

# Volume Preface

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Hearing and communication present a variety of challenges to the nervous system.	102
To be heard and to be understood, a communication signal must be transformed	103
from a time-varying acoustic waveform to a perceptual representation and then to	104
an abstract representation that combines the perceptual representation with memory	105
stores and semantic/referential information. Finally, this abstract representation	106
must be interpreted to form categorical decisions that guide behavior. Did I hear the	107
stimulus? From where and whom did it come? What does it tell me? How can I use	108
this information to plan an action? All of these issues and questions underlie audi-	109
tory cognition.	110
This volume emphasizes those literatures that <i>combine</i> measurements of behav-	111
ioral (psychophysical) responses with measurements of the responses of single neu-	112
rons. Since the auditory cortex is modulated by cognitive factors (e.g., attention,	113
memory, and reward values) and ongoing task demands, their effect on the neural	114
code can be tested only when behavioral responses and single-neuron activity are	115
simultaneously recorded. This relationship between behavior and single-neuron	116
activity is one of the most significant issues in auditory neuroscience and, more	117
generally, in sensory and cognitive neuroscience.	118
Chapters 2 and 3 set the stage for the remaining chapters in the book. In Chapter	119
2, Rauschecker reviews the hypothesis that the auditory cortex contains two func-	120
tional processing streams: one pathway devoted to the neural computations underly-	121
ing spatial processing (where is the sound?) and the other pathway devoted to	122
computations underlying auditory-object processing (what is the sound?). In Chapter	123
3, Scheich and Brosch review the contribution of the auditory cortex to cognitive	124
components of auditory behavior. The next section of this volume expands on the	125
topics raised by Rauschecker in Chapter 2. In Chapter 4, Recanzone discusses the	126
role of the auditory cortex in spatial processing and localization, while in Chapter 5,	127
Schnupp, Honey, and Willmore focus on auditory-object perception and the neural	128
correlates underlying this form of perception.	129

Chapters 6 and 7 focus on the neural processing and perception underlying a specific type of auditory object: vocal-communication signals. Chapter 6 by Steinschneider focuses on how listeners extract phonemes—the smallest unit of human speech—from the acoustic environment. In our daily lives, this ability seems automatic and even trivial. In Chapter 7, Ghazanfar and Chandrasekaran overview the multimodal nature of communication and the neural signals mediating multimodal communication.

The final three chapters of the book focus on attention, memory, and plasticity, themes that are initially introduced by Scheich and Brosch in Chapter 3. The interdependencies of attention and memory and the neural codes that underlie auditory attention and memory are discussed by Poremba and Bigelow in Chapter 8. Chapter 9 by Fritz, David, and Shamma raises the possibility that this idea may need refining, and the authors review a body of literature indicating that the tuning properties of a neuron are plastic and are functionally dependent on the immediate needs of the listener. Finally, in Chapter 10, Shepard, Kilgard, and Liu continue with the theme of plasticity and how a listener's experience has a profound impact on a neuron's response properties and how auditory information is organized and represented in the brain.

As is always the case with SHAR volumes, this volume builds on and complements many of the outstanding previous volumes in the SHAR series. In particular, the material in this volume is complemented by material in several volumes that focus on psychophysics and neural activity in the human auditory cortex including *Human Psychophysics* (Vol. 3, edited by Yost, Popper, and Fay), *Auditory Perception of Sound Sources* (Vol. 29, edited by Yost, Popper, and Fay), and *Human Auditory Cortex* (Vol. 43, edited by Poeppel, Overath, Fay, and Popper).

Yale E. Cohen, Philadelphia, PA  
Arthur N. Popper, College Park, MD  
Richard R. Fay, Falmouth, MA

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Cohen, Y.E.; Popper, A.N.; Fay, R.R. (Eds.)

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