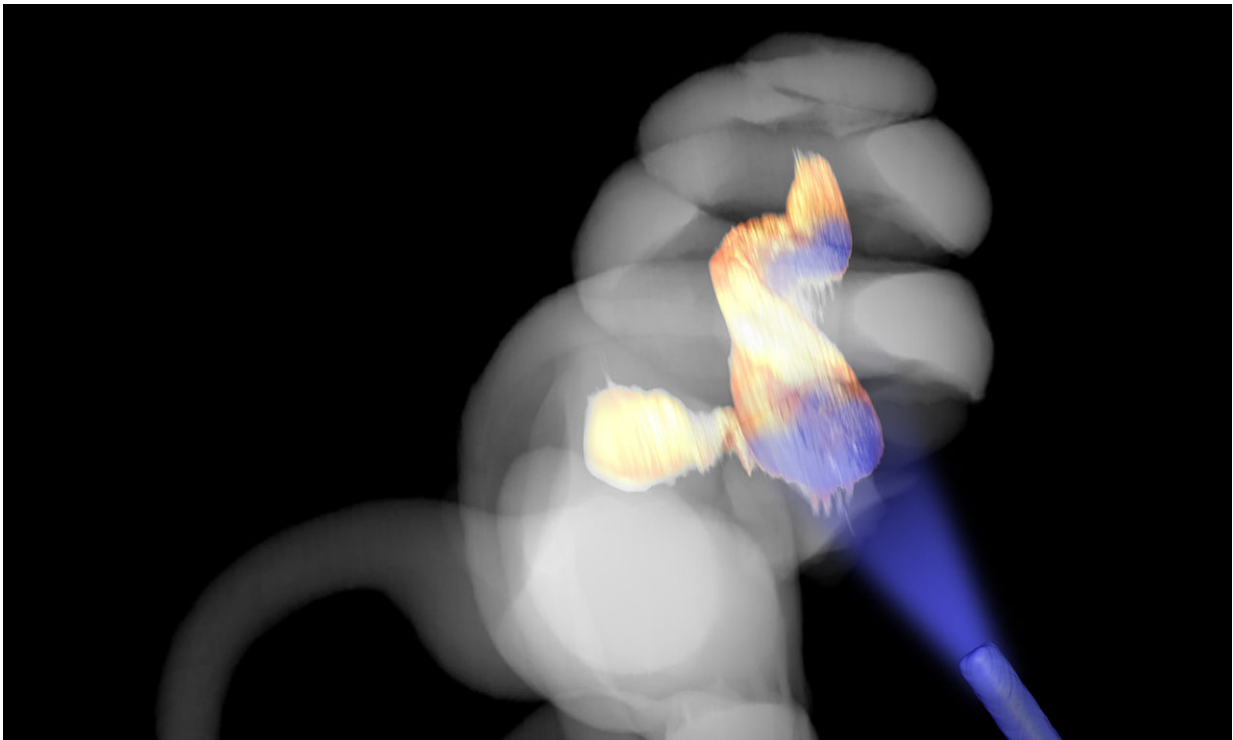


Light based cochlear implant restores hearing in gerbils

July 12 2018, by Bob Yirka



Deaf adult gerbils can hear again with optogenetic hearing restoration. Upon ototoxic treatment adult gerbils turned deaf due to loss of hair cells. With optogenetic stimulation they could hear again and perform a behavioural task. To this end a small optical fiber was implanted and stimulated parts of the snail shaped cochlea. The location of the auditory neurons in the cochlea is shown in orange while the stimulated area is shaded in blue. Credit: University Medical Center Göttingen, Germany

