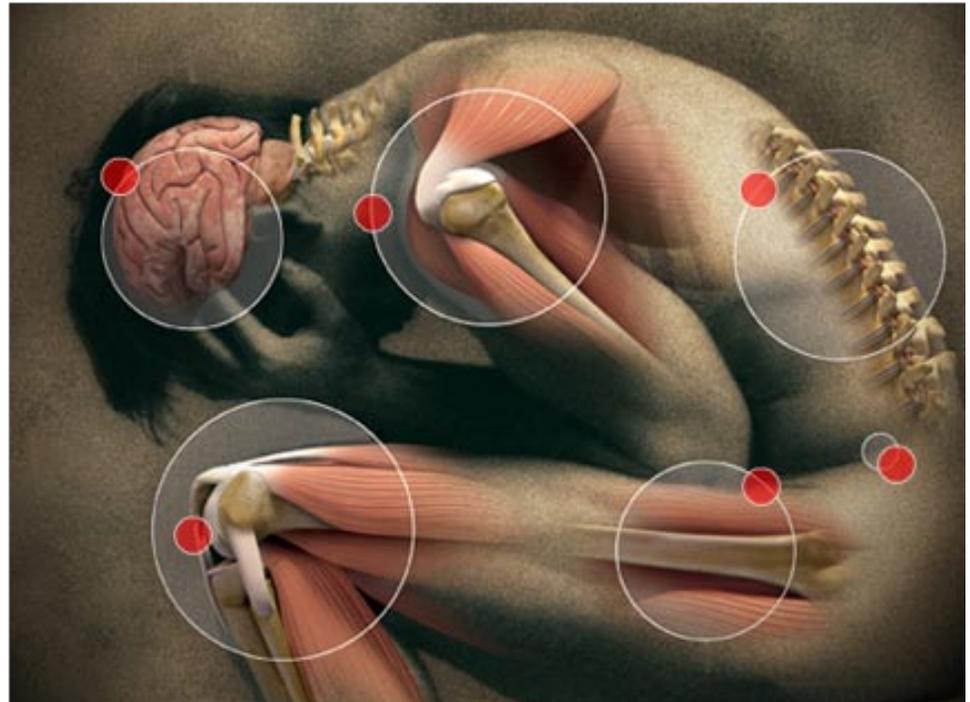


# SENSES

Sensory Receptors - detect environmental changes and trigger nerve impulses

- somatic senses (touch, pressure, temp, pain)
- special senses (smell, taste, vision, equilibrium)



# Receptors

1. Chemoreceptors =

---

2. Pain receptors =

---

3. Thermoreceptors =

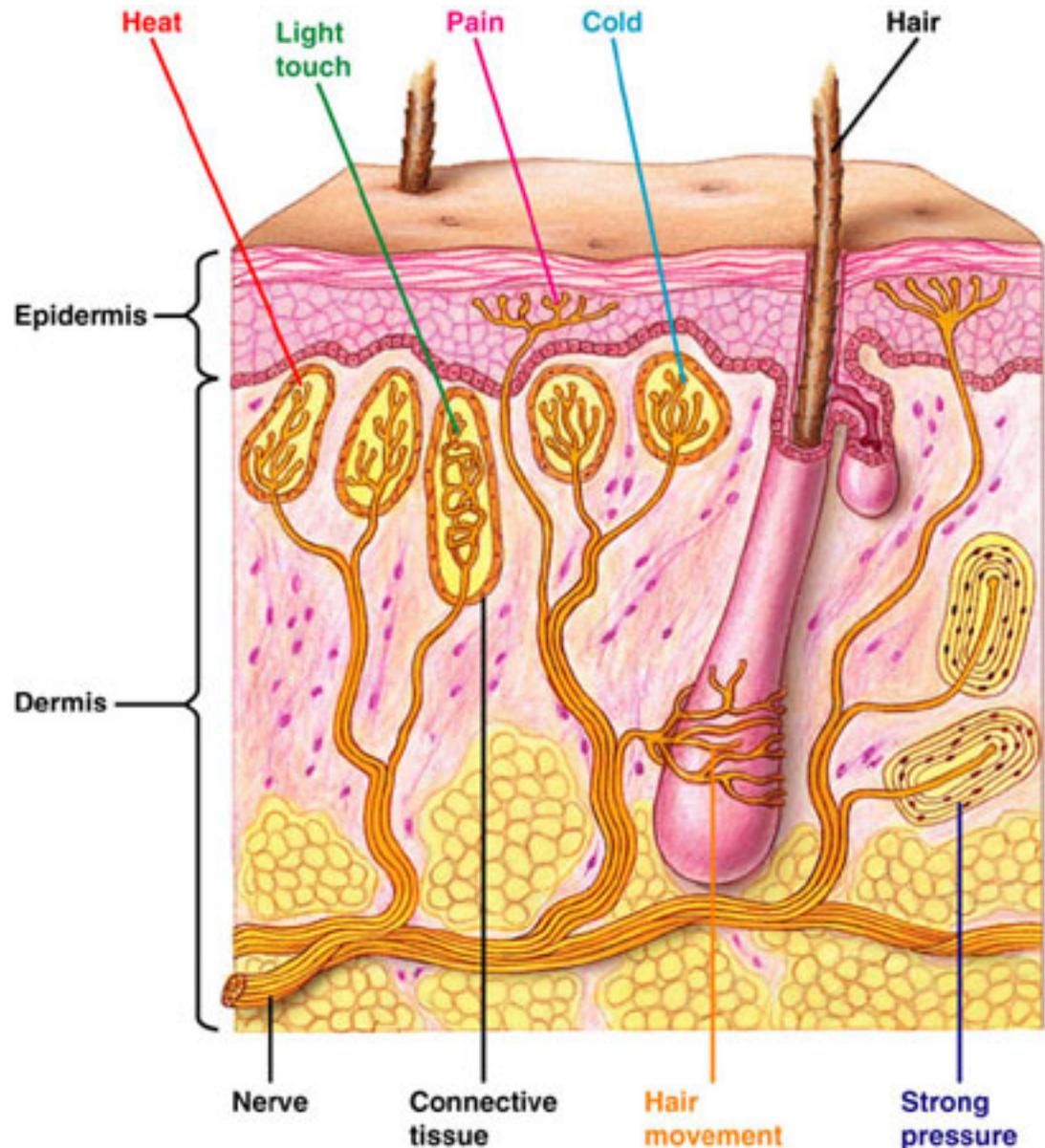
---

4. Mechanoreceptors =

---

5. Photoreceptors =

---



# Sensations

Sensation = feeling that occurs when a brain interprets a sensory impulse

Projection = process where the cerebral cortex causes a feeling to stem from a source (eyes, ears)

Sensory adaptation = sensory receptors stop sending signals when they are repeatedly stimulated



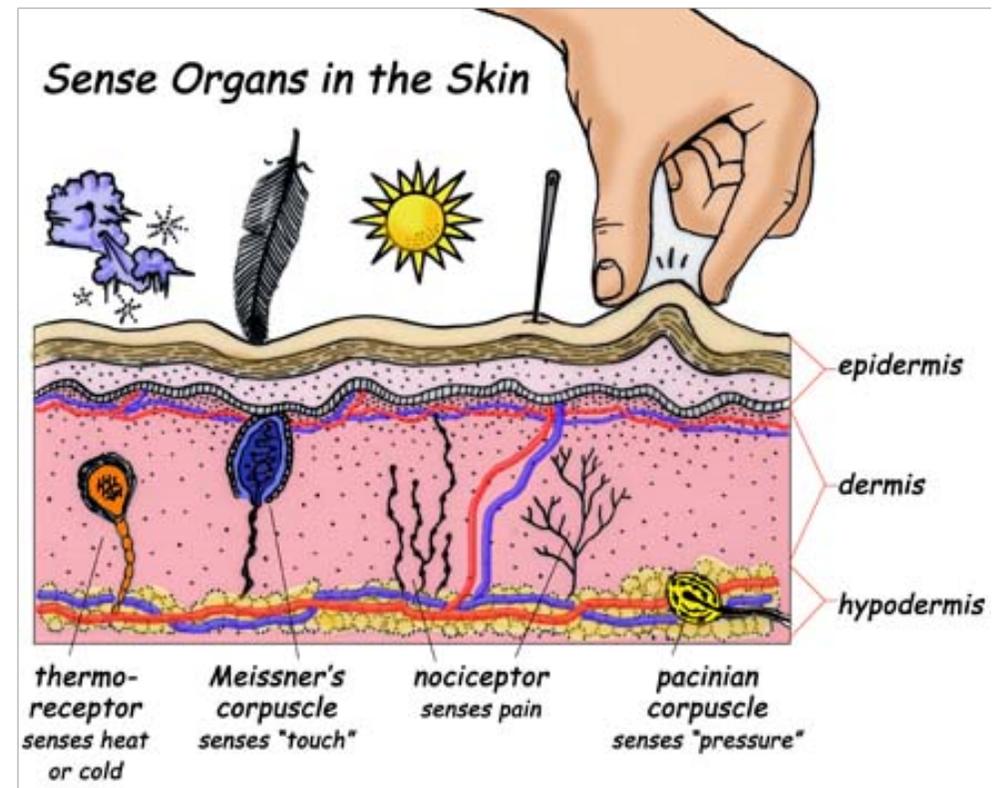
What do you think is going on in this picture?

