

# Laura M. (Laurie) Barge

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## Summary of Research Interests:

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**I study how minerals affect chemistry for the emergence of life and habitability on wet rocky planets.** I specialize in ocean / seafloor systems including hydrothermal vents (e.g. for the emergence of life on early Earth or ocean worlds), as well as mineral-aqueous chemistry in surface or near-subsurface soils (e.g. on Mars). I seek to understand mineral driven organic reactions, elemental cycling, and electrochemistry relevant to biological and prebiotic systems.

My ongoing projects span the following themes:

- Emergence of life: organic synthesis driven by reactive iron minerals and the evolution of cofactor-driven metabolic pathways under early Earth conditions.
- Hydrothermal vents in the lab and field: understanding the energy that vents produce for life, and how geochemical gradients promote mineral-organic chemistry on early Earth and ocean worlds.
- Redox chemistry in geological systems: understanding phosphorus, iron, and sulfur cycling in redox-active mineral systems relevant to habitability and origin of life on Mars and ocean worlds.
- Astrobiology field studies / Instrumentation: Developing analytical methods and science operational strategies for field exploration of hydrothermal vents (focus on laser spectroscopy and electrochemistry techniques).
- Outreach and mentoring for women / minorities in STEM. Particular focus on women in space science and integrating minority institute community college students into NASA-funded research.

## Current Positions:

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### Research Scientist, NASA Jet Propulsion Laboratory 2015 – present

- Co-lead, Origins and Habitability Laboratory at JPL. Lead astrobiology research team whose projects span various themes such as origin of life, extremophiles, habitability, and life detection. Hold weekly quiet hours with individual members, and weekly lab group and research group meetings. Facilitate ongoing program of seminars / networking events for the group, supervise management of lab.
- Science Lead, In-Situ Vent Analysis Divebot for Astrobiology Research (InVADER). Science-PI for a large project to send an innovative astrobiology spectroscopy payload to ocean world analog vent sites in the Pacific ocean.
- Investigation Lead, NASA Astrobiology Institute Icy Worlds team. Lead an Investigation (one of four within the \$8M project) consisting of ~12 Co-I's/collaborators researching the emergence of life in hydrothermal vents.
- PI, NASA-NSF Ideas Lab for the Origins of Life, "Becoming Biotic". Lead multi-institution effort to attempt to recapitulate ancient metabolic pathways by replacing protein enzymes with non-protein catalysts in early Earth conditions; supervise lab efforts at JPL involving contractors / postdoc.
- Co-PI, NSF "Bridge to the Geosciences" project. Develop and annually lead 3 one-day "geo-modules" at various institutions in the LA area, for cohorts of 20 community college students to learn about careers in geoscience.
- Selected recent publications / highlights:
  - L.M. Barge et al. (2019) Redox and pH Gradients Drive Amino Acid Synthesis in Iron Oxyhydroxide Mineral Systems. PNAS, 116 (11) 4828-4833; <https://doi.org/10.1073/pnas.1812098116>.
  - Awarded Presidential Early Career Award for Scientists and Engineers (for innovative fuel cell-based research); JPL Lew Allen Award; NASA Early Career Public Achievement Medal
  - Filmed / appeared in CBS Mission Unstoppable, Episode 3: "Nets, Neighborhoods and NASA"
  - Steering Committee member, NASA Astrobiology Program Research Coordination Networks: Network for Ocean Worlds (NOW) and Network for Life Detection (NFoLD).

### HiRISE Investigation Scientist, Mars Reconnaissance Orbiter, NASA Jet Propulsion Laboratory 2015 – present

- Act as liaison between the High Resolution Imaging Science Experiment (HiRISE) instrument team at University of Arizona and the MRO project at JPL. Duties include: preparing and impacting Mission Change Requests; participating in HiRISE team / Project Science Group meetings; providing MMR inputs; assisting with various tasks such as extended mission proposals.
- Conduct Mars-related research and perform mission-related outreach, e.g. public talks, JPL Open House.
- MRO cycle coordinator. Conduct 5-week preparation for MRO's 2-week observing cycles.

## Other Professional Experience:

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

**Blue Marble Space Institute of Science**, Research Scientist, 2013 – present; 2019-2020 Nominated & elected scientist representative to the BMS Board of Directors

### **NASA Jet Propulsion Laboratory**

NASA Astrobiology Institute 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

**University of Southern California**, Dept. of Earth Sciences, 2004-2009, advisor: Ken Nealson

NASA Harriett G. Jenkins Pre-doctoral Fellow; College Merit Fellow

Ph.D. Thesis title: "Self-organized chemical precipitates: Laboratory and field studies"

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

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

## 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 (Minor in Physics), Villanova University, Villanova, PA

Additional training:

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" Iceland, July 2009.

2006 International Summer School in Astrobiology: "Origins: From the Big Bang to Life." Spain, July 2006.

LAPLACE Astrobiology Winter School: "Habitable Planets Around Sun-like Stars: Common or Rare?". Tucson, AZ  
Jan 2006.

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

2005 Short Course on "Molecular Geomicrobiology", 3-4 Dec 2005, University of California at Berkeley.

## Publications:

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\*\* = Student / postdoc under my supervision

### In Review:

T. R. Maltais\*\*, D. VanderVelde, D. LaRowe, A. D. Goldman, **L. M. Barge**. Exploring Reactivity of Metabolic Intermediates and Cofactor Stability Under Early Earth Conditions. *Origins of Life and Evolution of Biospheres*, in review, 2019.

### Published / Accepted:

B.R. Lam, **L.M. Barge**, A.C. Noell, K.H. Nealson. Detecting Microbial Metabolism and Differentiating Between Abiotic and Biotic Signals Observed by Bioelectrochemical Systems in Soils. *Astrobiology*, in press 2019.

**L.M. Barge**, E. Flores\*\*, M.M. Baum, D. VanderVelde, M.J. Russell (2019) Redox and pH Gradients Drive Amino Acid Synthesis in Iron Oxyhydroxide Mineral Systems. *PNAS*, 116 (11) 4828-4833;  
<https://doi.org/10.1073/pnas.1812098116>.

Q. Wang, **L. M. Barge**, O. Steinbock (2019) Microfluidic Production of Pyrophosphate Catalyzed by Mineral Membranes Over Steep pH Gradients. *Chemistry - A European Journal*, <https://doi.org/10.1002/chem.201805950>.

S.D. Vance, **L.M. Barge**, S.S.S. Cardoso, J.H.E. Cartwright. (2019) Self-assembling ice membranes on Europa: Brinicle properties, field examples, and possible energetic systems in icy ocean worlds. *Astrobiology*, 19, 5,  
<https://doi.org/10.1089/ast.2018.1826>.

**L.M. Barge** (2019) Considering planetary environments in origin of life studies. *Nature Communications* 9, 5170  
<https://doi.org/10.1038/s41467-018-07493-3>

Hendrix A.R., Hurford T.R., **Barge, L.M.**, Bland M.T., Bowman, J.S., and 23 co-authors (2019) The NASA Roadmap to Ocean Worlds. *Astrobiology*, 19, 1, DOI: 10.1089/ast.2018.1955.

