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Designing a photosystem I-based artificial leaf for production of photoelectricity and solar fuel

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The amount of energy captured in one hour from sunlight that reaches planet earth equals the total amount of energy produced by human population per year. To efficiently convert the effectively inexhaustible solar energy into high energy density solar fuels provides one of the main challenges for mankind faced with dwindling fossil fuel reserves. Natural photosynthesis sustains life on earth as it provides nearly all the oxygen in the atmosphere, the food we consume and fossil fuels that we burn to run our present day economies. Imitating the reactions that occur at the early stages of photosynthesis represents the main challenge in the quest for construction of a viable 'artificial leaf'. In this talk, I will present our recent efforts on construction of the biohybrid solar-to-hydrogen biophotocatalytic cells and dye-sensitized solar cells that employ a highly efficient molecular machine of photosystem I (PSI), serving as light harvesting/charge separating biological module. I will also present our newest promising approach to improve the absorption cross-section of PSI by taking advantage of plasmonic interactions of this complex with silver nanowires in a highly oriented configuration with the use of cytochrome c553 as the bioconjugation cofactor. As absorption of PSI alone is comparatively low, the latter methodology provides an innovative approach to outperform the reported-to-date biohybrid devices used for solar energy conversion.

Biography

Joanna Kargul has completed her PhD in Biological Sciences from the University of Warwick, UK (1999) and in Habilitation from the University of Warsaw, Poland (2009). In 2011, she moved from Imperial College London to Warsaw, Poland to take up a Professorship at the University of Warsaw and to build an independent research group. She holds two Honorary Research Fellowships from Imperial College London and University College London. She is the Senior Managing Editor of the *International Journal of Biochemistry and Cell Biology*.

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