ReSound

For people with Cochlear Implants

Autumn 2024 Issue 83

Edale Cottage

Manchester Cicada

An association of cochlear implant users helping each other

This newsletter has been produced on behalf of Manchester CICADA

contents

Editorial

Welcome to the Autumn edition of Resound for 2024.

In this edition I am once again very pleased to be able to report on more of our regular events after the disruption of recent years.

We are trying to organise these events in various parts of our North West area to try and give as many people as possible a chance to come to at least one event a year.
If you have not been able to attend for whatever reason please get in touch so that we can try and be as inclusive as possible wherever you live.

All ideas about activities and events are more than welcome and friends and family are also

It's rewarding to see so many of our group being involved in so many different actvities to help others, from lipreading to raising money for charities and helping each other with our own technological issues!

Since the last edition we have also been developing our Facebook site so we can keep in contact easier and also be able to publicise and manage our events schedule quicker.

Further developments will see back copies of Resound and useful information about accessories there for your use.

The Facebook page is called Manchester Cicada Club.

Our website is also still available for those without Facebook access for news, events and links to many helpful websites and organisations. The link is:
www.manchestercicada.org.uk

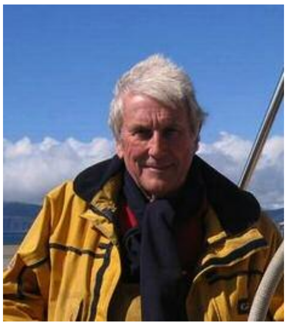
Enjoy this issue and as always feedback is appreciated.

From all of us on the EC, we wish you a Merry Xmas and a happy and prosperous New Year.

Kevin Williams - Editor

Family and Christmas

by John Newton



My great grandmother Katherine was born in 1848 in what is now Cumbria.

In 1867 when she was 19, she married my great grandfather John who was 20 at the time. Between that date and 1890 she gave birth to 9 boys and 5 girls going on to live cheerfully into her nineties as did her husband John. Her youngest was a boy Steadman, taking his mother's family name as his given name, which was customary then and later.

Steadman was killed in 1917 fighting in France, all the rest lived long lives, married and had children and with one exception not far from their place of birth.

There is absolutely nothing special about this history of my family. It is typical of the time and place, and probably not too different from many countries and cultures.

The custom of having large families seem to have changed quite abruptly, with the next generation from the beginning of the 20th century.

My grandfather Christopher had 3 girls and one boy, my maternal grandmother Annie had 4 children in addition to my mother. Compared with what is the norm now even these numbers seem large.

Nevertheless even the small, carefully planned families of the present day seem to accumulate their numbers quite surprisingly. Last Christmas was celebrated at my son's house when 16 people sat around an improvised table on a variety of chairs while our host carved the turkey. These were all people with direct family relationships to each other either by birth or marriage.

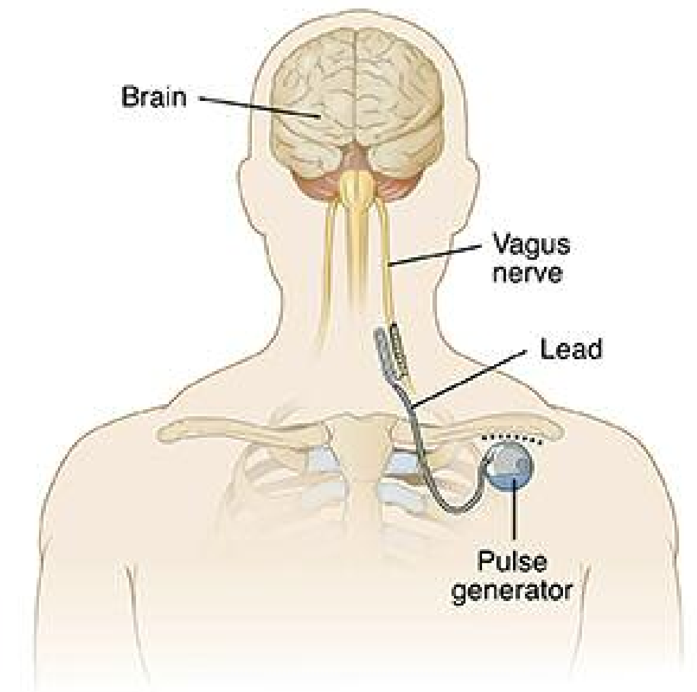
Of course, festivals celebrating midwinter existed well before the Christian era and you can choose your explanation for this. Did our unsophisticated ancestors worry, as the days got shorter, that the trend would continue and the world might turn dark for ever? Maybe they thought some ritual was needed to avoid that, a bit of magic? Or if they weren't worrying about that maybe they just wanted to celebrate the turn of the season and the lengthening days which promised another summer would eventually come. In the days when everyone lived off the land, in wintertime food could get more and more sparse. Maybe they needed a last fling before some essentials ran out and they found themselves hungry before the new crops arrived in the Spring?

