

Many proteins spontaneously self-assemble into regular, shell-like, polyhedral structures. Protein cages are useful—in nature and in the laboratory—as molecular containers for diverse cargo molecules, including proteins, nucleic acids, metal nanoparticles, quantum dots, and low molecular weight drugs. They can consequently serve as delivery vehicles, bioimaging agents, reaction vessels, and templates for the controlled synthesis of novel materials. Most ambitiously, self-assembly of hierarchically ordered supramolecular structures may serve as catalytic nanoreactors for short metabolic sequences. In this lecture, strategies for designing new protein containers, optimizing them by directed evolution and characterizing their structures and properties will be discussed. These efforts may provide practical routes to non-viral encapsulation systems for diverse applications in the test tube and in living cells.