The ability to hear is critical to understanding the world around us. The human ear is a fully developed part of our bodies at birth and responds to sounds that are very faint as well as sounds that are very loud. Even before birth, infants respond to sound.

So, how do we hear?

The ear can be divided into three parts leading up to the brain: the outer ear, middle ear and the inner ear. Each of these has different structures, functions, and problems.

The outer ear consists of the pinna, or auricle, and the ear canal (external auditory meatus). The pinna – the part of the "ear" that we see on each side of our heads – is made of cartilage and soft tissue so that it keeps a particular shape but is also flexible. The pinna is easy to see because it is on the outside of the head. The pinna serves as a collector of sound vibrations around us and guides the vibrations into the ear canal. It helps us decide the direction and source of sound. It is made of cartilage and helps to gather and localized sound. The auditory canal begins at a small opening in the pinna and ends at the eardrum. Its function is to direct sound to the middle ear. Sound travels down the ear canal, striking the eardrum and causing it to move or vibrate. If the auditory canal is blocked, sounds will be quieter and difficult to hear.

The middle ear begins with the eardrum at the end of the ear canal. The middle ear contains three tiny bones, called the ossicles. These three bones form a connection from the eardrum to the inner ear. As sound waves hit the eardrum, the eardrum moves back and forth causing the ossicles to move. As a result, the sound wave is changed to a mechanical vibration. The eardrum is a thin piece of tissue covers the end of the auditory canal. When sounds traveled through the auditory canal and reach the eardrum, it vibrates. The space behind the eardrum that contains three small bones called ossicles. They were the smallest bones in the human body and are connected to each other. This chain of tiny bones is connected to the eardrum at one end and to an opening to the inner ear at the other end. Vibrations from the eardrum cause the ossicles to vibrate which, in turn, creates movement of the fluid in the inner ear. The movement of the eardrum makes the first bone in the chain, the malleus to vibrate. When the malleus vibrates, it makes the rest of the chain move: first with the malleus, next the incus, and finally the stapes. Each bones vibration makes the next to bone move. If one of the ossicles is missing or broken, vibration stops. Damage to the ossicular chain and cars a hearing loss.

People who have a problem in the outer or middle ear have a conductive hearing loss. Conductive losses can usually be helped with medicine or surgery. Conductive losses can be caused by many problems such as: too much wax in the auditory canal, a perforated eardrum, and infection in the middle you're, or a broken bone in the ossicular chain.

The inner ear contains the sensory organs for hearing and balance. The cochlea is the hearing part of the inner ear. The semicircular canals in the inner ear are part of our balance system.

The cochlea is a bony structure shaped like a snail and filled with two fluids (endolymph and perilymph). The Organ of Corti is the sensory receptor inside the cochlea which holds the hair cells, the nerve receptors for hearing.
The mechanical energy from movement of the middle ear bones pushes in a membrane (the oval window) in the cochlea. This force moves the cochlea's fluids that, in turn, stimulate tiny hair cells. Individual hair cells respond to specific sound frequencies (pitches) so that, depending on the pitch of the sound, only certain hair cells are stimulated.

Signals from these hair cells are changed into nerve impulses. The nerve impulses are sent out to the brain by the cochlear portion of the auditory nerve.

The cochlea is very important because it is from where sound is sent to the brain. It has tiny nerves, hair cells, which are stimulated by the fluid movement. When the middle you're vibrations reach the inner ear, the fluid moves. It touches the hair cells. The hair cells are very sensitive to fluid, and they send messages to the auditory nerve. This is a special nerve which connects the hair cells and the brain. The auditory nerve sends the message to the brain, and the brain proceeds to sound.

The auditory nerve carries impulses from the cochlea to a relay station in the mid-brain, the cochlear nucleus. These nerve impulses are then carried on to other brain pathways that end in the auditory cortex (hearing part) of the brain.

