**PhD Project Title:** Feto-placental flow modelling from detailed vascular structural image analysis

**Project Supervisors:** Dr E Johnstone, Dr P Brownbill (Institute of Human Development), Prof OE Jensen (School of Mathematics)

**Eligibility:** European/UK Students Only

**Application Deadline:** 26 November 2014

**Project outline:**
Exchange of oxygen and nutrient between mother and fetus occurs within the placenta where maternal blood bathes placental villi, tree-like structures containing fetal capillaries. Abnormalities of placental villi are linked to pregnancy disease and alterations in fetoplacental blood flow may adversely affect fetal growth and development. We have used microCT technology to provide a unique detailed structural image of the fetoplacental vasculature. Mathematical, statistical and computational approaches are now needed to characterise the vessel network structure to assess the relationship between placental structure and blood flow efficiency at the whole-organ level. In this project, multi-scale mathematical models of the fetoplacental circulation will be developed involving (a) statistical characterisation of fetal network structure, (b) network flow simulations within individual villous branches and (c) upscaling techniques to facilitate simulations of the coupled fetal and maternal circulations. Models will be assessed against placentas from normal or abnormal pregnancies, using ex vivo perfusion analysis to determine areas of active feto-maternal exchange.

The successful candidate will be expected to have a strong background in applied mathematics, with a Bachelor’s degree in a relevant subject of at least upper second class standard; a masters-level qualification is preferred. The candidate will be trained during the project in microCT image analysis techniques, placental vascular casting and perfusion experiments. In addition to undertaking mathematical and computational modelling, this will equip them with an excellent understanding of the underlying physiology and an appreciation of the challenges of data analysis and interpretation. They will gain direct experience of computational biology and interpretation of large datasets.

This 4-year full-time studentship is a PhD opportunity within the MRC Doctoral Training Partnership (MRC DTP) scheme at the University of Manchester. Funding provides full support for tuition fees, annual tax-free stipend at Research Council UK rates (currently £13,863 per annum) and conference/travel allowance. The project is due to commence October 2015 and is open to UK/EU nationals only due to the nature of the funding.

**Informal enquiries** may be addressed to Oliver.Jensen@manchester.ac.uk

Please direct applications in the following format to Dr Ed Johnstone (edward.johnstone@manchester.ac.uk):

- Academic CV
- Official academic transcripts
- Contact details for two suitable referees
- A personal statement (750 words maximum) outlining your suitability for the study, what you hope to achieve from the PhD and your research experience to date.

Any enquiries relating to the project and/or suitability should be directed to Dr Johnstone. Applications are invited up to and including 26 November 2014.

Further details on the MRC DTP scheme and the shortlisting/interview process can be found at www.mhs.manchester.ac.uk/mrcdtp

**References:**