



IU BLOOMINGTON

EMERGING AREAS OF RESEARCH

Abstract Template -- Due June 30, 2017

Title of initiative to be proposed:

Integrative Approaches to Cognitive Hearing Science

Name of lead PI, with title, department/school:

Laura Hurley, Associate Professor, Biology/COAS

Key team member names and departments/schools (up to 10 names):

Jennifer Lentz, Larry Humes, Yi Shen, Nancy Nelson, Department of Speech and Hearing Sciences/ COAS; Donald Williamson, School of Informatics and Computing; Minje Kim, Department of Intelligent Systems Engineering/School of Informatics and Computing; Gary Kidd, Cognitive Science Program/COAS; David Pisoni, Department of Psychological and Brain Sciences/COAS; Daniel Maki, Department of Mathematics/COAS, Communication Disorders Technologies

Description of area to be proposed. What constitutes this area of research or creative activity as emerging? (Word limit=500)

Hearing loss is a significant health problem across the lifespan. Although hearing loss negatively affects intellectual development and quality of life, this area of research has been seriously neglected in the biomedical research agenda because hearing loss is not fatal. There is an emerging consensus that hearing loss in humans is not just an ear problem but a brain problem related to multisensory and cognitive processing of information. These types of interactions are exemplified in phenomena such as the association of relatively normal auditory thresholds with profound difficulty in understanding speech in noise, or in emotional contributions to disorders like tinnitus. Just as their origins involve much more than a simple loss of hearing, these disorders can impose severe social and societal costs by contributing to isolation, loss of productivity, and cognitive decline and dementia. This situation presents an important opportunity for audiologically based integrative approaches to research and treatment. We propose a cross-disciplinary coalition among IUB faculty to address this challenge. We will leverage existing expertise at IUB in hearing and cognitive science, in computer science and signal processing, and in basic research, to achieve the following goals.

- Developing innovative hearing technology: We are on the cusp of a new generation of hearing aid technology. 'Smart' hearing aids pre-process sound to focus on meaningful inputs like speech. These devices require novel data-driven algorithms for speech recognition, in conjunction with new approaches to streamlining the neural processing needs for these small, wearable devices. IUB faculty are authorities in these areas.
- Creating new models for auditory cognition: Central neural circuits underlie auditory cognition, but there is little understanding of how these contribute to disordered hearing. Neurochemical pathways may serve as a source of feedback from limbic to auditory regions, transforming the representation of auditory stimuli. Research on such systems could contribute to pharmacological strategies for hearing disorders.
- Clinical research in cognitive hearing science: There is a profound need for greater understanding of the historical or cognitive factors associated with hearing loss, and for the value of intervention through novel technological or pharmacological strategies. IUB faculty have a strong history of collaboration in cognitive hearing science, including in the development of clinical assessments such as PRESTO, which assesses speech-based recognition and cognition. In this area, we will collaborate with Communication Disorders Technology (CDT), a Bloomington-based company responsible for the National Hearing Test.

Leadership at IUB: Major resources that we have identified as important to achieving these goals and coalescing our group are 1-2 faculty who would bolster or provide a bridge between different domains of our existing expertise. These could include a faculty expert in cognitive hearing science, or with experience in uniting animal and human auditory research in our areas of interest. To bring attention to IUB's work in this area, we would leverage the reputations of several prominent IUB faculty members to initiate a conference in Cognitive Hearing Science. As a group, we are excited to serve Hoosiers and lead internationally in this rapidly emerging area.

Please submit to earprogram@indiana.edu