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# *Thematic Issue*

## Membranes and Their Interacting Partners in Peripheral Auditory Function

J. Santos-Sacchi, Guest Editor

## Foreword: Let's Hear It for the Membranes!

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Membranes have always held a special place in my heart, having been entranced by their magic when I was a freshman at Columbia College in New York City in 1969. Of course not much was known about them then, and even less was known about how these organelles help us hear. During the next 35 years, auditory researchers worked hard to elucidate the role of membranes in inner ear function. Indeed, during that time, scores of (now) senior auditory biophysicists have shaped our knowledge of how the inner ear works. In this special issue of the Journal of Membrane Biology, I have broken from tradition, and chosen to enlist a large group of young (except for me, of course) independent investigators to collaborate in telling us about the importance of membranes and associated molecules in a variety of cell types within the auditory periphery. Seven review articles are presented which span the molecular workings of cells ranging from hair cells to primary afferents. We begin by looking at the first step in auditory processing, the stereocilia transduction apparatus housed in the apical stereocilia of hair cells. This unique organelle not only can convert sound-evoked mechanical stimuli into electrical signals (receptor potentials) that permit us to perceive sound, but, as well, may play an important role in a feedback mechanism that can amplify those incoming stimuli. Drs. Ricci, Kachar, Gale, and Van Netten provide us with a detailed description of these events. The hair cell does not simply cable the resultant receptor potentials to afferents, but instead shapes its own responsiveness with the multitude of channel types within its apical and basolateral membranes. The next article in our special issue by Drs. Housley, Marcotti, Navaratnam, and Yamoah details what we know about these membrane constituents. In mammals, two hair cell types have evolved to aid in high-frequency discrimination, the inner and outer hair cells. The outer hair cell is both sensory receptor and mechanical effector, working to augment the mechanical responsiveness of the cochlea partition – cochlear amplification, as it is commonly called. Two reviews are devoted to this marvelous outer hair cell. In the first, Drs. He, Zheng, Kalinec, Kakehata, and Santos-Sacchi tell us about the experimental approaches which have lead to understanding the so called electromotility of this cell and the electromechanical characteristics of the cell's lateral membrane, which houses the unique voltage-dependent motor protein, prestin (SLC26A5). The following review of OHC models by Drs. Spector, Deo, Grosh, Ratnanather and Raphael explains to the physiologists what their experiments mean! In fact, by modeling the OHC's electromechanical activity we can also glean things which experimentalists cannot yet appraise. Inner hair cells provide up to 95% of the afferent input to the CNS. The cell type that begins the transit of acoustic information to the CNS, the spiral ganglion cell, must reliably capture the activity of inner hair cells, and the synaptic events that lead to AP generation are of prime import in this process. Drs. Nouvian, Beutner, Parsons and Moser provide us with our current understanding of synaptic transmission between hair cells and eighth nerve. Of course, it is the spiral ganglion cell soma and processes that ultimately must pass this information

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centrally, and their membrane plays the most critical role in determining timing characteristics required for high frequency transmission. Drs. Dulon, Jagger, Lin, and Davis detail the unique characteristics of these important links to the CNS. Finally, the hair cells and nerve fibers that reside within the organ of Corti cannot stand alone. A variety of supporting-cells provide structural and metabolic support for the organ, and without them our mechanoreceptors would be useless. One of the most important aspects of supporting-cell physiology is the syncitial network provided by gap junctional communication. Mutations of gap junctions account for a leading cause of deafness. Drs. Zhao, Kikuchi, Ngezahayo, and White review what we know about the role of gap junctions in cochlear homeostasis and pathology.

I think that this compilation of reviews underscores why membranes are important for peripheral auditory function. The wealth of information that these young investigators display in their reviews and the energy that these scientists bring to our field indicate that understanding membranes will remain an important goal for our community — for many years to come. Let's hear it for the membranes!