IITB-Monash Research Academy

Indian Institute of Technology Bombay | MONASH University

An Indian-Australian research partnership

Project Title:	**Fluorescence Sensing of Nitroaromatics & Explosives**	
Project Number	**IMURA0801**	
Monash Main Supervisor (Name, Email Id, Phone)	Dr David Turner, david.turner@monash.edu	*Full name, Email*
Monash Co-supervisor(s) (Name, Email Id, Phone)		
Monash Head of Dept/Centre (Name,Email)	Prof. Bart Follink, bart.follink@monash.edu	*Full name, email*
Monash Department:	School of Chemistry	
Monash ADGR (Name,Email)	Prof. Peter Betts, peter.betts@monash.edu	*Full name, email*
IITB Main Supervisor (Name, Email Id, Phone)	Prof. M. Ravikanth, ravikanth@chem.iitb.ac.in	*Full name, Email*
IITB Co-supervisor(s) (Name, Email Id, Phone)		*Full name, Email*
IITB Head of Dept (Name, Email, Phone)	Prof. Anindya Datta, adutta@iitb.ac.in	*Full name, email*
IITB Department:	Chemistry	

Research 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, Design, Management*

Research 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*
8	Design

The research problem

Sensing explosive molecules is a challenging task for which the methods used need to be safe and sensitive. In particular the ability to discriminate between molecules that are very chemically similar is a challenge. A particularly sensitive technique is to monitor the presence of explosives using 'host' molecules/materials for which a change in their fluorescent properties is elicited by the presence of a 'guest' species. The main challenge is the design of hosts, for either homogeneous or heterogeneous sensing, that are highly selective for similar analytes.

Project aims

This project will synthesise a variety of new fluorescence detectors for nitroaromatics and explosives. The project will follow a versatile and modular synthetic path to synthesise fluorescent species that have recognition sites for the targeted guests; these will be incorporated into receptors for both solution-phase and solid-state detection. The selectivity preferences of these receptors will be explored by studying the fluorescence emission properties of the hosts. The project aims to understand the selectivity of these new host species, in turn informing the design of the next generation of materials in an iterative manner. The project will make fundamental advances in the ability to discriminate between closely related analytes and aims to improve on existing technologies for the detection of explosives.

Expected outcomes

The expected outcomes from this project are:

- A new family (or families) of solution-phase fluorescence receptors for nitroaromatic and explosive analytes.
- A new family (or families) of solid-state fluorescence receptors (i.e. metal-organic frameworks) for nitroaromatic and explosive analytes.
- Improvements upon existing technologies for the trace detection of explosives.

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

The project falls within the scope of the 'nanotechnology' theme. The outcomes of the project will be molecular devices or materials that are able to selectively detect explosive analytes at the ppm level.

Capabilities and Degrees Required

The project will involve a significant amount of synthesis (organic and coordination chemistry) and analysis of host-guest binding by study of fluorescence properties.

A student who choses this project should have:

- Excellent BS (Four Years) or M.Sc in Chemistry.
- A demonstrable background in synthesis and/or spectroscopy.
- A desire to work on a cross-disciplinary project (synthesis, photophysics and material properties).

Potential Collaborators

Dr Toby Bell (Monash)

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.

Novel Functional Materials
Materials Chemistry/Science
Sensor and Sensor Networks