Defining the functional architecture of motion vision sensitive visual-motor circuits

ABSTRACT:

Background
Under natural conditions, the nervous system and the body of a moving animal interact continuously, and it is from this interaction that neural circuits form internal representations that guide animal behaviour, including our own. We focus on two internal representations: spatial perception and self-movement estimation. These representations depend on multimodal sensory-motor integration. How this integration is implemented across neural circuits is still an open question.

Aims
To answer this question, we study how movement is incorporated to visual motion processing into: 1) guide oriented behaviors, and 2) to estimate self-movement.

Method & Results
We combined anatomical, electropysiological and optical techniques, and identified novel visual neurons sensitive to small-field visual motion stimuli in the fruitfly *Drosophila melanogaster*. We are currently assessing their role in spatial orientation by reversible manipulations of their activity in behavioral paradigms we developed for oriented locomotion. For the second aim, we performed electrophysiological recordings from optic-flow sensitive neurons during explorative walking and found that these cells represent the fly's walking movements accurately (even in the absence of vision) by integrating visual and walking-related motor signals.

Conclusions
The identified novel visual neurons open the opportunity to study their role in orientated behaviors to understand how the brain combines walking with visual processing to create spatial perception. In addition, we demonstrated that optic-flow sensitive neurons receive non-visual detailed information about the walking movements of the fly to create a faithful representation of self-movement.

Keywords
Drosophila melanogaster, Motion vision, Walking, Oriented behaviors, Self-movement estimation, Sensorimotor integration

Published Work:

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