Shape deformation of RBCs in a doublet

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The high deformability of Red Blood Cells (RBCs) influences the blood flow and blood circulation as well as RBC aggregation. The deformability of the RBCs is determined by the elastic properties of the membrane and their high surface area to volume ratio.

Normally the blood flow is sufficient to prevent formation of RBC aggregates. However, in low shear rates or some pathological conditions the aggregation of RBCs occur [1]. The shape of RBCs in an aggregate differs from the equilibrium biconcave morphology. This change in the morphology of the cells is coupled to the contact areas between two cells in a doublet and as a result the strength of interaction energy.

We induce well-defined long range attraction between RBCs by adding mono disperse rod-like bacteriophage viruses with a high length to diameter ratio. The interaction is tuned by varying the concentration of the rod-like particles which results in different shape of the doublets. We investigate the deformation of a single RBC in a doublet from 3-D reconstructed confocal images. Our results show an increase in the bending energy of single RBCs in a doublet which is coupled to a decrease in the excluded volume for the rods with increasing the adhesion energy.

[1] P Ziherl, S Svetina, Flat and sigmoidally curved contact zones in vesicle–vesicle adhesion. Proc. Natl. Acad. Sci.104, 761–765 (2007).