Hearing

The ear is the sense organ that collects and detects sound waves and plays a major role in the sense of balance and body position. The sensory receptors for both hearing and equilibrium are mechanoreceptors found in the inner ear; these receptors are hair cells that have stereocilia (long microvilli) that are extremely sensitive to mechanical stimulations.

Anatomy of the ear

The ear has three divisions: the outer ear, the middle ear, and the inner ear.

1) Outer ear (Auricle, Ear Canal, Surface of eardrum): The outer ear is the most external portion of the ear. The outer ear includes the pinna (also called auricle), the ear canal, and the very most the superficial layer of the eardrum (also called the tympanic membrane). Although the word "ear" may properly refer to the pinna (the flesh covered cartilage appendage on either side of the head), this portion of the ear is not vital for hearing. The complicated design of the human outer ear does help capture sound, but the most important the functional aspect of the human outer ear is the ear canal itself. This outer ear canal skin is applied to cartilage; the thinner skin of the deep canal lies on the bone of the skull. If the ear canal is not open, hearing will be dampened. Ear wax (medical name - cerumen) is produced by glands in the skin of the outer portion of the ear canal. Only the thicker cerumen-producing ear canal skin has hairs. The outer ear ends at the most superficial layer of the

tympanic membrane. The tympanic membrane is commonly called the eardrum.

2) Middle ear (Ear bones): The middle ear includes the 3 ear bones ossicles: malleus (or hammer), incus (or anvil), and stapes (or stirrup). The malleus has a long process (the handle) that is attached to the mobile portion of the eardrum. The incus is the bridge between the malleus and stapes. The stapes is the smallest named bone in the human body. The stapes transfers the vibrations of the incus to the **oval window**, a portion of the inner ear to which it is connected. It is the final bone in the chain to transfer vibrations from the eardrum to the inner ear. The movement of the tympanic membrane causes movement of the first bone, which causes movement of the second, which causes movement of the third. When this third bone pushes down, it causes movement of fluid within the cochlea (a portion of the inner ear). This particular fluid only moves when the stapes footplate is depressed into the inner ear. Unlike the open ear canal, however, the air of the middle ear is not in direct contact with the atmosphere outside the body. The Eustachian tube connects from the chamber of the middle ear to the back of the pharynx. The middle ear in humans is very much like a specialized paranasal sinus, called the tympanic cavity, it, like the paranasal sinuses, is a hollow mucosa lined cavity in the skull that is ventilated through the nose.

3) **Inner ear** (Cochlea, Vestibule, and Semicircular Canals): The inner ear includes both the organ of hearing (the cochlea) and a sense organ (the labyrinth or vestibular apparatus) that is attuned to the effects of both gravity and motion. The balance portion of the inner ear consists of three semicircular canals and the vestibule. The inner ear is encased in the

hardest bone of the body. Within this ivory hard bone, there are fluid-filled hollows. Within the cochlea are three fluid filled spaces: the tympanic canal, the vestibular canal, and the middle canal. The eighth cranial nerve comes from the brain stem to enter the inner ear.