However, in my case, although I am not religious, I am entranced by the Christian Christmas story of God appearing on earth as a tiny baby. And not in a Royal Palace somewhere but in a stable bedded in straw among the animals, with humble parents and in mid-winter when "earth stood hard as iron, water like a stone". Who can resist the emotion of that scene? It reminds us that life itself is a miracle and to nurture a baby you need a family. We instinctively and rightly celebrate our own family at this time, the people who looked after us as a baby, were our companions as we grew up and share our memories as adults.

Merry Christmas!

Adding vagus nerve stimulation to training sessions may boost how well sounds are perceived

Just as a musician can train to more sharply distinguish subtle differences in pitch, mammals can improve their ability to interpret hearing, vision, and other senses with practice. This process, which is called perceptual learning, may be enhanced by activating a major nerve that connects the brain to nearly every organ in the body, a new study in mice shows.



Led by researchers at NYU Langone Health, the investigation centres on the vagus nerve, which carries signals between the brain and the heart, digestive system, and other organs. Experts have long explored targeting this nerve with mild electrical pulses to treat a wide variety of conditions ranging from epilepsy and depression to posttraumatic stress disorder and hearing disorders. Results of such efforts have been mixed, however, and the underlying mechanisms that might lead to improved hearing had until now remained unclear.

To more closely examine whether vagus nerve stimulation can boost perceptual learning, the study team trained 38 mice to tell apart musical tones. At first, performance improved for all animals, which made fewer and fewer mistakes over time.

However, while those without the treatment maxed out after about a week of training, rodents that received nerve stimulation continued to get better at the task, making roughly 10% fewer errors on average for most tests than they did prior to simulation.

In addition, mice in this group made half as many mistakes as their counterparts on the most challenging assessments, in which they needed to distinguish very similar tones.

"Our findings suggest that activating the vagus nerve during training can push past the limits of what animals, and perhaps even humans, can learn to perceive," said study lead author Kathleen Martin, BS, a graduate student at the Neuroscience Institute at NYU Grossman School of Medicine.

In a second part of the investigation, the researchers assessed how and where vagus nerve stimulation affects the brain. The results revealed that the technique boosts activity in the cholinergic basal forebrain, a region involved in attention and memory.

When the team instead suppressed this area during nerve activation, rodents did not gain additional learning benefits.

In addition, the team showed that vagus nerve stimulation increased neuroplasticity, a process in which brain cells become more able to adapt to new experiences and form memories, in the auditory cortex, the brain's main center of hearing.

This can lead to long-term cellular changes that allow new skills to endure well after training occurred, says Martin.

She notes that targeting the vagus nerve to boost hearing has previously been controversial among experts, with past studies in animals failing to show significant improvements.

The new study, which published online Sept. 16 in the journal Nature Neuroscience, suggests that the method can indeed work, although results took longer to show up than researchers initially expected, the authors say.

This delay, Martin adds, might in part arise because the electrical pulses used in the technique can distract test animals, which may need time to adjust to the sensation.

The authors note that using vagus nerve stimulation to enhance hearing has potential applications far beyond maximising musical ability.

Perceptual learning is a key component of both understanding a new language and adjusting to cochlear implants, neuroprosthetic tools used to restore hearing loss.

Notably, patients often take months to adjust to these devices and many continue to struggle with conversations even after years of use.

"These results highlight the potential of vagus nerve stimulation to speed up hearing improvements from cochlear implants," said study senior author Robert Froemke, PhD. "By boosting perceptual learning, this method might make it easier for implant recipients to communicate with others, hear cars approaching, and engage more effectively with the world around them."

