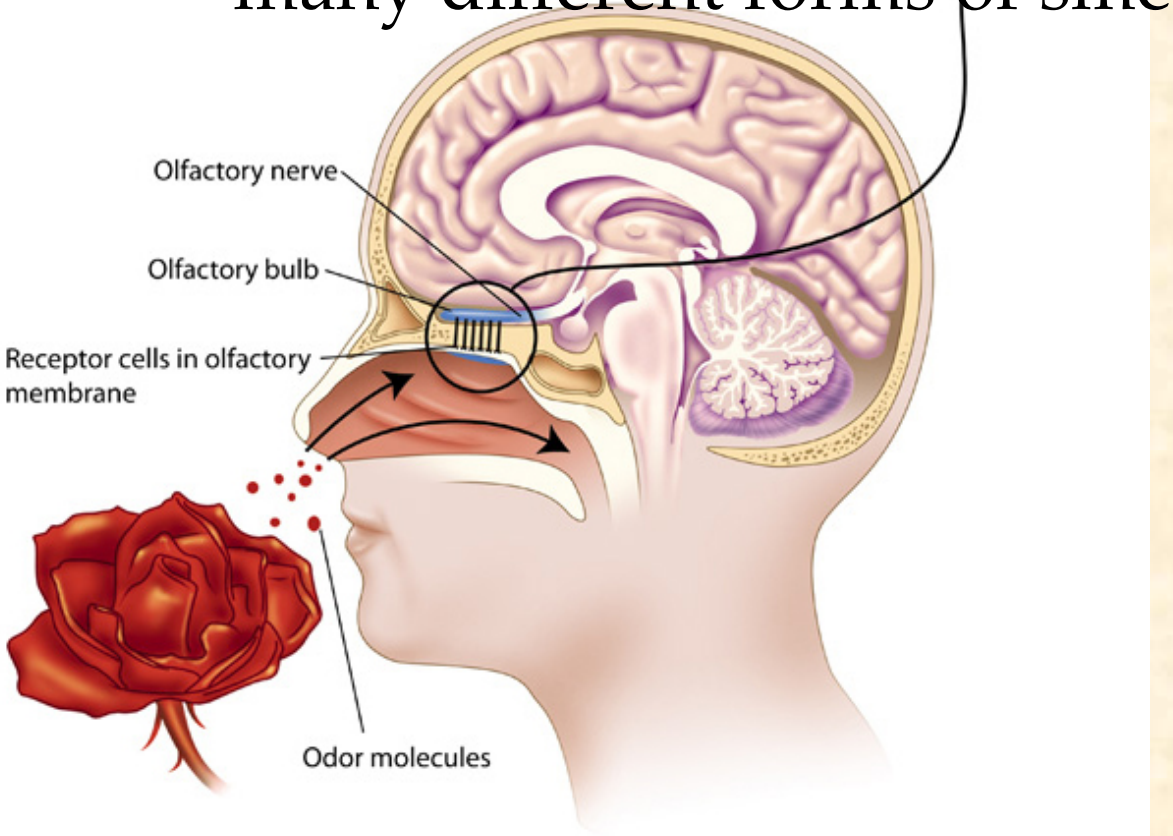
Taste

- Four basic tastes
  - Sweet
  - Salty
  - Sour
  - Bitter
- Recent discovery of fifth taste
  - Umami – Japanese word meaning savory or meaty. This sensation of fuller is common in meats, cheese and other protein-heavy foods.

