Mechanisms of ion channel clustering in axons

The long range goals of Dr. Rasband’s lab are to elucidate the processes that underlie the molecular assembly of electrogenic compartments of axons and the role that myelinating cells (oligodendrocytes and Schwann cells) play in this process in health and in disease. The Rasband lab explores the molecular basis of signaling between glial cells and axons in the brain and spinal cord under a variety of conditions including the normal process of myelination that occurs during development, demyelination and remyelination in disorders such as multiple sclerosis and the responses of axons and their myelinating cells to injuries of various types, including trauma. Dr. Rasband’s laboratory is working to understand the underlying mechanisms that regulate the clustering of ion channels at the sites that initiate and propagate action potentials: the axon initial segment and nodes of Ranvier. Many nervous system diseases and injuries result in the disruption of these domains. For example, traumatic brain and spinal cord injury (TBI and SCI), as well as demyelinating diseases like multiple sclerosis result in widespread axonal injury. It is now appreciated that a host of molecular events occurs that ultimately results in the disruption of axons and their excitable domains. One particularly sensitive component of axons is the spectrin/ankyrin based cytoskeleton. Spectrins and ankylins are highly enriched at axon initial segments and nodes of Ranvier and are essential for maintaining both the high-density cluster of ion channels. Dr. Rasband’s research team is working to uncover the molecular mechanisms regulating formation and maintenance of ion channel clusters in axons since any therapeutic strategy aimed at nervous system repair and/or regeneration will require the re-establishment of these excitable domains.


