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Structural analyses of flavin-binding photoreceptors by Fourier Transform Infrared (FTIR) spectroscopy

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Various types of Flavin (FAD or FMN)-binding photoreceptors have been discovered in plants and photosynthetic microorganisms from the 1990 to 2000. They are named cryptochrome, LOV-domain-containing proteins (e.g., phototropin) and BLUF-domain-containing proteins (e.g., photoactivated adenylyl cyclase). They are classified by their structures and photoreactions. The photoreactions of cryptochrome, LOV domain and BLUF domain are reduction of flavin, flavin-cysteine adduct formation and rearrangement of hydrogen-bonding network, respectively. Why are photoreactions different despite the identical pigments? Because flavin is surrounded by amino acid residues in a protein and amino acid residues must lead to specific response. The purpose of my research is to identify components (amino acid residues) which lead to specific responses. Also, another purpose is to reveal structural changes for the signal transduction. Fourier transform infrared (FTIR) spectroscopy is a useful method to investigate how structural changes take place in the chromophore and apoprotein. Especially we focus on the hydrogen-bonding alteration of X-H groups (X=N, O, S), which are difficult to be obtained from the X-ray crystallographic analyses. Here, I will present our FTIR studies of flavin-binding photoreceptors, cryptochromes, LOV domain and BLUF domain as well as photolyase. Photolyase is not a light-signaling protein but is similar as cryptochromes in amino acid alignments and tertiary structures. Photolyase is a DNA repair protein by use of near UV light. Unique protein structural changes obtained by the FTIR analysis will be discussed in relation to their functions.

Biography

Tatsuya Iwata has completed his PhD from Kyoto University, Japan and Post-doctoral studies in Osaka Prefecture University and Nagoya Institute of Technology (NITech) in Japan. He is an Assistant Professor of NITech. He has engaged in the study of proteins which function by light absorption.

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