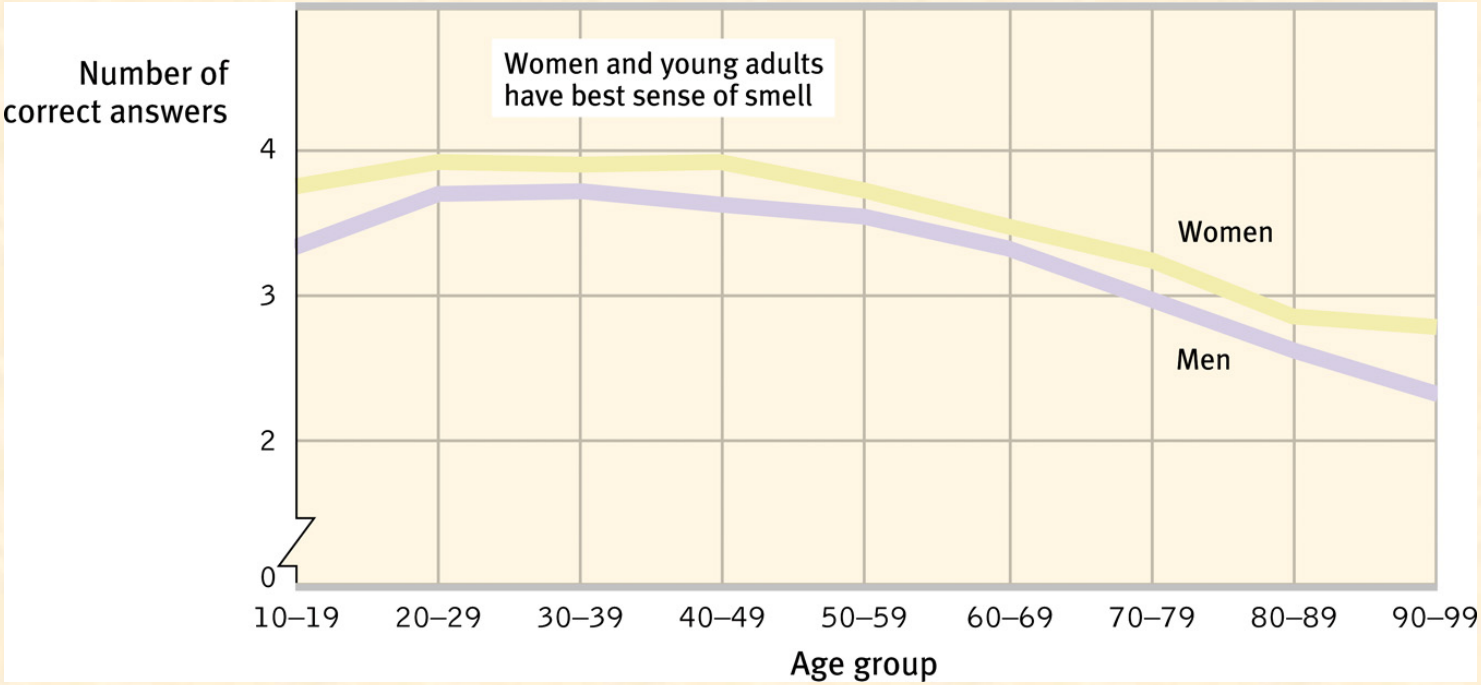
Smell

Like taste, smell is a chemical sense. Odorants enter the nasal cavity to stimulate 5 million receptors to sense smell. Unlike taste, there are many different forms of smell.



