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Motion of individual cells in high hematocrit blood flow in micro-channels

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Summary

In a small artery, the blood is no longer assumed as a homogeneous fluid, because the size of blood cells cannot be neglected compared to the generated flow field. In such a case, we need to treat the blood as a multi-phase fluid, and investigate the motion of individual cells in discussing the flow field. Blood may be modelled as a suspension of red blood cells (RBCs) in plasma, because about 99% of volume fraction of blood cells is RBCs.

In order to measure a blood flow experimentally, various methods have been employed. However, most of conventional techniques are difficult to observe behaviour of cells inside of the high hematocrit (Hct) blood flow because of the less optical transparency of the RBCs even when the flow speed is low. To overcome this problem, we use confocal micro-PTV (Particle Tracking Velocimetry) system. This system enables us to visualize the individual RBCs and cancer cells even in the high Hct blood by exciting the labelled RBCs by the laser.

In this study, we investigate the motion of RBCs and cancer cells by using confocal micro-PTV system. We measure individual trajectories of cells in various micro-channels under high Hct conditions, where the interaction between RBCs becomes significant Our results clearly demonstrate that the mixing of RBCs strongly depends on the hematocrit, the RBC property and the position in the micro-channel. It is also confirmed that the motion of individual cancer cells can be tracked by this system. These information is important for a better understanding the microcirculation.

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