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Rachel L. Harris, Ph.D.

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EDUCATION

2014: **Wellesley College** – Wellesley, MA 02481 USA, **A.B.** Biological Sciences; Minor: Russian
2017: **Princeton University** – Princeton, NJ 08544 USA, **M.A.** Geosciences
2020: **Princeton University** – Princeton, NJ 08544 USA, **Ph.D.** Geosciences

PROFESSIONAL EXPERIENCE

July 2020 – Present: **Harvard University** – Dept. of Organismic and Evolutionary Biology, Cambridge, MA 02138 USA
Postdoctoral Fellow
Advisor: Dr. Peter Girguis (pgirguis@oeb.harvard.edu)

August 2014 – May 2020: **Princeton University** – Dept. of Geosciences, Princeton, NJ 08544 USA
Ph.D. Student/Candidate
Advisor: Dr. Tullis C. Onstott (Deceased)
Dissertation: "Life on the Fringe: Surveying the Ecophysiological Tenacity of Methanogens and Anaerobic Methanotrophs in the Oligotrophic Deep Subsurface Biosphere"

January 2017 – July 2017: **Scripps Institution of Oceanography, UCSD** – Marine Biology Research Division, La Jolla, CA 92037 USA
Deep Carbon Observatory Deep Life Cultivation Internship
Advisor: Dr. Douglas Bartlett (dbartlett@ucsd.edu)

May 2014 – August 2014: **Centre National de la Recherche Scientifique (CNRS)** – Équipe Spectrométries et Dynamique Moléculaire, Laboratoire de Physique des Interactions Ioniques et Moléculaires, Aix Marseille Université - Campus St. Jérôme, Marseille, France
Research Scientist, Project VAHIIA (Volatile Analyses from the Heating of Interstellar/cometary Ice Analogues)
Advisor: Dr. Grégoire Danger (gregoire.danger@univ-amu.fr)

May 2011 – August 2011, January 2014 – May 2014: **Massachusetts Institute of Technology** – Dept. of Earth, Atmospheric, and Planetary Sciences, Cambridge, MA 02139 USA
Undergraduate Research Opportunities Program (UROP)/Senior Thesis
Advisors: Dr. Tanja Bosak (tbosak@mit.edu)
Dr. Vanja Klepac-Ceraj (vklepacc@welleslely.edu)
Thesis: "Hydrodynamic Conditions in Marine Benthic Environments Affect Nutrient Uptake and Biomineralization in Cyanobacterial Mats"

June 2012 – August 2012, June 2013 – August 2013: **NASA Ames Research Center** – NASA Astrobiology Institute, Moffett Field, CA 94035 USA,
SETI REU/Exobiology Branch (SSX) Intern

Advisor: Dr. David J. Des Marais (David.J.Desmarais@nasa.gov)

PROFESSIONAL PANELS & COMMITTEES

Mars Sample Return Campaign Science Group (NASA/ESA) 2022 - present
International panel of 16 scientists coordinating with the Mars2020 mission to recover and curate samples from the surface of Mars.

NASA Exobiology (ROSES program element C.5) 2022
Exobiology program panel reviewer for proposals in the "Early Evolution of Life and the Biosphere" area of research

Wellesley College. Science Center Summer Research Program. 2021
Alumnae panel on graduate school admissions in STEM.
Wellesley, MA USA

PEER REVIEWED PUBLICATIONS *(undergraduate mentees underlined)*

Harris, R. L. and Schuerger, A. C. Hydrogenotrophic methanogenesis at 7-12 mbar by *Methanosarcina barkeri* under simulated Martian atmospheric conditions. *PNAS. In Review.*

Mars Sample Return Campaign Science Group *[including **Harris, R. L.**]*. Report of the Science Community on the Proposed First Sample Depot for the Mars Sample Return Campaign. *Meteoritics & Planetary Science.* 2023. doi: 10.1111/maps.13981

Liu, J., **Harris, R. L.**, Ash, J. L., Ferry, J. G., Labidi, J., Krause, S. J. E., Prakash, D., Sherwood Lollar, B., Treude, T., Warr, O., and Young, E. D. Reversibility controls on extreme methane clumped isotope signatures from anaerobic oxidation of methane. *Geochimica et Cosmochimica Acta.* 2023. doi: 10.1016/j.gca.2023.02.022

Harris, R. L., Lau, M. C. Y., van Heerden, H., Cason, E., Vermeulen, J., Taneja, A., Kieft, T. L., DeCoste, C., Laevsky, G., and Onstott, T. C. FISH-TAMB, a fixation-free mRNA fluorescent labeling technique to target transcriptionally active members in microbial communities. *Microbial Ecology*. 2021. doi: 10.1007/s00248-021-01809-5.

