Review of: "Dynamics of blood cells during a routine laboratory examination"

Alexis Darras[1]

1 Universität des Saarlandes

Potential competing interests: No potential competing interests to declare.

The author reports theoretical investigations of the Focker-Planck and Langevin equations. He claims that his theoretical manipulations of these equations can be applied to the case of full blood to determine the influence of several physical parameters on full blood processing during erythrocytes sedimentation rate and full blood centrifugation.

Although studying physical processes related to blood has significant value, the author's work overlooked some critical considerations. In particular, the Focker-Planck and Langevin equations assume a dilute regime where particles do not interact and can freely diffuse. Red blood cells (RBCs) are mostly athermal (their thermal diffusion is negligible in comparison with their gravitational energy in usual conditions), tend to agglomerate in rouleaux and have a volume fraction of 45% in full blood, which is well above the percolation threshold for discs with the same aspect ratio [1]. Therefore, the validity of those equations in this case is far from guaranteed. Importantly, the author didn't provide any experimental measurement to confirm whether the trends predicted by their investigations are even qualitatively correct.

Additionally, the author's work fails to account for recent publications on erythrocyte sedimentation. Our experimental and analytical studies have demonstrated that, under standard conditions, red blood cells (RBCs) sediment as a percolating gel, which is better described by equations for porous networks[2][3][4][5][6], rather than the ones proposed by the author. While I'm convinced that this gel is fragile, and that the gel model will fail for a high enough centrifugation speed, there would still be strong hydrodynamic and solid-core repulsion between he RBCs in this case. Such interactions surely needs to be taken into account, at least through the rheological properties (i.e. variable viscosity) of such suspension. The author's hypothesis may only be relevant in highly diluted RBC suspensions, which are not typical of routine laboratory examinations. Thus, experimental validation is necessary to determine the range of dilution where the author's hypotheses can be considered valid.

In light of the recent publications on erythrocyte sedimentation, it is important that the author review the validity of their hypotheses and conduct experimental validation before considering the relevance of their theoretical investigations for real-world applications. For the moment, his theoretical investigations are an interesting exercise, but fail to demonstrate their practical significance for the mentioned applications.

References

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