Sensory Deprivation is a technique initially used by neuro-psychiatrists designed to deliberately reduce or completely remove stimuli from one or all of the senses.

# Somatic Senses

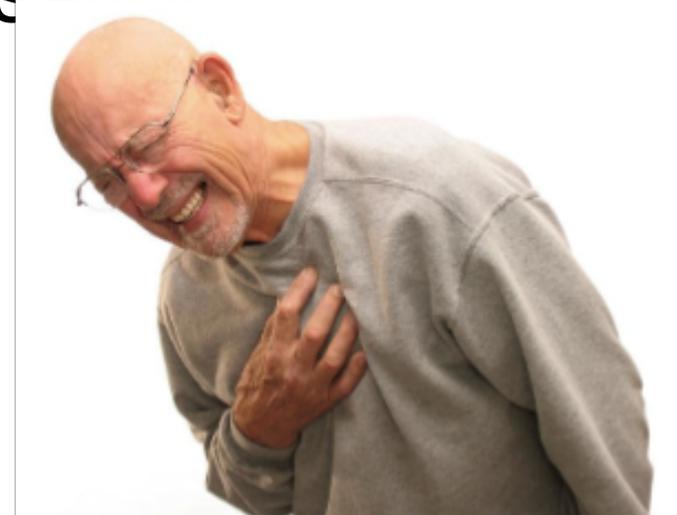
1. Sensory Nerve Fibers - epithelial tissue, pain and pressure
2. Meissner's corpuscles - hairless areas of skin (lips, fingertips)
3. Pacinian corpuscles - deep pressure (tendons, joints)

Temperature Senses  
(warm and cold receptors)



# Sense of Pain

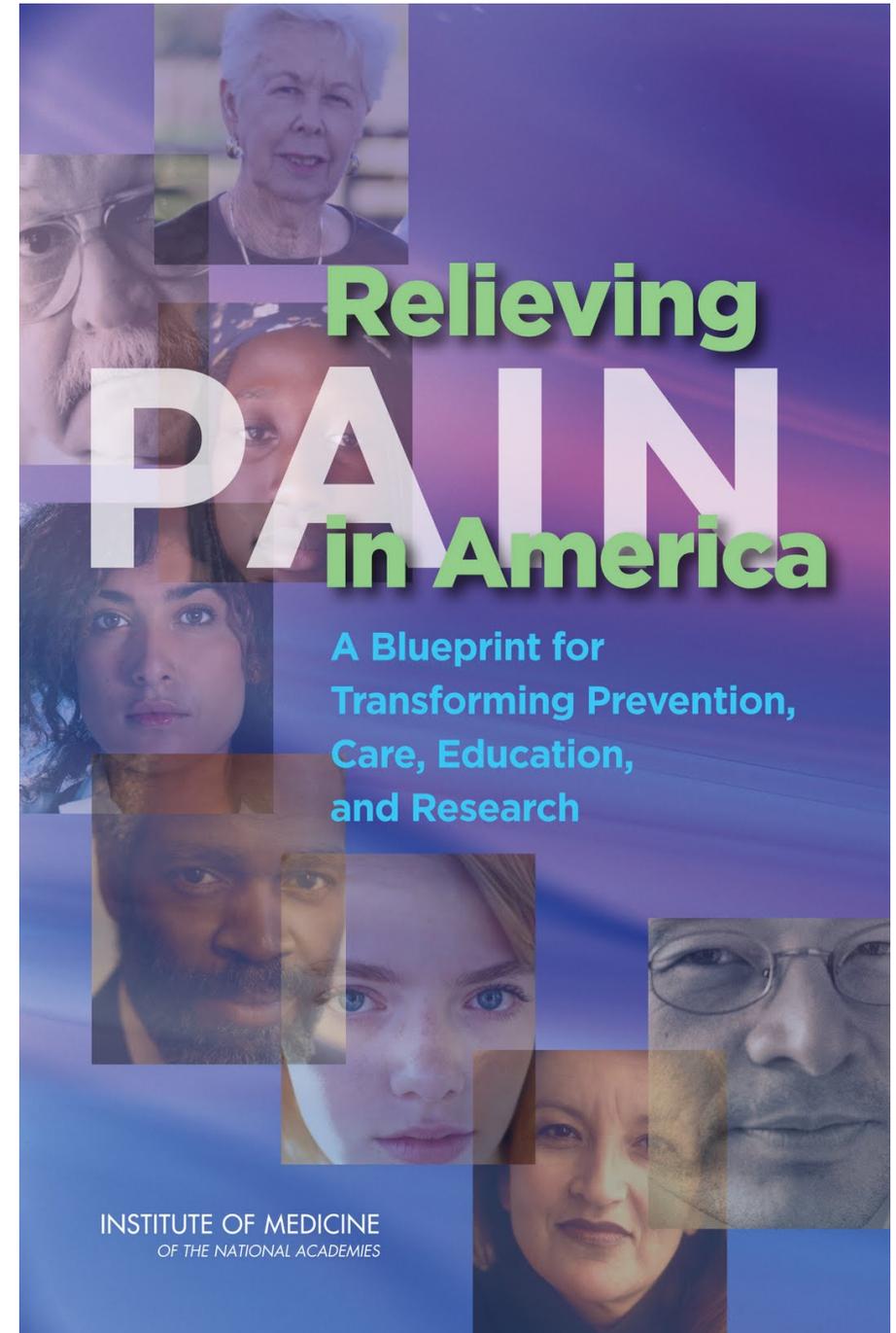
- Visceral Pain - occurs in visceral tissues such as heart, lungs, intestine
- Referred pain - feels as though it is coming from a different part (heart pain may be felt as pain in arm or shoulder)
- Acute Pain - originates from skin, usually stops when stimulus stops (needle prick)
- Chronic Pain - dull aching sensation



# Regulation of Pain

Inhibitors of Pain  
(natural brain  
chemicals can be  
mimiced by drugs such  
as morphine)

