Audiology & Neuro-Otology

Gummer A.W. (ed.)

Biophysics of the Cochlea: From Molecules to Models

Proceedings of the International Symposium on Mechanics of Hearing held at Titisee, Germany, on July 27 to August 1, 2002
World Scientific, Singapore 2003
ISBN 981–238–304–2

Proceedings from scientific meetings usually appeal only to the authors of the papers included in that book. This is mainly because at the time of its publication most of the preliminary results reported in the presentations are already available in their final form in peer-reviewed journals. The proceedings of the International Symposium on Mechanics of Hearing held at Titisee, Germany, on July 27 to August 1, 2002, and published early this year with the title of *Biophysics of the Cochlea: From Molecules to Models,* is an exception. In addition to the scientific papers, this book includes the comments and discussions raised for each manuscript at the time of its oral presentation and, most importantly, a final chapter with the edited transcript of the recording of a discussion session about outstanding topics of cochlear biophysics held by some of the most prominent researchers in the field. The first-hand information provided by these transcripts is precisely what makes this book particularly interesting.

The Titisee Symposium was the seventh in the series initiated in the Netherlands in 1983, which has since been held every 3 years in different countries. The previous one was held in Sendai, Japan, in 1999, and the next will take place in Portland, USA, in 2005. This is a small meeting, but it gathers many of the most renowned researchers in the field of auditory mechanics. Whereas previous conferences in this series included contributions dealing with the entire auditory organ (middle ear as well as neural encoding at the auditory nerve), this conference focused on cochlear processes only, an area that witnessed a remarkably fast development in the last 5 years. The identification of the motor molecule responsible for outer hair cell electromotility, for instance, finally confirmed a long-standing hypothesis that this response was indeed associated with conformational changes in an integral membrane protein. The application of the principles of Hopf bifurcation to the functioning of stereocilia opened new avenues to understanding signal amplification in the inner ear of mammals and nonmammal vertebrates. On the other hand, a by-product of active processes in the inner ear, otoacoustic emissions, has become an essential tool for the diagnosis of cochlear problems in human patients, especially newborns.

The quality of this carefully edited book is excellent. Black-and-white, halftone and color figures are of consistent and good quality. The book is divided into 6 chapters. The first 5 consist of scientific papers organized thematically and introduced by the manuscript corresponding to a plenary lecture relevant to that particular topic. Chapters I ('Stereocilia') and II ('Hair Cells') deal mostly with the transduction mechanism in the hair bundle and the soma of the outer hair cells. Chapter III ('Whole-Organ Mechanics') is dedicated to the mechanics of the organ of Corti, although it also includes 2 papers which focus on auditory mechanics in insects. Chapter IV ('Cochlear Models') is devoted, of course, to models of cochlear mechanics, whereas chapter V ('Emissions') deals with theoretical and clinical aspects of otoacoustic emissions. The final chapter VI ('Discussion Session'), which documents an open meeting held on the last evening of the conference, is possibly the most valuable one of the book. As mentioned before, a record of the questions that were asked and the answers given after each oral presentation is also included at the end of each paper.

From the transcripts, it is easy to infer that one of the major topics of discussion in this meeting was cochlear amplification and the possible involvement of critical oscillations known as Hopf (or Andronov-Hopf) bifurcation in this process. Four papers by researchers from France (P. Martin, S. Camalet and J. Prost, Institut Curie), Germany (F. Jülicher, Max-Plank-Institut), England (T.A.J. Duke and D. Andor, Cavendish) and the USA (A.J. Hudspeth, Rockefeller University) make the case for a model of cochlear amplification using many active dynamic systems self-tuned to the critical point of an oscillatory instability. The critical paper by George Zweig (Los Alamos/MIT) as well as the transcripts of the spirited discussions raised by this topic, on the other hand, offer invaluable information about their pros and cons. Stereociliary versus somatic motility as basis of cochlear amplification, prestin as the molecular motor driving outer hair cell fast motility and cochlear modeling are some of the other important points discussed in the special session included in the final chapter.

Overall, the conjunction of a wide vision of the field of cochlear biophysics in the year 2002 along with the transcribed opinions and comments of prominent researchers in the field about their own work and the work of their peers make this book valuable for everyone interested in hearing research.

Federico Kalinec, Los Angeles, Calif.

KARGER

Fax + 41 61 306 12 34
E-Mail karger@karger.ch
www.karger.com

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