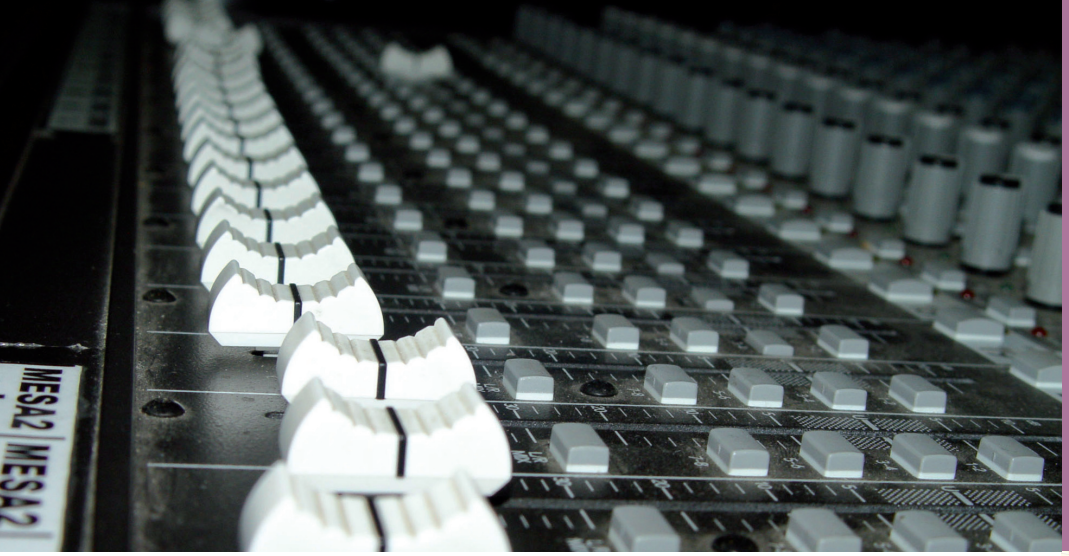

DISEASE FACT SHEET

Hearing Loss

Hearing Loss

Understanding hearing loss becomes much easier once we grasp the process of hearing. When a sound wave enters an ear, vibrations travel across a membrane known as the 'ear drum', through the tiny bones in our inner ear to a pea-sized, fluid-filled bony structure called the cochlea. Containing 15 000 microscopic 'hair cells', each vibrating to a different sound, or frequency, the cochlea is our main hearing organ. When pressed or moved, hair cells, like piano keys, send sound signals to our brains. Once hair cells die, or hearing starts to fail, we lose some of the sounds in the world around us.

As we age, hair cells die. This is natural and unavoidable. For reasons we can't explain, the hair cells corresponding to the high frequencies often die first. We might notice when the sibilant sounds in speech, such as 's', 'f' and 'sh', become harder to distinguish and we might lose the sounds of waves lapping, leaves rustling and birds singing. By the age of 60, more than half the population will be aware of at least some loss of hearing. Many people assume that those with hearing loss experience a world with the volume turned down. In fact, hearing loss can be experienced very differently depending on its causes; sometimes with loss of frequencies; sometimes with distortion of sound; sometimes with less ability to separate, or attend to, specific sounds.

Types of hearing loss

In adults, hearing loss may be gradual, as in age-related hearing loss. Sudden loss can occur from other factors such as viral infections of the inner ear. Hearing loss falls into two broad catagories:

• Conductive Hearing Loss – This is caused by damage or a blockage to the outer and/or middle ear and can be acquired or congenital. Loss of loudness is the key symptom. Causes may include perforated ear drums, middle or outer ear infections, blockages of the ear canal by impacted wax or foreign objects, or otosclerosis (a hereditary condition where bone grows around one of the bones of the middle ear).

• Sensorineural Hearing Loss – This is caused by damage or malfunction of the cochlea or the auditory nerve. Loss of loudness combined with lack of clarity are the key symptoms. Causes may include ageing, excessive noise exposure, diseases such as meningitis, and head injuries. One in 500 children are born with a congenital form of sensorineural hearing loss. Causes may include an inherited hearing loss, premature birth, lack of oxygen, damage from viruses such as rubella, and jaundice.

