Losing connections in a complex sound system

THE SILENT ABILITY: A SERIES IN 4 PARTS

PART 1: Adult Hearing Loss (today)
PART 2: Hearing Loss in Children (July 22)
PART 3: ANSD (Auditory Neuropathy Spectrum Disorder) and cochlear implants (August 26)
PART 4: Amplification success stories and sign language (September 23)

Freddie Petersen

Natalie Buttress

KNOWLEDGE is power. When something changes in our bodies, understanding what is happening goes a long way to helping us cope with the change.

Changes in your hearing can provoke anxiety, and seeing an audiologist will help to identify the type, quantity, and location of the problem. However, it is important to understand the process of hearing and the diagnosis in order to cope with the problem and understand the potential solutions.

Hearing is a complex interaction of sound energy with our perceptual organ, the ear.

However, the ear is merely the peripheral extension of the auditory pathway, which routes as a central nerve, all the way into the brain. It is in the auditory cortex of the brain that sound is actually understood in a meaningful way.

But how does it get there?

The conductive portion of the ear is responsible for the transmission of sound, before the sound energy is converted into electrical impulses. The outer ear (Pinna and Canal) lead the sound inwards. Sound enters the ear through the ear canal. The sound wave moves down the canal, which lends the sound enhanced resonances for the harmonics of speech. It impinges on the ear drum, which causes the drum to vibrate. The eardrum is the first structure of the middle-ear cavity, and when it vibrates it moves, in sequence, three of the tiniest bones in the body: the Malleus (Hammer), Incus (Anvil) and Stapes (Stirrup).

This bony chain of the middle ear is responsible for moving the sound from outside to the nerve and also for increasing the energy signature of the sound for precise transfer to the nerve fibres. Problems in the conducting of sound will result from any blockage of the ear canal (from wax, foreign objects, trauma, infections, bone growth, tumours or birth abnormalities).

In the middle ear, pressure differences between the outer atmosphere and the middle-ear cavity (including problems of the Eustachian tube where pressure is equalised or fluid build up from allergies and infection) will also change the conducting of sound.

In addition, fixation of the bone chain, disruption of the bone chain, or any condition causing added weight or stiffness to the chain, will result in a problem of energy transfer to the nerve, and thus conductive hearing loss.

An audiologist will diagnose the type of problem leading to hearing loss and begin the journey to reverse silence

With early identification and management, problems of the conductive portion of the ear can often be treated by surgical or medical intervention, to return the ear to its normal state. The removal of any obstruction, treatment of any infection, release of pressure or fluid, or reconstruction of bone can be performed after the correct diagnosis.

It is important to be diagnosed correctly, and early, as the proximity of the ear to the brain can mean more severe consequences for problems that can spread.

Also, medical management (when referred by an audiologist) is essential prior to the fitting of any hearing aids (which may still be needed after treatment).

The last bone in the chain has a connection to another smaller membrane, the oval window. Vibration of this membrane moves the fluid in The cochlea (inner ear). It is in the cochlea that small nerve endings, called hair cells, convert the sound from vibration (mechanical energy) to electrical energy, to transmit patterns of impulses to the auditory cortex via the auditory nerve.

Damage to the cochlea's hair cells is nearly always permanent, and can be caused by birth abnormalities, infections, genetics, diseases (such as diabetes), trauma, excessive sound, chemicals and ageing.

Since the hair cells are part of the central nervous system, they do not spontaneously regenerate. Thus, sensorineural hearing loss (in this part of the ear) is usually incurable.

However, in cases where there remains usable hearing, compensation for the hearing loss with corrected sound (via a hearing aid), recreates a better hearing function and restimulates the nerve fibres to remain as active as possible.

In some cases, where amplification is not helpful, a cochlear implant may be performed – where electrodes are embedded in the cochlea to replace the function of the hair cells. Research is ongoing to look for ways to stimulate the regeneration of the cochlear hair cells.

Diagnosis of problems in the cochlear may be preventative in some cases as it can be an indicator of other diseases. In addition, early management may preserve and retain function that has not been lost yet. It is crucial to have an assessment and rehabilitative treatment.

The auditory nerve is the transporter of the electrical impulses to the brain. En route, it passes through the brainstem, where signals from the two ears are integrated to help us locate sound and also separate signals from background noise. The role of the nerve supply, and using *both* ears, is essential in the function of hearing speech.

Retro-cochlear (after the cochlea) nerve damage may be caused by extreme noise trauma, benign tumours placing pressure on the nerve (sometimes requiring surgery or laser treatment), or due to auditory neuropathy (not yet fully understood). It is diagnosable with specific nerve function tests, and is usually caused by genetic or birth factors.

In auditory neuropathy, the hearing sensitivity may actually appear to be normal, but it is the quality and consistency of the signal to the brain, which is disrupted.

All of the above problems can cause distortion of the sound signal, and are helped to a degree by hearing aids, specialised listening devices, or implants, but the type of damage results in more limited help.