Froemke, the Skirball Professor of Genetics in the Department of Neuroscience and Physiology at NYU Grossman School of Medicine, says that the electrical stimulator devices currently used to activate the vagus nerve are only a few centimetres across and can be implanted in an out-patient surgical procedure.

Some devices, such as those used to ease migraines, are even less invasive and are simply held against the skin of the neck.

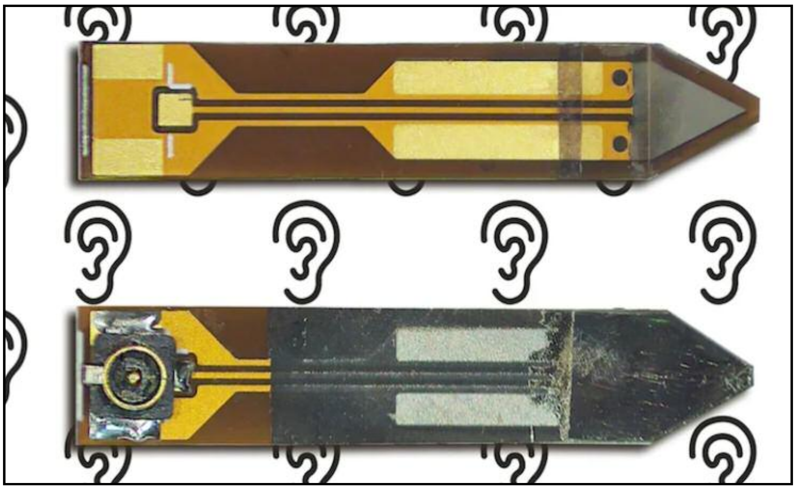
Based on their findings, the researchers next plan to test vagus nerve stimulation in rodents with cochlear implants to see if it improves their function, says Froemke, also a professor in the Department of Otolaryngology -- Head and Neck Surgery at NYU Grossman School of Medicine.

Also a member of NYU Langone's Neuroscience Institute, Froemke cautions that since the vagus nerve is much larger and more complex in humans than in mice, the effects of stimulating it may differ and therefore warrant further testing in human patients.

Update on implantable microphone for cochlear implants

Researchers have developed a prototype of an implantable microphone for a cochlear implant. Their device, which senses the movement of the ear drum in the inner ear, performed as well as commercial hearing aids and could someday enable a fully internalised cochlear implant.

The new device performs twice as well as current external cochlear microphones and promises a better quality of life for users by not requiring external components. The microphone includes a piezoelectric sensor to measure tiny movements on the underside of the eardrum and a high-performance, low-noise amplifier (LNA).



Cochlear implants, tiny electronic devices that can provide a sense of sound to people who are deaf or hard of hearing, have helped improve hearing for more than a million people worldwide, according to the National Institutes of Health.

However, cochlear implants today are only partially implanted, and they rely on external hardware that typically sits on the side of the head. These components restrict users, who can't, for instance, swim, exercise, or sleep while wearing the external unit, and they may cause others to forgo the implant altogether

On the way to creating a fully internal cochlear implant, a multidisciplinary team of researchers at MIT, Massachusetts Eye and Ear, Harvard Medical School, and Columbia University has produced an implantable microphone that performs as well as commercial external hearing aid microphones. The microphone remains one of the largest roadblocks to adopting a fully internalised cochlear implant.

This tiny microphone, a sensor produced from a biocompatible piezoelectric material, measures miniscule movements on the underside of the ear drum. Piezoelectric materials generate an electric charge when compressed or stretched. To maximise the device's performance, the team also developed a low-noise amplifier that enhances the signal while minimising noise from the electronics.

While many challenges must be overcome before such a microphone could be used with a cochlear implant, the collaborative team looks forward to further refining and testing this prototype, which builds off work begun at MIT and Mass Eye and Ear more than a decade ago.

"It starts with the ear doctors who are with this every day of the week, trying to improve people's hearing, recognizing a need, and bringing that need to us. If it weren't for this team collaboration, we wouldn't be where we are today," says Jeffrey Lang, the Vitesse Professor of Electrical Engineering, a member of the Research Laboratory of Electronics (RLE), and co-senior author of a paper on the microphone.

