Title: "The leech sensory network relies on a combination of chemical and electrical synapses"

Authors: Ihor Arkhypchuk[1], Jutta Kretzberg [1,2,3]
[1] Computational Neuroscience, Department of Neuroscience, Faculty VI, University of Oldenburg, Oldenburg, Germany,
[2] Cluster of Excellence Hearing4all, University of Oldenburg, Oldenburg, Germany,
[3] Research Center Neurosensory Science, Carl von Ossietzky Universität Oldenburg, Oldenburg, Germany

Abstract:
Touch to the skin and water movements are important environmental cues for the behavior of aquatic animals. In the medicinal leech, highly sensitive mechanoreceptors, the T (touch) cells, encode these stimuli. This study aims to explore a fast mechanism for tactile information processing based on an electrically connected network for processing T cell activity. Neurobiotin injections and immunohistochemistry yielded an electrical network of identified neurons. T cells leak Neurobiotin to an extensive network of interneurons, which in turn are electrically connected to motor neurons which directly activate muscle movements in multiple behaviors. For some of the coupled interneuron types, the functions are known, e.g. sensing water movements. Using current-clamp double recording, we found mutual connections between mechanoreceptors and interneurons. These recordings suggest an interplay between electrical and chemical synapse-based networks. In summary, our results highlight the complexity of mechanosensory processing in leeches, underscoring the complementary roles of electrical and chemical synaptic networks for the perception of the environment.