CELLULAR AND MOLECULAR ADAPTATIONS TO MEDITERRANEAN DEEP SEA HYPER SALINES LAKES

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Abstract

Mediterranean Deep Halophilic Anoxic lakes (DHAL's) are unique ecosystems in which microorganisms have to face hyper salinity and high pressure as main stressor agents. To understand the origin and the environmental adaptation of these halophilic microbes it is important to specify their limits of viability and the molecular modifications of their proteins. A study combining microbiology, biophysical and electron microscopy will be presented as well as a preliminary work on the characterization of a DHAL enzyme isolated by metagenomic screening.

Keywords: Salinity, Anoxia, Bacteria, Biotechnologies, Deep Sea Basins

Cellular and molecular adaptations to Mediterranean deep sea hyper salines lakes Mediterranean Deep Halophilic Anoxic lakes (DHAL's) are unique ecosystems in which microorganisms have to face hyper salinity and high pressure as main stressor agents. To understand the origin and the environmental adaptation of these halophilic microbes it is important to specify their limits of viability and the molecular modifications of their proteins. In order to investigate the possibility that the endogenous halophilic Archaeal communities found in DHAL's could be the result of surface ensemencements, we have studied the effects of salt stress on the extreme halophile *Halobacterium salinarium*. Gene expression and enzyme activity studies combined with in vivo molecular dynamics measurements (neutron diffusion) showed that low salt conditions represent a stressor equivalent to high temperature for extreme halophiles. We found however that a large proportion of the halophilic cells can survive to drasic reductions in environmental salt concentrations, first by concentrating KCl inside the cytosol and then by undergoing dramatic morphological changes. The stressed archaea were studied by electron and confocal microscopy. The result revealed cellular ultrastructural modifications that differ from other known microbial survival forms such as sporulation. The Halobacterium survival form was found to be able to resist normal sea-water conditions for long periods. A esterase from DHAL was identified from metagenomic screening by Ferrer et al. It exhibited salt and pressure-dependent activation. The corresponding ORFs was cloned in expression vectors and purified as soluble material. Biophysical measurements showed that the protein is a monomer that exists is solution as two conformational states controlled by the redox conditions. The protein is thus activated in DHAL anoxic conditions. Ferrer et al. 2005. Microbial enzymes mined from the Urania deep-sea hypersaline anoxic basin. Chemistry and Biology. 12, 895-904

References

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