# LKCMedicine PhD Research Project Submission Form

## Research Theme (Please indicate as appropriate)

| ☐ | Dermatology & Skin Biology |
| ☐ | Health Systems & Population Health |
| ☒ | Infection & Immunity |
| ☐ | Metabolic Disorders |
| ☐ | Neuroscience & Mental Health |
| ☐ | Medical Education |
| ☒ | Family Medicine & Primary Care |

| ☐ | Others (Please specify): |
| ☐ | Neurology & Mental Health |

## Research Project Title:

Cell invasion and mucosal immunity

## Project Description:

Animals are host to a large number of microorganisms, and there is extensive interaction between host and the microbiota at mucosal epithelia. Mucosal immunity allows an appropriate balance to be struck, thus enabling survival of beneficial bacteria while preventing excessive host inflammatory response. This project investigates the function of an unusual cell type in mucosal immunity. These are the club cells. Aside from morphological characterization in fixed samples – club cells are giant cells with very few organelles - and the observation that there is an increase in size when bacteria numbers increase or when the epithelium is under stress, very little data on their function is available. We have recently found that club cells in the zebrafish skin are subject to invasion by motile cells, leading to transport mucus and bacteria from the surface into the cytoplasm of club cells. In this project, the student will characterize the mechanism of entry and investigate the function of club cells. One hypothesis is that club cells function at the interface of the innate and adaptive immune system. The student will use a combination of live imaging, single cell transcriptome analysis and genetic manipulation to test this hypothesis, and to develop additional hypotheses. Experiments will be carried out using the gill and skin. This project is expected to provide new insight into the mechanisms underlying homeostasis between host and bacteria at mucosal epithelia, with potential impact on understanding diseases where this balance is lost.
**Brief summary of main Methodologies and/or Techniques to be learned during the proposed PhD (experimental or analytical):**

Molecular biology, fluorescence microscopy, genetic manipulation of zebrafish.

**Keywords:** innate immunity, emperipolesis, macrophage, neutrophil, club cell, zebrafish.

**Supervisor(s)**

**Primary Supervisor**

Name of Supervisor: Suresh Jesuthasan  
Designation: Assoc. Prof. of Behavioural Neuroscience  
Email: sureshj@ntu.edu.sg

**Co-Supervisor (need not be determined at this time)**

Name of Supervisor: Maggie Dallman  
Designation: Professor  
Email: m.dallman@imperial.ac.uk

**Main Location of Research Work (Please indicate as appropriate)**

☒ LKCMedicine Experimental Medicine Building @ Yunnan Campus  
☐ LKCMedicine Clinical Sciences Building @ Novena Campus  
Others (Please specify): Imperial College, London.

**Other Information**

1. Does the proposal need IRB’s approval? ☒ Yes ☐ No  
If “Yes”, is the IRB’s approval in place? ☒ Yes ☐ No

2. Does the project involve contact with patients? ☐ Yes ☒ No

3. Does the project involve contact with animals ☒ Yes ☐ No  
If “Yes”, is the NTU-Institutional Animal Care and Use Committee approval in place? ☒ Yes ☐ No

4. Is there a potential for overseas academic exchange as part of this research project? ☒ Yes ☐ No  
If “Yes”, please specify: This is a joint project with Imperial College, London.