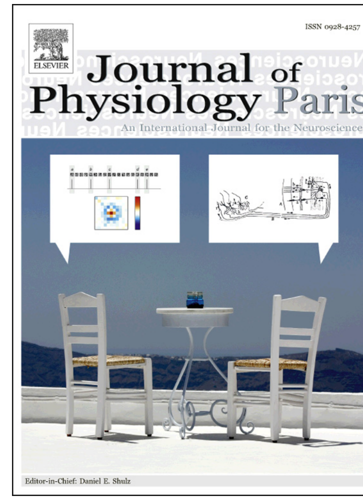
Editorial



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Editorial

The Electric Fish, Electrosensory and Electromotor Systems Meeting took place on April 28-29, 2016, at the Instituto de Investigaciones Biológicas Clemente Estable (IIBCE), Ministry of Education and Culture, in Montevideo, Uruguay. It was co-organized with our colleagues Ángel Caputi and Gerhard von der Emde.

Weakly electric fish are distinguished by their ability to explore the environment by sensing perturbations of their self-generated electric fields (electrolocation) and employing their electrosensory system to communicate with conspecifics. These teleosts that are widely distributed in America (Gymnotids) and Africa (Mormyrids) possess a sensory modality resulting from the concerted evolution of peripheral organs on both the effector (electric organ) and receptive (electroreceptors) ends of sensory-motor neural networks. These networks involve specialized peripheral pathways as well as a hierarchically organized network of brain centers ranging from the spinal cord to the telencephalon. Some of these brain centers are exclusively involved in the electromotor behavior i.e. the electric organ discharge, starting with a medullary central program generator composed of an autonomously active pacemaker nucleus driving synchronizing relay neurons. The relay neurons in turn project to spinal cord electromotor neurons that determine, along with peripheral electromotor pathways and the electric organ, the species specific electric organ discharge waveform. Higher level pre-pacemaker cells operate by synapsing on pacemaker and relay cells and thus modulating the frequency and patterning of the electric organ discharge and therefore enabling the regulation needed for its role in exploration and communication.

On the other "arm" of the electrosensory system, the rombencephalic electrosensory lateral line lobe is the first and exclusive relay of electrosensory information transmitted by various types of primary electrosensory afferents through parallel electrosensory pathways. The principal cells of this cerebellum-like structure are structurally and functionally suited for the comparison of electrosensory incoming signals with top down signals conveying the expectations generated by the actions of the animal as well as those resulting from multimodal integration. Principal electrosensory lateral line lobe cells project in turn to upstream rhombencephalic and mesencephalic brain centers - the praeminential nucleus and torus semicircularis respectively. While the praeminential nucleus is strictly involved in feedback to electrosensory lateral line lobe, the torus semicircularis provides ascending input to the optic tectum and diencephalon (preglomerular nucleus). The optic tectum is a multimodal integration center that uses electrosensory and other sense input to control motor output via its projections to the reticular formation. The preglomerular nucleus projects to the telencephalon and thus permits electrosensory-associated learning. The output and input "arms" or the electrosensory system are not only externally connected through the electric organ associated field but also internally, by motor command associated signals that project to electrosensory brain centers as occurs in Mormyrids. This permits modulation of the processing of electrosensory information in specific manner according on the origin of the electrosensory signals -either self or conspecific generated.