Molecular Mechanisms of DNA Damage Protection in *Halobacterium salinarium*, an Extremely Halophilic Bacterium

Hiroshi Ide, Hiroaki Terato and Takeshi Saito[1]

Faculty of Science and [1]Radioisotope Center, Hiroshima University

Summary

Halobacterium salinarium is an extremely halophilic archaebacterium that is commonly found in strong natural salines such as salt lakes and salt farms. The adaptation to high-salt environments is achieved by raising the intracellular salt concentration. Therefore, this bacterium contains 5.3 M K^+ and 3.3 M Cl^- in cells. This bacterium also need to deal with intensive ultraviolet (UV) light and possibly other DNA damaging agents due to it habitat.

In the present study, the sensitivity of *H. salinarium* to γ-rays, hydrogen peroxide and UV light was examined whether or not this bacterium has protection mechanism against environmental DNA damaging agents. *H. salinarium* was 4 to 20 times more resistant to the agents than *E. coli* B/r. The mutant defective in bacterioruberin, an antioxidant carotenoid associated with the cell membrane, also exhibited higher resistances (2-4 times) than *E. coli* B/r, suggesting that *H. salinarium* cells contained multiple DNA protection mechanisms which were dependent on and independent of bacterioruberin. To elucidate the latter mechanism and possible roles of the concentrated intracellular salts, DNA was irradiated by γ-rays and UV light in the absence and presence of KCl *in vitro*. Quantitation of DNA strand breaks (γ-rays) and pyrimidine dimers (UV) by agarose gel electrophoresis revealed that formation of these lethal DNA lesions was suppressed by concentrated KCl. These results suggest that KCl present in *H. salinarium* cells protects DNA from environmental DNA damaging agents, thereby increasing the resistance to these agents.