

Masters thesis project

Engineering of Proteins for Pressure-Stability

Rational mutagenesis leading to pressure stabilization

Background: Proteins are subject to the factors present in their environment including pH, temperature and also hydrostatic pressure. Many organisms live in high-pressure ecological niches. Natural high pressure environments include the deep ocean and within deep groundwater deposits. The organisms have a number of adaptations to these environments which can be identified and used to increase the pressure stability of proteins that exist at ambient pressure.

Objectives: This project will involve investigation of the role of point mutations on the pressure stability of proteins.

Requirements:

- Adequate completion and grades in Biochemistry and/or Biotechnology courses
- Interest in protein structure and/or enzyme function
- Previous laboratory experience. Familiarity with PCR and protein purification preferred.

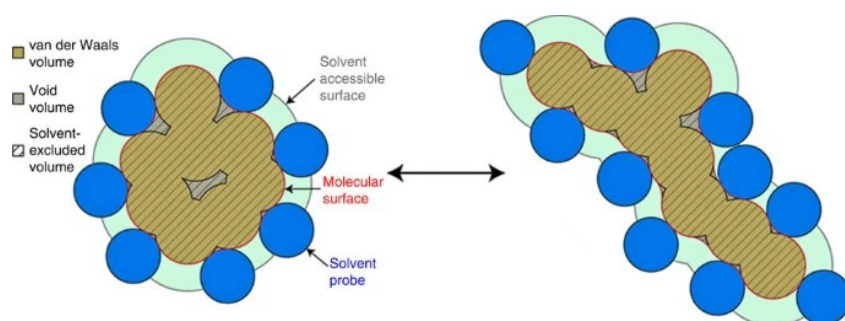


Figure 1: Pressure affects the interactions between proteins and solvent water with a sufficiently high pressure leading to protein unfolding [1]

Methods:

- PCR to generate point mutants
- protein purification

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Selected Literature:

- 1) Chen, C., Makhatadze, G. "Molecular determinant of the effects of hydrostatic pressure on protein folding stability" *Nat Commun* **8**, 14561 (2017)
- 2) Hazen R.M. "High pressure and the origin of life" *J. Phys. Condens. Matter* **14**, 11489 (2002)
- 3) Daniel, I., Oger, P., Winter, R. "Origins of life and biochemistry under high-pressure conditions" *Chem. Soc. Rev.* **35**, 858 (2006)