



Source: National Institutes of Health

Hearing loss is one of the most common sensory impairment in humans, with a significant economic and social impact globally. Cochlear implant (CI, pictured above) is currently the standard clinical treatment for profound hearing loss. Despite its relatively coarse representation of speech information, CI allows many post-lingually deafened adults to regain hearing sensation and pre-lingually deafened children to develop language skills. To date, most CI users are able to comprehend speech in quiet, but their speech recognition greatly degrades in noise. Also, their perception of musical melodies, speech intonations, and lexical tones is far from satisfactory. These challenging listening tasks all require a robust access to pitch cues, which is not available in current CI due to the small number of electrodes, the large spread of electrical field, and the loss of temporal fine structure cues.

In the Auditory Implant lab at ASU, we are exploring novel strategies at both the front- and back-end of CI processing to enhance CI performance in pitch-related listening tasks. One project investigates the interaction between pitch and timbre perception with CI. Based on the results, a pre-processing strategy will be developed to use congruent timbre cues to enhance pitch perception in speech and music for CI users. Another project aims to improve the neural coding of pitch cues by reducing the spread of electrical field and/or shifting the place of electrical stimulation. Stimulation modes that have been verified in psychophysical studies will be implemented in real-time CI processors to test their effects on speech and music perception. A third project, in collaboration with Dr. Lauren Hayes from the Herberger Institute, uses a vibrotactile device to deliver the fundamental frequency information to CI users. We hypothesize that such tactile input may be integrated with auditory input to enhance speech and music perception with CI.

Research opportunities are available in all these projects. We are looking for highly motivated and responsible students to assist with research design and data collection. For more information about the Auditory Implant lab, please visit <https://sites.google.com/site/asuailab/home>. If interested in the research opportunities, please contact Dr. Xin Luo, Assistant Professor, Department of Speech and Hearing Science, Arizona State University, Email: [xinluo@asu.edu](mailto:xinluo@asu.edu), Phone: 480-965-9251.