BIOGRAPHICAL SKETCH

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NAME: Hackett, Troy A.

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POSITION TITLE: Associate Professor

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	Completion Date MM/YYYY	FIELD OF STUDY
Indiana University, Bloomington, IN	BA	1987	Speech/Hearing Sci.
Indiana University, Bloomington, IN	MA	1989	Clinical Audiology
Vanderbilt University, Nashville, TN	Ph.D.	1996	Hearing Science
Vanderbilt University, Nashville, TN	PostDoc	1997-1999	Neuroscience

A. Personal Statement

Troy Hackett has devoted his entire career to research and clinical studies of the central auditory system, with an emphasis on the organization of the auditory forebrain. After 5 years of clinical practice in audiology, the PI began full-time research at Vanderbilt University. A major goal and accomplishment of this research program has been to build testable models of auditory cortical organization from studies in humans, nonhuman primates, and other animal models. A range of anatomical and neurophysiological techniques has been combined to characterize the structural and functional properties of brain areas that comprise the auditory cortical and thalamic networks. These techniques include: 1) architectonic and chemoarchitectonic profiles of brain areas; 2) gene and protein expression profiles of neurons in specific areas and pathways; 3) identification of connections and pathways between brain areas; 4) recording of neuron response profiles; and 5) comparative tissue analyses of human and nonhuman primate. The working model of primate auditory cortex (macaque, marmoset) established by this research program has been widely adopted worldwide, and is subject to continual refinement.

B. Positions and Honors

Positions and Employment

1985-1989	Research Assistant, Dept. of Speech & Hearing Sciences, Indiana University
1989-1993	Director of Audiology, Prof. Hearing Services, Ft. Wayne, Indiana
1993-1996	Graduate Student, Dept. of Hearing & Speech Sciences, Vanderbilt University
1997-1999	Postdoctoral Fellow, Dept. of Psychology, Vanderbilt University
2000-2004	Research Assistant Professor, Dept. of Hearing and Speech Sciences, Vanderbilt University School of Medicine
2004-2008	Assistant Professor (primary), Dept. of Hearing and Speech Sciences, Vanderbilt University School of Medicine.
2005-2008	Assistant Professor (secondary), Dept. of Psychology, Vanderbilt University.
2008 –present	Associate Professor (primary), Dept. of Hearing and Speech Sciences, Vanderbilt University School of Medicine.
2008 – present	Associate Professor (secondary), Dept. of Psychology, Vanderbilt University.

Other Experience and Professional Memberships

2007 – 2009	NIH Peer Review; AUD (auditory) study section, ad hoc reviewer
2009 – 2015	NIH Peer Review: AUD (auditory) study section, regular member

Awards & Honors

1996 – 1999	National Research Service Award, NIH F32 DC-00249
1993 – 1996	Vanderbilt Tuition Scholarship, Hearing & Speech Sciences
1993 – 1996	Harold Sterling Vanderbilt Scholarship, Vanderbilt University
1987	Exchange Clubs Scholarship, Indiana University
1987	Phi Beta Kappa, Indiana University
1987	Summa Cum Laude, Indiana University

C. Contributions to Science

The scientific contributions of this investigator have focused on the neuroanatomical and neurophysiological organization of the auditory forebrain in humans, nonhuman primates, and other species.

(1) Organization of the primate auditory forebrain

A foundational guide to the detailed exploration of any brain region is a valid map of the layout and connections of the areas that comprise that region. When intensive studies of auditory forebrain function began to increase in 1995, the PI was a graduate student in auditory neuroscience in the laboratory of Dr. Jon Kaas at Vanderbilt University. Over a period of about 20 years, the PI's laboratory produced a series of 45 papers and review articles in which the auditory forebrain was mapped in two nonhuman primate species that serve as major experimental models: macaque monkey, marmoset monkey. These papers combined neuroanatomical and neurophysiological techniques to produce maps, which are widely used by other laboratories worldwide as a guide to neurophysiological and neuroimaging studies of function. The models developed in monkeys have been partially extended to the human auditory forebrain. Reviews describing this extensive dataset include the following:

1. Kaas, J.H. & Hackett, T.A. (2000). Subdivisions of auditory cortex and processing streams in primates. *Proc. Natl. Acad. Sci.*, *97*, 11793-11799. PMCID: PMC34351.
2. Hackett TA (2007) Organization and correspondence of the auditory cortex of humans and nonhuman primates. In *Evolution of the Nervous System*, JH Kaas (Ed.)., Oxford: Elsevier; pp. 109-119.
3. Hackett TA (2011) Information flow in the auditory cortical network. *Hearing Res*, 271(1-2):133-46. PMID: 20116421. PMCID: PMC3022347.
4. Hackett TA (2015) Anatomic organization of the auditory cortex. *Handbook Clin Neurol*., 129:27-53.