Enkephalins  
Serotonin  
Endorphins



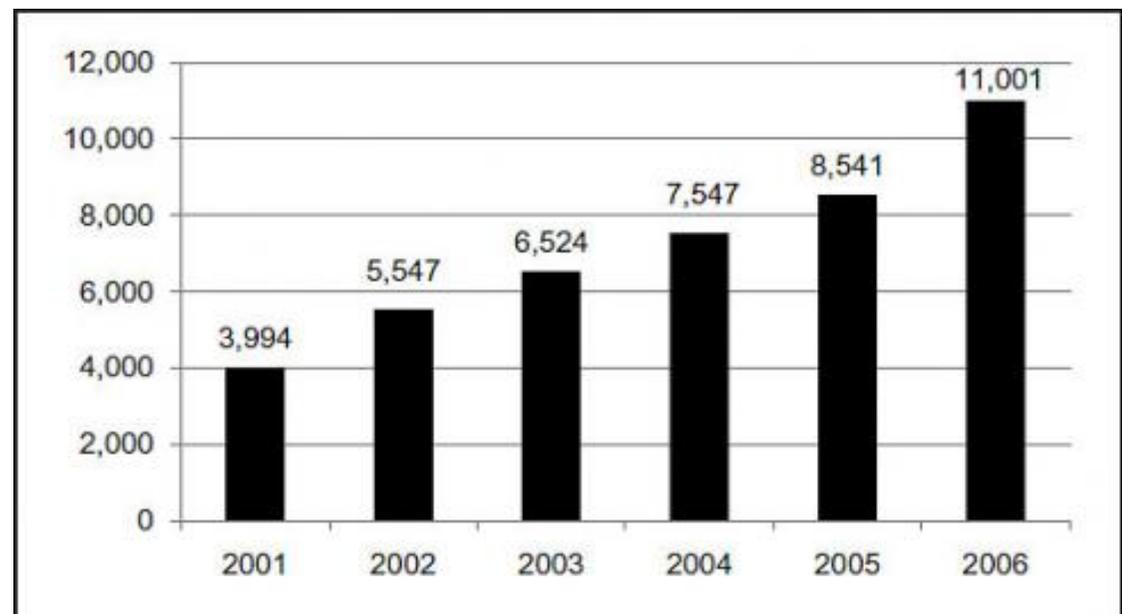
# The Rising Tide of Prescription Abuse

Courtney Love calls them the new LSD, or "lead singer's drug." Rapper Eminem has a tattoo of one on his bicep. David Spade even joked that they were in the goody bags given away at the Golden Globes. Hollywood is gripped by a new addiction: prescription painkillers. [Vicodin](#) and [OxyContin](#) have become the latest trendy drugs, and they can be just as powerful as heroin or cocaine.



2.6 million people nationwide now regularly use prescription pain pills for recreational purposes. Taken in small doses, painkillers produce feelings of euphoria with no hangover.

*Number of Reported Deaths*



# 10.4 Special Senses

Olfactory (smell)

Gustatory (taste)

Hearing & Equilibrium

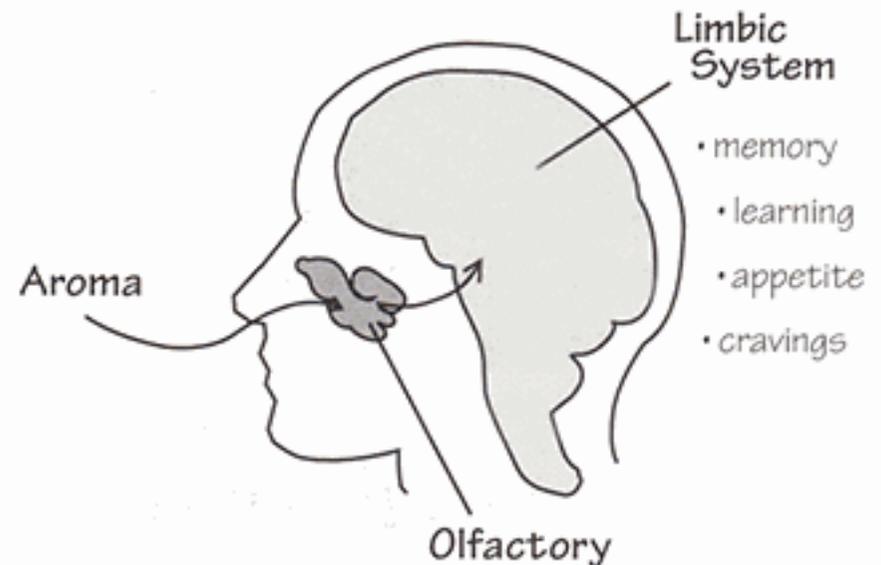
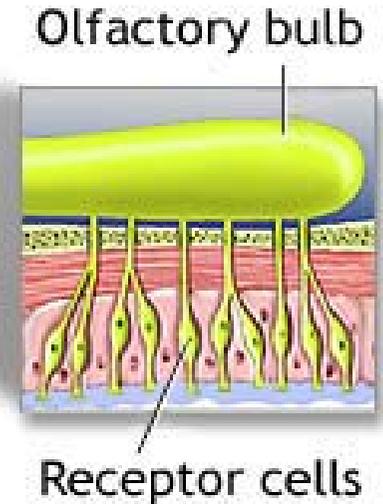
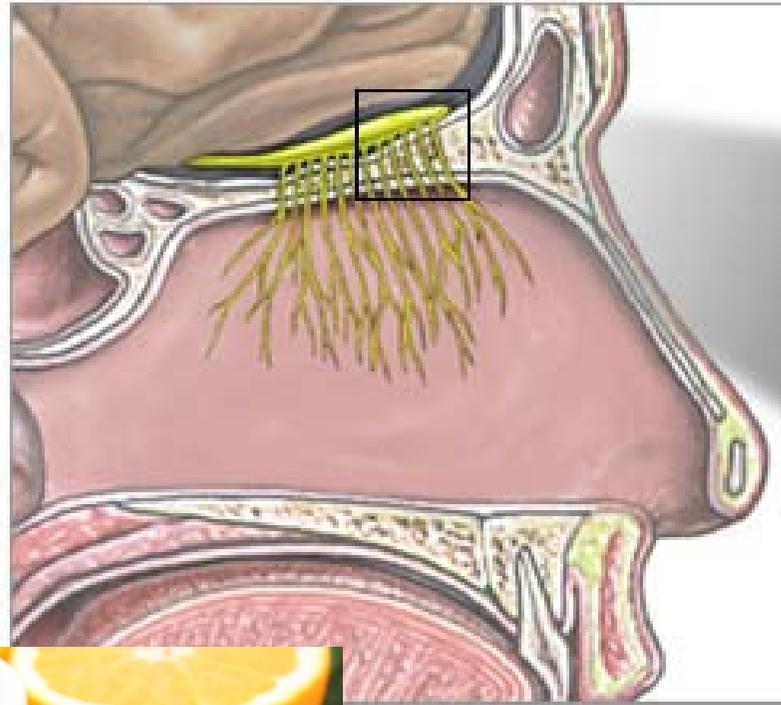
Sight



