

Volume Preface

This volume illustrates how two time-honored areas of research, auditory systems physiology and synaptic physiology, have come together to generate a new subfield of research, the synaptic mechanisms of auditory coding. That union has generated new insight into systems function, and its success is providing the stimulus for development or application of new techniques and ideas in our field. The topics primarily focus on synapses and ion channels in neurons of the central nervous system, with emphasis on the brainstem, but they also offer an informative look at the first auditory synapse in cochlear hair cells.

Chapter 1 by Trussell provides an overview and guide to the volume and shares thoughts about future research directions. Chapter 2 by Golding examines the voltage-gated ion channels of auditory neurons and how these determine the kind of computation that can be performed on acoustically driven inputs. With this as background, we turn to synapses in Chapter 3, wherein Nicolson shows how the molecular and physiological components of the hair cell synapse initiates coding.

The giant synapses of the auditory system have attracted attention of researchers both within and outside the auditory field, to great advantage. These terminals, the endbulbs and calyces of Held, are described in Chapter 4 by Manis, Xie, Wang, Marrs, and Spirou and also in Chapter 5 by Borst and Rusu. In Chapter 6, MacLeod and Carr describe the bases of synaptic coincidence detection and its role in sound localization, while in Chapter 7, Trussell examines how synaptic inhibition operates, with examples from the cochlear nucleus and superior olive.

Chapter 8 by Metherate and Chapter 9 by Tzounopoulos and Leão address the short- and long-term modifiability of auditory synapses and how this plasticity may be used in auditory processing. Metherate examines auditory neuromodulation and gives an example of its potential roles in attention. Tzounopoulos and Leão present the case for experience-dependent plasticity as a well-established component of auditory function from brainstem to cortex.

As in all previous SHAR volumes, there are chapters in other books of the series that have relevance to the general theme discussed in this volume. For example, the circuitry and computation in the auditory system, so related to synapse function, is discussed in chapters of Volume 15 (*Integrative Functions in the Mammalian*

Auditory Pathway), while synapses in the inner ear are considered in detail in Volume 8 (*The Cochlea*) and Volume 27 (*Vertebrate Hair Cells*). Finally, computational models of the auditory system, the topic of many chapters in this volume, are discussed in detail in Volume 6 (*Auditory Computation*) and Volume 35 (*Computational Models of the Auditory System*).

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