**L. M. Barge**, F. C. Krause, J.-P. Jones, K. Billings, P. Sobron (2018) Geo-Electrodes and Fuel Cells for Simulating Hydrothermal Vent Environments. *Astrobiology*, 18 (9), 1147-1158.

H.L. Juntunen, L. Leinen, B.K. Pitts, S.M. O'Hanlon, B. Theiling, **L.M. Barge**, P. Videau, M.O. Gaylor (2018) Investigating the kinetics of montmorillonite clay-catalyzed conversion of anthracene to 9,10-anthraquinone in the context of prebiotic chemistry. *Origins of Life and Evolution of Biospheres*, doi: 10.1007/s11084-018-9562-9.

Chin K. B., Chi I., Pasalic J., Huang C.-K., **Barge L. M.** (2018) An introductory study using impedance spectroscopy technique with polarizable microelectrode for amino acids characterization. *Review of Scientific Instruments* 89, 045108, <https://doi.org/10.1063/1.5020076>.

- Barge L. M.** and White L.M. (2017) Experimentally Testing Hydrothermal Vent Origin of Life on Enceladus and Other Icy/Ocean Worlds. *Astrobiology*, Special Collection on Enceladus, 17(9):820-833  
<https://doi.org/10.1089/ast.2016.1633>.
- Barge L.M.**, Cardoso S.S.S., Cartwright J.H.E., Doloboff I.J.\*\*, Flores E.\*\*, Macías-Sánchez E., Sainz-Díaz C.I., Sobrón P. Self-Assembling Iron Oxyhydroxide / Oxide Tubular Structures: Laboratory-Grown and Field Examples from Rio Tinto. *Proceedings of the Royal Society of London A*, Published 9 November 2016. DOI: 10.1098/rspa.2016.0466.
- Barge L.M.**, Branscomb E., Brucato J.R., Cardoso S.S., Cartwright J.H., Danielache S.O., Galante D., Kee T.P., Miguel Y., Mojzsis S., Robinson K.J., Russell M.J., Simoncini E., Sobron P. (2017) Thermodynamics, Disequilibrium, Evolution: Far-From-Equilibrium Geological and Chemical Considerations for Origin-Of-Life Research. *Origins of Life and Evolution of Biospheres*. 47(1):39-56, DOI: 10.1007/s11084-016-9508-z.
- O. Steinbock, J. H. E. Cartwright, **L. M. Barge**. (2016) The Fertile Physics of Chemical Gardens. *Physics Today*, 69(3), 44, doi: 10.1063/PT.3.3108. (Featured on cover of March 2016 issue)
- C. Scharf, N. Virgo, H. J. Cleaves II, M. Aono, N. Aubert-Kato, A. Aydinoglu, A. Barahona, **L. M. Barge**, S. A. Benner, M. Biehl, R. Brasser, C. J. Butch, K. Chandru, L. Cronin, S. Danielache, J. Fischer, J. Hernlund, P. Hut, T. Ikegami, J. Kimura, K. Kobayashi, C. Mariscal, S. McGlynn, B. Menard, N. Packard, R. Pascal, J. Pereto, S. Rajamani, L. Sinapayen, E. Smith, C. Switzer, K. Takai, F. Tian, Y. Ueno, M. Voytek, O. Witkowski, H. Yabuta (2015) A Strategy for Origins of Life Research. *Astrobiology* 15(12):1031-1042, DOI: 10.1089/ast.2015.1113.
- L. M. Barge**, Y. Abedian\*\*, M. J. Russell, I. J. Doloboff\*\*, J. H. E. Cartwright, R. D. Kidd, I. Kanik. (2015) From Chemical Gardens to Fuel Cells: Generation of Electrical Potential and Current Across Self-Assembling Iron Mineral Membranes. *Angewandte Chemie International Edition*, 54, 28:8184-8187, DOI: 10.1002/anie.201501663.
- L. M. Barge**, S. S. S. Cardoso, J. H. E. Cartwright, G. J. T. Cooper, L. Cronin, A. De Wit, I. J. Doloboff, B. Escribano, R. E. Goldstein, F. Haudin, D. E. H. Jones, A. L. Mackay, J. Maselko, J. J. Pagano, J. Pantaleone, M. J. Russell, C. I. Sainz-Díaz, O. Steinbock, D. A. Stone, Y. Tanimoto, N. L. Thomas. (2015) From Chemical Gardens to Chemobionics. *Chemical Reviews*, 115 (16), pp 8652–8703, DOI: 10.1021/acs.chemrev.5b00014.
- L. M. Barge**, Y. Abedian\*\*, I. J. Doloboff\*\*, J. E. Nunez\*\*, M. J. Russell, R. D. Kidd, I. Kanik. (2015) Chemical Gardens as Flow-Through Reactors Simulating Natural Hydrothermal Systems. *Journal of Visualized Experiments*, 105, DOI: 10.3791/53015.
- B. T. Burcar, **L. M. Barge**, D. Trail, E. B. Watson, M. J. Russell, L. B. McGown. (2015) RNA Oligomerization in Laboratory Analogues of Alkaline Hydrothermal Vent Systems. *Astrobiology*, 15(7): 509-522. doi:10.1089/ast.2014.1280.
- L. M. Barge**, T. P. Kee, I. J. Doloboff\*\*, J. M. P. Hampton, M. Ismail, M. Pourkashanian, J. Zeytounian\*\*, M. M. Baum, J. Moss, C.-K. Lin, R. D. Kidd, I. Kanik (2014) The Fuel Cell Model of Abiogenesis: A New Approach to Origin-of-Life Simulations. *Astrobiology*, 14(3):254-70.
- Russell, M. J., **Barge, L. M.**, Bhartia, R., Bocanegra, D., Bracher, P., Branscomb, E., Kidd, R., McGlynn, S., Meier, D., Nitschke, W., Shibuya, T., Vance, S., White, L. (2014) The Drive to Life on Rocky and Icy Worlds. *Astrobiology*, 14, 4, 308-343.
- Barge, L. M.**, \*\*Doloboff, I. J., Russell, M. J., VanderVelde, D., White, L. M., Stucky, G. D., Baum, M. M., \*\*Zeytounian, J., Kidd, R., Kanik, I. (2014) Pyrophosphate Synthesis in Iron Mineral Films and Membranes Simulating Prebiotic Submarine Hydrothermal Systems. *Geochimica Cosmochimica Acta*, 128, 1-12.
- J. Petruska and **L. M. Barge**. (2013) Bilaterally Symmetric Facial Morphology Simulated by Diffusion-Controlled Chemical Precipitation in Gels. *Chemical Physics Letters* 556, 315–319.
- L. M. Barge**, A. A. Pulschen, A. P. M. Emydio, C. Congreve, D. E. Kishimoto, A. G. Bendia, A. Teles, J. DeMarines, D. Stoupin (2013) Life, the Universe, and Everything: An Education Outreach Proposal to Build a Traveling Astrobiology Exhibit. *Astrobiology*, Vol. 13, No. 3, DOI: 10.1089/ast.2012.0834.
- L.M. Barge**, I. J. Doloboff\*\*, L. M. White, G. D. Stucky, M. J. Russell, I. Kanik. (2012) Characterization of Iron-Phosphate-Silicate Chemical Garden Structures. *Langmuir*, 28 (8), pp 3714-3721 (Featured on cover of Feb 28, 2012 issue)
- M. A. Chan, 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.
- B. Schoepp-Cothenet, W. Nitschke, **L. M. Barge**, A. Ponce, M. J. Russell, A. I. Tsapin (2011) Comment on “A Bacterium That Can Grow by Using Arsenic Instead of Phosphorus” *Science*, vol. 332, no. 6034, pl 1149.
- L. M. Barge**, D. E. Hammond, M. A. Chan, S. Potter, J. Petruska, K. H. Nealson (2011) Precipitation Patterns Formed by Self-Organizing Processes in Porous Media. *Geofluids*, 11: 124-133.
- L. M. Barge**, K. Nealson, J. Petruska (2010) Organic Influences on Inorganic Patterns of Diffusion-Controlled Precipitation in Gels. *Chemical Physics Letters*, Vol. 493, Issues 4-6, pp. 340-345.

