A storm in our veins

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Suppose you're hiking through the forest on a sunny afternoon as a light breeze passes through the trees, gently grazing your skin. Suddenly the sky opens up and a rainstorm ensues. The trees keep you dry, but the weather worsens and 50 mile-per-hour winds start knocking down trees, leaving you unprotected.

This is similar to what it's like inside our blood vessels, explained Eno Ebong, a new assistant professor in the Department of Chemical Engineering. Her research focuses on studying the effects of the mechanical forces of blood flow on the endothelial cells that line and protect our blood vessels—work that is aimed at advancing vascular disease treatment.

Under normal circumstances, the environment inside our blood vessels resembles a quiet, breezy day. But sometimes, it gets a little stormy. For instance, at branches, constrictions, or curvatures the geometry of a vessel becomes askew. Another way to think of it is like the plumbing of a house, when water flow problems occur at the pipes' curves. The same is true in the human body's plumbing, Ebong said. Geometry changes cause flow disruptions, effect the endothelial cells lining and protecting the vessel, and can eventually lead to plaque build up.

Thankfully, the vessels' endothelial cell lining has its own protective miniature forest, called the glycocalyx. Consisting mostly of sugar molecules and proteins, this structure stands on end like a forest of tiny trees. It's also the primary focus of Ebong's work.

"I study the structure of the glycocalyx under different flow conditions," said Ebong, who served as a post-doctoral researcher and professor at the Albert Einstein College of Medicine before coming to Northeastern. "I try to make the connection between glycocalyx structure and its function—or dysfunction—as a protective coat on top of the endothelial cells."

In previous and ongoing studies, Ebong's group has confirmed and defined the means by which the glycocalyx plays a role in endothelial cell protection. When new enzymes or manipulated genes were introduced and broke down different components in the glycocalyx, her team observed significant disruptions to the way the endothelial cells lining the blood vessels were impacted by flow. "The glycocalyx appears to be so much more complicated than we expected," she said.

By understanding the roles that the different glycocalyx components play in the material's protective function, Ebong said, she hopes to identify new targets and develop new tools to prevent, diagnose, or treat vascular disease.

Provided by Northeastern University

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