# Sense of Smell (Olfactory)

Odor -->  
Receptor Cell -->  
Olfactory bulb -->  
Olfactory Tract

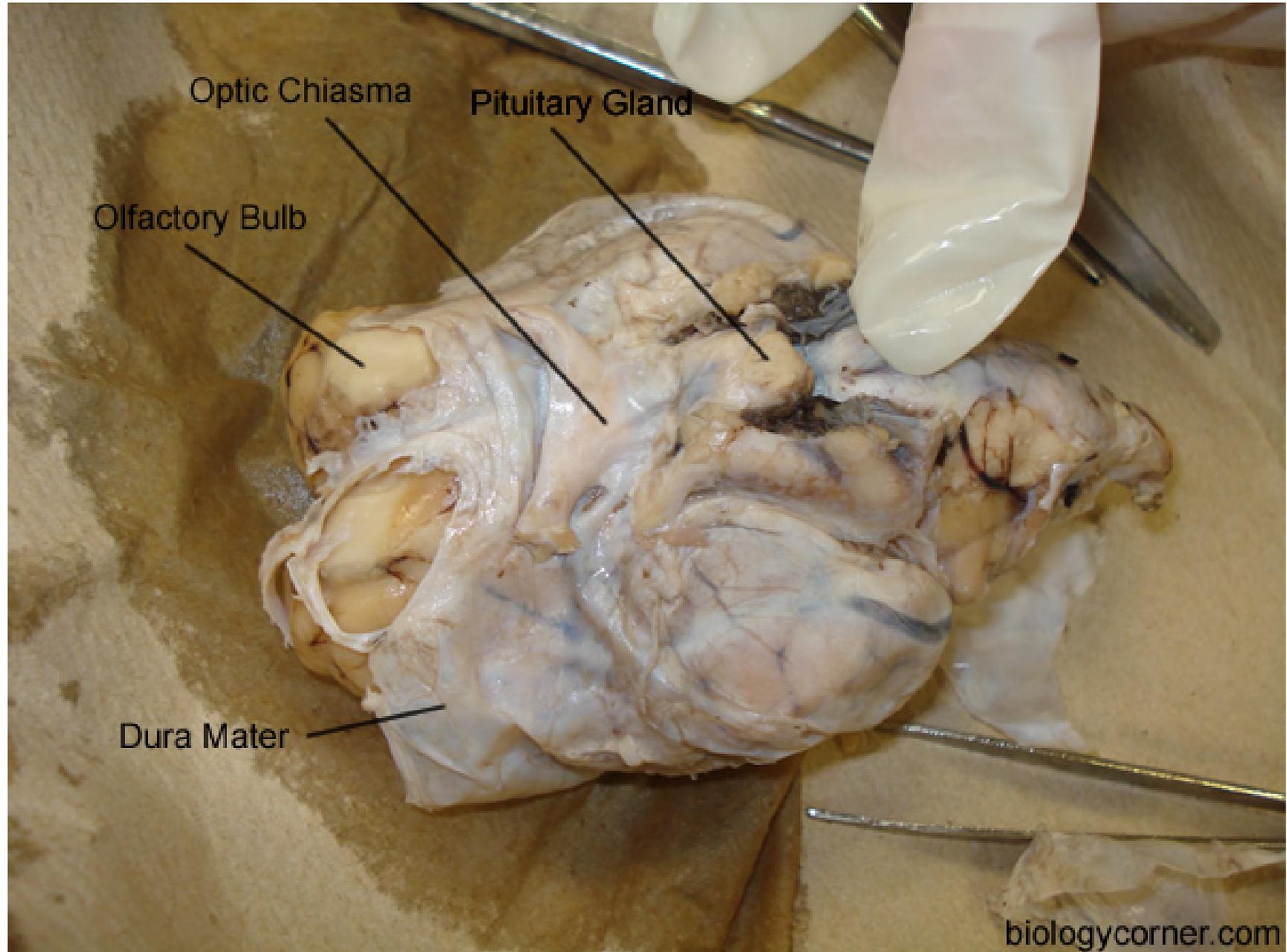
--> **LIMBIC SYSTEM**



Aromatherapy....

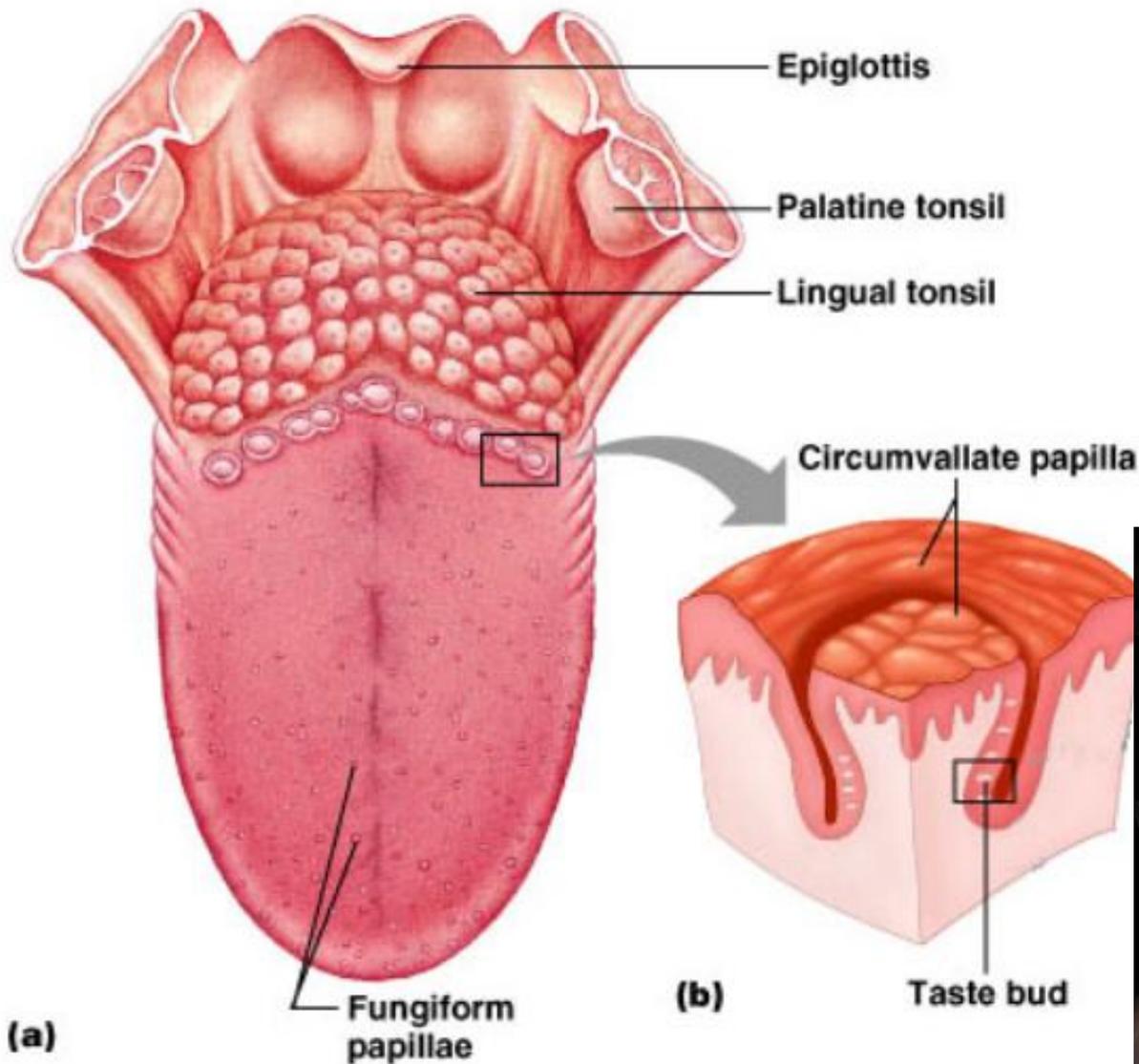
Real or Bunk?

