3D Cardiac Motion in Experimental Models of Pulmonary Arterial Hypertension –Modelling MRI Data by an Artificial Intelligence Approach

Right ventricular (RV) function is an independent predictor of survival in a broad variety of cardiopulmonary diseases including pulmonary arterial hypertension (PAH). Cardiac magnetic resonance imaging (CMR) has been recommended as the gold standard for RV assessment in clinic, e.g. RV mass, volume and function. However, manual cardiac segmentation from CMR images is challenging and poorly reproducible due to the complex morphology and geometry of the RV. Our clinical team is developing Artificial Intelligence (AI) techniques for the prediction of PAH patient survival and investigating how common and rare genetic variants influence right heart physiology. In parallel, this PhD project proposes to build up the AI tools to generate three-dimensional (3D) motion models of the hearts of pulmonary hypertension rodent models. Building on our initial machine training using 2D cine CMR data: 1) we will acquire high-resolution 3D and 2D cine CMR images to follow the PAH disease progression in the monocrotaline (MCT) and Sugen-hypoxia (SuHx) rats. Manual annotations will be performed for training a deep learning model for automated segmentation of rat hearts and for creating a 3D high-resolution atlas; 2) we will represent rat-specific cardiac motion on the atlas to determine regional and temporal heart function; 3) we plan to use the models to follow and understand the genetic modifiers of adaptation (e.g. BMPR2) and detect the effects of interventions (e.g. metabolic modulator) on RV remodelling; 4) lastly, we will use this pipeline to validate discoveries made using a parallel computational framework in large human populations that include UK Biobank.

Funding is for three years with £18,000 bursary per year and home/EU tuition fees.

Candidates must have a first class or upper second-class Honours degree (or overseas equivalent) in a relevant subject area. A Master's Degree is desirable but not essential. Applicants must also meet Imperial College's English language requirements – further details can be found at http://www3.imperial.ac.uk/registry/admissions/pgenglish

To apply, please send your CV (with contact details of 2 academic referees), and a research statement (max. 1.5 pages) describing why you are suitable for this PhD studentship to Candy White candy.white@imperial.ac.uk by Wednesday 12 June 2019. Informal inquiries can be sent to Professor Lan Zhao l.zhao@imperial.ac.uk or Dr Wenjia Bai w.bai@imperial.ac.uk

Closing Date 12 June 2019