Title
On the complexities of immobility

Abstract

Our work concerns the general problem of adaptive behaviour in response to predatory threats, and of the neural mechanisms underlying choice and implementation of defensive strategies. When faced with a threat, an animal must decide whether to freeze, reducing its chances of being noticed, or to flee to the safety of a refuge. Animals, from fish to primates, freeze, when faced with distant or inescapable threats, staying completely immobile for prolonged periods. We recently found that fruit flies also freeze when faced with a visual inescapable threat. Using this model organism, we demonstrated that threat-induced freezing corresponds to a distinct internal state from that of spontaneous immobility, as measured by the animal's cardiac activity. Furthermore, by measuring sugar levels and resistance to starvation we found that freezing behaviour is energetically costly, contradicting a widespread belief that freezing is an energy sparing preparatory state. In mammals the large number of brain regions involved in the expression of freezing suggests that this seemingly simple behaviour requires the integration of multiple sources of information. We believe that describing how contextual cues modulate freezing will be instrumental for our understanding of the organization of survival circuits in the brain. Towards this end, we are studying how flies process contextual cues, focusing on the social and spatial environment, and how these come to gate freezing. Given the knowledge regarding sensory detection of visual looming threats and descending neuron involved in the expression of freezing, we are now in a unique position to understand how information about a threat is integrated with cues from the environment to guide the choice of whether to freeze.