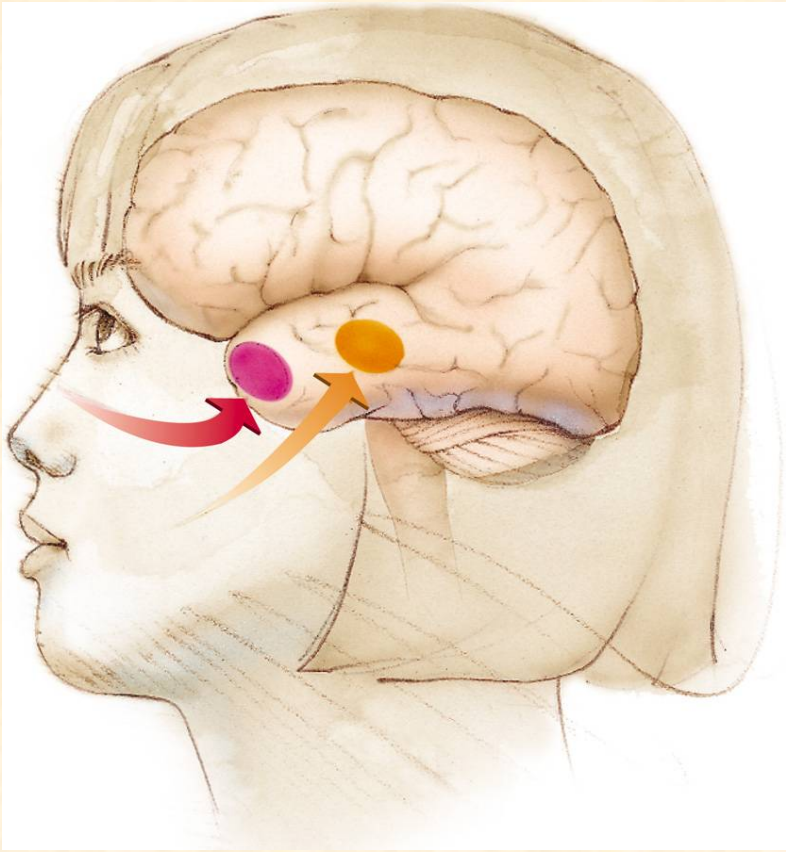
Age, Gender, and Smell

Ability to identify smell peaks during early adulthood, but steadily declines after that. Women are better at detecting odors than men.



