

PREFACE

Dysfunction of the cochlea is the most common of all human forms of sensory loss. The World Health Organization estimates that 250 million people have a significant level hearing loss. In the United States, 1 of every 1000 newborns has a severe to profound hearing loss. With age, about 60% of those over 70 years old will have a serious loss of auditory capability. More than 40 genes have been associated with cochlear sensory impairment. Critical to the prevention of hearing loss as a serious global health problem is the detailed knowledge of cochlear function.

The Workshop on Auditory Mechanisms: Processes and Models was the ninth in a series that has also come to be known as the “Mechanics of Hearing Workshops.” Inner ear mechanics is a special area of study that explores the details of function relevant to understanding normal hearing and hearing loss. It is easy to recognize the relevance of cochlear mechanics study to both basic and applied auditory science. The otoacoustic emission is one such topic. Otoacoustic emissions potentially provide a view into the cochlea to observe the micro-mechanics. However, interpretation of changes in the emissions requires a greater understanding of their origin and wave propagation. During the past 20 years since the start of the Workshops, research into the mechanics of hearing has undergone numerous major developments. Particularly important are the experimental procedures have been developed for manipulating and viewing the micro-mechanical responses of the inner ear, even down to the sub-cellular level.

The Workshop brought together an interdisciplinary group of scientists including the leading researchers working on the cochlea from the level of the whole system through the structural protein level. One character of the meeting that differs from the typical auditory neuroscience gatherings is the strong representation of mathematical modeling. This combination of experimentalists and modelers enables a deeper presentation and discussion of theoretical issues. Indeed, much time was available for formal discussion of two major scientific controversies: 1) On the role of outer hair cell stereocilia in “powering” cochlear amplification and 2) On the amount of reverse propagation of energy from the cochlea by fluid acoustic compression waves.

The book organization begins with papers on the function of the organ of Corti as a system in the chapter titled “Whole-Organ Mechanics.” “Hair Cells” follows concerning the soma of outer hair cells. Hair cell transduction is addressed in the chapter “Stereocilia” and otoacoustic emissions make up the chapter titled “Emissions.” Finally, modeling of cochlear function is treated in the chapter “Cochlear Models.” Each chapter has a paper from one or more plenary speakers. Of particular note is that this Workshop honored Prof. Egbert de Boer as a founder of the Mechanics Workshop series of meetings. His paper derives from a plenary lecture. Questions and answer responses are included at the end of the papers and there is a separate “Discussion” chapter that presents the content of a lively evening session of the Workshop.

The Workshop was supported and made possible by generous funding support from public and private sources. An NIH conference grant was provided by the National Institute on Deafness and Other Communication Disorders. Instrument manufacturers Polytec Inc., Tucker-Davis Technologies and Etymotic Research Inc. provided support. Of particular relevance, the Workshop received generous support from hearing aid manufacturers, The Oticon Foundation, Starkey Hearing Research Center, and a cochlear implant manufacturer, Advanced Bionics.

The Workshop also established a new model for scientific conferences, as there was a linked but financially separate, public science outreach/training event. Held at the Oregon Museum of Science and Industry in Portland, Drs. James A. Hudspeth and Billy Martin delivered an interactive lecture to a group of high school students. The Workshop attendees were also present. A reception followed, allowing the personal interaction of the students and the scientists. This event was generously funded by the Burroughs Wellcome Foundation.

The editors would like to thank the International Organizing Committee for their role in the planning of the Workshop and for efforts on finding financial support. We are grateful to the Plenary Lecturers for their stimulating presentations, to the session chairs and discussion moderators in helping run the meeting, and to all the participants for maintaining the tradition of a high quality meeting.

We are indebted to many others for the success of the Workshop and for this book. The Department of Otolaryngology at the Oregon Health & Science University is the home of the Oregon Hearing Research Center (OHRC) and responsible for creating the rich basic and clinical research environment that enables meetings such as this Workshop. The faculty and students of OHRC deserve praise for their assistance. We have deep gratitude for the core group of OHRC staff that contributed so much of their time and energy, Linda Howarth, Jill Lilly, Scott Matthews, Theresa Nims and Edward Porsov, without whose help the Workshop would have been ordinary at best, instead of extraordinary as it was.

Finally I wish to thank my scientist colleagues, many of whom are close friends, for creating such an exciting and fruitful scientific environment as the Mechanics of Hearing Workshop, and for the honor and pleasure of hosting this ninth Workshop.

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