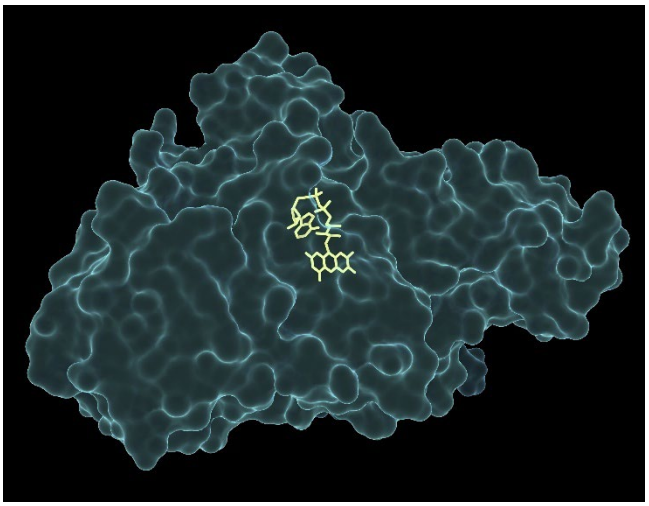
Engineering enzymes for photobiocatalysis

Project ID: 241

Supervisory team

Main supervisor: Dr Guto Rhys (Cardiff University)
Second supervisor: Dr Susannah Coote (University of Bath)
Other supervisors: Dr Fabio Parmeggiani (Cardiff University)

Host institution: Cardiff University



Project description: Photoenzymes found in nature harnesses light to produce energy such as in Photosystem II, or to repair DNA damage using DNA photolyases. These reactions are a sustainable route to create new molecules because photoenzymes operate in an aqueous environment and use light rather than chemicals to power reactions, thereby reducing waste. It is, therefore, not surprising that there is great interest in using photoenzymes to create all the molecules that we need for society, e.g. medicines and agrochemicals. The challenge, however, is that photoenzymes are rare.Recently, impressive developments have been observed in photobiocatalysis research, where scientists are engineering chemical reactions to occur by combining enzymes with light. This can be achieved in many ways including light-induced activation of reactants happening inside or outside of the enzyme. By combining synthetic photocatalysts with proteins we can develop new chemical reactions that go beyond what can be achieved using natural photoenzymes. In this project you will do just that!You will join an interdisciplinary supervisory to create new photobiocatalysis. You will explore synthetic photocatalysts and learn how they can be used to activate reagents. We will then collectively decide on what molecules to target. Armed with this information, you will develop and apply skills in rational and computational protein engineering to produce protein sequences that can control our chosen reaction. You will then test the solubility and stability of your theoretical protein sequences in the lab using recombinant protein expression. Finally you will optimise your enzyme sequence for photobiocatalysis using structurally guided directed evolution.The training offered in this project is highly multidisciplinary, combining molecular synthesis, molecular biology, structural biology, computational biology and enzyme engineering. Therefore, upon completing your degree, you will be highly employable in the growing biotechnological sector. You will be immersed in three research groups (Coote, Parmeggiani and Rhys), enabling you to learn science from broad scientific disciplines.The project is offered full or part time, however some experiments will require working on 2 or 3 consecutive days. We encourage anyone to apply with a good to excellent (e.g. equal to or greater than UK 2:1 or US 3.5 GPA) undergraduate or master's degree in chemistry, biochemistry, or similar training from another degree. We encourage you to apply regardless of age, disability, ethnicity, gender and sexual orientation. We are open to anyone looking to contribute to making the research groups diverse, inclusive and friendly environment.

Our aim as the SWBio DTP is to support students from a range of backgrounds and circumstances. Where needed, we will work with you to take into consideration reasonable project adaptations (for example to support caring responsibilities, disabilities, other significant personal circumstances) as well as flexible working and part-time study requests, to enable greater access to a PhD. All our supervisors support us with this aim, so please feel comfortable in discussing further with the listed PhD project supervisor to see what is feasible.