ASTROBIOLOGY EDUCATION AND OUTREACH USING HALOARCHAEA. P. DasSarma and S. DasSarma, Institute of Marine and Environmental Technology, University of Maryland, 701 East Pratt Street, Baltimore, MD 21202, sdassarma@som.umaryland.edu

Introduction: Astrobiology education and outreach are greatly aided by extremophilic organisms that may survive Mars and space conditions [1]. Halophilic Archaea (or Haloarchaea) represent some of the most hearty organisms on Earth and are ideal for public education on astrobiology due to their versatility [2-3]. They are well-known for their tolerance to multiple environmental extremes, including high salinity, desiccation, ionizing and ultraviolet radiation, cold temperatures, and oxygen limiting conditions, all of which are relevant for survival away from Earth. These organisms are colorful, safe to handle, found around the globe, and can serve as terrestrial analogs of potential extraterrestrial life forms. We are using two Haloarchaea, *Halobacterium* sp. NRC-1, which is a genetically tractable laboratory strain,, and *Halorubrum lacusprofundi*, an environmental isolate from Antarctica for astrobiology outreach and education [4].

Haloarchaea for Astrobiology: We have developed educational resources using Haloarchaea for performing hands-on education and outreach for life in extreme environments and astrobiology. The laboratory model, *Halobacterium* sp. NRC-1, is distributed in liquid cultures and embedded within salt crystals through Carolina Biological Supply, and included in the 'Life in Extreme Environments' kit [4]. Students of all ages can use these easily-cultured microbes in the classroom, museums, and elsewhere to learn about astrobiology, Haloarchaea, and how life may survive space-like conditions. Haloarchaeal microbes are popular for space missions and survive in the stratosphere and in orbit, suggesting the possibility of panspermia and seeding of planets. They also harbor capacity for growth using retinal based proteins for light absorption and phototrophy, which may have evolved in the early Earth ("Purple Earth" hypothesis) [1,2]. All together, Haloarchaea are ideal organisms for introducing astrobiology concepts to the public in a safe and engaging manner.

Haloarchaeal Research: Extensive research on Haloarchaea provides a foundation for education and outreach. Our comparative genomic analysis has established that core highly acidic proteins are conserved across the Haloarchaea family. These proteins are able to bind tightly to water and function when water is limiting [5-6]. We have also determined which proteins contribute to success under extreme conditions, including those involved in protecting and repairing DNA, as well as others involved in regulating expression of key genes [6-9]. Also, through analysis of a model Haloarchaeal enzyme, we have determined which amino acid residues are important for stability in cold and low water conditions [11-12].

Conclusions: Haloarchaea are able to survive exposure to multiple extreme conditions in the laboratory and conditions similar to those encountered in Mars and in space. The colorful and engaging properties of Haloarchaea may be employed to introduce astrobiology in schools and museums.

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