

Laura C. Motta

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Marine Chemistry and Geochemistry
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Research Interests

Inspired by environmental processes that challenge our current chemical knowledge, the *Theoretical Chemistry and Isotope Biogeochemistry Group at WHOI* is interested in advancing our fundamental understanding of chemistry through studying non-traditional stable isotopes. *Isotope effects are Nature's guide to chemistry. The question is: how should we interpret them when there is no chemical framework?*

Education

Double Ph.D. in Earth Sciences and Chemistry 2014–2019

Rackham Student Initiated Doctoral Program - University of Michigan

Earth Sciences Advisor: Professor Joel D. Blum

Theoretical Chemistry Advisor: Professor Paul M. Zimmerman

“Student Initiated Doctoral Programs provide students with the opportunity to combine studies from two Ph.D. programs, which will lead to a single Ph.D. citation for a double/dual PhD (*Earth Sciences and Chemistry*).”

B.A in Chemistry – Honors 2009–2013

Rutgers University-New Brunswick

Advisor: Professor John R. Reinfeld

Professional Experience

Theoretical Chemistry - Postdoctoral Fellow 2021–2023

The State University of New York at Buffalo

Advisor: Professor Jochen Autschbach

Environmental Sciences - Postdoctoral Researcher 2020

Pohang Institute of Science and Technology (POSTECH), Pohang, South Korea

Advisor: Assistant Professor Sae Yun Kwon

Theoretical Chemistry - Predoctoral Student International Fellowship 2019

Centre National De La Recherche Scientifique (CNRS) Toulouse, France

Visiting Scholar to learn Relativistic Quantum Chemistry. Mentor: Dr. Trond Saue

Ph.D. Student, NSF GRFP Predoctoral Fellow 2014–2019

University of Michigan, Rackham Student Initiated Doctoral Program

Advisors: Professors Joel D. Blum and Paul M. Zimmerman

NSF international REU, São Pablo, Brazil, Organic synthesis 2011

Universidade de São Pablo

Advisor: Professor Luiz F. Silva

Cruise or Fieldwork Participation

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| 1. Station ALOHA (22° 45'N, 158° 00'W) | 02/2014 (15 days) |
| 2. Station ALOHA (22° 45'N, 158° 00'W) | 09/2014 (15 days) |
| 3. Central Pacific Ocean (8° and 5° N, 155° W) | 09/2015 (28 days) |
| 4. Eastern Pacific Ocean (Puntarenas – San Diego) | 05/2023 (39 days) |

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| 5. Western Antarctic Peninsula | 12/2023 (36 days) |
| 6. Periodic Magi Cicadae Collection (Illinois; <i>Lead Fieldwork</i>) | 05/2024 (3 days) |

Planned Cruise and Fieldwork Participation

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| 1. Periodic Magi Cicadae Collection (Massachusetts; <i>Lead Fieldwork</i>) | 05/2025 (3 days) |
| 2. Atlantic Ocean: Gulf Stream (<i>Chief Scientist</i>) | 09/2025 (7 days) |

Awards

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| 1. National Academy of Sciences Kavli Fellow | 2025 |
| 2. International Institute Fellowship, U. Michigan (Theoretical Chemistry; Toulouse, France) | 2019 |
| 3. W. Linfield Award Fellowship, U. Michigan (Theoretical Chemistry; Toulouse, France) | 2019 |
| 4. Karle Symposium Best Poster Award, U. Michigan (Physical Chemistry Cluster) | 2018 |
| 5. Rackham Graduate Research Award, U. Michigan | 2018 |
| 6. National Science Foundation Graduate Research Fellowship | 2014 |
| 7. Rackham Graduate School Merit Fellowship, U. Michigan | 2014 |

Participation in Education

Teaching:

<i>Marine Isotope Chemistry Co-Lecturer</i> MIT-WHOI Joint Program	2025
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<i>Guest Lecture Marine Bioinorganic</i> MIT-WHOI Joint Program	2023
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<i>Isotope Geochemistry Workshop</i> Mercury isotope group, POSTECH, South Korea 4 lectures on understanding photochemical isotope effects of heavy elements	2020
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<i>Physical Chemistry II – Thermodynamics and Kinetics</i> CHEM463, Department of Chemistry, University of Michigan Future Faculty Graduate Instructor. Course Head: Paul M. Zimmerman	2018
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<i>Isotope Geochemistry</i> EARTH480, Department of Earth and Environmental Sciences, University of Michigan Guest Lecturer (2-lectures) Photochemical isotopes effects in the environment and how to interpret them	2018
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Supervision/Mentoring:

WHOI Summer Students
Frank Dorman (2024)

Technical Staff
Corinne Richard (2024-present)

Postdoctoral Scholar
Yipeng He (2025-present)

Professional Service & Community Involvement at WHOI

Junior WHOI/MIT JPCO joint program advisor	2024 – Present
Summer Student Fellow Department Representative	2025 – Present
Chemistry Search Committee	2025
Chemistry Seminar Organizer	2023 – Present

Ask A scientist - Outreach	2024
Summer Lecture Series – Undergraduate Lecture	2024
Member of CDEI	2024 – Present
Recruitment at the AISES (American Indian Science and Engineering Society)	2024
ERG Latinx Co-founder	2024 – Present
WHOI Postdoctoral Symposium Presenter/Panel – DEI Statement	2023

Professional Service & Community Involvement outside WHOI

Reviewer for: Environmental Science and Technology, Environmental Science and Technology Letters, Nature Geoscience, Science Advances, Geophysical Letters, ACS Inorganic Chemistry, ACS Earth and Space Chemistry, Nature Communications, and Water Research.

Reviewer for US NSF (MRI – EAR and GRFP)

Volunteer at the GeoFORCE program at U. of Texas at Austin Career Spotlight. 2021

Session Co-Chair, Mercury Isotopes: The 14th International Conference of Mercury as a Global Pollutant, Krakow, Poland

Publications

Manuscripts in review/revision

1. Ju Hyeon, Lee, **Laura C. Motta** et al., Isotope analysis reveals new pathway of mercury bioaccumulation in an upwelling ocean. *Nature Communications* (In review; 03/29/2025)
2. **Laura C. Motta**, Joel D. Blum, and Brian Popp. Photoreduction of Inorganic Mercury in Surface Seawater. *ACS Earth and Space Chemistry* (In revision; 04/01/2025).
3. **Laura C. Motta**, Seung Hyeon Lim et al., Pathway of anthropogenic mercury to Marine Biota. *Communications Earth and Environment* (In review; 03/05/2025)

Referred Publications

1. Seung Hyeon Lim, Younggwang Kim, **Laura C. Motta**, Eun Jin Yang, Tae Siek Rhee, Jong Kuk Hong, Seunghye Han, Sae Yun Kwon. Near surface oxidation of gaseous elemental mercury explains high mercury levels in the Arctic Ocean food web. *Nature Communications*. **2024**
2. Blaire Umhau, **Laura C. Motta**, Hilary Close et al., Particulate Mercury Export in the Central Pacific Ocean Using 234Th-238U Disequilibria. *Marine Chemistry* **2024**
3. **Laura C. Motta**, Jochen Autschbach. Actinide inverse trans influence versus cooperative pushing from below and multi-center bonding. *Nat Commun* **14**, 4307 **2023**.
4. **Laura C. Motta**, Joel D. Blum, Brian Popp, Blaire Umhau, Claudia Benitez-Nelson, Spencer Washburn, Hilary Close, and Jeffrey Drazen. “Mercury Isotopic Evidence for Importance of Particles as a Source of Mercury to Marine Organisms”. *Proceeding of the National Academy of Sciences* **2022**
5. **Laura C. Motta** and Jochen Autschbach. “Theoretical evaluation of Metal-Ligand Bonding in Neptunium Compounds in Relation to 237Np Mössbauer spectroscopy”. *Inorganic Chemistry* **2022**

