Brandeis
BioInspired Soft Materials
MRSEC

Experimental Soft Matter and Biological Physics
Openings: Two Postdoctoral Researchers, Brandeis University

(1) Non-equilibrium, dissipative self-assembly (Self-assembly and DNA nanotechnology)
(2) Growth and division of phospholipid vesicles (Membrane biophysics)

We seek two postdocs to join multidisciplinary, tightly integrated teams of students, postdocs, and faculty to work on two exciting projects: (1) studying non-equilibrium pathways to liquid-liquid phase separation; and (2) studying the growth and division of minimal phospholipid vesicles. Both positions will offer ample opportunities for professional development, including participating in cutting-edge science, gaining mentoring experience, and initiating your own research directions.

(1) Non-equilibrium, dissipative self-assembly. The project will explore non-equilibrium routes to liquid-liquid phase separation of macromolecular complexes. Whereas equilibrium phase separation leads to demixed bulk phases, driven dissipative systems can produce a diversity of steady states, including liquid domains of finite size. In this project, we will create new *in vitro* experimental systems to design and characterize the steady states that emerge in an active system, in which the continued consumption of energy suppresses bulk phase separation. There will be numerous opportunities to collaborate with other investigators within the Brandeis MRSEC, including Guillaume Duclos (Physics), Mike Hagan (Physics), and Avi Rodal (Biology).

Qualifications: Experience in experimental soft-matter physics or DNA nanotechnology. *Tasks:* Design and characterize DNA-based molecular complexes, as well as their phase behavior and higher-order assemblies. The phase behavior will be characterized using optical microscopy, confocal fluorescence microscopy, and light scattering. The goal is to discover new non-equilibrium mechanisms by which components self-organize into large, but finite-size, assemblies.

(2) Growth and division of vesicles. Supported by a Human Frontiers Science Program Grant, we aim to build a stably propagating cell from simple components. The cell will have a lipid membrane encapsulating DNA and transcription-translation machinery, and be able to grow and divide by internally synthesizing its own membrane material. The project is significant because a stably propagating cell is a vital element of natural selection. Extant life on Earth is a consequence of natural selection acting upon earlier forms of life, shaping the lineages over time. Thus at some point early in life's origins, a sustainably propagating cell must have emerged, allowing selective advantages to accumulate over generations. Research will be done in close collaboration with two international groups led by Yutetsu Kuruma (JAMSTEC, Japan) and Anna Wang (UNSW, Australia). Once travel resumes, there will be opportunities for travel to Australia and Japan.

Qualifications: Experience in experimental soft-matter physics, especially phospholipid membranes. *Tasks:* Create giant unilamellar vesicles using established protocols, characterize membrane mechanics and shape changes using optical microscopy and confocal fluorescence microscopy, and quantify membrane fission using microscopy and fluorimetry. The goal is to identify physical mechanisms by which membranes fold and fuse without division proteins.

Women and minority candidates are encouraged to apply. Brandeis University is an Affirmative Action/Equal Opportunity employer M/W/D/V.

Start Date: Flexible. **Location**: Brandeis University, Waltham, MA, USA
Submit applications to wrogers@brandeis.edu and specify the position you are applying for.
For more information, please see our group webpage: http://www.rogers-lab.com

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