IITB-Monash Research Academy

Indian Institute of Technology Bombay | MONASH University

An Indian-Australian research partnership

Project Title:	**Exploring the adhesive property of sickle cell of improved diagnosis**	
Project Number	**IMURA0679 (6)**	
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Research Clusters:

Highlight which of the Academy's CLUSTERS this project will address?
(*Please nominate JUST* ***one.*** *For more information, see www.iXXXXX.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

Define the problem

Sickle cell disease is an inherited blood disorder in which the red blood cells (RBCs) become stiff, sickle-shaped and more adhesive. While there is no cure for the disease yet, early diagnosis can prevent the high rate of child mortality in developing countries. The current two-step diagnosis paradigm of solubility test (screening), followed by hemoglobin electrophoresis or HPLC (confirmation), is not suitable for diagnosis in remote and low-resource areas. This project will study the adhesive properties of RBCs in healthy and sickle cell patients (both trait and disease) using surface acoustic wave (SAW) devices. We

will focus on exploring adhesiveness as a potential diagnostic marker. Furthermore, sickle cell patients suffer from recurrent vaso-occlusive crisis events, resulting from reduced deformability and increased adhesiveness of the RBCs. A systematic characterization of RBC adhesion properties in sickle cell disease will improve our mechanistic understanding of the vaso-occlusion process.

Project aims

Define the aims of the project

1. Development of a SAW-based device to study the adhesiveness of cells.
2. Characterization of the adhesion properties of healthy red blood cells.
3. Characterization of adhesion properties of red blood cells obtained from sickle cell trait and sickle cell disease patients.
4. Exploring the interplay between reduced deformability and increased adhesiveness of sickled RBCs to develop a mechanistic understanding of the vaso-occlusion process.

Expected outcomes

Highlight the expected outcomes of the project

1. The student will develop a SAW-based device for measuring cell adhesion.
2. We expect to establish whether adhesive properties of RBCs can be used as a potential biomarker to distinguish between healthy, sickle cell trait and sickle cell disease individuals.
3. We also expect to have a mechanistic understanding of the interplay of deformability and adhesiveness in the vaso-occlusion phenomenon.

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.

This project is in the area of biotechnology and stem cell research. It deals with development of a physical biomarker for one of the neglected tropical diseases, e.g. sickle cell disease.

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.

1. Demonstrated engineering aptitude, with good problem solving skills
2. Good laboratory skills acquired during a research project
3. The student must pick up both engineering (microfluidics and SAW devices) and biology (biology of the sickle cell disease) concepts and laboratory skills required for the project.

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.

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.

Microfluidics, surface acoustic wave devices, diagnostics, sickle cell disease