

# Laurie Barge, Ph.D.

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Research website: <https://www.lauriebarge.com/> | Lab website: [origins-habitability.jpl.nasa.gov](https://origins-habitability.jpl.nasa.gov)

**Relevant Expertise:** Barge has 20+ years of experience in conducting laboratory experiments to simulate chemistry in planetary environments; her research has led to development of methods to simulate hydrothermal systems on early Earth and ocean worlds. She co-founded and co-leads the JPL Origins and Habitability Laboratory, an astrobiology research group which studies how life emerges and can be detected on planets. Barge leads various research teams funded by NASA and others studying topics such as origin of metabolism, habitability of Enceladus and other ocean worlds, and exploration of hydrothermal vents in the lab and in the field. She is the Co-lead of the Nexus for Exoplanet System Science (NExSS), a steering committee member for the NASA Astrobiology program's Research Coordination Networks for Ocean Worlds (NOW) and Life Detection (NFoLD), and was named as a 2020 and 2021 Scialog "Signatures of Life in the Universe" Fellow. Barge is the HiRISE Investigation Scientist for NASA's Mars Reconnaissance Orbiter and a Participating Scientist for NASA's Mars Science Laboratory (*Curiosity* rover). For her astrobiology work Barge has received the Rosalind Franklin Award for Science in Astrobiology; the JPL Lew Allen Award; the NASA Early Career Public Achievement Medal; and the Presidential Early Career Award for Scientists and Engineers.

## Research Interests:

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- ***Astrobiology of ocean worlds:*** Assessing the habitability of ocean worlds, particularly in hydrothermal vent systems that may exist / have existed in ocean world interiors. Using terrestrial hydrothermal field sites as ocean world analogs, we develop analysis techniques and science strategies for life detection at vents.
- ***Planetary organic geochemistry:*** What processes can produce organic signatures on Mars and ocean worlds, and how can organics indicate the geochemical conditions in which they formed? What is the fate of bio-essential elements (e.g. nitrogen, phosphorus) on these worlds? We conduct lab studies of analog minerals to help identify organic / inorganic chemical pathways and produce useful test samples for mission-relevant instruments.
- ***Origin of life:*** Conducting laboratory simulations of hydrothermal systems on the early Earth, Mars, and ocean worlds, to understand whether these environments could have driven the emergence of life. Studies include organic synthesis, mineral-driven prebiotic chemistry, and emergence of metabolic pathways.

## Current Positions:

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**NASA Jet Propulsion Laboratory**      2010 - present

- **Senior Research Scientist** (2025 – present)
- **PI, JPL Origins and Habitability Laboratory.** Co-lead astrobiology research team of ~10-15 students / postdocs whose projects span themes such as origin of life, habitability, and life detection. Hold weekly quiet hours with individuals, weekly lab / group meetings; facilitate ongoing program of seminars for the group; manage laboratory.
- **NASA Mars Science Laboratory (MSL), Participating Scientist** (2022 – present) Lead investigation of abiotic / prebiotic organic chemistry driven by Mars analog minerals to understand how redox/pH conditions in Gale Crater could have driven formation of organics that were detected by MSL.
- **HiRISE Investigation Scientist, Mars Reconnaissance Orbiter (MRO), NASA Jet Propulsion Laboratory** (2015 – present) Liaison between the High Resolution Imaging Science Experiment (HiRISE) team at University of Arizona and the Mars Reconnaissance Orbiter (MRO) project at JPL.
- **MRO Payload Support Team (2015-present).** Conduct 5-week preparation for MRO's 2-week observing cycles.
- **Co-lead, Nexus for Exoplanet System Science (NExSS).** JPL Co-lead (on behalf of the Exoplanet Exploration Program, ExEP) of NASA research coordination network dedicated to the study of planetary habitability,
- **Program Area Scientist for Ocean Worlds, JPL Planetary Science Directorate** (2023 – 2025) Led astrobiology strategy & expertise for JPL's Planetary Sciences Directorate.

## Education:

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Ph.D., 12 / 2009, Geological Sciences, University of Southern California, Los Angeles, CA

B.S., 8 / 2004, Astronomy and Astrophysics, Villanova University, Villanova, PA

### Other Professional Experience:

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**Oak Crest Institute of Science**, Visiting Researcher, 2013 – present.

#### **NASA Jet Propulsion Laboratory**

NASA Astrobiology Institute (NAI) Postdoctoral Fellow (3/2013 – 3/2015)

Caltech Postdoctoral Scholar, NAI Icy Worlds Team (6/2010 – 3/2013)

Phoenix/Mars Science Laboratory Landing Site Working Groups, Graduate Researcher, 2004–2006

**Marathon Oil Company**, Petrophysics Intern, Summer 2008.

**NASA Goddard Space Flight Center**, NASA Academy Intern, Summer 2004.

Additional training:

2021 JPL Scientist-Mission Interface Workshop

2011 São Paulo Advanced School of Astrobiology (SPASA), São Paulo, Brazil.

2009 NASA/Nordic Astrobiology Summer School: "Water, Ice and the Origin of Life in the Universe"

2006 NASA/ESA International Summer School in Astrobiology: "Origins: From the Big Bang to Life."

LAPLACE Astrobiology Winter School: "Habitable Planets Around Sun-like Stars: Common or Rare?"

2005 NAI Astrobiology Winter School, U. of Hawaii, "Water on Earth and in Space"

### Peer-Reviewed Publications:

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*Italic / Underline* = Student / postdoc under my supervision

Riazi-Sekowski S, Bundang K, Chastain J, Carman N, Velling S, Aguilera J, Luna M, Trejo C, Alian O, Teece BL, Dzurilla KA, **Barge LM**, Weber JM. (2026) Organic Cofactors in the Electron Transport Chain: Properties and Connection to the Prebiotic World. *ChemSystemsChem*, 8(2): e00037, <https://doi.org/10.1002/syst.202500037>.

