



Understanding Biological Processes using Stochastic Modelling: Gaining Information from Uncertainty

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The molecular biology of life seems inaccessibly complex. It is subject to random variation and not exactly predictable. Still, mathematical models and statistical inference pave the way towards the understanding of biological mechanisms. In contrast to deterministic models, stochastic processes capture the randomness of natural phenomena and result in more reliable predictions of cellular dynamics. Stochastic models and their parameter estimation have to take into account the nature of molecular-biological data, including experimental techniques, measurement error and high dimensionality.

This talk presents according modelling and estimation techniques and their applications: the identification of differently regulated cells from heterogeneous populations using mixed models; parameter estimation for stochastic differential equations using computer-intensive Markov chain Monte Carlo techniques; and the realistic description of dynamical processes using Markov models with discrete-continuous state space.