

CURRICULUM VITAE

ZACHARY K. GARVIN

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EDUCATION

Ph.D. Candidate, Geosciences (September 2017-)
Princeton University, Princeton, NJ

M.A., Geosciences (October 2019)
Princeton University, Princeton, NJ

Sc.B., Microbiology/Immunology with Honors (May 2017)
Brown University, Providence, RI

Relevant Courses: Microbiology, Virology, Experimental Evolution, Organic Chemistry, Genetics, Advanced Biochemistry, Biostatistics, Planetary Geology, Earth: Evolution of a Habitable Planet, Terrestrial Biogeochemistry, Aqueous Geochemistry, Genomics and Computational Molecular Biology, Geomicrobiology, Microbial Life: A Geobiological View, Method and Logic in Quantitative Biology, Environmental Microbiology

RESEARCH INTERESTS

Primary interests are in the field of environmental microbiology as applied to the study of extremophilic organisms and astrobiology. Broad research goals are to study modern terrestrial analog environments and the microbes that inhabit them to determine the potential for extinct or extant microbial life on the early Earth, Mars, and other potentially-habitable bodies within the Solar System. Laboratory research has been driven by traditional microbiology along with modern -omics and analytical chemistry techniques in order to explore the biochemistry and evolutionary histories of microbes and their biomarkers in the environment.

RESEARCH EXPERIENCE

Graduate Student Thesis Research, **Princeton University** (2018-)

Advisor: Professor Tullis C. Onstott

Currently studying the soils surrounding Chilean hot springs to determine the potential for microbial trace gas (CH₄, CO, H₂, H₂S, and NH₃) uptake and lipid biomarker production/preservation in a Mars analog environment as a putative metabolic mechanism for extinct or extant Martian life.

Graduate Student 1st Year Project, **Princeton University** (2017- 2018)

Advisors: Professor Tullis C. Onstott, Dr. Maggie Lau

Analyzed soils from the ice-free regions of Antarctica for the microbial uptake of trace gases (CH₄, CO, and H₂) while performing analyses on global soil metagenomes for characterizing the controls on trace gas-utilizing microbes in soil environments (skills developed: GC, bioinformatics/metagenomics)

Undergraduate Researcher, **Brown University** (2016-2017)

Advisor: Professor Yongsong Huang

Developed suboxic peat incubations to promote and observe the growth of the unidentified brGDGT-producing bacterium (skills developed: accelerated solvent extraction, column chromatography, acid hydrolysis of lipids, HPLC-MS)

Undergraduate Research Assistant, **Brown University** (Summer 2016)

Advisor: Professor Yongsong Huang

Determined the relationship between various soil properties and bacterial brGDGT lipid distributions in U.S. soils for improved paleoclimate reconstructions (skills developed: HPLC-MS, factor analysis, multiple linear regression, R statistical programming)

Research Intern, **NASA Goddard Space Flight Center** (Summer 2014, 2015)

Advisors: Ms. Melissa Floyd, Dr. Alexander Pavlov, supported by Dr. Paul Mahaffy

Investigated the survival and potential growth of an extremophilic bacterial community in a simulated Martian environment (skills developed: microbial culturing, cell recovery from soil, bacterial staining, operation of Mars Simulation Chamber)

FIELD WORK

Arica-Tarapacá region, Chile (Spring 2019)

Soil sampling trip of an environmental gradient in the Arica-Tarapacá region of northern Chile, including sampling of a soil transect at Polloquere Hot Springs in the Salar de Surire salt pans.

Moab Khotsong Gold Mine, Orkney, South Africa (Fall 2018)

Installed U-tube water sampling device into a ~400 meter borehole at ~3 km depth to study the chemistry and microbial community in the highly saline water.

PUBLICATIONS

Peer-reviewed publications

Carrier, B. L., Beaty, D. W., Meyer, M. A., ..., **Garvin, Z. K.**, et al. Mars Extant Life: What's Next? Conference Report. *Astrobiology* **20**, 6 (2020).

Liang, R., Lau, M. C. Y., Saitta, E. T., **Garvin, Z. K.** & Onstott, T. C. Genome-centric resolution of novel microbial lineages in an excavated Centrosaurus dinosaur fossil bone from the Late Cretaceous of North America. *Environ. Microbiome* **15**, 8 (2020).

