Posttranscriptional Regulation in Nervous System Development and Plasticity

Organized by Kenneth S. Kosik, MD and Sourav Banerjee, PhD
Short Course II

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Introduction

The emergence of function from a set of molecular parts represents a core challenge in neurobiology. Databases are rapidly filling up with compendia of “omics” information (lists of genes, transcripts, proteins, etc.). Collecting these numerous individual units and using “systems” approaches to deduce function is gradually uncovering the links between the hierarchical levels of biological organization. One system that promises to be particularly informative is the microRNA (miRNA) system of ~21 nucleotide noncoding transcripts. The ~1000 different miRNAs in the mammalian genome form a cytoplasmic layer of posttranscriptional control that is comparable in complexity with the transcriptional control system in the nucleus. Because each miRNA targets many mRNAs, which are often functionally related, miRNA target sets are capable of revealing functional networks of transcripts. Another approach to neuronal systems is taking advantage of the dendrite as distinct cellular compartment. By experimentally capturing proteins and transcripts that are restricted in their localization to the dendrite, one attempts to infer function, particularly functions related to plasticity. Combining miRNA biology with the study of local molecular and physiological activity at the synapse has been a highly productive research vein. However, miRNA biology has opened a much broader window onto the nervous system, and where this system of small RNAs has been most revealing is in nervous system development.

Therefore, using a diversity of model systems, this short course will highlight RNA-mediated regulatory mechanisms involved in fine-tuning the growth and targeting of neuronal dendrites, synapse development, and synaptic plasticity, as well as the development of the neuromuscular junction and lineage decisions in oligodendrocytes. This course will cover many of the most important recent discoveries in this burgeoning area of neurobiology, relevant to both the function and dysfunction of the nervous system. Attendees will be able to discuss their own thoughts informally with speakers in order to shape their current research interest and direction.

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