in prep:

- L. M. Barge**, E. Flores\*\*, J. Weber\*\*, M. M. Baum, D. VanderVelde, A. Castonguay. Geochemical gradients determine organic product distributions in proto-metabolic reaction networks. In prep, 2019.
- N. Hermis\*\*, G. LeBlanc, **L. M. Barge**. Simulation of Prebiotic Early Earth Hydrothermal Chimney Systems in a Thermal Gradient Environment. In prep, 2019.

- K. Chin, **L. M. Barge**, S. M. Perl, N. Hermis.\*\* On Developing an Electrochemistry-Based Geochemical Framework in Planetary Minerals Using in-situ Electrical Spectroscopy. In prep, 2019.
- L. M. Barge**, H. Nishimura\*\*, E. Flores\*\*, K. Fujishima, M. Deswani. Effects of amino acids on phosphorus adsorption to iron hydroxides on the early Earth. In prep, 2019.
- L. M. Barge**, J. Major\*\*, S. Perl, E. Flores\*\*, D. VanderVelde, A. Fraeman, B. Theiling. Phosphorus adsorption in redox-active mineral systems on early and present-day Mars. In prep, 2019.

#### **Awards / Grants:**

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- 2019 PI, JPL Researchers on Campus program: Fate of nitrate/nitrite in an ancient ocean on Mars
- 2019 JPL Strategic RTD “Fate of Organics on Ocean Worlds”, PI / Task Lead: “Understanding abiotic organic chemistry driven by minerals in Ceres’ and Enceladus’ oceans”
- 2019 JPL Lew Allen Award proposal; “Studying Venus to Understand Astrobiology of Terrestrial Planets”
- 2018-2021 PI, NASA Habitable Worlds, “Phosphorus Redox Chemistry on Icy and Rocky Planets”
- 2018-2021 Science-PI, NASA PSTAR, “In-Situ Vent Analysis Divebot for Exobiology Research” (PI: Pablo Sobron)
- 2015-2019 Investigation Lead / Co-I, NASA Astrobiology Institute, Cooperative Agreement Notice (CAN-7), “Icy Worlds: Astrobiology at the Water-Rock Interface and Beyond” (PI: Isik Kanik)
- 2015-2019 Co-PI, NSF Improving Undergraduate STEM Education (IUSE), “GP-EXTRA - Bridge to the Geosciences for Community College Students”, (PI: Marianne Smith, Citrus College)
- 2017-2019 PI, JPL Topical R&TD, “Planetary Habitability Test Beds”
- 2018-2021 Co-I, NASA MaTISSE, “In-situ Spectroscopic Europa Explorer (iSEE)” (PI: Pablo Sobron, SETI)
- 2019 Co-PI, JPL Technical Equipment and Facilities Infrastructure Management (TEFIM) Program, “Geobiology Analysis Suite” (suite of laboratory Raman and LIBS instruments for geobiology research, with Scott Perl)
- 2019 Co-I, JPL Spontaneous R&TD, “Power Generation from Hydrothermal Vent Energy for Robotics and In Situ Sensing Operations”; (PI: Terry Hendricks, JPL)
- 2018 PI, JPL Spontaneous R&TD, “Phosphorus Chemistry on Early and Present Day Mars” (with A. Fraeman)
- 2018 Co-I, JPL Topical R&TD, “Developing an Electrochemistry-Based Geochemical Framework for Organic Systems” (PI: Keith Chin, JPL)
- 2018 Co-I, JPL Topical R&TD, “Prebiotic and Microbial Bioindicators for Exoplanet Discovery” (PI: Tiffany Kataria, JPL)
- 2018 Co-I, JPL Presidents & Director’s Fund, “Biogeochemical signatures of hypersaline brine systems” (PI: Scott Perl)
- 2018 Co-Lead, JPL Blue Sky Study: Planetary Soils (with S. Perl)
- 2017 PI, NASA/NSF Ideas Lab for the Origins of Life, “Becoming Biotic: Recapitulating the Origin of Ancient Metabolic Pathways” (with USC and Oberlin College)
- 2017 PI, JPL Spontaneous R&TD, “Which Came First, Proteins or Cofactors? Recreating Metabolic Reactions on the Early Earth”
- 2017 Co-I, JPL Spontaneous R&TD, “Hydrothermal Vent Instrument Anchoring Platform” (PI: Chris Yahnker, JPL)
- 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” (PI: Keith Chin)
- 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”
- 2016 Co-Lead, JPL Blue Sky Study: Origin of Life
- 2015 JPL Advanced Concept Development: “Sulfate and amino acid absorption in Mars analog minerals”
- 2014 JPL Planetary Instrument Advanced Concept Development, “Simulated Seafloor Systems for Origin of Life Studies”, L. Barge and M. Russell.
- 2014 PI, NASA Astrobiology Institute Early Career Collaboration Grant: “Prebiotic Phosphorus Chemistry”, Collaboration with the UK Astrobiology Society and University of Illinois at Urbana-Champaign.
- 2013 Co-I, JPL Strategic University Partnership Program award, “Microbial Fuel Cells for in-situ life detection” (JPL PI: Aaron Noell, USC PI: Ken Neelson)
- 2013 PI, NASA Astrobiology Institute Early Career Collaboration Grant: “Effects of Catalytic Iron-Containing Minerals on RNA Synthesis”, Collaboration with the New York Center for Astrobiology.
- 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”

#### **Activities, Service, Leadership:**

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**Steering Committee member, NASA Network for Ocean Worlds (NOW)**

**Steering Committee member, NASA Network for Life Detection (NFoLD).** Lead NFoLD Action Group: Impact NASA Programs and Missions.

#### **Conference Sessions**

- AbSciCon 2019, Session Organizer:

- Plenary Session: Ocean World Exploration in our Solar System
- Session: Beyond CHNOPS: Exploring Habitability on Icy Ocean Worlds
- Session: Growing the Astrobiology Field: Inviting K-12, Undergraduates, Underrepresented Groups, Citizen Scientists, and the Public into the Search for Life and Its Origins
- AGU 2018, Session Organizer (P33G Analogue Studies of Gradient Systems Relevant to Astrobiology on Ocean Worlds and Mars)
- Goldschmidt 2018, Session Chair (Prebiotic Chemistry and the Archean Record of Early Life)
- AGU 2017, Session Chair (Investigating mineral-organic interactions relevant to astrobiological systems on Mars and other planetary bodies)

**Steering Committee member, NSF Research Coordination Network on the Exploration of Life's Origins.** Award led by The Santa Fe Institute will host a series of core meetings / topical working groups over a 5-year period that will explore 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-present.** Lead "Detection of Life" theme and participate 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:**

- Co-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; spring 2018.
- Co-lead, 2017 JPL Space Life Sciences study for Astrobiology. leading 4-month study (with S. Perl) to assess Astrobiology expertise at JPL, develop an astrobiology community, and strategize paths forward.
- Co-lead, 2016 JPL Blue Sky Study for the Origin of Life. Co-led a ~6-month study to recommend JPL's institutional investment and strategies for origin of life research.

