

CURRICULUM VITAE: DANIELLE HAAS FREEMAN

PhD Candidate in Chemical Oceanography
MIT-WHOI Joint Program

PROFILE

I'm an experimental chemist focused on the environmental fate of organic compounds, including pollutants, with expertise in photochemistry and oil chemistry. I'm passionate about teaching and making science more accessible to students through "real world" connections.

EDUCATION

Ph.D. *MIT-WHOI Joint Program*, Chemical Oceanography In Progress

Advisor: Dr. Collin P. Ward

Relevant Coursework:

- Aquatic Chemistry
- Marine Chemistry
- Environmental Organic Chemistry
- Marine Organic Geochemistry
- Environmental Toxicology
- MIT Graduate Student Teaching Development Program
- Communicating Ocean Science (Teaching Development)

A.B. *Bowdoin College*, Chemistry 2017

Graduated Summa Cum Laude with Honors in Chemistry

Additional major in Hispanic Studies

Advisor: Dr. Dharni Vasudevan

Thesis: "Building a mechanistic understanding of the sorption of substituted pyridines to aluminosilicate clays"

Relevant Coursework:

- Organic Chemistry
- Inorganic Chemistry
- Physical Chemistry
- Analytical Chemistry
- Environmental Chemistry
- Biogeochemistry
- Chemical Tracers of Ocean Processes
- Sea Education Association: Practical Oceanographic Research
- Study Abroad (Autonomous University of Yucatán) with full Spanish language immersion

PEER-REVIEWED PUBLICATIONS

**Equal contributions*

Journal publications

- **Freeman, D.H.**; Niles, S.F.; Rodgers, R.P.; French-McCay, D.P.; Longnecker, K.; Reddy, C.M.; Ward, C.P. Hot and cold: Photochemical weathering mediates oil properties and fate differently depending on seawater temperature. 2023.
 - Highlighted by [C&EN News](#)

- **Freeman, D.H.** and Ward, C.P. [Sunlight-driven dissolution is a major fate of oil at sea.](#) *Science Advances*. 2022.
 - Press release by [WHOI](#)
 - Highlighted by [The Hill](#), [SYFY Wire](#), and [Deutschlandfunk Radio](#)
- Ward, C.P.; Bowen, J.C.; **Freeman, D.H.** and Sharpless, C.M. [Rapid and Reproducible Characterization of the Wavelength Dependence of Aquatic Photochemical Reactions Using Light Emitting Diodes \(LEDs\).](#) *ES&T Letters*. 2021.

Papers in prep

- **Freeman, D.H.;*** Shaheen, S.W.;;* Frey, S.; Jolin, W.; Vasudevan, D. Charge delocalization in heterocyclic amines distinguishes the nature and extent of cationic amine sorption to aluminosilicates. Anticipated publication date in 2023.

CONFERENCE PRESENTATIONS

**Presenter*

Oral presentations

- ACS 2023 Aquatic Photochemistry Session: Sunlight and temperature mediate the fate of oil in diverse spill environments by **Freeman, D.H.***, and Ward, C.P. (Indianapolis, Mar 2023)
- ACS 2022 Fate of Pesticides and Oil Session: Sunlight-driven chemistry impacts oil fate in diverse spill scenarios by **Freeman, D.H.***, and Ward, C.P. (San Diego, Mar 2022)
- ACS 2021 Aquatic Photochemistry Session: Photochemical dissolution of oil at sea: Assessment of rates and controls by **Freeman, D.H.***, and Ward, C.P. (Virtual, Mar 2021)
- Multi-Partner Research Initiative (MPRI) Student Research Forum (Fisheries and Oceans Canada) 2020: Dissolving oil in a sunlit sea by **Freeman, D.H.***, and Ward, C.P. (Virtual, Dec 2020)
- SERDP ESTCP 2020: Gschwend, P.* with Brenneis, R., Bugher, N., Chow, C.M., Dai, M., Franco, L., **Freeman, D.**, Goss, M., Helstrom, E., Perez-Lodeiro, N., Riedinger, K., Tantawi, O., Traylor, S. What chemical properties of PFAS appear to limit our ability to anticipate their environmental fates and effects? (Virtual, Nov 2020)