Harris, R. L., Schuerger, A. C., Tamama, Y., Garvin, Z., Wang, W., and Onstott, T. C. Regulatory responses of *Methanosarcina barkeri* to freezing temperatures and perchlorates: Transcriptional response to prolonged perchlorate exposure in the methanogen *Methanosarcina barkeri* and implications for Martian habitability. *Scientific Reports*. 2021. doi: 10.1038/s41598-021-91882-0.

Warr, O., Giunta, T., Onstott, T. C., Kieft, T. L., **Harris, R. L.**, Nisson, D. M., and Sherwood Lollar, B. The role of low-temperature ^{18}O exchange in the isotopic evolution of deep subsurface fluids. *Chemical Geology*. 2021. doi: 10.1016/j.chemgeo.2020.120027.

Carrier, B. L., et al. *[including **Harris, R. L.**]*. Mars Extant Life: What's Next? Conference Report. *Astrobiology*. 2020. doi: 10.1089/ast.2020.2237.

Harris, R. L., Lau, M. C. Y., Cadar, A., Bartlett, D. H., Cason, E., van Heerden, E., and Onstott, T.C. Draft Genome Sequence of "*Candidatus* Bathyarchaeota" Archaeon BE326-BA-RLH, an Uncultured Denitrifier and Putative Anaerobic Methanotroph from South Africa's Deep Continental Biosphere. *Microbiology Resource Announcements*. 2018. doi: 10.1128/MRA.01295-18.

Lau, M.C.Y., **Harris**, **R. L.**, Oh, Y. Yi, M. J. and Onstott, T.C. Taxonomic and functional compositions impacted by the quality of metatranscriptomic assemblies. *Frontiers in Microbiology*. 2018. doi:10.3389/fmicb.2018.01235.

Huang, J., Salvatore, M., Edwards, C. S., **Harris, R. L.**, and Christensen, P. C. A complex fluviolacustrine environment on early Mars and its astrobiological potentials. *Astrobiology* **18**(8). 2018. doi:10.1089/ast.2017.1757.

Lau, M. C. Y., Kieft, T. L., Kuloyo, O., Linage-Alvarez, B., van Heerden, E., Lindsay, M. R., Magnabosco, C., Wang, W., Wiggins, J. B., Guo, L., Perlman, D. H., Kyin, S., Shwe, H. H., **Harris, R. L.**, Oh, Y., Yi, M. J., Purtschert, R., Slater, G. F., Ono, S., Wei, S., Li, L., Sherwood Lollar, B., and Onstott, T.C. An oligotrophic deep-subsurface community dependent on syntrophy is dominated by sulfur driven autotrophic denitrifiers. *PNAS*. 2016. doi: 10.1073/pnas.1612244113

WHITE PAPERS

Edwards, C D. et al. *[including **Harris, R. L.**]*. Deep Trek: Mission Concepts for Exploring Subsurface Habitability & Life on Mars – A Window into Subsurface Life in the Solar System. *Submitted to the National Academies Planetary Science and Astrobiology Decadal Survey, 2023-2033.* 2020.

Garvin, Z. K., et al. *[including **Harris, R. L.**]*. Mars Trace Gas Fluxes: Critical Strategies and Implications for the Upcoming Decade. *Submitted to the National Academies Planetary Science and Astrobiology Decadal Survey, 2023-2033.* 2020.

Stamenkovíc, V. et al. *[including **Harris, R. L.**]*. Deep Trek: Science of Subsurface Habitability & Life on Mars – A Window into Subsurface Life in the Solar System. *Submitted to the National Academies Planetary Science and Astrobiology Decadal Survey, 2023-2033.* 2020.

