Vibrational spectroscopy in development of models of reorganization and degradation of RBC membranes

Due to the exposure to oxidative stress, red blood cells undergo different structural, morphological and mechanical damages which are preceded by the alterations of biochemical state. **It is assumed that the first signs of oxidative stress in erythrocytes occur in membranes, while its general effect depends on the nature of the oxidative factor.** The research hypothesis which will be verified in this project is **possibility to identify different mechanisms of red blood cell degradation induced by oxidative stress**, starting with membrane structure reorganization to cytoplasm alterations. The another question is: Is it possible to indicate biomarkers of oxidative stress by tracking changes in red blood cells from micro- to nano- structural level with using of non-destructive spectroscopic methods?

The membrane damage induced by oxidative stress can include different modifications such as lipid peroxidation, protein aggregation, loss of the lipid bilayer asymmetry and impairment of the membrane integrity resulting from the separation of cytoskeleton from lipid bilayer. All changes are resulted in the loss of biconcave shape of erythrocyte and permanently lead to hemolysis. **However, detailed mechanisms of membrane degradation by oxidative factors are still ambiguous and are a challenge for clinical medicine.** Owing to this fact, scientists are continually looking for suitable tools for study of alterations in membranes, especially at the nanostructural level.

Spectroscopic and microscopic methods proposed in project (ATR-FTIR, Raman, oUHD-FTIR imaging, nanospectroscopy FTIR, UV-Vis, AFM) enable non-destructive and label-free examination of biological samples taking into account all aspects connected with biochemical, topological and morphological profile of erythrocytes. **The objective of the project is to determine possible mechanisms of erythrocyte and its membrane degradation by multivariable studying *in vitro* the effect of selected oxidative agents about different chemical nature.**

The research will be focused on the **indication of early signs of membrane degradation** and **correlation of biochemical and morphological changes** chemically induced in erythrocytes. Understanding these alterations could broaden the knowledge about oxidative mechanisms in different diseases or aging process. We believe that set of modern spectroscopic and microscopic techniques can provide the extensive profile of changes induced by oxidative stress in the erythrocytes.