From cells to tissue: coping with heterogeneity when modelling the electrophysiology of the human heart

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In biology, as in many sciences, stochasticity manifests itself at many temporal and spatial scales. How do modellers capture this inherent variability? How does a biological system use it productively? When is it filtered? How do modellers validate models in the presence of this variability? This talk makes some attempts to address these deep issues in the context of modelling and simulating the electrophysiology of the heart. The main focus will be on the study of ion channel dynamics in a cardiac cell through the stochastic Langevin equation and the modelling of the propagation of an electrical wave in cardiac tissue through the use of non-local space-fractional reaction-diffusion equations.

This is joint work with Blanca Rodriguez, Annamaria Carusi, David Kay, Alfonso Bueno-Orovio, Ciara Dangerfield, John Walmsley (all Oxford) and Esther Pueyo (Zaragoza)