PREPRINTS AND WORKING PAPERS

Harris, R. L., Alian, O., Klonicki, E., Treude, T., and Girguis, P. R. Prolific rates of anaerobic methane oxidation on metalliferous hydrothermal sulfide chimneys at Ringvent site, North Guaymas Basin. *In prep.*

Schuerger, A. C. and **Harris, R. L.** Geochemistries of diverse Mars analog soils can boost or inhibit methane production at freezing temperatures. *In prep.*

Harris, R, L., and Schuerger, A. C. Hydrogenotrophic Methanogenesis at 7-12 mbar by *Methanosarcina barkeri* under Simulated Martian Atmospheric Conditions. *Research Square*. 2023. doi.org/10.21203/rs.3.rs-3221337/v1.

TEACHING EXPERIENCE

Harvard University Extension School – Cambridge, MA 02138, Arts & Humanities Division

Co-Instructor
Fall 2020: HUMA E-103 – Sea Monsters Throughout the Ages: Fables, Films, and Facts
Co-Instructor: Dr. Peter Girguis (pgirguis@oeb.harvard.edu)

Princeton University – Princeton, NJ 08544, Dept. of Geosciences
Assistant in Instruction
Spring 2018: GEO 428 – Biological Oceanography
Instructor: Dr. Bess B. Ward (bbw@princeton.edu)
Fall 2017, Fall 2018: GEO 255 – Life in the Universe
Instructor: Dr. Tullis C. Onstott
(tullis@princeton.edu)

Wellesley College – Wellesley, MA 02481, Dept. of Astronomy
Teaching Assistant
Fall 2012, Fall 2013, Spring 2014: ASTR 102 – Intro to Astronomy
Instructor: Dr. Stephen Slivan (sslivan@wellesley.edu)

STUDENTS ADVISED

Beck Saine. Harvard ’22. (Chemistry, Earth & Planetary Sciences). Senior Thesis. 2021
Program for Research in Science and Engineering.
“Redox potential (Eh) as an agnostic biosignature for active microbial metabolisms at deep-sea hydrothermal vents in the East Pacific Rise and Guaymas Basin”

Sarah Crucilla. Caltech ’20. (Geology). 2020 – 2021
Post-Baccalaureate Researcher, Girguis Lab, Harvard University.
“Geoelectrochemical metal aggregation at hydrothermal vents: Implications for prebiotic chemistry”
Current position: PhD student at Harvard University, Department of Earth & Planetary Sciences

Yuri Tamama. Princeton ’22. (Geosciences). 2019
Princeton Environmental Institute Summer Internship Program.
“Transcriptomics of Methanogens Under Simulated Subsurface Conditions of Mars”

Calvin Rusley. Princeton’20. (Geosciences). Junior Project. 2018 – 2019
“Exploring the Limits of Life in a South African Deep Subsurface Brine”
Current position: PhD student at Caltech, Division of Geological and Planetary Sciences

Olivia Guan. Princeton ’21. (Economics). 2018
Princeton Environmental Institute Summer Internship Program.
“Abiotic Hydrogen and Methane Gas Production from Butyl Rubber Stoppers”.
Current position: Undergraduate Course Assistant for Econometrics at Princeton University

Andreia Cadar. Rochester Institute of Technology ’20 (Biotechnology). 2017
“*De novo* metagenome assembly and annotation of a South African Subsurface Lithoautotrophic Microbial Ecosystem (SLiME)”

Current position: *Ph.D. student at University of Connecticut Health Center*

Jana M. Suriano. Princeton ’17. (Geosciences). Senior Thesis. 2016 – 2017
“Survival and Metabolism of *Methanosarcina soligelidi* Under Simulated Martian Subsurface Conditions”.
Current position: MS student at University of Wisconsin – Stevens Point, Soil and Waste Resources Program

Anjali Taneja. Princeton ’16. (Dept. of Geosciences). Junior Project. 2014
“Development of a Fluorescent Probing Protocol to Detect *in situ* Prokaryotic mRNA Transcription”.
Current position: Software Technical Architect Leader at IBM

PATENTS

Harris, R. L., Lau-Vetter, M. C. Y., Onstott, T. C. Fluorescent *in situ* Hybridization of Transcript-Annealing Molecular Beacons (FISH-TAMB). US Provisional Patent (63/093,347). 2020