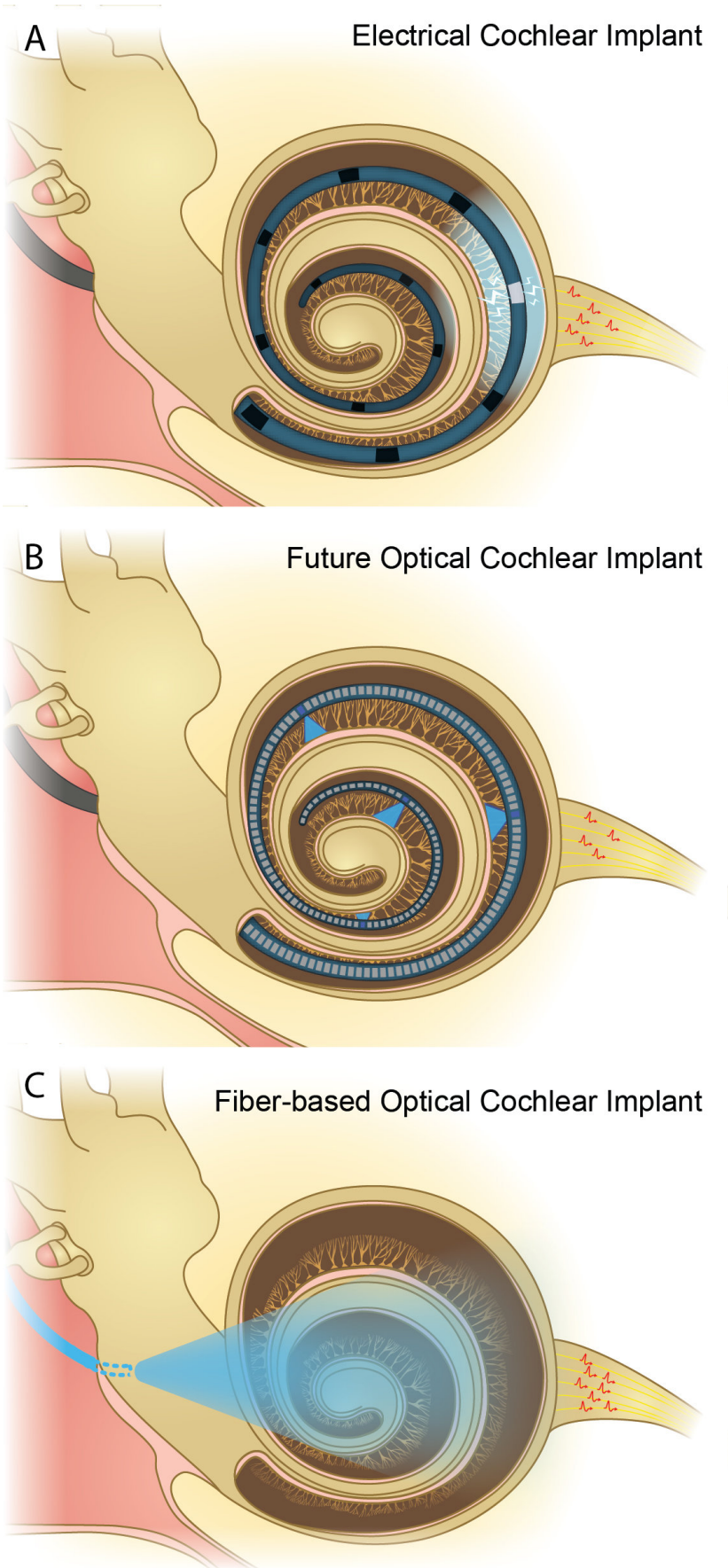
A team of researchers with members from a variety of institutions across Germany has developed a new type of cochlear implant—one based on light. In their paper published in the journal *Science Translational Medicine*, the group describes their new implant and how well it worked in test gerbils.

Over a half-century ago, scientists came up with a way to partially restore hearing in people with cochlear damage—a cochlear [implant](#). The same basic technology is still in use today—such devices work by converting sounds to electrical signals, which are transmitted to neurons that carry the signal to the brain. And while the implants have helped many people to hear, they still suffer from one major problem. Too many simultaneous sounds, such as speech in a crowded room, become muffled. This is because the electrical signals run into one another, causing degradation of the messages carried to the brain. In this new effort, the researchers have converted sound to [light](#) instead of electricity, because light can be directed more precisely.

