

An Indian-Australian research partnership

Project Title: **Smart Nanoparticles for Detection of Vulnerable Atherosclerotic Plaques and their Therapeutic Stabilisation**

Project Number **IMURA0678 (6)**

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IITB Department:

Biosciences & Bioengineering

Research Academy Clusters:

Highlight which of the Academy's CLUSTERS this project will address?

(Please nominate **JUST one**. For more information, see www.iitbmonash.org)

- | | |
|---|---|
| 1 | Material Science/Engineering (including Nano, Metallurgy) |
| 2 | Energy, Green Chem, Chemistry, Catalysis, Reaction Eng |
| 3 | Math, CFD, Modelling, Manufacturing |
| 4 | CSE, IT, Optimisation, Data, Sensors, Systems, Signal Processing, Control |
| 5 | Earth Sciences and Civil Engineering (Geo, Water, Climate) |
| 6 | Bio, Stem Cells, Bio Chem, Pharma, Food |
| 7 | Semi-Conductors, Optics, Photonics, Networks, Telecomm, Power Eng |
| 8 | HSS |

The research problem

Myocardial infarction is the most frequent direct cause of death worldwide. It is typically caused by the rupture of an unstable atherosclerotic plaque which then results in thrombotic occlusion of a coronary artery and consequently loss of myocardial tissue.

Until now there is no reliable technology that would allow the identification of those atherosclerotic plaques that are prone to rupture. As such there is a major need for the development of innovative imaging technologies that can identify the dangerous, rupture-prone atherosclerotic plaque.

For therapeutic plaque stabilisation there is only one major drug class, the statins, available so far. Although there are several therapeutic strategies conceivable, they typically are limited by the fact that they have severe side effects, if applied systemically. Therefore, one of the major challenges to develop therapeutic options for plaque stabilisation is the localised delivery of drugs to the plaque.

Project aims

- 1) To develop smart nanoparticles that are specifically enriched at the vulnerable atherosclerotic plaque for imaging
- 2) To develop smart nanoparticles that are targeted towards vulnerable atherosclerotic plaques and that contain a specific trigger facilitating the release of their drug load.

Expected outcomes

- 1) Generation of nanoparticles that can be used for the identification of vulnerable plaques. Several imaging modalities will be applied, such as ultrasound, magnetic resonance imaging, CT, PET and fluorescence imaging.
- 2) Generation of plaque-stabilising nanoparticles that can be used as smart drug carriers with inbuilt mechanisms of site-specific targeting and triggered drug release.

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

- The project is based on Prof Banerjee's unique expertise and skills to generate smart nanoparticles and Prof Peter's extensive expertise in nanoparticle targeting and the assessment of their biological effects in a newly developed mouse model of plaque instability/rupture (tandem stenosis model). Thereby the focus of the project is very much aligned with the theme of material science/engineering of nanoparticles specifically for medical application.

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.

Masters in Biotechnology or Pharmaceutical Sciences or Biomedical Engg or Chemical Engg or Nanotechnology

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.

Prof Wenlong Cheng

Select up to **(4)** keywords from the Academy's approved keyword list (**available at www.iitbmonash.org**) relating to this project to make it easier for the students to apply.

Nanotechnology, molecular imaging, drug delivery, atherosclerosis