**ACC Bio 169 Virtual class notes 9/2**
1. Reviewed transduction by cochlea.
 Reviewed how info re spatial orientation is received by vestibular organs and
 semicircular canals.
2. Discussed the pathway by which information from the vestibule (maculae in the utricle and saccule of the vestibule and ampullae of the semicircular canals) and cochlea transmits information via Cranial nerve VIII, the vestibulocochlear nerve, to the brain for processing.
The **vestibular cochlear nerve** enters the brain between the base of the pons (middle brainstem) and medulla oblongata (lower brainstem). But where does this nerve originate?
The **cochlear** portion of this nerve originates at a cluster of nerve cells called the spiral ganglia. When the stereocilia of the hair cells in the cochlea are triggered, the hair cells depolarize, releasing neurotransmitter (glutamate) into their synapses with the peripheral process of spiral ganglion neurons. The axons of these nerves form the cochlear nerve. The cochlear nerve travels to the cochlear nucleus in the brainstem (ipsilateral = same side). Most of the information then crosses over to the other hemisphere, travelling to the contralateral = opposite superior olivary complex while some of the nerve fibers relay info to the ipsilateral superior olivary complex. From there, the information travels to the inferior colliculus of the midbrain. Some of the info then crosses over again to the thalamus then moves on to the auditory cortex which is nestled into the lateral sulcus of the temporal lobe. The cortex exhibits a tonotopic arrangement…sections of the cortex respond only to particular frequencies similar to the arrangement of the cochlear hair cells responding to individual frequencies based on their placement along the basilar membrane.

The **vestibular** portion of the vestibular nerve transmits information from the vestibular system of the inner ear. Hair cells in the cristae of the ampullae at the base of each of the semicircular canals activate afferent receptors sending information about rotational positioning. Hair cells found in the maculae of the utricle trigger afferent receptors in response to acceleration. Hair cells found in the maculae in the saccule trigger afferent receptors in response to vertical motion. These five sensory organs send their information to the vestibular ganglia, clusters of bipolar neurons. From there, the information travels to the vestibular nuclei seated between the medulla and pons. From there, some of the afferent fibers travel to the cerebellum which uses this information to maintain balance and coordination. Other nerve tracts leave the vestibular nuclei and descend to the spinal cord to help control posture or ascend to the
to the thalamus and then eventually to the cortex where you process your conscious perception of movement/gravity).

3. Explored **Olfaction and Gustation**…smell and taste.
Olfaction:
Lining our nasal cavities is a mucous layer called the olfactory epithelium. Convolutions in the nasal conchae increase the surface area of the nasal cavity, increasing the number of receptor cells lining the cavity. This epithelial tissue exhibits millions of olfactory receptor cells. Each cell has a dendrite with cilia (olfactory hair) that is exposed to the nasal cavity. The cilia have chemoreceptors on their surface that can be triggered by specific chemical compounds. When a receptor is triggered, it depolarizes the receptor cell, starting an action potential that is carried by the axon of the receptor cell through the cribform plate of the ethmoid bone, to the olfactory bulb. The olfactory bulb consists of clusters called glomeruli. These clusters contain neurons that receive stimuli from specific olfactory receptor cells. From the olfactory bulb, the signal is carried to the olfactory tract to the olfactory cortex I the temporal lobe for processing by also shares information with other areas of the brain such as the amygdala (memory) and areas that stimulate visceral and emotional responses to an odor.
How does the receptor on the olfactory hair start the action potential when triggered??
You got it…it’s a G protein system which ultimately opens up a Na+ channel by activating cAMP, permitting an ion exchange which starts the ball rolling. Look at the pic on the website for a peak at the sequence of event.

**Gustation:**
Your tongue is covered with little bumps called (lingual) **papillae.**
**Filiform papillae**: most numerous of the lingual papillae, cone-shaped papillae that cover the front 2/3 of the tongue. These papillae do not exhibit taste buds but provide info re touch.
**Fungiform papillae:** found on the tip and sides of the tongue and scattered among the filiform papillae. They have taste buds that can distinguish all five tastes.
**Foliate papillae:** found oneach side and back of the tongue. They exhibit taste buds.
**Circumvallate papillae:** There are only about 10 of these large papillae which are
found at the very back of the tongue. These papillae contain taste buds that detect bad tastes and serve as a gag reflex initiator.

What is a **taste bud**? Taste buds cover the side grooves of these papillae. Each taste bud exhibits taste receptor (gustatory) cells…a hundred or so give or take 50 in each bud. Taste receptor cells exhibit microvilli sometimes called taste hairs. These sensory microvilli extend into the mouth via a taste pore. There are receptors on these microvilli that interact with taste chemicals in food. Each type of chemical will interact with a specific receptor and the pathway by which that receptor starts an action potential varies. Once the tase receptor cell depolarizes, it releases a neurotransmitter that stimulates sensory neurons travelling into the brain via cranial nerves 7.9 and 10. The pathway travels through the medulla, the thalamus, to the gustatory cortex of the frontal lobe. There are five identifiable taste sensations: sweet, bitter, sour, salty and umami.
Mechanoreceptors in mouth cavity also provide information re texture of a food sometimes called “mouth feel”. Likewise, pain and temperature info is relayed via nerve endings on the epithelium of the oral cavity. Taste along with smell provide the whole picture…imagine trying to taste something when you have a stuffy nose.