**Scientific abstract: Multiple channels of tactile information flow in the somatosensory system.**

Rodents use their whiskers to distinguish between surfaces and objects having subtly different textures and shapes. While it is widely accepted that the cooperative activity of different mechanoreceptors is essential to accomplish these complex tasks, the role of each type of mechanoreceptor remains poorly understood. Hypothesis

This research aims to elucidate the role of specific types of mechanoreceptors signaling in the orchestration of neuronal circuits underlying sensorimotor behavior. Using molecular, electrophysiological, and imaging techniques *in vivo*, we will seek to achieve the following specific aims: ***First***, we will use optogenetic tagging of Merkel-cell-associated slowly adapting, and Club-like and lanceolate receptors rapidly adapting afferents (*see preliminary results*) that will allow us to record spikes from single genetically identified afferents during behavior. *The results of these experiments will provide a quantitative description of the mechanoelectrical transformation in different tactile channels originating from the whisker follicle.* ***Second***, Using two-photon Ca2+ imaging and electrophysiological recording from layers 2/3 and 4 cortical neurons, we found that the optical stimulation of the different mechanoreceptors leads to an activation of distinct neuronal pools in the barrel cortex (*see preliminary results*). We plan to elaborate and extend this preliminary evidence in awake mice while they whisk freely in the air and against various complex surfaces. *We anticipate that these experiments will enable us to decipher the dynamic role of the different mechanoreceptors in transforming tactile information into spatiotemporal activation patterns of cortical neurons.* ***Third***, we will examine the degree to which the different mechanoreceptors have any functional role in sensorimotor behavior. Specifically, we will use awake, head-fixed mice trained to discriminate between different surfaces. To determine the mechanoreceptors' functional role in sensory perception and decision, we will transiently inactivate them during active touch. Moreover, using optical activation, we will create patterns of illusory surfaces and determine whether their activation is sufficient or necessary for perceptual decisions. *Together, the results of this study will significantly advance our understanding of the functional circuitry that underlies critical components of sensorimotor integration processing in the behaving animal.*