Mixed hearing loss, when there is a problem in both the conductive pathway and in the nerve pathway, may also occur.

How is it diagnosed?

An audiologist or clinician will always take a person's family and medical history. After that, a series of hearing tests are generally carried out to determine the type of hearing loss. Sounds will be transmitted through headphones (air conduction) and through the skull (bone conduction) at different frequencies and volumes. Speech tests (where someone attempts to decipher words spoken at softer and softer levels) will also be carried out.

The results of hearing tests will be plotted on a chart called an audiogram, that will show hearing thresholds (the levels at which various frequencies become audible) in both ears. This will tell the audiologist whether or not the person is likely to benefit from wearing a hearing aid.

"15,000 microscopic hair cells detect sound in the cochlea"

"One in every 500 children will be born with a congenital hearing loss"

"One in six Australians suffer from hearing loss"

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Breakthrough Medical Research

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HEARING LOSS

"Be part of progress"

Can we prevent hearing loss?

Noise induced hearing loss is caused by a combination of loudness of sound and length of exposure. The louder the sound (measured in decibels), the less exposure is needed to suffer a hearing loss. Sounds loud enough to cause ringing in the ears afterwards are loud enough to cause hearing damage. Prolonged exposure to loud noise will kill hair cells. A single very loud sound (such as a gun shot or explosion) can cause instant hearing loss. To prevent noise-induced hearing loss, we can either wear ear plugs or avoid loud noise.

How is hearing loss treated?

The treatment of hearing loss depends on the cause. Bacterial infections of the middle ear can be treated with antibiotics; blockages of the outer and middle ears can be cleared; surgery can repair damaged ear drums, and bones of the middle ear affected by otosclerosis can be replaced by artificial bones.

At present, age-related hearing loss cannot be cured, but a hearing aid may help. There are many different types of hearing aids and an audiologist will advise which one is most suitable. For the profoundly deaf, a cochlear implant may assist. This device transmits sound directly into the auditory nerve via electrodes surgically implanted into the cochlea. Recipients of a cochlear implant will need to learn how to marry the electronic sounds produced by the implant with lip reading skills.

What research is Garvan doing in this area?

Degeneration of hair cells in the inner ear occurs commonly with ageing and following excessive sustained noise. Since hair cells are not replaced in humans, the sensory deprivation is permanent and irreversible. Garvan's Hearing Research Group in the Neuroscience Research Area is exploring the potential of adult stem cells to generate new hair cells. Until recently, it was believed that nerve cells could not be regenerated. It is now known that the brain contains stem cells that can become new nerve cells.

One source of stem cells is the lining of the nose. These stem cells constantly replace cells that enable us to smell. Olfactory stem cells, as they are known, are easily accessible, abundant and have the potential to be used for a range of stem cell therapies tailored to an individual patient. They can also be taken from one's own body thus eliminating the problems of tissue rejection. Garvan's Hearing Research Group has successfully demonstrated that adult olfactory stem cells can be converted into new hair cells. Fine surgical techniques have recently been refined to reintroduce test cells into the mouse inner ear. The technique is now ready to be applied to injection of stem cells and testing for functional recovery of hearing.

Further sources of information

Better Hearing Australia	www.betterhearing.org.au
Australian Hearing	www.hearing.com.au

Garvan Institute of Medical Research – how you can get involved

The Garvan Institute of Medical Research was founded in 1963. Initially a research department of St Vincent's Hospital in Sydney, it is now one of Australia's largest medical research institutions with approximately 500 scientists, students and support staff. Garvan's main research areas are: Cancer, Diabetes & Obesity, Immunology, Osteoporosis & Bone Biology and Neuroscience.

Your support makes it possible for the Garvan scientists to continue their great work. You can help by making a donation or a bequest, holding a community fundraiser or volunteering your time for Garvan. For details on how to get involved, please visit www.giving.garvan.org.au or contact the Garvan Research Foundation on
(02) 9295 8110.

Education is one of Garvan's top priorities. Our Public Engagement Coordinator can visit your community group or school to give a talk on a number of science and health related topics. Garvan also offers regular tours of our facilities. For further details, visit our website or call (02) 9295 8108.

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