

Bath Monash Global PhD Programme in Sustainable Chemical Technologies

Project Title:	Multi-detector online monitoring of precision polymerizations
Supervisor at Bath:	Dr Ulrich Hintermair
Supervisor at Monash:	Professor Tanja Junkers (lead)
Home Institution:	Monash University
Indicative period at Host Institution:	12 months with exact dates to be confirmed

Project Summary

Automated chemical synthesis using machine learning algorithms is a rapidly growing field of research. While automation is by definition a chemical engineering task, its development holds high potential also from a synthetic side. With automated, computer controlled protocols at hand, synthesis targets become available that typically would not be approachable in classical synthesis. Especially in conjunction with flow chemistry, unprecedented precision can be reached in (macro) molecular design. At Monash, we recently demonstrated how online-size exclusion chromatography in combination with machine learning can lead to ultra-precise polymer synthesis (see Rubens *et al. Angew. Chem.* **2019**), while concomitantly eliminating largely the human factor from synthesis (resulting in high reproducibility and scalability of the obtained processes). With the extensive online-monitoring facility at Bath University, these endeavors can be brought to a higher level of sophistication. The combined expertise between both institutions should allow for the development of processes that control almost every variable in a polymerization process. Within the proposed PhD thesis, a fully integrated flow process would be established using living/controlled polymerizations to synthesize polymers with extremely high definition. Variables to assess are monomer conversion, molecular weight, dispersity, endgroup chemistry and copolymer composition. This process will then be used to create materials libraries that can be tested either in situ in the Bath facilities, or offline at either institution. Specific synthesis targets include block copolymers, but also more complex macromolecular architectures.

Features of the programme

- PhD researchers will be registered at both institutions and will be awarded a joint PhD degree.
- PhD researchers will be jointly supervised by academics from both Monash and Bath Universities.
- All PhD researchers in the joint programme will also undertake a bespoke advanced training plan covering a range of topics focusing on sustainability.
- Applicants can apply to either Monash University or the University of Bath as their nominated home institution.
- PhD researchers will undertake a period of no less than 12 months at the partner institution.
- Up to four scholarships/studentships will be offered. Additional and suitably qualified applicants who can access a scholarship/studentship from other sources will be also considered. Evidence of funding must be provided.
- The scholarships/studentships include:
 - a *full tuition fee sponsorship* provided by Bath (home or EU students only) or Monash for the course duration (up to a maximum 42 months)

- a *living allowance (stipend)* provided by Monash or Bath Universities. Note: Overseas Student Health Cover (OSHC) must be paid by the student, unless covered by the university.

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How to apply

Please express interest for up to three projects in order of preference. Please submit your application at the Home institution of your preferred project. However, please note that you are applying for a joint PhD programme and applications will be processed as such.

The deadline to submit applications is Sunday 12 May.

Monash University

Expressions of interest (Eoi) can be lodged through <https://forms.gle/XkC1TKpqVQh4B4N1A>. The Eoi should provide the following information:

CV including details of citizenship, full transcripts of academic records, evidence of English language level (IELTS or TOEFL), nominate your host institution (ie Bath or Monash), two referees and contact details, indication of which projects are of interest.

University of Bath

Please submit an application through the following link:

https://samis.bath.ac.uk/urd/sits.urd/run/siw_ipp_lgn.login?process=siw_ipp_app&code1=RDUCH-MO01&code2=0001

Please make sure to mention in the “finance” section of your application that you are applying for funding through the joint Bath/Monash PhD programme for your specified projects.

In the “research interests” section of your application, please name up to three projects you are interested in and rank them in order of preference. Please also include the names of the Bath lead supervisors.