Large-Scale Multidisciplinary Approach to Protecting and Restoring Hearing
Department of Otolaryngology-HNS, Stanford University School of Medicine, Stanford, CA

Introduction
Our mission is to create biological cures for major forms of inner ear hearing loss through a research effort that is sustained, large-scale, multidisciplinary, focused, goal–oriented, and transformational.

Stem Cell Therapy
Biological methods to repair the damaged cochlea by regenerating inner ear hair cells from a patient’s own skin or blood cells.

Gene Therapy
An important strategy for restoring hair cells in genetic hearing loss is re-writing of the flawed genetic code.

Molecular Therapy
Novel drugs that could either prevent the cochlea from losing hair cells or lead to self-repair within the cochlea.

Inner Ear Imaging and Targeted Neural Stimulation
Team of Stanford otolaryngologists and bioengineers are developing noninvasive optical imaging and stimulation techniques.

Faculty
Stanford has assembled an interdisciplinary team of scientists, engineers, and physicians drawing upon expertise from many different domains for the shared purpose of curing hearing loss.

Nik Blevins, MD
- Clinician-scientist with focus on: Inner ear microendoscopy and prosthetic design for minimally invasive imaging of the inner ear.
- Microsurgical robotics - developing instrumentation and techniques
- Surgical Simulation - developing immersive environment for simulation of ear for use in training, assessment and preoperative planning

Kay Chang, MD
- Clinician-scientist with focus on: Congenital hearing loss, neonatal hearing screening, genetics of hearing loss, otoacoustic emissions, auditory physiology, and ototoxicity
- Current research: radiologic evaluation of congenital inner ear anomalies and analysis of how Connexin-based mutations can alter management of infants with congenital hearing loss

Alan G. Cheng, MD
- Surgeon-scientist with a clinical interest in caring for patients with hearing loss and deafness and research interest in inner ear development and regeneration
- Current research to understand how aminoglycosides enter the inner ear and to redesign AGs to preclude entry into the inner ear
- Recently awarded The New Faculty Physician Scientist Award, by the California Institute of Regenerative Medicine (CIRM)

Nicolas Grillot, PhD
- Newly recruited basic scientist interested in the genetics of hearing loss.
- Current goal is to discover the entire set of genes associated with hearing loss and to understand their molecular function within the inner ear

Stefan Heller, PhD
- Basic scientist focused on inner ear hair cell regeneration
- Research goal to describe the otic lineage from an early placodal progenitor until it splits up into multiple cell types making up the sensory epithelia, innervating ganglia, and accessory structures
- Develop treatments for hearing loss via regenerative methods

Robert Jackler, MD
- Chair of the Department of Otolaryngology - Head and Neck Surgery and head of the Stanford Initiative to Cure Hearing Loss (SICHL)
- Otologist-neurotologist who specializes in complex ear diseases with special interest in tumors of the lateral and posterior cranial base
- Goal in leading SICHL is to create biological cures for major forms of hearing loss

Mira Mustapha, PhD
- Basic scientist with goal to understand the pre- and post-synaptic mechanism of auditory neuropathy using human and mouse genetics
- Research focus on thyroid dependent development of neural circuitry in the cochlea
- Identifying which genes play important roles in cochlear hair cell innervation and synapse formation will further basic understanding about how the auditory system develops

John S. Oghalai, MD
- Clinician-scientist with focus on understanding the mechanisms of hearing loss and directly and rapidly improving the care of patients with hearing loss
- Research goal is have the ability to identify why any given patient who comes to clinic has hearing loss, and use this information to guide management using regenerative strategies that are in active development

Gerald Popelka, PhD
- Chief of the Audiology Department at Stanford
- Research focus on development of new stimulus probes, new measurement probes, related digital signal processing, and automated measurement systems necessary for comprehensive measures of auditory function in common research animals such as mice and guinea pigs, particularly for frequencies up to 100,000 Hz

Sunil Puria, PhD
- Associate Professor (Consulting) in the OtoBiomechanics Group
- Research interests in: Middle-ear and Inner-ear Biomechanics, Auditory Technologies, Surgical simulations, Imaging (uCT and MRI)

Anthony Ricci, PhD
- Basic Scientist with focus on furthering the understanding of mechanotransduction and how sensory hair cells communicate with the central nervous system
- Developing novel technologies and working with other researchers to provide technical insight
- Development of novel, non-ototoxic, aminoglycoside antibiotics while retaining effectiveness

Recent Developments

Heller Lab - published in Cell
Reconstruction of the Mouse Otocyst and Early Neuroblast Lineage at Single-Cell Resolution
Research to identify the cellular and molecular profile of the embryonic cells that ultimately will differentiate into the hair cells and supporting cells of the different vestibular organs and the cochlea.

Cheng Lab - published in Development
Spontaneous hair cell regeneration in the neonatal mouse cochlea in vivo
It has been widely accepted that spontaneous hair cell regeneration occurs in chickens and other non-mammals, but not in mammals. The finding in this paper illustrate that spontaneous hair-cell regeneration does occur in the immature mammalian cochlea, up to the first postnatal week.

Ricci Lab - published in Review
Research upends understanding of how humans perceive sound
The process of adaptation allows the human ear to detect a wide range of sounds from a pin dropping to a loud boom, without damage to the sound sensitive inner ear hair cells. Findings showed that calcium is not necessary for mechanotransduction, “thus challenging the 30-year-old hypothesis and opening the door to new models of mechanotransduction and adaptation”

Oghalai Lab - published in PLOS ONE
New Findings on Blast Induced Hearing Loss
Findings show that hearing loss due to loud blasts, such as roadside bombs and other explosions, might not be reversible. Imaging showed that blasts caused hair cell and nerve cell damage, rather than damage to the cochlear structure, as previously thought – possibly leading to a future in which a patient could be treated with drugs to prevent further damage to the inner ear and to prevent a damaging immune response following a blast.

Contact Information
HearingLossCure.stanford.edu
Kate Morris - kmorris@ohns.stanford.edu