DEVELOPMENT OF A CHIRAL AMINO ACID SEPARATION BY MICROCHIP ELECTROPHORESIS FOR ANALYSIS OF EXTRATERRESTRIAL SAMPLES. Jessica S. Creamer[1], Maria F. Mora[1], Luther Beegle[1], and Peter A. Willis[1], [1]NASA Jet Propulsion Laboratory, 4800 Oak Grove Dr. Pasadena, CA 91109

Overview: The search for habitable environments and life in our Solar System is one of the highest priorities guiding ongoing research and technology development at NASA. To investigate the chemistry of these extraterrestrial worlds, robotic systems capable of *in situ* collection and analysis of samples for future missions are needed. Toward this goal we have developed the Chemical Laptop, the first battery-powered, automated, reprogrammable, and portable astrobiology instrument. The Chemical Laptop houses the microfluidics, electronics, and optics needed to perform highly sensitive analysis (parts-per-trillion) of biomarkers in liquid samples using microchip electrophoresis coupled to laser induced fluorescence (ME-LIF).

Amino acids are just one of the building blocks of life that can be used as specific biomarkers. While abiotic reactions tend to create a wide variety of molecules exhibiting a Gaussian distribution of chemical properties [1], life creates specific molecules that are needed to perpetuate biotic processes. For example, while more than 70 amino acids have been found on meteorites [2,3], only 20 specific amino acids are used to build proteins for terrestrial life. Hence our "amino acid alphabet" contains only 20 specifically chosen "letters" [4]. Moreover, these 20 protein amino acids have a unique chiral nature. Homochirality is necessary for proper protein folding; therefore, biologically produced amino acids will produce an excess of either L- or D-amino acids, while those generated from abiotic reactions are a racemic mix of both L- and D-forms. Therefore, a chemical analysis of soil from an alien world that showed an enantiomeric excess of either L- or D-amino acids would present very compelling and powerful evidence for the existence of extraterrestrial life.

Approach: Currently, a separation capable of resolving all 19 chiral pairs of terrestrial amino acids (and glycine) is being developed using conventional capillary electrophoresis (CE) instrumentation. Following optimization, the method will be transferred to ME and performed on the Chemical Laptop for a fully portable analysis that can be used in the field. This work builds upon previous chiral separations performed on-chip which were demonstrated to be capable of resolving a total of five chiral pairs (Val, Ser, Ala, Glu, and Asp) and Gly [5-7].

The next stage in our technology development will be to couple an automated extraction instrument [8] to the Chemical Laptop for aqueous organic extraction prior to analysis by ME-LIF. This system will be able to perform a truly end-to-end analysis of Mars analog samples, which is the ultimate goal of an in situ astrobiology instrument deployed on an extraterrestrial target. For this presentation we will summarize the progress towards these goals and give a status report of ongoing efforts in this area.

Acknowledgment: Funding provided from the NASA PICASSO Program task "Microfluidic Life Analyzer" (2014-2017, PI Willis). Jessica Creamer is a NASA Postdoctoral Program (NPP) fellow at the Jet Propulsion Laboratory, a proggram administered by Oak Ridge Associated Universities through a contract with NASA. This work was carried out at the Jet Propulsion Laboratory, California Institute of Technology, under contract with NASA. Government sponsorship acknowledged.

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