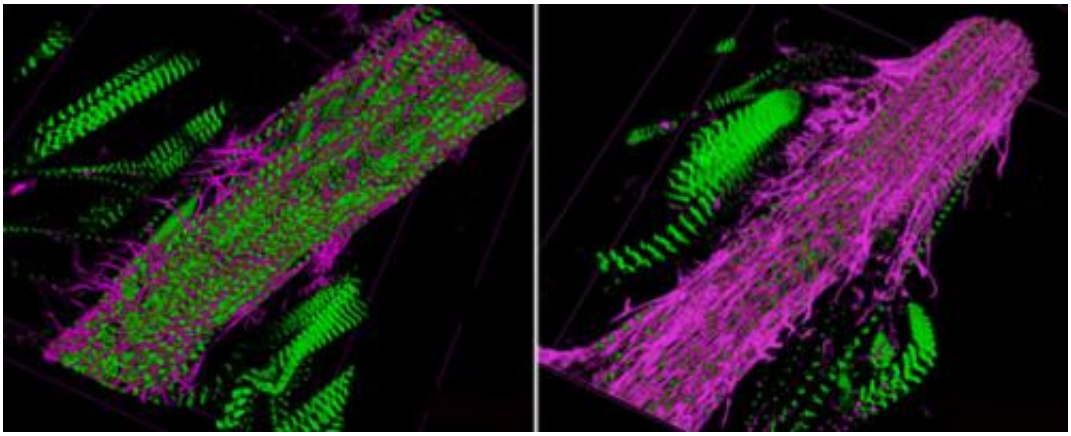
Diabetic fruit flies support buzz about dietary sugar dangers

January 17 2013



Cardiac fibrosis (shown in purple), a hallmark of heart disease, is clearly increased in fruit flies on a high-sugar diet (right), as compared to flies on a normal diet (left). Credit: Sanford-Burnham Medical Research Institute

Regularly consuming sucrose—the type of sugar found in many sweetened beverages—increases a person's risk of heart disease. In a study published January 10 in the journal *PLOS Genetics*, researchers at Sanford-Burnham Medical Research Institute and Mount Sinai School of Medicine used fruit flies, a well-established model for human health and disease, to determine exactly how sucrose affects heart function. In addition, the researchers discovered that blocking this cellular mechanism prevents sucrose-related heart problems.

"Our study reveals a number of specific sugar-processing enzymes that

could be targeted with therapies aimed at reducing sucrose's unhealthy effects on the heart," said Karen Ocorr, Ph.D., research assistant professor at Sanford-Burnham and the study's corresponding author.

Diabetic fruit flies with heart problems

The research team was the first to model heart disease caused by type 2 diabetes in fruit flies. They achieved this simply by feeding the flies a diet high in sucrose. High-sucrose flies showed many classic signs of human type 2 diabetes, including high blood sugar and insulin signaling defects. The team also saw signs of diabetes-induced heart malfunction in these flies—deteriorating heart function, cardiac arrhythmia and fibrosis.

Next the researchers wanted to know exactly what sucrose is doing inside the flies' cells that makes it harmful to hearts. To answer this question, they looked for molecular networks that are triggered or altered by sucrose.

The team eventually pinpointed one particular biochemical system, called the hexosamine pathway. This series of biochemical reactions normally plays only a minor role in the way cells process sugar to produce energy. But some research also suggests that the hexosamine pathway is linked to diabetes in humans.

"It's remarkable that we're able to use the fruit fly as a discovery tool for elucidating basic molecular mechanisms, not only of many types of heart disease, but also dietary influences that help us understand what happens in human hearts," added Rolf Bodmer, Ph.D., professor at Sanford-Burnham and a senior author of the study.

Dampening sugar's negative effect on the heart

The researchers further probed the hexosamine pathway in their new diabetes model. They found that artificially increasing sucrose-processing via the hexosamine pathway harms the heart. In contrast, when they specifically blocked this pathway, they prevented some of the high-sucrose induced heart defects, such as cardiac arrhythmias.

"Diet-induced heart damage is one of our society's most serious health issues. Our flies now give us a tool to explore the role of high dietary sugar, and the means to identify treatments in the context of the whole body," said Ross Cagan, Ph.D., professor at Mount Sinai School of Medicine and a senior author of this study.

Provided by Sanford-Burnham Medical Research Institute