Project Title:	**Agile sensing and imaging platform for bio-marker discovery**
Project Number	**IMURA0958**

Monash MainSupervisor (Name, Email, Phone)	Prof. Raman Singh, Raman.Singh@monash.edu	*Full name,Email*
Monash Co-supervisor(s) (Name, Email, Phone)	Prof. Santosh Panjikar, Santosh.Panjikar@monash.edu, santoshp@ansto.gov.au	
Monash Head of Dept/Centre(Name,Email)	Prof.Chris Davies, Chris.Davies@monash.edu	*Full name, email*
Monash Department:	Department of Mechanical and Aerospace Engineering	
Monash ADGR (Name,Email)	Assoc Prof Timothy Scott, Timothy.Scott@monash.edu	*Full name, email*
IITB Main Supervisor (Name, Email, Phone)	Prof. Siddhartha Duttagupta, sdgupta@ee.iitb.ac.in	*Full name,Email*
IITB Co-supervisor(s) (Name, Email, Phone)	Prof. Ashutosh Kumar, ashutoshk@iitb.ac.in Prasenjit Bhaumik, pbhaumik@iitb.ac.in	*Full name,Email*
IITB Head of Dept (Name, Email, Phone)	Prof.BG Fernandes, bgf@ee.iitb.ac.in +91-22-2576-7400	*Full name, email*
IITB Department:	Electrical Engineering	

Research Clusters: Research Themes:

Highlight which of the Academy's CLUSTERS this project will address? *(Please nominate JUST **one**. For more information, see www.iitbmonash.org)*	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 *Material Science/Engineering (including Nano, Metallurgy)*	*1 Advanced computational engineering, simulation and manufacture*
2 *Energy, Green Chem, Chemistry, Catalysis, Reaction Eng*	2 *Infrastructure Engineering*
3 *Math, CFD, Modelling, Manufacturing*	3 *Clean Energy*
4 *CSE, IT, Optimisation, Data, Sensors, Systems, Signal Processing, Control*	4 *Water*
5 *Earth Sciences and Civil Engineering (Geo, Water, Climate)*	5 *Nanotechnology*
6 ***Bio, Stem Cells, Bio Chem, Pharma, Food***	6 ***Biotechnology and Stem Cell Research***
7 *Semi-Conductors, Optics, Photonics, Networks, Telecomm, Power Eng*	7 *Humanities and social sciences*
8 *HSS, Design, Management*	8 Design

The research problem
The objective is to develop compact, robust, and cost-effective sensing/imaging platform(s) for proteomics and metabolomics applications. The focus area is biomarker discovery for metabolic disease such as diabetes. Diabetes severely impacts upon vision, brain, and kidney, andis also associated with increased risk of viral infections. Specifically, coronavirus strains can alter body glucose metabolism leading to onset of diabetes, and may cause complications in patients with pre-existing diabetic conditions.The primary goal is to designrapid sensing/imaging platforms based on functionalized graphene derivative nano-composites to detect pH, color change and other dynamic attributes exhibited during a specific metabolite-enzyme reaction. The specific challenge lies in enhancing the effectiveness of the biomarker discovery process through use of AI/ML driven algorithms for rapid pattern retrieval and recognition.

Project aims

The principal aims of the project are:

1. Development of functionalized graphene derivative nano-composites.

2. Bio-sensing and imaging tool-box for monitoring metabolite-enzyme reaction attributes.

3. AI/ML driven algorithms for rapid and effective assessment.

What is expected of the student when atIITB and at Monash?

This interdisciplinary project will require and benefit from regular combined supervision at all times. In fact, most of the required facilities are available both at IITB and Monash. However, some specific arrangement is described below:

Both at Monash and IITBombay: Nano-composite characterisation

IITBombay: Bio-sensor design tools, Bio-imaging set-up for benchmarking purpose

Monash: Functionalized graphene-derivativenanocomposite, sensor characterisation.

Expected outcomes

1. Development of sensors for monitoring biomarker attributes
2. Development of algorithms for rapid bio-marker imaging

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

The sensing and imaging capability will address the universal health-care objective related to early discovery of diabetes and related disease/disorders

Potential RPC members from IITB and Monash

IITB: Prof. Virendra Singh (EE), Prof Sanjeeva Srivastava (BSBE)

Monash: Dr.Parama Banerjee

Capabilities and Degrees Required

List the ideal set of capabilities:
Nanomaterials

| Sensors |
| Spectroscopy |

Necessary Courses

| Bio Sensors and Bio MEMS |
| Nano-electronics |
| Nano-electronic materials characterisation |

Potential Collaborators

| Biotechnology companies focused on biomarker discovery, bio-sensing and bio-imaging |

Select up to **(4)** keywords from the Academy's approved keyword list **(available at http://www.iitbmonash.org/becoming-a-research-supervisor/)** relating to this project to make it easier for the students to apply.

| Functional materials, Nanotechnology, Bioscience, Sensors |