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Stability of red cells flowing in a narrow tube[1] NATALIE BEAMS, JONATHAN FREUND, University of Illinois at Urbana-Champaign — Red blood cells are well known to line up in an orderly arrangement when forced to flow through a narrow capillary-scale round tube (diameter $\leq 8\mu$m). However, in slightly larger tubes this order can break down, resulting in apparently chaotic flow. We investigate this breakdown using a high-fidelity boundary integral solver for flowing blood cells. This solver has been validated for both the flow of organized and highly deformed cells in narrow tubes and for more random flow in larger tubes. Our studies focus on a family of cases with 8 red cells, each discretized with spherical harmonics. The cells are modeled as elastic shells enclosing a viscous fluid. Studying the development of instabilities using ad hoc perturbation techniques as well as non-normal modal analysis, we show a strong increase in instability for larger tube diameters. Increasing the cell interior viscosity is also observed to increase the amplification of perturbations.

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