Title: Hidden Hearing Loss and Computational Models of the Auditory Pathway: Predicting Speech Intelligibility Decline

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A common complaint of listeners with normal clinical hearing thresholds is difficulty in understanding speech in noise. Recent animal studies have shown that noise exposure causes selective loss of low spontaneous rate auditory nerve fibers (ANFs) and reduction of auditory brainstem response wave-I amplitudes.   The goal of this research is to utilize computational models of the auditory periphery and auditory cortex to study the effect of low spontaneous rate ANF loss on the cortical representation of speech intelligibility in noise. The auditory-periphery model of Zilany et al. (JASA 2009,2014) is used to make predictions of auditory nerve (AN) responses to speech stimuli under a variety of difficult listening conditions. The resulting cochlear neurogram, a spectrogram-like output based on ANF outputs, is then used as a low-auditory-level foundation for two different but related cortical representations of speech: the Spectro-Temporal Modulation Index (STMI; Elihali et al., Speech Comm. 2003) and 2D Fourier Analysis (Wang and Quatieri., IEEE, 2012). Reducing the number of low spontaneous rate ANFs in the cochlear neurogram was found to cause a blurring of speaker specific components that increase the difficulty of speaker separation. Suprathreshold deficits in speech intelligibility, as measured by STMI, may be related to ANF loss or degradation. Further study may lead to strategies to mitigate intelligibility decline by optimizing information at the cortical level.