**2012-2017 Co-chair, NASA Astrobiology Institute Focus Group: "Thermodynamics, Disequilibrium, Evolution".** 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, Journal of Physical Chemistry, Langmuir, Chemical Physics, Journal of the American Chemical Society, Journal of Molecular Evolution, Origins of Life and Evolution of Biospheres.*

#### **Organizer (Conferences / Events)**

- Co-Organizer, Geochemical requirements for the emergence of life: VIII TDE Focus Group workshop, Earth-Life Science Institute (ELSI), Tokyo, Japan, Nov. 2014.
- Co-Organizer, Workshop on "Engines of Life: Thermodynamic Pathways to Metabolism". Beyond Center, Arizona State Univ. and the NAI TDE Focus Group, 5/2013.
- Organizing committee, 2012 Astrobiology Graduate Conference (Los Angeles, CA).
- Organizing committee, 2012 Astrobiology Research Focus Group (USC Wrigley Center, Catalina Island, CA).
- Organizing committee, Research Focus Group at the 2009 Astrobiology Graduate Conference, Seattle, WA. (Funded by the NAI Conference and Workshop Fund.)

**Memberships:** American Chemical Society (ACS), International Society for the Study of the Origin of Life (ISSOL), American Geophysical Union (AGU)

#### **Outreach:**

- California State University Los Angeles, 2018 National Chemistry Week invited speaker / activity leader, Oct 2018
- University of Southern California, Earth Sciences Career Mentorship Panelist, April 2018
- Invited panelist, Citrus College Careers in Math and Science workshop, 2013.
- Invited panelist, "Women in Planetary Sciences" panel at the YSS Undergraduate Planetary Science Research Conference at LPSC, 2011 and 2013.

#### **Media:**

Appeared in CBS Mission Unstoppable, "Nets, Neighborhoods and NASA": <https://www.cbs.com/shows/mission-unstoppable/video/cLLoupSSWqojCjcg2xv0hsmZm2whbzU/mission-unstoppable-nets-neighborhoods-and-nasa/>  
 JPL Feature Story, "NASA Study Reproduces Origins of Life on Ocean Floor", 2/25/2019, by Arielle Samuelson, <https://www.jpl.nasa.gov/news/news.php?feature=7340>

Featured in PBS "Second Genesis: The Quest For Life Beyond Earth", with Carolyn Porco, <http://www.pbs.org/the-farthest/second-genesis/> (start at 12:37)

Featured in Astrobiology Magazine, "Hydrothermal Experiments Bring Enceladus to Earth", by Charles Choi, Nov 30, 2017, <https://www.astrobio.net/news-exclusive/hydrothermal-vent-experiments-bring-enceladus-earth/>

Featured in Scientific American, “Life's Origins by Land or Sea? Debate Gets Hot” by Rachel Brazil, ChemistryWorld on May 15, 2017. <https://www.scientificamerican.com/article/lifes-origins-by-land-or-sea-debate-gets-hot/>

Featured in Engadget, “The search for a habitable second Earth”, by Steve Dent, May 27, 2017, <https://www.engadget.com/2017/05/27/search-habitable-planets-second-earth-exoplanets/>

Featured in NOVA web short, “Make your own hydrothermal vent”, By Karishma Desai and Ari Daniel, <http://www.pbs.org/wgbh/nova/earth/make-your-own-vent.html>

Featured in New Scientist, “Genesis in a jar: How chemical gardens may lead us to alien life”, Aug 10 2016 by Joshua Sokol, <https://www.newscientist.com/article/2100538-genesis-in-a-jar-how-chemical-gardens-may-lead-us-to-alien-life/>

Featured in Nautilus Magazine, “The Fly in the Primordial Soup”, by Nathaniel Comfort, June 23, 2016, <http://nautil.us/issue/37/currents/the-fly-in-the-primordial-soup>

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

Invited speaker, “Findings of Water on Mars”, Space Fest 2015, California Science Center (Los Angeles).

JPL Feature Story, “Researchers Use Seafloor Gardens to Switch on Light Bulb”, August 5, 2015, by Whitney Clavin, <http://www.jpl.nasa.gov/news/news.php?feature=4679>.

Astrobiology Magazine News Exclusive, “Could ‘Green Rust’ be a Catalyst for Martian Life?”, May 21, 2015, by Elizabeth Howell, <http://www.astrobio.net/news-exclusive/could-green-rust-be-a-catalyst-for-martian-life/>

Orange County Register, “Did sea-floor battery spark life on Earth?”, by Pat Brennan, April 26, 2014. <https://www.ocregister.com/2014/04/28/did-sea-floor-battery-spark-life-on-earth/>

Invited Guest, Planetary Radio, “Was a Natural Fuel Cell Key to the Origin of Life on Earth?”, with Matt Kaplan: <http://www.planetary.org/multimedia/planetary-radio/show/2014/0701-was-a-natural-fuel-cell-key-to-the-origin-of-life-on-earth.html>.

JPL Feature Story, “New Study Outlines ‘Water World’ Theory of Life’s Origins”, April 15, 2014, by Whitney Clavin, <http://www.jpl.nasa.gov/news/news.php?release=2014-115>.

NASA Astrobiology Institute Research Highlights, “The Seafloor Electric”, 04/15/2014, <http://astrobiology.nasa.gov/articles/2014/4/15/the-seafloor-electric/>

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, <http://www.jpl.nasa.gov/news/news.php?release=2014-079>

Astrobiology Magazine News Exclusive, “Life’s Fuel Cells”, March 13, 2014, by Sheyna Gifford, <http://www.astrobio.net/exclusive/6062/life%E2%80%99s-fuel-cells>

NASA Astrobiology Institute Research Highlights, “Life’s Origins in a Prebiotic Fuel Cell”, 03/14/2014, by Aaron Gronstal, <http://astrobiology.nasa.gov/articles/2014/3/14/lifes-origins-in-a-prebiotic-fuel-cell/>

University of Leeds press release, “Simulating how the Earth Kick-Started Metabolism”, by Sarah Reed, 03/13/14, [http://www.leeds.ac.uk/news/article/3504/simulating\\_how\\_the\\_earth\\_kick-started\\_metabolism](http://www.leeds.ac.uk/news/article/3504/simulating_how_the_earth_kick-started_metabolism)

Daily Galaxy, “What We Might Find in Europa’s Alien Ocean World”, 03/2014, [http://www.dailygalaxy.com/my\\_weblog/2014/03/what-we-might-find-in-europas-alien-ocean-world.html](http://www.dailygalaxy.com/my_weblog/2014/03/what-we-might-find-in-europas-alien-ocean-world.html)