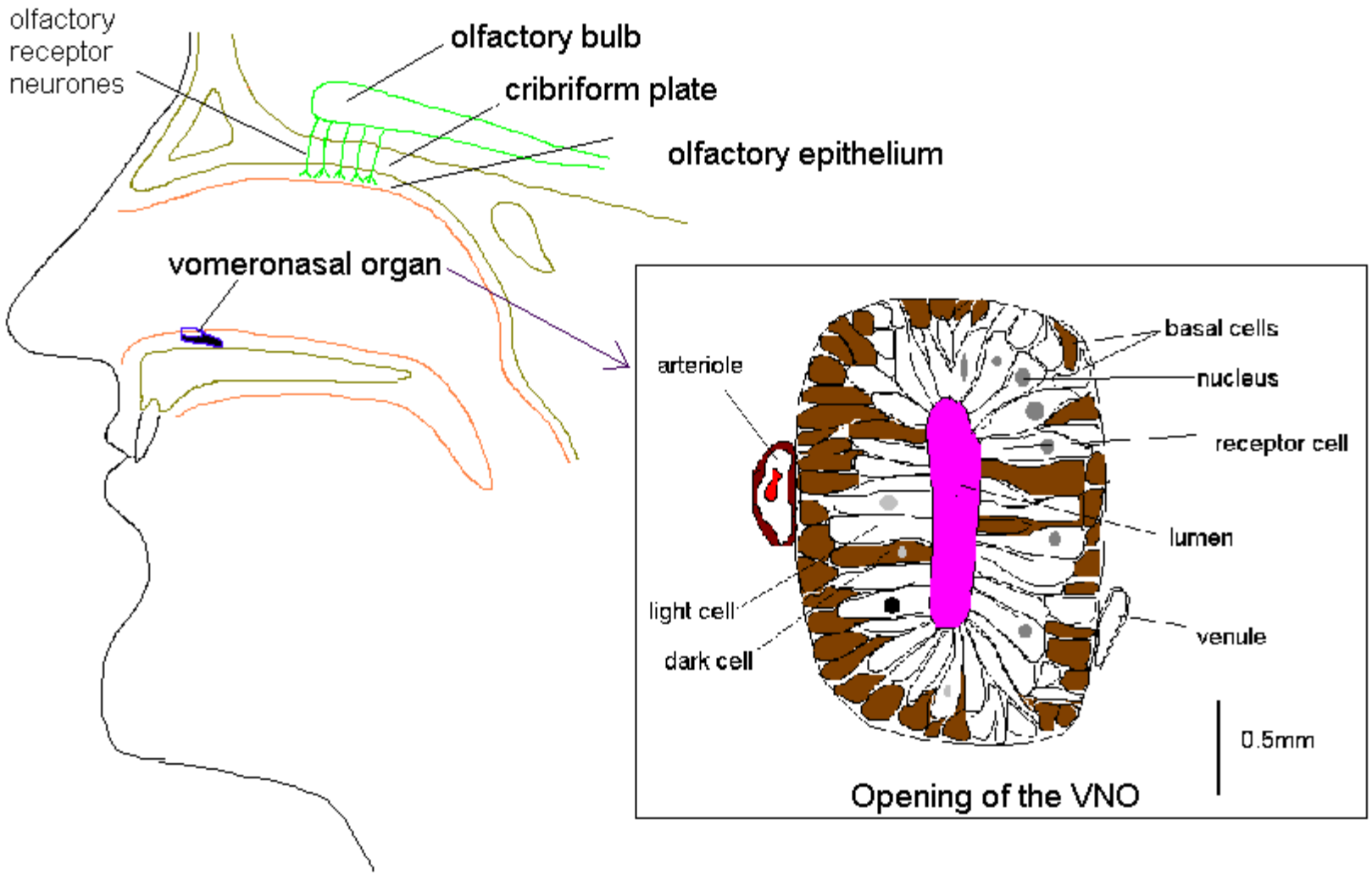
Smell and Memories

The brain region for smell (in red) is hard wired into brain regions involved with memory (limbic system – amygdala and the hippocampus). That is why strong memories are made through the sense of smell.



Smell

- Anosmia
  - Complete loss of the ability to smell
- Pheromones
  - Used by animals as a form of communication
  - Provides information about identity
  - Also provides information about sexual receptivity
- Pheromones stimulate the vomeronasal organ (VNO)
- Information from the VNO is sent to a special part of the olfactory bulb used for pheromonal communication


olfactory
receptor
neurones
olfactory bulb
cribriform plate
olfactory epithelium
vomeronasal organ
arteriole
basal cells
nucleus
receptor cell
lumen
light cell
dark cell
venule
0.5mm
Opening of the VNO

The Skin Senses

- Skin is the largest sense organ
- There are receptors for pressure, temperature, and pain
- Touch appears to be important not just as a source of information, but as a way to bond with others
- Touch Localization
  - Touch localization depends on the relative lengths of the pathways from the stimulated parts to the brain.

Body Position and Movement

The sense of our body parts' position and movement is called kinesthesis. The vestibular sense monitors the head (and body's) position.

