

Abstract Submitted  
for the DFD19 Meeting of  
The American Physical Society

**A Microfluidic Platform for the Study of Cell Deformability<sup>1</sup>**

AMIR SAADAT, DIEGO A. HUYKE, INGRID H. OVREEIDE, DIEGO I. OYARZUN, Stanford University, PAULINA V. ESCOBAR, Pontificia Universidad Catlica de Chile, JUAN G. SANTIAGO, ERIC S. G. SHAQFEH, Stanford University, SHAQFEH TEAM, SANTIAGO TEAM — Reduced deformability of red blood cells (RBCs) can affect the hemodynamics in the microcirculation and reduce the oxygen transport efficiency. To this end, we developed a high-fidelity computational model of RBCs in confined microchannels to inform design decisions and fabricate a microfluidic device to measure RBC deformability. We applied our computational simulation platform to determine the appropriate deformability figure(s) of merit to quantify RBC stiffness based on an experimentally measured, steady cell shape. In particular, we determined a shape parameter based on the moment of area that is sensitive to the changes in the membrane stiffness and size. We conducted experiments and developed automatic image processing codes to track the velocity and morphology of individual RBCs within microchannels. For this purpose, we fabricated PDMS microchannels with square cross-sections ( $7 \times 7 \mu\text{m}^2$ ) and applied a small (order 10 kPa) gauge pressure at the inlet to induce cell movement (order  $10 \text{ mm s}^{-1}$ ). Our experimental setup can record 200 cells per second, and achieve image exposure times on the order of  $10 \mu\text{s}$ . This microfluidic device and supporting computational tools are intended to diagnose blood cell disorders in chronic fatigue syndrome (CFS) patients relative to the healthy controls.

<sup>1</sup>Open Medicine Foundation (OMF)

Amir Saadat  
Stanford University

Date submitted: 01 Aug 2019

Electronic form version 1.4