Universe Today, “Did Life on Earth As We Know It Come From Geological Life?”, by Elizabeth Howell, 03/13/14, <http://www.universetoday.com/110310/did-life-on-earth-as-we-know-it-come-from-geological-life/>

Oak Crest Institute of Science, press release, “How the Earth Kick-started its Metabolism Simulated in a Laboratory”, by Lisa Lucio, 03/2014. <http://oak-crest.org/oakcrest-news/how-the-earth-kick-started-its-metabolism-simulated-in-a-laboratory/>

Featured in Chemical & Engineering News: “Gardens of Eden”, by Carmen Drahl, March 18, 2013. Vol. 91, Issue 11, pp. 44-45, <http://cen.acs.org/articles/91/i11/Gardens-Eden.html>

## Honors / Awards:

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- 2019 NASA Early Career Public Achievement Medal
- 2019 Presidential Early Career Award for Scientists and Engineers (PECASE) for innovative fuel cell-based research
- 2018 JPL Lew Allen Award for Excellence, for pioneering research on the application of electrochemistry to studies of the origin and emergence of life. (Awarded to 4 JPL-ers annually to recognize and encourage significant individual accomplishments or leadership in scientific research or technological innovation by JPL employees during the early years of their professional careers.)
- 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)

### **Seminars, Invited Talks, Oral Presentations**

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- Plenary panel member, Astrobiology Science Conference 2019, “Plenary Session: Unresolved Issues in the Origins of Life: Multidisciplinary Perspectives”, Seattle, WA  
 Invited guest speaker, World Water Day Europa (Astronomy Night series), Intrepid Museum Sea, Air and Space, NYC.  
 Invited guest lecturer, USC astrobiology course, “Self-organization and biosignatures in geochemical systems”  
 Invited guest lecturer, Caltech astrobiology course, “Self-organization and biosignatures in geochemical systems”, Feb 22, 2019  
 Invited seminar speaker, University of Nevada Las Vegas Geoscience Department, “Prebiotic Metabolic Reaction Networks Driven by Reactive Iron Minerals on Rocky / Ocean Worlds”, Feb 22, 2019  
 Invited speaker, Molecular Origins of Life – Center for Advanced Studies (CAS) Conference 2018, “Simulating Prebiotic Chemistry in Hydrothermal Systems on Early Earth and Ocean Worlds”, Munich, Germany, Oct 2018.  
 Invited speaker (“The Search for Life on Mars”), Family Astronomy Night series, Intrepid Museum Sea, Air and Space, NYC (August 2018)  
 Keynote Speaker (Prebiotic Chemistry and Habitability in Serpentinizing Hydrothermal Systems on Early Earth and Other Worlds), Session: Microbe-Fluid-Rock Interaction in Hydrothermal Systems, Goldschmidt 2018  
 Solicited talk, COSPAR 2018 Scientific Event F3.2: The Evolving Chemical Universe: From Proto-stars to the Origin of Life. (“Experimental Simulations of Prebiotic Chemistry Driven by Hydrothermal Gradients in Ocean Worlds”)  
 Invited Lecturer, 2018 NASA/ESA International Summer School in Astrobiology (Biomarkers: Signs of Life Through Space and Time), Santander, Spain. Lectures: “Ocean Worlds: Geochemistry, Redox Cycling, and Habitability”; “Ocean Worlds: Defining Biosignatures and Developing Strategies for Life Detection”.  
 Invited Speaker, International Symposium on *Environments of Terrestrial Planets Under the Young Sun: Seeds of Biomolecules*, (“Exploring Environmental Conditions for Prebiotic Chemistry on Early Terrestrial Planets”), Goddard Space Flight Center, April 2018.  
 Invited Seminar, Johns Hopkins University Applied Physics Lab, “Life and its Origin in Hydrothermal Systems on Early Mars and Ocean Worlds”, April 2018.  
 Invited Seminar, University of Tulsa Chemistry Department, “Self-Organization in Geochemical Systems: Recognizing Life and its Origin”, March 2018.  
 Invited Speaker (Session: Prebiotic Environments), 2018 Gordon Research Conference on the Origins of Life (January 2018)  
 Discussion Leader (Life Detection), 2018 Gordon Research Conference on Geobiology (January 2018)  
 Caltech Planetary Science Seminar, May 2017, “Recognizing Life and its Origin: Emergent Phenomena in Abiotic Organic-Mineral Gradient Systems”  
 Invited talk, Astrobiology Science Conference, session on Origin of Life in Hydrothermal Vents, “Prebiotic Chemistry in Chemical Garden Structures at Hydrothermal Vents: The Importance of Gels and Gradients”. Mesa, AZ, 2017, Abstract #3477.  
 Invited talk, American Geophysical Union session on Enceladus: “Simulating Prebiotic Chemistry in Alkaline Hydrothermal Vents on Enceladus and other Ocean Worlds”, San Francisco, Dec 2016.  
 Invited speaker, “Emergence of Metabolism in Alkaline Hydrothermal Vents: An Analog for Enceladus?” Enceladus Focus Group meeting, UC Berkeley, June 2016.  
 NASA Astrobiology Institute Early Career Seminar, “Chemical Gardens, Chimneys, and Fuel Cells: Simulating Prebiotic Chemistry in Hydrothermal Vents on Ocean Worlds”. June 1, 2016 <http://nai.nasa.gov/seminars/featured-seminar-channels/early-career-seminars/2016/6/1/chemical-gardens-chimneys-and-fuel-cells-simulating-prebiotic-chemistry-in-hydrothermal-vents-on-ocean-worlds/>  
 Invited seminar, Cal State Northridge. May 4, 2016.  
 Invited STEM Industry Panelist, USC Beyond the PhD 2016: PhD and Postdoctoral Career Conference.  
 Invited seminar, “From Geochemistry to Biochemistry: Emergence of Life in Alkaline Hydrothermal Vents”, University of Tulsa, April 15 2016.  
 Invited seminar, “From Geochemistry to Biochemistry: Simulating Prebiotic Chemistry Driven by Geochemical Gradients in Alkaline Hydrothermal Vents”. Johns Hopkins and Space Telescope Science Institute “Planets, Life and the Universe” NAI-sponsored Series, March 3 2016.

Invited speaker, "Hydrothermal chimneys as flow-through chemical reactors: Laboratory simulations of far-from-equilibrium systems at seafloor interfaces", Conference on Re-conceptualizing the origin of life, Carnegie Institute, Washington DC, 2015.

Invited Seminar, Sept. 2015, *Experimentally Simulating Seafloor Systems for Origin of Life and Planetary Habitability*. Caltech Division of Geological and Planetary Sciences, Yuk Lunch Seminar.

Invited Speaker, University of Washington Astrobiology Colloquium Series, *Self-Organizing Chemical Systems: From Materials Science to Astrobiology*, Seattle, WA, May 2015.

Invited Speaker, Chemistry Seminar Series, Florida State University, *Self-Organization in Far-From-Equilibrium Systems: From Materials Science to Astrobiology*, Tallahassee, FL, May 2015.