Weber JM, Martinez E, Sheppard RY, Rodriguez LE, Celestian A, Teece BL, **Barge LM**. (2026) Mars Mineral Weathering Experiments in a Continuous-Flow Reactor. *Geofluids*, <https://doi.org/10.1155/gfl/6180315>.

Sheppard RY, Weber JM, Rodriguez LE, Trejo C, Hausrath EM, **Barge LM**, (2026) The effect of clay minerals on Li in martian groundwater simulant, *Icarus*, 443, 116769, doi: j.icarus.2025.116769. 2026.

Dzurilla KA, Herndon EC, **Barge LM**, Forsythe JG. (2025) Sample preparation for MALDI-TOF mass spectrometry of model prebiotic reactions in simulated ocean world environments. *ACS Omega*, 10, 43, 51709–51715. <https://doi.org/10.1021/acsomega.5c07633>

Teece, B.L., Cannelli, S.M., Garibello, C. F. McGlynn S., **Barge, L.M.** (2025) Hydrothermal vents through space and time: experimentally simulating dynamic flow-through systems on Earth and other worlds. *Earth Science Reviews*, 271, 105311. <https://doi.org/10.1016/j.earscirev.2025.105311>

Dzurilla KA, Pasek MA, **Barge LM**. (2025) Constraints of Prebiotic Phosphorus Reactions Within Enceladus Hydrothermal Systems. *ChemSystemsChem*, 0, e00029, doi.org/10.1002/syst.202500029

Velling SJ, Weber JM, Jones J-P, Wertheim A, Alian OM, Rossman GR, **Barge LM**. (2025) Porous Silica Scaffolds Enable Mechanically Robust Simulated Hydrothermal Chimney Growth. *Langmuir*, 41, 19111 – 19126. <https://doi.org/10.1021/acs.langmuir.5c00933>

Weber, J. M.; Rodriguez, L. E.; Cable, M. L.; Ingham, M.; **Barge, L. M.**; Chodas, M.; Cochran, C. J.; Elder, C. M.; Fayolle, E.; Henderson, B. L.; Hosseini, S.; Marusiak, A. G.; Melwani-Daswani, M.; Nordheim, T. A.; Perl, S. M.; Ono, M. (2025) Architectures and Instruments for Enceladus Exploration. *JGR Planets*, 130(11): e2024JE008908, <https://doi.org/10.1029/2024JE008908>.

Rodriguez, L. E.; Weber, J. M.; Cable, M. L.; **Barge, L. M.**; Castillo-Rogez, J. C.; Chodas, M.; Ferguson, S. N.; Schenk, P. M.; Vance, S. D.; Carpenter, K.; Ingham, M. D.; Cochran, C. J.; Elder, C. M.; Henderson, B. L.; Hosseini, S.; Marusiak, A. G.; Noell, A. C.; Perl, S. M.; Ono, M. (2025) A roadmap for the Exploration of Enceladus. *JGR Planets*, 130(12): e2024JE008907, <https://doi.org/10.1029/2024JE008907>.

Velling, SJ, Rodriguez LE, Oyala PH, Jones J-P, **Barge LM**, Weber JM (2025) Application of "Electron Paramagnetic Resonance Spectroscopy for Studies of Prebiotic Metals and Complexes. *28th Volume of Metals in Life Sciences*,

Metal Ions and the Route to Life, CRC Press, 2025.

Martinez, E., Flores, E., Valadez, D., Weber, J. M., VanderVelde, D., Sheppard, R. Y., Hodyss R., Castillo-Rogez J., Melwani Daswani M., Henderson B.L., **Barge, L. M.** (2025). Organic Adsorption onto Iron Hydroxide and Sulfide Minerals: Implications for Ceres Sample Return Analysis. *ACS Earth and Space Chemistry*, 9, 5, 1060–1069. <https://doi.org/10.1021/acsearthspacechem.4c00372>

Keller F., Kataria T, **Barge LM,** Chen P, Yung Y, Weber JM (2025) An Exploration of Origin of Life for Exoplanetary Science *Frontiers in Astronomy and Space Science*, 2025, 12, 1544426. <https://doi.org/10.3389/fspas.2025.1544426>

Carman NA, Hausrath EA, Celestian A, Chavez J, Hermis N, LaRowe DE, Fraeman A, Sheppard RY, Adcock CT, Tschauner O, Rampe EB, Price R, **Barge LM.** (2024) Fe/Mg-silicate chemical gardens as analogs to silicate-rich hydrothermal chimneys on early Earth and Mars. *ACS Earth and Space Chemistry*, 8, 10, 1982–1996. <https://doi.org/10.1021/acsearthspacechem.4c00109>

Yanchilina A.G., Rodriguez L.E., Price R., **Barge L.M.,** Sobron P. (2024) Sensing Remote Realms of the Deep Ocean on Earth—and Beyond. *Eos*, 105, <https://doi.org/10.1029/2024EO240375>.

Teece B.L., Havig J.R., Hamilton T.L., **Barge L.M.** (2024) Geochemical context for the interpretation of hydrothermal organics in planetary environments. *Nature Astronomy*, 8, 1513–1520.

Marlin TC, Weber JM, Sheppard RY, Perl S, Diener D, Baum M, **Barge LM.** (2024) Chemical gardens as analogues for prebiotic chemistry on ocean worlds. *CHEM*, 11, 102289. <https://doi.org/10.1016/j.chempr.2024.08.012>

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Rodriguez, L.E.; Weber, J.M.; **Barge, L.M.** (2024) Evaluating Pigments as a Biosignature: Abiotic / Prebiotic Synthesis of Pigments and Pigment Mimics in Planetary Environments. *Astrobiology*, 24, 8, 767-782.

**Barge L.M.** and Fournier G. (2024) Considerations for Detecting Organic Indicators of Metabolism on Enceladus. *Astrobiology*, 24,3,328-338.

