Developing novel photonic nanomaterials inspired by photosynthetic biomembranes

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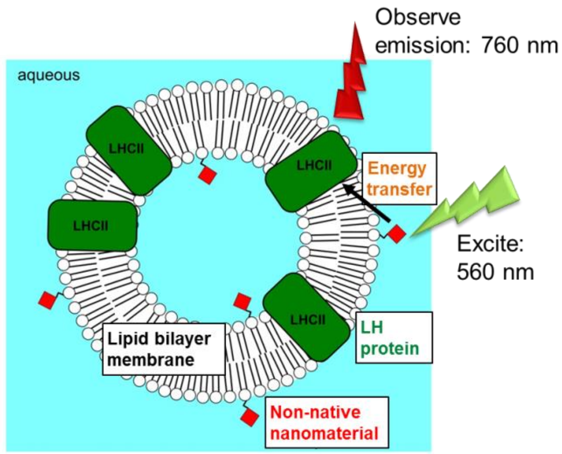
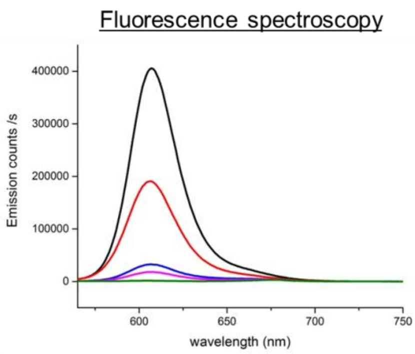
Photosynthesis is essential for life on Earth and a source of great inspiration for the design of new optically-active materials **[1]**. "Light-harvesting" (LH) proteins found in plant chloroplasts absorb photons of light using a network of coordinated pigment molecules (e.g. chlorophylls). Energy absorbed is transferred between LH proteins, which act collectively as a satellite dish for energy trapping with remarkable quantum efficiency **[2]**. Yet, they are inherently limited by lack of stability of proteins and limited wavelength range of light absorbed. Novel systems with enhanced optical properties and greater stability can be designed by interfacing LH proteins with non-natural nanomaterials **[3]**.

This PhD project will investigate the potential for integrating nanomaterials, such as lipid dyes and quantum dots, with photosynthetic systems. LH proteins and lipids will be used as building blocks and combined with a range of nanomaterials to generate modular biomembrane systems with an enhanced absorption range. You will use absorption and fluorescence spectroscopy and graphical analysis to quantify the efficiency of energy transfer, showing the improvement over the protein alone. The micro- and nanoscale organization of such LH systems can be controlled with surface patterning techniques and characterized with atomic force and fluorescence microscopy. Objectives include: (i) proof-of-concept demonstration of a bio/hybrid system with high efficiency energy transfer, (ii) micro-patterning these LH membranes on solid surfaces, (iii) exploring applications for novel chip-based devices. This project is suitable for applicants with an interest in biophysics, biochemistry, or nanoscience. Funded. Contact: **P.G.Adams@Leeds.ac.uk** ASAP.





References

[1] Adams et al. (2015) Diblock copolymer micelles and supported films with noncovalently incorporated chromophores: a modular platform for efficient energy transfer. *Nano Letters* 15: 2422-2428.

[2] Sener et al. (2011) Forster Energy Transfer Theory as reflected in the structures of photosynthetic Light-Harvesting systems. *ChemPhysChem* 12:518-531.

[3] Werwie et al. (2012) Bio serves nano: biological Light-Harvesting Complex as energy donor for semiconductor quantum dots. *Langmuir* 28: 5810-5818.