Also housed within the inner ear are the semicircular canals, the utricle, and the saccule. These structures help control the sense of steadiness or balance. These balance organs share the temporal bone space with the cochlea. These organs also share the same fluid that is in the cochlea. As the body moves, the fluid moves. This process maintains balance. When there are problems in the semicircular canals, the person will have problems with balance and equilibrium.

The canals are responsible for balance and the cochlea for hearing. This is why some deaf people have balanced disorders.

Movement of the fluid in the inner ear, or cochlea, causes changes in tiny structures called hair cells. This movement of the hair cells sends electric signals from the inner ear up the auditory nerve (also known as the hearing nerve) to the brain.

If people are born with a damaged cochlea, they will have a permanent hearing loss. Scientists are experimenting with cochlear implants, artificial devices that replace damaged cochleas. Some people are trying to find ways to repair cochleas, but so far they have not succeeded.

Nerves do not grow back when they are hurt. Damage to the hair cells, auditory nerve, or cochlea is permanent. This type of hearing loss is a sensory neural hearing loss. Hearing aids are not a cure for sensory neural hearing loss or cochlear damage. They are helpful, but will not solve the person's hearing problem. Doctors cannot operate on the hair cells, auditory nerve, or cochlea.

Most people who are profoundly deaf have a sensory neural hearing loss. Although hearing aids help, they will not restore normal hearing to a person with a damaged cochlea, or auditory nerve.

The brain then interprets these electrical signals as sound.
What are the symptoms of a hearing loss

- Saying "what" or "huh" during normal conversation
- Tinnitus (ringing in the ears)
- Muffled hearing
- Difficulty understanding what people are saying, especially when there are competing voices or background noise.
- Listening to the television, an iPod or radio at higher volume than in the past.
- Avoiding conversation and social interaction.
- Ear pain, itching, or irritation.
- Pus or fluid leaking from the ear may result from an injury or infection that is causing hearing loss.
- Vertigo (sensation of dizziness described as “spinning” can occur with hearing loss caused by Meniere’s Disease, acoustic neuroma or labyrinthitis.

How is hearing measured?

When describing hearing loss, we generally look at three categories: Type of hearing loss, degree of hearing loss and configuration of hearing loss. With children, it is especially important to diagnose and treat a hearing loss as early as possible. This limits its potential impact on learning development. Hearing loss can greatly affect the quality of life for adults as well. Unmanaged hearing loss can have an impact on employment, education, and general well-being.

Hearing loss can be categorized by which part of the auditory system is damaged. There are three basic types of hearing loss: conductive, sensorineural and mixed hearing loss.

Conductive hearing loss occurs when sound is not conducted efficiently through the outer ear canal to the eardrum and the tiny bones (ossicles) of the middle ear. Conductive hearing loss usually involves a reduction in sound level or the ability to hear faint sounds. This type of hearing loss can often be corrected medically or surgically.

Degree of hearing loss refers to the severity of the loss. The table below shows one of the more commonly used classification systems. The numbers are representative of the patient's hearing loss range in decibels (dB HL).

Degree of hearing loss  Hearing loss range (dB HL)

- Normal  –10 to 25dB
- Mild 26 to 40dB
- Moderate 41 to 55dB
- Moderately severe 56 to 70dB
- Severe 71 to 90dB
- Profound 91+dB
Some possible causes of conductive hearing loss:

- Fluid in the middle ear from colds
- Ear infection (otitis media)
- Allergies (serous otitis media)
- Poor Eustachian tube function
- Perforated eardrum
- Benign tumors
- Impacted earwax (cerumen)
- Infection in the ear canal (external otitis)
- Presence of a foreign body
- Absence or malformation of the outer ear, ear canal, or middle ear

Sensorineural hearing loss (SNHL) occurs when there is damage to the inner ear (cochlea), or to the nerve pathways from the inner ear to the brain. Most of the time, SNHL cannot be medically or surgically corrected. This is the most common type of permanent hearing loss.

SNHL reduces the ability to hear faint sounds. Even when speech is loud enough to hear, it may still be unclear or sound muffled.

