

Grass Symposium Abstracts 2021

Molecular Mechanosensors in Ctenophores

Oscar Arenas Sabogal

The detection of mechanical forces is essential for the survival of all living organisms. Despite its importance, most of our current knowledge of how these cues are detected and how they influence behavior is limited to research in animals like mammals, flies and, worms. Yet, little is known of how animals with simple nervous systems (nerve nets) use mechanical stimuli to drive their behaviors. Ctenophores, like *Mnemiopsis leidyi*, are descendants from animals that predate the split of invertebrates and vertebrates. These animals have a sensory structure -the aboral organ - that detects mechanical forces. However, we don't know the physiological and molecular basis for this sensitivity. I hypothesize that *M. leidyi* have several mechanically activated channels that transform mechanical stimuli into electrical signals. Using a combination of molecular and bioinformatic tools, I am studying the molecular basis for detection of mechanical cues in this animal.

Exploring Local Translation in the Squid Giant Axon

Bernardo Pinto

Neurons have the challenging task of providing the molecular machinery to axons that extend far away from the cell body. Supplying proteins during axon development and maintenance requires temporal and spatial control. This is achieved through local proteins synthesis in the axon. Does electrical activity or metabolic state affect the expression of axonal proteins? I aim to establish the squid giant axon as a model to study local translation and test the effects of electrical activity in the synthesis of axonal proteins. I will determine the synthesis of newly synthesized trough puromycin tagging. This is a first step into the study of protein synthesis regulation in the squid giant axon.

The smell of carbon dioxide:

Neural circuits and genes involved in tick host-seeking

Carola Städele

My research focuses on addressing "What makes a tick tick?". We currently lack a good understanding of how ticks find hosts, what sensory cues they might use, and the neuronal processes and receptors important for tick host-seeking. My work confirms that exhaled carbon dioxide (CO₂) is a critical behavioral activator and attractant for *Ixodes scapularis* - the deer tick and primary vector for Lyme disease

in the US. In the presence of CO₂, *I. scapularis* ticks start to waive their forelegs which bear a specialized sensory structure called Haller's organ. My behavioral experiments show that the Haller's organ is crucial for CO₂ detection. Removal or covering abolishes *I. scapularis* responses to CO₂. I will present the first findings towards uncovering the neural circuitry for CO₂ detection in the tick brain (synganglion) and receptors potentially involved in this task.

How do planktonic animals sense pressure?

Luis Bezares Calderon

How do small planktonic animals sense and respond to pressure? I investigated this question using the larva of the sea squirt *Ciona*. Using custom-built pressure vessels I found that the larvae showed a weak, but clear response to pressure, or barokinesis. I found that another species of sea squirt found in Eel pond shows a stronger response. Together with Grass fellow Arenas-Sabogal, I found that Ctenophores also show a barokinesis response. I began analyzing the effect of pressure on the locomotion of these animals. During my fellowship I developed a microscopy pressure chamber that can be used to run calcium imaging experiments and allow me to identify the pressure sensory cells in *Ciona* and in other planktonic animals.

Mechanosensation in Alligators

Duncan Leitch

Crocodylians are ambush predators that are close relatives to both birds and dinosaurs, and they have thrived in diverse semi-aquatic habitats in body forms substantially unchanged since they first appeared in the fossil record approximately 95 MYA. Part of their success as an order includes their notable sensory adaptations for interacting with their environment to locate potential prey and communicate with conspecifics. In particular, the faces of all crocodylians are endowed with thousands of discrete tactile receptors that confer a sense of touch exceeding the acuity of our own fingertips. As explored using American alligators, the nervous system of crocodylians shows distinct anatomical and physiological adaptations to facilitate their sophisticated sense of touch.