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

Rodents use their whiskers to distinguish between surfaces and objects with 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 roles of each type of mechanoreceptor remain poorly understood. Hypothesis

This proposed study aims to elucidate the role that signaling through specific types of mechanoreceptors plays 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 the optogenetic tagging of Merkel-cell-associated slowly adapting afferents, and Club-like and lanceolate receptor-associated rapidly adapting afferents to record spikes from individual genetically identified afferents in specific behavioral settings. *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. We plan to elaborate on 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 roles that different mechanoreceptors play in transforming tactile information into the spatiotemporal activation patterns of cortical neurons.* ***Third***, we will examine the degree to which the different mechanoreceptors have a functional role in the shaping of sensorimotor behavior. Specifically, we will use awake, head-fixed mice trained to discriminate between different surfaces. To determine the functional role that mechanoreceptors play in sensory perception and decision-making, 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 context of animal behavior.*