Eduardo Rosa-Molinar

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The research of Dr Rosa-Molinar, from the Biological Imaging Group at the University of Puerto Rico-Rio Piedras, seeks to decipher a “gap-junction-coupled motor pattern-generating microcircuit” that consists of a small number of gap-junction coupled neurons forming unique patterns and that underlies an innate behavior, i.e., behavior that is "hard-wired" into the nervous system, is usually inflexible, and is triggered by a stimulus.

To that end, Dr Rosa-Molinar’s group 1) collaborates in the development of new functional nanomaterials that span spatial domains from sub-nanometer to microns ; 2) enhances existing and develops new methods to use those nanomaterials in selectively labeling neural cells and the protein network that constitutes the cytomatrix at the pre-synaptic and post-synaptic active zone of “mixed” synapses, a juxtaposition of chemical and electrical synaptic components associated with the identifiable neurons; 3) improves existing and develops new tissue contrast reagents and techniques; 4) develops imaging methods for high-resolution three-dimensional (3D) photon-based and high-throughput 3D electron-based microscopies to collect and disseminate 3D teravoxel or petavoxel image data; 5) tests computer algorithms that can reveal complex patterns and relationships; and 6) uses as a “reference species” the Western Mosquitofish *Gambusia affinis* (Mosquitofish), a species that has unique advantages and is ideally suited for “mapping” a gap-junction-coupled motor pattern-generating microcircuit and for testing and refining novel tools and methods.

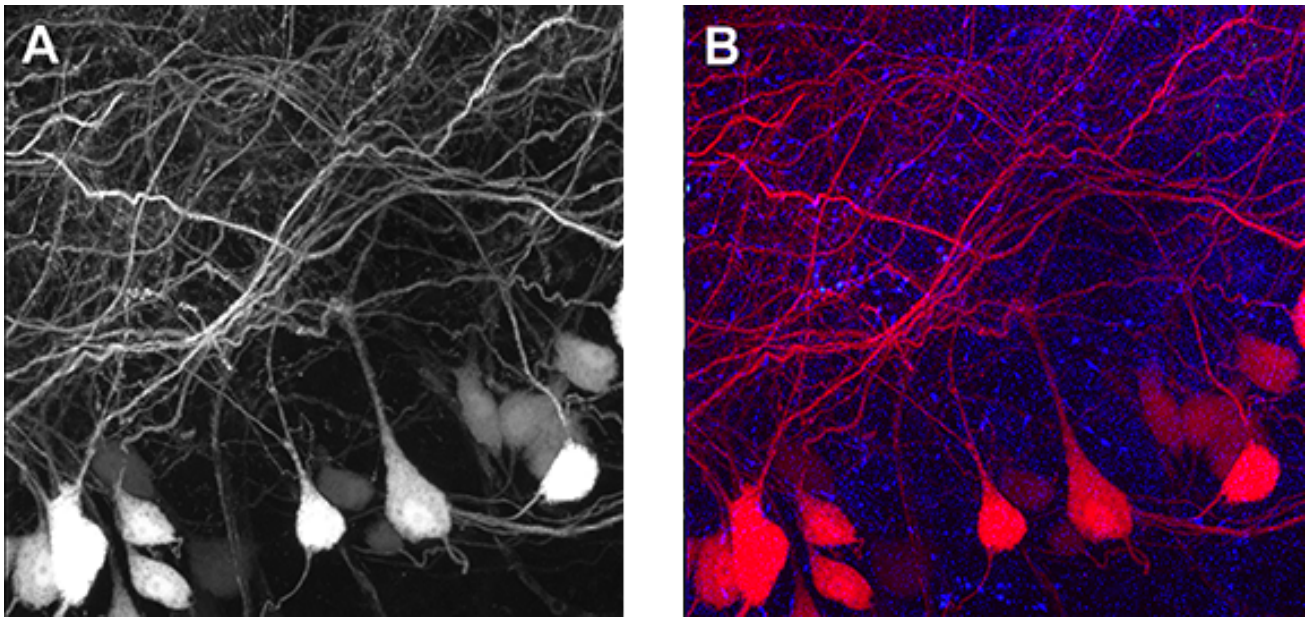

Fig A. 0.32 kDa Alexa Flour 594 Biocytin (AFB) labeled extensive motor neurons and their dendritic arbors in the 14th ventral root spinal segment. Fig B. Connexin 34.7 immunohistochemistry (blue puntata) combined with and 0.32 kDa AFB retrograde tracer (red) reveals the puncta density and their location.