Lang's coauthors include co-lead authors Emma Wawrzynek, an electrical engineering and computer science (EECS) graduate student, and Aaron Yeiser SM '21; as well as mechanical engineering graduate student John Zhang; Lukas Graf and Christopher McHugh of Mass Eye and Ear; Ioannis Kymissis, the Kenneth Brayer Professor of Electrical Engineering at Columbia; Elizabeth S. Olson, a professor of biomedical engineering and auditory biophysics at Columbia; and co-senior author Hideko Heidi Nakajima, an associate professor of otolaryngology-head and neck surgery at Harvard Medical School and Mass Eye and Ear. The research is published today in the Journal of Micromechanics and Microengineering.

Overcoming an implant impasse

Cochlear implant microphones are usually placed on the side of the head, which means that users can't take advantage of noise filtering and sound localisation cues provided by the structure of the outer ear.

Fully implantable microphones offer many advantages. But most devices currently in development, which sense sound under the skin or motion of middle ear bones, can struggle to capture soft sounds and wide frequencies.

For the new microphone, the team targeted a part of the middle ear called the umbo. The umbo vibrates unidirectionally (inward and outward), making it easier to sense these simple movements.

Although the umbo has the largest range of movement of the middle-ear bones, it only moves by a few nanometers. Developing a device to measure such diminutive vibrations presents its own challenges.

On top of that, any implantable sensor must be biocompatible and able to withstand the body's humid, dynamic environment without causing harm, which limits the materials that can be used.

"Our goal is that a surgeon implants this device at the same time as the cochlear implant and internalised processor, which means optimizing the surgery while working around the internal structures of the ear without disrupting any of the processes that go on in there," Wawrzynek says.

With careful engineering, the team overcame these challenges.

They created the UmboMic, a triangular, 3-millimetre by 3-millimetre motion sensor composed of two layers of a biocompatible piezoelectric material called polyvinylidene difluoride (PVDF). These PVDF layers are sandwiched on either side of a flexible printed circuit board (PCB), forming a microphone that is about the size of a grain of rice and 200 micrometres thick. (An average human hair is about 100 micrometres thick.)

The narrow tip of the UmboMic would be placed against the umbo. When the umbo vibrates and pushes against the piezoelectric material, the PVDF layers bend and generate electric charges, which are measured by electrodes in the PCB layer

Amplifying performance

The team used a "PVDF sandwich" design to reduce noise. When the sensor is bent, one layer of PVDF produces a positive charge and the other produces a negative charge.

Electrical interference adds to both equally, so taking the difference between the charges cancels out the noise.

Using PVDF provides many advantages, but the material made fabrication especially difficult. PVDF loses its piezoelectric properties when exposed to temperatures above around 80 degrees Celsius, yet very high temperatures are needed to vaporize and deposit titanium, another biocompatible material, onto the sensor.

Wawrzynek worked around this problem by depositing the titanium gradually and employing a heat sink to cool the PVDF.

But developing the sensor was only half the battle -- umbo vibrations are so tiny that the team needed to amplify the signal without introducing too much noise.

When they couldn't find a suitable low-noise amplifier that also used very little power, they built their own.

With both prototypes in place, the researchers tested the UmboMic in human ear bones from cadavers and found that it had robust performance within the intensity and frequency range of human speech.

The microphone and amplifier together also have a low noise floor, which means they could distinguish very quiet sounds from the overall noise level.

"One thing we saw that was really interesting is that the frequency response of the sensor is influenced by the anatomy of the ear we are experimenting on, because the umbo moves slightly differently in different people's ears," Wawrzynek says.

The researchers are preparing to launch live animal studies to further explore this finding. These experiments will also help them determine how the UmboMic responds to being implanted.

In addition, they are studying ways to encapsulate the sensor so it can remain in the body safely for up to 10 years but still be flexible enough to capture vibrations.

Implants are often packaged in titanium, which would be too rigid for the UmboMic.

