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The flow of red cells through spleen-like filtering slits JONATHAN FREUND, University of Illinois at Urbana-Champaign — It is widely understood that the spleen is the principal site in the body for removal of old red blood cells. As they age during their approximately 120 day lifetimes, red blood cells have increasingly slow relaxation times. This mechanical change is potentially the identifying characteristic for filtering in the spleen, which is thought to occur in particularly narrows slit-like passages ($< 1\mu$m $\times \sim 7\mu$m). The mechanism of the filtering, however, is unclear. Most simply, increasing cell viscosity with age would slow, rather than stop, cell passage. Similarly, 'testing' the cells via significant strains during each passage through the spleen might be expected to accelerate aging through fatigue-like mechanisms. Our detailed simulations of red cells passing trough a model slit geometry suggest that increasing cell viscosity can fundamentally change its passage. The results are suggestive of a bifurcation, such as in the onset of instability, with increasing cell interior viscosity. Higher viscosities (or elastic capillary numbers) are seen in cases to lead to a fingering-like instability, which might be expected to severely damage aged cells, leading to their removal, while leaving younger low viscosity cells relatively unstressed.

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