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New clues about heart health uncovered by team of biomedical engineer

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An engineering school isn't where you normally hear about advancements that could improve heart health, but researchers at the University of Calgary's Schulich School of Engineering have used a device that simulates blood flow to uncover new information that could help prevent heart attacks and strokes.

In a paper published in the July issue of the *American Journal of Physiology – Heart and Circulatory Physiology*, biomedical engineer Kristina Rinker and her team have shown that the presence of a particular form of the protein Smad2 in the cells that line blood vessels appears to influence artery health. Now the researchers are exploring ways to manipulate this protein to create new treatments for cardiovascular disease.

"Where we see an abundance of a specific form of Smad2, we see other characteristics of healthy tissue. In areas prone to disease, there is significantly less of the protein," explains Rinker, a researcher in the Department of Chemical and Petroleum Engineering. "Our conclusion is that Smad2 may be important in helping cells resist the development of cholesterol plaque that is often responsible for heart attacks and strokes."

Researchers used a device called a flow chamber to study how Smad2 behaves as a result of exposure to patterns of fluid flow. Cells were subjected to conditions that are similar to actual blood flow patterns in the body. The version of the device used for this study was designed by Rinker and research associate Bob Shepherd.

“This new information about Smad2 would not have come about using standard tests that don’t account for fluid flow. This is a great example of how the understanding and application of engineering principles can contribute to medical research,” says Shepherd.

This research establishes a completely new role for Smad2, which is already known to be important for the normal growth, development and functionality of many organs and tissues in the body. The study, which involved some collaboration with the Faculty of Medicine, fills in many gaps in the current knowledge of how blood flow influences vessel health.

“The forces resulting from blood flow directly affect the properties of vascular cells and their level of susceptibility or resistance to disease, so we needed to study artery cells that were exposed to fluid flow conditions,” explains Shepherd.

Rinker’s team will use the flow chamber system extensively as they explore ways to develop their finding to create new treatments for cardiovascular disease. Rinker and Shepherd are also working with Innovate Calgary and Biovantage – an Alberta Ingenuity Centre that collaborates with researchers and industry – to commercialize their device and make it available for widespread use, such as in the pharmaceutical industry. Because many drugs work by first entering the bloodstream, the system should enable improvements in the development of new medications. They expect to have a commercial prototype ready this fall.

Provided by University of Calgary