Researchers see low-calorie diet's effects in fly brain, mouthpart

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A novel technique for measuring tiny, rapid-fire secretions in the brains and mouthparts of fruit flies (drosophila) is providing insights into the beneficial effects of eating less -- information that ultimately could help people suffering from neuromuscular disorders. Benjamin Eaton, Ph.D., assistant professor of physiology in the School of Medicine at the UT Health Science Center San Antonio, is senior author of a newly published paper on the subject. Credit: The University of Texas Health Science Center San Antonio

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Using the method, researchers uncovered never-before-seen brain

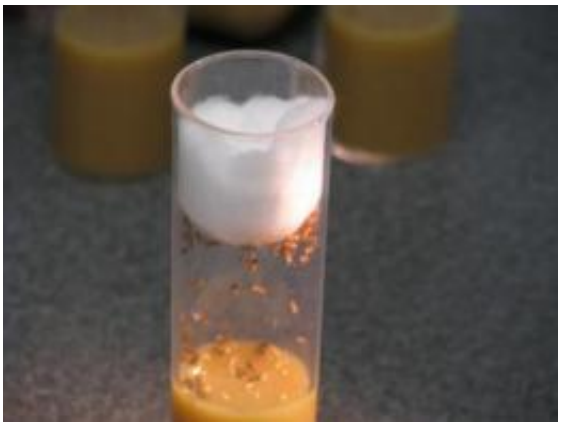
chemistry that helps explain why fruit flies genetically manipulated to mimic conditions such as Parkinson's disease and myasthenia gravis are more vigorous and live longer when fed a restricted diet.

Published in June by *Aging Cell,* the research was conducted by a team from the School of Medicine and the Barshop Institute for Longevity and Aging Studies at The University of Texas Health Science Center San Antonio.

Why eating less may be therapeutic

Senior author Benjamin Eaton, Ph.D., assistant professor of physiology, says the results demonstrate how limiting calories may be therapeutic for people with various syndromes.

Lead author Joel Rawson, Ph.D., and the Eaton team developed a novel system to analyze the impact of diet on life span and motor behavior as well as on neurotransmission, which is believed to underlie most neurological disorders in humans.



Fruit flies are informing scientists about neuromuscular disorders and the possible impact of eating less on brain chemistry and motor behavior. These flies are from the laboratory of Dr. Benjamin Eaton, assistant professor of physiology

in the School of Medicine at the UT Health Science Center San Antonio. Credit: The University of Texas Health Science Center San Antonio

Flies on the low-calorie diet showed a 100 percent increase in the release of brain chemicals, which are called neurotransmitters, from their neurons. These chemicals carry signals from one nerve cell to another across gaps called synapses. The brain has millions of synapses that are believed to be the critical structures required for normal brain function. Diseases such as Parkinson's harm them irreparably.

Firing up the muscle activity

Furthermore the chemicals were secreted at critical locations. "Diet restriction increased the neurotransmitters released at synapses called neuromuscular junctions," Dr. Eaton said. "These synapses, which form on muscle, transmit nerve impulses from the brain to muscles, resulting in movement. If neuromuscular junctions degenerate, resulting in the release of less neurotransmitter, then muscle activity diminishes. This is observed in diseases such as myasthenia gravis and amyotrophic lateral sclerosis (ALS)."

The observation that diet could directly affect the amount of neurotransmitter secreted by the neuron was a novel observation that had not been seen previously.

"People have seen that diet has effects on the nervous system, but the nuts and bolts of what it is doing to neurons have not been established," Dr. Eaton said. ""We believe we have shown a novel and important effect."

Probing the fly proboscis

The team genetically engineered a single pair of motor neurons to develop neurodegenerative disease, resulting in a decrease of the flies' ability to extend the proboscis, which they use to gather food. The team then dissected the head to locate the appropriate muscles on the proboscis and quantified the neurotransmitter activity occurring there, which continues to take place even after death.

"We went into the very muscles that that these motor neurons controlled and analyzed neurotransmission using electrodes," Dr. Eaton said. "We showed diet can rescue proboscis extension by increasing the amount of neurotransmitter released. This suggests that diet could be an important therapy for improving muscle function during motor diseases such as ALS."

Next up is to define the proteins in neurons that are being altered by diet restriction, he said.

Provided by University of Texas Health Science Center at San Antonio

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