Circadian and Genetic Modulation of Visually-Guided Navigation in *Drosophila* Larvae

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Past decades have brought forward important advances in understanding circadian rhythm mechanisms in animals ranging from fruit flies to humans. *Drosophila* larvae have a relatively simple nervous system compared to their adult counterparts, yet they both share a homologous molecular clock with mammals. Moreover, larvae exhibit robust attraction and avoidance behaviors in response to external stimuli such as light and chemicals, which makes them an ideal model organism to study behavioral output of circadian rhythm.

Despite the complexity and level of detail previously described for larval photo-behavioral programs, it remains unknown how these animals modulate navigational decisions in a circadian fashion. In order to investigate how distinct navigation strategies are modulated by circadian time, we employ a computer-based tracking system, which allows detailed evaluation of the navigation strategies and investigate larval visually guided navigation at different time-points of the day. We first analyze navigation relevant behaviors as naïve responses at four different circadian times: dawn (CT0), midday (CT6), dusk (CT12) and midnight (CT 18). Intriguingly, none of the behaviors which are critically involved in navigation show a circadian modulation. However, we show that there is a strong modulation of the light-response during the course of the day with the largest difference being between dawn and midnight. We further find that mutants with disrupted clock mechanism show severe deficits in circadian modulated behaviors, supporting that a functional molecular clock as well as proper neural signaling of pacemaker neurons is essential for maintaining circadian-modulated visually guided navigational decision making. All in all, these data add onto studies of circadian modulation of visually guided avoidance behaviors, paving the way for in depth dissection of underlying mechanisms of this modulation in the fruit fly larva.

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