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Characterizing Large-Pore Protein Crystals for Advanced Material Applications[1] LUKE F. HARTJE, BRIAN E. MUNSKY, CHRISTOPHER D. SNOW, Colorado State University — With rapidly growing interest in therapeutic macromolecules, high-density information storage, and advanced biofunctional fabrics comes the need for new materials capable of guest macromolecular storage and metered release on the nanoscale level. One novel possibility for such materials are engineered large-pore protein crystals (LPCs). Composed of numerous chiral constituents, LPCs are ordered biologically derived nanoporous materials exhibiting hexagonal close-packed pores greater than 8 nm. These substantial pores distinguish LPCs from typical nanoporous scaffolds, enabling engineered LPC materials to readily uptake, immobilize, and controllably release macromolecular guests. The chemical diversity and functional versatility of LPCs make them promising targets for use as nanostructured scaffolds with potential applications in drug delivery, biosensing, enantiomer separations, and multifunctional textiles. This work highlights our efforts to experimentally and computationally investigate macromolecular transport and interaction energies within an LPC environment using time-lapse confocal microscopy, bulk equilibrium adsorption, and hindered diffusion simulation.

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