Poster presentations

- ACS 2022 ENVR Poster Session: A bright, LED-lit future for aquatic photochemistry. Ward, C.P.,* **Freeman, D.H.*** Nelson, T., Cory, R., Kling, G., Bowen, J., Sharpless, C. (San Diego, Mar 2022)
- ACS 2017 ENVR Poster Session: Building a mechanistic understanding of the sorption of substituted pyridines to aluminosilicate clays by **Freeman, D.H.***, Sullivan, J., Shaheen, S., and Vasudevan, D. (San Francisco, Apr 2017)

HONORS AND AWARDS

- **MIT Teaching Development Fellowship** 2022
The fellow serves as a point of contact for teaching development opportunities and organizes events for fellow graduate students in their department
- **NSF Graduate Research Fellowship** 2019

- **Ida M. Green Fellowship** 2019
Awarded to a limited number of incoming women graduate students at MIT
- **Sumner Increase Kimball Prize for the Natural Sciences** 2017
Awarded to a single natural sciences major at Bowdoin College
- **ACS Award in Analytical Chemistry** 2017
Awarded to a single chemistry major at Bowdoin College
- **William Campbell Root Award** 2017
Awarded to a single chemistry major at Bowdoin College for service to the chemistry department
- **Philip C. Bradley Hispanic Studies Prize** 2017
Awarded to a single Hispanic Studies major at Bowdoin College
- **Almon Goodwin Phi Beta Kappa Prize** 2017
Shared between two Bowdoin College seniors
- **Philip Weston Meserve Prize** 2016
Awarded to a single chemistry or biochemistry junior at Bowdoin College
- **Sarah and James Bowdoin Scholar Book Award** 2014-5
Awarded for a GPA of 4.0 for the previous year at Bowdoin College
- **Organic Chemistry Prize** 2015
Awarded to a single chemistry student at Bowdoin College
- **Sophomore Spanish Prize** 2015
Awarded to a single Hispanic Studies student at Bowdoin College
- **Creative Nonfiction Prize** 2014
Awarded to a single student at Bowdoin College based on a writing submission

AWARDED GRANTS

- **Woods Hole Oceanographic Institution Ocean Venture Fund. Freeman, D.H.** Light and heavy, sweet and sour: Quantifying petroleum oil photo-reactivity as a function of chemical composition. 2023.
- **Application for magnet time at the National High Magnetic Field Laboratory** Ward, C.P. and **Freeman, D.H.** Analysis of photochemical incorporation of ¹⁸O-labeled dioxygen and water into crude oil using ultra high-resolution mass spectrometry: a novel assessment of reactants and pathways. 2020.

RESEARCH

Research Fellow and Research Assistant, WHOI, Woods Hole, MA 2019-Present
Advisor: Collin Ward

- Built and characterized LED photo-reactors via nitrite actinometry and radiometry
- Used bench scale experiments and photochemical rate modelling to quantify the importance of photo-dissolution (transfer from the oil phase to the marine dissolved organic carbon pool) as a fate process during oil spills
- Assessed changes in oil viscosity, density, dissolved organic carbon production, and oil-seawater interfacial tension as a function of light exposure and temperature
- Assessed the sensitivity of oil spill model equations governing entrainment of surface oil to changes driven by the joint action of sunlight and temperature
- Wrote multiple protocols for common lab techniques

- Trained new users in instruments, methods, and the background of photochemistry
- Techniques used: photochemical incubations, radiometry, nitrite actinometry, fluorescence spectroscopy, UV/Vis absorbance spectroscopy, membrane inlet mass spectrometry, oil physical properties measurements, total organic carbon (TOC) analysis, seawater collection and preparation for experimental work

Honors Research Student, Bowdoin College, Brunswick, ME 2016 to 2017
Advisor: Dharni Vasudevan

- Used pulse input chromatography to measure solid-water partitioning constants for organic cations
- Showed that isotherms for sorption of heterocyclic aromatic amines to aluminosilicate clays were nonlinear at low concentration, in contrast to non-heterocyclic analogs

