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BIOMATH

Department of Biomathematics Seminar Series:
Frontiers in Systems and Integrative Biology

Stochastic nucleation and growth

Maria D'Orsogna, Ph.D.
Assistant Professor
Mathematics Department
CSU Northridge

Thursday, Feb. 23, 2012
4:00 PM
23-105 Center for the Health Sciences (CHS)

ABSTRACT:

The binding of individual components to form composite structures is a ubiquitous phenomenon within the sciences.

Within heterogeneous nucleation, particles may be attracted to an initial exogenous site: the formation of droplets, aerosols and crystals usually begins around impurities or boundaries. Homogeneous nucleation on the other hand describes identical particles spontaneously clustering upon contact.

Given their ubiquity in physics, chemistry and material sciences, nucleation and growth have been extensively studied in the past decades, often assuming infinitely large numbers of building blocks and unbounded cluster sizes. These assumptions also led to the use of mass-action, mean field descriptions such as the well known Becker Doering equations. In cellular biology, however, nucleation events often take place in confi ned spaces, with a fi nite number of components, so that discrete and stochastic effects must be taken into account.

In this talk we examine finite sized homogeneous nucleation by considering a fully stochastic master equation, solved via Monte-Carlo simulations and via analytical insight. We find striking differences between the mean cluster sizes obtained from our discrete, stochastic treatment and those predicted by mean field treatments.

We also consider heterogeneous nucleation stochastic treatments, first passage time results and possible applications to prion unfolding and clustering dynamics.

Host: Van Savage, Ph.D.

To receive e-mail seminar notices, contact David Tomita (dtomita@biomath.ucla.edu)