Gutiérrez-Ariza C., **Barge L.M.,** Ding Y., Cardoso S.S.S., McGlynn S.E., Nakamura R., Giovanelli D., Price R., Lee H.E., Huertas F.J., Sainz-Díaz C.I., Cartwright J.H.E. (2024) Magnesium silicate chimneys at the Strytan hydrothermal field, Iceland as analogues for prebiotic chemistry at alkaline submarine hydrothermal vents on the early Earth. *Progress in Earth and Planetary Science*, 11, 11, <https://doi.org/10.1186/s40645-023-00603-w>.

Testón-Martínez, S.; Huertas-Roldan, T; Knoll, P.; **Barge, L.M.;** Sainz-Díaz, C.I.; Cartwright, J.H.E. (2023) A microfluidic labyrinth self-assembled by a chemical garden. *Physical Chemistry Chemical Physics* 25, 30469–30476.

Martinez, E.; Rodriguez, L.; Sheppard, R.; Zhang, Y.; Cid, C.; Khodayari, A.; **Barge, L.M.** (2023) Nitrate reactivity in iron (oxy)hydroxide systems: Effect of pH, iron redox state, and phosphate. *ACS Earth and Space Chemistry*, 7, 11, 2287–2297.

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**Barge L. M., Flores E., Weber J. M.,** Fraeman A. A., Yung Y. L., VanderVelde D., Martinez E., Castonguay A., Billings K., Baum M. M. (2022) Prebiotic reactions in a Mars analog iron mineral system: effects of nitrate, nitrite, and ammonia on amino acid formation. *Geochimica et Cosmochimica Acta*, 336, 469-479. <https://doi.org/10.1016/j.gca.2022.08.038>

**Barge L.M., Rodriguez L.E., Weber J.M.,** Theiling B.P. (2022) Determining the “Biosignature Threshold” for Life Detection on Biotic, Abiotic, or Prebiotic Worlds. *Astrobiology*, 22, 4, 481-493 <http://doi.org/10.1089/ast.2021.0079>.

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- Weber J.M., Henderson B.L., LaRowe D.E., Goldman A.D., Perl S.M., Billings K., **Barge L.M.** (2022) Iron-sulfur minerals drive NAD<sup>+</sup> reduction under prebiotic Earth conditions. *Astrobiology*, 22, 1, 25-34. <https://doi.org/10.1089/ast.2021.0035>.
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- Flores, E., Martinez, E., Rodriguez, L. E., Weber, J. M., Khodayari, A., **Barge, L. M.** (2021) Effects of Amino Acids on Phosphate Adsorption onto Iron (Oxy)hydroxide Minerals under Early Earth Conditions. *ACS Earth and Space Chemistry*, 5, 5, 1048–1057. <https://doi.org/10.1021/acsearthspacechem.1c00006>.
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- Barge L. M., Flores E., Weber J.,** Baum M. M., VanderVelde D., Castonguay A. (2020) Effects of Geochemical and Environmental Parameters on Abiotic Organic Chemistry Driven by Iron Hydroxide Minerals. *JGR-Planets*, 125, 11, e2020JE006423, <https://doi.org/10.1029/2020JE006423>.
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- Chin K., Pasalic J., Hermis N., Barge L. M. (2020) Chemical Gardens as Electrochemical Systems: In-situ Dynamic Characterization of Simulated Prebiotic Hydrothermal Chimneys by Impedance Spectroscopy. *ChemPlusChem*, 85(12):2619-2628.
- Jones J.-P., Firdosy S. A., **Barge L. M.**, Bescup J. C., Perl S. M., Zhang X., Pate A. M., Price R. E. (2020) 3D Printed Minerals as Astrobiology Analogs of Hydrothermal Vent Chimneys. *Astrobiology*, 20, 12, 1405-1412, <http://doi.org/10.1089/ast.2020.2260>.
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- Barge L.M.**, Jones J.-P., Pagano J., Martinez E., Bescup J. (2020) 3-Dimensional Analysis of a Simulated Prebiotic Hydrothermal Chimney. *ACS Earth and Space Chemistry*, 4, 1663-1669. <https://doi.org/10.1021/acsearthspacechem.0c00186>.
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- Wang Q., **Barge L. M.**, Steinbock O. (2019) Microfluidic Production of Pyrophosphate Catalyzed by Mineral Membranes Over Steep pH Gradients. *Chemistry - A European Journal*, 25, 18, 4732-4739, <https://doi.org/10.1002/chem.201805950>.
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Chan M. A., S.L. Potter, B.B. Bowen, W. T. Parry, **L. M. Barge**, W. Seiler, E.U. Petersen, J. R. Bowman (2012) Characteristics of terrestrial ferric oxide concretions and implications for Mars. In J. Grotzinger and R. Milliken, *Sedimentary geology of Mars: SEPM Special Publication No. 102*, p. 253-270.

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#### Submitted:

Trejo CA, Teece BL, Khodayari A, **Barge LM**, Weber JM. Investigating polycyclic aromatic hydrocarbon transport in planetary hydrothermal systems: relevance for Mars exploration. In revision, 2025

Omran A, Dzurilla KA, Rodriguez L.E., Gonzalez A, Feng T., Abbatiello J, **Barge L.M.**, Pasek M. Far-from-equilibrium polyphosphate generation from phosphite oxidation and its implications for the early Earth and ocean worlds. *ChemSystemsChem*, In review.

Shea JJ, Soderman CR, Teece BL, Weller OM, **Barge LM**, Shorttle O. Mantle melting on Mars with applications for sample return. *EPSL*, in review.

**Barge LM**, Eigenbrode J, Fournier G, Theiling B. Emergence of Biosignatures on Earth & Implications for Life Detection. *PNAS*, in revision, 2025

Castillo-Rogez, J.; Courville, S.; Melwani Daswani, M.; Hofmann, A.; Robinson, K.; Mousis, O.; Hanni, N.; Henderson, B. L.; Hodyss, R.; Diab, J.; Bose, M.; Reynoso, L.; Weber, J. M.; Yu, X.; **Barge, L. M.**; Lunine, J. “Influence of Organic Matter on the Evolution of Icy Worlds.” *Icarus*, 2026, *submitted*.

