2014 YCCSA SUMMER SCHOLARSHIP PROJECT SUBMISSION

This form is for prospective project supervisors to submit their projects to be included in the YCCSA Summer Scholarships Programme for 2014.

It is the purpose of the Summer School that any projects submitted are interdisciplinary in nature.

Date	*6/1/14*
Main Supervisor's Name	*Prof Martin Bees*
Main Supervisor's Department	*Mathematics*
Co-supervisors' name(s) and Departments	*Dr Mark Coles, Biology*
Project Title	*Multiscale mechanical models of wound healing*
Project Description	*The skin of mammals provides an essential barrier to infection. When the skin is cut or broken the body reacts by inducing inflammation, new tissue formation and structural remodelling. The processes are governed by a complex network of signal molecules. Unbalanced systems can lead to impaired or non-functional healing, with associated risk of infection and further complications, with a significant and ongoing healthcare burden.* *Efficacious and timely wound healing is due to a subtle balance between mechanical and biochemical factors. However, the underlying coupling of tissue contraction and cell migration and proliferation are not well-understood. Mathematical models aim to provide a means to unravel these key mechanisms by exploring coupling and testing hypotheses. There has been much recent development of mathematical descriptions dealing with particular aspects of the wound healing process, but comparisons between theoretical and experimental studies have mainly been qualitative, limited by the mathematical approaches employed. Recently Martin Bees (Mathematics) and Mark Coles (Biology) have set up a collaboration, jointly supervising a PhD student, to develop theoretical and in vivo experimental techniques in tandem, to provide testable and useful descriptions of the wound healing process.* *The project student will work on developing and analysing spatial models of wound healing under the supervision of Martin Bees in mathematics, guided by Mark Coles in Biology. In particular, the student will work closely with the supervisors and other members of the group to explore the coupling between mechanical aspects, such as tissue stress, and migration and propagation leading to epithelialisation of the wound surface.*

Required skills	*The student should have a good background in mathematical modelling and analysis, using ordinary and partial differential equations, with preference given to a mathematician or physicist. Some experience with Matlab would be useful but not essential.*
Project dates	*10 weeks, including the majority of the YCCSA summer school period starting Monday, 14 July 2014 and finishing Friday, 12 September 2014.*
Other information	*Anything that doesn't easily fit above.*
References	*E. A. Gaffney, K. Pugh, P. K. Maini, and F. Arnold, "Investigating a simple model of cutaneous wound healing angiogenesis," Journal of mathematical biology, vol. 45, pp. 337–374, 2002.* *S. Maggelakis, "A mathematical model of tissue replacement during epidermal wound healing," Applied Mathematical Modelling, vol. 27, no. 3, pp. 189–196, Mar. 2003.* *K. E. Murphy, C. L. Hall, P. K. Maini, S. W. McCue, and D. L. S. McElwain, "A fibrocontractive mechanochemical model of dermal wound closure incorporating realistic growth factor kinetics.," Bulletin of mathematical biology, vol. 74, no. 5, pp. 1143–70, May 2012.* *H. J. Wearing and J. A Sherratt, "Keratinocyte growth factor signalling: a mathematical model of dermal-epidermal interaction in epidermal wound healing.," Mathematical biosciences, vol. 165, no. 1, pp. 41–62, May 2000.*

When complete, please email the form to sarah.christmas@york.ac.uk