Ramon Grima: Exact and approximate solutions for spatial stochastic models of chemical systems

Stochastic effects in chemical reaction systems have been mostly studied via the chemical master equation, a non-spatial discrete stochastic formulation of chemical kinetics which assumes well-mixing and point-like interactions between molecules. These assumptions are in direct contrast with what experiments tells us about the nature of the intracellular environment, namely that diffusion plays a fundamental role in intracellular dynamics and that the environment itself is highly non-dilute (or crowded). I will here describe our recent work on obtaining (i) exact expressions for the solution of the reaction-diffusion master equation (RDME) and its crowded counterpart (cRDME) in equilibrium conditions and (ii) approximate expressions for the moments in non-equilibrium conditions. The solutions portray an emerging picture of the combined influence of diffusion and crowding on the stochastic properties of chemical reaction networks.