#### In preparation:

Dzurilla KA, Teece BL, Pasek MA, Garcia A, Weber JM, **Barge LM**. A Comparison of Phosphorus Chemistry in the Ocean and Hydrothermal Environments on Enceladus. In prep, 2025

Maltais TR, Weber JM, VanderVelde D, **Barge LM**. The Use of NMR Spectroscopy to Study Geologically Relevant Chemical Reactions in Origins of Life Research. In prep, 2025

Weber JM, Dzurilla KA, Goldman AD, LaRowe DE, Henderson BL, Celestian A, **Barge LM**. Nonenzymatic 1,4-Benzoquinone Reduction with Iron sulfur minerals as a prebiotic analog to the electron transport chain. In prep, 2025

Mahr TJ, Teece BL, Zaugg G, Dzurilla KA, Weber JM, **Barge LM**. Laboratory analogs of black smoker hydrothermal vent mineral facies relevant to planetary science. In prep, 2025.

Dzurilla KA, Herndon EC, Forsythe JG, **Barge LM**. Constraints of Depsipeptide Formation in High Saline Conditions. In prep, 2025.

## Funded Projects / Grants:

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### As PI:

- 2026 – 2027 PI, “Emergence of the electron transport chain: Testing the transition from minerals to proto-enzymes” Foundation sponsor (\$150K)
- 2024 – 2027 PI, NASA Habitable Worlds, “Feeding Enceladus’ Deep Biosphere” (\$832K)
- 2024 PI, JPL Center for Academic Partnerships program, “Joint STEM Pathways Program with Undergraduate Institutes” (\$30K)
- 2023 – 2026 PI, NASA Exobiology, “Simulating the Emergence of Metabolism in an Alkaline Hydrothermal Vent” (\$1M)
- 2022 – 2023 PI, Technical Equipment and Facilities Infrastructure Management (TEFIM) Program, “Astrobiology Elemental Analysis Facility” (ICP-OES) (\$174K)
- 2022 – 2023 PI, JPL Center for Academic Partnerships program, “Peer Mentoring for Student Pathways in STEM” (\$50K)
- 2022 – 2023 PI, Scialog / NASA Astrobiology Program, “Mars Sample Return: Connecting Martian Environmental Geochemistry to Returned Samples” (with F. Rivera-Hernandez, Georgia Tech) (\$50K)
- 2022 – 2023 PI, JPL Researchers on Campus (JROC) program: “New Materials Science Technologies for Testing Origin of Life on Ocean Worlds” (\$25K)
- 2022 – 2025 PI, NASA Mars Science Laboratory Participating Scientist Program, “Investigating Abiotic Mineral-Organic Chemistry to Interpret Organic Detections on Mars” (\$382K)
- 2022 PI, JPL TEFIM, “Planetary Geochemistry Simulation Facility” (\$170K)
- 2022 JPL HBCU / MSI program, “Developing Student Pipelines in Earth, Environmental, and Planetary Science” (\$40K)
- 2019 – 2022 JPL Strategic R&TD “Fate of Organics on Ocean Worlds”, PI / Task Lead: “Understanding abiotic organic chemistry driven by minerals in Ceres’ and Enceladus’ oceans” (\$700K)
- 2021 – 2022 Co-PI (with L. Rodriguez), JPL Data Science Pilot Project, “Developing machine learning models to facilitate the untargeted identification and classification of organics in complex mixtures via tandem mass spectrometry” (\$50K)
- 2021 – 2022 Co-PI (with J. Weber), JPL Spontaneous R&TD “Novel Continuous Flow Reaction Design to Test Martian Weathering” (\$40K)
- 2021 – 2022 PI, Scialog / NASA Astrobiology Program, “Synthetic Mineral Geo-Electrodes for Detecting Life on Ocean Worlds” (with J. Marlow, Boston U.) (\$50K)
- 2020 – 2023 PI, JPL Strategic R&TD, “Venus Science into the Next Decade” (\$600K)
- 2020 – 2025 Co-PI, NSF Improving Undergraduate Student Education (IUSE), “Pathways to STEM” (PI: M. Smith, Citrus College) (\$2.5M)
- 2021 – 2022 PI, JROC: “Mineral Catalyzed Enzymatic Reactions for Origin of Life on Rocky and Ocean Worlds” (\$20K)
- 2021 PI, JPL Spontaneous R&TD: “Hydrothermal chemistry test facility for astrobiology experiments” (\$44K)
- 2018 – 2021 PI, NASA Habitable Worlds, “Phosphorus Redox Chemistry on Icy and Rocky Planets” (\$945K)
- 2018 – 2021 Science-PI, NASA Planetary Science and Technology Through Analog Research, “In-Situ Vent Analysis Divebot for Exobiology Research” (PI: P. Sobron) (\$5M)
- 2017 – 2020 PI, NASA/NSF Ideas Lab for the Origins of Life, “Becoming Biotic: Recapitulating the Origin of Ancient Metabolic Pathways” (\$1M)
- 2020 PI, JROC program: “Investigating mechanisms of carbon reduction and abiotic methane generation on Mars” (\$20K)
- 2019 PI, JPL Spontaneous R&TD, “Can nitrates on Mars drive subsurface organic chemistry?” (\$30K)
- 2019 PI, JPL Researchers on Campus program: “Fate of nitrate/nitrite in an ancient ocean on Mars” (\$20K)
- 2019 JPL Lew Allen Award proposal; “Studying Venus to Understand Astrobiology of Terrestrial Planets” (\$20K)
- 2015 – 2019 Co-PI, NSF Improving Undergraduate STEM Education (IUSE), “GP-EXTRA - Bridge to the Geosciences” (\$600K)
- 2017 – 2019 PI, JPL Topical R&TD, “Planetary Habitability Test Beds” (\$400K)

