My current research focuses on the molecular and genetic analysis of the nervous system, more specifically the structure and function of neurotransmitter receptors and ion channels and their modulation by protein kinases and G-proteins. We are interested in studying the molecular mechanisms by which neurons transmit, receive and store information in the mammalian central nervous system. Neurons communicate with each other using a combination of electrical and chemical signalling. The molecules which mediate this signalling are voltage-gated ion channels and neurotransmitter receptors. In our major project we have isolated a family of neuronal cDNAs that encode voltage-gated calcium channels. Current work includes the characterization of the molecular and sub-cellular localization of calcium channel sub-types in the nervous system, and the analysis of the functional properties and modulation of calcium channel
subtypes in a number of exogenous expression systems. In another project we have isolated mutations in unc-2, a gene encoding a neuronal calcium channel in the nematode Caenorhabditis elegans. Upon introduction of the identified point mutations into a rat homologue it is apparent that single amino acid substitutions can dramatically alter calcium channel biophysical properties. Current work includes the identification of extragenic revertants in order to define novel gene products that affect calcium channel function in vivo. Other projects include the study of G-proteins and kinases involved in modulation of calcium channels, the use of the yeast 2-hybrid system to identify novel proteins that interact with calcium channels, and also the knock-out of ion channel and receptor gene expression using anti-sense techniques in cultured cells and animals.

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