INVITED TALKS

American Geophysical Union Fall Meeting 2023
“Act locally, [re]think globally: A microbial perspective of habitability and ecosystem-scale processes and how we might be underestimating the extent of habitable refugia in astrobiological targets”
B078 – Targeting Microhabitats for Life Detection and Biological Investigations

Harvard College Freshman Seminar Program 2022
“Mars: The Hidden Ocean World”
Guest Lecturer, Freshman Seminar 50V – Sea Monsters

Archaea Power Hour 2022
“Methanogens, perchlorates, transcriptomics, and Mars: Adaptive strategies of *Methanosarcina barkeri* to combat extreme oxidative stress”
Archaea Power Hour Virtual Seminar Series

Harvard University Microbial Sciences Initiative 2021
“FISH-TAMB: The First Live-Cell Imaging Technique to Target Gene-Specific mRNA in Prokaryotes”
Friday Chalk Talk Series
Cambridge, MA USA

Wellesley College. Dept. of Biological Sciences 2019, 2020
“Fantastic niches and where to find them: Exploring the thermodynamic limits of microbial habitability”
Guest Lecturer, BISC 201 – Microbiology
Wellesley, MA USA

Princeton University. Dept. of Geosciences 2019

"Hiding in plain sight? Tracing cryptic anaerobic methane oxidation to the cosmopolitan deep biosphere phylum *Candidatus* Bathyarchaeota"
Environmental Geology and Geochemistry Seminar Series
Princeton, NJ USA

Princeton University. Dept. of Molecular Biology 2018
"Canaries in a gold mine: How biogeochemistry and genomics revealed a novel anaerobic methanotroph in Candidate Phylum Bathyarchaeota"
Prokaryotes Seminar Series
Princeton, NJ USA

CONFERENCE PRESENTATIONS

Harris, R. L., and Girguis, P. R. Act locally, [re]think globally: A microbial perspective of habitability and ecosystem-scale processes and how we might be underestimating the extent of habitable refugia in astrobiological targets. AGU Fall Meeting, San Francisco, CA. *Invited speaker.* 2023.

German, C. R. Randolph-Flagg, N., Kang, W., Robinson, K., **Harris, R. L.**, Winnikoff, J. R., Som. S., Diaz, M., Ely, T., and Elkassas, S. M. Exploring ocean worlds among the Uranian system's moons. Uranus Flagship 2023: Investigations and instruments for cross-discipline science. Pasadena, CA. 2023

Harris, R. L., and Girguis, P. R. Redox biosignatures at metalliferous mid ocean ridge systems. Exploring Ocean Worlds annual meeting. Tempe, AZ. Oral presentation. 2023.

Meyer, M. A., Kminek, G. and the Mars Sample Return Campaign Science Group *[including **Harris, R. L.**]*. The Mars Sample Return Campaign Science Group and Summation of the Mars 2020-Mars Sample Return Depot Workshop. AGU Fall Meeting. Chicago, IL. Oral presentation. 2022.

Alian, O. M., **Harris, R. L.**, Girguis, P. R., and Schrenk, M. O. Bulk measurements and microscale heterogeneity: Reconciling differences for the detection of agnostic biosignatures. AGU Fall Meeting. Chicago, IL. Poster presentation. 2022.

Harris, R. L., and Schuerger, A. C. Methanogenesis at 7-12 mbar under a simulated Martian atmosphere: New revelations from transcriptomics on the habitability of the shallow Martian subsurface. AGU Fall Meeting. Chicago, IL. Poster presentation. 2022.

Liu, J., **Harris, R. L.**, Ash, J. L., Ferry, J. G., Labidi, J., Krause, S. J. E., Prakash, D., Sherwood Lollar, B., Treude, T., Warr, O., and Young, E. D. Reversibility controls on extreme methane clumped isotope signatures from anaerobic oxidation of methane. Goldschmidt. Honolulu, HI. Oral presentation. 2022

Liu, J., **Harris, R. L.**, Ash, J. L., Ferry, J. G., Labidi, J., Krause, S. J. E., Prakash, D., Sherwood Lollar, B., Treude, T., Warr, O., and Young, E. D. Methane clumped isotope signature of anaerobic oxidation of methane. EGU General Assembly. Vienna, Austria. Oral presentation. 2022.