Invited Plenary Speaker, *Habitability in the Universe: From the Early Earth to Exoplanets*; First conference of the COST (European Cooperation in Science and Technology) ORIGINS Action, Portugal, March 2015.

Seminar, Georgia Tech Planetary Seminar Series, *Prebiotic Chemistry at Water-Rock Interfaces: Implications for Habitability on Rocky and Icy Worlds*. March 3, 2015.

Seminar, UCLA iPLEX Lunch series, UCLA Institute for Planets and Exoplanets, February 2015.

Seminar, Oak Crest Institute of Science, "From Geochemistry to Biochemistry: Emergence of Metabolism in Hydrothermal Vents on Rocky and Icy Worlds", December 2014.

Seminar, Earth Life Science Institute (ELSI), "Laser Fuel Cells Simulating Hydrothermal Vents", Japan, Nov 2014.

Oral presentation, Origins 2014 / 2<sup>nd</sup> ISSOL – Bioastronomy Joint International Conference, *Simulating Hydrothermal Vents as Geochemical Fuel Cells*, Nara, Japan, July 2014.

JPL Postdoc Seminar, *Hydrothermal Vents as Geochemical Fuel Cells and Origin of Life*. 6/2/2014.

Seminar speaker, University of Southern California Geobiology Seminar Series, 04/2014.

Invited speaker, 2<sup>nd</sup> Earth Life Science Institute (ELSI) International Symposium, Tokyo, Japan, 3/2014.

Invited seminar, Institute for Genomic Biology, University of Illinois Urbana-Champaign. *Chemical Gradients, Disequilibrium, and the Origin of Life*. 2/2014.

Seminar, *Harnessing Geochemical Gradients at the Origin of Life*, University of Leeds, School of Chemistry, Leeds, UK, 10/2013.

Invited seminar, *The Emergence of Metabolism from Geochemical Fuel Cells on Wet Rocky Planets*. ELSI and Japan Agency for Marine-Earth Science and Technology (JAMSTEC), Tokyo, Japan, 12/2013.

Invited seminar, *Harnessing Geochemical Gradients at the Origin of Life*. Georgia Tech, Center for Ribosomal Origins and Evolution, 9/2013.

Oral Presentation, *Self-Assembly and Emergence in Prebiotic Hydrothermal Systems*. Emergence in Chemical Systems 3.0 International Conference, University of Alaska, Anchorage, 6/2013.

Oral Presentation, *From Fuel Cells to Life*, Workshop on "Engines of Life: Thermodynamic Pathways to Metabolism", Arizona State Univ. and the NAI TDE Focus Group, 5/2013.

Invited speaker, *Testing the Emergence of Bioenergetics in Hydrothermal Vents*. Princeton Origin of Life Workshop, Princeton Center for Theoretical Science, January 2013.

JPL Postdoc Seminar, *Emergence of Bioenergetics in Hydrothermal Systems on Icy Worlds*. Nov 29, 2012, NASA Jet Propulsion Laboratory.

Oral presentation, *Emergence of Bioenergetics*, European Astrobiology Network (EANA) meeting, Stockholm, Sweden, Oct. 2012.

Invited Seminar, *Fuel Cell Simulations of the Origin of Life*. University of Budapest, October 2012.

Invited Speaker, *Energetics of Chemical Gardens in Prebiotic Systems*, Lorentz Center workshop on "Chemical Gardens", Leiden University, the Netherlands, May 2012.

Invited Speaker, *What it Means to be an Astrobiologist*. NASA Space Science Workshop "Explore: Life on Mars?", University of Wisconsin-Madison / UW Geology Museum, April 2012.

Seminar, Apr. 2012, *Chemical Gardens as Energy Traps for the Emergence of Metabolism in Hydrothermal Systems*. University of Wisconsin-Madison Geology Department.

Seminar, Nov.2011, *Electrochemistry of Self-Assembling Inorganic Membranes: Simulating the Origin of Metabolism in Hydrothermal Systems*. Inorganic-Organometallics Seminar, Caltech Division of Chemistry and Chemical Engineering.

Seminar, Sept. 2011, *From Self-Assembling Inorganic Membranes to Pre-Biotic Chemistry: A Hydrothermal Origin-of-Life Model for Icy Moons*. Caltech Division of Geological and Planetary Sciences, Yuk Lunch Seminar.

Oral Presentation, *Characterizing the Proton-Motive Force in Self-Assembling Inorganic Membranes*. 2<sup>nd</sup> workshop of the NAI TDE Focus Group, Florence, Italy, 9/2011.

Oral Presentation, *Pyrophosphate Generation in A Proton Gradient*. NAI TDE Focus Group, Centro de Astrobiologia, Madrid, March 2011.

Seminar, *Driving Pyrophosphate Synthesis by an Ambient Proton-Motive Force? Part of double seminar ("Life Emerges Through Entropy Trapping")* with L. M. White and M. J. Russell, Jet Propulsion Laboratory, 2/3/2011.

**L. M. Barge**, J. Petruska, S. Potter, M. A. Chan, J. Cho, K. Nealon (2008) *Mineral Precipitation in Porous Media: Laboratory Diffusion Experiments as Analogues for Concretion Formation in Utah and on Mars*. Keynote presentation at the 2008 Australian Earth Sciences Convention, Perth, Western Australia, 7/2008.

**L. M. Barge**, J. Petruska, K. Nealon (2007) *Experimental Observations of Diffusion-Driven Mineral Precipitation:*

*Implications for Concretion Formation on Earth and Mars.* Oral presentation at the 2nd International Workshop on Exploring Mars and its Terrestrial Analogues, Trento, Italy.

### **Student and Postdoc Supervision:**

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2019-present: committee member for Chris Mehta, Ph.D. candidate, University of South Florida  
2019-present: Jessica Weber, JPL Postdoc (origin of life)  
2019-present: Laura Rodriguez, JPL Postdoc (hydrothermal vents)  
2019-present: Sarah Crucilla, undergraduate intern, Caltech (origin of metabolism)  
2018-present: Eduardo Martinez, M.S. candidate, CSULA (chemical gardens)  
2018-present: Jonathan Major, M.S. candidate, University of Tulsa, (phosphorus on Mars / ocean worlds)  
2018-present: committee member for Carolyn Lang, Ph.D. candidate, University of South Florida  
2017-present: Ninos Hermis, M.S. candidate / graduate student intern, CSU-LA (fuel cells, temperature gradients)  
2013-present: Erika Flores, M.S. candidate / graduate student intern, CSU-LA (reductive amination in iron hydroxides)  
2017-present: 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)

