

## EDUCATION

### Yale University | New Haven, CT

- Ph.D. in Chemical and Environmental Engineering 2022
- M.Phil. in Chemical and Environmental Engineering 2019
- M.S. in Chemical and Environmental Engineering 2019

### North Dakota State University (NDSU) | Fargo, ND

- M.S. in Civil and Environmental Engineering 2017
- B.S. in Civil and Environmental Engineering, (GPA 3.97/4.00), *summa cum laude* 2016

### Normandale Community College | Bloomington, MN 2012 – 2013

## APPOINTMENTS AND RESEARCH EXPERIENCE

### Assistant Professor | University of Colorado–Boulder Starting 2026

- Department of Chemical and Biological Engineering

### Visiting Assistant Professor | University of Colorado–Boulder 2025 – 2026

- Department of Chemical and Biological Engineering

### Research Scientist II | Massachusetts Institute of Technology 2024 – 2026

- Department of Chemical Engineering (PI: Prof. Michael Strano)

### Postdoctoral Research Associate | Massachusetts Institute of Technology 2022 – 2024

- Department of Chemical Engineering (PI: Prof. Michael Strano)

### NSF Graduate Research Fellow | Yale University 2017 – 2022

- Department of Chemical and Environmental Engineering (PI: Prof. Menachem Elimelech)

### NDWRRI Graduate Research Fellow | NDSU 2016 – 2017

- Department of Civil and Environmental Engineering (PI: Prof. Achintya Bezbaruah)

### NSF Research Experience for Undergraduates | NDSU 2013 – 2016

- Department of Civil and Environmental Engineering (PI: Prof. Achintya Bezbaruah)

## SELECTED AWARDS AND HONORS

- AEESP Outstanding Doctoral Dissertation Award 2023
- Schmidt Science Fellowship Finalist 2022
- ACS C. Ellen Gontier Environmental Chemistry Award 2021
- National Science Foundation Graduate Research Fellowship 2016
- North Dakota Water Resources Research Institute Fellowship 2016
- Barry M. Goldwater Scholarship 2015
- Astronaut Scholarship Foundation nomination from NDSU 2015
- North Dakota Water Education Foundation Scholarship 2015
- Minnesota Society of Professional Engineers – Traverse Des Sioux Chapter Scholarship 2015
- North Dakota Society of Professional Engineers – Chapter 4 Scholarship 2015
- Minnesota Surveyors and Engineers Society Scholarship 2014, 2015
- Minnesota Society of Professional Engineers – Southwest Chapter Scholarship 2014
- Presidential Honor Scholarship 2013 – 2016

## PEER-REVIEWED PUBLICATIONS

9 first-author (†equal contribution) and 1 corresponding-author (\*) papers, 25 total, *h*-index = 18, # citations = 2823  
— as of 07/10/2025 —

