REGULATION OF PHOTOSYNTHETIC ACTIVITY AT THE LEVEL OF PIGMENT-PROTEIN COMPLEXES

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Regulation of photosynthetic activity comprises mechanisms that operate at all organization levels of plants, including the whole organism (leaves movement), the cell (chloroplast translocation), the thylakoid membranes (membrane reorganization following the phosphorylation of the antenna complexes) and at the molecular level (within the pigment-protein complexes). Molecular mechanisms that operate in the largest photosynthetic antenna complexes of Photosystem II (LHCII), in response to changing light intensity, are manifested in specific organization of the protein. Formation of molecular aggregates of LHCII is essentially facilitated by the presence of the xanthophyll pigments involved in the so called xanthophyll cycle: violaxanthin and zeaxanthin. The LHCII aggregates are stabilized by formation of hydrogen bonds between the α-helices of neighboring protein molecules, as concluded from the analysis of FTIR spectra of the protein in the amide I region. Formation of aggregated structures of LHCII results in excitonic interactions between the antenna pigments and affects localization of the energy levels responsible for excitation energy transfer and quenching. LHCII aggregates are characterized by high rate of thermal energy dissipation and therefore can potentially play essential role in protection of the photosynthetic apparatus against photo-destruction. The hypothesis will be presented and discussed, according to which regulation of the photosynthetic antenna function at the level of pigment-protein complexes is realized via the xanthophyll pigment-induced protein aggregation.