WWTF Project LS14-084

Whole brain imaging of decision-making in freely moving C. elegans

Abstract

Sensory to motor transformations performed by the brain involve perception, decision making, and motor execution, all of which take place across different brain regions involving cross talk and feedback. A full understanding of these processes thus requires a holistic experimental approach, which in most cases is impeded by the sheer size and complexity of brains. Here we outline how fundamental insights into these topics can be made by real time whole brain imaging in the tractable model organism C. elegans. We have recently published two new approaches that enable us to perform near simultaneous recording of the activity of nearly all individual neurons in the C. elegans brain, made possible by combining a nuclear localized Ca2+-sensor for unambiguous cell segmentation with new high-speed volumetric microscopy technologies. In addition, in our recent unpublished work we have developed a method for simultaneous recording of single neuron activity and behavior in freely crawling worms. Here we propose to further develop and combine the microscopy and behavioral tracking techniques for high-resolution brain-wide imaging of animals freely navigating in gradients of chemosensory cues. The new methods will enable us to track sensory processing and interneuron dynamics and directly relate these to the diverse motor outputs a worm generates. For the first time it will be possible to capture a complete view of brain-wide sensory to motor information flow at single cell resolution while an animals performs navigational decision making.

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106025 - Neurobiology (60%) | 103021 - Optics (40%)

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Principal Investigator:	Manuel Zimmer
Institution:	Research Institute of Molecular Pathology (IMP)
Collaborators:	Alipasha Vaziri (University of Vienna) (Co-Principal Investigator)

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Further links about the involved persons and regarding the project you can find at
https://archiv.wwtf.at/programmes/life_sciences/LS14-084