TOOLBOX

Brain-wide map links fruit fly behaviors to neurons

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Triggering neuron activity with flashes of light allows scientists to tie behaviors in fruit fly larvae to specific neuron groups, reports a study published 25 April in *Science*[1]. The study catalogs the associations between neurons and the movements they control.

Investigating how an interconnected group of neurons, or a circuit, triggers or modifies a behavior helps researchers understand how brain functions might be disrupted in disorders **such as autism**. Fruit fly larvae have a well-developed brain and nerve cord that contain only about 10,000 neurons, which makes their motor circuits simpler to characterize.

Researchers can use a technique called optogenetics to **selectively and noninvasively switch individual neurons** on with flashes of light. This lets them isolate and study particular circuits by observing the effect of activating a few neurons at a time.

In the new study, researchers examined 37,780 larvae from 1,054 different lines of fruit flies. The flies are engineered so that specific groups of neurons — for example, motor and sensory neurons that together produce behaviors such as crawling — fire in response to blue light.

The researchers recorded each larva before, during and after exposure to blue light. They then used computer algorithms to evaluate videos of the larvae's movements during the light exposure. The algorithms analyzed factors such as the area the larvae covered, their speed and their direction. The algorithms then sorted the behaviors into similar groups.

Based on this analysis, the researchers found that the neuron-behavior relationship is not as rigid as they had assumed. Stimulating the same group of neurons in one larva does not always result in the same behavior, for example. A neural circuit’s activity before stimulation, as well as innate differences among individuals, may account for the occasional unexpected action, the researchers

suggest.

The data create a behavioral atlas for fruit flies, with a list of neurons likely to be involved in each action. Together with functional brain activity studies and **maps of the connections between individual neurons**, the atlas may help scientists explore how neuronal circuits give rise to behaviors.

REFERENCES:

1. Vogelstein J.T. *et al. Science* **344**, 386-392 (2014) **PubMed**