Can terrestrial microbes grow on Mars?
By LYNN ROTHSCHILD

The theme for AbSciCon 2012 is "Exploring Life: Past and Present, Near and Far." The conference will address our current understanding of life - from processes at the molecular level to those which operate at planetary scales. Studying these aspects of life on Earth provides an essential platform from which to examine the potential for life on other worlds, both within our solar system and beyond.

Session Family: Mars Session Title: *"Can terrestrial microbes grow on Mars?"* Short title (for abstract submission): *"Can terrestrial microbes grow on Mars?"* Description: Mars exhibits a variety of extreme environments characterized by high UV and ionizing radiation flux, low pressure anoxic atmosphere, scarce or absent liquid water, extreme low temperatures, etc. The ability of terrestrial microorganisms to survive and adapt to the Mars environment has profound implications for astrobiology, planetary protection, and Mars life detection missions.

At the NASA Ames Synthetic Biology Initiative, we believe that synthetic biology has the potential to revolutionize human space exploration. As such, the initiative is dedicated to applying the tools and techniques of synthetic biology to space exploration and astrobiology. Biological solutions will be invaluable for space exploration because they are not resource intensive, and they are versatile and self-renewing.

An understanding of how to work with DNA in an unfavorable environment is paramount to utilizing biological tools on space missions. Furthermore, the ability to adjust life to the parameters of Mars is vital both to discovering what life on Mars might look like, and to using biological tools under such conditions. As a first step, we need an energy-efficient, low cost means of transporting, storing, and protecting genomic DNA, DNA parts, and whole microbial strains.

Our goal is to develop and demonstrate viable and superior alternatives to standard DNA storage methods, which can be optimized to the conditions of space exploration, using synthetic biology as a tool. This includes protocols and kit designs for easy and repeatable DNA and strain recovery from protective storage conditions. We are constructing newly engineered genetic parts for different valuable host organisms, designed to increased long-term survival and functional retention. These methods should be applied for DNA and strain storage and transportation.

In parallel, we seek inspiration from natural organisms that have developed means for survival in extreme environmental conditions. We are utilizing novel techniques for analysis of lipid biomarkers in the Antarctic Dry Valleys in order to identify resident microbes in the Antarctic soil and permafrost, as well as biomarker fossils of organisms that survived in the valleys in ages past. Through the identification of these life forms, we hope to understand and draw on new biological tools and strategies for synthetic biological applications on Mars.