Harris, R. L., Schuerger, A. C., Hartmann Reardon, C., Wang, W., Tamama, Y., Garvin, Z. K., Onstott, T. C., and Girguis, P. R. Is Martian methane a biosignature? New insights from transcriptomics into the

ecophysiology of methanogens under simulated Martian temperatures, pressures, atmospheric composition, and perchlorates. AbSciCon. Atlanta, GA. Invited Panelist. 2022.

Girguis, P. R., **Harris, R. L.**, Baker, I., Marlow, J. J., Picard, A., and Gartman, A.The Needle in the Haystack is still a Needle: Honing in on Biosignatures for Life Detection on Other Worlds. AbSciCon. Atlanta, GA. Oral presentation. 2022.

Crucilla, S., **Harris, R. L.**, and Girguis, P. R. Geoelectrochemical aggregation of molybdenum and tungsten for use in prebiotic chemistries. AbSciCon. Atlanta, GA. Poster presentation. 2022.

Harris, R. L., Mitchell, J., Hwang, Y., Travis, B., and Girguis, P. R. FISH-TAMB – A Rapid, Fixation-Free Tool for Real-Time, Nanoscale Imaging of Microbial Transcription. Ocean Sciences Meeting. Virtual. Oral presentation. 2022.

Crucilla, S., **Harris, R. L.**, and Girguis, P. Geochemical aggregation of molybdenum and tungsten at hydrothermal vents: Implications for prebiotic chemistry. AGU Fall Meeting. New Orleans, LA. Oral presentation. 2021.

Saine, B., **Harris, R. L.**, and Girguis, P. Cooking up chemolithoautotrophy: Monitoring redox conditions during the incubation of a microbial consortium from a hydrothermal sulfide chimney in the East Pacific Rise. AGU Fall Meeting. New Orleans, LA. Poster presentation. 2021.

Harris, R. L., Ferry, J. G., Labidi, J., Treude, T., Sherwood Lollar, B., Onstott, T. C., and Young, E. Predicting thermodynamic disequilibrium of $^{13}CH_3D$ processed by AOM. C-DEBI Annual Meeting. Virtual. Oral presentation. 2020.

Warr, O., Giunta, T., Onstott, T. C., Kieft, T. L., **Harris, R. L.**, Nisson, D. M., and Sherwood Lollar, B. Geochemical Signatures of Fluid-Rock Interaction: Earth Surface Weathering to Hydrothermal Systems. GSA Annual Meeting. Virtual. Oral presentation. 2020.

Harris, R. L., Tamama, Y., Suriano, J., Wang, W., Schuerger, A., and Onstott, T. C. Follow the Methane: Pushing Methanogens to the Extreme to Understand the Limits of Biological Methanogenesis Under Simulated Martian Subsurface Conditions. AGU Fall Meeting. San Francisco, CA. Oral presentation. 2019.

Harris, R. L., Bartlett, D. H., Lau, M. C. Y., Onstott, T. C., and the Scientific Team of IODP 370. *In vivo* visualization of methyl coenzyme M reductase transcriptional activity in deep biosphere anaerobic methanotrophs (ANMEs). Deep Carbon Science 2019: Launching the Next Decade of Deep Carbon Science. Washington, D.C. Poster presentation. 2019.

Harris, R. L. Ehlmann, B. L. Bhartia, R., and Onstott, T. C. Biologically Mediated Anaerobic Methane Oxidation – The Missing Sink in an Active Martian Methane Cycle? Mars Extant Life: What's Next? Carlsbad, NM. Oral presentation. 2019.

Harris, R. L., Lau, M. C. Y., Labidi, J., Hu, D., Hoyt, A., Liu, X., Cobb, A., Zhuang, G., Cason, E., Vermeulen, J., van Heerden E., Kieft, T., Sherwood Lollar, B., Young, E., Harvey, C., Cliff, J., Bartlett,

D. H., Onstott, T. C., and the Scientific Team of IODP 370. Hiding in plain sight? Tracing cryptic anaerobic methane oxidation to the cosmopolitan deep biosphere phylum *Candidatus* "Bathyarchaeota". Gordon Research Seminar on Archaea: Ecology, Metabolism, and Molecular Biology. Les Diablerets, Switzerland. Oral presentation. 2019.

