

# Springer Handbook of Auditory Research

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Sandra Gordon-Salant • Robert D. Frisina  
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# The Aging Auditory System

 Springer

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This volume is dedicated to our friend and colleague, Dr. Judith A. Finkelstein, for her sustained interest in the field and her exceptionally strong support for research during her years at the National Institute on Aging (1995-2006) of the National Institutes of Health. Her efforts were instrumental in guiding new and seasoned investigators alike toward securing funding for research on age-related hearing loss and fostering communication between researchers to promote innovative scientific developments in this area. This volume showcases the work of many of the investigators with whom Dr. Finkelstein worked, either as chapter authors or as authors of hundreds of citations that are referenced throughout.

The senior volume editors also wish to express their appreciation to their spouses, Steven and Susan, for their love and support through all of the late-night experiments, the grant and paper deadlines, and travel to sometimes unusual meeting sites.

# Series Preface

## Springer Handbook of Auditory Research

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 coeditor having special expertise in the topic of the volume.

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# Volume Preface

Age-related hearing loss (ARHL) is one of the top three most common chronic health conditions affecting individuals aged 65 years and older. The high prevalence of age-related hearing loss compels audiologists, otolaryngologists, and auditory neuroscientists alike to understand the neural, genetic, and molecular mechanisms underlying this disorder. A comprehensive understanding of these factors is needed so that effective prevention, intervention, and rehabilitative strategies can be developed to ameliorate the myriad of behavioral manifestations. This volume presents an overview of contemporary research trends on ARHL from interrelated disciplines whose studies aim to meet this compelling need.

The overall objective of this volume is to bring together noted scientists who study presbycusis from the perspective of complementary disciplines for a review of the current state of knowledge on the aging auditory system. In Chapter 1, Gordon-Salant and Frisina provide an overview to the volume and put the material in the perspective of the field in general. In Chapter 2, Schmiedt presents the morphology and physiology of age-related changes in the auditory periphery, with a description of animal models that control for the effects of known acquired disorders (e.g., noise exposure and ototoxicity) on peripheral auditory system function. In Chapter 3, Canlon, Illing, and Walton describe the direct effects of biological aging at each major level of the ascending central auditory nervous system, with a focus on anatomical, physiological, and neurochemical alterations. This is followed by Chapter 4 by Ison, Tremblay, and Allen that reviews definitive evidence of ARHL in animals and compares findings with those obtained from humans, for whom control of diet, environment, genetics, and other factors is not possible. Chapter 5, by Fitzgibbons and Gordon-Salant, begins a series of chapters on behavioral manifestations of presbycusis in human listeners. Fitzgibbons and Gordon-Salant review changes in hearing sensitivity over time as well as age-related alterations in the perception of the spectral, intensive, and temporal attributes of simple and complex nonspeech acoustic signals. Results of masking and suppression studies are also presented. This is followed in Chapter 6 by Eddins and Hall who discuss binaural processing and temporal asymmetries in aging for both speech and nonspeech signals. In Chapter 7, Schneider, Pichora-Fuller, and Daneman present an integrated systems approach to explain the levels of processing required for spoken language comprehension in communication situations

encountered in daily life. In Chapter 8, Humes and Dubno review the effects of aging on speech perception, with an effort to distinguish the effects of peripheral hearing loss from those attributed to higher-level processing problems on speech perception performance of older people. The epidemiology of ARHL is presented in Chapter 9 by Cruickshanks, Zhan, and Zhong. Finally, in Chapter 10, Willott and Schacht consider chemical and environmental strategies for delaying the onset and progression of ARHL.

Although this volume focuses on hearing in aging adult humans, there are chapters in other volumes of the Springer Handbook of Auditory Research that provide additional related material. Many chapters in *Auditory Trauma, Protection, and Repair* (Volume 31, edited by Schacht, Popper, and Fay) and *Hair Cell Regeneration, Repair, and Protection* (Volume 33, edited by Salvi, Popper, and Fay) consider issues of damage to hearing and to the ear and methods by which some of these problems might arise. One technical intervention for treating changes in hearing with age that is gaining momentum is fitting presbycusis listeners with cochlear implants, and these are considered in depth in *Cochlear Implants: Auditory Prostheses and Electric Hearing* (Volume 20, edited by Zeng, Popper, and Fay). Issues related to general perception sounds by humans are also considered at length in chapters in *Auditory Perception of Sound Sources* (Volume 29, edited by Yost, Popper, and Fay) and in an early volume in the series on *Human Psychophysics* (Volume 3, edited by Yost, Popper, and Fay). Other volumes with considerable bearing on this include *Clinical Aspects of Hearing* (Volume 7, edited by Van De Water, Popper, and Fay), *Speech Processing in the Auditory System* (Volume 18, edited by Greenberg, Ainsworth, Fay, and Popper), and *Plasticity of the Auditory System* (Volume 23, edited by Parks, Rubel, Popper, and Fay).

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