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Philip K. Maini is a Professor at the Centre for Mathematical Biology, Mathematical Institute at the University of Oxford. He co-authored a Bellman Prize winning paper (1997), was awarded a Royal Society Leverhulme Trust Senior Research Fellowship for 2001-2 and a Royal Society-Wolfson Research Merit Award (2006-11). In 2009 he was awarded the LMS Naylor Prize and Lectureship. His present research projects include the modelling of avascular and vascular tumours, normal and abnormal wound healing, and a number of applications of mathematical modelling in pattern formation in early development, as well as the theoretical analysis of the mathematical models that arise in all these applications.

Modelling collective cell movement in biology

Abstract
Collective cell movement occurs in many areas of biology, both in normal circumstances and in disease. Here, we review some recent work in three different areas - acid-mediated cancer cell migration, cranial neural crest cell migration, and epithelial cell movement. These applications lead to three different mathematical frameworks, namely, a coupled system of nonlinear partial differential equations, a hybrid model combining a partial differential equation with an off-lattice individual-based model, and an individual-based model for epithelial sheets. We show that the results are consistent with experimental observations as well as predicting new, and subsequently validated, biological phenomena and that mathematically, these models reduce to nonlinear transport equations with the macroscopic tissue level diffusion coefficient incorporating the microscopic cell level behaviour.