- (1) X. Xu, X. Jin, M. Kuehne, D.-L. Bao, J. Martis, Y.-M. Tu, **C.L. Ritt**, et al., “Hydrogen bonding in water under extreme confinement unveiled by nanoscale vibrational spectroscopy and simulations,” *Nature* (accepted)
- (2) D.J. Lundberg, J. Kim, Y.-M. Tu, **C.L. Ritt**, M.S. Strano, “Concerted methane fixation at ambient temperature and pressure mediated by an enzymatic and Fe-ZSM-5 catalytic couple,” *Nat. Catalysis*, 7, 1359-1371 (2024)
- (3) Y.-M. Tu<sup>†</sup>, M. Kuehne<sup>†</sup>, R.P. Misra, **C.L. Ritt**, et. al., “Environmental damping and vibrational coupling of confined fluids within isolated carbon nanotubes,” *Nat. Commun.* 5605 (2024)
- (4) L.F. Villalobos, K.E. Pataroque, W. Pan, T. Cao, M. Kaneda, C. Violet, **C.L. Ritt**, M. Elimelech, “Orientation Matters: Measuring the Correct Surface of Polyamide Membranes with Quartz Crystal Microbalance,” *J. Membr. Sci. Lett.* 100048 (2023)
- (5) **C.L. Ritt**<sup>\*</sup>, M.G. Barsukov<sup>†</sup>, I.V. Barsukov, E.M. Syth, M. Elimelech, “Influence of graphite geography on the yield of mechanically exfoliated few-layer graphene,” *Carbon*, 208, 355-364 (2023)
- (6) Aluru, N.R., Aydin, F., Bazant, M.Z., Blankschtein, D., Brozena, A.H., de Souza, J.P., et al., “Fluids and electrolytes under confinement in single-digit nanopores,” *Chem. Rev.* 123, 2737-2831 (2023)
- (7) **C.L. Ritt**, J.P. de Souza, M.G. Barsukov, S. Yosinski, M.Z. Bazant, M.A. Reed, M. Elimelech, “Thermodynamics of charge regulation during ion transport through silica nanochannels,” *ACS Nano* 16, 15249-15260 (2022)
- (8) M. Heiranian, R.M. DuChanois, **C.L. Ritt**, C.A. Violet, M. Elimelech, “Molecular simulations of transport phenomena in polymeric membranes: Implications for membrane design,” *Environ. Sci. Technol.* 56, 3313-3323 (2022)
- (9) **C.L. Ritt**<sup>†</sup>, M. Nami<sup>†</sup>, M. Elimelech, “Laser interferometry for precise measurement of ultralow flow rates from permeable materials,” *Environ. Sci. Technol. Lett.* 9, 233-238 (2022)
- (10) **C.L. Ritt**, M. Liu, T.A. Pham, R. Epsztein, H.J. Kulik, M. Elimelech, “Machine learning reveals key ion selectivity mechanisms in polymeric membranes with subnanometer pores,” *Sci. Adv.* 8, 2, eabl5771 (2022)
- (11) **C.L. Ritt**<sup>†</sup>, T. Stassin<sup>†</sup>, D.M. Davenport, R.M. DuChanois, I. Nulens, Z. Yang, N. Segev-Mark, A. Ben-Zvi, M. Elimelech, C.Y. Tang, G.Z. Ramon, I.F.J. Vankelecom, R. Verbeke, “The Open Membrane Database: Synthesis–structure–performance relationships of reverse osmosis membranes,” *J. Membr. Sci.* 641, 119927 (2022)
- (12) C. Lu, C. Hu, **C.L. Ritt**, X. Hua, J. Sun, H. Xia, Y. Liu, D. Li, B. Ma, M. Elimelech, J. Qu, “In situ characterization of dehydration during ion transport in polymeric nanochannels,” *J. Am. Chem. Soc.* 143, 14242-14252 (2021)
- (13) R. Verbeke, D.M. Davenport, T. Stassin, S. Eyley, M. Dickmann, J. Alexander, P. Dara, **C.L. Ritt**, C. Bogaerts, W. Egger, R. Ameloot, J. Meersschaut, W. Thielemans, G. Koeckelberghs, M. Elimelech, I.F.J. Vankelecom, “Chlorine-resistant epoxide-based membranes for sustainable water desalination,” *Environ. Sci. Technol. Lett.* 8, 818-824 (2021)
- (14) W.-H. Zhang, M.-J. Yin, Q. Zhao, C.-G. Jin, N. Wang, S. Ji, **C.L. Ritt**, M. Elimelech, Q.-F. An, “Graphene oxide membranes with stable porous structure for ultrafast water transport,” *Nat. Nanotechnol.* 16, 337-343 (2021)

