Seminar
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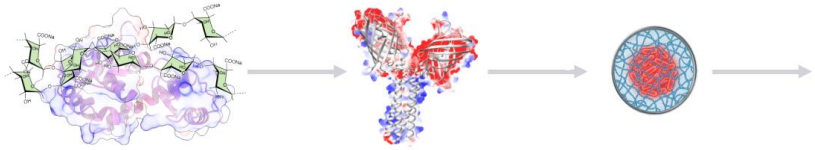
PROTEIN COLLOIDS: FROM SOFT MATTER TO FUNCTIONAL BIOMATERIALS

Proteins are extraordinary materials: they are encodable, redesigned atom by atom, and programmed to emit light, sense chemicals, catalyze reactions, or organize matter. Yet outside the controlled conditions of the laboratory, proteins often fail because time, heat, solvents, interfaces, and mechanical stress slowly reveal their kinetic fragility. In this talk, I will discuss how protein colloids can bridge the gap between molecular function and real-world biomaterials. Starting from simple electrostatic complexes between alginate and lysozyme, I will show how polysaccharide structure controls protein association, retention, and stabilization. I will then introduce genetically encoded oligomerization as a way to "tie" fluorescent proteins together, creating soluble macro-oligomers that preserve photophysics while becoming more resistant to harsh environments. Finally, I will present our recent work on solution blow spraying to generate cell-sized alginate beads that encapsulate bacteria as inducible living microreactors for far-red smURFP production. Across these examples, the central idea is that bringing proteins together—without destroying their function—creates crowded, hydrated, and programmable soft-matter environments. Protein colloids therefore offer a route to take proteins everywhere: from optical materials and bioimaging to sensing, living biomaterials, and environmental technologies.



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