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Title:
Cell recognition molecules and the establishment of neural circuits

Abstract:
My research group has identified cellular recognition molecules that allow neurites to discriminate between one another during the assembly neural circuits. I will focus on our studies of the Drosophila visual system. This system is favorable for these studies due to the ease of genetic manipulation and the availability of a detailed map of synaptic connectivity. Through genetic and molecular screens, we have identified proteins of the Cadherin and Immunoglobulin (Ig) superfamilies that regulate specific steps in circuit assembly. These included the classical cadherin, N-cadherin, and the adhesion GCPR cadherin , flamingo, as well as the many Ig superfamily proteins encoded by the Dscam loci via gene duplication and alternative splicing and through gene duplication and divergence of Dpr and DIP loci. In this morning's talk I will focus on the role of Dprs and DIPs in regulating circuit assembly in the developing medulla region of the fly visual system. Through RNA sequencing studies of seven classes of neurons forming connections in different layers of the visual system, we demonstrated that neurons express vast numbers of cell surface and secreted proteins. Among these, Dprs, a family of 21 Ig-containing proteins, were expressed in a cell-type specific and highly dynamic fashion. Dprs interact differentially with another family of Ig proteins, DIPs. Mapping cellular patterns of Dpr and DIP expression revealed that many cognate pairs were expressed on synaptic partners. Through a series of genetic studies we demonstrated that cognate heterophilic interactions between specific Dpr/DIP proteins contribute to cell survival, axon targeting and synapse number. Commonalities in the strategies of wiring between the fly and mammalian visual systems will be discussed.