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Fluid Flows and Their Role in the Regulation of Biological Molecules in the Bloodstream CHARLES SING, ALFREDO ALEXANDER-KATZ, Massachusetts Institute of Technology — We use computer simulations to elucidate the physics underlying blood clotting mechanisms. A straightforward and general model for the behavior of proteins such as von Willebrand Factor (vWF) under various flow conditions has been developed. The particular case of vWF is considered in depth, since it demonstrates the counter-intuitive behavior of adsorbing to a surface at higher flow rates. We use the globule-stretch transition of a collapsed polymer to explain this phenomenon, and have identified the conditions necessary to induce this transition. We have also developed a theory to explain the mechanism of this transition, which is based on the nucleation and growth of large thermal protrusions. Upon the consideration of the specific length and time scales present under biological conditions, it is apparent that vWF is strongly regulated by elongational flows. We can show how phenomena from the molecular to physiological levels are supplemented by this understanding of vWF function.

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