Spring 2025 Joint Colloquium
Materials Department & Materials Research Laboratory

William Jacobs, PhD

Princeton University

Friday, April 11, 2025
11:00 am | Henley Hall 1010

Order from disorder: Designing sequence-programmable protein condensates

Biology provides numerous examples of phase-separated protein and nucleic acid condensates, which establish distinct compartments for spatially organizing biomolecules within living cells. This mechanism of spatial organization relies on the ability of biomolecular systems to navigate high-dimensional phase diagrams by tuning the interactions among proteins and nucleic acids in a multicomponent mixture. In this talk, I will discuss optimization and machine learning approaches that can be used to design the compositions of multicomponent biomolecular condensates. These approaches reveal how compositional specificity is encoded in complex mixtures and how intrinsically disordered protein sequences can be designed to stabilize coexisting multicomponent condensates. These results shed light on the physicochemical limits of phase-separation-mediated spatial organization in biological systems and establish practical strategies for engineering fully programmable biomolecular condensates.

Bio: William Jacobs obtained a B.S. in Physics and Engineering Science from the University of Virginia in 2010 and a Ph.D. in Theoretical Chemistry from the University of Cambridge in 2014. After completing a postdoc in Theoretical Chemistry and Biophysics at Harvard University, he began his independent career at Princeton University in 2019, where he is also affiliated with the department of Chemical and Biological Engineering, the Princeton Materials Institute, and the Biophysics program.

Hosted by Omar Saleh