Principal Investigator: Michelle Molis  
Title: Perception of dynamic acoustic signals by hearing-impaired listeners  

MeSH Terms: hearing; hearing loss, sensorineural; speech perception  

Objectives: The purpose of this program of research is to understand the perception of dynamic acoustic signals by hearing-impaired listeners, with the long-term goal of improving speech understanding by these individuals in adverse listening conditions.  

Plan: The proposed research compares the performance of normally-hearing and hearing-impaired listeners on a number of tasks designed to assess basic perceptual abilities in response to complex, non-speech auditory stimuli that change in frequency over time. Based on the results of this assessment, a computational model will be developed that can account for differences in speech intelligibility due to hearing status and stimulus characteristics.  

Methods: Both normally-hearing and hearing-impaired listeners will serve as subjects. Experimental procedures will consist of adaptive tests of spectral change detection and discrimination in non-speech stimuli which possess some of the timing and frequency characteristics of speech and assessment of spectral change detection and discrimination in several types of competing background noise and with simulated reverberation. Speech recognition ability in background noise and reverberation will also be assessed. The effectiveness of the computational model will be evaluated by comparing model predictions with actual listener performance for the full range experimental conditions evaluated.  

Findings to Date: This study has not started; there are no findings to report.  

Clinical Relevance: Speech is an inherently dynamic signal and spectral dynamics are integral to perception of both consonants and vowels. The rate, direction, and extent of formant movements provide cues to consonant and vowel identity. The loss of peripheral auditory sensitivity, precise temporal processing, and frequency selectivity associated with hearing loss and aging will disrupt the perception of formant movements. As a result, the reduction or elimination of dynamic spectral cues may impair speech understanding, especially in adverse listening conditions such as background noise or reverberation. There has been little systematic investigation of these abilities for hearing-impaired listeners who may be expected to have deficits in temporal processing and/or frequency selectivity. The application of this information to a model of speech recognition will have implications for the development of new hearing aid processing strategies and rehabilitative auditory training programs that may enhance speech intelligibility and reduce listening effort in hearing-impaired veterans.  

Relevance to VA Mission: Hearing loss is one of the most prevalent disabilities among Veterans. Communication difficulties can be a debilitating problem and source of great frustration for hearing-impaired Veterans with age-related or noise-induced hearing loss. Hearing disability can interfere significantly in vital communication between patients and their physicians and care-givers.