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Putting a photon to biological work: lessons from novel photoactive yellow protein homologs. WOUTER HOFF, MIWA HARA, JIE REN, MASATO KUMAUCHI, AIHUA XIE, Oklahoma State University, DELMAR LARSEN, TYLER MIX, University of California Davis, SHOJIRO HARAGUCHI, TAKAHITO SHINGAE, MASASHI UNNO, Saga University — The photoactive yellow protein (PYP) is a photosensory protein from the bacterium *Halorhodospira halophila* that has been used extensively as a model system for functional protein dynamics and biological signaling. We have been studying PYP homologs from a diverse set of bacteria. The PYP from *Salinibacter ruber* (Srub PYP) revealed a novel "spectral isotope effect" when the protein is dissolved in D_2O. We were able to assign this effect to H/D exchange of an active side COOH group that forms an ionic hydrogen bond to the deprotonated (negatively charged) light-absorbing chromophore in PYP. Srub PYP also allowed us to measure Raman Optical Activity (ROA) spectra under resonance and pre-resonance conditions. This work revealed that pre-resonance (ROA) spectra are informative for analyzing active site distortions in PYP. Finally, ultrafast pump-probe experiments on three different PYPs revealed that the primary I_0 photoproduct observed in Hhal PYP is not populated in some other PYP homologs. This observation has implications for the mechanism of chromophore photoisomerization at the start of the functional photocycle of PYP. These results illustrate how studies of different members of a protein family can lead to novel insights into basic mechanisms underlying protein function

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