Chapter 22

Human Senses

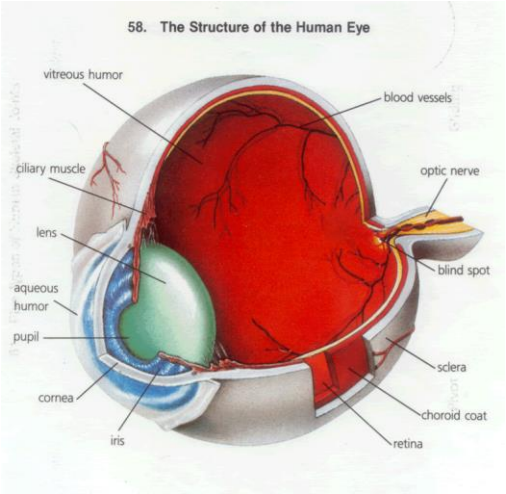
What are the 5 Senses?

- 1. Sense of Sight – Vision
- 2. Sense of Hearing - Auditory
- 3. Sense of Smell – Olfactory
- 4. Sense of Taste –
- 5. Sense of Touch -

Vision - Structure

Need to know these structures & their function:

- **Cornea**: begins to focus light
- **Aqueous humor**: fluid between inside of cornea & the outside of the lens
- **Iris**: the color of the eye. A muscle that opens & closes to regulate pupil size
- **Pupil**: hole through which light passes
- **Lens:** flexible structure that focuses image on the retina



Vision - Structure

Need to know these structures & their function:

- **Ciliary muscle**: ligaments attach the lens to these, they contract & stretch the lens allowing near & far focus
- **Vitreous humor**: fluid inside eyeball maintains size & shape of the eye
- **Retina:** contains the rods & cones that are sensitive to light
- **Choroid coat**: middle layer of the eyeball
- Sclera: the outer "whites of the eye"
- **Optic nerve**: takes rod & cone impulse back to the occipital lobe for processing

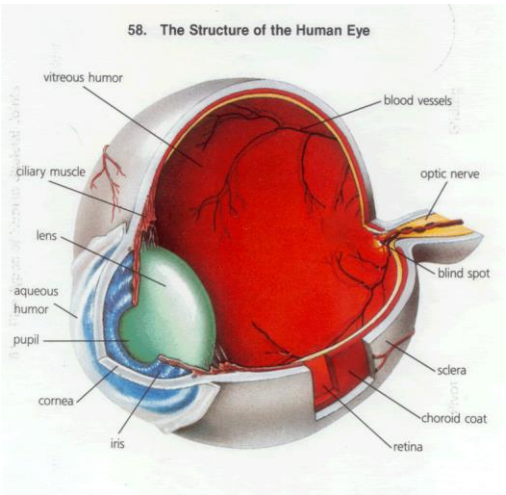
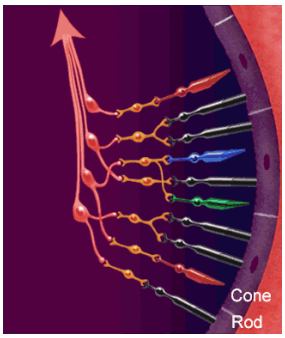
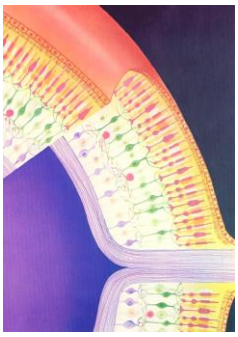
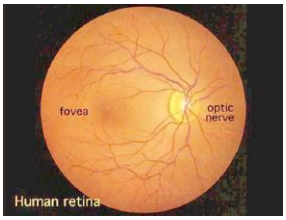


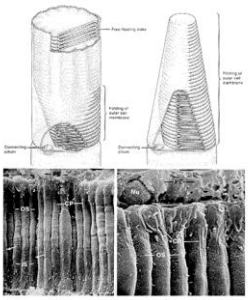
Image Processing

- **Fovea** – The central region where images focused is the **fovea**.
- **Rods** – about **1 billion**, sensitive to brightness, light and dark & movement
- **Cones** – detect color, about **3 million**. 3 types of cones, sensitive to red, blue & green wavelengths of light.
- All rods & cones have nerve fiber attached, these collect at the back of the eye and form the optic nerve which carries the signal back to the eye.



