Understanding relationship of proteins, fatty acids could help treat diseases

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(PhysOrg.com) -- It's widely understood that eating a diet high in saturated fats increases the risk for a long list of chronic and deadly diseases, including diabetes and coronary heart disease. Understanding how this works at a molecular level, however, is much more complicated.

Paul Black, professor and chair of the University of Nebraska-Lincoln's department of biochemistry, and his colleagues are close to cracking some of the mystery, which may lead to better treatments for several major human diseases. A $640,266 grant from the National Institutes of Health National Institute of General Medical Sciences, funded recently by the American Reinvestment and Recovery Act, is helping Black advance his research.

When we eat, certain proteins in our bodies act like traffic cops, directing different fatty acids -- from the "good" fats in salmon to the "bad" fats in margarine -- where they need to go.

Eating too many saturated fats overwhelms the system, causing the fatty acid transport proteins to function less efficiently. Fatty acids end up in places they shouldn't and contribute to obesity and other metabolic diseases.

Black's team studies how these proteins discriminate among different types of fats -- for example, essential versus nonessential fatty acids. This is important because cells cannot make essential fatty acids, which play important roles in the cell. These proteins appear to guide the transport of different types of fatty acids across the plasma membrane of the cell and into different metabolic compartments.

"I think this research is going to be a big step forward in understanding mechanistically how these proteins work," Black said, and how diseases develop when things go wrong.

For example, as fatty acids build up abnormally in muscle cells, the body's ability to respond to insulin changes, leading to insulin resistance and Type 2 diabetes. Dysfunctions in these proteins also may contribute to coronary heart disease, fatty liver diseases and certain types of cancers. Such diet-related diseases are the No. 1 causes of death in the U.S.

"Understanding the pathophysiology of these complex diseases and the role of lipid metabolism in general will have huge economic consequences to the health care industry of the United States," Black said.

Fatty acid transport proteins appear to play other vital roles. They are

thought to be involved in transporting essential fatty acids across the placental barrier during pregnancy, a critical process for embryonic brain development. These proteins also are thought to be involved in transporting essential fatty acids into the brain where they are essential to brain development and function.

"We're right there on the edge," said Black. "We don't quite know all of the answers, but we have a good feeling that we're heading in the right direction

ARRA funding allowed Black and his project colleague, Concetta DiRusso, professor of biochemistry and nutrition and health sciences, to hire two postdoctoral fellows, two graduate students and two technicians. More generally, ARRA also "has energized the scientific community," Black said. "If we want to be competitive in a global marketplace, we have to maintain the highest quality research that this country can possibly afford. This funding was extremely timely because a number of junior faculty, in particular, are now going to be able to progress and really drive the research forward."

Provided by University of Nebraska-Lincoln