Michael G. Heinz

Background:

- PhD at MIT
  - Speech and Hearing Bioscience and Technology
- Postdoctoral Fellow at Johns Hopkins Univ.
  - Biomedical Engineering

Current Position:

- Assistant Professor of Speech, Language, and Hearing Sciences
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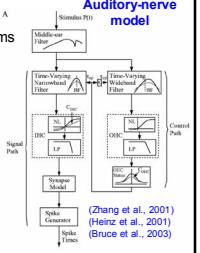
Current Research Areas

- **Long-term goals**
  - to understand the neural bases for robust speech perception by studying the effects of sensorineural hearing loss on neural coding
  - to transfer this knowledge to technologies that improve the lives of people with hearing loss
- **Specific Interests**
  - neural coding in normal and impaired auditory systems
  - neural mechanisms for enhanced speech coding
  - models of auditory signal processing and perception
  - psychoacoustics
  - auditory prostheses
- **Funding**
  - NIH: National Institute on Deafness and Other Communication Disorders
  - NOHR: National Organization for Hearing Research Foundation

Auditory-nerve model



(Zhang et al., 2001)
(Heinz et al., 2001)
(Bruce et al., 2003)

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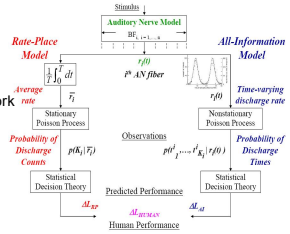
Methodologies

- **Auditory Neurophysiology**
  - auditory nerve and cochlear nucleus of chinchillas
  - Normal and impaired hearing
- **Computational Modeling**
  - Auditory-nerve model
  - Signal detection theoretic framework
    - to relate physiology to perception
  - Normal and impaired hearing
- **Psychoacoustics**
  - Human listeners
  - Normal and impaired hearing



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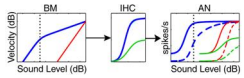
Recent Results

Neurophysiology

- Both outer- and inner-hair-cell (OHC/IHC) damage affects the coding of sound level in the auditory nerve (AN)
  - *Inconsistent with common hypotheses for the neural correlates of loudness recruitment*
  - Alternative hypotheses:
    - spatiotemporal AN responses (associated with OHC function)
    - changes in central synaptic gain following impairment



- Population responses can be simulated from a single AN fiber

Computational Modeling

- Nonlinear spatiotemporal cues provide robust information about sound-level
  - in conditions with degraded average-rate code but robust perception
  - can be decoded with a cross-frequency coincidence detector

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Future Directions

Speech Coding

- The effects of SNHL on the neural coding and perception of concurrent speech (source segregation)
  - Conditions where hearing aids and automatic speech recognizers currently have the greatest difficulty

Clinical Applications

- Diagnostic tests/modeling to identify the degree of OHC/IHC damage in individual patients
- Improved signal-processing strategies for hearing aids and cochlear implants

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