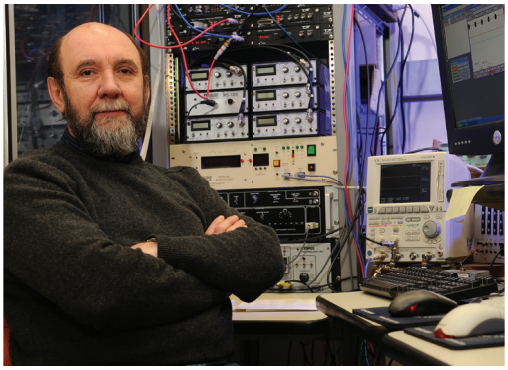

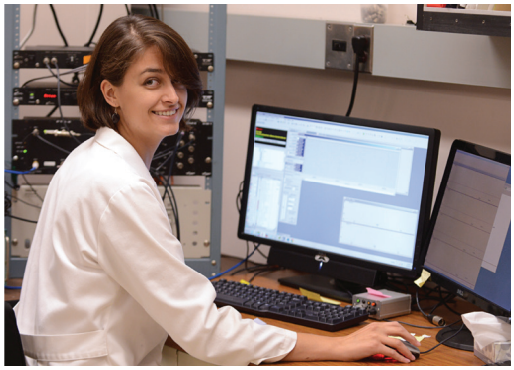

THE HEARING RESEARCH GROUP

Hearing disorders of many types begin in the inner ear, but they have long-term effects in the brain. The Hearing Research Group at NEOMED is interested in how the central nervous system functions in association with hearing and vocal communication, how it is affected by hearing disorders, and how interventions of the peripheral and central nervous systems may ameliorate hearing disorders.

Merri Rosen, Ph.D. *(Director)*

Dr. Rosen's team studies neural mechanisms underlying the interactive effects of early stress and early hearing loss. The lab measures how transient hearing loss, such as accompanies ear infections in children, impairs perception of speech-related sounds later in life, and the neural changes that induce these perceptual deficits. We examine how early stress can cause similar perceptual problems, and can worsen problems induced by transient hearing loss. Understanding the mechanisms behind these changes allows the laboratory to develop strategies for intervention and remediation.

Jianxin Bao, Ph.D.

Dr. Bao's team focuses on developing new drug and gene therapies for hearing disorders such as hearing loss and tinnitus. The prevalence of age-related hearing loss is 63 percent for those 70 years of age and above. Approximately 15 percent of Americans between the ages of 20 and 69 — or 26 million Americans — have noise-induced hearing loss. Tinnitus is highly associated with hearing loss. There are no medications against these disorders. The group conducts studies to prevent hearing loss and tinnitus through development of new technology platforms.

Alexander Galazyuk, Ph.D.

Dr. Galazyuk's laboratory studies tinnitus — the perception of sound in the ears or head when no external source is present. The American Tinnitus Association estimates that 50 million Americans experience tinnitus to some degree, with 16 million patients requiring tinnitus treatment. Tinnitus is the most prevalent disability among active military personnel and veterans. Dr. Galazyuk's group is working to identify underlying brain mechanisms responsible for the development of tinnitus, as well as potential therapies for tinnitus.

Yong Lu, Ph.D.

Dr. Lu's laboratory investigates the functions and cellular mechanisms of an important group of proteins (metabotropic glutamate receptors) in auditory processing under normal hearing and hearing loss conditions. The laboratory aims to provide a basic understanding of the role of these proteins in functionally well-established auditory circuits that analyze information for the localization of sound sources. Ultimately, this will provide the basis for therapeutic intervention in hearing disorders characterized by impaired sensitivity to precise temporal features in sounds.

Julia Huyck, Ph.D. *(Kent State University)*

Dr. Huyck's group investigates changes in perception and perceptual learning on basic auditory and speech perception tasks during adolescence as well as the biological (e.g., sex, brain circuitry, medical history) and cognitive (e.g., attention, memory) factors that affect individual performance on these tasks. This research may identify strategies for the rehabilitation of adolescents and young adults with auditory processing disorder (~6 percent) or those with hearing loss (~20 percent) who are adjusting to new hearing aids or cochlear implants.

Bruna Mussoi, Au.D., Ph.D. *(Kent State University)*

Dr. Mussoi's laboratory studies the factors that impact age-related changes in the auditory system, specifically as they relate to speech perception difficulties. The group uses electrophysiological and behavioral methods to address the relative contributions of peripheral, central and cognitive mechanisms to changes in speech perception in older adults. Ultimately, this knowledge can provide the basis for the development of auditory rehabilitation strategies that are better suited for the needs of the growing population of older adults.

Jeffrey Mellott, Ph.D.

Dr. Mellott's laboratory, using complex circuit tracing and imaging methods, studies how the neural circuits in hearing change as we age. Age-related hearing loss is associated with a reduction in GABA, a key neurochemical used to communicate among neurons throughout the auditory system. The loss of GABA leads to a variety of hearing deficits, including impairment of the ability to detect fine differences in the timing of sounds. Identifying these circuits will allow for improved therapeutic brain targets to ameliorate age-related hearing loss.

Brett Schofield, Ph.D.

Dr. Schofield's group uses sophisticated microscopy to study neural circuits that underlie hearing. Acetylcholine and GABA are chemicals used by nerve cells for many aspects of hearing, including selective attention, learning and understanding speech, especially in a noisy environment. They help the brain adapt during development and aging and respond to damage. The long-term goal of this research is to understand how acetylcholine and GABA contribute to these tasks. Understanding these circuits can provide a basis for developing therapies to improve hearing.

Jeffrey Wenstrup, Ph.D.

Dr. Wenstrup's team studies how emotional centers in the brain interact with the auditory system to establish the meaning of speech and other social vocalizations. How these sounds are interpreted depends on their acoustic structure, the presence of other sensory stimuli, and our internal state. The Wenstrup laboratory studies mechanisms acting within the basolateral amygdala that integrate these information types, and seeks to relate these mechanisms to disorders that result in an altered emotional response to speech, such as autism and post-traumatic stress disorder.

Bradley Winters, Ph.D.

Sound localization is critically important for selective attention which facilitates communication. Dr. Winters' lab seeks to better understand the specialized cellular properties of brainstem neurons that support sound localization by comparing timing and intensity information between the two ears. Dr. Winters uses advanced electrophysiological and imaging approaches to study synaptic plasticity and dendritic physiology in these circuits. Understanding the biology of sound localization may underpin the development of more effective interventions for those with impairments.

NEOMED researchers study several hearing and communication health issues:

Age-related hearing loss • Noise-induced hearing loss • Hearing loss during development

Auditory processing disorder • Tinnitus • Emotional disorders in speech communication

Please visit our webpage for more information on joining or supporting our team:

neomed.edu/research/hearing