Some possible causes of SNHL:

- Illnesses
- Drugs that are ototoxic to hearing
- Hearing loss that runs in the family (genetic or hereditary)
- Aging
- Head trauma
- Malformation of the inner ear
- Exposure to loud noise

Sometimes a conductive hearing loss occurs in combination with a sensorineural hearing loss (SNHL). In other words, there may be damage in the outer or middle ear and in the inner ear (cochlea) or auditory nerve. When this occurs, the hearing loss is referred to as a mixed hearing loss.

When hearing is tested, the results are charted on an audiogram. The loudness of that sound is increased until the patient responds to the softest sound they can hear. Loudness of each sound is measured in decibels (dB) normally between 0 to 110 dB.

Hearing is also tested with different pitches, or frequencies, that are measured in Hertz (Hz). Frequencies close to those of the speech sounds are tested (from 250 to 8000 Hz.)

When can hearing loss occur?

We can become hearing impaired at any age: before we are born, during childhood, or as adults. Each age of onset has a different name and may have different causes.
Prenatal deafness means that a baby is born deaf. There are several reasons why this can happen. If parents are deaf, they may have a deaf baby. This does not happen very often though. There are also genes related to deafness that hearing parents can pass on to their child. Even if parents are hearing, they may have genes for hearing impairment.

One of the most common types of prenatal deafness is caused by a disease called Rubella, or German measles. During the 1960s, there was an epidemic of rubella, and thousands of children were affected. Many of them were born deaf.

Other prenatal causes of deafness can include, accidents, medicine or ototoxic drugs that the mother takes, illnesses, and genetic syndromes. Genetic syndromes are a group of characteristics that a child inherits from its parents.

Infants can also lose their hearing after birth. If there is a problem during birth, brain damage can result. When this happens, the child can be born deaf.

Although full-term pregnancy is supposed to last for nine months, babies are sometimes born early. If this happens, and the baby is very tiny, it is called a premature birth. Premature babies can have many problems because their bodies are too small or not fully developed. If the respiring tour a system is not strong enough, the baby can stop breathing. The brain needs oxygen, and if the baby stops breathing, the brain doesn't get the oxygen it needs and the baby can be deaf or mentally retarded.

Another complication which can occur to a newborn baby is related to the blood. If the baby and its mother have different blood types, there can be many problems. There are several different blood types. There are many different combinations of blood types and positive and negative factors. When the mother has the negative type and the baby has a positive type the situation called Rh incompatibility occurs. This means that the baby's blood and the mother's blood do not get along. They both become very sick from this. When the baby is born, all of its blood has to be removed and new blood added. This transfusion of blood saves the baby's life. If the baby's blood conflicts with its mother's there can be damage even before the transfusion and this can result in deafness. Many babies do not even survive when there is a Rh incompatibility problem. Fortunately the incompatibility of babies and mother's blood can be control today.

Many problems that a Deaf child has from an early age of onset are related to language learning. If the baby loses its hearing before it learns to talk, it will not learn language the same way a hearing baby learns language. Using hearing before age 3 is called prelingual deafness. This means the child becomes deaf and for it learned a language. When a child knows how to talk and then loses its hearing, usually after age 3, it is called postlingual deafness, which means after language has been learned.

Adults can also develop deafness. Hearing losses that adults may experience can be caused by exposure to loud noise (factory noise or music), or hearing loss due to aging (called presbycusis.)

Effects of Hearing Loss on Development
It is well recognized that hearing is critical to speech and language development, communication, and learning. Children with listening difficulties due to hearing loss or auditory processing problems continue to be an under identified and underserved population.

The earlier hearing loss occurs in a child's life, the more serious the effects on the child's development. Similarly, the earlier the problem is identified and intervention begun, the less serious the ultimate impact.

**There are four major ways in which hearing loss affects children**

1. It causes delay in the development of receptive and expressive communication skills (speech and language).
2. The language deficit causes learning problems that result in reduced academic achievement.
3. Communication difficulties often lead to social isolation and poor self-concept.
4. It may have an impact on vocational choices.