

Stochastic Modeling of Secretion Dynamics in Inner Hair Cells of the Auditory Pathway

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Abstract : Glutamate release of the cochlear inner hair cell (IHC) ribbon synapse is a fundamental step in transferring sound information in the auditory pathway. Otoferlin is the calcium sensor in the IHC and its activity has been related to many auditory disorders. In order to simulate secretion dynamics occurring in the IHC in a few milliseconds timescale and with high spatial resolution, we proposed an active-zone model solved with Monte Carlo algorithms. We included models for calcium buffered diffusion, calcium-binding schemes for vesicle fusion, and L-type voltage-gated calcium channels. Our results indicate that calcium influx and calcium binding is managing IHC secretion as a function of voltage depolarization, which in turn mean that IHC response depends on sound intensity.

Keywords : inner hair cells, Monte Carlo algorithm, Otoferlin, secretion

Conference Title : ICABEMR 2018 : International Conference on Advanced Biomedical Engineering and Medical Robotics

Conference Location : Prague, Czechia

Conference Dates : August 13-14, 2018