HST 722 / 9.044
“Brain Mechanisms in Hearing and Speech”
Course Introduction

• Course Web Site (explains everything):

• An advanced course covering anatomical, physiological, behavioral, and computational studies of the central nervous system relevant to speech and hearing.

• Students learn primarily by discussions of scientific papers on topics of current interest. A topic usually consists of one lecture & two class periods devoted to discussions of papers.

• Grade and Assignments:
  – Paper presentations, discussion leading and class participation, 65%
  – Written & oral assignments associated with Student-chosen Topics, 35%
Course Topics

- Dorsal cochlear nucleus: Signal processing, multisensory integration and plasticity (Hancock)
- Quantitative approaches to the study of neural coding (Delgutte)
- Speech motor control (Guenther)
- Descending Systems (Brown)
- Neuroimaging correlates of human auditory behavior / multisensory integration (Melcher)
- Student Topics: Initial Presentations
- Language processing I: Cortical representation (Caplan)
- Language processing II: Auditory Processing Disorders (Melcher and others)
- Student Topics: Final Presentations
Most auditory nuclei are located near dorsal surface of brainstem

Auditory Structures
- 8N: 8th Nerve
- CN: Cochlear Nucleus
- LL: Lateral Lemniscus
- IC: Inferior Colliculus
- SC: Superior Colliculus
- ICO: Commissure of IC
- BIC: Brachium of IC
- MGB: Medial Geniculate Body
- AI: Primary Auditory Cortex

Other Structures
- ICM: Cerebellum
- 5N; Trigeminal Nerve

Aitkin (1986)
The ascending auditory pathway

Descending pathway roughly parallels ascending pathway
Dorsal cochlear nucleus: Signal processing, multisensory integration and plasticity (Hancock)

Complex circuitry of the Dorsal Cochlear Nucleus:
Quantitative methods for studies of neural coding (Delgutte)

Signal detection theory allows rigorous comparisons between neurophysiological and psychophysical data.
Descending Systems (Brown)

From Schofield and Coomes (2005)
Speech motor control (Guenther)
Neuroimaging correlates of human auditory behavior (Melcher)

From Petrides and Pandya (1988)
Neuroimaging correlates of human auditory behavior (Melcher)

From Ball et al. (2007)
Peri-Sylvian Cortical Areas are Associated with Language
Language processing I: Cortical representation (Caplan)

From Caplan and Gould (2003)
Student Topics

• Initial Presentations (about mid-way through the course)
  – Each student chooses, writes up (about 6 pages), and defends orally (10 min. presentation) a topic germane to hearing / speech
  – Propose 3-4 papers on this topic that could be discussed at the Final Presentations
  – We will vote on which several topics to choose for the Final Presentations

• Final Presentations (at end of the course)
  – Each winning topic is presented by a group of students
  – The group presents the topic and leads the discussion of the papers

• Example Student Topics have been Absolute Pitch, Auditory Short-Term Memory, A Gene for Speech?, and Auditory Learning in Songbirds
Dorsal Cochlear Nucleus Papers

Discussed 9/13:

Discussed 9/18: