

Key words

sound waves

hearing loss

tinnitus

cochlea



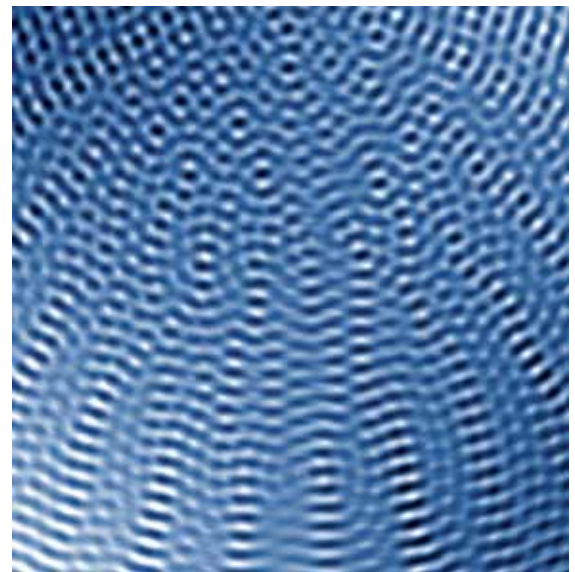
Can you hear me? I said, Can you hear me?

Loud music can be fun, but it can also be harmful.

*Hearing loss is usually associated with the elderly, straining to hear the TV while turning up their hearing aid. As a teenager losing the ability to hear correctly seems decades away but hearing loss is increasingly becoming a problem for young adults and teenagers. **Eimear O'Carroll** explains why.*

How many of your friends own an mp3 player? Or go to a club or disco every weekend? Or queue for hours to be right at the front when going to see their favourite band in concert? It is exactly these activities that are contributing to the rise in hearing loss and that may create a deaf generation in thirty years time. A study carried out at Children's Hospital Boston found that 1 in 5 teenagers in the USA now have mild hearing loss, a staggering figure for people so young. They also showed that this figure has risen by nearly 5% in the last 20 years as they tested from 1988-94 and again in 2005-06.

Hearing loss can occur in many different ways. At concerts the main factor involved, which most people know, is your proximity to the speakers. However there are other important issues like the interference of sound that is coming from multiple speakers, when the sound waves combine and either add or cancel each other. This creates loud and quiet patches in the room. And the rain is not the only thing to think about when going to an outdoor concert, the sound has no walls to reflect off, like it would indoors, so there are no reflected sound waves that would also add to the loud and quiet spots.



This image shows how sound waves from multiple sources interfere with each other to produce louder and softer regions.

Similarly the volume that you listen to music on your iPod or mp3 player at is one of the obvious factors that contribute to noise induced hearing loss but it is not the only one. Your headphones make a big difference too due to the varied levels of sound intensity. Sound played through inner ear headphones will do more damage to your hearing than the same volume through outer ear headphones. Intensity is a measure of the power per unit area and the more intense the sound the more harmful it is to the sensitive sound receptor cells in the inner ear.

In all cases, the length of time that you are exposed to the loud music is a critical factor in the damaging of your hearing. At a typical rock

concert the sound intensity is around 120 decibels, dB. This means that if you're about 20 metres away from the stage you can only stay there for two hours before your ears begin to be damaged. You may not feel like the music coming from your mp3 player is too loud but it may not be safe to listen at that volume for a long period of time.

The problem of hearing loss has now entered the sporting world with the emergence of the vuvuzela at the South African World Cup in 2010. The growing phenomenon of the use of the vuvuzela horn at the World Cup and other sporting events around the globe, including football matches here in the UK, will see sports fans suffering from hearing loss and ringing in the ears in the same way concert goers currently do.

