Improving the precision of bionic devices with light

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For a person with normal hearing, sound waves travel in the fluid-filled cochlea of the inner ear, causing sensory hair cells to react and send signals to the brain via the auditory neurons. For those with hearing loss, these hair cells have died. To counter this, a cochlear implant can be inserted which uses electrical stimulation to mimic the function of a normal hearing response. Although cochlear implants have been a wonderful breakthrough, the quality of sound has room for improvement; the way that the electrodes activate the neurons is not very accurate. This leads to poor speech understanding when there is background noise, and poor perception of complex sounds such as music.

Prof. Rachael Richardson leads a team at the Bionics Institute researching ways to improve the quality of hearing for people with cochlear implants. The team have used optogenetics, which involves a simple genetic alteration of auditory nerves with a light sensitive molecule, enabling them to be activated via focused light beams. The results have proven that through the use of optogenetics the precision of bionic devices can be improved.

"There is so much scope to improve the quality of information transfer from bionic devices to the brain. The ability to precisely control nerve activity will be a game changer for the treatment of many health conditions," explains Prof. Richardson.

The findings have been published today in the *Journal of Neural Engineering*

Higher fidelity cochlear implants will be transformative for people with hearing impairment by improving both the quality and realism of hearing. This will reduce the disability experienced by people with hearing loss in everyday life.

Sam McLarty, a cochlear implant recipient is extremely appreciative of advancements in technology and the continuous research undertaken by the Bionics Institute to improve cochlear implant devices. "I look forward to being able to go out to a restaurant with my family and friends and not find the background noise a challenge."

More information: Alex Thompson et al. Hybrid optogenetic and electrical stimulation for greater spatial resolution and temporal fidelity of cochlear activation, *Journal of Neural Engineering* (2020). DOI: 10.1088/1741-2552/abbff0

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