- (15) **C.L. Ritt**, J.R. Werber, M. Wang, Z. Yang, Y. Zhao, H.J. Kulik, M. Elimelech, "Ionization behavior of nanoporous polyamide membranes," *Proc. Natl. Acad. Sci. U.S.A.* 117, 30191-30200 (2020)
- (16) D.M. Davenport, **C.L. Ritt**, R. Verbeke, I.F.J. Vankelecom, M. Elimelech, "Thin film composite membrane compaction in high-pressure reverse osmosis," *J. Membr. Sci.* 610, 118268 (2020)
- (17) X. Lu, U.R. Gabinet, **C.L. Ritt**, X. Feng, A. Deshmukh, K. Kawabata, M. Kaneda, S.M. Hashmi, C.O. Osuji, M. Elimelech, "Relating selectivity and separation performance of lamellar two-dimensional molybdenum disulfide (MoS<sub>2</sub>) membranes to nanosheet stacking behavior," *Environ. Sci. Technol.* 54, 9640-9651 (2020)
- (18) R. Epsztein, R.M. DuChanois, **C.L. Ritt**, A. Noy, M. Elimelech, "Towards single-species selectivity of membranes with subnanometre pores," *Nat. Nanotechnol.* 15, 426-436 (2020)
- (19) C.J. Porter, J.R. Werber, **C.L. Ritt**, Y.F. Guan, M. Zhong, M. Elimelech, "Controlled grafting of polymer brush layers from porous cellulosic membranes," *J. Membr. Sci.* 596, 117719 (2020)
- (20) **C.L. Ritt**<sup>‡</sup>, S.K. Patel<sup>‡</sup>, A. Deshmukh, Z. Wang, M. Qin, R. Epsztein, M. Elimelech, "The relative insignificance of advanced materials in enhancing the energy efficiency of desalination technologies," *Energy Environ. Sci.* 13, 1694-1710 (2020)
- (21) F. Aydin, C. Zhan, **C.L. Ritt**, R. Epsztein, M. Elimelech, E. Schwegler, T.A. Pham, "Similarities and differences between potassium and ammonium ions in liquid water: A first-principles study," *Phys. Chem. Chem. Phys.* 22, 240-2548 (2020)
- (22) **C.L. Ritt**<sup>‡</sup>, J.R. Werber<sup>‡</sup>, A. Deshmukh, M. Elimelech, "Monte Carlo simulations of framework defects in layered two-dimensional desalination membranes: Implications for permeability and selectivity," *Environ. Sci. Technol.* 53, 6214-6224 (2019)
- (23) J. Luo, M. Sun, **C.L. Ritt**, X. Liu, Y. Pei, J. Crittenden, M. Elimelech, "Tuning Pb(II) adsorption from aqueous solutions on ultrathin iron oxychloride (FeOCl) nanosheets," *Environ. Sci. Technol.* 53, 2075-2085 (2019)
- (24) **C.L. Ritt**, B.J. Chisholm, A.N. Bezbaruah, "Assessment of molecularly imprinted polymers as sustainable phosphate sorbents," *Chemosphere*, 226, 395-404 (2019)
- (25) M.E. Hossain, **C.L. Ritt**, T. Almeelbi, A.N. Bezbaruah, "Biopolymer beads for aqueous phosphate removal: Possible Application in eutrophic lakes," *J. Environ. Eng.* 144, 04018030 (2018)

## Under Review

- (1) **C.L. Ritt**<sup>‡</sup>, M. Quien<sup>‡</sup>, Z. Wei<sup>‡</sup>, H. Gress, M.T. Dronadula, K. Altmisdort, Y.-M. Tu, M. Gadloff, N.R. Aluru, K.L. Ekinici, J.S. Bunch, M.S. Strano, "A molecularly impermeable polymer from two-dimensional polyaramids," (*in revision at Nature* <https://doi.org/10.26434/chemrxiv-2024-c8b17-v2>)
- (2) Y.-M. Tu, X. Gong, M. Quien, Zitang Wei, **C.L. Ritt**, M.S. Strano, "Morphological characterization of 2D polyaramids using transmission electron microscopy," (*Under Review*)

## PATENTS

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- (1) **C.L. Ritt** and M.S. Strano, "Plant nanobionics for enhanced phytoremediation," *PCT Patent Application No. PCT/US2024/025618* (2024)

## INVITED TALKS

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- (1) **C.L. Ritt**, "Engineering the next generation of separation materials for water and energy needs," *Center for Integrated Nanotechnologies (CINT)*, Sandia National Laboratories, Albuquerque, NM (06/25/2025)
- (2) **C.L. Ritt**, "Engineering the next Generation of separations for water, energy, and the environment," *University of North Carolina–Chapel Hill Dept. Environmental Sciences and Engineering*, Chapel Hill, NC (03/25/2025)