# Olfactory Bulb on Sheep Brain

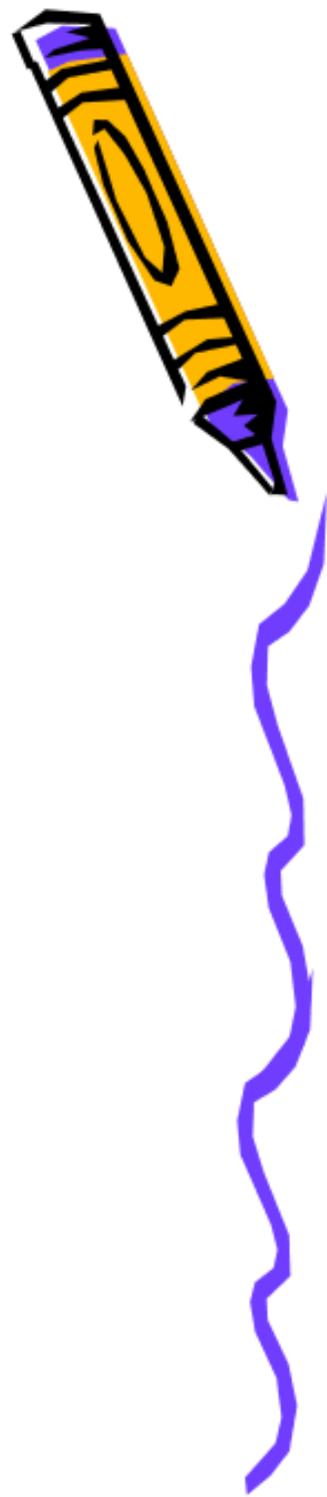


# Sense of Taste (Gustatory)

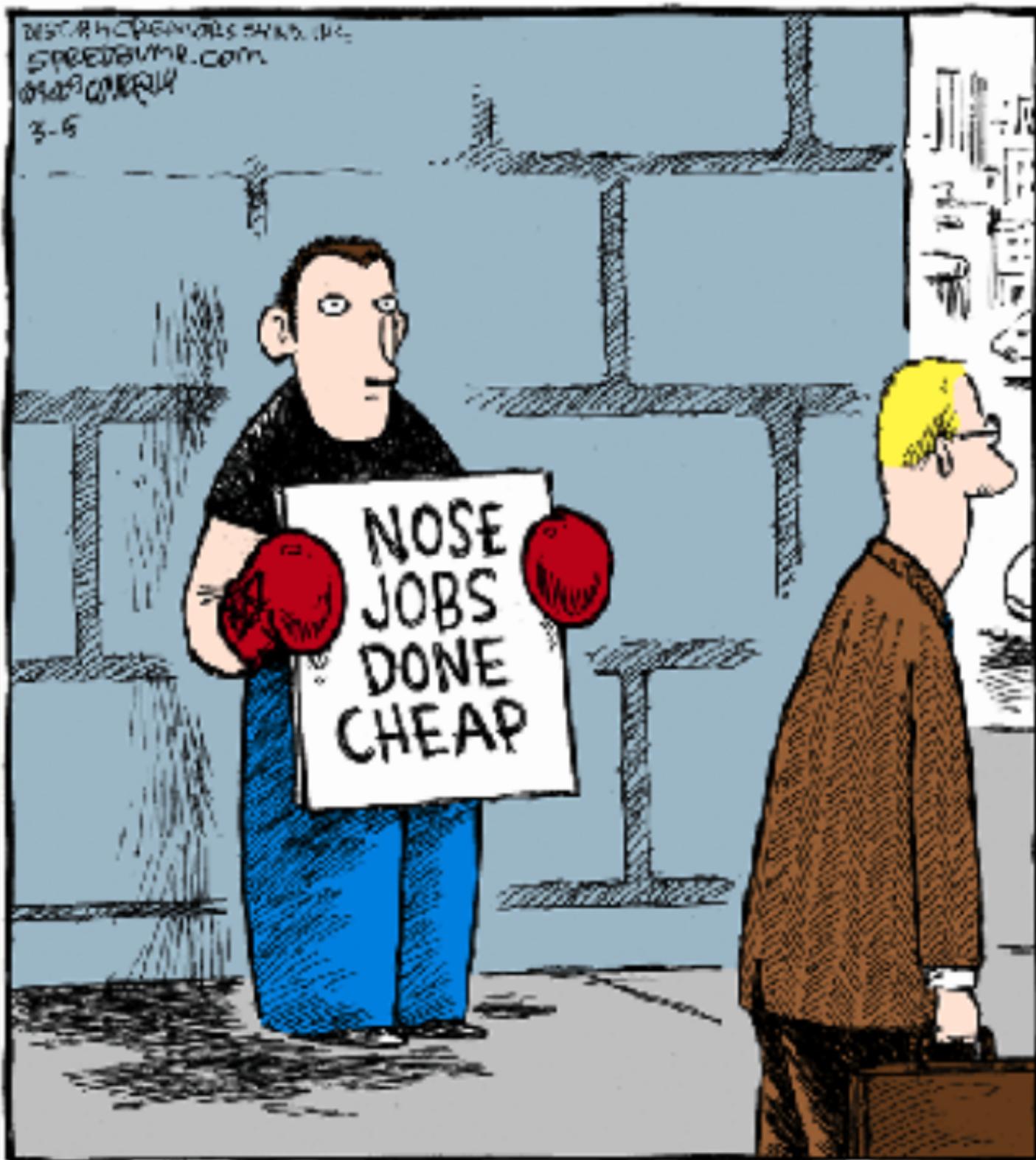
Sweet  
Sour  
Bitter  
Salty



- What did the right eye say to the left eye?
- Between you and me, something smells!