Dr Rosa-Molinar’s group uses a wide range of methodologies ranging from selective neuronal laser ablation, through multiple light microscopy techniques, to electron microscopy. Recently the group, in collaboration with Mark Browne, PhD and Robin Battye, Ph.D (Andor Technology) and Dane Maxfield, Ph.D. (Technical Instruments), used the Diskovery multi-modal imaging platform and Bitplane’s Imaris 8 to combine the confocal imaging of neurons and dendrites with super-resolution imaging of the same sample fields. This work was done at the Marine Biological Laboratory and supported by a Grass Imaging Award (Grass Foundation to Dr. Rosa-Molinar). Combining data captured on the Diskovery platform, with the analysis and visualisation of Imaris, the group was able to generate high contrast and detailed 3D reconstructions with a resolution, in terms of dendritic detail, previously unachievable. These results are described in a publication submitted to Frontiers in Neuroanatomy. Diskovery utilizes the patented Borealis illumination which, amongst other benefits, delivers highly uniform illumination. This means that the whole illuminated field receives an equal amount of light to activate fluorophores, and so the resulting images from which the super-resolution algorithms derive meaningful data, are free of intensity variation artefacts. In addition, Diskovery provides an optical path which allows the investigator to vary the field of illumination with the field of view, either to the camera of choice, or to maximize on power density for faster bleaching, faster blinking, and so faster imaging.

The Biological Imaging Group. Seen in the picture (front row; left to right) is Irma I. Torres-Vazquez, M.S., Melanie Rodríguez-Alvarado, B.S., Celimar Negrón-Morales, and Noraida Martinez-Rivera, B.S; (back row; right to left) Jose L. Serrano-Velez, Ph.D. and Eduardo Rosa-Molinar, Ph.D.

Biography

Eduardo Rosa-Molinar, Ph.D. is an Associate Professor of Integrative Anatomy and Neurobiology, Department of Biology, University of Puerto Rico-Rio Piedras, Group Leader of the Biological Imaging Group, University of Puerto Rico-Rio Piedras, Associate Professor of Neurobiology (adjunct), Institute of Neurobiology, Puerto Rico Center for Environmental Neuroscience, University of Puerto Rico-Medical Sciences, and an Associate Scientist (adjunct), The Eugene Bell Center for Regenerative Biology and Tissue Engineering, Marine Biological Laboratory. Dr. Rosa-Molinar is also the Chairman of the Advanced Imaging Centre, a strategic collaborative group from Science and Industry working to ensure that imaging analytical tools keep pace with imaging trends.

Recent Publications

- Serrano-Velez, J. L., Rodriguez-Alvarado, M., Martinez-Rivera, N., Torres-Vazquez, I. I., and Rosa-Molinar, E. (2015). Analyzing the microcircuit anatomy of a fast motor behavior. Front. Neuroanat. (paper in review following revision with data collected from the Andor Diskovery multi-modal imaging platform).
- Hewitt, S. M., Baskin, D. G., Frevert, C. W., Stahl, W. L., and Rosa-Molinar, E. (2014). Controls for immunohistochemistry: Controls for Immunohistochemistry: The Histochemical Society's Standards of Practice for Validation of Immunohistochemical Assays. J. Histochem. Cytochem. Jul 14. pii: 0022155414545224. [Epub ahead of print] PMID: 25023613.
- Serrano-Velez, J. L., Rodriguez-Alvarado M., Torres-Vazquez I. I., Fraser, S. E., Yasumura, T., Vanderpool, K. G., Rash, J. E. and Rosa-Molinar, E. (2014). Abundance of gap junctions at glutamatergic mixed synapses in adult Mosquitofish spinal cord neurons. Front. Neural Circuits 8 (66):1-16; doi: 10.3389/fncir.2014.0006.
- Torres-Vazquez, Irma, Christian Torrech-Santos, Jose Serrano-Velez, Kathleen Rein, and Eduardo Rosa-Molinar. "In vivo demonstration of okadaic acid internalization in glutamatergic spinal motor neurons (1050.3)." The FASEB Journal 28, no. 1 Supplement (2014): 1050-3.
- Martinez-Rivera, Noraida, Jose Serrano-Velez, Irma Torres-Vazquez, and Eduardo Rosa-Molinar. "Superficial neuromasts as proprioceptive receptors in poeciliid fish (1050.11)." The FASEB Journal 28, no. 1 Supplement (2014): 1050-11.