# Volume Preface

The past decade has brought great advances in our understanding of the mechanisms underlying auditory pathologies. Molecular biology and genetics primarily have contributed to this enhanced understanding, which in turn has driven the design of novel rational therapeutic interventions. This volume presents recent developments in auditory research and their potential translation to the clinical setting. In particular, the authors address the major entities of peripheral auditory trauma; discuss the underlying mechanisms, the central nervous system consequences, and protective interventions; and finally explore the possibilities to restore cochlear morphology and function.

Two themes pervade the chapters in this book: cellular homeostasis and cell death. In the broadest sense, all auditory pathologies are disorders of cellular homeostasis. The book appropriately starts with a consideration of genetic factors that determine the function and the dysfunction of the auditory organ and predispose an individual to acquired hearing loss. Shalit and Avraham (Chapter 2) review the revolution in genetics that has given us profound insight into the genes that are involved in inner ear disorders. Extending the chapter on genetics from a physiological perspective, Wangemann in Chapter 3 treats disorders of the cochlea with the background of our understanding of cellular metabolism and metabolic regulation. Following a comprehensive assessment of the principles of homeostasis, the author discusses the most prominent or well understood homeostatic disorders.

Tinnitus, a major enigma among hearing disorders, is the topic of Chapter 4 by Bauer and Brozoski. The authors review current theories, potential mechanisms, and promising treatments. Autoimmune inner ear disease is now recognized as a genuine inner ear disorder. In Chapter 5, Gopen and Harris discuss the basic immunology of the inner ear, the pathophysiology of the disease including that studied in animal models, as well as clinical diagnosis and treatment of autoimmune hearing loss. The changes in hearing associated with age-related hearing loss reflect alterations in both the cochlea and the central auditory pathways. In Chapter 6, Ohlemiller and Frisina discuss our current understanding of the various forms of presbycusis derived from clinical observations and animal models. Auditory pathologies resulting from noise or drugs have long been established. Noise-induced hearing loss is discussed in Chapter 7 by Henderson, Hu, and Bielefeld, while in Chapter 8, Rybak, Talaska, and Schacht summarize the latest on drug-induced hearing loss.

While the preceding chapters primarily deal with the peripheral auditory system as the site of the initial lesion of auditory trauma, Morest and Potashner detail the pathophysiology of central auditory pathways and its molecular basis in Chapter 9.

The complexity of the cellular regulation of cell death pathways, as well as endogenous protective mechanisms, are considered in Chapter 10 by Green, Altschuler, and Miller. In addition to a detailed consideration of cell death pathways, the authors outline the state-of-the-art attempts to protect the cochlea against environmental insults, with special attention to the spiral ganglion neurons.

Finally, Heller and Raphael introduce the most recent revolutionary developments in hair cell regeneration and stem cell therapy in Chapter 11. They give us a vision of a future when hearing loss and loss of hair cells may be reversed by genetic or pharmacological manipulation.

As often is the case, earlier volumes of the Springer Handbook of Auditory Research Series also provide background or additional information about material covered in this volume. Related topics in Vol. 7 of the series (*Clinical Aspects of Hearing*, edited by Van de Water, Popper, and Fay) include chapters on molecular genetics (Steel and Kimberling), ototoxicity (Garetz and Schacht), and the psychophysical study of tinnitus (Penner and Jastreboff). An additional discussion of homeostasis is found in a chapter by Wangemann and Schacht in Vol. 8 (*The Cochlea*, edited by Dallos, Popper, and Fay). Supplementing the summary of genetics in this volume are the chapters of Vol. 14 (*Genetics and Auditory Disorders*, edited by Keats, Popper, and Fay) that discuss genes and mutations in hearing impairment (Avraham and Hasson), genetic epidemiology of deafness (Nance and Pandya), and genetic counseling (Arnos and Oelrich). Finally, Vol. 26 (*Development of the Inner Ear*, edited by Kelley, Wu, Popper, and Fay) includes several relevant chapters on the molecular biology of ear development, including a chapter by Herzano and Avraham on developmental genes associated with hearing loss in humans. The current volume thus builds on and expands the information presented in earlier volumes of the Handbook of Auditory Research.

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