

## **Prokaryotic adaptation to different environmental conditions at the genomic level: Molecular evolution analysis**

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Prokaryotic microorganisms are able to survive and proliferate in severe environmental conditions. In this report we apply a computer-based approach to compare the genomes and proteomes from three thermophilic archaea species of the *Pyrococcus* genus, *P. furiosus*, *P. horikoshii*, and *P. abyssi* to identify features of their molecular evolution related to adaptation strategy to diverse environmental conditions. Phylogenetic analysis of rRNA genes from 26 *Pyrococcus* strains suggested that the divergence of *P. furiosus*, *P. horikoshii* and *P. abyssi* might have occurred from ancestral deep-sea organisms. It was demonstrated that the function of genes that have been subject to positive Darwinian selection is closely related to abiotic and biotic conditions to which archaea managed to become adapted. Divergence of the *P. furiosus* archaea might have been due to loss of some genes involved in cell motility or signal transduction, and/or to evolution under positive selection of the genes for translation machinery. In the course of *P. horikoshii* divergence, positive selection was found to operate mainly on the transcription machinery; divergence of *P. abyssi* was related with positive selection for the genes mainly involved in inorganic ion transport. Analysis of radical amino acid replacement rate in evolving *P. furiosus*, *P. horikoshii* and *P. abyssi* showed that the fixation rate was higher for radical substitutions relative to the volume of amino acid side-chain.

The results suggest the important role of hydrostatic pressure as a cause of variability in the *P. furiosus*, *P. horikoshii* and *P. abyssi* genomes evolving in different habitats. Nevertheless, adaptation to pressure does not appear to be the sole factor ensuring adaptation to environment. For example, at the stage of the divergence of *P. horikoshii* and *P. abyssi*, an essential evolutionary role may be assigned to changes in the trophic chain, namely, acquisition of a consumer status at a high (*P. horikoshii*) or low level (*P. abyssi*).

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### References:

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