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

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

**Research Project Title:**

Memory impairment, network dysfunction and sleep following traumatic brain injury

**Project Description:**

Memory dysfunction is a common after traumatic brain injury (TBI). We have shown that they are associated with a functional disconnection between the medial temporal lobe and the default mode network (DMN) (Di Simone Brain 2016). These cognitive and physiological abnormalities persist for reasons that are unclear. Sleep potentially influences recovery from TBI. It is important for memory consolidation and is often disrupted after TBI. However, there is a limited understanding of how sleep is related to cognition after TBI. In other contexts, sleep disturbance is associated with alterations of DMN function and we have previously shown that subjective reports of sleep disturbance are associated with DMN abnormalities. Therefore, sleep disturbance may contribute to post-traumatic memory impairment through an effect on DMN function.

This project will investigate this hypothesis, by testing whether memory function after TBI is correlated with the disruption of normal sleep architecture and whether this is associated with abnormal interactions between the medial temporal lobe and the DMN. The work will integrate with studies planned in LKC by Dr Chan Lai Gwen and link into on-going work in Prof. Sharp’s lab. Thirty patients and thirty controls with a range of memory function be recruited in the chronic phase after injury at LKC. Sleep architecture will be studied objectively using polysomnography, wrist actigraphy and urinary melatonin. The structure and function of large-scale memory networks will be investigated using magnetic resonance imaging (MRI).

In collaboration with Prof. Zetterberg we will also investigate blood biomarkers including neurofilament light to test whether sleep disturbance is associated with evidence of persistent brain injury and neurodegeneration. Clarifying the links between sleep and cognitive function after TBI has large potential translational value, as treating sleep disturbance is an attractive target for improving persistent cognitive impairment and potentially limiting long-term neurodegenerative consequences of injury.

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

**Keywords:**
### Supervisor(s)

**Primary Supervisor**
- **Name of Supervisor:** Balazs Gulyas
- **Designation:** Professor
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**Co-Supervisor (need not be determined at this time)**
- **Name of Supervisor:** David Sharp
- **Designation:** Professor, Imperial College London
- **Email:** david.sharp@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. Is there a potential for overseas academic exchange as part of this research project?  
   - [ ] Yes  
   - [ ] No

   If “Yes”, please specify: NA