Researchers identify key components of blood that directly affect flow behavior

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Cardiovascular diseases are the leading cause of deaths worldwide—yet researchers still don't fully understand how blood flows or even which components within blood can lead to cardiac issues.

While several circulatory system models are used today in an attempt to better understand blood flow, they still don't account for the complex rheological behavior of blood. Because blood is a complex suspension of red and white blood cells and platelets suspended within a plasma that contains various proteins, it can exhibit complex flow behavior.

Many of the models currently used ignore these complexities and assume a Newtonian behavior or a constant thickness.

During the 88th Annual Meeting of The Society of Rheology, being held Feb. 12-16, in Tampa, Florida, Jeffrey S. Horner, a doctoral candidate who works in both the Beris and Wagner Research Groups in the Department of Chemical and Biomolecular Engineering at the University of Delaware, will present a new approach.

"Our research team aims to explore and model these non-Newtonian characteristics of blood flow through careful, well-documented measurements, and by combining expertise within the fields of rheology, computational modeling, and biology," Horner said.

The goal is to identify key components of blood that directly affect the flow behavior. "We hope that eventually rheology can be used as a diagnostics tool to detect early signs for cardiovascular disease as well as various other blood diseases," he said.

This work is a significant departure from previous efforts within the field of blood rheology. "Our experiments are among the first to provide reliable data that properly preconditions the sample and reports the full physiological parameters that affect flow behavior—all of which are conducted using state-of-the-art rheological equipment," noted Horner.

The team is also implementing transient tests that, to their knowledge, have never been conducted on blood samples before and are designed to explore the flow regimes that occur in the human body. "The modeling we're doing of transient blood flows is thought to be the first successful effort to represent more than just the steady shear behavior of human blood," Horner said.

Once transient behavior is understood and correlated to the physiological parameters within the blood, "we can then use rheology as a diagnostic tool for human blood," added Horner. "As a diagnostic tool, it will enable earlier and quicker detection of various diseases."

More information: Investigation of the human blood rheology in transient flows. www.rheology.org/SoR172/ViewPaper?ID=161

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