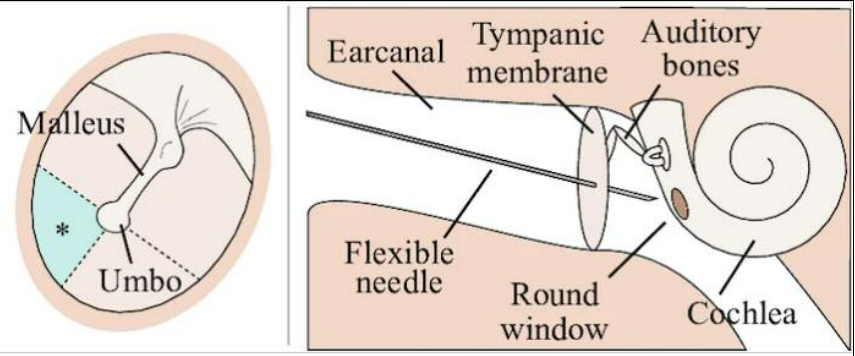
They also plan to explore methods for mounting the UmboMic that won't introduce vibrations.

"*The results in this paper show the necessary broad-band response and low noise needed to act as an acoustic sensor. This result is surprising, because the bandwidth and noise floor are so competitive with the commercial hearing aid microphone. This performance shows the promise of the approach, which should inspire others to adopt this concept. I would expect that smaller size sensing elements and lower power electronics would be needed for next generation devices to enhance ease of implantation and battery life issues*," says Karl Grosh, professor of mechanical engineering at the University of Michigan, who was not involved with this work.

This research was funded, in part, by the National Institutes of Health, the National Science Foundation, the Cloetta Foundation in Zurich, Switzerland, and the Research Fund of the University of Basel, Switzerland

The Fully Implantable UmboMic

UmboMic is a polyvinylidene difluoride (PVDF)-based biocompatible microphone that attaches to the eardrum at the middle ear section called the umbo.



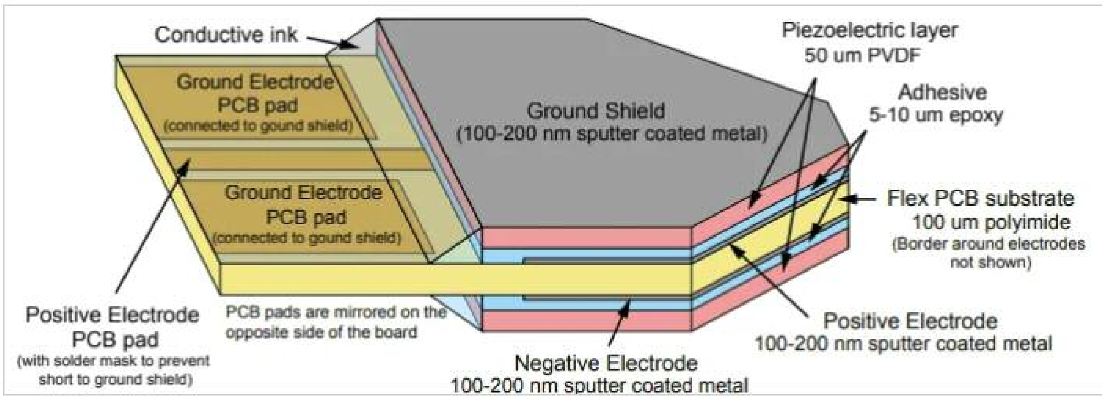
Anatomy of the tympanic membrane (middle ear). Image used courtesy of ResearchGate

The umbo is a small conical structure in the tympanic membrane.

The tympanic membrane separates the outer from the inner ear, with the ear canal opening to the outside on one side and the auditory bones on the other.

While the umbo delivers the most movement of any section of the ear, its movement is still quite small—in the nanometer range. The means that a sensor must be extremely sensitive and will require significant amplification. The team was unable to find a workable off-the-shelf amplifier solution, so they had to develop their own high-performance differential LNA.

The sensor is constructed of symmetrical layers deposited on both sides of a flex PCB core. It’s built up and trimmed post-fabrication and sputter coated with an aluminum ground/shield. The result is a highly sensitive differential sensor with excellent biocompatibility characteristics. The completed sensor can then be implanted into the umbo.