6. Yo Han Yang, Sae Yun Kwon, Martin Tsui, **Laura C. Motta**, Spencer Washburn, Jaeseon Park, Kim Minseob, and Shin Kyung-Hoon. "Ecological traits of fish for mercury biomonitoring: Insights from compound specific nitrogen and stable mercury isotopes". *Environmental Science and Technology* **2022**
7. Miling Li, Sae Yun Kwon, Martin T. K. Tsui, Brett Poulin, **Laura C. Motta**, Moonkyoung Cho. "Internal dynamics and metabolism of mercury in biota: a review of insights from mercury stable isotopes". *Environmental Science and Technology*. **2022**, doi:10.1021/acs.est.1c08631.
8. **Laura C. Motta** and Jochen Autschbach. "²³⁷Np Mössbauer Isomer Shift: A Lesson About the Balance of Static and Dynamic Electron Correlation in Heavy Element Complexes". *Journal of Chemical Theory and Computation*. **2022** 18, 3483-3496 .
9. **Laura C. Motta** and Jochen Autschbach. "Theoretical prediction and interpretation of ²³⁷Np Mössbauer isomer shifts". *Journal of Chemical Theory and Computation*. **2021**, doi:10.1021/acs.jctc.1c00687
10. Ju Hyeon Lee, Sae Yun Kwon, Runsheng Yin, Aaron Y. Kurz, **Laura C. Motta**, Seung-Il Nam. "Spatiotemporal characterization of mercury isotope baselines and anthropogenic influences in sediment cores". *Global Biogeochemical Cycles*, **2021**, 35(10), e2020GB006904.
11. Saebom, Jung, Sae Yun Kwon, Yongseok Hong, Runsheng Yin, **Laura C. Motta**. "Isotope investigation of mercury sources in a creek impacted by multiple anthropogenic activities". *Chemosphere*. **2021**, 130946
12. Spencer J. Washburn, Joel D. Blum, **Laura C. Motta**, Bridget Bergquist, Peter Weiss-Penzias. "Isotopic composition of Hg in Fog Waters of Coastal California, USA". *Environmental Science and Technology Letters*. **2020**, 8, 3-8
13. Joel D. Blum, Jeffrey C. Drazen, Marcus W. Johnson, Brian N. Popp, **Laura C. Motta**, Alan J. Jamieson. "Mercury Isotope Identify Near-Surface Marine Mercury in Deep Sea Trench Biota". *Proceeding of the National Academy of Sciences*. **2020**, 117
14. **Laura C. Motta**, Alan D. Chien, Alan Rask, and Paul Zimmerman. "Mercury Magnetic Isotope Effect: A Plausible Photochemical Mechanism". *J. Phys. Chem. A*. **2020**, 124, 3711-3719
15. **Laura C. Motta**, Kritee, K, Joel D. Blum, Martin Tsui, John R. Reinfelder. "Mercury Isotope Fractionation During the Photochemical Reduction of Hg(II) Coordinated With Organic Ligands". *J. Phys. Chem. A* **2020**, 124, 2842-2853
16. **Laura C. Motta**, Joel D. Blum, Brian N. Popp, Jeffrey C. Drazen, and Hilary G. Close. "Mercury Stable Isotopes in Flying Fish as a Monitor of Photochemical Degradation of Methylmercury in the Atlantic and Pacific Oceans". *Marine Chemistry* **2020**, 223.
17. Blaire P. Umhau, Claudia R. Benitez-Nelson, Hilary G. Close, Cecelia C. S. Hannides, **Laura C. Motta**, Brian N. Popp, Joel Blum, and Jeffrey C. Drazen. "Seasonal and spatial changes in estimates of Carbon flux using ²³⁴Th:²³⁸U disequilibria in the North Pacific Subtropical Gyre". *Marine Chemistry*, **2019**, 217, 103705
18. **Laura C. Motta**, Joel D. Blum, Marcus W. Johnson, Blaire P. Umhau, Brian N. Popp, Spencer J. Washburn, Jeffrey C. Drazen, Claudia R. Benitez-Nelson, Cecelia C.C.S. Hannides, Hilary G. Close, and Carl Lamborg.

“Mercury cycling in the North Pacific Subtropical Gyre as revealed by mercury stable isotope ratios”. *Global Biogeochemical Cycle*, **2019**, 33, 777-794

19. K. Kritee, **Laura C. Motta**, Joel D. Blum, Martin T. K. Tsui, and John R. Reinfelder. “Photomicrobial Visible Light-Induced Magnetic Mass Independent Fractionation of Mercury in a Marine Microalga”. *ACS Earth and Space Chemistry*, **2017**, DOI: 10.1021/acsearthspacechem.7b00056.

Other Publications (Media)

1. WCVB Interview - CityLine: Breaking the "green ceiling": women at the waterfront (01-19-2025)
<https://www.wcvb.com/article/cityline-breaking-the-green-ceiling-women-at-the-waterfront/63462861>
2. Voices of the Sea (2-14 Episode: Science Journalists at Sea; 2016) Highlight of our research on board of the R/V Kilo Moana

Invited Presentations

2025

1. *Isotope Effects: Nature's Guide to Chemistry*. National Academy of Sciences Kavli Frontiers of Science Symposium (Flask Poster Talk and Poster)
2. *Isotope Effects: Nature's Guide to Chemistry*. Washington State University Chemistry Department Seminar.

