Encapsulins: Molecular and Synthetic Biology of Protein Nanocompartments

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Abstract

Encapsulins are icosahedral protein nanocompartments that range in size from 20 to 50 nm. The eponymous feature of encapsulins is their ability to selectively encapsulate dedicated cargo proteins during shell self-assembly. Encapsulation is facilitated by an efficient cargo loading mechanism based on targeting peptides or domains present in all native cargo proteins. Targeting peptides have proved to be highly modular, making encapsulins an excellent platform for non-native cargo encapsulation with broad applications in biomedicine, biocatalysis, and bionanotechnology. In this talk, I will present two ongoing lines of investigation in my laboratory. First, a novel aspect of encapsulin biology related to bacterial sulfur metabolism will be discussed, including novel structural, biophysical, and mechanistic insights into a widespread desulfurase encapsulating protein nanocompartment. Second, I will report on our progress on engineering encapsulin nanocompartments for applications as enzyme nanoreactors through pore engineering with the goal of establishing a useful platform technology for the biocatalysis and bionanotechnology communities.