Targeted Project / AY 2026 -2027

Wiring cyanobacteria to anodes for solar foods production

Project Reference: TRG-CHE-JZ26

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Main BBSRC strategic theme: Bioscience for renewable resources and clean growth

Secondary BBSRC strategic theme: Bioscience for sustainable agriculture and food

Project outline:

The ability for photosynthetic biofilms to generate electricity upon light irradiation is not only an intriguing biological phenomenon, but one that offers an exciting prospect for renewable solar energy generation in emerging technologies. In particular, photosynthetic microorganisms such as cyanobacteria can be leveraged in bioelectrochemical devices to generate chemicals, materials and power. However, state-of-the-art bioelectrochemical systems are presently generating much lower outputs than theoretically predicted, and (bio)engineering efforts to boost performance are hindered by the poor understanding of the extracellular electron transfer mechanisms. This project aims to explore new chemical and engineering methodologies to probe and enhance the chemistries taking place at the biofilm-electrode interface, with the aim to collaboratively produce several novel prototype devices.

This project will involve the student learning how to perform microbial electrochemistry, bio-device engineering, and electrode materials design via techniques such as 3D printing. The student will be embedded in an international consortium (linked to a European Innovation Centre Pathfinder project grant, 'SOLARSPOON', where the overall consortium project aims to produce novel off-grid devices for converting solar energy into food ingredients such as proteins and lipids.

This project is highly interdisciplinary and will expose the student to microbiology and bioenergetics, electrochemistry, materials design and engineering, various physical and chemical biology techniques (electrochemistry, microscopy, many types of spectroscopy). Based in the Zhang lab in Chemistry, there will be highly collaborative work with engineers from the Reisner Group at Chemistry; polymer chemists and theoreticians from Technical University of Munich; device engineers from Denmark Technical University; synthetic biologists from Imperial College London; and the company Solar Foods from Finland.

This project sits firmly within the theme of Bioscience for Renewable Resources and Clean Growth.