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Role of Chaperones in Extremophilic Adaptations in Archaea

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Abstract

Protein folding in the archaea is a fascinating research topic because many archaeal species are able to grow under extreme conditions, by maintaining a viable proteome in environmental niches that exclude most other organisms. But the functioning of protein folding machinery inside archaeal cells is not yet well understood. Chaperone proteins are expected to play an important role in maintenance of such proteomes. A survey of archaeal genomes for the presence of bacterial and eukaryotic chaperone homologs revealed several interesting features. Nearly all sequenced archaeal genomes possess a common core of molecular chaperones.

In various archaeal organisms, for which the whole genome sequences were available, our objective was to identify the constitution, working and evolution of the protein folding machinery as a whole. A database (CrAgDb) has thus been developed to facilitate the collection and annotation of all the chaperone proteins present in 144 sequenced archaeal genomes. These proteins belong to 11 classes and 18 families. Further analysis of this curated data has led us to highlight the unique features of the archaeal chaperone machinery which can provide useful model systems for studying eukaryotic diseases related to protein folding.

On the basis of clustering analysis, the distribution of various chaperone proteins in the archaeal organism, can be grouped into three types. The first group contains the chaperones that exist in all archaeal genomes; the second group constitutes the chaperone proteins that are present in only two phyla and the third group of chaperones is found in few archaea. The detailed analysis at the level of sequence and structure provides the essential information about these families. *Picrophilus torridus* and *Sulfolobus solfataricus* were used model organisms to understand the association and interactions between various chaperone families and to differentiate the archaeal and eukaryotic protein folding machinery.

Citation

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