

Modeling protein diffusion-like motion over cell membranes

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Abstract

We propose and study statistical models for individual protein diffusion in cell membranes in collaboration with the team of Prof. D. Golan from Harvard medical school. Computer enhanced video microscopy permits to record plane images of the tiny gold bead's (attached to the protein molecule) trajectory several thousand times a second. The data collected in experiments shows departures from classical Brownian motion and warrants inclusion of interaction of the protein being tracked with particles of various sizes (modeled as Compound Poisson component), Diffusion with Obstacles and Binding Sites modeled as a two state Markov Chain, and additional camera-added noise. Two versions of parameter estimation for models of this kind are developed: one based on the method of moments and another based on Bayesian sampling from the posterior distribution of the parameters given the data. Goodness-of-fit tests and simulations are performed to test adequacy of the model proposed.