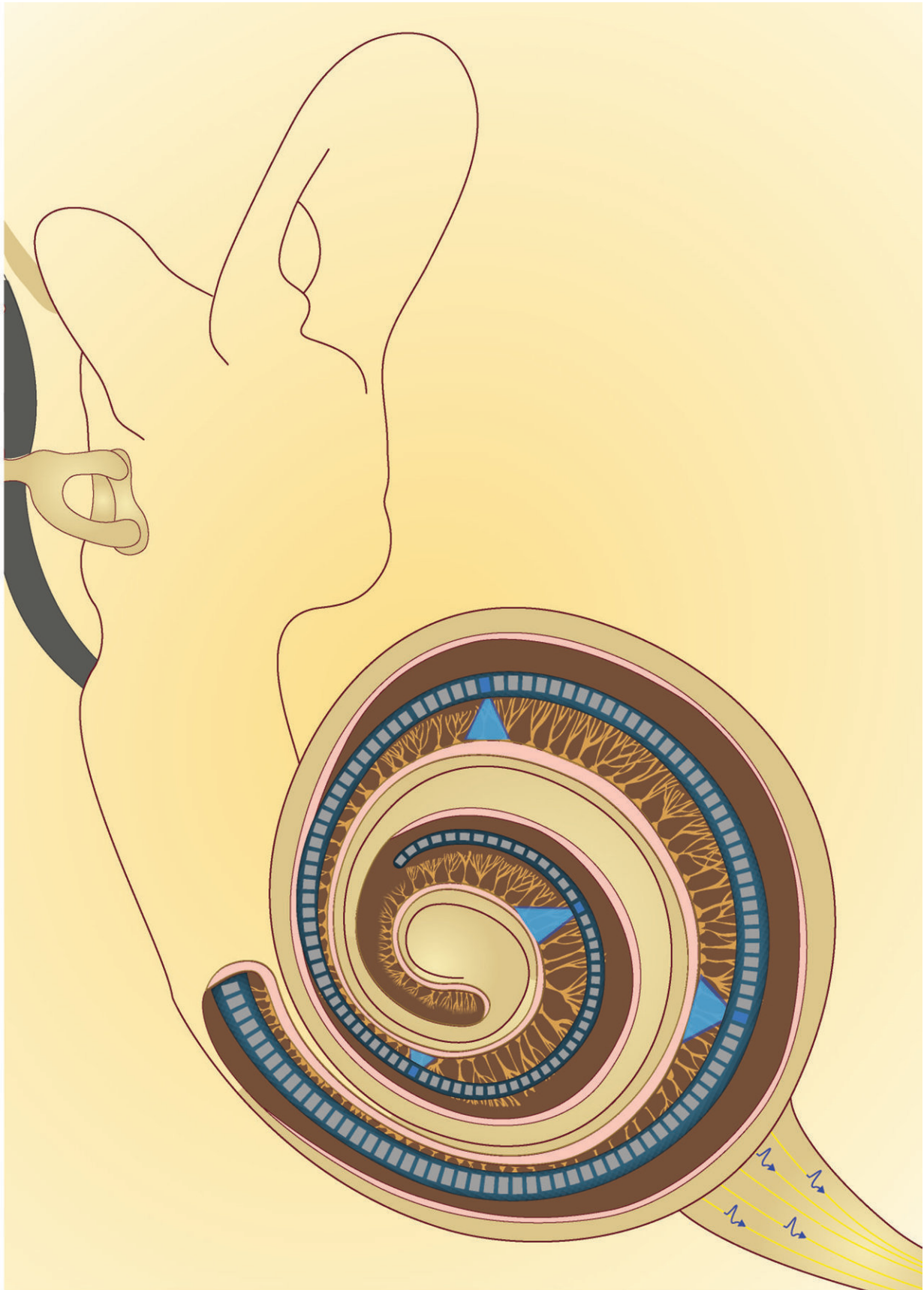
The new implant fires light directly at cochlear neurons. But for that to have an effect, the researchers had to get the neurons in test gerbils to respond to it. To make that happen, they injected a virus carrying gene encoding for light sensitivity directly into the cochlea. To test their device, they trained some gerbils to jump from one part of their cage to another when they heard a certain sound before the device was implanted. Afterward, light from the implant was activated and that caused the gerbils to jump as they had before, showing their brains were receiving the same signals. Next, the team caused cochlear-based hearing loss in the test gerbils and once again fired up the new implant. They report that the gerbils jumped just as they had in response to the prior sound, proving their hearing had been restored.

The researchers suggest their device is a proof of concept for a way to improve [cochlear](#) implants. The next logical step would be to add

electronics to the [device](#) to convert sound signals to light, which would then stimulate neurons in the ear in the same way [electrical signals](#) have done in the past.



(A) electrical cochlear implants contain 12-24 electrodes which typically provide less than 10 independent frequency channels for users. This is due to the fact that current spread (light blue shade) leads to activation of a large population of neurons along the frequency axis of the cochlea and thereby limits the frequency resolution and dynamic range of electrical coding. (B) optical stimulation promises spatially confined activation of neurons in the auditory nerve allowing for a higher number of independent stimulation channels and, thereby, improving frequency and intensity resolution using future oCIs. (C) this preclinical animal study used single channel optical stimulation by inserting an optical fiber into the cochlea. Credit: University Medical Center Göttingen, Germany



Schematic illustration of the newly proposed optical cochlear implants. A strip of LEDs is inserted into the snail shaped cochlea. Optical cochlear implants promise spatially confined activation (blue shade indicates light from activated LEDs) of neurons in the auditory nerve allowing for a higher number of independent stimulation channels and, thereby, improving frequency and intensity resolution. Credit: University Medical Center Göttingen, Germany

More information: C. Wrobel et al., "Optogenetic stimulation of cochlear neurons activates the auditory pathway and restores auditory-driven behavior in deaf adult gerbils," *Science Translational Medicine* (2018). stm.sciencemag.org/lookup/doi/10.1126/scitranslmed.aao0540

© 2018 Medical Xpress

Citation: Light based cochlear implant restores hearing in gerbils (2018, July 12) retrieved 27 April 2024 from <https://medicalxpress.com/news/2018-07-based-cochlear-implant-gerbils.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.