2) Organization and transcriptome profiling of the mouse auditory forebrain

The mouse has become an important animal model in studies of the mammalian auditory system, but the organizational properties have not been systematically studied. In 2009, in collaboration with Dr. Daniel Polley (Eaton-Peabody Labs), the PI began working on the organization of the auditory forebrain in adult and developing mice, combining established (chemoarchitecture, tract tracing, single unit neurophysiology) and new techniques (next-generation sequencing of total RNA). To date, these efforts have produced 5 papers, including a database containing the first complete transcriptome of the auditory forebrain (A1, MGB) in any mammalian species.

1. Hackett TA, Rinaldi Barkat T, O'Brien BM, Hensch TK, Polley DB (2011) Linking topography to tonotopy in the mouse auditory thalamocortical circuit. *J Neurosci.*, 31(8):2983-2995. PMID: 21414920
2. Torii M, Hackett TA, Rakic P, Levitt P, Polley DB (2012) EphA signaling impacts development of topographic connectivity in auditory corticofugal systems. *Cereb Cortex,* 23(4): 775-785. PMID: 22490549. PMCID: PMC3593572.
3. Hackett TA, Clause AR, Takahata T, Hackett NJ, Polley DB (2015) Differential maturation of vesicular glutamate and GABA transporter expression in the mouse auditory forebrain during the first weeks of hearing. *Brain Structure Function*, in press.
4. Hackett TA, Guo Y, Clause AR, Hackett NJ, Garbett K, Zhang P, Polley DB (2015) Transcriptional maturation of the mouse auditory forebrain. *BMC Genomics*, in press.

3) Multisensory features of the auditory forebrain

The central auditory pathways interface with other sensory systems and the motor system. The anatomical substrates of these interactions are poorly understood. Primarily in collaboration with Dr. Charles Schroeder (Columbia Univ., Nathan Kline Institute), a series of 7 research studies and 4 review articles were published in which neuroanatomical and neurophysiological techniques were combined to study the influences of non-auditory inputs on auditory activity in the auditory forebrain. These studies are ongoing. Collaborations with the laboratory of Dr. Jon Kaas have generated 3 papers on related aspects of visual and somatosensory cortex organization. Representative reviews and a special issue of Hearing Research devoted to this topic include the following:

(1) Schroeder CE, Lakatos P, Smiley J, and Hackett TA (2007) How and why do multisensory inputs target auditory cortex? In *Auditory Evoked Potentials*, R. Burkhard, M. Don and J. Eggermont (Eds.)., 651-671.
(2) Hackett TA, Schroeder CE (2009) Multisensory integration in auditory and auditory-related areas of cortex, *Hearing Res*, 258:1 – 3. PMID: 19932881. PMCID: Editorial
(3) Hackett, TA (2012) Multisensory Convergence in the Thalamus. In B. Stein et al (eds.) *New Handbook of Multisensory Processing*, 2nd Ed, MIT Press, 49-66.
(4) Morrilon B, Hackett TA, Kajikawa Y, Schroeder CE (2015) Predictive motor control of sensory dynamics in auditory active sensing. *Curr Opin Neurobiol*, 31:230-238.

A complete listing of my publications can be found at: http://auditorybrainatlas.org/page4/index.html

D. Research Support

Ongoing Research Support

R01 DC011490 C.E. Schroeder (PI) 03/01/11 – 02/28/16
Neurophysiology and Anatomy of Multisensory Processing
This project combines multichannel neurophysiology and neuroanatomy (tract tracing, chemoarchitecture) to characterize the response properties of neurons in the cortex and thalamus that are responsive to multiple sensory modalities, and identify the structural elements that underlie those interactions.
Role: Co-investigator (anatomical experiments)

Completed Research Support

K18 DC012527-01 Hackett (PI) 01/01/13 – 12/31/14
Gene Expression During Postnatal Development of the Central Auditory Pathway
The primary research goals of this project were to (1) use next-generation sequencing of total RNA to conduct transcriptome profiling of central auditory structures in mouse central auditory pathways during postnatal development (before and after hearing onset); (2) use sequencing to guide selection of genes and proteins for in situ hybridization and immunohistochemical assays in intact tissue sections. The professional goal was to retool the PI and laboratory by incorporating molecular biological tools into the ongoing research program.
Role: Principal investigator

R21 DC012918 Y. Kajikawa (PI) 07/01/13 – 06/30/15
Neuronal properties and behavioral role of the auditory parabelt
The goal of this project is to establish for the first time the basic response properties of neurons in the parabelt region of auditory cortex in awake primates. In addition to response latencies and tonotopy, the stimulus battery also probes for evidence of information flow from caudal to rostral along the superior temporal gyrus. Anatomical assays include tract tracing to provide anatomical evidence of feedforward information flow (caudal to rostral) and identify the locations of electrode tracts.
Role: Co-investigator (anatomical experiments)