DESTROY CREATIONS BY N.D. INC.  
SPEEDBUMP.COM  
©1999 CORRELL  
3-6



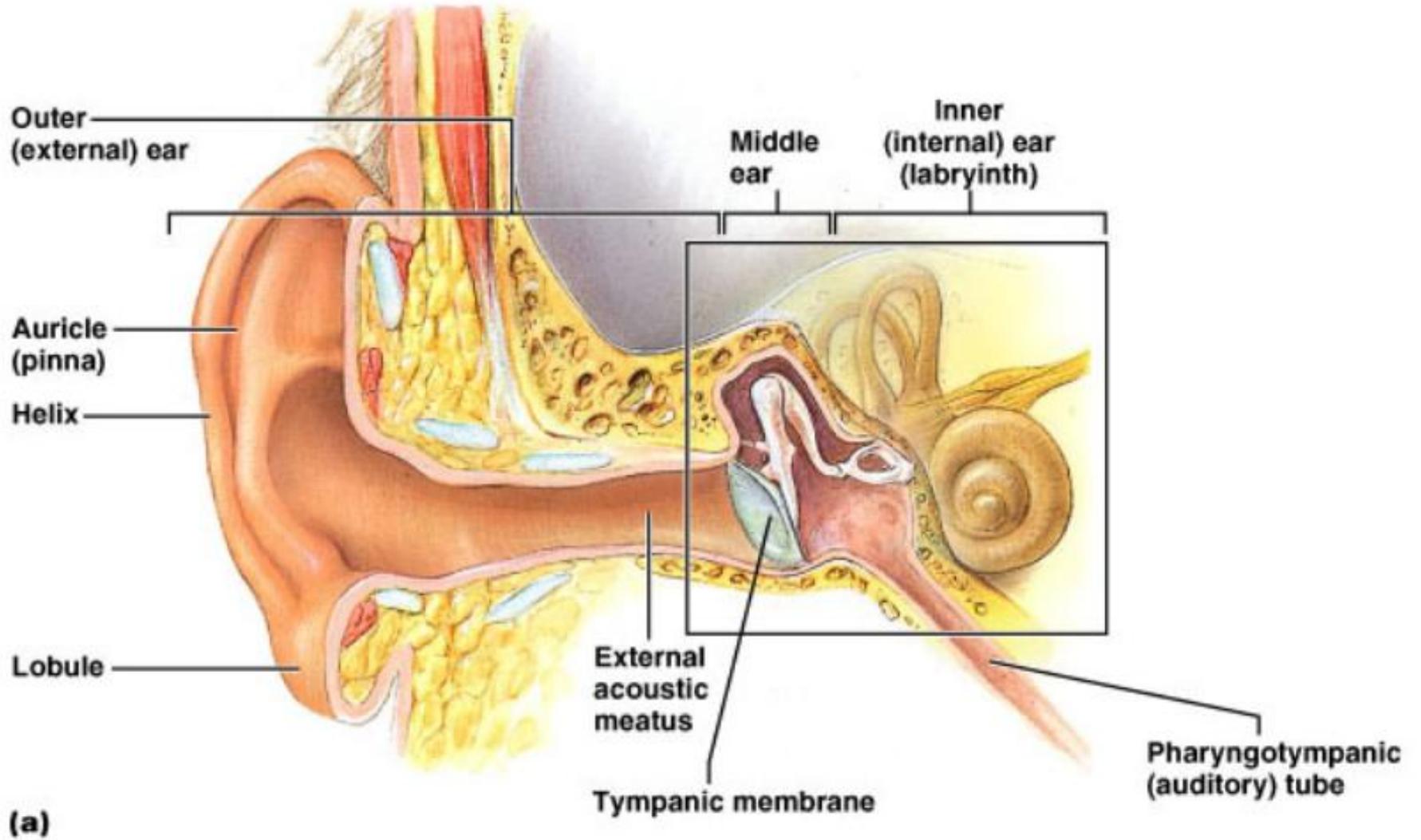
# Sense of Hearing

External Ear

Auricle (pinna) - outer ear

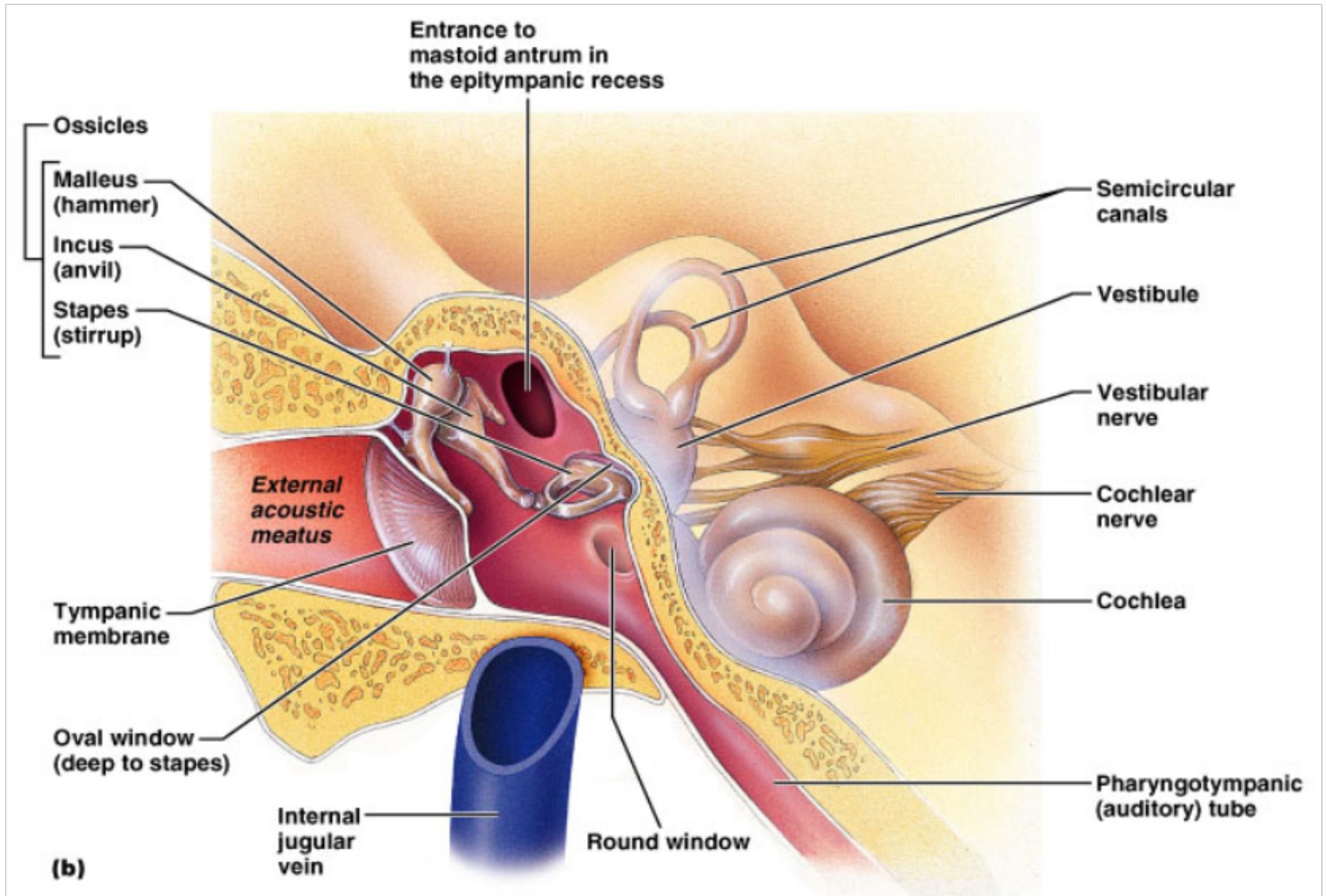
External Auditory Meatus





# Middle Ear (tympanic cavity)

- Eardrum (tympanum)
- Auditory Ossicles - malleus, incus, stapes
  - transmit vibrations and amplify the signal
- Auditory Tube (eustachian tube) -
  - connects the middle ear to the throat -
  - helps maintain air pressure

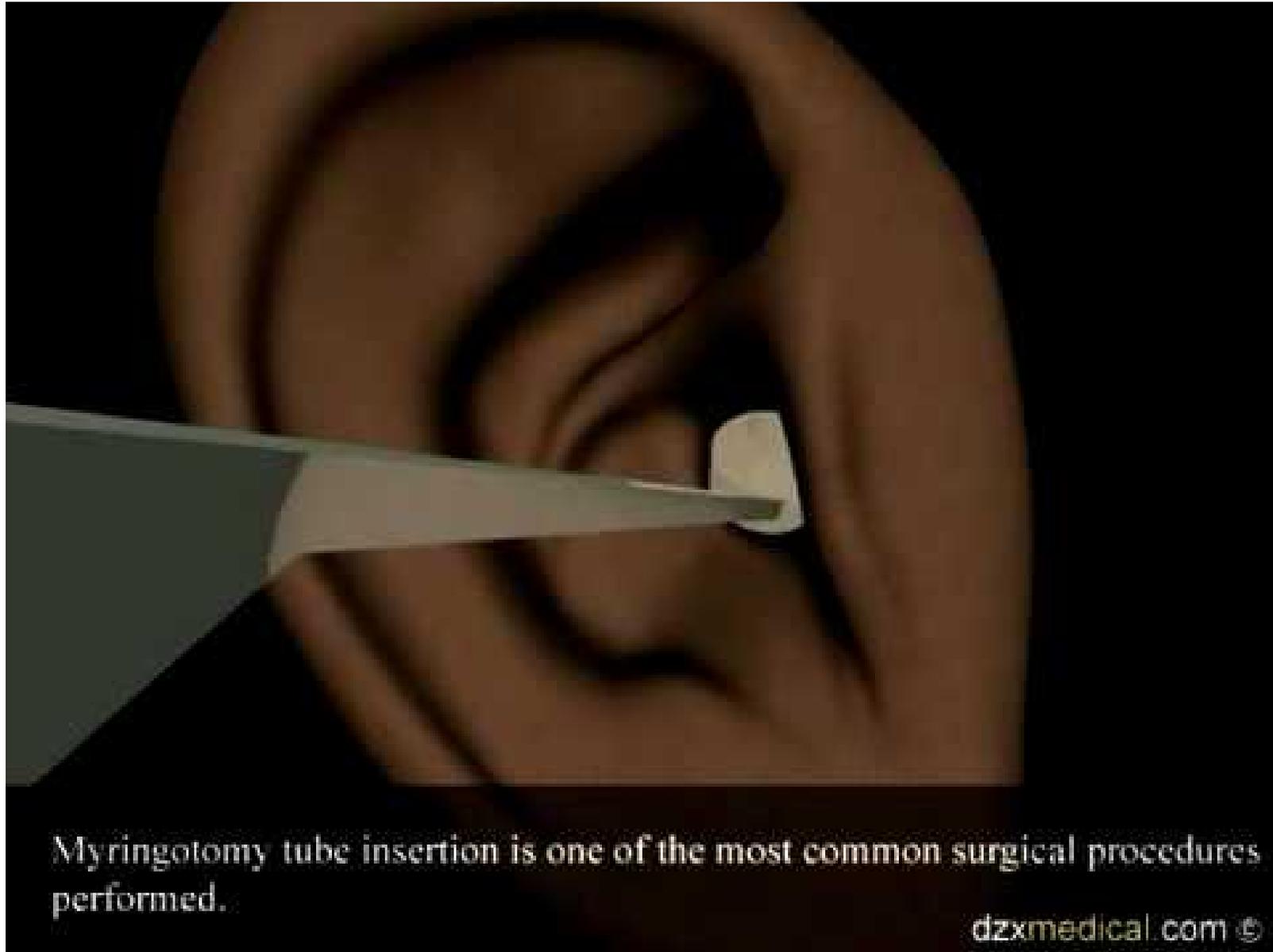


# Inner Ear

- Labyrinth - communicating chambers and tubes  
Osseous Labyrinth and Membranous Labyrinth  
Perilymph and Endolymph (fluids within the labyrinth)
- Semicircular Canals - sense of equilibrium
- Cochlea - sense of hearing
- Organ of Corti - contains hearing receptors, hair cells detect vibrations



# Why do children get tubes put in their ears?



Myringotomy tube insertion is one of the most common surgical procedures performed.

# Inner Ear: Cochlea

- Inside the cochlea are special neurons called **HAIR CELLS**
- The stapes is attached to the **OVAL WINDOW**, and vibrations cause the perilymph to vibrate; the hair cells here transmit this vibration.
- Therefore the **HAIR CELLS** in this region are receptors for **HEARING**.