Harris, R. L. Lau, M. C. Y., Cadar, A., Bartlett, D., Cason, E., van Heerden, E., and Onstott, T. C. Metabolic Potential of an Uncultured, Putatively Denitrifying Anaerobic Methanotroph from South Africa's Deep Biosphere Belonging to Candidate Phylum Bathyarchaeota. AGU Fall Meeting. Washington, D. C. eLightning presentation. 2018.

Onstott, T. C., Ehlmann, B. L., Sapers, H. M., Magnabosco, C., Lau, M. C. Y., Kieft, T. L., **Harris, R. L.**, Marlow, J. J., Ivarsson, M., and Neubeck, A. A Review of The Continental Subsurface Biomass and Biodiversity: Implications for Exploring a Potential Martian Subsurface Biosphere. AGU Fall Meeting. Washington, D. C. Oral presentation. 2018.

Onstott, T. C., Ehlmann, B. L., Sapers, H., Marlow, J., Ivarsson, M., Neubeck, A., Nisson, D. **Harris, R. L.**, Garvin, Z., Niles, P., and Coleman, M. How Mars 2020 Could Look for Life in the Noachian Stratigraphy at NE Syrtis or Midway. Fourth Landing Site Workshop for the Mars 2020 Rover Mission. Glendale, CA. Oral presentation. 2018.

Harris, R. L., Bartlett, D., Hoshino, T., Brynes, A. W., Walsh, K. M., Lau, M. C. Y., and Onstott, T. C. Stable isotopic evidence of high-pressure, high-temperature anaerobic methane oxidation in sub-seafloor sediments from IODP 370 site C0023A: insights and investigations from a one-year incubation experiment. IODP Expedition 370 2nd Post-Cruise Meeting – University of Aberdeen. Aberdeen, UK. Oral presentation. 2018.

Harris, R. L., Bartlett, D., Hoshino, T., Byrnes, A. W., Walsh, K. M., Lau, M. C. Y., Onstott, T. C. and the Scientific Team of IODP Expedition 370. Revisiting the potential role of Bathyarchaeota in deep biosphere methane oxidation. A study of sub-seafloor sediments from IODP 370 site C0023A in the Nankai Trough. Northeast Geobiology Symposium. Woods Hole, MA. Poster presentation. 2018.

Harris, R. L., Bartlett, D., Byrnes, A. W., Walsh, K. M., Lau, M. C. Y., Onstott, T. C., and the Scientific Team of IODP Expedition 370. Assessing the High Temperature, High Pressure Subsurface for Anaerobic Methane Oxidation. AGU Fall Meeting. New Orleans, LA. Poster presentation. 2017.

Harris, R. L., Lau, M. C. Y., van Heerden, E., Cason, E. B., Vermeulen, J., Taneja, A., Kieft, T. L., DeCoste, C., Laevsky, G., and Onstott, T. C. Labeling of prokaryotic mRNA in living cells using fluorescent *in situ* hybridization of transcript-annealing molecular beacons (FISH-TAMB). Sigma Xi Student Research Conference. Raleigh, NC USA. Poster presentation. 2017.

Harris, R. L., Huang, J., Salvatore, M., Edwards, C., Christensen, P., Xiao, L., and Xu, Y. Assessing the astrobiological potential of a unique Martian Evaporitic Fluviolacustrine Environment. AbSciCon. Mesa, AZ USA. Poster presentation. 2017.

Harris, R. L., Lau, M. C. Y., Onstott, T. C. Elucidation of active players in biogeochemical cycling via fluorescent in situ hybridization of transcript-annealing molecular beacons (FISH-TAMB). ISME-16. Montréal, Canada. Oral presentation. 2016.

Onstott, T. C., Lau, C. Y. M., Magnabosco, C., **Harris, R. L.**, Chen, Y., Slater, G., Sherwood Lollar, B., Kieft, T. L., van Heerden, E., Borgonie, G., and Dong H. Biogenic carbon on Mars: A subsurface chauvinistic viewpoint. AGU Fall Meeting. San Francisco, CA. Oral presentation. 2015.

