Title of PhD project	**MRI tractomics of glial brain tumours**	
Supervisor	Professor Franklyn Howe	SGUL
Co-Supervisor	Dr Thomas Barrick	SGUL
Co-Supervisor	Dr Philip Benjamin	SGUL
Brief description of project	This is an exciting opportunity to join a translational MRI research group that is developing quantitative biomarkers to aid diagnosis and prognosis for a wide range of brain pathologies. In this neuroimaging project the aim is to develop better methods of predicting the future growth of glial brain tumours. Glial tumours are a major challenge to diagnose and treat due to their genetic variability and infiltrative growth patterns that are not accurately defined with routine clinical MRI. This project will investigate the infiltration of tumours into surrounding white matter using a new diffusion MRI technique – Quasi-Diffusion Imaging (QDI). QDI has been developed at St George's to maximally utilise 3T MRI technology and heavily diffusion weighted scans, and has high sensitivity to detect pathological damage. QDI will be used to detect white matter tracts within and around the tumour, and develop a tractomic characterisation of damage and infiltration. Machine learning methods will be used to relate this complex data to the patient's future outcome and develop prognostic biomarkers. You will join an MR research team of physicists, mathematicians and computer scientists who collaborate with neurosurgeons and neuroradiologists. You will have a physics and mathematics background, with computer skills and a strong desire to develop new technology into practical clinical tools, that aid the neuro-onocological team provide better treatment for brain tumour patients.	
Skills we expect a student to develop/acquire whilst pursuing this project	Understanding of the physics of MRI and development of programming skills in Matlab, Unix and specialist image processing software for brain tumour image analysis.	

	Basic understanding of brain tumour biology, radiological and pathological diagnostic methods, treatments and patient outcomes. An understanding of pattern recognition and image processing methods and their application to neuroimaging data. Application of statistical methods to evaluate novel MRI data classification algorithms and how to develop image-processing pipelines for MRI data. How to interact effectively within a multi-disciplinary team of clinical, biomedical and computer science experts. Understand and comply with ethical and information governance regulations of patient data. Develop skills to effectively present complex image analysis methodology to general scientific and clinical audiences and presentation of results and preparation of papers for expert peer review
Particular prior educational requirements for a student undertaking this project	Minimum 2:1 honours BSc in a scientific discipline with a strong physics and mathematics components: physics, mathematics, engineering, computer science etc. Ideally with an MSc or other research/industry experience that incorporated medical imaging or machine learning as appropriate for the project.
Project key words	Magnetic resonance imaging (MRI) Brain tumour Machine learning Quasi-Diffusion Imaging (QDI)
Possible under 1+4 route? Master's options identified.	No
MRC Core Skills developed through this project	Quantitative skills Interdisciplinary skills
MRC LID themes	Translational and Implementation Research
Further reading	Quasi-diffusion magnetic resonance imaging (QDI): A fast, high b-value diffusion imaging technique Tractography and the connectome in neurosurgical treatment of gliomas: the premise, the progress, and the potential Modern Brain Tumor Imaging The DTI Challenge: Toward Standardized Evaluation of Diffusion Tensor Imaging Tractography for Neurosurgery