



Modelling of fibroblast-matrix mechanobiology

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We are seeking applications from motivated mathematics, science or engineering graduates with strong mathematical/computational modelling skills interested in studying for a Ph.D. in an exciting interdisciplinary environment.

Mechanobiology relates to the interaction between biology and mechanics. It plays a central role in tissue homeostasis, development and disease. Computational models of mechanobiology have the potential to provide fundamental insight into disease processes and guide clinical decisions, e.g. *'should we treat, and, if so, how do we optimise treatment?'* However, whilst continuum models of solid and fluid mechanics have become increasingly sophisticated, detailed modelling of the underlying biology is lacking. Consequently, the insight such models can provide and their potential application remains limited.

The mechanical properties of the biological tissue change during disease. The influence this has on cell mechanobiology, tissue maintenance and thus disease evolution remains to be understood. The aim of this project is to develop a novel a chemo-mechano-biological mathematical model of a fibroblast and its interaction with the extra-cellular-matrix. The model will describe the nonlinear mechanics of a fibroblast, its protein expressions and relate how it configures (populations of) collagen fibres to the matrix to: the structural integrity of its cytoskeleton; integrin attachments; its mechanical environment. The mathematical modelling will be underpinned by in vitro experiments which characterize: how the biaxial cyclic deformation environment of human fibroblasts influences their morphology and protein expressions; the traction forces fibroblasts exert on the ECM.

This project will be supervised by Dr Paul Watton (Lecturer in the Department of Computer Science) and external supervisors (Prof Ray Ogden FRS and Dr Huabing Yin) at the University of Glasgow. The student will belong to a newly funded multi-institutional £2.5 EPSRC Centre on Soft-Tissue Mechanics (Glasgow, Sheffield, Heriot-Watt, St Andrews) (www.softmech.org) which will provide an active and stimulating environment and be a member of the Insigneo Institute of *in silico* Medicine (www.insigneo.org) and the theoretical mechanobiology group (www.themebio.org).

The internally funded studentship, (which is available to start from April 2016), will include full payment of fees at the UK/EU level, along with a stipend of £14057 per annum. International students are eligible to apply, however will have to pay the difference between home rate and international fees.

The successful candidate will be expected to have a good 2:1 or 1st class degree in Mathematics, Engineering or Science subject with evidence of sound mathematical and programming skills and an interest in modelling biology. Previous experience in mathematical modelling, continuum mechanics and the finite element method preferred.

For an informal discussion on the project please email Dr. Paul Watton: P.Watton@sheffield.ac.uk To apply, please use our [standard on-line PhD application form](#) together with your CV and two references, and indicate on your form that you are replying to this advert. Deadline: 1st June 2016