The auditory cortex is the area in the temporal lobes of the brain, where sound is interpreted for meaning. It is a central function which gives all sound that we hear, a context.

We would not be able to understand our auditory world if it were not for the functions of auditory attention, memory and association, sequencing (keeping sound in order), closure (filling in missing bits), analysis (breaking sound into its components), synthesis (fusing sounds together), and all word recognition.

Auditory processing disorders are often the result of a lack of skills development, or a loss of skills in this part of the brain.

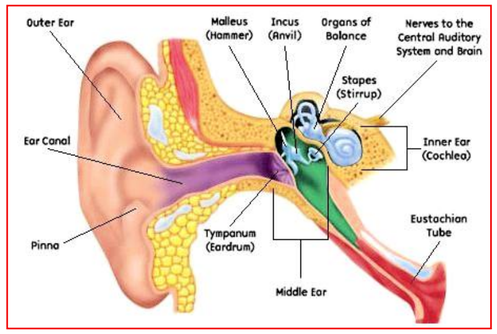
Genetics, birth problems, infections, trauma and disease can contribute, including syndromes, untreated ear infections, dementia, stroke, brain injury and importantly, untreated hearing loss in the peripheral ear.

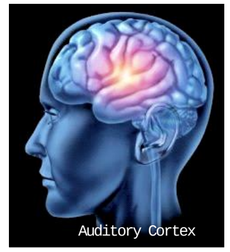
People with problems in this area sometimes require extensive rehabilitative therapy from a speech-language therapist and audiologist, in order to recover their function.

If you have any concerns about your hearing, see an audiologist.

Email SAAA (The South African Association of Audiologists) admin@audiologysa.co.za or visit www.audiologysa.co.za. Contact SASLHA (The South African Speech-Language-Hearing Association) on www.saslha.co.za.

Buttress has been working in the audiology profession since 1994, served as the president of the South African Speech, Language Hearing Association in 2001 and was awarded the Widex International Senso Diva award in Denmark in 2003 for improving the quality of life for people with hearing difficulties. For more information see www.nb-hearing.co.za





Helping deaf adults to be recognised

Andrea Lewis

ABOUT 15 percent of the world's adult population has some degree of hearing loss and 5.3 percent have profound hearing loss. But hearing loss has been consistently overlooked or disregarded on government agendas, despite being the most prevalent sensory impairment globally.

The growing number of people with hearing loss in South Africa raises the crucial question of how the government should implement strategies to improve access to services such as health and education.

Hear2Day, an organisation advocating better conditions for and supporting people with hearing loss, was established in 2006. This group meets regularly to discuss and share experiences related to hearing loss. A small legion of volunteers and audiologists are on a mission to open up the world of communication and access for hearing-impaired adults.

Hear2day's desire to assist others and create awareness of this silent disability became more fervent once it realised there were no official bodies in South Africa that advocated the protection of the rights of the hearing-impaired who lived and worked in the hearing world.

There are three groups of adults with hearing loss – those who develop hearing loss before learning spoken language (pre-lingually deaf), those who have progressive hearing loss, and those who develop hearing loss later in life for medical, environmental or genetic reasons.

People born with severe to profound hearing loss learn sign language as their primary means of communication, or learn to speak with access to therapy and appropriate technology, such as hearing aids and cochlear implants.

Adults with hearing loss who use spoken language do not belong to the deaf world or culture, nor do they easily fit in the hearing world. This can be likened to living in "a twilight zone".

Hear2day addresses critical issues regarding legislation and advocacy.

The organisation encourages people living with hearing loss to stand up for their rights and overcome barriers that threaten their quality of life.

For more information, visit www.hear2day.co.za or contact hear2day at hello@hear2day.co.za

Warning signs that noise is becoming dangerous

Natalie Buttress

UNLESS you live in the jungles of Borneo or the islands off Papua New Guinea, you'll have to agree that we live in a noisy world.

As our population, industry and entertainment increase, so do the sound energy signatures of our environments. Who can forget the indelible mark of the vuvuzela on the Fifa World Cup 2010 in South Africa? We South Africans may even remember its noise more easily than we can recall which team won (Spain).

Unfortunately, our ears are not designed to absorb the sound energy we experience today. Scientists in the field of audiology understand that the impact of noise on our hearing (here we categorise wanted and unwanted sound sources) is having a greater and greater negative consequence. Audiologists are seeing more patients with hearing loss of the nerve supply (sensorineural) – hearing loss often caused by excessive sound exposure – in younger and younger people. In the short time since personal music players were introduced, we have seen a 25 percent increase in the number of teenagers with hearing loss.

Other ear symptoms that are caused by this type of damage include tinnitus (ringing in the ears), hyperacusis (excessive sensitivity to normal sound) and even vertigo (a sense of dizziness).

Social noise exposure is definitely on the rise, and audiologists are struggling to educate people about the dangers of excessive sound exposure to preserve our ear function so that it may last a lifetime.

