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Effect of constitutive laws on erythrocyte membrane response MARIANNA PEPONA, Duke University, JOHN GOUNLEY, Oak Ridge National Laboratory, AMANDA RANDLES, Duke University — Despite the extensive literature on the modelling of red blood cells, only a few works have compared the response of a deforming red blood cell to different constitutive laws. In the current work, three different constitutive equations are considered: the strain-hardening Skalaks law, the strain-softening neo-Hookean model, and Yeohs law, whose nature and degree of strain-hardening/softening depend on the deformation regime and type. The performance of these laws is assessed on accurately capturing deformations in the longitudinal and transverse directions, and under shear via optical tweezers, micropipette aspiration and wheel numerical experiments, respectively. Particular emphasis is given to the nonlinear deformation regime, i.e. moderate and large deformations, where it is known that the discrepancies between various constitutive laws are most prominent. Finally, we compare the aforementioned laws in the configuration of a single red blood cell flowing inside a capillary. This work aims at providing criteria for selecting the constitutive law best describing the erythrocyte membrane mechanics for the deformation type and regime of interest.

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