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Researchers looking inside vessels to understand blood's ebb and flow

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Researchers have known for some time that the blood vessels that transport blood to and from tissues and organs in the body are more than just bodily pipelines. Arterioles and capillaries, the small vessels, actually play a key role in regulating the flow of the blood they're carrying. Biomedical engineers at Drexel University, who study cardiovascular function, are creating a mathematical model that explains just how they do it.

The team, which includes Drs. Dov Jaron, Kenneth Barbee and Donald Buerk from Drexel's School of Biomedical Engineering, Science and Health Systems, will look specifically at mechanisms that govern the production of nitric oxide in the circulatory system. Nitric oxide is a chemical produced by endothelial cells that line the inner walls of blood vessels, which regulates blood pressure and flow by dilating the vessels. It also plays a role in the immune system's response to injuries and infections.

"This research is significant since the mechanisms that control the production of nitric oxide, and thereby control blood flow, are not fully known," Jaron said. "NIH is making it a priority to study this, since defects in nitric oxide in blood and tissues are known to lead to many diseases."

The National Heart, Lung and Blood Institute of The National Institutes of Health has pledged more than $3.3 million over five years to the Drexel team in hopes that its model could eventually play a role in

combating one of the nation's leading killers: heart disease.

"This team is uniquely qualified to perform this research because it combines expertise in mathematical modeling and experiments," Barbee said. "We have identified novel mechanisms involved in the regulation of nitric oxide production that are not apparent using standard experimental approaches alone."

Using a flow chamber, invented at Drexel specifically for this type of research, the team will examine nitric oxide production in endothelial cells grown in the lab. While introducing chemical catalysts and inhibitors the team will be able to track –in real time- how nitric oxide is produced. Adding this data on location and time factors involved in the production of nitric oxide will give Drexel's model another layer of depth and accuracy.

"In addition to the flow chamber technology, we also have the unique capability for using sensitive microelectrodes to measure nitric oxide in the microcirculation," Buerk said.

One thing that scientists already know about nitric oxide in the body is that the presence of high levels of cholesterol can block its production and thus contribute to the development of vascular disease. Drexel's model, which will be open-source, could help researchers in the field gain greater understanding of vascular function and test hypotheses about the biological pathways leading to the production of nitric oxide.

Provided by Drexel University