Emmy Umaña

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EDUCATION

University of Wisconsin-Madison June 2026
Ph.D. in Chemical Engineering 3.90 GPA
Advisors: Victor M. Zavala & Matthew A. Gebbie

University of Kansas May 2021
B.S. in Chemical Engineering 3.95 GPA
University Honors Program

RESEARCH EXPERIENCE

Gebbie Lab and Zavalab, University of Wisconsin-Madison **Fall 2021 – Present**
Active Machine Learning for Electrolyte Optimization - NSF GRFP Fellow
• Screening carbonate and ionic liquid electrolyte materials using active learning models for various performance metrics, such as conductivity and cycling efficiency in Dr. Victor M. Zavala's and Dr. Mathew A. Gebbie's Lab.
New Representations for Ionic Liquid Transport Property Predictions - NSF GRFP Fellow
• Developing new ionic liquid molecular representations using SMARTS and identifying key structural motifs to improve machine learning aided electrolyte design.
• Mentoring undergraduate researchers in experimental design, data analysis, and scientific communications.
Ionic Liquid Property Scaling Analyses - NSF GRFP Fellow
• Analyzing ionic liquid databases utilizing statistical and machine learning techniques to identify ionic liquid property scaling relationships and discover the limits of computational modeling.
Microrheological Ion Flux Mapping - NSF GRFP Fellow
• Mapping ion diffusion using fluorescent microscopy to visualize ion diffusion in concentrated electrolytes.

Leonard Lab, Center for Environmentally Beneficial Catalysis **Spring 2020 – Spring 2021**
Machine Learning for Catalyst Selection - Undergraduate Research Fellow
• Tagged publications for natural language processing machine learning models in Dr. Kevin Leonard's lab.
Electrocatalytic Water Splitting - Undergraduate Research Fellow
• Created an experimental setup and optimized reaction conditions for electrocatalytic hdyrogen production.

Computational Materials Group, University of Wisconsin-Madison **Summer 2020**
Materials Property Prediction, NSF REU Research Assistant
• Trained machine learning models for material properties predictions using MAST-ML for various metallic materials in Dr. Dane Morgan's research group.

Shiflett Research Group, University of Kansas **Spring 2018 – Spring 2020**
Vaccine Encapsulation Project - Undergraduate Research Assistant
• Stabilized vaccine proteins against thermal denaturation via adsorption onto metal oxides surfaces in Dr. Mark Shiflett's lab.

AWARDS AND HONORS

- **University of Wisconsin-Madison Student Research Grants Competition Conference Travel Award** (2024)
- **Foundations of Process/product Analytics and Machine learning Conference Travel Award** (2023)
- **National Science Foundation Graduate Research Fellowship** (2023)
- **University of Wisconsin-Madison - Roland A. Ragatz Teaching Assistant Award** (2023)
- **Tau Beta Pi Engineering Honor Society Fellowship** (2022)
- **University of Wisconsin-Madison Hougen Award** (2021)
- **University of Kansas Graduation with Honors** (2021)
- **University of Kansas Dept. of Chemical Engineering Outstanding Performance Award** (2021)
- **University of Kansas College of Engineering Undergraduate Research Fellowship** (2020)

OUTREACH & WORK EXPERIENCE

Gebbie Lab, Madison, WI **Spring 2022 – Present**
Climate and Inclusion Chair
• Highlighting minority scientists during department and group meetings to improve community inclusion.
• Posting minority scientist highlights to the lab blog and website.

Chemical Engineering Graduate Student Association, Madison, WI **Fall 2021 – Present**
Recruitment Chair October, 2024 - Present
• Planning graduate student recruitment events in coordination with department faculty and hosting perspective students for on-campus visits. *Co-President* October, 2023 - October, 2024
• Guiding graduate student events, planning outreach efforts, and facilitating student-faculty communications.
Social Chair October, 2021 - October, 2023
• Hosted department events to promote faculty, staff, and student engagement.

Graduate Engineering Research Scholars, Madison, WI **Fall 2021 – Present**
Recruitment and Outreach Committee Member
• Coordinating Opportunities in Engineering Conference events and serving on graduate student panels for current and prospective students.

Colorado School of Mines, Golden, CO **Summer 2024**
Data Fluency in Education Workshop
• Developed public, data-centric lesson plans for 6-12 grade classrooms during a 3-day workshop focused on improving data literacy in elementary education.

Univeristy of Wisconsin-Madison Engineering Expo, Madison, WI **2022, 2023, 2024, 2025**
Volunteer
• Demonstrated and taught electrocatalysis, recycling, and modular engineering concepts to K-12 students.

Wisconsin Science Festival, Madison, WI **2022, 2023, 2024**
Volunteer
• Guided K-12 students and the broader Madison community through science-inspired art and science demonstrations.

Graduate Teaching Assistant, Madison, WI **Fall 2022 – Spring 2023**
CBE 324 – Transport Lab
• Lectured on heat, mass, and momentum transport lab and industrial applications and guided students through group lab experiments.

