**LKCMedicine PhD Research Project Submission Form**

**Research Theme** (Please indicate as appropriate)

- [ ] Dermatology & Skin Biology
- [ ] Health Systems & Population Health
- [ ] Metabolic Disorders
- [x] Medical Education
- [ ] Family Medicine & Primary Care
- [ ] Infection & Immunity
- [ ] Neuroscience & Mental Health
- [x] Others (Please specify): Developmental Biology

**Research Project Title:**

Solving the BMP morphogen gradient dynamics during tissue patterning

**Project Description:**

Embryonic axes are established during gastrulation through the action of morphogens. These specify cell fates along each axis yet how they are established, fine-tuned and interpreted in 3 dimensional space is unclear, as current modelling cannot account for observed measurements. One of the most important families of morphogens is the BMPs, which specify the dorsal-ventral axis during gastrulation.

Due to its importance and potency during patterning, the BMP morphogens are balanced by counteracting inhibitory morphogens. There has been little comparative analysis of the dynamics of these opposing system and their read-outs over time.

Funded from a multi-lab MOE Tier 3 grant, this studentship will require interaction with others in the lab and other labs in Singapore, including imaging and computational groups. The project will use advanced zebrafish genetic manipulation to fluorescently tag morphogens and image their diffusion in space and time, with the aim of accurately establishing the parameters of morphogen diffusion and patterning.

**Brief summary of main Methodologies and/or Techniques to be learned during the proposed PhD (experimental or analytical):**

The project will employ zebrafish embryology and genetic manipulation including BAC recombineering and CRISPR/Cas9 based recombination, followed by light-sheet imaging and modelling.

**Keywords:**

Morphogen, BMP, zebrafish, Computational modelling
**Supervisor(s)**

**Primary Supervisor**

<table>
<thead>
<tr>
<th>Name of Supervisor:</th>
<th>Tom Carney</th>
</tr>
</thead>
<tbody>
<tr>
<td>Designation:</td>
<td>Assistant Professor</td>
</tr>
<tr>
<td>Email:</td>
<td><a href="mailto:tcarney@ntu.edu.sg">tcarney@ntu.edu.sg</a></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Name of Supervisor:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Designation:</td>
<td></td>
</tr>
<tr>
<td>Email:</td>
<td></td>
</tr>
</tbody>
</table>

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

- [x] LKCMedicine Experimental Medicine Building @ Yunnan Campus
- [ ] LKCMedicine Clinical Sciences Building @ Novena Campus
- Others (Please specify):  

**Other Information**

1. Does the proposal need IRB’s approval? [ ] Yes [x] No
   - If “Yes”, is the IRB’s approval in place? [ ] Yes [ ] No
2. Does the project involve contact with patients? [ ] Yes [x] No
3. Is there a potential for overseas academic exchange as part of this research project? [ ] Yes [x] No
   - If “Yes”, please specify:  NA