

An Indian-Australian research partnership

Project Title: **Production of Functional Biopolymers under Continuous Flow**

Project Number **IMURA0659**

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Research Academy Themes:

Highlight which of the Academy's Theme(s) this project will address?

(Feel free to nominate more than one. For more information, see www.iitbmonash.org)

1. **Advanced computational engineering, simulation and manufacture**
2. Infrastructure Engineering
3. Clean Energy
4. Water
5. Nanotechnology
6. **Biotechnology and Stem Cell Research**
7. Humanities and Social Sciences

The research problem

Define the problem

Biopolymers such as gelatin, collagen and hyaluronic acid are commonly used as components of hydrogel scaffolds for tissue engineering, and as bio-inks employed in bioprinting. These biopolymers are most commonly required to be functionalised with certain chemical groups in order for them to be crosslinked (either chemically or physically), and thus form a stable hydrogel. Functionalisation is currently only carried out in batch processes, which are inefficient and difficult to control. In contrast, flow chemistry techniques could lead to a drastic reduction in the time required to produce functionalised biopolymers, as well as produce benefits in the control of the functionalisation process itself (for

example, limiting the extent of functionalisation at non-target in the polymer).

Project aims

Define the aims of the project

The aims of the project are

- Development of efficient flow chemistry processes for the functionalisation of biopolymers.
- Use of the functionalised biopolymers to create hydrogels and bio-inks
- Application of the resulting biomaterials in soft tissue engineering (skin).

Expected outcomes

Highlight the expected outcomes of the project

The expected outcomes of the project are

- Development of flow processes for the production of functional biopolymers
- Functionalised biopolymers with which to create biomaterials for tissue engineering and bio-printing
- New hydrogels and bio-inks

How will the project address the Goals of the above Themes?

Describe how the project will address the goals of one or more of the 6 Themes listed above.

Biopolymers are at the core of functional biomaterials used as hydrogels and bio-inks for tissue engineering, regenerative medicine and stem cell research.

Advanced manufacturing is one of the 6 themes and continuous flow synthesis fits well within this theme as it has been projected as the process for the chemical factories of tomorrow.

Capabilities and Degrees Required

List the ideal set of capabilities that a student should have for this project. Feel free to be as specific or as general as you like. These capabilities will be input into the online application form and students who opt for this project will be required to show that they can demonstrate these capabilities.

The candidate should have the right bend of mind to work in this interdisciplinary area wherein both biopolymer as well as continuous flow process skills are required. An ideal candidate will be one with a strong background in (bio)chemistry with some exposure to cell biology or materials science.

Potential Collaborators

Please visit the IITB website www.iitb.ac.in OR Monash Website www.monash.edu to highlight some potential collaborators that would be best suited for the area of research you are intending to float.

N/A

Please provide a few key words relating to this project to make it easier for the students to apply.

Biopolymers, continuous flow synthesis, hydrogels, bio-inks, tissue engineering