- 2018 PI, JPL Spontaneous R&TD, “Phosphorus Chemistry on Early and Present Day Mars” (\$30K)
- 2017 PI, JPL Spontaneous R&TD, “Which Came First, Proteins or Cofactors? Recreating Metabolic Reactions on the Early Earth” (\$30K)
- 2016 PI, NASA Astrobiology Institute Director’s Discretionary Fund, “Catalytic Diversity at the Emergence of Metabolism: Hydrothermal Carbon Dioxide Reduction on Fe/Ni-Sulfide Catalysts”
- 2016 PI, JPL Spontaneous R&TD, “Geo-Electrodes for Astrobiology Experiments”
- 2015 JPL Advanced Concept Development: “Sulfate and amino acid absorption in Mars analog minerals”
- 2014 PI, NASA Astrobiology Institute Early Career Collaboration Grant: “Prebiotic Phosphorus Chemistry”,
- 2013 PI, NASA Astrobiology Institute Early Career Collaboration Grant: “Effects of Catalytic Iron-Containing Minerals on RNA Synthesis”
- 2007 PI, NASA Astrobiology Institute Lewis and Clark Fund for Exploration and Field Research: “A Study of Precipitation in Diffusion–Controlled Systems: Implications for Concretion Formation in Terrestrial and Martian Systems”

As Co-I:

- 2023 – 2025 Co-I, NASA SMD Bridge Program Seed Funding, “Environmental Pollution Reduction Inspired by Planetary Science”
- 2022 – 2025 Co-I, JPL Strategic R&TD, “Assessing Origin of Life (OOL) Scenarios for Exoplanet Studies”
- 2020 – 2023 Co-I, NASA Habitable Worlds: “Habitability of saponite-rich hydrothermal systems of early Mars”
- 2015 – 2019 Investigation Lead / Co-I, NASA Astrobiology Institute, Cooperative Agreement Notice (CAN-7), “Icy Worlds: Astrobiology at the Water-Rock Interface and Beyond”
- 2018 – 2021 Co-I, NASA MaTISSE, “In-situ Spectroscopic Europa Explorer (iSEE)”
- 2019 Co-PI, JPL Technical Equipment and Facilities Infrastructure Management (TEFIM) Program, “Geobiology Analysis Suite”
- 2019 Co-I, JPL Spontaneous R&TD, “Power Generation from Hydrothermal Vent Energy for Robotics and In Situ Sensing Operations”
- 2018 Co-I, JPL Topical R&TD, “Developing an Electrochemistry-Based Geochemical Framework for Organic Systems”
- 2018 Co-I, JPL Topical R&TD, “Prebiotic and Microbial Bioindicators for Exoplanet Discovery”
- 2018 Co-I, JPL Presidents & Director’s Fund, “Biogeochemical signatures of hypersaline brine systems”
- 2018 Co-Lead, JPL Blue Sky Study: Planetary Soils
- 2017 Co-I, JPL Spontaneous R&TD, “Hydrothermal Vent Instrument Anchoring Platform”
- 2017 Co-I, JPL Spontaneous R&TD, “New Electromechanical Technique for Detecting Life in Simulated Ocean World Environments using a Portable In-Situ Electrochemical Impedance Spectroscopy (EIS) System”
- 2016 Co-Lead, JPL Blue Sky Study: Origin of Life
- 2014 JPL Planetary Instrument Advanced Concept Development, “Simulated Seafloor Systems for Origin of Life Studies”
- 2013 Co-I, JPL Strategic University Partnership Program award, “Microbial Fuel Cells for in-situ life detection”

**Selected Activities, Service, Leadership:**

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**NASA Decadal Astrobiology Research and Exploration Strategy (DARES)**

- **Task Force 1 panel member**, 2025. Member of committee to formulate the next NASA Astrobiology Strategy.
- **Task Force 2 Focus Area lead**, 2026, Led “Focus Area 1” committee focused on origin of life, one of 9 focus areas within the larger DARES Task Force 2 activity to formulate the NASA Astrobiology Strategy.

**Panel Member, National Academies of Science, Engineering, Medicine, “A Science Strategy for the Human Exploration of Mars: Panel on Astrobiology”, 2024 - 2025**

**Committee member, MEPAG Mars Search for Life Science Analysis Group (SFL-SAG), 2024-2025.**

## Professional Societies

- Scientific Society for Astrobiology (SSA): Co-founder and Executive Board Co-Chair
- American Chemical Society, Southern California Section, Executive Committee member (2021-2023)
- Memberships: American Chemical Society (ACS), American Geophysical Union (AGU)

**Steering Committee member**, NASA Astrobiology Research Coordination Networks: Network for Ocean Worlds (NOW), Network for Life Detection (NFoLD), Prebiotic Chemistry and Early Earth Environments (PCE3)

## Selected Conference Leadership

- Scientific Organizing Committee member, Astrobiology Science Conference (AbSciCon) 2022
- Session chair at various national meetings: AbSciCon 2019, AGU 2018; AGU 2017; Goldschmidt 2018
- 2018 Gordon Research Conference on Geobiology, Discussion Leader (Life Detection)

**Steering Committee member, NSF Research Coordination Network on the Exploration of Life's Origins.** Award led by The Santa Fe Institute hosted a series of core meetings / topical working groups over a 5-year period that explored the rules under which life is assembled.

**ELSI Origins Network (EON) Advisory Board, 2014-2018.** Member of a 12-person international advisory board for the ELSI Origins Network, an international origin of life institute run by the Earth-Life Science Institute of Tokyo Tech.

**Member, Roadmap for Ocean Worlds (ROW) team, NASA Outer Planet Assessment Group (OPAG), 2016.** Led "Detection of Life" theme / participated in ROW meetings, to produce documents of science goals relating to specific targets for use in future studies of / missions to ocean worlds.