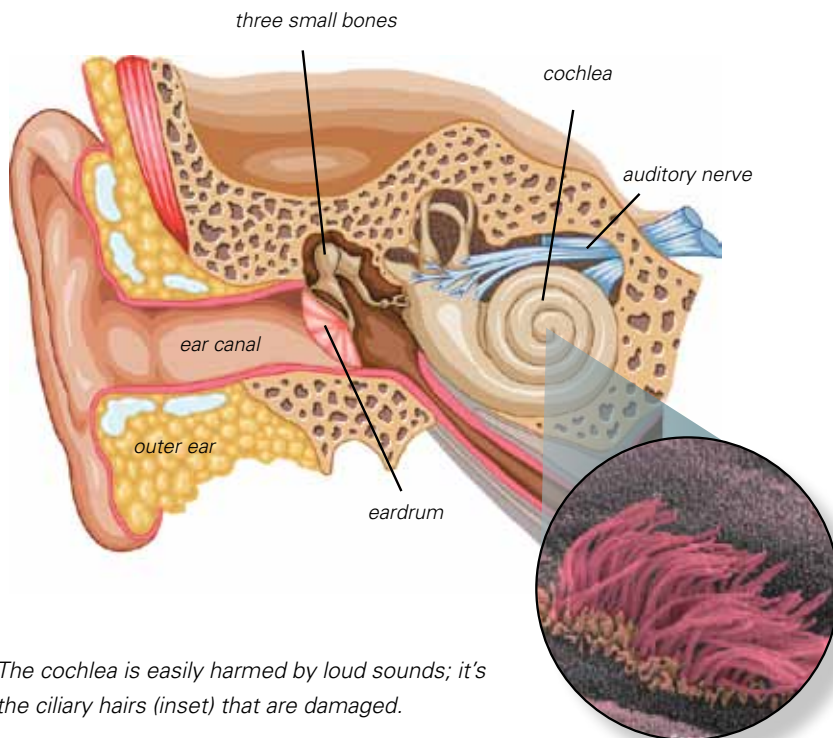


Playing a vuvuzela in Cape Town Stadium, June 2010

How the damage is done

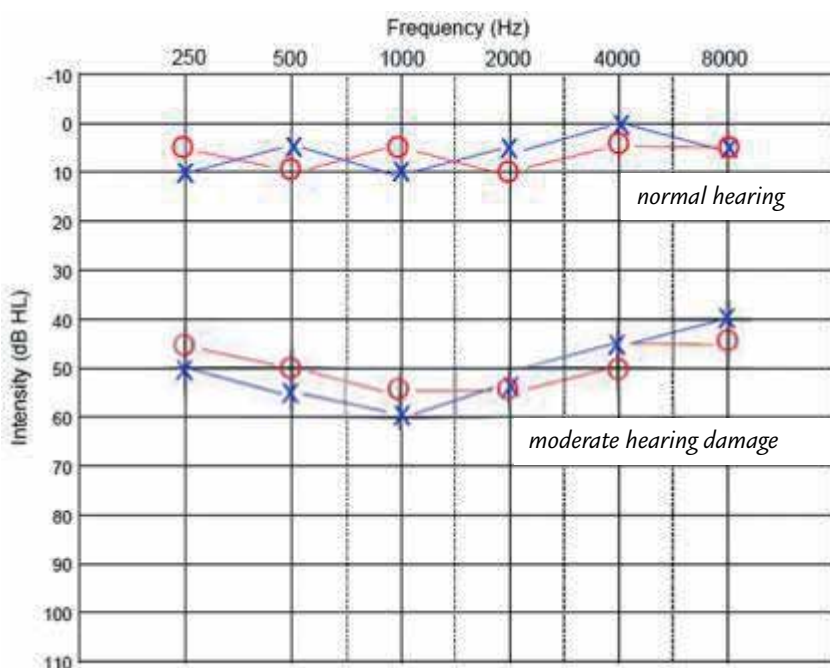
The cochlea in the inner ear contains the sound receptor cells that are like little hairs. These hairs move in response to sounds and their movements are converted to electrical signals and sent to the brain where they are interpreted as sound. When you listen to loud music or are in a noisy environment the cochlear hairs get bent or in extreme cases broken. These damaged cells cannot receive the sound as well as they usually would and they also interfere with each other.

