**University of Leicester**

**BBSRC MIBTP Studentship Project 2024-5 entry.**

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| **Project Reference** |  |

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| **Additional Supervisor** |  |

**Section 2 – *Project Information***

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| **Project Title** | Chemical energy conversion in biology studied using advanced spectroscopic and structural tools |
| **Project Summary**  |
| Redox properties of metal-containing active sites are critically important to many biocatalytic processes: one third of all proteins contain a redox-active metal, and ca 22% of submissions to the Protein Data Bank contain a transition metal. Metalloproteins capable of extracting energy from H2 gas, sequestering CO2 from the atmosphere, or performing complex monooxygenation reactions, rely upon the ability to access and control a range of often exotic metal oxidation states in an aqueous environment. Much of this crucial chemistry occurs at extremely fast rates, making it challenging to study using conventional structural and spectroscopic methods. This project aims to investigate the catalytic mechanisms and structural dynamics of metalloenzymes that are vital for chemical energy conversion, with a focus on hydrogenase. State-of-the-art spectroscopic and structural studies will be combined with computational analysis to reveal critical but elusive transient intermediates by studying reactions in real time on sub-microsecond timescales. The outcomes of this project will provide a step change in our understanding of the mechanism of hydrogenase and other metalloenzymes, and will serve as inspirational catalysts for future green energy technologies A PhD student will gain a broad range of interdisciplinary skills in spectroscopy, electrochemistry, chemical biology, structural biology, and biophysics whilst addressing critical questions about how nature achieves efficient chemical energy conversion. **Techniques that will be undertaken during the project:*** Molecular Biology (cloning & mutagenesis)
* Protein expression and purification
* X-ray Spectroscopy
* Time-resolved spectroscopy (infrared, Raman)
* Synchrotron science
* Chemical synthesis

Enzyme kinetics Protein crystallisation  Structure determination   |

**To apply please refer to**

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