Investigation on the disaggregation mechanisms of red-blood-cells

Authors:

- Nicolas Moreno, CFD-MS Group, Basque Center for Applied Mathematics (nmoreno@bcamath.org)
- Dmitry Fedosov, IBI, Forschungszentrum Jülich (d.fedosov@fz-juelich.de)
- Marco Ellero, CFD-MS Group, Basque Center for Applied Mathematics (mellero@bcamath.org)

Abstract: The aggregation and disaggregation of red blood cells (RBCs) play a crucial role in biological processes and the characterization of pathological conditions. Currently, various mechanisms have been identified for RBC interactions, primarily involving either depletion or bridge formation between proteins at the cell membrane[1]. Recent experimental evidence suggests that these interactions may occur concurrently, leading to intricate disaggregation phenomena.

In this study, we present a numerical model that leverages highly-resolved triangulated RBC membranes[2] to capture both depletion and bridge formation. Notably, our model also accounts for the formation of mobile bridges. By comparing our results on RBC disaggregation with existing experimental evidence[3], we observe an initial dependence of the force on the depletion interaction, followed by an increase in force just before cell separation due to bridge migration. Interestingly, when bridges are not allowed to diffuse, the characteristic disaggregation behavior deviates from experimental observations.

Furthermore, we propose a reduced spring-dashpot model that effectively describes the observed disaggregation mechanism. Our findings contribute valuable insights to understanding RBC dynamics and hold promise for applications in biomedical research and clinical contexts.

References:

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