## JPL Study Lead:

- 2018 JPL Blue Sky Study for Planetary Soils. Creating chemical analogs of Mars and icy world soils / sediments for use in life detection studies.
- 2017 JPL Space Life Sciences study for Astrobiology. Co-led study to assess Astrobiology expertise at JPL, develop an astrobiology community, and strategize paths forward.
- 2016 JPL Blue Sky Study for the Origin of Life. Co-led a study to recommend JPL's institutional investment and strategies for origin of life research.

**Co-chair, NASA Astrobiology Institute Focus Group: "Thermodynamics, Disequilibrium, Evolution" 2012-2017.**

Organized two workshops per year in cooperation with other astrobiology and planetary science institutes around the world: including Centro de Astrobiologia (Madrid); Earth-Life Science Institute (Japan); Brazilian Synchrotron Light Laboratory (LNLS); INAF-Astrophysical Observatory of Arcetri (Italy).

**NASA Proposal Review Panels**, Small Innovative Missions for Planetary Exploration (SIMPLEx), Maturation of Instruments for Solar System Exploration (MaTISSE), Habitable Worlds, Exobiology.

**Referee**, *Nature Scientific Methods*, *Nature Astronomy*, *Nature Communications*, *Journal of Physical Chemistry*, *Langmuir*, *Chemical Physics*, *Journal of the American Chemical Society*, *Angewandte Chemie*, *Journal of Molecular Evolution*, *Astrobiology*, *Origins of Life and Evolution of Biospheres*, *Geophysical Research Letters*, *Earth Science Reviews*.

## Selected Recent Outreach:

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- Invited participant, University of Southern California Dornsife Dialogues ([Discovering Life In Unexpected Places](#)) "conversations among leading scholars and distinguished alumni regarding a wide range of topics relevant to our world today", Feb 2026.
- Invited Lecturer, NASA/ESA International Summer School in Astrobiology, Santander, Spain
  - 2025: Origins to Organisms: Understanding Life's Beginnings
  - 2018: Biomarkers: Signs of Life Through Space and Time
- Invited speaker, NASA Prebiotic Chemistry and Early Earth Environments (PCE3) community workshop, ["Formation of Precursors, Simple Molecules, Selection"](#)
- Guest on NASA's Gravity Assist Podcast, ["Gardens at the Bottom of the Sea"](#), Aug 2020:
- [Featured](#) on NASA's "Ask an Astrobiologist" series
- Intrepid Sea, Air and Space Museum (NYC): Invited guest speaker, 2019 World Water Day Europa; Family Astronomy Night series ("The Search for Life on Mars"), 2018.
- Invited speaker, "Findings of Water on Mars", Space Fest 2015, California Science Center (Los Angeles)
- Selected invited talks:

- AbSciCon 2019: Plenary panel speaker, “Plenary Session: Unresolved Issues in the Origins of Life: Multidisciplinary Perspectives”
- NASA Planetary Science & Astrobiology Decadal Survey panel on Ocean Worlds and Dwarf Planets, 2021, “Laboratory Experiments in Support of Ocean World Exploration”
- Goldschmidt 2018, Keynote Speaker - Session: Microbe-Fluid-Rock Interaction in Hydrothermal Systems.
- COSPAR 2018 invited talk, Scientific Event F3.2: The Evolving Chemical Universe: From Proto-stars to the Origin of Life.
- 2018 Gordon Research Conference on the Origins of Life, Invited Speaker (Prebiotic Environments)
- AbSciCon 2017: Invited talk, session on Origin of Life in Hydrothermal Vents
- American Geophysical Union 2016 Fall Meeting Invited talk, session on Enceladus

#### University seminars / lectures:

- 2025: University of Southern California, Portland State University, SUNY
- 2024: WHOI, Rutgers, UC Riverside, College of Charleston, U. of Texas
- 2023: Earth-Life Science Institute (Tokyo Tech); Caltech geoclub seminar; CU Boulder geology seminar; NASA GSFC seminar; NASA Headquarters seminar; Harvard Origins seminar
- 2022: Boise State chemistry seminar, UCLA Earth & Planetary Sciences colloquium, U Penn Earth & Environmental Sciences colloquium, Florida Tech astrobiology seminar
- 2021: Caltech Astrobiology course, UCLA / UCB planetary science seminar series, Georgia Tech Earth and Atmospheric Sciences seminar, U. of Hawaii planetary science seminar
- 2020: McGill Astronomy Seminar Series; Queens University Astronomy seminar; Caltech Yuk Lunch Seminar
- 2019: University of Southern California and Caltech astrobiology course guest lecturer; U. of Nevada Las Vegas Geoscience department seminar; Earth-Life Science Institute (ELSI, Tokyo Tech)
- 2018: Johns Hopkins University Applied Physics Lab; U. of Tulsa
- 2017: Caltech Planetary Science Seminar
- 2016: CSU Northridge astronomy seminar; U. of Tulsa; Johns Hopkins and Space Telescope Science Institute
- 2015: Caltech Yuk Lunch Seminar; University of Washington Astrobiology Colloquium Series; Florida State University Chemistry Seminar Series; Georgia Tech Planetary Seminar Series; UCLA iPLEX Lunch series
- 2014: Oak Crest Institute of Science (Monrovia, CA); USC Geobiology Seminar Series; Institute for Genomic Biology, University of Illinois Urbana-Champaign; ELSI
- 2013: Georgia Tech, Center for Ribosomal Origins and Evolution; ELSI and Japan Agency for Marine-Earth Science and Technology (JAMSTEC); University of Leeds, School of Chemistry
- 2012: University of Budapest; University of Wisconsin-Madison Geology Department
- 2011: Caltech Inorganic-Organometallics Seminar; Caltech Yuk Lunch seminar

#### **Media Features:**

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Featured in Nature Career Q&A: [How Los Angeles neighbours partnered to show under-represented students the 'unspoken rules' to success](#), Dec 2024.

