ASK FY 20 Innovation Fair Information

Proposal Title:

Developing A Miniaturized Biology Assay for the Astrobiology Search Kit

P.I Name: P. Marcum

Org: SSA

Implementing org: SST

**Requested Amount**: $25, 000.00

KIPR Overhead: $2500.00

Science (KIPR 16,000.00) & SSA (3000.00) H. Smith & P. Marcum

SST Overhead: (2000.00)

Materials and Supplies

Proposed Innovation:

Innovation Aim/ Objective:

Develop a life detection assay for the Astrobiology Search Kit that will indicate the presence or absence of life within the sample at a detection limit of 10^2 cells/ ml equivalent. Specifically to design an assay to detect acetate- a biomolecule in several metabolic pathways (methanogenesis, aceteogenesis) and is not known to be present in the absence of life.

Background:

Currently, the ASK instrument has a total bio-load assay that can detect 10^3 cells/ ml equivalent. We would like to add an additional assay to the life detection arsenal, specifically acetate. The quantity of acetate combined with other solutes, will help determine the metabolic pathway of organisms detected. If there is no acetate detected, then there is likely no life, since acetate is a byproduct of every known metabolic pathway on Earth. We will gain knowledge on the biogeochemistry whether the results are positive or negative. A sensitivity of 10^2 is what we will design the test to since that is the calculated lowest level of organisms anticipated on a planetary surface – Europa.

Innovative Description:

Partnering with Retego Labs we will develop an acetate assay to use in the Astrobiology Search Kit advanced spectrometer. Our current knowledge of metabolic pathways (methanogeneis, and acetogenesis) both produce acetate. There is no known method of producing acetate abiotically, therefore the detection of acetate indicates the presence of biology. There is no current assays to directly detect acetate. We would be developing the first assay. Our development plan is based on the development of previous assays. We start with EPA standards then modify and increase the sensitivity based on our detection needs. In this case the detection is 10^2 cells/ml equivalent. This assay would be useful on Titan where if life exists the biogeochemistry is methane based instead of water based like Earth (possibly Mars, Europa).

Innovation Deliverables:

The design of an assay using detect Acetate using the Astrobiology Search Kit instrument.

Innovation Statement:

Our proposal is innovative because an acetate assay does not exist because its’ Earth applications are limited. There is not really a use on Earth for an Acetate assay. For life detection the presence of Acetate would indicate life. The quantity of Acetate compared with methane and sulfur could provide clues to metabolic process with the extraterrestrial microbial ecosystem. We will use Earth Analogs such as the Lost City as examples to base our calculations of the metabolic pathway ratios.

Relevance and Value to NASA and Ames:

This is an assay for universal life detection and will give insight into the geochemistry of the planetary body if no life is present. It is relevant to Astrobiology and astrobiology instrumentation which is relevant to NASA ARC. And it is relevant to planetary science division as it seeks to search for life on other planetary bodies. Also relevant to the overall NASA science goal of “Are we alone”