

**Name:** Danielle Simkus (she/her/hers)

**Code:** 691

**Home institution:** NASA Goddard / Catholic University of America

**Name of Task:** Isotopic Enrichment of Meteoritic Organics (691.006),  
Astrobiology Analytical Laboratory

**Role in task/What do you do for CRESST:**

I am a postdoctoral researcher in the Astrobiology Analytical Laboratory (AAL) at NASA Goddard Space Flight Center and I study organic matter contained in extraterrestrial samples. Using analytical techniques such as gas chromatography mass spectrometry (GC-MS) and isotope ratio mass spectrometry (IRMS), I look for small biologically relevant prebiotic organic molecules (e.g., aldehydes, ketones, alcohols, and carboxylic acids) in the solvent extracts of meteorites (samples of asteroids that have landed on Earth) and other astromaterials. The overarching goal of my work is to advance our understanding of the non-biological processes involved in the formation and preservation of prebiotic compounds in space, by studying the distributions, stable isotopic compositions, and the chirality (the left and right “handedness”) of these compounds across various meteorite types. Ultimately, understanding these processes gives us a better sense of how common the building blocks of life may be within our solar system.



**What is your background:**

I’m originally from Canada. I grew up in British Columbia and completed my undergraduate and post-graduate degrees in Alberta and Ontario. It was during my B.Sc. at the University of Alberta that I discovered my passion for astrobiology. I was studying general Biology and Earth Sciences at the time and I knew I was interested in space studies, but I didn’t think I had the background to pursue a career in the field. That mindset changed when I spent a summer working with an Earth Sciences professor and curator of the Alberta Meteorite Collection, Dr. Christopher Herd. My research project involved analyzing amino acids in meteorites to understand their extraterrestrial origins. I was fascinated by the topic and so excited to have found a field of research that fit so well with my education path and, from that project onwards, I was totally hooked! I shifted my research focus towards studying topics in astrobiology and organic geochemistry, and studied the organic content of meteorites for my Ph.D. thesis. Through Dr. Herd and my Ph.D. work, I connected with my current supervisor and colleagues at NASA Goddard, and I ultimately ended up at NASA Goddard as a postdoc in 2018!

**Favorite part of being a CRESST Scientist:**

I feel very fortunate to be able to work with such brilliant and wonderful people! Working in the AAL at NASA Goddard has honestly been a dream come true for me, and I love that I get to investigate such big-picture and thought-provoking questions through my everyday work. Not only do I get to work directly on samples from space, but I also get to apply my work to questions such as: How common are the building blocks of life in the Universe? And what does this mean for the potential for life beyond Earth?

**Highlights of research as a CRESST Scientist:**

One of the highlights of my research as a CRESST scientist has been working as part of the [Apollo Next Generation Sample Analysis \(ANGSA\) program](#). Through ANGSA, my research group analyzes the organic composition of lunar soils that have been specially curated since the Apollo missions in the 1970s! I really enjoy the collaborative aspect of this project – not only working in coordination with my AAL team

members, but also coordinating with several other teams and dozens of other scientists and engineers to maximize the valuable science attained from these precious samples. Another major highlight of my work has been my involvement as a collaborator on the science team for [OSIRIS-REx](#), a sample-return mission to the asteroid Bennu. Specifically, I am involved in the planning process for analyzing prebiotic compounds in the returned samples. Even though I have only recently joined the team, and we still have two more years to wait until the samples are returned to Earth, the anticipation and planning for the analysis of these samples have already been such an amazing experience.

#### **Selected publications:**

Smith, H. H., A. S. Hyde, **D. N. Simkus**, et al. 2021. "The Grayness of the Origin of Life." *Life*, **11 (6)**: 498 [[10.3390/life11060498](#)]

**Simkus, D.**, J. C. Aponte, J. E. Elsila, et al. 2019. "Methodologies for Analyzing Soluble Organic Compounds in Extraterrestrial Samples: Amino Acids, Amines, Monocarboxylic Acids, Aldehydes, and Ketones." *Life*, **9 (47)**: 30 pages [[Full Text \(Link\)](#)] [[10.3390/life9020047](#)]

**Simkus, D. N.**, J. C. Aponte, J. E. Elsila, et al. 2019. "New insights into the heterogeneity of the Tagish Lake meteorite: Soluble organic compositions of variously altered specimens." *Meteorit Planet Sci*, **54**: 1283-1302 [[10.1111/maps.13276](#)]

**Simkus, D. N.**, J. C. Aponte, R. W. Hilts, et al. 2019. "Compound-specific carbon isotope compositions of aldehydes and ketones in the Murchison meteorite." *Meteorit Planet Sci*, **54 (1)**: 142-156 [[10.1111/maps.13202](#)]

Herd, C. D., R. W. Hilts, A. W. Skelhorne, and **D. N. Simkus**. 2016. "Cold curation of pristine astromaterials: Insights from the Tagish Lake meteorite." *Meteorit Planet Sci*, **51 (3)**: 499-519 [[10.1111/maps.12603](#)]

**Simkus, D. N.**, G. F. Slater, B. S. Lollar, et al. 2016. "Variations in microbial carbon sources and cycling in the deep continental subsurface." *Geochim Cosmochim Acta*, **173**: 264-283 [[10.1016/j.gca.2015.10.003](#)]

Herd, C. D., A. Blinova, **D. N. Simkus**, et al. 2011. "Origin and Evolution of Prebiotic Organic Matter As Inferred from the Tagish Lake Meteorite." *Science*, **332 (6035)**: 1304-1307 [[Full Text \(Link\)](#)] [[10.1126/science.1203290](#)]

#### **Selected awards:**

- NASA Goddard Annual Code 690 Peer Award (2021)
- NASA Goddard Code 690 Special Thanks and Recognition (STAR) Award (2021)
- Izaak Walton Killam Memorial Scholarship (2016 – 2018)
- Gordon A. McKay Award, The Meteoritical Society (2016)
- Graduate Student Fellowship, Smithsonian Institution, Washington, D.C. (2014)
- President's Doctoral Prize of Distinction, University of Alberta (2013 – 2016)
- NSERC Alexander Graham Bell Canada Graduate Scholarship (2013 – 2016)
- NSERC Collaborative Research and Training Experience (CREATE) M.Sc. Fellowship (2011 – 2013)
- NSERC Undergraduate Student Research Award (2009)

**To Contact Danielle to learn more about her work and collaboration, she can be reached at:**  
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