Openings: Four Postdoctoral Researchers in Self-Limited Assembly, Brandeis University
(1, 2) Experimental Soft Matter (DNA origami and self-assembly);
(3) Computational Soft Matter (Modeling self-assembly pathways);
(4) Theoretical Soft Matter (Theory-directed design)

We seek four postdocs to join a multidisciplinary, tightly integrated team of four investigators within the Brandeis Bioinspired Soft Materials research center (Ben Rogers, Seth Fraden, Mike Hagan, and Greg Grason) to design and synthesize new DNA-origami building blocks, elucidate the mechanisms of their assembly into self-limiting architectures, and model the assembly pathways using theory and computer simulation. Our team of students, postdocs and faculty will work together across groups and disciplines to achieve our goals. This position offers ample opportunities for your professional development including participating in exciting cutting-edge science, gaining mentoring experience, and initiating your own research directions.

The team will develop a versatile class of DNA-origami building blocks to elucidate the fundamental physical principles for engineering components that self-assemble into large, but finite-size, superstructures. The self-assembly of size-controlled architectures is prevalent in living systems. The adaptive functions of biological materials, including viral shells, cytoskeletal filaments, and photonic nanostructures of bird feathers arise from the regulated finite size of self-assembled architectures. In contrast, most inorganic materials form unlimited structures like crystals. In this project, we will advance two complementary paradigms for bottom-up assembly of size-controlled architectures: one uses curved building blocks that assemble into self-closing structures; the other uses ill-fitting blocks that accumulate distortions upon assembly to form structures with open boundaries.

This research addresses many fundamental questions in self-assembly: How do shapes, interactions, and flexibilities of building blocks control the assembly size? How can self-limiting assembly be adapted to distinct morphologies, like ropes, fibers, sheets or shells? Are there fundamental or practical limits to the sizes of controllably assembled structures? By answering these questions and more, we aim to develop engineering principles to create size-controlled architectures with high yield. A timely application envisioned for this new technology is a general anti-viral agent, e.g. a covid cure.

(1, 2) Design, characterization, and self-assembly of DNA-origami building blocks. Qualifications: Experience in experimental soft-matter physics or DNA nanotechnology. Tasks: Design and characterize DNA-origami building blocks and their subsequent higher-order assemblies. Individual building blocks will be characterized with electron microscopy (EM), including single-particle cryoEM. Assemblies will be characterized using EM, optical microscopy, and light scattering. The goal is to understand mechanisms by which components self-assemble into large, but finite-size, superstructures. Supervisors: Profs. Rogers and Fraden (Brandeis).


(4) Theory-directed design of new assemblies. Qualifications: Experience in soft-matter theory, discrete geometry, and computational physics. Applicants are sought with interests in fields such as soft matter, thermodynamics, and materials science. Tasks: Design particle shapes and interactions. Simulate DNA-origami designs using available computational packages, including oxDNA and ENRG MD. Develop theoretical predictions of target assemblies and design rules. Supervisors: Profs. Rogers (Brandeis), Hagan (Brandeis), and Grason (UMass: Amherst).

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

Start Date: September 2020. Location: Brandeis University MRSEC, Waltham, MA, USA
Submit applications to MRSECpostdoc@brandeis.edu and specify the position you are applying for. Please include a CV, a list of references, and a brief description of your previous research.

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