Sensory physiology research was heavily influenced by molecular identification of transient receptor potential (TRP) ion channel family. Discovery of these unique family of membrane receptors allowed detailed study of their structure-function relationship. TRP channel expression in sensory neurons, but also apparently in keratinocytes provides living organisms with the ability to fast and accurately detect noxious thermal and chemical stimuli and to transmit this noxious signaling to higher nervous system structures.

Despite recent efforts to elucidate molecular mechanisms of temperature or chemical activation of these non-selective cation channels, there is still no unifying hypothesis that is able to explain complex behaviour of these receptors.

This dissertation aims to investigate three aspects of the TRP channel function:

1. Molecular characterization of acute desensitization of vanilloid receptor TRPV1 and investigation of the role of phosphorylation sites for calmodulin kinase II.
2. To characterize mechanisms of etanol-induced inhibition of menthol receptor TRPM8 and to find out possible physiological consequences of this inhibition.
3. To explore the role of inner pore region in activation gating of ankyrin receptor TRPA1 and identify amino acids involved in this process.

Our findings contribute to better understanding of the general role of TRP channels in pain sensation and may serve as a useful model for targeting the function of nociceptive neurons with new, more specific ion channel blockers.