http://www.heyokamagazine.com

Whirling Dervishes

Bob Daemmrich/ The Image Works

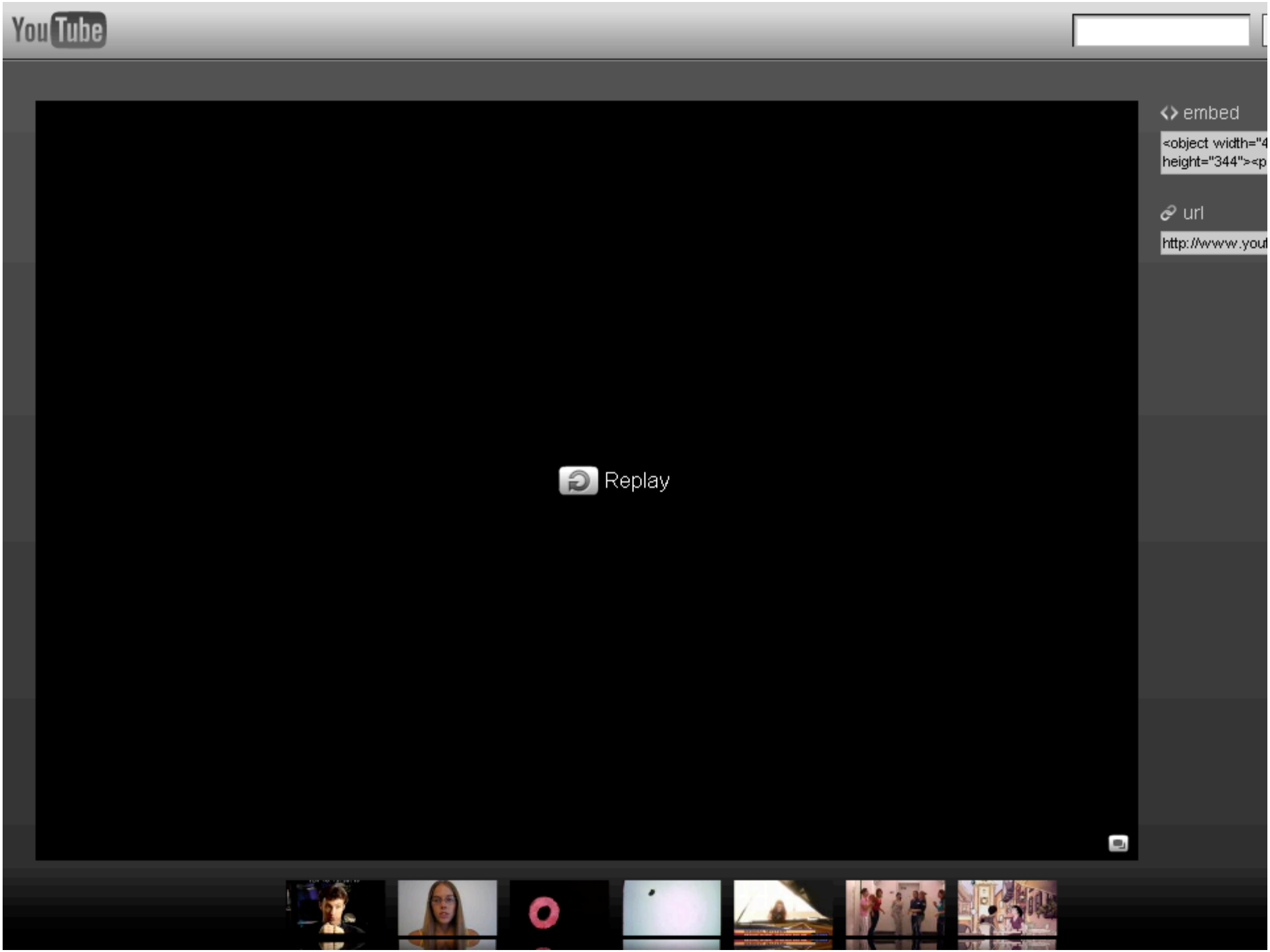
Wire Walk

Vestibular Senses

- Vestibular senses provide information about equilibrium and body position
- Fluid moves in two vestibular sacs
- Vestibular organs are also responsible for motion sickness
- Motion sickness may be caused by discrepancies between visual information and vestibular sensation

Synesthesia

- The extraordinary sensory condition in which stimulation of one modality leads to perceptual experience in another. Literally, the term means “to perceive together.”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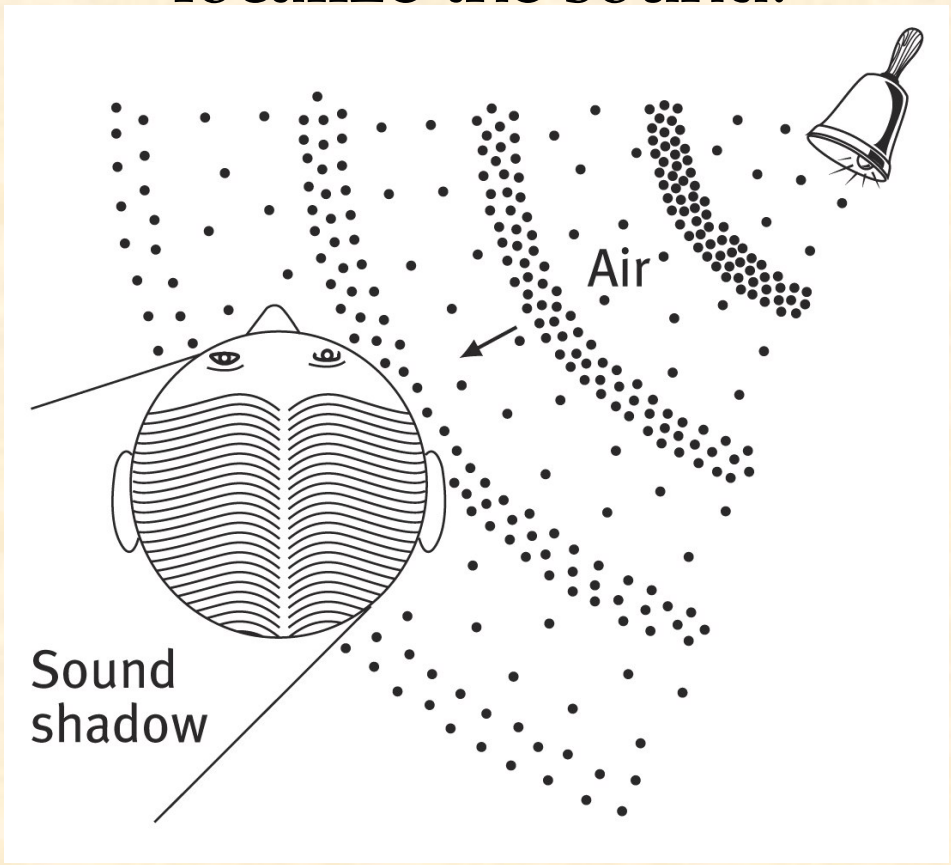
Theories of Hearing