- (3) **C.L. Ritt**, “Engineering the next generation of separation materials for water and energy needs,” *University of Colorado–Boulder Dept. Chemical and Biological Engineering*, Boulder, CO (02/13/2025)
- (4) **C.L. Ritt**, “Engineering the next generation of separation materials for water and energy needs,” *Colorado State University Dept. Civil and Environmental Engineering*, Fort Collins, CO (01/28/2025)
- (5) **C.L. Ritt**, “Engineering the next generation of separation materials for water and energy needs,” *Georgia Institute of Technology School of Chemical and Biomolecular Engineering*, Atlanta, GA (01/21/2025)
- (6) **C.L. Ritt**, “Elucidating the rate-limiting ion transport mechanisms in nanoporous polymer membranes,” *Princeton University Andlinger Center for Energy and the Environment*, Princeton, NJ (03/18/2024)
- (7) **C.L. Ritt**, “Rate-limiting ion transport mechanisms in nanoporous polymer membranes: Dehydration or electrostatics?” *Stanford University Dept. Civil and Environmental Engineering*, Stanford, CA (02/22/2024)
- (8) **C.L. Ritt**, “Rate-limiting ion transport mechanisms in nanoporous polymer membranes: Dehydration or electrostatics?” *University of Wisconsin–Madison Dept. Chemical and Biological Engineering*, Madison, WI (02/12/2024)
- (9) **C.L. Ritt**, “Rate-limiting ion transport mechanisms in nanoporous polymer membranes: Dehydration or electrostatics?” *University of Illinois at Urbana–Champaign Dept. Civil and Environmental Engineering*, Urbana, IL (01/16/2024)
- (10) **C.L. Ritt**, “Rate-limiting ion transport mechanisms in nanoporous polymer membranes: Dehydration or electrostatics?” *6<sup>th</sup> Annual Physics of Membrane Processes Workshop*, King Abdullah University of Science and Technology (KAUST), Saudi Arabia (11/14/2023)
- (11) **C.L. Ritt**, “Rate-limiting ion transport mechanisms in nanoporous polymer membranes: Dehydration or electrostatics?” *Cornell University Dept. Civil and Environmental Engineering*, Ithaca, NY (11/30/2023)
- (12) **C.L. Ritt**, “Rate-limiting ion transport mechanisms in nanoporous polymer membranes: Dehydration or electrostatics?” *New York University Dept. Civil and Environmental Engineering*, Brooklyn, NY (03/02/2023)
- (13) **C.L. Ritt**, M. Elimelech, “Heterogeneous ionization of polyamide membranes: Implications for reverse osmosis and nanofiltration,” *Wetsus Symposium*, Leeuwarden, Netherlands (04/21/2022)
- (14) **C.L. Ritt**, M. Liu, H.J. Kulik, M. Elimelech, “Exploring the molecular mechanisms behind ion selectivity in nanoporous polymeric membranes,” *ACS Fall National Meeting & Exposition: C. Ellen Gonter Award*, Atlanta, GA (08/21/2021)

## TEACHING, MENTORING, AND CERTIFICATIONS

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**Guest Lecturer** | MIT, Engineering Nanotechnology (10.585) Fall 2024

- Instructed graduate ChemE students on the principles of nanotechnology in membrane science (22 students)

**Teaching Fellow** | Yale University, Intro to Environmental Engineering (ENVE 120) Spring 2019

- Instructed undergraduates on implementing aquatic chemistry in environmental engineering (44 students)

**Teaching Assistant** | NDSU, Fluid Mechanics Laboratory (CE310) Spring 2016 – Spring 2017

- Taught principles and applications of fluid mechanics in civil engineering (6 – 13 students)

**Teaching Assistant** | NDSU, Introduction to Civil Engineering (CE111) Spring 2015

- Held well-attended office hours for undergraduates in Civil Engineering (112 students)

### Graduate Student Mentoring

- Yile Jiang | MIT, Chemical Engineering Spring 2025 – Present

- Project: *Nanosensors for plant wounding waveforms*
- Sanjay Garimella | MIT, Chemical Engineering Fall 2024 – Present
  - Project: *2D polyaramids as a stable and scalable platform for H<sub>2</sub> storage*
- Michelle Quien | MIT, Chemical Engineering Fall 2022 – Present
  - Project: *Ultralow air permeability of 2D polymer films*
- Camille Violet | Yale University, Chemical & Environmental Engineering Fall 2019 – Fall 2022
  - Project: *The role of specific chemical interactions in selective ion transport*

### Undergraduate Student Mentoring

- Lucas Ospina | MIT, Chemical Engineering Spring 2024
  - Project: *Plant nanobionics to enable methanotrophic plants*
- Joshika Chakraverty | MIT, Chemical Engineering Spring 2024 – Fall 2025
  - Project: *Isobars described by a confined fluid equation of state*
- Dora Ogbonna | University of California – San Diego, Chemical Engineering Spring 2021 – Fall 2022
  - Goldwater Scholar Community Mentorship Program
- Michelle Barsukov | Yale University, Chemical Engineering Spring 2020 – Fall 2022
  - Project: *Influence of graphite geography on the yield of exfoliated few-layer graphene*
- Christian Martinez | Yale University, Economics Spring 2021
  - Project: *The Open Membrane Database*

