Title of the project

Mechanodiagnostics of RBC-related diseases

Category (translational/bioengineering/biodesign): Translational research

Investigators (IISc and clinical institutions)

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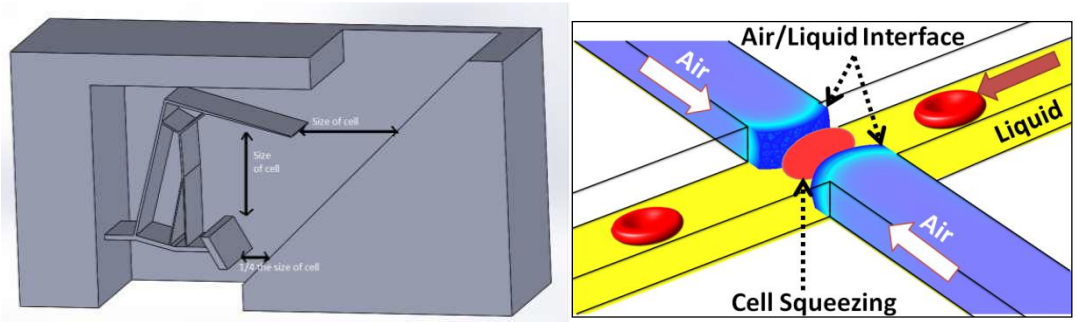
Statement of research

Aided by a few techniques, changes in mechanical response of single cells are correlated to diseases states such as malaria, cancer, etc. In this project, we explore a high-throughput mechano-diagnostics technique to measure the deformability of single cells. In our past work, we had developed miniature graspers to manipulate and mechanically characterize single biological cells. We have also developed techniques in controlling air-liquid interfaces to constrict single cells in flow. While continuing these efforts, in this project, we want to develop moving interfaces—solid-liquid and air-liquid—inside flow-channels. The interfaces help us trap and squeeze single cells and thereby measure their deformability and interior properties. While the technique is general, we propose to apply it on red blood cells (RBCs) in healthy and disease conditions to assess disease conditions. As an additional effort that is directly relevant to clinical practice, we propose to develop a microfluidic chip for quick estimation of hemoglobin content. This is deemed to be useful in blood-camps and primary health-centres where hemoglobin levels need to be assessed quickly, cost-effectively and reliably. The standard practice in resource-challenged settings is to use the settling time of a blood-drop in copper-sulfate solution. Although effective, this technique suffers from variable environmental conditions such as temperature and improper calibration. We aim to incorporate this or another technique to develop a microfluidic chip-based portable hemoglobin sensor.



Conceptual design of movable solid-liquid and air-liquid interfaces to test the deformability of single RBCs in flow