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Ion channels regulate biophysical specializations in the auditory brainstem

Jason Tait Sanchez
Northwestern University, USA

Ultrafast and temporally precise action potentials are biophysical specializations of auditory brainstem neurons; properties necessary for encoding sound localization and communication cues. Fundamental to this, are voltage dependent potassium and sodium ion channels. In this presentation, I will report our recent findings on how these ion channels shape action potential properties in the developing auditory brainstem. Using patchclamp recordings from individual cochlear nucleus neurons, our results indicate that the refinement of active ion channel properties operate differentially in order to develop action potential specializations. Such differential regulation promotes the firing of fast, reliable and phased-locked action potentials at relatively high rates of afferent stimulation, a biophysical property required for normal auditory information processing. Developmental changes in ion channel subunit content were the largest contributor to this process and blockade of specific ion channel function resulted in aberrant neuronal excitability and action potential control. The idea that the regulation of ion channel properties is a critical mechanism underlying auditory pathophysiological conditions will also be discussed.

Biography

Jason Tait Sanchez has earned a PhD in Auditory Neuroscience from Kent State, Master's degree in Audiology from Michigan State and a Bachelor's degree in Communication Sciences and Disorders from Northern Colorado. He is clinically trained in Audiology from the Cleveland Clinic and has completed Post-doctoral Training in Developmental Auditory Neurobiology from the University of Washington. As the Director of the Central Auditory Physiology Laboratory at Northwestern, his research investigates developmental mechanisms underlying ion channel and synaptic receptor function. Such biophysical properties may guide requirements for cochlear implant and hearing aid design and potentially provide pharmacological targets to improve disorders of the auditory system.

jason.sanchez@northwestern.edu

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