Non-referreed publications

Garvin, Z. K. Biodiversity, biogeography, and microbial carbon cycling of hot spring communities in the high Andean plateau with implications for early Mars. *NASA Astrobiology Institute Early Career Collaboration Award Report* (2019).

PROFESSIONAL PRESENTATIONS

Garvin, Z. K. Trace Gas Consumption as a Metabolic Strategy for Life Beneath the Martian Surface and the Means to Detect It. Presented virtually at Mars Exploration Program Analysis Group (MEPAG) Meeting 38. April 16, 2020.

Garvin, Z. K., Abades, S. R., Trefault, N., Alfaro, F. D., Onstott, T. C. High-Affinity Trace Gas Consumption by Soil Microbial Communities Around Hot Springs in the Andean Altiplano with Implications for Early Mars. Poster presented at AGU Fall Meeting. San Francisco, CA. December 10, 2019.

Garvin, Z. K., Abades, S. R., Trefault, N., Alfaro, F. D., Onstott, T. C. High-Affinity Trace Gas Consumption by Soil Microbial Communities Around Hot Springs in the Andean Altiplano: Implications for the Evolution of Martian Metabolisms. Oral presentation at Mars Extant Life: What's Next? Carlsbad, NM. November 7, 2019.

Lau, M. C. Y., Onstott, T. C., **Garvin, Z. K.** Global Survey of the High-Affinity Methane-Oxidizing Bacteria in Published Microbial Communities. Presented at AGU Fall Meeting. Washington D.C. December 13, 2018.

Garvin, Z. K., Huang, Y. Inducing the bacterial production of brGDGT lipids in a suboxic peat environment. Presented at the Brown University Undergraduate Honors Thesis Oral Presentation Forum. May 1, 2017.

Garvin, Z. K., Huang, Y. Inducing the bacterial production of brGDGT lipids in a suboxic peat environment. Presented at the Brown University Institute at Brown for Environment and Society Senior Research Poster Presentation Event. April 28, 2017.

Garvin, Z. K., Floyd, M. Life on Mars: extremophilic bacteria in a simulated martian environment. Presented at the NASA Goddard Summer Intern Poster Competition. July 30, 2015.

Floyd, M., Pavlov, A. A., **Garvin, Z. K.** Growth of microorganisms from an extreme Earth environment in a Mars simulation chamber. Presented at the NASA Goddard Science and Exploration Directorate Science Seminar Series. September 24, 2014.

HONORS AND AWARDS

Walbridge Fund Graduate Award for Environmental Research (2020)

Competitively selected by the Princeton Environmental Institute (PEI) to support Ph.D. dissertation research focused on environmental topics

NASA Astrobiology Early Career Collaboration Award (2019)

Received travel grant to conduct field research along an environmental gradient across the Arica-Tarapacá region of northern Chile and to perform trace gas analyses in the lab of Dr. Eric Boyd at Montana State University.

W. Michael Blumenthal Family Fund Fellowship, Princeton University (2017-2018)

Nominated by the Geosciences Graduate Studies Work Committee and selected to receive the named fellowship to support full-time graduate study for the 2017-2018 academic year.

Sigma Xi, Brown University Chapter, Associate Membership (2017)

Inducted into the Brown University Chapter of the Society of Sigma Xi for a high level of competence in science and demonstration of significant scientific research.

Brown University Voss Undergraduate Research Fellowship (2016-2017)

Fellowship awarded by the Institute at Brown for Environment and Society to support environmental research to be completed for a senior honors thesis project.

NASA Goddard Space Flight Center Intern Poster Competition, 1st Place (2015)

Awarded 1st place among all NASA Goddard interns in the *Science* category for summer research poster presentations (title: “Life on Mars: Extremophilic Bacteria in a Simulated Martian Environment”).

TEACHING AND ADVISING

Princeton Environmental Institute Summer Internship Program

Summer 2020

Mentor and project lead for Princeton undergraduate interns

Janelle Arnold, Class of 2023

Mae Kennedy, Class of 2023

Natural Disasters (GEO 103), Princeton University

Spring 2019

TA, lab instructor and grader