[Women in chemistry: Q&A with Dr Laurie Barge](#). *Commun Chem* 8, 54 (2025).

Featured in Spectrum News 1: [Research interns at JPL want to know if answers to Earth's environmental issues lie on Mars](#). Nov 27, 2024.

Featured in NPR / Short Wave Sea Camp newsletter, August 2025.

NPR Short Wave interview, [“Did life start on the ocean floor — and what does that mean for alien life?”](#) Nov 2024

Los Angeles Times, [“Algae here, alien life out there — Cal State L.A.-JPL partnership connects engineers to astrobiology”](#)

JPL / NASA press release, [“NASA Grant Brings Students at Underserved Institutions to the Stars”](#)

JPL / NASA press release featuring two recent publications, [“Removing Traces of Life in Lab Helps NASA Scientists Study Its Origins”](#)

USC Dornsife College of Letters, Arts, and Sciences, [Profile: Searching for the Origins of Life](#)

Featured in University of Southern California News, [“Could alien worlds hold life? One USC Dornsife alumna aims to find out”](#), by Margaret Crable

Appeared in BBC Reel, [“The mystery of how life began on Earth”](#), 9 Nov 2020

Featured in Knowable Magazine, [“Searching high and low for the origins of life”](#), by Anne N. Connor:

Appeared in CBS Mission Unstoppable, [“Nets, Neighborhoods and NASA”](#)

JPL Feature Story, [“NASA Study Reproduces Origins of Life on Ocean Floor”](#), 2/25/2019, by Arielle Samuelson, Appeared in PBS [“Second Genesis: The Quest for Life Beyond Earth”](#) (start at 12:37)

Featured in Astrobiology Magazine, [“Hydrothermal Experiments Bring Enceladus to Earth”](#), by Charles Choi, 2017

Featured in Scientific American, [“Life's Origins by Land or Sea? Debate Gets Hot”](#) by Rachel Brazil, ChemistryWorld on May 15, 2017.

Featured in Engadget, [“The search for a habitable second Earth”](#), by Steve Dent, May 27, 2017 ,

Appeared in NOVA web short, [“Make your own hydrothermal vent”](#), By Karishma Desai and Ari Daniel,

Featured in New Scientist, [“Genesis in a jar: How chemical gardens may lead us to alien life”](#), Aug 10 2016 by Joshua Sokol,

Featured in Nautilus Magazine, [“The Fly in the Primordial Soup”](#), by Nathaniel Comfort, June 23, 2016,

Appeared in *How the Universe Works* (Discovery Channel), S04E05 “Dawn of Life”, aired 12/15

JPL Feature Story, [“Researchers Use Seafloor Gardens to Switch on Light Bulb”](#), August 5, 2015, by Whitney Clavin.

Astrobiology Magazine News Exclusive, [“Could ‘Green Rust’ be a Catalyst for Martian Life?”](#), May 21, 2015, by Elizabeth Howell

Orange County Register, [“Did sea-floor battery spark life on Earth?”](#), by Pat Brennan, April 26, 2014.

Invited Guest, Planetary Radio, [“Was a Natural Fuel Cell Key to the Origin of Life on Earth?”](#), with Matt Kaplan:

JPL Feature Story, [“New Study Outlines ‘Water World’ Theory of Life’s Origins”](#), April 15, 2014, by Whitney Clavin,

NASA Astrobiology Institute Research Highlights, [“The Seafloor Electric”](#), 04/15/2014,

Radio Interview, KPFT-FM Houston, *Weltanshauung* weekly show with Michael DeLeonardis, April 10, 2014.

JPL Feature Story, [“How Did Life Arise? Fuel Cells May Have Answers”](#), March 13, 2014, by Whitney Clavin,

Astrobiology Magazine News Exclusive, [“Life’s Fuel Cells”](#), March 13, 2014, by Sheyna Gifford

NASA Astrobiology Institute Research Highlights, [“Life’s Origins in a Prebiotic Fuel Cell”](#), 03/14/2014, by Aaron Gronstal

University of Leeds press release, [“Simulating how the Earth Kick-Started Metabolism”](#), by Sarah Reed, 03/13/14

Daily Galaxy, [“What We Might Find in Europa’s Alien Ocean World”](#), 03/2014

Universe Today, [“Did Life on Earth As We Know It Come From Geological Life?”](#), by Elizabeth Howell, 03/13/14

Oak Crest Institute of Science, press release, [“How the Earth Kick-started its Metabolism Simulated in a Laboratory”](#), by Lisa Lucio, 03/2014.

Featured in Chemical & Engineering News: [“Gardens of Eden”](#), by Carmen Drahl, March 18, 2013. Vol. 91, Issue 11, pp. 44-45.

### **Selected Honors / Awards:**

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2025 Selected as JPL Senior Research Scientist

2024 NASA Diversity, Equity, and Inclusion Medal

2023 JPL Polaris Award for Exceptional Contributions to DEIA

2023 Rosalind Franklin Society Award in Science for Astrobiology

2020 Scialog “Signatures of Life in the Universe” Fellow (received funded awards in 2020, 2021)

2019 Presidential Early Career Award for Scientists and Engineers (PECASE), for innovative fuel cell-based research

2019 NASA Early Career Public Achievement Medal (for advances in origin of life research)

2019 NASA Group Achievement Award, InSight EDL Communications Team

2018 JPL Lew Allen Award for Excellence, for pioneering research on the application of electrochemistry to studies of the origin and emergence of life.