### Certifications and Licensure

- MIT Machine Learning for Big Data and Text Processing: Foundations 2025
- MIT Machine Learning for Material Informatics Certification 2024
- MIT Kaufman Teaching Certificate Program 2024
  - 10-week interactive workshop series to develop advanced teaching abilities
- Registered Engineering Intern, North Dakota, License No. EI-29898 2022

## INDUSTRY EXPERIENCE

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**Consultant** | Rocky Mountain Institute, Boulder, CO 2025

- Technical assessment of graphene oxide membranes for chemical separations

**Consultant** | Plazmod, New Haven, CT 2022

- Advanced characterization of plasma-based nanometric film depositions

**Founding Member** | The Open Membrane Database, New Haven, CT 2021

- Led an international collaboration to develop first open-access database for aqueous membrane separations
- Produced performance and characterization calculators

**Engineering Intern** | Hakanson Anderson Associates Inc., Anoka, MN 2015

- Designed wastewater treatment facility expansion for the City of Bethel, MN
- Constructed AutoCAD watershed map to model flow habits/water quality and develop BMPs
- Created ArcMap exhibits to track municipal utilities, inspections, and ponds

## RESEARCH FUNDING

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### Previous Research Funding

(\*Indicates projects where I am PI or co-PI)

| Funding Agency, Project Title, and Award No.                                                                                                              | Period Covered          | Amount (total costs) |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|----------------------|
| MIT-Tata Alliance* (PI: M.S. Strano, MIT)<br>“Two-dimensional polyaramids as low-cost, H <sub>2</sub> -impermeable coatings” (76211)                      | 07/01/2025 – 07/01/2028 | \$900,000            |
| MIT Energy Initiative Seed Fund (PI: M.S. Strano, MIT)<br>“Development of novel two-dimensional polymers”                                                 | 06/01/2023 – 05/31/2024 | \$150,000            |
| DOE Energy Frontier Research Center (PI: M.S. Strano, MIT)<br>“The Center for Enhanced Nanofluidic Transport (CENT <sup>2</sup> ) Renewal” (DE-SC0019112) | 08/01/2022 – 07/31/2026 | \$10,800,000         |

## LEADERSHIP AND SERVICE

### Journal Article Review (30 manuscripts)

- *Environ. Sci. Technol.* (ES&T, ×8) and *ES&T Lett.* (×6)
- *Water Res.* (×3)
- *Chem. Eng. Sci.* (×2)
- *ACS Appl. Mater. Interfaces* (×2) and *ACS ES&T Eng.* (×1)
- Others (×1): *Sci. Adv.*; *Nat. Water*; *Angew. Chem.*; *Water Res.*; *npj Mater. Sustain.*; *Chemosphere*; *Water. Environ. Res.*; *J. Phys. Chem.*

### External Proposal Review Panels

DOE SBIR/STTR – Phase I 2024

### University Service

- DOE Center for Enhanced Nanofluidic Transport – Phase 2 (CENT<sup>2</sup>) 2022 – Present
  - Executive Officer 2024 – Present
  - Senior Associate Executive Officer 2023 – 2024
- DOE Center for Enhanced Nanofluidic Transport (CENT) 2018 – 2022
  - Student Research Council
- NSF Research Center for Nano-Enabled Water Treatment (NEWT) 2018 – 2022
- NDSU AWWA/WEF | *Student Chapter President* 2014 – 2015

### Conferences and Symposia

- Annual CENT<sup>2</sup> Symposium | *Chair* 2023 – 2025
  - College Park, MD; Cambridge MA; Stanford, CA
- AEESP Research and Education Conference, Boston, MA | *Organizer* 2023
- 18<sup>th</sup> Annual Robert M. Langer Symposium, New Haven, CT | *Consultant* 2021
- 16<sup>th</sup> Annual Robert M. Langer Symposium, New Haven, CT | *Chair* 2018
- 1<sup>st</sup> Annual Equity in the Job Search Symposium, New Haven, CT | *Organizer* 2017
- International Prairie Student Conference, Fargo, ND | *Organizer* 2014

### Outreach

- NSF-GRFP panelist for Goldwater Scholar Community 2021
- CT SEED (educating children in sciences) | *Volunteer* 2018 – 2022
- Girls Science Investigations | *Volunteer* 2018 – 2022
- NEWT Café (educating children in nanosciences) | *Volunteer* 2018
- K-12 STEM outreach for homeschooled students | *Volunteer* 2016
- The Big World of Nanotechnology Summer Program | *Developer and Director* 2016
- North Dakota Water and Pollution Control Conference Service Project | *Volunteer* 2014