

Design, synthesis, and application of new ligands for Earth abundant metal catalysts

The pharmaceutical industry is committed to reducing both the cost and the environmental impact of its drug discovery and manufacturing operations. The ability to replace catalysts based on precious metals (Pd, Rh, Ir...) with those based on Earth abundant metals (EAMs; e.g., Ni, Co, Fe...) is key to this commitment. However, the ligands optimised for precious metals over decades of research are not necessarily appropriate for EAMs. As a result, their performance in catalysis is often muted, and exciting new reactivity cannot be unlocked. In addition, some of the best ligands available for EAMs currently cost orders of magnitude more than the metal itself, and their synthesis can contribute significantly to the environmental footprint of a process.

In collaboration with AstraZeneca, this PhD will explore new catalytic approaches to chiral phosphine ligands designed specifically for EAMs, and will apply these ligands in novel, complexity-generating reactions.

We will develop a novel method to rapidly construct the chiral phosphines from readily available, stable building blocks. This method must be general (to allow ligand library synthesis), atom efficient (to reduce carbon footprint), and highly scalable (with the potential to one day support drug manufacture). The ligands that we prepare will be bench-marked and optimised against current challenges in asymmetric catalysis before we explore entirely new applications.

The successful applicant will receive high level training in (asymmetric) organic synthesis, transition metal catalysis and ligand design, and compound purification / characterisation (e.g., NMR spectroscopy). You will gain experience of high throughput experimentation and will have the opportunity to further your knowledge of theory / mechanism, and to gain strong transferable skills (e.g., presentations and report writing).

How to Apply

Please make an online application for this project at the following page [How to apply | Study at Bristol | University of Bristol](#).

Funding

The project is fully-funded for four years, starting from Autumn 2026, and offers a 3-month placement at AstraZeneca. Due to funding restrictions the project is only available to UK candidates.

A full studentship will cover UK tuition fees, a training support fee and a stipend (£20,780 p.a. in 2025/26, updated each year) for 4 years.

Candidate Requirements

Applicants must have obtained, or be about to obtain, a First or Upper Second Class UK first degree, or the equivalent qualifications gained outside the UK, in chemistry.

Getting in Contact

Enquiries: For informal enquiries, please email your CV and cover letter to Professor Liam Ball. Please provide the names and e-mail addresses of two referees. Further information about the Ball group's research can be found here:

<https://www.theballgroup.co.uk/>