Study finds that blockages in fruit fly brains quickly form and dissolve

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Work by Shermali Gunawardena (right) and graduate student Gary Iacobucci has found that brain blockages in fruit flies can form and dissolve in less than 30 seconds, which may lead to the development of new drugs to treat neurological diseases.

(Medical Xpress)—Motorists in Los Angeles, San Francisco and other gridlocked cities could learn something from the fruit fly. Scientists have found that cellular blockages, the molecular equivalent to traffic jams, in nerve cells of the insect's brain can form and dissolve in 30 seconds or less.

The findings, presented in the journal *PLOS ONE*, could provide scientists much-needed clues to better identify and treat neurodegenerative diseases such as Alzheimer's and Huntington's.

"Our research suggests that fixed, permanent blocks may impede the transport of important cellular components and, ultimately, lead to cellular degeneration and death," says lead researcher Shermali Gunawardena, PhD, an assistant professor of biological sciences in the University at Buffalo's College of Arts and Sciences. "Conversely, blocks that resolve themselves may be benign."

She continues: "This is an important distinction that could help researchers decide which kind or type of blocks to focus on when developing drugs and other forms of therapy for some of these debilitating diseases."

Scientists have long known that many essential cellular components are transported along tracts of nerve cells called neuronal pathways, and that these movements are required for the growth, function and maintenance of neurons. Only recently, however, have they been able to understand the many proteins that help control these movements.

In the UB study, researchers examined isolated nerve cells from fruit fly larvae. Neuronal pathways of these larvae are similar to neuronal pathways in humans.

Traditionally, researchers have identified blockages through still images of dead larvae. These images provide a snapshot only, instead of a depiction of the behavior of the accumulated components over distinct periods of time.

UB researchers altered the approach by analyzing the neuronal pathways of living larvae. Unlike the still images, this method shows how the transport of components changes as neuronal pathways evolve over time.

The researchers found that certain blockages form and dissolve rather quickly. For example, one blockage appeared and disappeared within 29 seconds. Its relatively short life, Gunawardena said, indicates that the blockage is likely benign and not harmful to the cell.

The distinction is significant, she said, because it could allow researchers to focus on permanent blockages that likely halt cellular movement and may pose more serious health risks.

Researchers also looked at how the transport of essential materials over several days contributed to the growth of neurons. If transport was disrupted, growth of the neuron was compromised. As the neuron grew, the movement of some components carrying synaptic proteins increased while other components did not show significant changes.

This suggests that the transport of components in neuronal pathways is linked to the growth and function of the nerve cell.

Taken together, the findings suggest that more research must be conducted to better understand the spatial and temporal characteristics of how essential materials are transported within neurons of living organisms. This, in turn, will provide clues into how defects in this system can lead to neurodegenerative diseases and, perhaps, better ways to identify and treat these ailments.

More information: Iacobucci GJ, Rahman NA, Valtueña AA, Nayak TK, Gunawardena S (2014) "Spatial and Temporal Characteristics of Normal and Perturbed Vesicle Transport." *PLoS ONE* 9(5): e97237. DOI: 10.1371/journal.pone.0097237

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