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Studies on interaction of carotenoids-binding proteins with lipid membranes in model systems

Abstract

This doctoral thesis presents results of research on the molecular organization of carotenoids in the protein environment. The examined carotenoids were lutein and zeaxanthin, classified as xanthophyll's and β-carotene represenly carotenes. The analyzed proteins were bovine serum albumin (BSA) and human glutathione S-transferase (GST).

The aim of the study was to gain insight into the so far not understood process of carotenoid pigment transport to the retina. Carotenoids are compounds which have hydrophobic properties. Thus, their aggregation in aqueous environments causes significant difficulties, concerning, assimilation in the human body. The analyzed pigments are diet - supplied only and originate from plants. Another problem is how these two carotenoid pigments spread through the human body so as to be able to fulfill their physiological functions. Therefore, it is supposed that carotenoid transport involves conveyors e.g. those that transport to the retina, where the carotenoids function as a filter for blue light and shield against photo-oxidation.

To study the molecular organization of carotenoids in the protein environment the following spectroscopic methods were used: UV-Vis electron spectroscopy, FTIR spectroscopy and circular dichroism. Studies on interactions of carotenoid-binding proteins complexes were performed using model lipid membranes and liposomes formed from egg lecithin. During the

study of the interactions of pigment - protein complexes with membranes, the following measurement techniques were applied: resonance Raman spectroscopy and Raman imaging, combined Langmuir and FTIR - ATR techniques and electrophysiological technique - BLM.

The obtained experimental results show that carotenoids form specific protein-pigment complexes with the analyzed proteins. Furthermore, the investigated xanthophyll's combine with BSA and GST non - specifically in the form of immobilized molecular aggregates. Analyzed protein - pigment complexes interact with model lipid bilayers, affecting the modification of the properties of structural as well as electrical parameters of the membranes. This results indicate that both the BSA and GST can be used as molecular transporters of carotenoids in living organisms.