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Volume 21: Plasticity of the Auditory System
Edited by Thomas N. Parks, Edwin W Rubel, and Richard N. Popper

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Plasticity of the Auditory System

With 48 Illustrations

Springer

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Series Preface

The *Springer Handbook of Auditory Research* presents a series of comprehensive and synthetic reviews of the fundamental topics in modern auditory research. The volumes are aimed at all individuals with interests in hearing research including advanced graduate students, postdoctoral researchers, and clinical investigators. The volumes are intended to introduce new investigators to important aspects of hearing science and to help established investigators to better understand the fundamental theories and data in fields of hearing that they may not normally follow closely.

Each volume presents a particular topic comprehensively, and each serves as a synthetic overview and guide to the literature. As such, the chapters present neither exhaustive data reviews nor original research that has not yet appeared in peer-reviewed journals. The volumes focus on topics that have developed a solid data and conceptual foundation rather than on those for which a literature is only beginning to develop. New research areas will be covered on a timely basis in the series as they begin to mature.

Each volume in the series consists of a few substantial chapters on a particular topic. In some cases, the topics will be ones of traditional interest for which there is a substantial body of data and theory, such as auditory neuroanatomy (Vol. 1) and neurophysiology (Vol. 2). Other volumes in the series deal with topics that have begun to mature more recently, such as development, plasticity, and computational models of neural processing. In many cases, the series editors are joined by a co-editor having special expertise in the topic of the volume.

RICHARD R. FAY, Chicago, Illinois
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Volume Preface

Basic science studies of the auditory system have provided neuroscience with some of its most instructive examples of highly specialized functions arising from unique structures. Working out the developmental mechanisms by which these structures and functions arise continues to provide information of great value to general developmental biology as well as increases our understanding of how the many complex elements coalesce during normal development to form a functional auditory system. Such an understanding of the developing auditory system could potentially impact the optimization of treatment of developmental hearing losses in humans during the first years of life when the auditory system is most plastic, and thus serve in the mitigation of hearing problems in the large numbers of people who experience significant hearing loss.

The chapters in this volume provide a unique understanding of the development and plasticity of the auditory system. In Chapter 1, Parks and Rubel provide an overview of the rest of the volume, as well as discuss the meaning and use of the concept of plasticity. Rubel, Parks, and Zirpel (Chapter 2) focus on development of the cochlear nucleus (CN), among the best understood of the central nervous system (CNS) auditory centers. In reviewing the extensive research literature on normal development of the mammalian superior olivary complex (SOC), Friauf (Chapter 3) notes how many key events occur prior to the onset of hearing: neurogenesis, cell migration, axon and dendrite outgrowth, target selection, and synaptogenesis. Moore and King (Chapter 4) note that adjustments in binaural hearing are probably involved in the natural response to growth-related changes in head size and other natural changes in interaural cues, as well as disease- and injury-induced hearing asymmetries. Although studying plasticity in the auditory cortex is important, it is particularly difficult, for reasons Weinberger considers in Chapter 5. Analysis of auditory neuron function in awake behaving organisms has yielded some of its most impressive results in the study of birdsong. As Brenowitz and Woolley (Chapter 6) discuss, the study of neural plasticity in birdsong has also led neuroscience to recognize the existence of ongoing generation and replacement of projection neurons in the endotherm brain and hormonally induced seasonal changes in the morphology, pharmacology, and physiology of CNS neurons. Finally, Lakes-Harlan

(Chapter 7) approaches plasticity in the insect auditory system by considering four contexts in which it occurs.

As is often the case with chapters in the volumes in the Springer Handbook of Auditory Research, related chapters are often found in other volumes. The structure and function of the CNS discussed in most of the chapters in this volume are considered in great depth for mammals in Vol. 15 (*Integrative Functions in the Mammalian Auditory Pathway*). Related chapters in hearing in birds can be found in Vol. 13 (*Comparative Hearing: Birds and Reptiles*) and on insects in Vol. 10 (*Comparative Hearing: Insects*). Most extensively, issues on development of the auditory system are also found in Vol. 9, which can almost be considered as a companion to this one, *Development of the Auditory System*, and especially in chapters by Sanes and Walsh on development of central auditory processing and Cant on structural development of the central auditory pathways in mammals.

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