Structural Studies on Carboxysomes

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Carboxysomes are microcompartments found in autotrophic bacteria; they function to sequester RuBisCO for optimal carbon fixation. Carboxysomes are essentially primitive organelles, composed entirely of protein. Genomic sequencing is revealing the surprisingly wide distribution of proteinaceous organelles that are structurally related to the carboxysome. In order to understand principles of carboxysome assembly and function, we have undertaken EM and crystallographic analyses of the carboxysome and its isolated component proteins and enzymes. We have determined the structures of two of the carboxysome shell components. Our data provide the first molecular details of carboxysome structure and assembly that show striking parallels to principles of viral architecture. Our data also provide insights into the structural basis of function, including import and export of substrate and products.

Keywords: carbon-fixation, biological macromolecules, organelle assembly