Excitonic structure and dynamics in various photosynthetic antenna protein complexes: hole-burning and modeling studies

Ryszard Jankowiak

Department of Chemistry and Department of Physics, Kansas State University, Manhattan, KS, USA

Low temperature (high-resolution) hole-burning (HB) spectroscopy and modeling studies of various optical spectra of photosynthetic complexes provide new insight into excited state electronic structure and dynamics. The following complexes will be briefly discussed: 1) The CsmA–bacteriochlorophyll *a* complex from *C. tepidum*. In this case, in contrast to literature data, an alternative structure is proposed for the baseplate; 2) The FMO antenna complex from *C. tepidum* and its mutants. Using an experimentally determined shape for the spectral density for the lowest-energy state ($J_{ph}(\omega)$), simulated optical spectra are obtained from structure-based calculations for the FMO trimer. For higher energy pigments, the effect of a broader $J_{ph}(\omega)$ shape with a different *S* factor and/or variable Γ_{inh} are also tested for comparison. I will demonstrate that in order to properly describe various low-temperature optical spectra, a downward uncorrelated excitation energy transfer (EET) between trimer subunits must to be taken into account. That is, after light induced coherences vanish within each monomer, uncorrelated EET between the lowest exciton levels of each monomer takes place due to static structural inhomogeneities in the trimer. The information gained provides new insight into disorder, excitonic structure, EET dynamics and mutation induced changes induced via site directed mutagenesis; and 3) The B800-850 LH2 antenna complex from *Alc.vinosum*, which exhibits an unusual spectral splitting of the B800 absorption band. Here, we propose that various protein conformations lead to either strong or weak hydrogen bonds between the protein and B800 pigments.

Biography

Ryszard Jankowiak is a Distinguished Professor of Chemistry and Ancillary Distinguished Professor of Physics at Kansas State University, Manhattan, KS, USA. He is also affiliated with the Photosynthetic Antenna Research Center, Washington University, Saint Louis, MO. He has published over 230 papers in various areas of physical chemistry, toxicology, chemical carcinogenesis, physics, and biophysics. Currently he studies photosynthetic reaction centers and various antenna pigment complexes (including mutants) of green plants/algae and photosynthetic bacteria using solid-state low-temperature (laser-based) spectroscopies and theoretical modeling. Research Gate score: 43.2; over 5,340 citations. H INDEX 39. Contact phone numbers: +(785) 532-6785 or +(785) 410-4163.