Institute for Collaborative Biotechnologies

SEMINAR

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1001 Engineering Science Building

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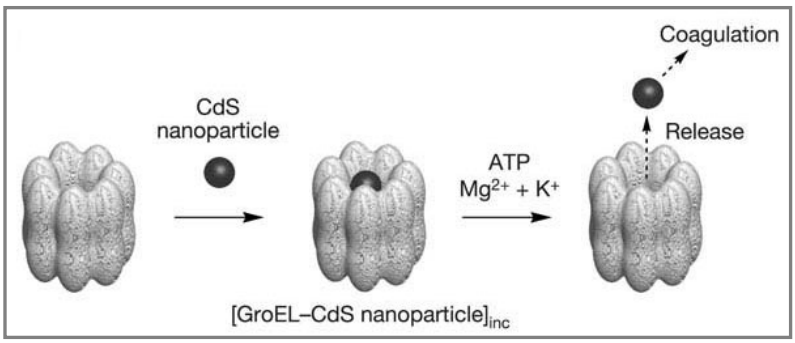

Chaperonin-mediated stabilization and ATP-triggered release of semiconductor nanoparticles

Structure, Function and Application of Hyperthermophilic Molecular Chaperones

Protein folding is assisted by molecular chaperones *in vivo*. The molecular chaperone system of hyperthermophilic archaea is very simple compared with those of other organisms. Only the genes for four groups of chaperones, i.e. group II chaperonin, prefoldin, small heat shock protein and peptidyl-prolyl *cis-trans* isomerase, were identified in the total genomic sequences of hyperthermophilic archaea. They lack Hsp70, Hsp90 and Hsp104, which previously were thought to be indispensable chaperones in any cells. Thus, the four chaperones appear to play essential roles in protein maintenance in hyperthermophilic archaea. We have performed research aimed at elucidating the structure and function of group II chaperonin and its partner chaperone, prefoldin, from hyperthermophilic archaea.

We have determined the structure of the group II chaperonin from *Thermococcus* sp. strain KS-1. The most characteristic point in the structure of the group II chaperonin is that the helical protrusion at the tip of the apical domain forms a built-in lid for the central cavity. Conformation of this built-in lid changes with the cycle of ATP hydrolysis. The role of the helical protrusion was further elucidated using helical protrusion deletion mutants.
Prefoldin is a cofactor of the group II chaperonin, and is thought to capture an unfolded protein and transfer it to the group II chaperonin for correct folding. Using the prefoldin from the hyperthermophilic archaeum, *Pyrococcus horikoshii* OT3 (PhPFD), we examined the manner in which the prefoldin cooperates with the group II chaperonin and also identified the protein-protein interaction sites.

Because the molecular chaperones exhibit the ability to capture various proteins in nanometer sizes, it is suggested that they can also capture nano-particles with similar characteristics. I also present our recent results using our chaperones for manipulating proteins and semiconductor nano-particles as an example of nanobiotechnology.

Biography

Education

1982	Bachelor, Department of Chemical Engineering, University of Tokyo
1984	Master, Department of Chemical Engineering, University of Tokyo
1988	Doctor, Department of Chemical Engineering, University of Tokyo

Positions

1987 – 1991	Researcher, Central Research Center, Asahi Glass Co., Ltd.
1991 – 1998	Researcher, The Institute of Physical and Chemical Research (RIKEN)
1998 – 2003	Associate Professor, Department of Biotechnology and Life Science Tokyo University of Agriculture and Technology
2003 –	Professor, Department of Biotechnology and Life Science, Tokyo University of Agriculture and Technology

Research Subjects

- Structure and character of molecular chaperones
- Structure and character of nitrile hydratase family proteins
- Development of automated DNA analysis systems and their applications
- MD simulation of proteins
- D-amino acid and amino acid racemases
- Bioremediation