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Drosophila larval vision: A behavioral, modellistic and electrophysiological approach

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Vision is an essential sensory system, which provides a biological advantage to numerous animal species. In this thesis, we wanted to understand how *Drosophila* larvae make decisions when presented with simple visual stimuli, but also how these simple visual stimuli are perceived and decoded.

In the first part, we studied *Drosophila* larval behaviour under different light conditions. We used a video-tracking software to visualize their trajectories, and quantified them according to several navigational parameters. We also assessed larval navigation by formulating a probabilistic model to understand their decision-making mechanisms.

Our experiments show that larvae robustly avoid light, although with a high stochastic component. Their navigation is more efficient when the light intensity is higher, and the intensity gradient is steeper. However, the efficiency of larval navigation reaches a plateau at intensities of around I $\approx$ 20 W/m^2 and intensity gradients of about I' $\approx$ 0.20 $W/m^2/cm$. We also measured the influence of a major component, light directionality, which plays a more significant role in larval navigation than light intensity or intensity gradient.

The proposed probabilistic model accurately reproduces larval navigation, showing that larvae use a trade-off between stochasticity and targeted navigation to efficiently reach their goal.

In the second part, we addressed how larval eyes decode light. To measure activity in the eyes, we used an electrophysiological technique called sharp recordings, which enabled us to measure changes in the membrane potential.

We found that the photoreceptors in the larval eyes show different types of activity, including bursts and spikes. The relationship between these two types of activities and light-decoding is not very clear and will require further research.

The fact that bursts mediate larval response to light is exciting, and, even though its exact function remains elusive, we speculate that it is a more efficient way of conveying light information than with single spikes.

Jury:

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