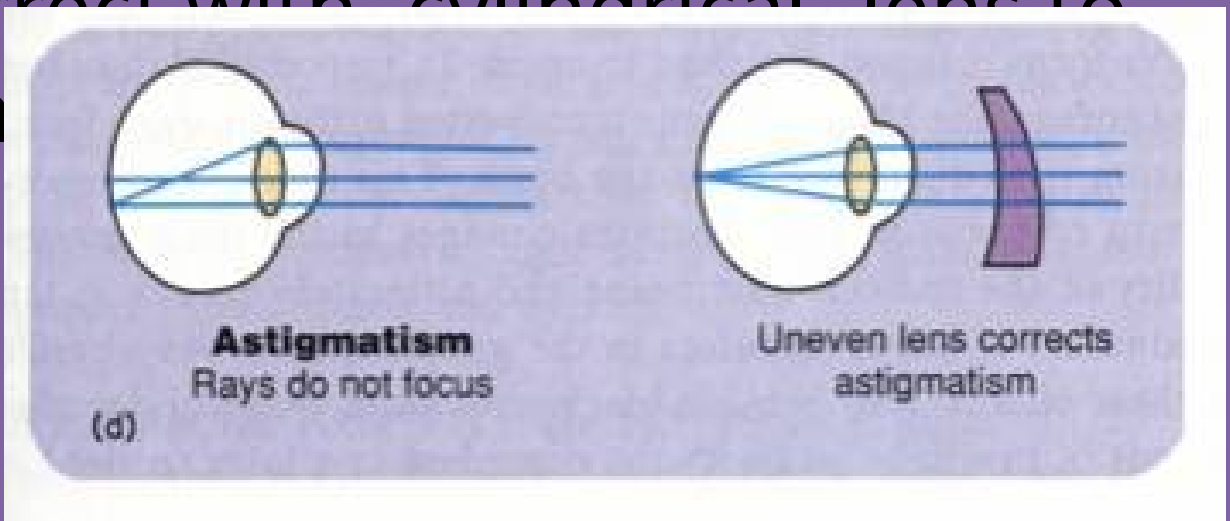
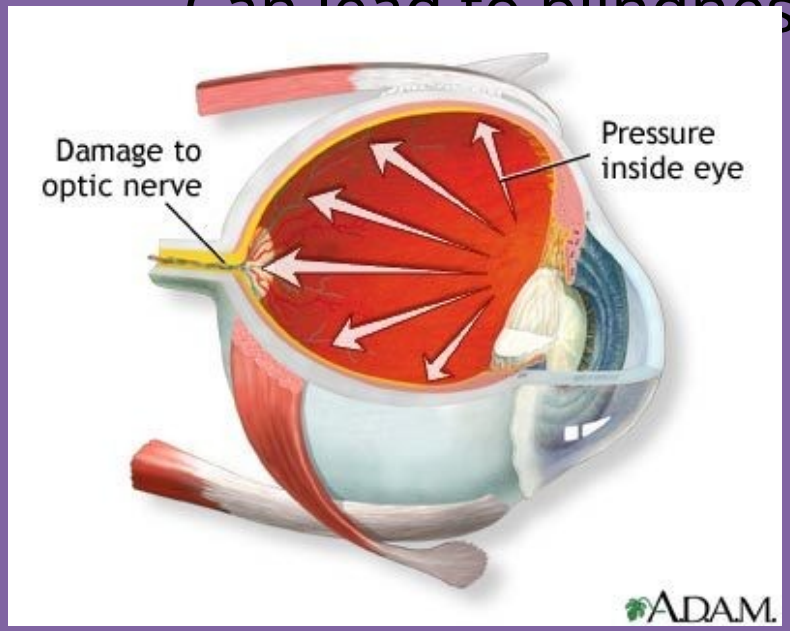


Color Blindness

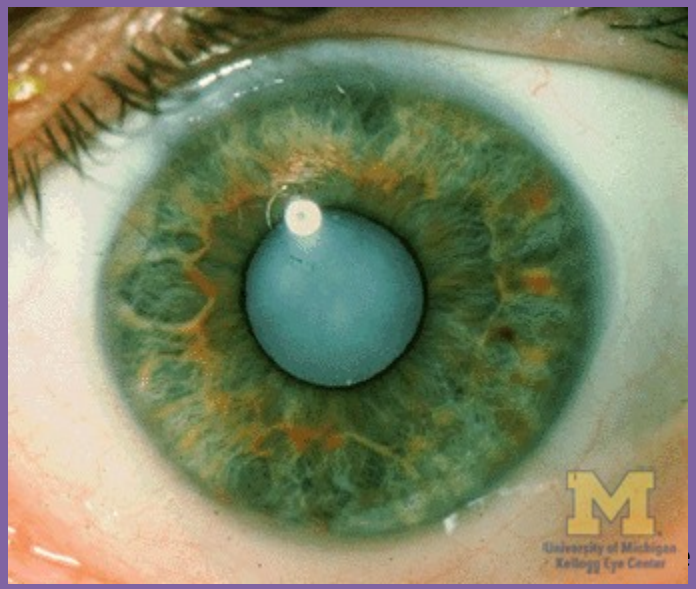
- Red-green color-blindness – occurs when red or green cones or pigments are missing
  - Due to sex-linked gene (on X chromosomes) so more common in men.
- Non-sex-linked condition
  - Blue-color blindness- missing blue cones or pigments
  - Monochromats: people who are totally colorblind, more severe

Disorders of the Eye

- Glaucoma
  - Damage to the optic nerve occurs due to increased eye pressure
  - Can lead to blindness



- Cataracts
  - Clouding of the lens that affects vision
  - Very common in older people



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