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A 3D Spatial Model of AMPA Receptor Topography and Release Position at Cochlear Inner Hair Cell Ribbon Synapses

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The cochlea encodes an incredible dynamic range of sounds at the ribbon synapse between inner hair cells and spiral ganglion neurons. The post-synaptic densities (PSD) of these synapses are unusually large and have heterogenous composition, distribution, and ionic current responses to stimulation. AMPA-type glutamate receptors (AMPARs), responsible for fast neurotransmission at these synapses, may play a role in determining the sound response properties of these synapses. However, it is currently unclear how the number of AMPARs within single PSDs, their spatial distribution, and their molecular heterogeneity influence the resulting synaptic current. This talk will explore how computational models of AMPARs at the ribbon synapse PSD can be used to probe how spatial organization of channels and vesicle release might work in synchrony to produce the vast range of excitatory post synaptic currents seen in physiological data.

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