TEACHING

MIT-WHOI Joint Program, Woods Hole, MA 2019-Present

- Co-developed and led a workshop on how to plan an outreach lesson around your research (Oct 2022)
- Co-developed and led a class session on organic pollutants in the ocean for WHOI's Blue Economy internship program, serving undergrads from Cape Cod Community College and UMass Dartmouth (Jan 2022)
- Co-developed and led a guest class session for Cape Cod Community College's Environmental Science course (taught by Catherine Etter) on oceanography (Oct 2021)
- Co-developed and led a graduate student discussion on creating inclusive classroom spaces as part of the MIT-WHOI Joint Program JEDI (Justice through Equity and Diversity through Inclusion) student initiative (July 2020)
- Developed and led a guest class session for the Sea Education Association Oceans and Climate course (taught by Ben Harden) on permafrost dissolved organic matter and climate change feedbacks (Mar 2020)

Bowdoin College, Brunswick, ME 2017-2019
Lab Instructor (full-time), Bowdoin Chemistry Department

- Taught lab sections for analytical, organic, and general chemistry with 6-30 students each, with 3 courses per semester.
- Developed and led pre-lab lectures and demos on lab safety, experimental techniques, and instrument use
- Guided students through experiments and independent projects
- Designed and graded lab assignments
- Developed and led workshops on scientific writing and data analysis using Excel for my students
- Co-led a science writing workshop open to all undergraduates at the Bowdoin Center for Learning and Teaching (Mar 2018)

NON PEER-REVIEWED PUBLICATIONS

**Equal contributions*

- **Freeman, D.H.** [Sunlight and the fate of oil at sea](#). *Oceanus*. 29 Sep 2022.

- Bhatt, E.*, Blevins, M.G.*, **Freeman, D.H.***, and Taenzer, L.* [Graduate student perspectives on equitable remote learning](#). *EOS*, 102. 2021.

MENTORING

- MIT-WHOI Joint Program**, Woods Hole, MA 2019-Present
- Mentored a Blue Economy Intern from Cape Cod Community College on a semester-long and summer research project on the biodegradation of oil (Jan 2022-Sep 2022)
 - Mentored three SEA Students from Amherst College, Smith College, and the University of Delaware on the development of an independent research project (unfortunately cut short by COVID) (Feb-Mar 2020)

OUTREACH AND SERVICE

- MIT-WHOI Joint Program**, Woods Hole, MA 2019-Present
- Served as a volunteer docent at [Zephyr Marine](#)'s oceanography museum and assisted with mini oceanographic "research cruises" for visiting students (middle to high school aged) (2019-2023)
 - Maintained a science [blog](#) describing my grad school research (2019-2023)
 - Developed a teaching resources document describing the various opportunities for MIT-WHOI students to gain teaching experience while in grad school, which has been incorporated into orientation materials for incoming students (Apr 2023)
 - Coordinated the first ever on-location offerings of the MIT Teaching and Learning Lab for WHOI-based students (2-hr commute from MIT), starting with a short course on lesson planning (Oct 2022)
 - Volunteered as a writer and web manager for [Through the Porthole](#), The MIT-WHOI Joint Program student-led Academic Recruitment Newsletter (founding member) (2020-2022)
 - Co-developed and led two consecutive outreach lessons for 4th Grade students at Mullen Hall Elementary School (Falmouth, MA) on animal adaptations and oil spills (Fall 2021)
 - Led a Skype a Scientist classroom visit to Chemistry and Earth Science students at Portland High School (Portland, ME) (May 2021)

PROFESSIONAL TRAINING

- **MIT Teaching Certificate**, MIT Teaching and Learning Lab, 2022.
 - Certificate earned after completing short courses in lesson planning, microteaching, inclusive teaching, and subject design
- **Conflict Resolution Training**, Community Dispute Settlement Center, 2021.
 - Three-part Zoom course offered for interested MIT and WHOI students and employees, with active participation in conflict resolution role-play
- **Undergraduate Mentoring Workshop**, Sea Education Association (SEA), 2020.
 - Workshop leading to a mentoring relationship with SEA students, facilitated by SEA faculty member Ben Harden