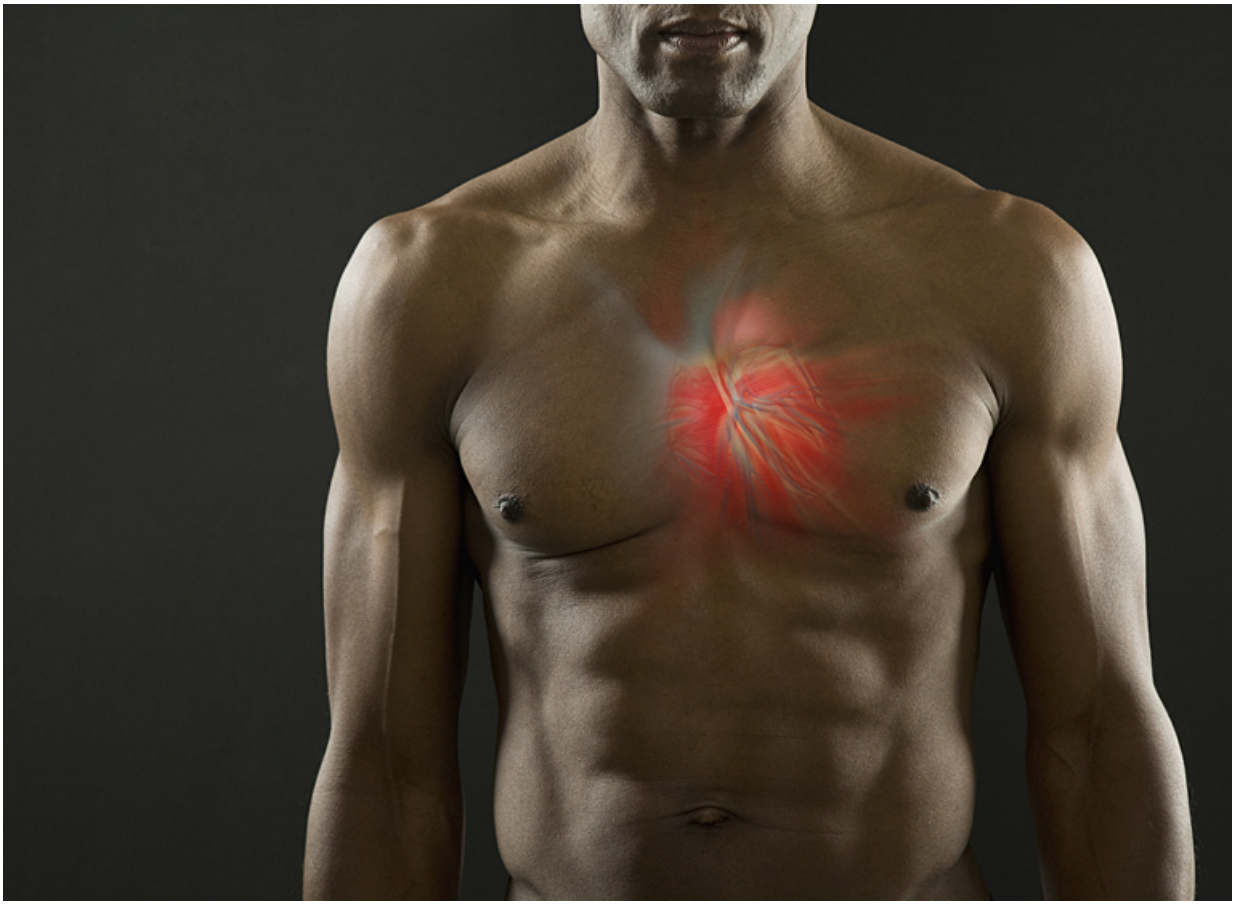
Do hearts fail because they're hooked on blood sugar?

October 13 2015, by Josh Barney



Researchers at the UVA School of Medicine are investigating whether the heart develops an excessive reliance on blood sugar, causing damaging changes that lead to heart failure.

Could your heart get hooked on blood sugar? Researchers at the University of Virginia School of Medicine think so, and they will determine if blocking that addiction could prevent enlargement of the heart that can lead to deadly heart failure.

The project, combining pioneering metabolic science with cutting-edge imaging, has been backed with a four-year grant totaling $1.9 million from the National Institutes of Health's National Heart, Lung and Blood Institute.

The heart normally sustains itself on fatty acids. But when under stress, such as from high blood pressure, it turns to glucose – blood sugar – for easy energy. This is normal and healthy, but the UVA researchers think it may become dangerous if the heart begins to gorge on glucose long-term.

"Glucose is good for the heart, but too much glucose is not good," explained lead researcher Bijoy Kundu of the Department of Radiology and Medical Imaging. "We need the right balance between glucose and fatty acids to maintain function [of the heart]."

Preliminary data from human studies suggests there are metabolic changes in glucose metabolism prior to the development of cardiac hypertrophy, a thickening and stiffening of the heart muscle, Kundu noted. This enlargement of the heart impedes its ability to function and pump blood efficiently.

"The heart is a metabolic omnivore. It uses whatever fuel it needs at the right time. But at a certain point, this adaptive process can become maladaptive," Kundu said. "We hypothesize that this maladaptive response – this initial beneficial response going wrong – is responsible for contractile dysfunction of the heart, which … eventually leads to heart failure."

Kundu and his team plan to use cutting-edge nuclear imaging techniques they have developed to watch these metabolic changes unfold. The goal is to determine when the heart's reliance on glucose goes from good to bad.

"The hypothesis is, metabolic remodeling precedes cardiac dysfunction, and if you can identify a therapeutic window you can do an intervention and prevent cardiac dysfunction, the subsequent structural remodeling and prevent heart failure," said Kundu, a member of UVA's Robert M. Berne Cardiovascular Research Center.

The researchers also will test to see if the diabetes drug metformin, which suppresses glucose production by the liver, can prevent the damaging effects of glucose on the heart in rats.

"We believe it will target glucose metabolism and it will prevent impairments in contractile function," Kundu said.

Ultimately, Kundu hopes his work will determine the metabolic cause of cardiac hypertrophy, determine when it can best be averted and provide the drug that could stop it.

"If you identify all these metabolic changes early on," he said, "we can do a therapeutic intervention and prevent these downstream effects. Essentially, we could prevent cardiac hypertrophy and subsequent heart failure."

Provided by University of Virginia