Agent-based aggregated models of biological systems

Grzegorz A. Rempała

Most stochastic Markovian models in biology are constructed as either stochastic agent-based models (ABMs) or stochastic chemical reaction networks (CRNs). These models incorporate randomness but differ in representing system components. ABMs model agents as discrete entities with behavior rules, allowing for complex dynamics. Stochasticity is introduced through probabilistic interaction rules or random agent properties. In contrast, stochastic CRNs represent species and reactions, where randomness arises from randomly occurring chemical reactions based on species concentrations. While CRNs offer mathematical tractability, ABMs are better for modeling complex systems with non-uniform spatial distributions, like tissues or microbial communities. Combining aspects of both models would expand the modeling toolbox for molecular biology. This presentation outlines one potential such framework using differential equations and survival analysis methods. Some examples of possible applications will be discussed.

Grzegorz A. Rempała, The Ohio State University
e-mail : rempala.3@osu.edu