Project Title: Optical Coherence Tomography: A revolutionary noninvasive diagnostic tool for middle ear disease

Abstract: Middle ear disorders constitute a large fraction of patients seen in an otolaryngology practice. Middle ear pathology, such as ossicular chain fixation or interruption, is a common cause of significant conductive hearing loss of up to 60 dB. Current imaging approaches do not have the resolution to detect subtle changes in the middle ear and the most accurate means to diagnosis middle ear disease requires surgery under general anesthesia to elevate the eardrum in order to visualize the middle ear to make proper diagnosis. Optical coherence tomography (OCT) is an exciting new technology that can image cross-sections of soft tissues with a high spatial resolution, thus it can ?see through? the intact eardrum to noninvasively examine the middle ear. Using a recently developed triggered OCT technique, we can simultaneously measure sound-induced vibration of the eardrum and the ossicles without violating the eardrum. The combination of morphological information of the middle ear structures and quantification of acoustically-driven vibration of the middle ear using OCT as a noninvasive diagnostic tool has the great potential to revolutionize the diagnosis and management of middle ear disease. We have performed proof-of-concept structural and ossicular motion measurements using triggered OCT in cadaveric ears with no ear canal. In this project, an otoscope probe that couples both sound and OCT laser beams into the intact cartilaginous and bony ear canals of patients will be developed, along with bench testing on cadaveric human temporal bones. These steps are precursors of translational studies in live subjects and patients.