Harris, R. L., Onstott, T. C., van Heerden, E., Cason, E., and Kieft, T. Technical considerations for deep life drilling. International Continental Drilling Program DSeis Workshop. Potchefstroom, South Africa. Oral presentation. 2015.

PUBLIC OUTREACH

Meadowview Middle School. 2021
Guest Speaker, Mission to Mars Lego Camp
Mount Airy, NC USA

Rotary International Foundation 2021
"From *Viking* to *Perseverance:* 45 years of reimagining life detection on Mars"
Guest Speaker, Rotary Club of Mount Airy
Mount Airy, NC USA

Lawrence High School. STEM Careers Day. 2018, 2019, 2022, 2023
Lawrenceville, NJ USA. *Invited scientist.*

QUEST – Questioning Underlies Effective Scientific Teaching.
- "Using Math to Search for Life on Other Worlds" 2018
- "Life in Extreme Environments" 2016

Princeton, NJ USA. *Course organizer. Workshop leader.*

Princeton University Science Olympiad Invitational. "Microbe Mission". 2018
Princeton, NJ USA. *Biology/Life Sciences Judge.*

Dark Sky Festival – Lassen Volcanic National Park. 2013
NASA Astrobiology Institute. "Mars Analog Environments".
Mineral, CA USA. *Participating early career scientist.*

SYNERGISTIC ACTIVITIES

Synthesis Lead. "Seafloor2Surface: Redox Gradients as Biosignatures in Earth's Ocean and Ocean Worlds". Exploring Ocean Worlds (80NSSC19K1427) 2023

Primary Session Convener. AGU Fall Meeting
- "The New Mars Underground" 2023
  San Francisco, CA USA
- "The New Mars Underground: Nexus of Decadal Planetary Science Objectives" 2022
  Chicago, IL USA

• "The New Mars Underground: Astrobiology, Planetary Science, and Space Resources At the Dawn of Mars Sample Return" 2021
New Orleans, LA USA
• "The New Mars Underground 3.0" 2020
Virtual

Executive Committee. Harvard FAS Postdoctoral Association
Treasurer 2022 - present
Advocacy Committee Chair 2021 - present
Harvard University Faculty of Arts and Sciences
Cambridge, MA USA

Co-chair: Gordon Research Seminar on Deep Carbon Science 2022
"Carbon at the Intersection of the Biosphere and Geosphere"
Bates College, Lewiston, ME USA

Sandbox Team. MIT Sandbox Innovation Fund Program 2021-2022
Team Syntrophia
Massachusetts Institute of Technology
Cambridge, MA USA

"Ocean-Shot" Cohort 2 Member. National Academies of Sciences, Engineering, and Medicine 2021
"FISH-TAMB for a healthier ocean: A novel, scalable tool by Syntrophia to sustainably harness microbial power and supercharge bioindustrial processes"
Authors: Rachel L. Harris
Nicholas Lyons
Hiroko Muraki-Gottlieb

Finalist Cohort. Activate Eco Life Sciences Venture Program 2020 - 2021
Syntrophia
Co-founder: Nicholas Lyons. MIT Sloan '22. E: njlyons@mit.edu
Sustainability advisor: Hiroko Muraki Gottlieb, J.D. E: hmurakigottlieb@fas.harvard.edu
Sponsored by Harvard University Biotech Club
Harvard Business School
MIT Sloan School of Management

Member. Future Leaders of Ocean Worlds (FLOW) 2020 - present

Proprietor. Network for Ocean Worlds (NOW) twitter account 2020 - present
Twitter handle: @Ocean_Worlds
NOW is a NASA Astrobiology-funded Research Coordination Network (RCN) investigating science and technology of ocean worlds exploration

Session co-chair: "Potential Martian Extant Life Environments III – Subsurface" 2019
Mars Extant Life: What's Next? Carlsbad, NM USA.

