



Program in Polymers  
and Soft Matter

## SEMINAR

# “Engineering protein electrostatic interactions for intracellular phase separation”

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**Prof. Allie Obermeyer**

**Department of Chemical Engineering, Columbia University**

**Abstract:** Protein de-mixing has recently been implicated in the organization of cellular components. These phase separated membraneless organelles create distinct environments that are essential to cellular processes ranging from cell signaling to gene expression. Several membraneless organelles appear to have the same physical properties as complex coacervates – liquid-liquid phase separated mixtures of oppositely charged polyelectrolytes. However, protein polymers differ significantly from synthetic polyelectrolytes. Proteins are amphoteric, have low charge density, and frequently adopt a globular folded structure. These differences impact the complexation and phase separation of proteins with (bio)polyelectrolytes. We have engineered proteins to determine predictive design rules for intracellular complex coacervation with biological polyanions. We employ these design rules to create synthetic organelles by promoting phase separation of engineered proteins of interest in *E. coli*.

**Allie Obermeyer** was born in Arlington, TX and raised in Birmingham, MI. She earned her B.S. from Rice University and her Ph.D. at the University of California, Berkeley where she was an NSF Graduate Research Fellow. She completed her postdoctoral work at the Massachusetts Institute of Technology where she was an Arnold O. Beckman Postdoctoral Fellow. She started her independent career in the Chemical Engineering Department at Columbia University in January 2017.

Allie's research interests are at the intersection of chemistry, biology, and materials science and are motivated by a goal to improve human health. At Rice, she worked in the laboratory of [Seichi P.T. Matsuda](#) on the characterization of terpene cyclases from

*Arabidopsis thaliana*. At UC Berkeley, she worked in the laboratory of [Matthew Francis](#) as a part of the Chemical Biology Graduate Program. For her doctoral research, Allie developed bioconjugation reactions for the selective modification of proteins and created new targeted imaging agents based on virus-like particles for the detection of cardiovascular disease. At MIT, Allie worked in the laboratory of [Bradley Olsen](#) exploring complex coacervation as a method for encapsulating and stabilizing proteins. Allie investigated the design rules for globular protein complex coacervation and strategies to immobilize proteins in coacervates.

Aside from science, Allie enjoys hiking, cooking and rooting for the Golden State Warriors.

Allie's CV can be found [here](#).