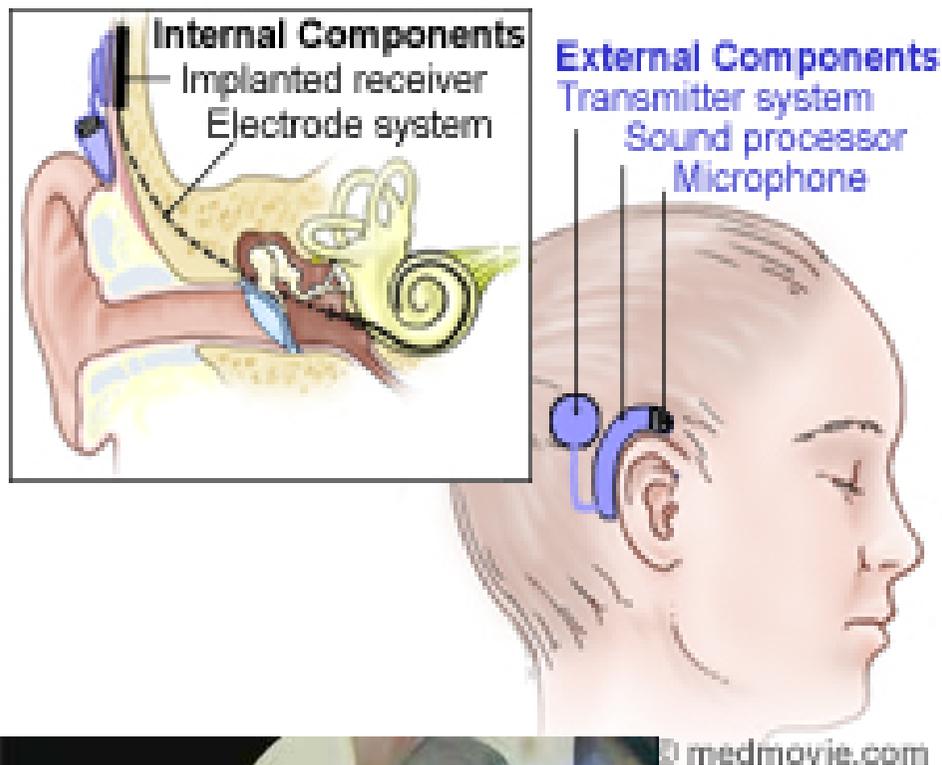
As you age, hair cells become damaged (loud music can speed this process along). Older people usually can't hear frequencies that younger people can hear. [Try the hearing test!](#)

# Steps in Hearing

1. Sound waves enter external auditory meatus
2. Eardrum vibrates
3. Auditory ossicles (malleus, incus, stapes) amplify vibrations
4. Stapes hits oval window and transmits vibrations to cochlea
5. Organs of corti contain receptor cells (hair cells) that deform from vibrations
6. Impulses sent to the vestibulocochlear nerve
7. Auditory cortex of the temporal lobe interprets sensory impulses
8. (Round window dissipates vibrations within the cochlea)

# Cochlear Implants

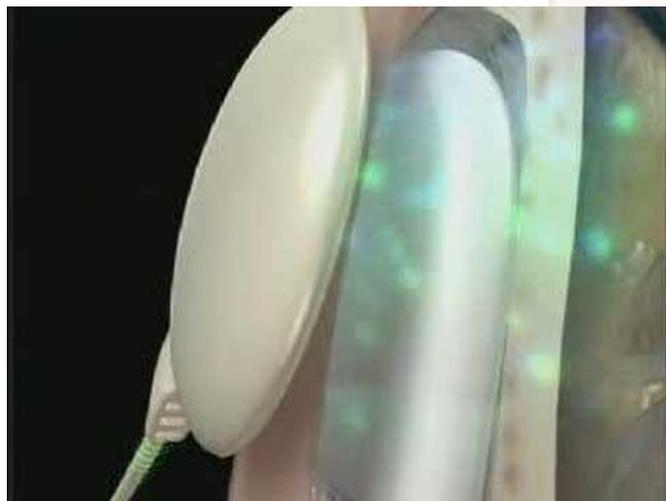
## Cochlear Implant Device



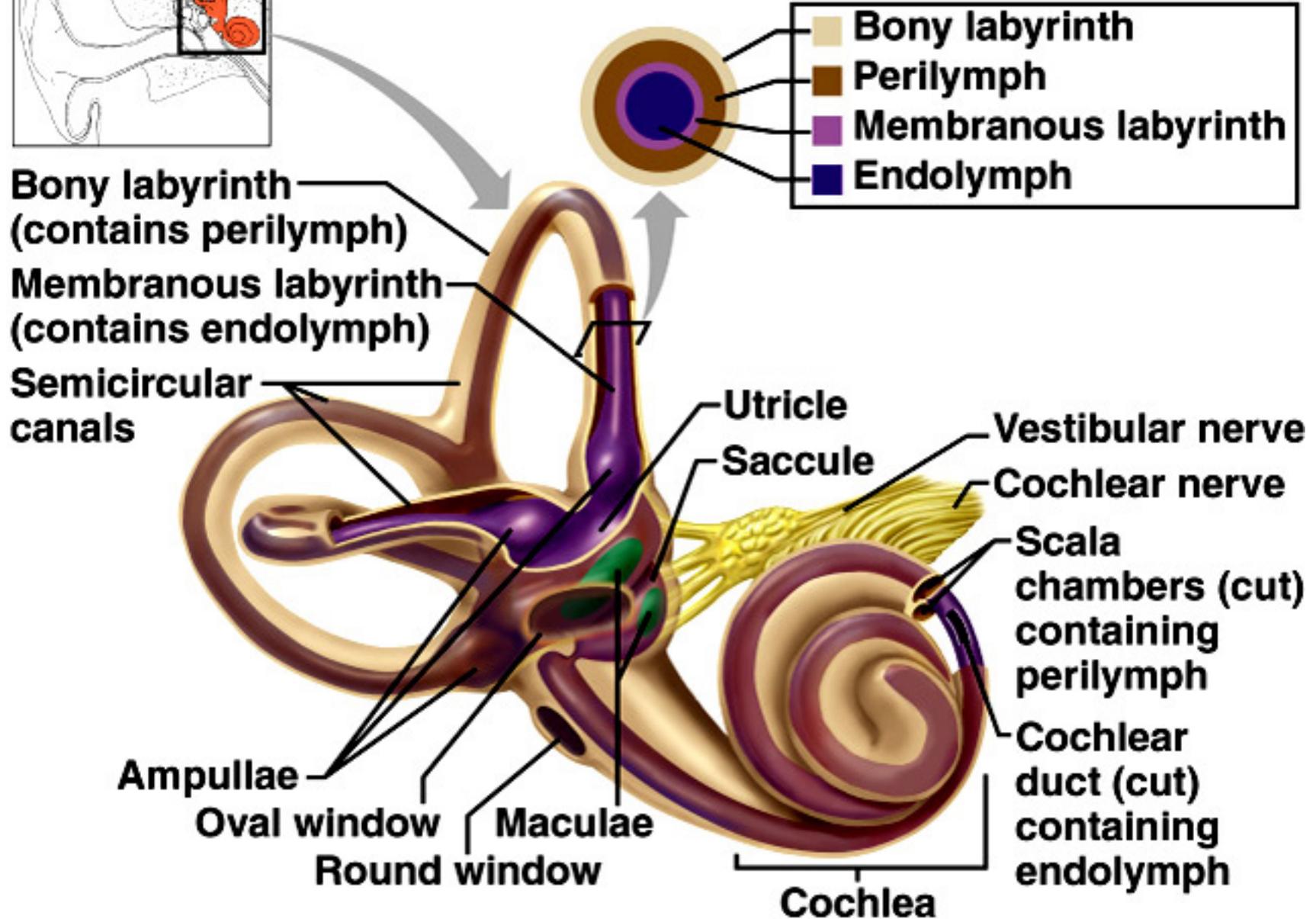
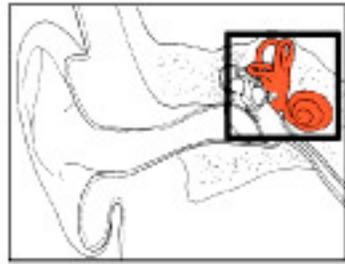
A cochlear implant receives sound from the outside environment, processes it, and sends small electric currents near the auditory nerve.

These electric currents activate the nerve, which then sends a signal to the brain. The brain learns to recognize this signal and the person experiences this as "hearing".

The cochlear implant somewhat simulates natural hearing, where sound creates an electric current that stimulates the auditory nerve. However, the result is not the same as normal hearing.



