

PhD Position:**Developing arterial spin labelling MRI for non-invasive measurement of blood flow in human heart**

Tissue blood flow is a key indicator of metabolic activity, alteration of which is often associated with disease states. Arterial Spin Labelling (ASL) Magnetic Resonance Imaging (MRI) is a high precision technique for the measurement of blood flow, with wide applications in the brain [1]. However its application in the heart is of limited success due to the presence of cardiac and respiratory motion. In addition, the fact that the blood flow signal is less than 2% of static tissue signal demands that the implementation of the technique seeks to preserve maximal blood flow signal while minimising background tissue contamination [2].

This project aims to adapt, compare and improve current ASL techniques for the measurement of myocardial blood flow. The work on the project will include implementation of two different ASL techniques, phantom validation, healthy subject validation, analysis of acquired data and a small scale pilot application in a patient population. The successful applicant will incorporate cardiac and respiratory trigger into the ASL sequence, simulate and optimise the sequence components (including gradient modulated adiabatic RF pulses) accounting for high field inhomogeneity in the heart and implement the sequence to meet industrial standard. The successful candidate will further investigate dynamic physiological recording, where the cardiac and respiratory motions are monitored and dynamically fed back to the scanner to adjust scan parameters on the fly. At the end of the PhD, the applicant is expected to have a strong understanding of MR physics, sequence development meeting industrial standard, simulation and optimisation methods, physiological monitoring and its interfacing with the MRI scanner and from bench to bed translational physics.

This work will be conducted on the state-of-the-art 3T whole body MR scanner (Philips Medical Systems) situated at the Aberdeen Biomedical Imaging Centre (ABIC). Methodology development will be carried out using the Philips Pulse Programming Environment (PPE), and the data analysis will be performed in Matlab and SPSS. Aberdeen has a long tradition of methodology development for biomedical applications, where a culture of strong interaction between multidisciplinary scientists and clinicians stimulates scientific progression. The successful applicant will join a rapidly expanding cardiovascular MR research team, which includes physicists, cardiologists and radiologists.

1. He J, Hollingsworth KG, Newton JL, Blamire AM. Cerebral vascular control is associated with skeletal muscle pH in chronic fatigue syndrome patients both at rest and during dynamic stimulation. *NeuroImage: Clinical*. Elsevier; 2013;2:168–173.
2. He J, Blamire AM. Application of variable-rate selective excitation pulses for spin labeling in perfusion MRI. *Magn Reson Med*. 2010 Mar;63(3):842–847.

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The Centre for Doctoral Training in Integrated Magnetic Resonance is a collaboration between researchers at the Universities of Warwick, St Andrews, Dundee, Southampton, Aberdeen and Nottingham.