2024

3. *Unraveling Particulate Marine Mercury Cycling: A Study Across the North Pacific*. Korean Oceanography Conference
4. *Actinide inverse trans influence: Cooperative 'Pushing from Below' and multi-center bonding*. Angular Momentum Virtual Symposium.
5. *Electronic Structure and Covalency of Actinide Complexes*. Pacific Northwest National Laboratory – Heavy Element/Energy.
6. *Unraveling Marine Mysteries and Global Mercury Pollution using Mercury Stable Isotopes*. Department Seminar at Marine Sciences UConn.
7. *The Journey of Anthropogenic Mercury to Marine Biota*. ASLO
8. *A Theoretical Investigation of Actinide Covalency*. International Conference on Coordination Chemistry.

2023

9. *Reveling the Mysteries of Marine Mercury with Non-Traditional Stable Isotopes*. Gordon Research Conference – Chemical Oceanography.

2022

10. *Reveling the Mysteries of Marine Mercury with Non-Traditional Stable Isotopes*. Arizona State University.
11. *Unraveling the Secrets of the Marine Biogeochemical Mercury Cycle Using Stable Isotopes*. Texas A&M, seminar.
12. *Unraveling the Secrets of the Marine Biogeochemical Mercury Cycle Using Stable Isotopes*. POSTECH, South Korea, seminar.
13. *Unraveling the Secrets of the Marine Biogeochemical Mercury Cycle Using Stable Isotopes*. WHOI, Marine Chemistry and Geochemistry seminar.
14. *The Marine Mercury Cycle in a Changing Climate*. University at Buffalo, MEETS (Materials, Energy, Environment) Seminar.

2020

15. *Mercury cycling in the ocean*. POSTECH, South Korea.

Contributed Presentations and Abstracts

1. **Laura C. Motta**, Joel D. Blum, Paul. M. Zimmerman. “Mechanisms for Mercury Stable Isotope Fractionation during Aqueous Photodecomposition”. Goldschmidt. Barcelona, Spain 2019
2. **Laura C. Motta**, Joel D. Blum, Alan D. Chain, Paul M. Zimmerman. “Magnetic Isotope Effect: Anomalous Case Study of Mercury Stable Isotopes”. The 16th International Spin Chemistry Meeting, Schluchsee, Germany 2017. *Limited number of graduate student oral presentations*
3. **Laura C. Motta**, Joel D. Blum, Hilary Close, Brian Popp, Jeff Drazen. “Mercury Isotopes in Flying Fish as a Monitor of Photodemethylation in the Atlantic and Pacific Oceans”. The 13th International Conference of Mercury as a Global Pollutant, Providence, RI, USA 2017
4. **Laura C. Motta**, Joel D. Blum, Marcus W. Johnson, Brian N. Popp, Blaire Umhau, Hilary Close, Cecilia Hannides, Claudia Benitez-Nelson. “Mercury Stable Isotopes Reveal Deep Methylation of Mercury and its Uptake into the Open Ocean Food Web”. Ocean Science Meeting, New Orleans, LA, USA 2016
5. **Laura C. Motta**, Joel D. Blum, John Reinfelder, Brian Popp, Hilary Close. “Photochemical Transformations of Inorganic Mercury and Methylmercury in the Oceans revealed through Stable Isotope Fractionation of Mercury”. The 12th International Conference of Mercury as a Global Pollutant, Jeju, Korea 2015
6. Reinfelder, J.R., Kritee, **Laura C. Motta**. "Photomicrobial reduction and dark oxidation of mercury in marine surface waters". Goldschmidt, Sacramento, CA, 2014.
7. **Laura C. Motta**, K. Kritee, Joel D. Blum, Martin Tsui, John Reinfelder. “Mercury Stable Isotope Biogeochemistry – Effects of pH, dissolved oxygen, and wavelength of light on Hg stable isotope fractionation during photochemical reduction of organically complexed Hg(II)”. The 11th International Conference of Mercury as a Global Pollutant, Edinburg, Scotland 2013