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Methods of Light Scattering for Investigation of the Structurally-functional Properties of Erythrocytes

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The methods of optics of scattering medium were developed and used for deciding some tasks linked with diagnostics of blood and erythrocytes. With reference to problems of an optical coherent tomography, the influence of glucose addition to specimens of diluted blood on the transmission spectrums have been investigated by experimentally and by simulation. Results of numerical modeling have shown, that the essential optical cleaning of blood can be achieved, but only at the concentrations of glucose, considerably exceeding physiological norm. Our experimental data for erythrocyte suspended in mixtures of blood plasma with glucose did not confirm blood optical clearing by using of glucose as the immersion liquid: transmission is decreasing for all wavelengths with the addition of glucose solution, as a result of erythrocyte interaction with an environment. At the glucose concentration greater than 20-25%, the spectral transmissions were increased as result of erythrocyte hemolysis. A model of changes in erythrocyte sizes at osmotic imbalance in a hypotonic medium is designed under the assumption of free diffusion of water through erythrocyte membranes. The mechanisms of the formation of the scattering properties of erythrocyte suspensions depending on a degree of osmotic balance infringement are studied with accounting for erythrocyte swelling and its hemolysis. Satisfactory agreement between computational and experimental data certifies the adequacy of the proposed model. The method differs by simplicity and can be put into practice with the help of standard spectrophotometers. Suggested methods, based on measurement of characteristics of scattered light, can be used for research of influence of druges on the viscous-elastic properties of erythrocyte membranes and on processes of transmembrane water transferring and also erythrocyte osmotic resistance.