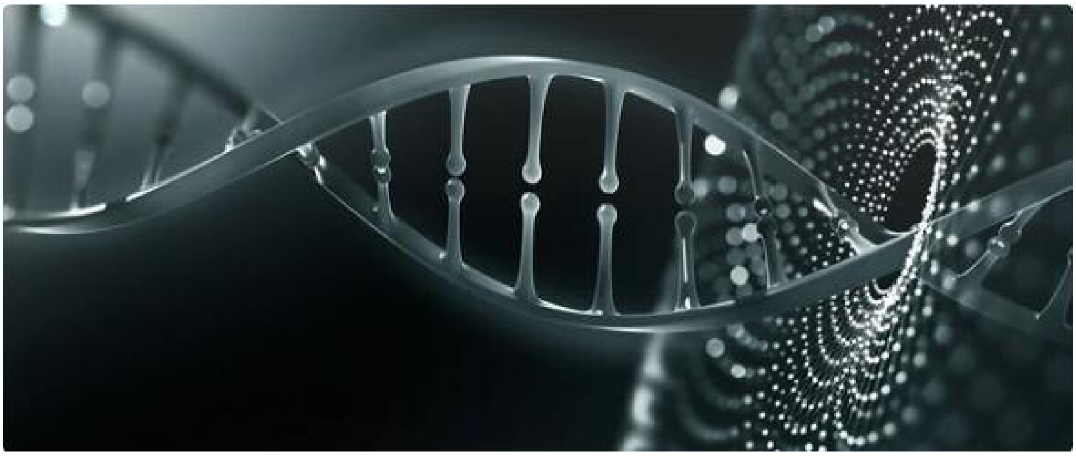


Proof of concept biocompatible piezoelectric sensor. Image used courtesy of MIT

The microphone demonstrated a performance of “32.3 dB SPL over the frequency range 100 Hz to 7 kHz, good linearity, and a flat frequency response to within 10 dB from about 100 Hz to 6 kHz.” Typical human hearing has a flat frequency response in the 100 Hz to 4 kHz range.

Gene therapy – a new approach for paediatric hearing loss

by Professor Manohar Bance



A new gene therapy is being trialled for children with a rare form of deafness caused by variants in the OTOF gene

Hearing and auditory processing are incredibly complex, so it is unsurprising that there are a huge number of different ways this process can be disrupted, resulting in deafness or hearing loss. Among these are a number of genes, in which certain variants may compromise hearing.

Deafness in the genome

There are more than 30 different genes associated with non-syndromic hearing loss (where hearing is the only affected part of the body, as opposed to syndromes where it is only one of several affected systems), many of which have roles in the development and functioning of the inner ear.

Among these is the OTOF gene, which encodes the protein otoferlin.

Otoferlin is necessary for the tiny hair cells in the inner ear to transmit the information received by the ear to the nerve that takes the signal to the brain. Children can have two non-functional copies of the OTOF gene and no other functional issues with the ears and brain, but the connection between them is disrupted.

"Children with a variation in the OTOF gene are born with severe to profound hearing loss, but they often pass the newborn hearing screening so everyone thinks they can hear. The hair cells are working, but they are not talking to the nerve," explained academic lead in Otology and Neurotology at Cambridge University Hospitals Trust, Professor Manohar Bance, who is leading the trial at Addenbrooke's Hospital in Cambridge.

As a monogenic condition, deafness caused by otoferlin deficiency is an ideal target for gene therapy due to everything else being present and functioning correctly. Although experimental, Professor Bance and his colleagues believe that gene therapy could be more effective than the current standard treatment of cochlear implants. He stressed that, like with cochlear implants, the best results are likely to be seen when treatment is administered early in life, while the parts of the brain that deal with processing sound are still able to adapt.

Clinical trial

The trial will recruit 18 children in the UK, Spain and the US who will each be followed for five years to see how the gene therapy affects their hearing.

The gene therapy will work by injecting a harmless virus that contains a working copy of the OTOF gene into the patient's cochlea.

The procedure is performed under general anaesthetic and is similar to cochlear implant surgery.

It is especially important that patients who have another treatment option – in this case a cochlear implant –are not disadvantaged by taking part in a clinical trial, compared to the normal standard of care.

As such, the clinical trial is planned in three stages, to minimise any risk to the young patients:

Stage 1: a low dose of the gene therapy will be introduced into one ear only.

Stage 2: if there has been no adverse reaction, a second higher dose of the same gene therapy will be introduced into the same ear as Stage 1.

Stage 3: after ensuring the safety and effectiveness of the first two stages, a final dose will be administered in both ears.

If the treatment causes a reaction, or is unsuccessful after 6 months, the children will still be able to receive cochlear implants if their parents wish.

