Molecular mechanisms of co-functioning of xanthophylls and retinal in the retina of the human eye

The human eye delights and amazes in many respects, not only with the precision of vision and the ability to distinguish millions of colors but also with the ability to function in an extremely wide range of light intensity, which in natural conditions can change even by a factor equal to ten billion! Such a challenge requires that photoreceptors have extremely different or even seemingly contradictory attributes: on the one hand, very high sensitivity, and on the other hand, photo-stability. The very central part of the retina, containing cone photoreceptors responsible for color and precise vision, is subjected to long-term exposure to high-intensity light, which is associated with the risk of photo-oxidative damage. This fragment of the retina is referred to as the *Macula lutea* (yellow spot) because of the high concentration of the yellow pigments lutein and zeaxanthin, belonging to the class of xanthophylls. Macular xanthophylls play a protective role against oxidative degeneration through several mechanisms, including attenuation of blue light and quenching of reactive oxygen species. Xanthophylls are not synthesized in the human body and must be supplied through the diet. Low levels of macular xanthophylls are a major risk factor for age-related macular degeneration (AMD), recognized as the leading cause of blindness in the elderly. In the research project, we will study the mechanisms and functions directly related to light-induced degeneration of the retina and the photoprotective effects of lutein and zeaxanthin. We expect that a significant increase in our knowledge in this field will accelerate the efforts of many research centers around the world to develop strategies to prevent, slow down and even treat AMD.