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Measuring shear force transmission across a biomimetic glycocalyx ISABEL BRAY, DYLAN YOUNG, JAN SCRIMGEOUR, Department of Physics, Clarkson University, Potsdam NY 13699 — Human blood vessels are lined with a low-density polymer brush known as the glycocalyx. This brush plays an active role in defining the mechanical and biochemical environment of the endothelial cell in the blood vessel wall. In addition, it is involved in the detection of mechanical stimuli, such as the shear stress from blood flowing in the vessel. In this work, we construct a biomimetic version of the glycocalyx on top of a soft deformable substrate in order to measure its ability to modulate the effects of shear stress at the endothelial cell surface. The soft substrate is stamped on to a glass substrate and then enclosed inside a microfluidic device that generates a controlled flow over the substrate. The hydrogel chemistry has been optimized so that it reliably stamps into a defined shape and has consistent mechanical properties. Fluorescent microbeads embedded in the gel allow measurement of the surface deformation, and subsequently, calculation of the shear force at the surface of the soft substrate. We investigate the effect of the major structural elements of the glycocalyx, hyaluronic acid and charged proteoglycans, on the magnitude of the shear force transmitted to the surface of the hydrogel.

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