How cochlear implants work  
(youtube video)



**Bony labyrinth**  
(contains perilymph)

**Membranous labyrinth**  
(contains endolymph)

**Semicircular  
canals**

**Ampullae**

**Oval window**

**Round window**

**Maculae**

**Utricle**

**Saccule**

**Vestibular nerve**

**Cochlear nerve**

**Scala  
chambers (cut)  
containing  
perilymph**

**Cochlear  
duct (cut)  
containing  
endolymph**

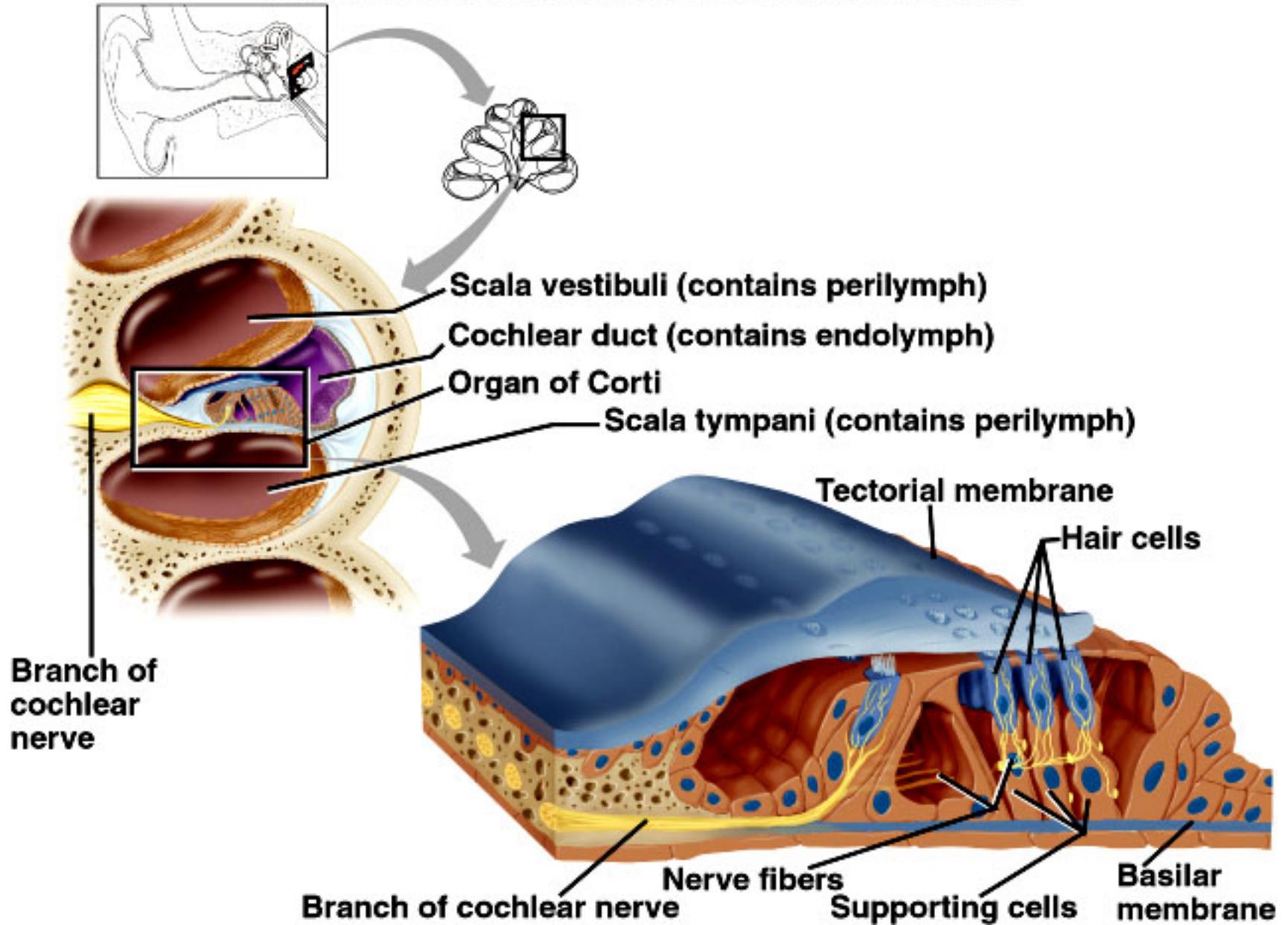
**Cochlea**

**Bony labyrinth**

**Perilymph**

**Membranous labyrinth**

**Endolymph**

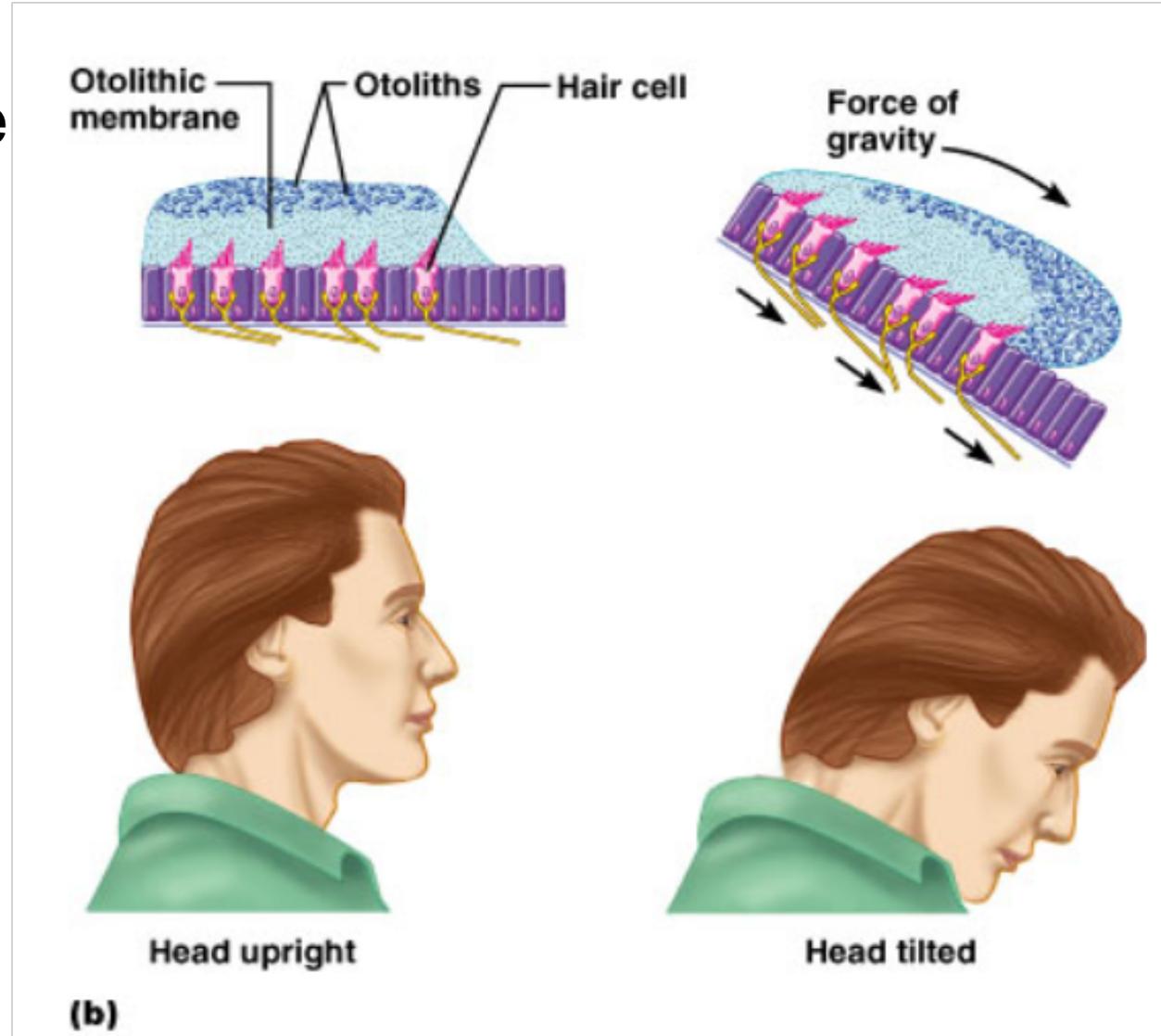


# Sense of Equilibrium

Static Equilibrium - sense the position of the head, maintain stability and posture

Dynamic Equilibrium (semicircular canals) - balance the head during sudden movement

Cerebellum - interprets impulses from the semicircular canals and maintains overall balance and stability



# What You Need to Know

1. Label the ear (see handout)
2. Identify structures on the models
3. Watch the tutorials (understand the steps and structures involved in hearing)

