**Ch 15 Special Senses- Part 2 Smell, Taste, and Hearing Notes**

Smell (\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_) and taste (\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_) are complementary senses which let us know whether to savor a substance or avoid it. Both of these systems use sensors called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. Chemicals must be dissolved in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ solution. Smell receptors are excited by chemicals dissolved in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. Taste receptors respond to chemicals dissolved in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

Smell

The organ of smell is the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. It is located in the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and covers the superior \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. It contains \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ neurons. The olfactory \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ cells lie at the base of the epithelium.

Olfactory neurons are unusual \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ neurons that have thin apical \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ which terminate in a knob that contains nonmotile \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ covered with mucus which captures and dissolves odorants. The axons of the receptor cells gather in bundles to create the olfactory nerve (cranial nerve I). Olfactory neurons are unusual because they are one of the few types of neurons that undergo turnover throughout adult life. These neurons have \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ cells that create new neurons every \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ days.

Smells can contain \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of different odorants and humans have \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ “smell” genes active in the nose. The nasal cavity also contains receptors for \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to respond to irritants like ammonia, chili peppers, or menthol.

In order to smell a substance, it must be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (in gaseous state).

Taste

The sensory organs for taste are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. There are approximately \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ located on the tongue contained in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (peglike projections of the tongue mucosa). There are 3 types:

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ papillae= scattered across tongue
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ papillae= on side walls of tongue
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ papillae= largest; form a “V” at back of tongue
* There are also a few on the soft palate, cheeks, pharynx, & epiglottis.

Each tastebud contains \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ flask-shaped epithelial cells.

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ epithelial cells contain microvilli called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ that project into taste pores.
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ epithelial cells are stem cells that divide every \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ days.

There are 5 basic taste sensations:

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_= sugars, alcohol, etc
2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_= hydrogen ions in solution
3. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_= metal ions including sodium chloride
4. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_= alkaloids, nicotine, caffeine, etc
5. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_amino acids glutamate & aspartate (beef, cheese, MSG)

There is a possible 6th taste= long chain fatty acids from lipids (could explain our liking of fatty foods)

To be able to taste a chemical, it must:

* be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in saliva
* diffuse into a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* contact \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

The nerves responsible for carrying taste impulses are:

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ nerve (cranial nerve VII)- anterior 2/3 tongue
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ nerve (cranial nerve X)- posterior 1/3 tongue & pharynx
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ nerve – epiglottis & lower pharynx

Taste triggers reflexes involved in digestion such as increased \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in mouth, increased secretion of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ into stomach as well as protective reactions such as \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

Taste is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_% smell. It also relies on other receptors that determine temperature and texture as well as pain (spicy foods).

The Ear

The ear has 3 major areas:

|  |  |
| --- | --- |
| Area | Function |
| External (outer) |  |
| Middle (tympanic cavity) |  |
| Internal (inner) |  |

**I. External Ear**--consists of 2 parts:

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (pinna)= functions to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_= auditory canal that transmits sound waves to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* **Tympanic Membrane=** boundary between \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ears. Thin, connective tissue membrane that \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in response to sound and transfers sound energy to bones of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ear.

**II. Middle Ear (Tympanic Cavity)=** small \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_-filled cavity in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ bone. Surrounded laterally by the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and medially by the bony wall containing the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ windows.

* **Pharyngotympanic (auditory) tube=** connects the middle ear to the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. It was formerly called the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ tube. It is usually flattened but can be opened by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ or \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to equalize the pressure.
* **Auditory ossicles:** 3 small bones in tympanic cavity; named for their \_\_\_\_\_\_\_\_\_; suspended by ligaments so they can transmit vibrations of the eardrum to the oval window.

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_= “hammer” ; secured to eardrum
2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_= “anvil”; bone in center
3. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_= “stirrup”; base fits into oval window

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_= inflammation of the middle ear; common in children; causes eardrum to bulge outward and become inflamed.

**III. Internal (Inner) Ear=** also called the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (maze); located in temporal bone behind eye socket.; has 2 major divisions:

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ labyrinth- channels throughout the bone; divided into the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, & \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

1. Vestibule- egg-shaped; contains the maculae (receptor regions that respond to gravity and changes in head position).
2. Semicircular Canals- 3 canals oriented in 3 planes of space (anterior, lateral, and posterior); contain receptors that respond to angular (rotational) movements of head.
3. Cochlea- “the organ of hearing” small, spiral, bony chamber; the spiral organ {Organ of Corti} contains cochlear hair cells arranged in rows that connects to cochlear branch of nerve VIII to brain.

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ labyrinth- membranous sacs and ducts within the bony labyrinth filled with \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

Hearing

Hearing is the reception of an \_\_\_\_\_\_\_\_\_ sound wave that is converted to a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ wave which stimulates the cochlear hair cells that send impulses to the brain for interpretation.

Sound has 2 properties:

* Frequency – number of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ that pass a given point in a given time. The distance between 2 consecutive crests is called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. Pitch is the perception of different \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* Amplitude- height of the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_; is perceived as \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and measured in decibels.

***Maculae*** are sensory receptor organs that measure\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. They are located in the inner ear and monitor \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. They respond to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ acceleration forces but not rotation.

**Crista ampullaris (crista)** are receptors for \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ acceleration. They are located in the inner ear as well.

Disorders:

Equilibrium problems cause symptoms of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. Patients may also suffer from nystagmus (involuntary eye jerking).

Motion sickness- occurs when the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ input differs from the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ input and causes conflicting information.

Deafness-

* Conduction deafness- occurs from \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Sensorineural deafness- occurs from \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_; can be treated using \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ implants

Tinnitus is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in the absence of auditory stimuli. It can be caused by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Meniere’s Syndrome is a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ disorder that affects \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. It causes \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and can be treated with anti-motion sickness drugs or surgery.