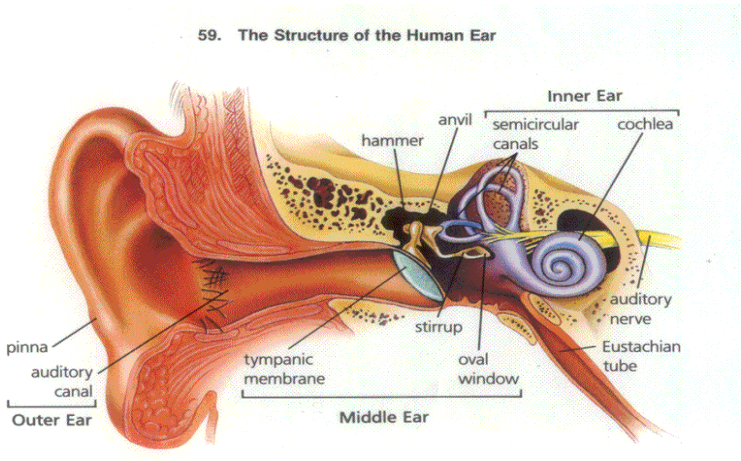






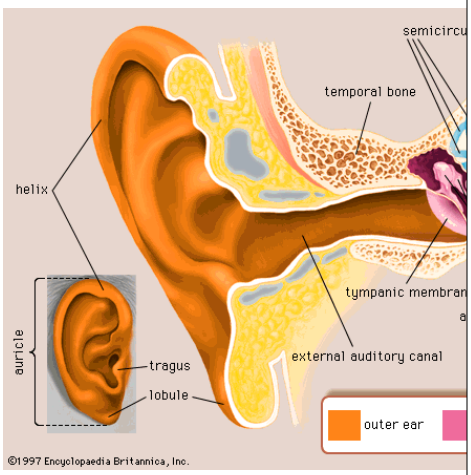
Hearing – Human Sound

Need to know these structures & their function: Outer Ear, Middle Ear, Inner Ear, Pinna, Auditory canal, Tympanum, Malleus, Incus, Stapes, Oval Window, Cochlea, Auditory Nerve, Semicircular Canals, Eustachian Tube



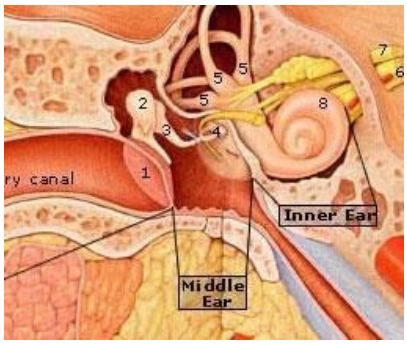
Outer Ear

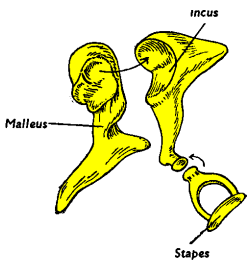
- **Pinna**- (the ear flap aka **auricle**), used to focus the sound waves into the ear canal
- **External Auditory Meatus** – the "hole through the temporal bone that opens the space for the ear canal, the middle & inner ears
- **Auditory Canal** – (ear canal), focuses the sound onto the ear drum
- **Tympanic membrane** – (ear drum), end of the outer ear, beginning of the middle ear. Sound starts the ear drum vibrating.



Middle Ear

- Tympanic membrane vibrates
- Causing the 3 smallest bones in to vibrate, one after the next
  - **Malleus** (hammer) is touching the ear drum & vibrates first
  - Next is the **Incus** (anvil)
  - Last is the **Stapes**
  - **Eustachian Tube**: tube that connects the middle ear w/ the pharynx. This allows the pressure on both sides of the ear drum to equalize.



