Thursday, September 27, 2018
10:00-10:30 a.m.

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Diversity, structure, function, assembly and engineering of carboxysomes and other bacterial microcompartments for enhancing primary productivity

Carboxysomes and other bacterial microcompartments are multienzyme-containing organelles composed entirely of protein. The carboxysome is a self-assembling metabolic module for CO_2 fixation found in all cyanobacteria. These large (~100-500 nm) polyhedral bodies sequester Carbonic Anhydrase and RuBisCO within a protein shell, thereby concentrating substrates and reducing photorespiration. Because carboxysomes and other BMCs function to organize reactions that require special conditions for optimization, including the sequestration of substrates, cofactors, or toxic intermediates and the protection of oxygen sensitive enzymes, they have received considerable attention as templates for synthetic nanoreactors in bioengineering. There are two central challenges to building bespoke protein-based nanoreactors, design and assembly of multi-enzyme cores and engineering of the shell proteins to serve as a selectively permeable barrier, thereby providing the interface between the cytosol and the encapsulated reactions. Progress in our efforts to engineer carboxysomes and, more broadly to take advantage of protein-based compartmentalization in bioengineering, will be discussed.