Energy Transfer and Charge Separation in a Hybrid Bio-Conjugate Bacterial Reaction Center

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The photosynthetic Reaction Center (RC) from purple bacterium *Rb Sphaeroides* has unique photoconversion capabilities, ideally useful to build up bio-hybrid devices for solar energy conversion. Covalent functionalization of the bacterial RC with suitable chromophoric antennas is an useful strategy to extend the absorption cross section of the pristine protein into the visible portion of the solar spectrum.[1-3] To this purpose, heptamethyne cyanine dyes were synthesized to acts as a light harvesting antennas in the visible spectral range, leading to a robust increase in ability of energy photoconversion compared to the native system. We have characterized the dynamics of energy and charge transfer in this bio-conjugated RC employing sub-picosecond Visible-Pump/IR-Probe spectroscopy and 2D electronic spectroscopy (2DES). Our results evidence that the artificial antenna is able to efficiently funnel the harvested energy towards the RC chromophores on a <10ps timescale. The timescale of the following charge separation events is similar to the native protein. Furthermore, 2DES measurements show that the short timescale interactions among the RC's pigment are not perturbed in the Bio-Conjugate system.

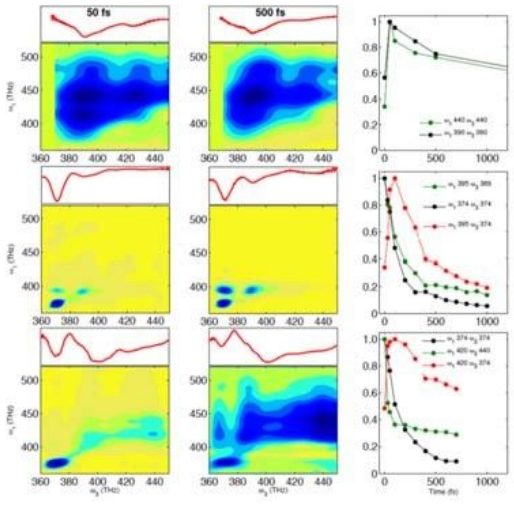

Figure 1: 2DES Spectra of Heptamethyne Cyanine dye (Top Panel); Bacterial RC (Middle Panel) and Bio-Conjugate RC (Bottom Panel)

[1] Milano, F. *et al*, *Angewandte Chemie, Int. Ed.*, **51**, 11019-11023, (2012). [2] Operamolla A. *et al*, *J. Mater. Chem C*, **3**, 6472-6478, (2015); [3] Belviso B.D. *et al*, *RCS Adv*, **57**, 3789-3800, (2016)