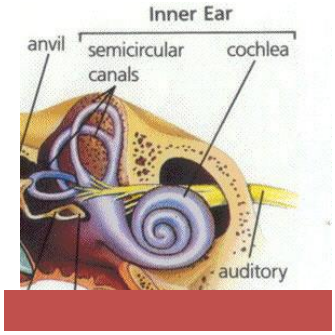


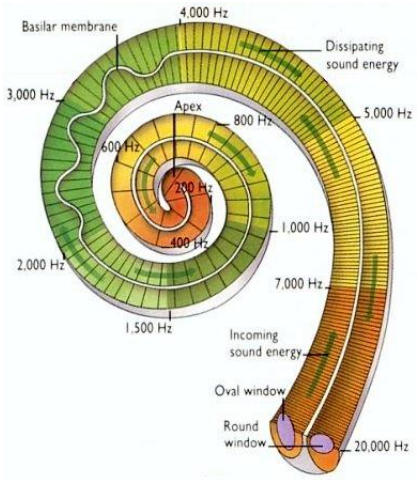
The Bones of the Middle Ear.

Inner Ear

The Stirup vibrates the oval window of the cochlea. Cochlea is a long fluid filled tube, folded in half and the coiled up like a snail shell. The entire inner surface is lined w/ cillia. Attached to the cillia is a nerve fiber. Once cillia are vibrated, the attached nerves are stimulated & send signal to the brain.

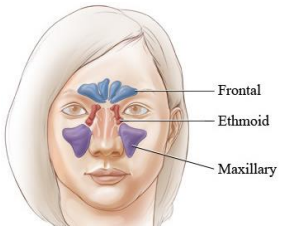
Balance is achieved by the semicircular canals. 3 canals in 3 different planes are able to determine body position in space

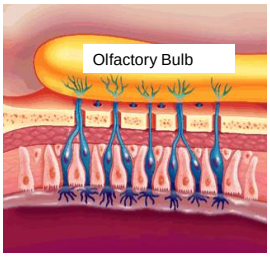


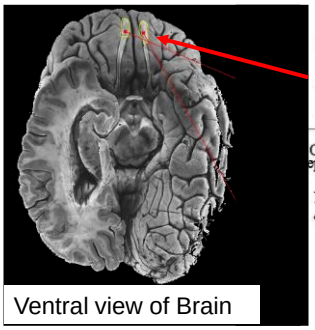


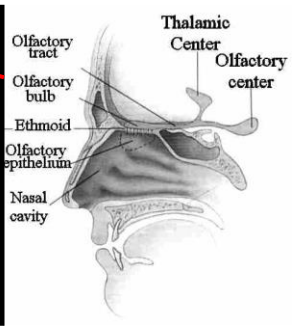
Sense of Smell - Olfaction

- **Odors** – chemical molecules floating in the air
- 3 main sinuses w/ **Turbinates** that cause the breathed air to mix
- Surface of sinuses is called the **Mucosa**, Made of **epithelial cells**
- On superior surface of the ethmoid sinus are 1000's of **Olfactory Cells**
- Odors bind w/ Olfactory Cells which stimulate attached **olfactory nerves**
- These nerves combine & organize in one of two **Olfactory Bulbs**
- Bulbs attach by olfactory tract directly to the brain