### **Teaching/Mentoring:**

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2013-present: Mentor for various JPL/NASA undergraduate and graduate intern programs, typically 5+ students per year, including: JPL Student Independent Research Internship (SIRI) Program, Minority Student Programs, NASA Undergraduate Internship (UI) program, JPL Visiting Student Research Program (JVS RP), Caltech SURF Summer Intern Program), JPL Student Internship Program.  
2014-present Mentor, Tulsa Community College / JPL intern program  
2014-present Mentor, Citrus College / JPL intern program (with Dr. Marianne Smith)  
2014 Mentor, Blue Marble Space undergraduate intern program. Developed and implemented pilot program for a new science summer undergraduate internship, combining research, ethics, and communication modules.  
2013 Postdoc Mentor, Women Mentoring Women Program at Caltech  
Interviewee, *Gigniks* (non-profit film project interviewing professionals for high school career guidance).  
2007 Teaching Assistant, GEOL 125 – Earth History (USC Dept. of Earth Sciences)  
Teaching Assistant, GEOL 240 – Earthquakes (USC Dept. of Earth Sciences)  
2006 Assistant Science Instructor (Astronomy), Sally Ride Science Camp at UCLA.  
2001-2004 Teaching Assistant, AST 1073 – Stellar Lab (Villanova Dept. of Astronomy and Astrophysics)  
Teaching Assistant, AST 1075 – Planets Lab (Villanova Dept. of Astronomy and Astrophysics)  
Teaching Assistant, PHY 2601 – Computational Physics Lab (Villanova Dept. of Physics)

### **Published Abstracts:**

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\*\* = Student / postdoc under my supervision

**Barge LM**, Jones J-P, Sobron P, Perl S & Chin K. (2019) Studying Habitability of Redox-Active Hydrothermal Systems on Earth and Ocean Worlds. *Goldschmidt Abstracts*, 2019.  
**LM Barge**, E Flores, MM Baum, D VanderVelde (2019) Redox-Active Minerals Affect Product Selectivity in Prebiotic Organic Reaction Networks. 2019 Astrobiology Science Conference  
**LM Barge**, J-P Jones, SM Perl, N Hermis, FC Krause, K Billings (2019) Geoelectrochemical Systems Supporting Life and its Origin on Early Earth and Ocean Worlds. 2019 Astrobiology Science Conference, Abstract #501-4  
E Flores\*\*, H Nishimura, E Martinez, **LM Barge**, K Fujishima, A Khodiyari (2019) Concentration of Phosphate for Prebiotic Reactions by Iron Hydroxide Adsorption. 2019 Astrobiology Science Conference, Abstract #133-101

- J Major\*\*, B Theiling, **LM Barge**, WC Cornell (2019) Synthesized metal hydroxides as a proxy for prebiotic phosphorus cycling on Mars. 2019 Astrobiology Science Conference, Abstract #141-174
- E Martinez\*\*, JJ Pagano, M Hooks\*\*, **LM Barge** (2019) Simulation of Seafloor Chimneys using Organic and Inorganic Compounds. 2019 Astrobiology Science Conference, Abstract #133-110
- P Sobron, **LM Barge**, et al. (2019) InVADER: Furthering the Understanding and Exploration Readiness of Terrestrial and Planetary Underwater Vent Systems. 2019 Astrobiology Science Conference, Abstract #142-185
- N. Hermis\*\*, **LM Barge**, RE Price, G LeBlanc (2019) Simulation of Iron Hydroxide and Magnesium Silicate Hydrothermal Chimney Systems In a Thermal Gradient Environment. 2019 Astrobiology Science Conference, Abstract #133-109
- L. M. Barge, E. Flores\*\*, S. M. Perl, D. VanderVelde, M. M. Baum. (2019) Abiotic Organic Synthesis and Product Distributions in Mars Analogue Iron Mineral Systems. 2019 LPSC Abstract #1439.
- N. Hermis\*\*, **L. M. Barge**, G. LeBlanc, S. Perl, K. Chin (2018) Simulation of Prebiotic Early Earth Hydrothermal Chimney Systems in a Thermal Gradient Environment. 2018 AGU Fall Meeting, abstract P33G-3908.
- S. Vance, **L. M. Barge**, S. S. S. Cardoso, J. H. E. Cartwright, B. Journaux (2018) Brinicles and the Fates of Trapped Salts in the Ices of Ocean Worlds. 2018 AGU Fall Meeting, abstract P21E-3388.
- P. Sobron, **L. M. Barge**, J. Amend, J. Burnett, R. Detry, I. Doloboff, D. S. Kelley, A. Marburg, A. K. Misra, A. Nawaz, R. E. Price, M. Smith, K. Zacny, B. Thornton (2018) Exploring Underwater Vent Systems: New Technologies and Strategies to Advance Life Detection and Scientific Understanding of Ocean Worlds. 2018 AGU Fall Meeting, abstract P33G-3903.
- K. Chin, **L. M. Barge**, S. M. Perl, N. Hermis\*\* (2018) On Developing an Electrochemistry-Based Geochemical Framework in Planetary Minerals Using in-situ Electrical Spectroscopy. 2018 AGU Fall Meeting, abstract P33G-3905.
- J. Major\*\*, **L. M. Barge**, S. M. Perl, B. P. Theiling, A. Fraeman, E. Flores\*\*, D. VanderVelde. (2018) Manganese Hydroxides and Their Role in Phosphorus Nutrient Cycling on Mars. 2018 AGU Fall Meeting, abstract P33G-3914.
- E. Flores\*\*, **L. M. Barge**, D. VanderVelde, M. Baum (2018) Synthesis of Amino Acids via Reductive Amination Mediated by Iron Oxyhydroxides. 2018 AGU Fall Meeting, abstract P33G-3906.
- LeBlanc G, Wirth D, **Barge LM** & Hermis N\*\* (2018) Electrode-Mineral Interfaces for the Evaluation of Prebiotically Relevant Electrochemistry. Goldschmidt Abstracts, 2018 1426.
- Barge LM**, Flores E\*\*, Chin K, Jones J-P, Hermis N\*\* & Baum MM (2018) Prebiotic Chemistry and Habitability in Serpentinizing Hydrothermal Systems on Early Earth and Other Worlds. Goldschmidt Abstracts, 2018 135.
- Jocic S, Aguirre V, Castonguay A, **Barge LM**, Moss JA & Baum MM (2018) Reduction of Mixed Nitrate/Nitrite via Green Rust Chloride and Sulfate. Goldschmidt Abstracts, 2018 1182.
- L.M. Barge**, E. Flores\*\*, D. Vandervelde, M.M. Baum (2018) Reductive Amination Driven by Iron Hydroxides in Hydrothermal Systems. Goldschmidt Abstracts, 2018 134.
- L. M. Barge**, F. C. Krause, J-P. Jones, K. Billings, P. Sobron, Simulating Electrochemistry of Hydrothermal Vents on Enceladus and Other Ocean Worlds. 2017 AGU Fall meeting, abstract P43B-2882
- V. Sloan, **L.M. Barge**, M. Smith. Engaging diverse community college students in the geosciences through a year-round career mentoring and research workforce program. 2017 AGU Fall meeting, abstract ED34A-04.
- N. Hermis\*\*, **L.M. Barge**, K.B. Chin, G. LeBlanc, R. Cameron\*\*. Electrochemistry of Prebiotic Early Earth Hydrothermal Chimney Systems. 2017 AGU Fall meeting, abstract B53A-1947.
- E. Flores\*\*, **L. M. Barge**, D. VanderVelde, M. M. Baum. Iron Hydroxide Minerals Drive Organic and Phosphorus Chemistry in Subsurface Redox / pH Gradients. 2017 AGU Fall meeting, abstract P43G-02.
- Cameron R. D.\*\*, Hermis N.\*\*, Chin K., LeBlanc G., **Barge L. M.** Electrochemistry of Early Earth Hydrothermal Chimneys and Simulations of Possible Prebiotic Metabolic Pathways. XVIIIth Intl Conf on Origin of Life 2017 [#4176]
- Flores E.\*\*, VanderVelde D., Russell M. J., Baum M. M., **Barge L. M.** Redox and pH Gradients Drive Amino Acid Synthesis at Hydrothermal Vents. XVIIIth Intl Conf on Origin of Life 2017 [#4178]
- Barge L. M.**, Flores E.\*\*, Abedian Y.\*\*, Maltais T.\*\*, Cameron R.\*\*, Hermis N.\*\*, Chin K., Russell M. J., Baum M. M. Effects of pH and Redox Gradients on Prebiotic Organic Synthesis and the Generation of Free Energy in Simulated Hydrothermal Systems. XVIIIth Intl Conf on Origin of Life 2017 [#4179]
- Abedian Y.\*\*, Maltais T.\*\*, VanderVelde D., Flores E.\*\*, **Barge L. M.** Phosphorous and Amino Acid Adsorption in Early Earth Seafloor Minerals. XVIIIth Intl Conf on Origin of Life 2017 [#4177]
- Hammer A. C.\*\*, Corbit B. C., Doloboff I. J., **Barge L. M.** Structural and Compositional Diversity in Iron-Based Hydrothermal Chimney Simulants Grown with Functionalized Organics. XVIIIth Intl Conf on Origin of Life 2017 [#4208]
- L. M. Barge**, F. C. Krause, J.-P. Jones, K. Billings, P. Sobron (2017) Geo-Electrodes and Fuel Cells for Simulating Hydrothermal Vent Environments. *Astrobiology Science Conference 2017*, Abstract #3470.
- L. M. Barge**, O. Steinbock, J. H. E. Cartwright (2017) Prebiotic Chemistry in Chemical Garden Structures at Hydrothermal Vents: The Importance of Gels and Gradients. *Astrobiology Science Conference 2017*, Abstract #3477
- Y. Abedian\*\*, D. VanderVelde, E. Flores\*\*, **L. M. Barge** (2017) Phosphorus and Amino Acid Adsorption in Iron Oxyhydroxides Representing Early Earth Seafloor or Hydrothermal Chimney Systems. *Astrobiology Science Conference 2017*, Abstract #3484

