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A macromolecular model for the endothelial surface layer JAMES HARDEN, Department of Physics, University of Ottawa, DARINA DANOVA-OKPETU, Department of Physics, Vrije Universiteit, GARY GREST, Sandia National Labs — The endothelial surface layer (ESL) is a micron-scale macromolecular lining of the luminal side of blood vessels composed of proteoglycans, glycoproteins, polysaccharides and associated plasma proteins all in dynamic equilibrium. It has numerous physiological roles including the regulation of blood flow and microvascular permeability, and active participation in mechanotransduction and stress regulation, coagulation, cell adhesion, and inflammatory response. The dynamic structure and the mechanical properties of the ESL are crucial for many of its physiological properties. We present a topological model for the ESL composed of three basic macromolecular elements: branched proteoglycans, linear polysaccharide chains, and small plasma proteins. The model was studied using non-equilibrium molecular dynamics simulations and compared with scaling theories for associating tethered polymers. We discuss the observed dynamical and mechanical properties of the ESL captured by this model, and the possible physical insight it provides into the physiological behavior of the ESL.

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