School of Engineering Student Ambassador, Lawrence, KS **Spring 2019 – Spring 2021**
Chemical Engineering Ambassador
• Outreached to prospective engineering students to provide departmental and school information.
• Presented at Engineering Scholars Day and filmed research videos as an online resource for prospective students.

Undergraduate Teaching Assistant, Lawrence, KS **Spring 2021**
C&PE 525 - Heat and Mass Transfer
• Assisted students with in-class and recitation problems for heat and mass transfer.

SELF Engineering Leadership Fellows Program, Lawrence, KS **Fall 2018 – Spring 2020**
Tutor & Academic Assistant
• Led small group and individual tutoring for engineering, chemistry, physics, calculus 1-3, and C++ courses.
• Organized semesterly projects to provide learning experiences for SELF fellows.

TECHNICAL SKILLS

Languages: Python, C++, Julia, MATLAB

Computation Techniques: Artificial Neural Networks, Graph Neural Networks, Bayesian Optimization, Data Convolution.

Lab Techniques: Cyclic Voltamettry, Electrochemical Impedance Spectroscopy, Dark-field Microscopy, Microfluidic Sample Preparation.

PUBLICATIONS

Published

[1] **J. E. Umaña**, Ryan K. Cashen, Matthew A. Gebbie & Victor M. Zavala (2025). **Uncovering Ion Transport Mechanisms in Ionic Liquids Using Data Science.** *Digital Discovery.*

[2] Nicole A. Montoya, Kaylee E. Barr, Simon Velasquez Morales, **J. E. Umaña**, Channary Ny, Rhianna E. Roth, Edward J. Reyes, Brian C. Kirchhoff, Eric R. Hartman, Lillian L. Higgins, Kalena M. Nichol, Ana Rita C. Morais, Alan M. Allgeier, Phillip Gao, William D. Picking, David R. Corbin, and Mark B. Shiflett (2020). **Protein Stabilization and Delivery: A Case Study of Invasion Plasmid Antigen D Adsorbed on Porous Silica** *Langmuir, 36, 47, 14276–14287.*

[3] Nicole A. Montoya, Kaylee E. Barr, Brian C. Kirchhoff, Edward Reyes, **J. E. Umaña**, Kalena M. Nichol, Eric R. Hartman, William D. Picking, Phillip Gao, David R. Corbin, and Mark B. Shiflett (2020). **Development of Silica-Immobilized Vaccines for Improving Thermo-Tolerance and Shelf-Life** *Kansas Journal of Medicine, 13, 6-9.*

In Preparation

[4] Qianli Xing, **J. E. Umaña**, Victor M. Zavala, & Fang Liu (2025). **Streamlined Electrolyte Design for Anode-Free Sodium Metal Batteries Guided by Data-Efficient Bayesian Optimization.** *In Preparation.*

[5] **J. E. Umaña**, N. A. Zawicki, Rose K. Cersonsky, Matthew A. Gebbie & Victor M. Zavala (2025). **Identifying the Impact of Chemical Functional Groups on Ionic Liquid Conductivity.** *In Preparation.*

[6] Ryan K. Cashen, Manish Kumar, Saam Farzam, **J. E. Umaña**, Binyang Wang, Eli B. Rodeheaver, Richard J. Hommel,Charles G. Fry, Catherine F. M. Clewett, Michael D. Graham, & Matthew A. Gebbie. (2025). **Direct Visualization of Ion Transport in Ionic Liquids using Ion Flux Mapping.** *In Preparation.*

Presentations

[7] **J. E. Umaña**, Qianli Xing, Andrew C. Cavell, Victor M. Zavala, & Fang Liu (2025, March). **Navigating a High-Dimensional Sodium Battery Electrolyte Mixtures Design Space using Bayesian Optimization.** *University of Wisconsin-Madison Data Science Research Bazaar.*

[8] **J. E. Umaña**, Ryan K. Cashen, Mathew A. Gebbie & Victor M. Zavala (2024, October). **A Data Science Framework for the Analysis of Ion Transport Mechanisms in Ionic Liquids.** *American Institute of Chemical Engineers Annual Meeting.*

[9] **J. E. Umaña**, Ryan K. Cashen, Mathew A. Gebbie & Victor M. Zavala (2024, August). **Linking Ion Transport Mechanisms to Ionic Correlations in Ionic Liquids Using a Data Science Framework.** *Ionic Liquids Gordon Research Conference.*

[10] **J. E. Umaña**, Ryan K. Cashen, Mathew A. Gebbie & Victor M. Zavala (2023, July). **Utilizing Machine Learning to Bridge Ion Transport Models in Ionic Liquids.** *Foundations of Process/Product Analytics and Machine learning Conference.*

[11] Kaylee E Barr, **J. E. Umaña**, Kalena M Nichol, Edward J Reyes, Eric R Hartman, Brian C Kirchhoff, David R Corbin, Ana RC Morais, & Mark Shiflett (2019, November). **Thermal Stabilization of Invasion Plasmid Antigen D (IpaD) Using Silica Gels.** *American Institute of Chemical Engineers Annual Meeting.*