

“Limitations of Peptide Formation on Enceladus” ECCA - Final Report

During February of 2025, I had the opportunity to travel to the College of Charleston to collaborate with Dr. Jay Forsythe through the NASA Early Career Collaboration Award (ECCA). For 2 weeks, I worked in Dr. Forsythe’s lab on constraining depsipeptide/peptide formation from amino acid and hydroxy acid monomers in saline solutions at alkaline pH (pH 9), similar to those expected on Enceladus. During the trip, the project was expanded to include three different pH’s relevant to other planetary conditions, such as Mars and Europa. This project required sample preparation and analysis of ~600 samples testing each condition combination experimentally. Fourier-transform infrared (FTIR) spectroscopy and Matrix-Assisted Laser Desorption/Ionization (MALDI) were utilized for sample analysis, and required method development for optimization of S/N in the high salt samples. Results from the project expanded our knowledge of oligomerization mechanisms and the planetary conditions capable of more complex prebiotic chemistry. This work produced two publications, one on the [MALDI sample preparation of high saline samples](#) (Dzurilla et al., 2025) and one on the oligomerization within high saline environments (Dzurilla et al., 2026 *in prep*), as well as a presentation at AbSciCon 2026.



Figure 1: Experimental Sample of the saline solution and monomers

The NASA ECCA not only facilitated scientific progress, but provided an opportunity for me to develop a new relationship with a mentor. Collaborating with Dr. Forsythe and his students assisting on the project established an important relationship in my professional development. Dr. Forsythe went above and beyond to mentor me and ensure that I was learning useful scientific skills. The depsipeptide/peptide project provided an avenue for me to expand my scientific expertise in prebiotic chemistry into polymer reactions critical to life’s emergence. Receiving the ECCA has been an essential part of my scientific development, and has helped establish lasting relationships that I plan to continue into the rest of my career.

References:

Dzurilla, K. A., Herndon, E. C., Barge, L. M., & Forsythe, J. G. (2025). Sample Preparation for MALDI-TOF Mass Spectrometry of Model Prebiotic Reactions in Simulated Ocean World Environments. *ACS Omega*. <https://doi.org/10.1021/acsomega.5c07633>

ECCA Final Report – Dr. Katherine Dzurilla

Dzurilla, K. A., Herndon, E. C., Forsythe, J. G., & Barge, L. M. Constraints of Depsipeptide Formation in High Saline Conditions. (*in prep for ACS Earth and Space Chemistry*)