- Place theory
  - Pitch (how high or low something is) is determined by location of vibration along the basilar membrane
  - But this doesn't explain low-pitch since we haven't found specific positions for those on the bm
- Frequency theory
  - Pitch is determined by frequency hair cells produce action potentials
  - If the frequency of the sound is 100 waves per second then the neuron fires at 100 pulses per second.
  - But we can hear frequencies above 1000 waves per second but can't fire neurons faster than 1000 pulses per second.
  - Volley Principle
    - Pattern of sequential firing creates a combined high frequency signal

Localization of Sounds

Because we have two ears, sounds that reach one ear faster than the other ear cause us to localize the sound.



Hearing Loss

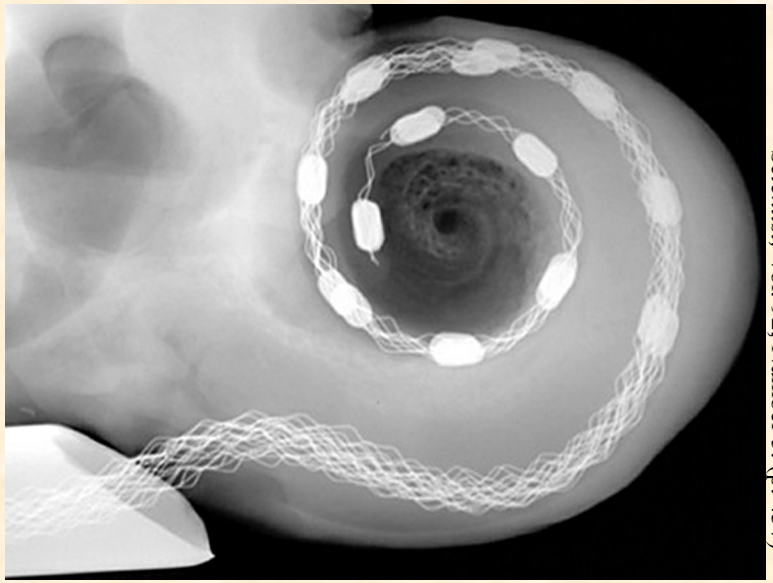
- Conduction Hearing Loss: Hearing loss caused by damage to the mechanical system that conducts sound waves to the cochlea.
  - Surgery
- Sensorineural Hearing Loss: Hearing loss caused by damage to the cochlea's receptor cells or to the auditory nerve, also called nerve deafness.
  - Hearing aid to amplify sound
  - Cochlear Implant

Deaf Culture

Cochlear implants are electronic devices that enable the brain to hear sounds.

EG Images/ J.S. Wilson ©

Deaf Musician



Wolfgang Gstottner. (2004) *American Scientist,* Vol. 92, Number 5. (p. 437)

Cochlear Implant