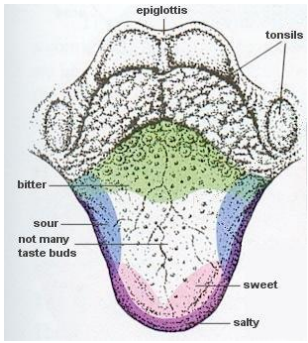


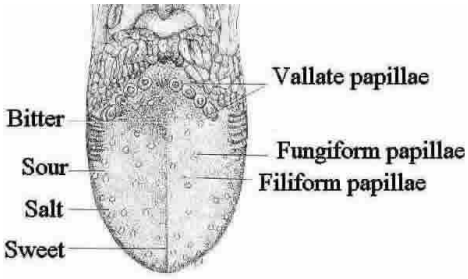

Ventral view of Brain



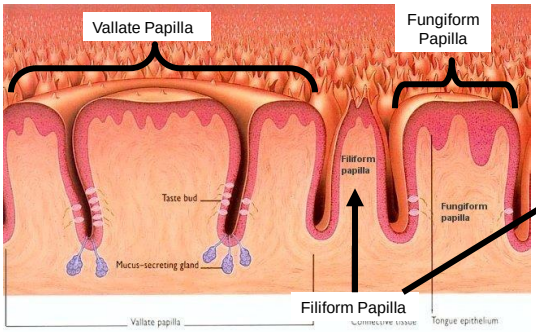
Taste

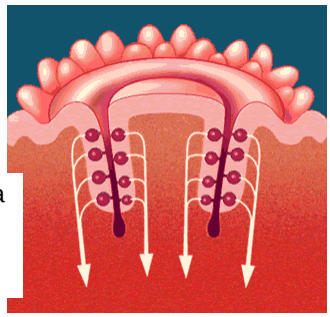
- Brain can sense 4 basic tastes: **Sweet, Sour, Salty & Bitter**
- 50 -150 Taste Receptor Cells make up a **Taste Bud.**
- Many Taste Buds are located on **Papilla** (the "bumps" on the upper surface of the tongue)
- Most taste buds located **on sides & back** of tongue, very few in middle of tongue
- Most Papilla are on the tongue but also found on the palate, pharynx & epiglottis
- 3 types (shapes) of Papilla
  - **Vallate** Papillae
  - **Fungiform** papillae
  - **Filiform** papillae





3 Types of Papillae

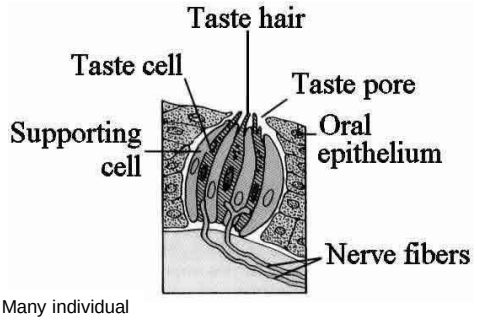


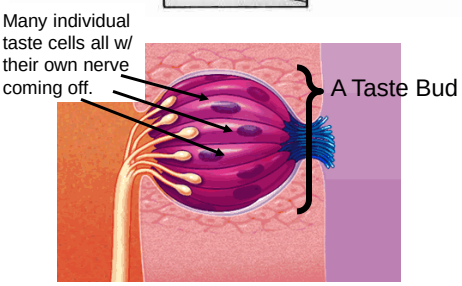


Taste Buds on a Vallate Papilla. Arrows indicate nerves

50 -150 Taste Cells per Taste Bud

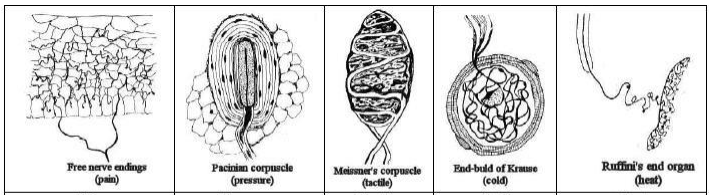
- Each **taste cell** is located in the Oral Epithelium & consists of small hairs attached to nerve receptors that lie in the **taste pore**.
- dissolved food or drink **binds** to a **receptor**, like a key in a lock.
- If the key fits, then the taste cell sends a **signal** to the **brain**, telling it that this morsel is **sweet, salty, sour,** or **bitter.**





Sense of Touch

- Touch receptors are nerve cells that tell your brain about tactile sensations.
- **Mechanoreceptors** – (pain, pressure & tactile)
  - **Pain** - **Free nerve endings** informs the brain about pain, and they are located over the entire body.
  - **Pressure** – detects pressure and limb position
  - **Tactile** - are located all over the skin but grouped mainly on the skin of the fingertips & lips. Only stimulated when touched. They tell the brain the shape and feel of an object in the hand, or the touch of a pleasant or aggravating touch. They adjusts to the environment, which is why the brain eventually ignores clothing that you are wearing.
- **Thermoreceptors** – (heat & cold)
  - **Cold** - can be found in the skin, conjunctiva, lips, and tongue.
  - **Heat** - are found over the entire body in the skin.



Pain	Pressure	Tactile	Cold	Heat
Mechanoreceptors			Thermoreceptor	