University of Fribourg / Faculty of Science and Medicine / Department of Biology

High-throughput behavioral analysis platforms to dissect nociceptive behavior and its plasticity in *C. elegans*

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This PhD thesis covers the development of methods and stimulation and recording devices for the automated quantitative analysis of the stereotyped nocifensive behavioral output of the thermal nociceptive pathway of the nematode *C. elegans.*
The first chapter consists of a general introduction, presenting the concepts of sensory systems, nociception, pain, and experimental assays to measure associated nocifensive behaviors elicited by noxious heat stimulation in a number of animal models. Additionally, we review optogenetic tools. Finally, we focus on worm behavioral trackers, which will be pivotal in determining the design limitations of our stimulation devices, described in Chapter 2 and Chapter 3.
The second chapter is a paper currently submitted and in review. It focuses on the development and implementation of a set of two complementary platforms that can deliver high-throughput acute noxious heat stimulation, also recording and quantifying resultant nocifensive behavior in freely moving worm populations.
The third chapter describes a device for blue light optogenetic stimulation. The development of the device was informed by the general design principles and software pipelines developed during Chapter 2.
The fourth chapter is a collaboration with a colleague, Dr. Gabriella Saro. It dissects the calcium responses occurring in the FLP thermonociceptors under sustained noxious heat stimulation regimens. Additionally, using the optogenetic stimulation device developed in Chapter 3, we present a complementary behavioral study.
The fifth chapter is a collaboration with another colleague, Dr. Filipe Marques, which employed one of the heat stimulation devices developed in Chapter 2.
Within this body of work, we provide a set of powerful tools to characterize the behavior of *C. elegans* in the context of noxious heat stimulation. We establish that these tools are suitable for characterizing both the basal sensitivity and plasticity of the stereotyped reversal behavior triggered by noxious heat stimulation or via optogenetic stimulation. Additionally, we further validate our devices by uncovering the behavioral contribution of molecules known to be involved in the thermal nociceptive pathway.

Jury:
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