Organizer and co-founder: Princeton Geomicrobiology Journal Club 2016 - 2020

HONORS AND AWARDS

Harvard Microbial Sciences Initiative Annual Symposium Poster Competition, 2nd place 2023
Jet Propulsion Laboratory Mars Student Travel Grant 2019
Arnold T. Guyot Teaching Award 2018
Sigma Xi Superior Presentation Award 2017
Deep Carbon Observatory Deep Life Cultivation Internship 2016-2017
ISME-16 Travel Grant 2016
National Science Foundation Graduate Research Fellow 2015-2020
Three Generations Prize for Writing in the Sciences – Wellesley College 2014
Edward M. Armfield Scholar – Northwestern North Carolina 2010-2014
Frances Meaker Colville Scholar – Wellesley College 2013
Office of the Provost Student Research Grant – Wellesley College 2013
Dr. Gerald A. Soffen Memorial Travel Grant 2013

FIELD WORK

Western Galapagos Spreading Center, R/V *Falkor(Too)* 2023
Moab Khotsong Gold Mine, Gauteng Province, South Africa 2015, 2016
Beatrix Gold Mine, Free State, South Africa 2015, 2016
Fjaðrárgljúfur (Feather River Canyon), Iceland 2016
Western Cape Province hot springs, South Africa 2015
Limpopo Province hot springs, South Africa 2015
Death Valley springs, Nevada USA 2014
Lassen Volcanic National Park hot springs, California USA 2012, 2013

GRANTS RECEIVED

NSF Program in Oceanographic Technology and Interdisciplinary Coordination 2023
"Development of a simple, low-cost device for sample collection and on-site Preservation using a common oceanographic deployment platform". (LN53LCFJFL45).
Postdoctoral Fellow.

NASA Exobiology Program. "Exploring Ocean Worlds – Ocean Systems Science 2020 - 2023
to Support the Search for Life". (80NSSC19K1427).
Postdoctoral Fellow.

Census of Deep Life. "Utilizing Metagenomics to Resolve the Metabolic 2018
Potential of a Novel Bathyarchaeota Archaeon Putatively Implicated in Deep Biosphere Methane Cycling in South Africa's Beatrix Gold Mine and IODP 370 Site C0023A in the Nankai Trough". *Lead PI.*

Integrated Ocean Discovery Program. Expedition 370: T-Limit of the Deep Biosphere 2017
Off Muroto. "Utilizing FISH-TAMB for the Isolation of CH_4-Cycling Microbes in the Nankai Trough". *Lead PI.*

Deep Energy – Deep Carbon Observatory. "Impact of Thermophilic and Barophilic Anaerobic Methane Oxidizers on the Clumped Isotopic Composition of Methane". *Co-I.* 2017

NASA Exobiology Program. "Transcriptomics and Proteomics of Methanogens under Simulated Subsurface Conditions that Mimic Recurring Slope Lineae on Mars". (NNX17AK87G). *Co-I.* 2017 - 2020

GRANTS IN REVIEW

National Science Foundation Program in Biological Oceanography. 2023
"Methanotrophy at Hydrothermal Vents: A Missing Methane Sink".
Wrote and submitted proposal.

SKILLS

Laboratory

Microbial ecology of extreme environments
Methane Biogeochemistry
Fluorescent *in situ* Hybridization (FISH)
Flow Cytometry
Cavity Ring-Down Spectroscopy (CRDS)
Gas Chromatography Mass Spectrometry (GC-MS)
Ion Chromatography Mass Spectrometry (IC-MS)
Isotope Ratio Mass Spectrometry (IRMS)
Microscopy – epifluorescence and confocal
DNA/RNA isolation, amplification, purification, and sequencing
Micro-CT

Computational

Bioinformatics ([meta]genomics, [meta]transcriptomics)
R
Unix/Linux/Bash/Slurm
The Geochemist's Workbench
Adobe Illustrator

Linguistic

English: Native
Russian: Advanced
French: Intermediate

SOCIETY MEMBERSHIP

Scientific Society for Astrobiology (founding member)	2023 - present
American Mountain Guides Association (Professional)	2018 - 2020
American Society for Microbiology	2017 - present
International Society of Microbial Ecology	2016 - present
American Geophysical Union	2016 - present
The Mars Society	2016 - present

Sigma Xi 2014 - present

ACTIVE CERTIFICATIONS

Personal Survival Techniques (STCW Code) 2023