

## **Connecting coarse- and fine-grained reaction-diffusion models.**

### Abstract:

Spatial reaction-diffusion models have been employed to describe many emergent phenomena in biological systems. The modelling technique for reaction-diffusion systems that has predominated due to its analytical tractability and ease of simulation has been the use of partial differential equations (PDEs). However, due to recent advances in computational power, the simulation, and therefore postulation, of computationally intensive individual-based models has become a popular way to investigate the effects of noise in reaction-diffusion systems.

In a wide variety of biological situations, computationally-intensive, high-resolution models are relevant only in particular regions of the spatial domain. In other regions, coarser representations may suffice to capture the important dynamics. Such conditions necessitate the development of hybrid models in which some areas of the domain are modelled using a coarse-grained representation and others using a more fine-grained representation.

In this talk I will discuss recent work from my group on connecting coarse and fine representations of reaction-diffusion phenomena. The models to be coupled will include both on and off-lattice individual-based representations of diffusion with and without volume exclusion as well as macroscopic partial differential equations. In each scenario we will demonstrate good agreement between our hybrid models and the full individual-based representation whilst achieving significant computational savings.