

THESIS DEFENSE: Molecular and Cellular Aspects of Proprioceptive Control in C. elegans

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October 24, 2023
10:00
ICFO Auditorium

Locomotion behavior is the output of the integrated clues by the nervous system along with proprioceptive regulation, which encompasses responses such as avoiding, feeding, and reproduction. Mechanosensation, the ability to sense mechanical force, relies on mechanically-gated ion channels that convert force into neuronal signals through conformational changes. Unraveling the mechanisms underlying these mechanosensitive channels poses a significant challenge for neurobiologists and cell biologists. My PhD work employed multidisciplinary approaches in biology, physics, mathematics, and engineering to investigate the regulation of proprioception in the model organism C. elegans in the molecular and cellular scales.
In my research, I focused on understanding the role of the interneuron DVA during

movement and its ability to draft signals from body curvatures. Using genetically modified strains and calcium imaging techniques, I demonstrated that DVA responds to compressive forces through its axon, leading to an influx of calcium ions through the TRP-4 channel. Additionally, I discovered that bending of the worm stretches the DVA axon and activates the potassium ion channel TWK-16. Both channels detect mechanical forces and modulate DVA signal, such interplay encodes calcium signals along the body curves, facilitating the reception and fine-tuning of muscle contractions in different body segments. Moreover, I discovered the critical role of beta-spectrin in maintaining the structural integrity and proprioceptive function in response to force. To delve deeper into the subject, additional research was conducted to examine the role of beta-spectrin in the ageing process and its impact on proprioception and protein expression in C. elegans.

Apart from the proprioceptive regulation through neuronal signal, my study revealed that the DVA-specific neuropeptide, NLP-12, is responsible to modulate locomotion behavior. Using transgenic animals, imaging techniques, and protein modification approaches, the results showed that NLP-12 is required to promote the DVA-mediated motor output. Interestingly, first evidences suggest that NLP-12 release is controlled by mechanical force. However, the exact mechanism on such effect will be further characterized.

During my PhD research, I developed a novel technique called Fluorescent Landmark Interference (FLInt) for integrating transgenes into the C. elegans genome using CRISPR/Cas9. FLInt is a simple, rapid, and flexible method for establishing transgenic C. elegans strains based on the precise excision of fluorescent genes at a specific locus as markers of integration. FLInt has gained widespread popularity and is now employed as a routine method in C. elegans research laboratories around the world.The novelty of my PhD study lies in its pursuit of both fundamental knowledge and practical applications: (1) to understand the broader concept of mechanosensation and gain valuable insights into how organisms perceive and respond to mechanical stimuli and (2) to offer an accessible and efficient tool for C. elegans research community and enhance future studies using C. elegans model.

Wednesday October 24, 10:00 h. ICFO Auditorium
Thesis Director: Pr of Dr. Michael Krieg
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