Energy landscape and the two-scale large deviations for biological stochastic dynamics

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The construction of energy landscape for bio-dynamics is attracting more and more attention recent years. In this talk, I will introduce the strategy to construct the landscape from the connection to rare events, which relies on the large deviation theory for Gillespie-type jump dynamics. In the application to a typical genetic switching model, the two-scale large deviation theory is developed to take into account the fast switching of DNA states. The comparison with other proposals of landscape theories are also discussed. We demonstrate that different large deviation rate functionals and diffusive limits arise when considering different regimes for genetic translation and switching processes. We also discuss its implications on Michaelis-Menten kinetics. This is a joint work with Fangting Li, Xiaoguang Li, Cheng Lv, Feng Lin and Peijie Zhou.