Laser tweezers: their application for trapping and manipulating live cells

Diploma thesis abstract

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A setup of double channel optical tweezers was designed and a possibility of its application for studying mechanisms of aggregation of red blood cells was investigated. The principles of optical trapping are based on using forces acting on a particle from a tightly focused laser beam and holding it in localized area without any mechanical influence.

It was experimentally proved that long-time trapping of red blood cells (erythrocytes) by a focused laser beam does not cause any visible changes of shape and size. A possibility of deformation of a single cell was checked and trapping and manipulating of both individual erythrocyte and rouleaux consisting of several cells (from 2 to 9) was demonstrated. The setup of laser tweezers was calibrated a using method based on the Stokes law, defining the force due to viscous drag acting on a spherical particle. This allowed to measure the force of interaction between erythrocytes during their aggregation in plasma. The differences between aggregation in plasma and synthetic solution of dextrans were found out and three possible scenarios of disaggregation were detected during destroying of rouleaux by laser tweezers.

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