Opening up new possibilities

Preliminary results from the first stage of the trial have provided encouraging results with its first patient in regard to safety and efficacy. If the approach is successful at the completion of the study, it could be used to target other genes causing deafness or hearing loss.

"It's really important that we get the first gene therapy treatment right because it will allow us to proceed to treating other genetic conditions" said Professor Bance.

A brief history of time ... OK CICADA events!

by Kevin Williams

At this time of each year we tend to look back and reminice on recent events. As I started the process my thoughts turned to what we have acheived as a group of people over the many years that we have been meeting and realised the range both geographically and interest wise that we have been part of. Here are some snapshots of us over the years, you may or may not recognise yourselves! Looking forward to seeing you as we expand the events next year.

Caldon Canal trip 2011

He ordered a sausage butty!

Bowling in Chester

One of many BBQ's at Cefn Du

Lunch at Daresbury / Lewis Carrol visit

Canal trip from Riley Green

The Maritime museum trip to Liverpool

Christmas dinner at the Liner

Getting in the mood at Lyme Hall

Visit to Gaskell house

Port Sunlight tour

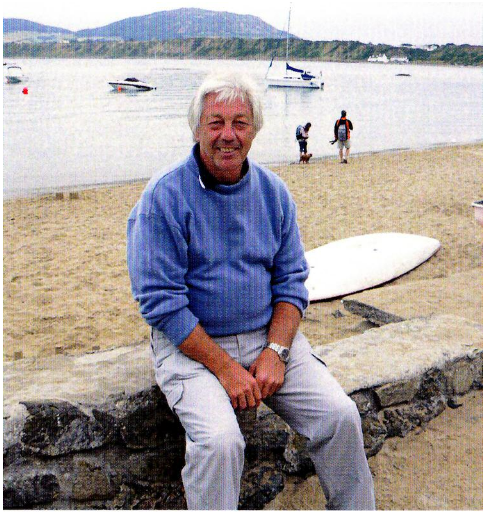
The top of the Liver building!

Back to school at Quarry Bank Mill

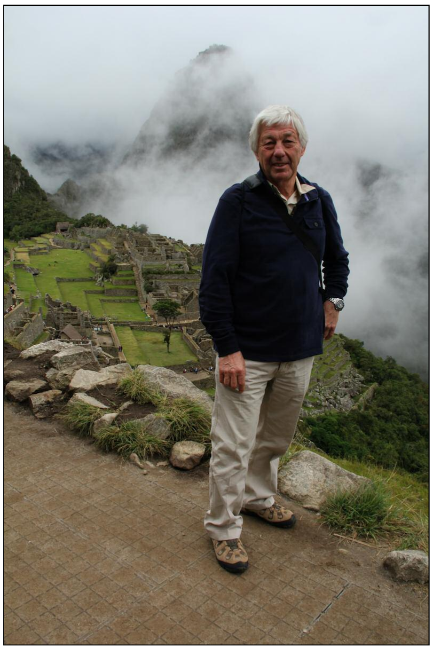
Lake district trip on the Gondola

Obituary

Jeffrey Mulholland 1943 - 2024

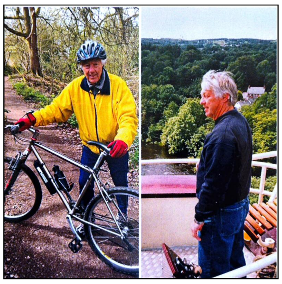


We are sad to report the passing of Jeff Mulholland, a long time member of CICADA after a long fight against cancer.
Jeff was a lifelong golfer and adventurer (though not at the same time).



In the Mist

We have published in Resound, tales him of travelling to Machu Picchu in South America and in many other strenuous activities where he always led from the front.



He was involved in our visit many years ago to the Shire Horse sanctuary which is in mid Cheshire not far from there he lived.

He was an accomplished artist as well, and was never afraid of a new and challenging experience, a recent one being the visit to the Falconry Centre.

What would the caption be for this scene then, 'A meeting of minds'?

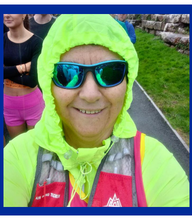
Our thoughts go out to Liz and his family.

