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Assessing the Functional State of Red Blood Cells by Using the Laser Interference Microscopy

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Estimation of possibilities of laser interference microscopy at noninvasive investigation of morphofunctional state dynamics of peripheral blood red blood cells exposed in vitro to adrenaline (10^{-9} g/ml), cortisol (5×10^{-7} g/ml), propranolol beta-adrenoblocker (10^{-9} g/ml) and glutar aldehyde (0.1%) was performed. Concentrations of malonate dialdehyde, adenosine triphosphoric acid and 2.3-diphosphoglycerate were determined in red blood cells. Our results demonstrated that there is a dependence of erythrocytes' optical-geometric characteristics on peculiarities of their structural and functional organization. The intensification of cell's metabolic activity at decreasing in oxidative potential at the presence of cortisol and propranolol was accompanied by the decrease in erythrocyte phase height

by 18% and 29% ($p < 0.05$) and decrease in phase diameter by 3 and 5%, respectively ($p < 0.05$). Decrease in metabolic activity in red blood cells as a result of increased oxidative stress at the glutarous aldehyde action caused an increase in either phase height or phase diameter of the cells. The results show that laser interference microscopy allows estimation of metabolic activity in real time in living red blood cells. The latter leads to increase in data information regarding morphological features and functional capabilities of the cells.

Keywords: laser interference microscopy, red blood cells, phase diameter, phase height, functional activity