Establishing Thermus thermophilus as a biotechnology platform for biocatalysis

Supervisory team:
Main supervisor: Dr Guto Rhys (Cardiff University)
Second supervisor: Dr Vicki Gold (University of Exeter)
Dr Mark Young (Cardiff University), Prof Jennifer Littlechild (University of Exeter)

Host institution: Cardiff University

Project description:
Whole-cell biocatalysis offers a sustainable route to the production of modern medicines and materials. One of the barriers to using biocatalytic approaches more generally is the intolerance of enzymes and organisms routinely used in industry to the demanding reaction conditions required, such as high temperature and the use of co-solvents. Therefore, there is a huge potential to expand biocatalysis by adapting more robust enzymes and organisms.
Thermus thermophilus is a thermophilic gram-negative bacteria that has natural competence and an approximate optimal growth temperature of 65 °C. Therefore, it could be a robust host to perform new chemical reactions using engineered thermostable enzymes.

In this project, you will join an interdisciplinary supervisory team to study and develop Thermus thermophilus into a new biosynthetic platform. You will explore the tolerance limits of the organism to organic solvents, pH and temperature, and will uncover the cellular phenotypic and morphological changes that occur at these environmental extremes.

With this information in-hand, you will use recombinant protein expression to explore the production of engineered enzymes in Thermus thermophilus, and seek to produce high-value compounds using whole-cell biocatalysis. The technology developed in this project will provide an equitable solution to the bioproduction of medicines and materials, as the reactions will tolerate hotter ambient temperatures. This avoids the need for expensive cooling systems, and provides a future-proof approach to biocatalysis in the context of an increasing global temperature.
The training offered in this project is highly multidisciplinary, combining molecular biology, structural biology, and enzyme engineering. Therefore, upon completing your degree, you will be highly employable in the growing biotechnological sector. You will be immersed in two research groups (Rhys and Gold), 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 an undergraduate or master's degree in chemistry, biochemistry, or similar training from another degree. The supervisory team provide a supportive environment that cares about the development of their students and staff. 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.