

Volume Preface

Research on sensory efferents has entered a renaissance period, particularly with respect to the auditory and vestibular systems. Since the discovery of auditory efferents by Grant Rasmussen, understanding of its significance to sensory processing has grown. To accentuate the whole efferent system associated with the ear, this volume covers a wide range of topics addressing the biology of auditory and vestibular efferents. Basic research reviews of the anatomy, electrophysiology, and pharmacology lead into discussions of cellular and molecular features of the inner ear. Chapters on the development and evolution of efferent systems illuminate key phylogenetic stages and ontogenetic mechanisms that have given rise to present-day efferent systems. The final chapters provide an overview of central efferent anatomy and neuronal responses and plasticity to efferent activation.

The first chapter by David Ryugo introduces the idea of sensory efferents and explores the concept with respect to biological mechanisms and behavior. The behavioral responses of organisms when confronted by sensory challenges are often best explained by invoking a functioning efferent system. When considering what a nervous system must do, one can design experiments to test hypotheses about what the nervous system actually does. This context sets the stage for the rest of the volume.

Chapter 2 by Chris Brown exploits the basic relationship between structure and function to establish an anatomical foundation for understanding olivocochlear neurons. This discussion is followed by a summary of the physiological response properties of the efferent neurons in Chapter 3 by John Guinan. The anatomical distinctions outlined in Chapter 2 are consistent with the different mechanisms utilized by the lateral and medial olivocochlear systems to alter cochlear function. The separate olivocochlear systems use different chemical mechanisms that are discussed in detail by Bill Sewell in Chapter 4. Sewell's introduction to cochlear efferent neurochemistry is followed by a consideration of the role of special nicotinic receptors and various ion channels by Eleonora Katz, Ana Belén Elgoyhen, and Paul A. Fuchs in Chapter 5 to explain how acetylcholine mediates fast inhibition.

Chapter 6 by Joseph C. Holt, Anna Lysakowski, and Jay M. Goldberg introduce the vestibular component of inner ear efferents. This update on the current knowledge of vestibular efferents emphasizes the complicated nature of the system and hints at new directions and questions.

Dwayne Simmons, Jeremy Duncan, Dominique Crapon de Caprona, and Bernd Fritzsche review development of the vestibulocochlear efferent system in Chapter 7 and reveal provocative findings that shape our understanding about mechanisms of inner ear development. This treatise is followed by Chapter 8 in which Christine Köppl addresses efferent system diversity in terms of evolutionary concepts.

Chapter 9 by Brett Schofield describes the descending auditory circuitry that forms long descending projections as well as short feedback loops within the central auditory system. Chapter 10 by Donald Robertson and Wilhelmina Mulders discusses the central effects of efferent activation on physiological response properties of auditory neurons, and Nobuo Suga, Weiqing Ji, Xiaofeng Ma, Jie Tang, Zhongju Xiao, and Jun Yan summarize in Chapter 11 how many forms of brain and behavioral plasticity depend on efferent systems.

As is often the case, chapters in a newer SHAR volume are complemented by, and complimentary to, chapters in earlier volumes. Although there have been few chapters in earlier volumes that were specifically on efferent systems, the issue was critical as parts of chapters in volumes such as *The Cochlea* (Vol. 8), *Integrative Functions in the Mammalian Auditory Pathway* (Vol. 15), and *The Vestibular System* (Vol. 19). In addition, the anatomy of the olivocochlear vestibular system was specifically discussed by W. Bruce Warr in Vol. 1 of this series, *The Mammalian Auditory Pathway: Neuroanatomy* and by Russell and Lukashkin in *Active Processes and Otoacoustic Emissions* (Vol. 30).

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