Industrial guidelines for hearing suggest that workers in loud environments should be provided with, and consistently wear, ear protection in any environment that exposes them to more than 85dB (decibels) for more than 20 minutes. This would also apply to other areas of sound, such as concerts, movies, music players, musical instruments, riding a motorbike, flying a plane and many other sound sources.

Musicians and industrial workers have always had a high incidence of hearing loss. Sadly, this is also occurring to many people who are neither of these..

How do we know if sound is dangerous? Any sound that creates psychological or physical discomfort is unsafe. You should respond immediately to reduce or remove yourself from such a sound environment.

Sound is measured in decibels and excessive sound exposure has a time-intensity interaction. This means that we can listen to loud sound for short periods of time, medium-loud sound for a little longer, and medium sound for even longer. Massively loud sound above 100dB should not be listened to at all, and impact sounds such as shots can be immediately damaging.

If you are in the same sound circumstances every day, the impact on your hearing will become collective.

The rule of thumb should be that if you can have a conversation at a normal level of speech without looking at your conversation partner's face, the sound is safe. But even then, the ear nerves need rest from time to time.

How can we protect our hearing?

Know your hearing status: have a baseline test to establish how you are hearing, and monitor it with a repeat test from time to time (annual is best).

Wear ear protection: audiologists can take ear impressions and manufacture customised ear protection that limits sounds above a certain quantity, while allowing softer levels to be audible.

These products last a long time if well-fitted, and reduce the risk of hearing damage.

They are crucial for people who experience loud environmental sound, but need to communicate during their day.

Many people take their protectors out when they need to communicate, exposing themselves to high levels of noise.

Over-the-counter earplugs are less effective, but are definitely preferable to not having any protection.

Limit the intensity level (below 85dB) or period of exposure.

Rest your hearing by sitting in silence for periods during the day.

What are the warning signs that noise is affecting my hearing?

You have immediate pain, nausea or dizziness in response to a sound.

You hear a "shhhhhhhhhh" in your ears for a few minutes, hours or days after exposure. (Your ears may return to normal, but repeated exposure will probably result in a permanent change).

You notice tinnitus (ringing) that remains and does not fade.

You begin to have difficulty with clarity of speech in environments where it is more difficult to listen, such as in a restaurant, watching television, listening to accents, or in a group conversation.

Common sound sources, levels

> "Hearing loss is not the end of the world, life goes on. Attitude is very important and I also don't believe in self-pity. Life happens

It took a while to remember to check whether my dad was wearing his 'money'

Chevon Petersen

AT THE age of 33 my dad, Freddie Petersen, came home with hearing aids on his ears. My parents told my brother and I "from now on you must always look at your father when you talk to him and remember if anything happens at night, he can't hear", that was it, end of story.

It was two decades later, after having my son diagnosed with a hearing impairment at the age of 4, that I realised the impact of hearing loss on one's quality of life and started asking questions about my dad.

I remember the frustration I had as a child, constantly having to repeat myself. I remember my mom repeatedly telling my dad that he had a hearing problem and he should go see a doctor. My mom eventually got so fed up that she called the doctor herself and made an appointment for my dad. The doctor scheduled an appointment for him to see an ear, nose, and throat (ENT) specialist and audiologist at Groote Schuur Hospital.

The diagnosis was that the bones in his ears were hardening (a middle ear condition, otosclerosis). The ENT specialist suggested that he have a stapedectomy (where the stapes are removed and replaced with prosthesis).

My dad decided against the operation since the risk at the time included facial nerve paralysis, vertigo and that surgery may increase hearing loss. In some cases hearing improvement was only temporary. He was then referred for hearing aids.

His first pair of hearing aids didn't benefit him much so he decided to see an audiologist in private practice who referred him for an in-the-canal hearing aid for his bad ear. At the time it cost our family R5 000 which my parents paid off over a period of six months. This was in the mid-1990s, a lot of money for a family living on a minimum income.

With the in-the-canal hearing aids children often asked my dad why he was walking with money in his ears and he had to explain to them that it was a hearing aid that helped him to hear better and they would just say "oh, okay". End of interest.

My dad suspects that he probably had hearing loss as a teenager already. He always sat in the front of the class and often struggled to hear people, but back then people just got on with it. There were more important things for his family to worry about, like where their next meal would come from. It took us a while to stop talking to my dad when he wasn't wearing his hearing aids, but we are now in the habit of, especially in the mornings, first checking he is wearing his hearing aids before we talk to him. Or we will ask him to put on his hearing aids, which at times he does reluctantly. My dad feels it is a benefit that he can literally "switch off" when he doesn't want to hear the world – an ability hearing people don't have. In 20 years my dad's hearing loss deteriorated to severe.

"Hearing loss is not the end of the world, life goes on. Attitude is very important in this world and I also don't believe in self-pity. Life happens," says Freddie.

How fortunate am I to have a deaf dad. I could not have asked for a better role model for my hearing-impaired son. These two special men in my life have an incredible bond, their hearing loss is the one thing that no one else shares in our family, they are unique and they get on with life. It's not easy, but they do. With a smile.

Freddie and his grandson both benefit from bilateral hearing aids.