This interference is interpreted by the brain as sound, even in the complete absence of sound, and frequently manifests itself as ringing in the ears. This ringing in the ears, called tinnitus, is one of the signs that you have done damage to your hearing. Tinnitus is one of the most common complaints of modern day living and it is regularly experienced after concerts, discos and listening to your mp3 player at high volumes. In 2008 I carried out a survey on 12–40-year-olds to discover their habits in relation to hearing and sound protection. 92% of them have experienced temporary tinnitus at some point after attending a noisy event like a concert or disco or working in a loud environment, a truly staggering figure.



The cochlea is easily harmed by loud sounds; it's the ciliary hairs (inset) that are damaged.

Along with ringing in the ears other signs that your hearing is not as good as it once was include not being able to hear high frequencies and finding speech difficult to comprehend. The normal range of human hearing is between 20 and 20 000 hertz, Hz. As people get older they lose the ability to hear the top portion of frequencies, this is usually 17 000 Hz and above but varies from person to person. Startlingly this loss of high frequencies is now being observed in teenagers and young adults. There has been no conclusive study done on this yet, but one of the strongest hypotheses is that the increased usage of mp3 players at high volumes is doing damage to teenagers' hearing.



Audiograms show how well people hear at different frequencies. X = left ear, O = right ear.

Caring for your hearing

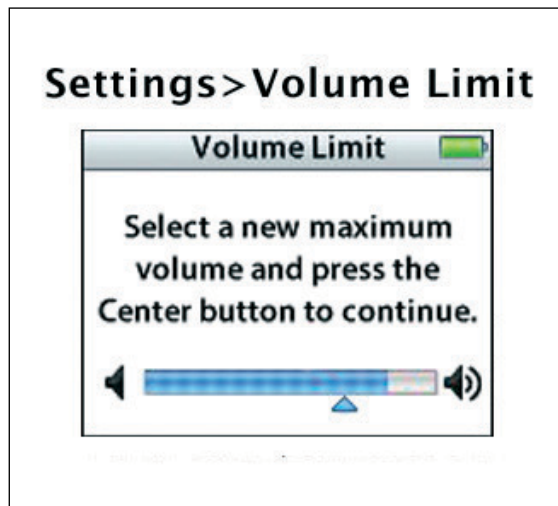
Hearing loss can be prevented by taking a few simple steps towards protecting your ears. The safest option is to avoid loud noise entirely but this isn't always practical.

When attending concerts or discos it is a good idea to use a pair of earplugs. The music will still be loud enough for you to hear it but you won't incur the same levels of damage that you would without the protection. If you're trying to avoid ringing in your ears the next morning you won't want to be dancing beside the speakers when you're out at the weekend.

When using your mp3 player try not to listen at too high a volume. Try using the volume limiter, which is on most devices, to prevent you from turning up the volume beyond a safe level. Switching your headphones from inner ear headphones to outer ear headphones can reduce the sound intensity levels that your ears are subjected to.



Earbuds – more likely to cause damage than outer ear headphones.



Here's how to reduce the risk of hearing damage from an iPod.

If you work in a noisy environment it is the law that your employer must provide you with hearing protection depending on the intensity of the sound and the length of time for which you will be exposed. Even people who work in bars and clubs would also be advised to wear hearing protection if the music is particularly loud. Similarly if you play a musical instrument or are in a band you should use earplugs when performing – many classical musicians complain of hearing loss at an early age, it's not just the rockers that have all the fun!



Noise is a workplace hazard.

The recent publicity about hearing loss among teenagers provides some sobering facts about the decrease in auditory ability in young people. However by highlighting this issue and by informing young adults about the dangers of high intensity sound it is possible to change attitudes and form healthy hearing habits that you can carry into the future. Small and simple measures like wearing earplugs at a concert can make a big difference in both the short and long term. Our society seems only to be getting louder so by tackling the issue of hearing loss now we can aim to stop the deaf generation.

Eimear O'Carroll is studying Physics at Edinburgh University.

Look here!

You can read Eimear's previous article about temporary tinnitus and its cure here:

http://www.sep.org.uk/catalyst/articles/catalyst_20_4_455.pdf

Representatives of the music industry have joined forces with the UK Health and Safety Executive to produce Sound Advice:

<http://www.soundadvice.info>