LIQUID CRYSTAL MATERIALS RESEARCH CENTER

SPECIAL SEMINAR SERIES

Cell Biology and Active Liquid Crystals: Reevaluating the Tactoid Hypothesis of Spindle Structure

Dan Needleman

School of Engineering and Applied Sciences
Harvard University

A wide variety of subcellular structures exist in a non-equilibrium steady-state with a constant flux of matter and energy continuously maintaining their architecture. A prime example of this is the spindle: a self-organizing ensemble of proteins that segregates chromosomes during cell division. While many of the individual components of the spindle have been studied in detail, it is still unclear how these molecular constituents self-organize into this structure and how this leads to the internal balance of forces that are harnessed to divide the chromosomes. More generally, there is no accepted framework for understanding the organization of ensembles of active, biological molecules, such as the spindle.

A number of groups have suggested that certain cellular structures can be understood using modified forms of continuum models from liquid crystal physics, but it is still unclear how profitable this approach is. We are testing if such active liquid crystal models are valid for describing the spindle by measuring the spindle's internal fluctuations, structure, and response to perturbations. I will present our overall approach and preliminary results, which make use of a combination of single molecule tracking, spinning disk confocal microscopy, quantitative polarized light microscopy, and magnetic tweezers. We are comparing the results from these quantitative experiments with predictions from various coarse-grained models to determine if spindles really are active liquid crystal.

Wednesday, April 14th at 1:30 p.m.
Duane Physics 11th Floor Commons Room

Sponsored by the Liquid Crystal Materials Research Center
Department of Physics, University of Colorado.

http://lcmrc.colorado.edu