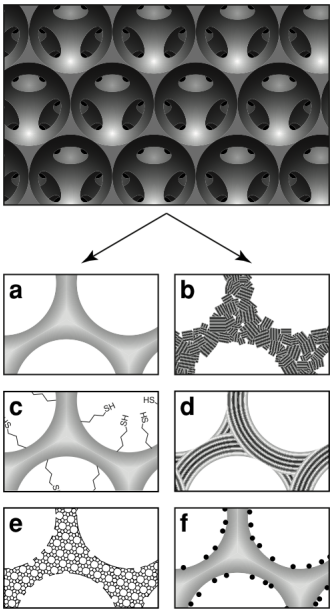
Bio-nano hybrid materials for waste remediation and energy conversion

Drs C.F. Blanford and S.J. Haigh, University of Manchester, School of Materials

In this project you will have the opportunity to work on an innovative project focused on improving global health. You will design and make new bio-nano hybrid materials for applications such as:

- Industrial wastewater remediation, particularly for the transformation of toxic organic compounds like dyes or pesticides into benign products;
- Energy capture from dilute waste streams such as urea or fertiliser in the field run-off; and
- The creation of higher-value chemicals or fuels from agricultural waste materials or feedstock chemicals.

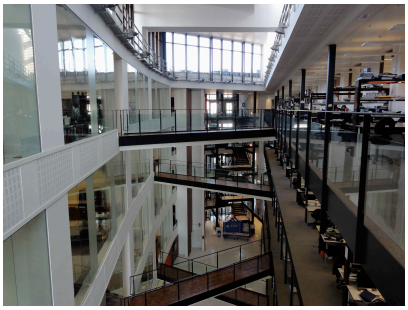
This project builds on the Blanford group's expertise in producing artificial opals — a beautiful class of materials which consists of arrays of uniformly sized, nanosized spheres (illustrated in the upper portion of the cartoon). These can be used as templates to produce both organic and inorganic structures with interconnected pores, the precise chemistry and dimensions of which you will tailor for different reactions (lower portion of the cartoon).



You will then functionalise your 'inverse opal' structures with biological materials, either homogeneous protein catalysts (enzymes) or whole cells. The large voids allow easy flow of solutions and suspensions through the superstructures, which is important for catalytic transformation and cellular communication, while ~10 nm mesopores within the wall structure can support and anchor individual proteins or active nanoparticles. An important part of this project will be to explore the activity of these novel materials for different environmentally relevant reaction pathways and perform iterative investigations to optimise performance.

The candidate for this project must have a 2:1 or first-class degree (or equivalent) in physics, chemistry, biochemistry, engineering or related field, with an interest in porous materials synthesis. Knowledge of solid-state chemistry or protein handling is useful but not required.

The materials synthesis, biology and biochemistry components of this project will be carried out in the Manchester Institute of Biotechnology (MIB), pictured below. The MIB is an interdisciplinary research institute at the University of Manchester designed to promote new collaborations between the physical and life sciences. Characterisation of the nanostructured materials in three dimensions will performed using high resolution optical and electron microscopy. This project will therefore benefit from the new Titan ChemiSTEM transmission electron microscope, which was recently purchased by the School of Materials. Initial work on this project has been funded by the Bill and Melinda Gates Foundation and involves partners at the University of Durham and Imperial College London.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