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

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

**Research Project Title:**

Human Umbilical Cord-Lining Derived Induced Pluripotent Stem Cells (CLIPS) as a Universal Source of Cells for Regenerative Therapy for Neurosensory Disorders

**Project Description:**

Neurological and Sense Disorders (NSDs) exact a huge socio-economic impact globally particularly in countries with rapidly aging populations like Singapore. Current treatments for NSDs are largely symptomatic, which offer little prospects for improving prognosis for these diseases. Given that NSDs are characterized principally by the loss of selected cellular populations, cell-based therapies represent an intuitive therapeutic approach. However, a major obstacle is the issue of immune compatibility, which concerns all types of donor cells including induced pluripotent stem cells (iPS). What we need is a source of iPS that is hypo-immunogenic that can serve as universal donor cells for cell therapy.

Given that the maternal-fetal interface are widely considered to be immunoprivileged, we hypothesize that umbilical cord lining-derived iPS are endowed with immunoprivilege properties and could serve as an ideal source of cells for regenerative medicine. Accordingly, the objective of this proposal is to develop a safe, stable and renewable source of hypo-immunogenic iPS from human umbilical cord lining cells and demonstrate that their utility for allogeneic transplantation in two important models of NSDs: Parkinson’s disease (PD) and Adult Macular Degeneration (AMD), which are recognized by the Neurosensory Taskforce as diseases of national priority. The development of such an ideal cell source will be of huge impact and will represent a game changer to regenerative medicine. ([https://www.straitstimes.com/singapore/health/creating-new-nerve-cells-to-treat-parkinsons](https://www.straitstimes.com/singapore/health/creating-new-nerve-cells-to-treat-parkinsons))
<table>
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<tr>
<th>Brief summary of main Methodologies and/or Techniques to be learned during the proposed PhD (experimental or analytical):</th>
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<tr>
<td>We will develop a safe, stable and renewable source of hypo-immunogenic iPS from human umbilical cord lining cells (designated CLiPS) that is suitable for use as universal donor cells for allogeneic transplantation. By using our established rodent and non-human primate models of PD and AMD, we will transplant CLiPS-derived neural progenitors into these animals to provide preclinical validation of their therapeutic potential. By means of transcriptomic and epigenomic analyses, we also aim to elucidate the mechanism underlying the hypo-immunogenicity of CLiPS. Finally, we will establish a pipeline to manufacture clinical grade (cGMP-compliant) cord lining iPS that will be ready for human trials.</td>
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<td>Techniques to be learnt include stem cell culture and biology, differentiation of iPS cells into neuronal progenitors and neurons, electrophysiology, immunocytochemistry and immunohistochemistry, confocal microscopy, and animal work (disease modelling, transplantation, behavioural analysis) etc.</td>
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<tr>
<td><strong>Keywords:</strong></td>
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<td>Parkinson’s disease, induced pluripotent stem cells, cell-based therapy, neurorestoration.</td>
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### Supervisor(s)

#### Primary Supervisor

<table>
<thead>
<tr>
<th>Name of Supervisor:</th>
<th>Lim Kah Leong</th>
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</thead>
<tbody>
<tr>
<td>Designation:</td>
<td>Professor and Vice Dean (Research)</td>
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<td>Email:</td>
<td><a href="mailto:Kahleong.lim@ntu.edu.sg">Kahleong.lim@ntu.edu.sg</a></td>
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#### Co-Supervisor *(need not be determined at this time)*

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<th>Name of Supervisor:</th>
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<td>Designation:</td>
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<td>Email:</td>
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### Main Location of Research Work *(Please indicate as appropriate)*

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

### Other Information

1. Does the proposal need IRB’s approval?  
   - [x] Yes  
   - [ ] No

   If “Yes”, is the IRB’s approval in place?  
   - [ ] Yes  
   - [x] No

2. Does the project involve contact with patients?  
   - [ ] Yes  
   - [x] No

3. Does the project involve contact with animals  
   - [x] Yes  
   - [ ] No

   If “Yes”, is the NTU-Institutional Animal Care and Use Committee approval in place?  
   - [ ] Yes  
   - [x] No

4. Is there a potential for overseas academic exchange as part of this research project?  
   - [x] Yes  
   - [ ] No

   If “Yes”, please specify:  
   - Japan – Kyoto University *(Centre for iPS Cell Research and Application)*

Note: In the process of obtaining IRB and IACUC approval from NTU