

# Real-Time Feedback for Positioning Electrode Arrays in Cochlear Implants

## Summary

Vanderbilt researchers have discovered a method of monitoring the placement of electrodes in cochlear implants (CIs) through the use of electrical impedance measurements. This technology offers real-time feedback on electrode positioning, which can be used to more accurately place electrodes during initial implantation, or better program the implants after they have been placed. These enhancements combine to give increased hearing quality to both new and existing CI patients.

## Addressed Need

Cochlear implants have been shown to be most effective when implanted at a young age, as this is a critical period in childhood development where the brain is learning to process and interpret sounds. Positioning CIs correctly in infants and young children can be very difficult, and current methods of evaluating implant effectiveness must be done after installation. These post-operation evaluations often require CT scans, increasing exposure to radiation. This innovation will allow doctors to more easily install and position electrode arrays for CI patients, offering real-time feedback and minimizing radiation exposure.

## Technology Description

In the present technology, a microcontroller is used to generate electrical pulses between electrode pairs in the implants. The differential voltage across the electrode pair is then measured many times every pulse. This data is compared to a model, which correlates system resistance with the electrode-to-modiolus distance. This distance has been shown to have a strong correlation with hearing outcomes, thus providing a direct metric to ensure proper placement.

## Unique Features

- The system is low-cost and can be used with existing hardware.
- Real-time feedback to ensure proper implant deployment. This reduces the possibility of membrane-tears and other complications.
- Enables closed-loop control of the electrode insertion, meaning the process can be completely automated with a robotic procedure.
- Determination of electrode position relative to nerves to enhance CI programming after surgery.

## Technology Development Status

The technology has been prototyped and tested for use with existing cochlear implants. Additional testing and prototype refinement is planned.

## Intellectual Property Status

A patent application has been filed.

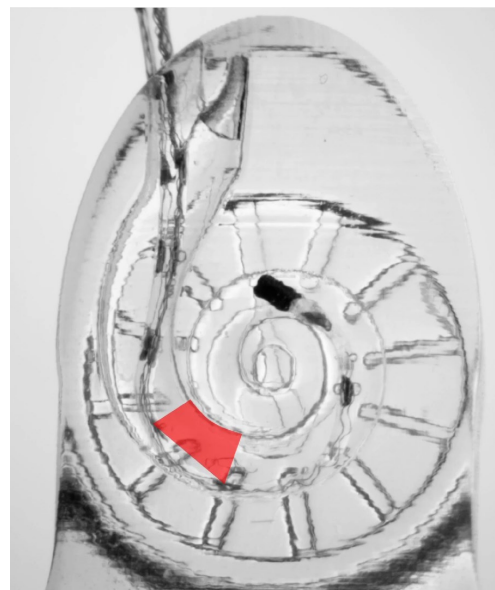


Figure 1: The present technology enables real-time feedback of cochlear implant placement during surgery using electrical impedance measurements.

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