

SETG, a Search for Extraterrestrial Genomes

An *in situ* PCR Detector For Life on Mars

Ancestrally Related to Life on Earth

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Proposal Summary

On Earth, very simple but powerful methods to detect life by the DNA polymerase chain reaction (PCR) are now standardly used. A soil sample from an extreme environment can be surveyed for the signature of life, a DNA fragment of a gene that is universal to life on Earth in less than 2 hours in any standard molecular biology laboratory. Due to massive meteoritic exchange between Earth and Mars (as well as other planets), a reasonable case can be made for life on Mars or other planets to be related to life on Earth. In this case, the supremely sensitive technologies used to study the extremes of life on Earth can be applied to the search for life on other planets. We propose to develop a PCR detector for *in situ* analysis on other planets, most immediately, Mars. This instrument is so sensitive it should allow the detection very low levels of microbial life on Mars, and will determine its phylogenetic position by analysis of the DNA sequence of the genes detected *in situ*. Our team includes leaders in gene analysis from Harvard University plus the management and engineering staff of MJ Research, a 400 person company that is the second largest manufacturer of PCR machines in the world, plus the planetary science and space engineering expertise of the MIT team members. We propose to develop a prototype of the DNA amplification module of this instrument which will be validated using terrestrial samples. We are aiming for an instrument that is less than 5 Kg and requires less than 10 Watts during any experimental run. We also propose to explore contamination reduction protocols and to expand the DNA probes used to explore the boundaries of detectable life on Earth, to maximize our chances of detecting life that is divergent from life on Earth.

Note: MJ Research has since been sold to BioRad; Mike Finney continues to act as a Co-I.

For more information see:

<http://web.mit.edu/setg/>

<http://genetics.mgh.harvard.edu/RuvkunWeb/projects/LifeOnMars.html>