2016 Selected to attend the NSF-NASA Ideas Lab for the Origins of Life (proposal was selected in 2017)

2016 Jet Propulsion Laboratory Voyager Award (for leadership in astrobiology activities visible outside JPL)

2015 NASA Group Achievement Award (Icy Worlds Team)

2013-2015 NASA Astrobiology Postdoctoral Fellowship

- 2012, 2011 American Astronomical Society International Travel Grant
- 2009 Women in Science and Engineering (WiSE) Travel Grant  
NASA Harriet G. Jenkins Pre-doctoral Fellowship  
USA Funds Access to Education Scholarship
- 2008 Women in Science and Engineering (WiSE) Merit Fellowship  
USC Dean Joan M. Schaefer Research Award  
Phi Kappa Phi Love of Learning Award
- 2007 American Astronomical Society International Travel Grant  
USC Dean Joan M. Schaefer Merit Scholarship / Research Award  
USC Dept. of Earth Sciences Outstanding Teaching Assistant Award (2007 & 2006)
- 2006 Mars Exploration Program Student Travel Grant
- 2004 Keck Fellowship, University of Southern California  
College Merit Award Fellowship, USC College of Letters and Sciences  
National Merit Scholarship, Villanova University (2000-2004)  
Blue White Scholarship, Villanova University (2003-2004)

### Student and Postdoc Supervision:

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**Bold = postdoc; *Italic / underline = thesis committee member***

- 2026-present: Chris Koenig, M.S. civil engineering, CSULA (Enceladus organics)
- 2025: Kamil English, M.S. civil engineering, CSULA (Enceladus organics)
- 2025: Melih Cakar, M.S. Biochemistry, Freie Universität Berlin (Enceladus mineralogy)
- 2024-present: Christian Mendoza, M.S. civil engineering, CSULA (iron redox chemistry)
- 2024-present: Osama Alian, JPL Postdoc (origin of life in hydrothermal vents)**
- 2023-present: Seneca Velling, Ph.D. materials science, Caltech (hydrothermal chimneys) \*Thesis advisor
- 2023-2025: Cathy Trejo, M.S. civil engineering, CSULA (hydrothermal organic chemistry)
- 2022-present: Bonnie Teece, JPL Postdoc (hydrothermal vents)**
- 2022-present: Katherine Dzurilla, JPL Postdoc (phosphorus chemistry)**
- 2022-present: Matt Luna, undergraduate (Citrus College / USC)
- 2019-2022: Jessica Weber, JPL Postdoc (origin of life)**
- 2019-2022: Laura Rodriguez, JPL Postdoc (hydrothermal vents)**
- 2020-2022: Rachel Sheppard, JPL Postdoc (Mars redox environments)**
- 2022-present: Nancy Carman, Ph.D. candidate, UNLV (Geosciences)
- 2022-present: Billal Zayat, Ph.D. candidate, USC Chemistry (electrochemistry / ocean worlds)
- 2021-present: Dennise Valadez, M.S. Physics, CSULA (origin of metabolism)
- 2021-present: Julia Chavez, M.S. Environmental Engineering, CSULA (saponite precipitation)
- 2020-2025: Tess Marlin, Ph.D. candidate / graduate student intern, Caltech (origin of metabolism)
- 2018-present: Eduardo Martinez, M.S. candidate, CSULA (nitrate/phosphate chemistry)
- 2013-present: Erika Flores, M.S. candidate / graduate student intern, CSULA (reductive amination in iron hydroxides)
- 2020: Sarah Lamm, graduate student intern, U. of Kansas (Raman and LIBS of iron minerals)
- 2020: Medha Prakash, undergraduate intern, U. of Virginia (carbon redox chemistry)
- 2017-2020: Ninos Hermis, M.S. candidate / graduate student intern, CSULA (fuel cells, temperature gradients)
- 2018-2019: Jonathan Major, M.S. candidate, University of Tulsa, (phosphorus on Mars / ocean worlds)
- 2019: Sarah Crucilla, undergraduate intern, Caltech (origin of metabolism)
- 2019: Ph.D. committee member for Chris Mehta, University of South Florida
- 2017-2019: Michelle Hooks, NASA STAR fellow, USC (organic effects on chemical gardens)
- 2018: Angel Chavez, undergraduate intern, UC Irvine (Mars soil simulations)
- 2018: Hiroki Nishimura, undergraduate intern, Tokyo University of Marine Science and Technology (phosphorus)
- 2017: Thora Maltais, Postdoctoral researcher (TCA cycle reactions on early Earth)**
- 2016-2017: Ryan Cameron, undergraduate intern, Tulsa Community College / CSU-Northridge (electrochemistry)
- 2013-2017: Lily Abedian, undergraduate intern, UC San Diego (electrochemistry, phosphorus chemistry)
- 2017: Liz Miller, undergraduate intern, Bard College (reductive amination in iron hydroxides)
- 2016: Arden Hammer, undergraduate intern, Oberlin College (organic effects on chemical gardens)
- 2016: Kayo Kallas, undergraduate intern, Santa Monica College (reductive amination in iron hydroxides)

2011-2015: Ivria Doloboff, undergraduate intern, CSU-Long Beach (chemical gardens; phosphorus chemistry)  
2013-2015: Timothy Lin, undergraduate intern, UC Riverside (carbon reduction on hydrothermal sulfide minerals)  
2015: Arlette Valencia, undergraduate intern, Citrus College (iron hydroxides)  
2014: Jessica Nunes, undergraduate intern, Citrus College (iron hydroxide chemical gardens, organics, phosphorus)  
2012-2013: Nery Rafael, undergraduate intern, CSU-Long Beach (iron hydroxides)  
2012: John Zeytounian, undergraduate intern, University of Southern California (electrochemistry of iron sulfides)

### **Mentoring:**

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2013-present: Mentor for various JPL/NASA undergraduate and graduate intern programs, typically 10+ students per year, including: JPL Student Independent Research Internship (SIRI) Program, Minority Student Programs, NASA Undergraduate Internship (UI) program, JPL Visiting Student Research Program (JVSRP), Caltech SURF Summer Intern Program), JPL Student Internship Program.

### **Published Abstracts:**

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Over 200 published abstracts for national and international conferences (Lunar and Planetary Science Conference, American Geophysical Union, American Chemical Society, Astrobiology Science Conference, Goldschmidt, International Conference for the Origin of Life, American Astronomical Society, AAS Division of Planetary Sciences, and others).