Lip reading corner

One of the things we talk about in lipreading sessions is how to make the best of difficult situations. Christmas can be challenging when you have a hearing loss. It's lovely to spend time with family and friends, but it can be very difficult to follow a conversation, and very tiring. Here's a few tips that we suggest in our class:

- Talk to family members, before Christmas, about what will help you to join in.
- If watching TV is part of the day, request the subtitles are switched on.
- Some extra equipment might be helpful. I have a mini-mic, that can amplify individual speakers.
- Try and arrange where you sit at mealtimes. Sit away from music speakers, and somewhere where you can see everyone's face.
- Make sure the light levels are good. Candlelight makes lipreading very difficult.
- Don't be afraid to ask people to repeat things. Having a buddy can be helpful - someone who will make sure you're following the conversation.
- Find a quiet room for some time out, it can be very tiring.

Above all, have a lovely Christmas, and here's wishing everyone all the best for 2025.



The Wigan Runner updates

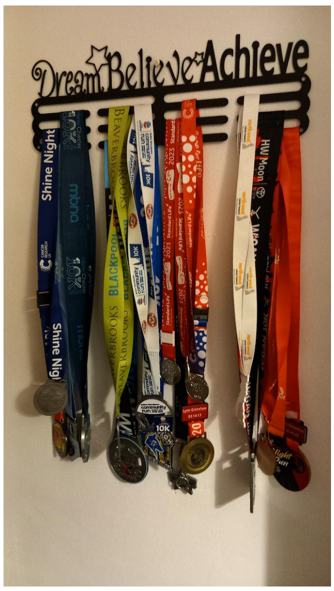
Lynn Grimshaw

We have followed Lynn's marathon progress throughout the year from wet runs up in Newcastle to drier runs at Blackpool, a very well travelled competitor indeed.

This time of year as the running eases off, the thespian activity begins, from Daisy the Flower fairy in Panto in November to auditioning for the the role of Geraldine in the Vicar of Dibley.

Two events are already in the calendar for 2025, a half marathon in March at Wigan and a full marathon in Manchester in April.

I think she's going to need a bigger rack for all the medals soon!



Notes

We will be publsihng a full list of proposed events in the new year but this item we think should definitely be on the agenda.

Exchange Hall, Manchester, M2 3GX
Thursday 31st July 2025 - Sunday 24th August 2025

We would welcome any feedback or suggestions for events, articles for Resound especially if you have been through a situation and have come through it and have knowledge that might help others.

Either email
secretary@manchestercicada.org.uk

Or write to me at the address below, all submissions are welcome.

CICADA

Website:www.manchestercicada.org.uk

Facebook group:Manchester CICADA club

Secretary direct contact:Text 07533217730

Main contacts for Cicada listed at the bottom of this page.

Manchester Implant Centre

The Richard Ramsden Centre for Auditory Implants,Peter Mount Building, Manchester Royal Infirmary, Oxford Road,Manchester, M13 9WL

Main Contact Details:
TeL: 0161 701 6931 (Appointments)
TeL: 0161 276 8079 (repairs and spares)

http://www.manchestercicada.org.uk/implant-clinic/

National Support organisations

British Tinnitus Association:
https://www.tinnitus.org.uk/

Hearing Link:
https://www.hearinglink.org/

RNID (Action on Hearing Loss):
https://www.actiononhearingloss.org.uk/

Disabled Travel Advice:
http://www.disabledtraveladvice.co.uk/

Meniere's Society:
http://www.menieres.org.uk/

National Deaf Children's Society:
http://www.ndcs.org.uk/

National Association of Deafened People (NADP): http:// www.nadp.org.uk/

Equipment Suppliers for Deaf People

Sarabec: https://www.sarabec.com/

Connevans: http://www.connevans.co.uk

Hearing Link UK: https://www.hearinglink.org/

RNID (Action on Hearing Loss):
https://www.actiononhearingloss.org.uk/

Accessory help

The accessory help page has links to videos about how to connect your processor to different accessories, such as remote microphones, TV support etc. that may be supplied to you by the implant centre.

https://www.manchestercicada.org.uk/accessory-help/

Chairman	**Honorary Treasurer**	**Hon Secretary**
John Newton	Alan Corcoran	Kevin Williams
32 Queens road	45 Polefield Road	107 Manchester Road
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Derbyshire	Manchester	Cheshire
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