- E. Flores\*\*, D. VanderVelde, K. Kallas\*\*, M. J. Russell, M. M. Baum, **L. M. Barge** (2017) Amino Acid Synthesis Under Alkaline Hydrothermal Chimney Conditions. *Astrobiology Science Conference 2017*, Abstract #3491
- R. D. Cameron\*\*, K. Chin, E. Flores\*\*, G. LeBlanc, **L. M. Barge** (2017) Simulating Electrochemistry of Iron-Nickel Sulfide Hydrothermal Chimneys. *Astrobiology Science Conference 2017*, Abstract #3502
- A. C. Hammer\*\*, B. C. Corbit, I. J. Doloboff, **L. M. Barge**. Mineralogy, Morphology, and Organic Modifications of Iron-Based Hydrothermal Chimney Simulants. *Astrobiology Science Conference 2017*, Abstract #3036
- J. H. E. Cartwright, **L. M. Barge**, S. S. S. Cardoso, S. Vance. Self-Assembling Ice Membranes: Brinicle Properties, Field Examples, and Possible Energetic Systems in Ocean Worlds. *Astrobiology Science Conference 2017* (2017), Abstract #3512.
- G. LeBlanc, D. M. Wirth, H. D. Whitehead, J. Yungbluth, G. Ludewick, **L. M. Barge**, R. Cameron\*\*. Electrochemical and Rapid Prototyping Strategies for more Precise Analysis of Geo-Electrochemical Environments of Interest to Astrobiology. *Astrobiology Science Conference 2017*, Abstract #3168.
- L. B. McGown, B. T. Burcar, **L. M. Barge**, M. J. Russell, E. B. Watson. Exploring Alkaline Hydrothermal Vent Environments for Abiotic RNA Polymerization. *Astrobiology Science Conference 2017*, Abstract #3294.
- D. M. Wirth, G. LeBlanc, H. D. Whitehead, J. Yungbluth, G. Ludewick, **L. M. Barge**, R. D. Cameron\*\*. Electrochemical Deposition of Iron Sulfides and Iron Hydroxides: Mimicking Hydrothermal Vent Systems Relevant to Origin of Life Studies. *Astrobiology Science Conference 2017*, Abstract #3210.
- H. D. Whitehead, G. LeBlanc, D. M. Wirth, J. Yungbluth, G. Ludewick, **L. M. Barge**, R. D. Cameron\*\*. Unique Electrochemical Cells for the Analysis of Hydrothermal Vent Prebiotic Chemistry Experiments. *Astrobiology Science Conference 2017*, Abstract #3208.
- M. Smith, V. Sloan and **L. M. Barge** (2017) "Partnering for Diversity: A Year-Round Experiential Learning Project to Engage Community College Students in the Geosciences" American Meteorological Society's 26th Symposium on Education, part of the 97th Annual Meeting, January 2017, Seattle, WA.
- Cameron R. D.\*\*, **Barge L. M.**, Chin K. B., Doloboff I. J., Flores E.\*\*, Hammer A. C.\*\*, Sobron P., Russell M. J., Kanik I. (2016) Catalytic Diversity in Alkaline Hydrothermal Vent Systems on Ocean Worlds. 2016 DPS / EPSC meeting abstract.
- Flores E.\*\*, **Barge L. M.**, VanderVelde D., Kallas K.\*\*, Baum M. M., Russell M. J., Kanik I. (2016) Amino Acid Synthesis in Seafloor Environments on Icy Worlds. 2016 DPS / EPSC meeting abstract.
- L. M. Barge, M. J. Russell, P. Sobron, M. M. Baum, I. Kanik. Designing Far-From-Equilibrium Experiments for Origin of Life and Planetary Habitability. 2015 Astrobiology Science Conference.
- L. M. Barge**, P. Sobron, E. Flores\*\*, M. J. Russell, A. Wang, I. Kanik. Phase Transformations of Green Rust: Laser Raman Characterization With Implications for Origin of Life and Mars Astrobiology. 2015 Astrobiology Science Conference Abstract #7617.
- P. Sobron, **L. M. Barge**, M. J. Russell, R. Price, T. Schneiderman, K. Takai, M. Yamamoto. Hydrothermal Mineral Precipitates as Habitable Environments: A Synergistic Imaging, Raman, and LIBS Approach to Exploring Underwater Chimney Materials. 2015 Astrobiology Science Conference.
- P. Sobron, **L. M. Barge**, J. Amend, M. Church, L. Dubord, K. Fristad, B. Kirkwood, A. Misra, K. Nealon, M. Parente, R. Price, M. Russell, M. Smith, K. Zacny, R. Leveille, B. Reese, B. Thornton, K. Takai. A Multi-Sensor Payload Concept for the Exploration of Planetary Underwater Hydrothermal Systems. 2015 Astrobiology Science Conference.
- L. M. Barge**, M. J. Russell, S. Vance, P. Johnson, I. Kanik. The Detection of Disequilibria and/or Life in a Europa Plume. Workshop on the Potential for Finding Life in a Europa Plume, NASA Ames Research Center, 2015.
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