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Combinatorial gene expression correlates to Neuronal Arbor Diversity

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Abstract

The central nervous system of vertebrates is an extremely complex network built of thousands of neuronal cell types, each with unique morphological, physiological and molecular properties, and serving unique circuit functions determining the metabolic neuronal processes. How this diversity is generated, and in particular, how the morphological and connectivity diversity is generated is a matter of intense scrutiny.

We are using molecular genetic approaches to label neuronal populations consisting of a variety of cell types, and describe their morphology and development. In addition, by combinatorial genetic strategies, we are able to label and manipulate individual cell types. Our current focus is on Retinal Ganglion Cells (RGC), the projection neurons that convey the visual signal from the eye to the brain. We have generated reporter mouse lines expressing a reporter gene at either of three transcription factors, Brn3a, Brn3b and Brn3c. These lines allow us to label groups of RGC types expressing these genes. We are then describing the anatomy and development of these neurons, and gain insights into how combinatorial gene expression can result in diverse neuronal morphologies and functions. We now report that similar combinatorial transcriptional activity might be at work in the generation of all major classes of projection sensory neurons.

Using immunolabeling and magnetic affinity purification, we are currently screening for downstream effectors for morphological diversity in sensory neurons, by RNA sequencing technology. We will discuss some preliminary"omic" findings and data validation issues related to global gene expression in sensory neurons.

Biography

Dr.Badea is a principal investigator at the National Eye Institute/NIH. He holds a MD degree from the "IuliuHatieganu" Medical University in Cluj, Romania, a MA degree from Columbia University in New York, USA, and a PhD degree from Johns Hopkins University in Baltimore, USA. As a graduate student and postdoctoral fellow in Johns Hopkins, Dr. Badea developed methodologies for sparse genetic labeling and gene manipulation in mice, with the goal to characterize and study neuronal cell types in the visual system. Applications of this methodology resulted in insights into neuronal circuits function and development published in prestigious journals such as Nature, Cell and Neuron. Currently Dr. Badea's group is focusing on molecular strategies for characterizing gene expression profiles in isolated neuronal cell type populations.