
Investigation of erythrocytes' cell-cell adhesion using holographic optical tweezers and atomic force microscopy

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Red blood cells (RBCs) are a major component of blood clots which form physiologically as a response to injury or pathologically in thrombosis. The active participation of RBCs in thrombus solidification was previously proposed, but not yet experimentally proven. Holographic optical tweezers and single cell force spectroscopy were used to study potential cell-cell adhesion in between RBCs. Irreversible intercellular adhesion of RBCs could be induced by stimulation with lysophosphatidic acid (LPA), a compound known to be released by activated platelets.

We identified Ca^{2+} as an essential player in the signaling cascade by directly inducing Ca^{2+} influx using A23187. The elevation of internal Ca^{2+} concentration leads to intercellular adhesion of RBCs similar to that induced by LPA stimulation. Based on single cell force spectroscopy adhesion of the RBCs was identified to be approximately 100 pN, a value large enough to be of significance inside a blood clot or in pathological situations like the vaso-occlusive crisis in sickle cell disease patients.