

Ryan Scott Kingsbury, Ph.D., P.E.

Summary

I study **ion-selective materials for clean water and energy processes**. Through a combined **10 years of research, industrial, and startup experience** in addition to my PhD, I have built a unique skillset encompassing **water and wastewater treatment practice, electrochemical characterization techniques, organic and inorganic membrane synthesis, and computational methods** including density functional theory and molecular dynamics simulations. I have also acquired strong **project management, communication, and collaboration** skills. Going forward, I will leverage my unique skillset to build a signature platform for **systematic and comprehensive studies of ion sorption and transport in engineered materials**, thereby **accelerating discovery** of ion-selective materials for applications in **resource recovery, synthetic fuel production, water desalination, and advanced manufacturing**.

Education and Training

- 2019-** **Postdoctoral Researcher at Lawrence Berkeley National Laboratory**
Topic 1: Integrating a next-generation density functional into the Materials Project database
Advisor: Kristin Persson
- Topic 2: Validating computational approaches to understand ion dehydration in synthetic polymer membranes
Advisor: Eric Hoek
- 2015-2019** **Ph.D. in Environmental Sciences and Engineering from the University of North Carolina at Chapel Hill**
Topic: Investigation of selective mass transport in ion exchange membranes for clean energy and water processes
Advisor: Orlando Coronell
- 2008-2010** **Master of Science in Environmental Engineering from the University of North Carolina at Chapel Hill**
Topic: Effect of magnetic ion exchange and ozonation on disinfection by-product formation
Advisor: Philip C. Singer
- 2003-2007** **Bachelor of Science in Civil Engineering from the University of Texas at Austin**
GPA 4.0/4.0
- 2003-2007** **Bachelor of Arts in Plan II Honors from the University of Texas at Austin**
GPA 4.0/4.0

Industry Experience

- 2018-** **Senior Engineering Research Consultant, Membrion Inc., Seattle, WA**
- Guided development of low-cost ceramic ion exchange membranes for electrodialysis.
 - Trained and mentored two research scientists in electrochemical techniques.
- 2013-2015** **Founder and CEO, Bluecell Energy LLC, Research Triangle Park, NC**
- Invented and reduced to practice a novel energy storage technology based on saltwater.
 - Worked with business team to analyze system cost-effectiveness and feasibility.

2010-2013 Environmental Engineer, CDM Smith, Raleigh, NC

- Performed planning, design, and construction support for physical / chemical treatment processes at multiple water and wastewater treatment facilities.

Peer-Reviewed Publications (12 first author, 6 coauthor, *h*-index 10)

(* = Corresponding Author, ^ = equal contribution)

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1. Liu, F., **Kingsbury, R.S.**, Rech, J., You, W., Coronell, O.* Effect of osmotic ballast properties on the performance of a concentration gradient battery. *Water Research*. In press. DOI: [10.1016/j.watres.2022.118076](https://doi.org/10.1016/j.watres.2022.118076)
 2. Li, C., **Kingsbury, R.S.**, Zhou, L., Shyamsunder, A., Persson, K. A., Nazar, L.F.* Tuning the solvation structure in aqueous zinc batteries to maximize Zn-ion intercalation and optimize dendrite-free zinc plating. *ACS Energy Letters* 7(1): 533-540, 2022. DOI: [10.1021/acsenergylett.1c02514](https://doi.org/10.1021/acsenergylett.1c02514)
 3. **Kingsbury, R.S.**, Bartel, C.J., Dwaraknath, S., Gupta, A., Munro, J.M., Horton, M., Persson, K. A.* Performance comparison of r2SCAN and SCAN metaGGA density functionals for solid materials via an automated, high-throughput computational workflow. *Phys. Rev. Materials* 6: 013801. DOI: [10.1103/PhysRevMaterials.6.013801](https://doi.org/10.1103/PhysRevMaterials.6.013801)
 4. **Kingsbury, R.S.**, Hegde, M., Wang, J., Kusoglu, A., You, W., Coronell, O.* Tunable anion exchange membrane conductivity and permselectivity via non-covalent, hydrogen bond crosslinking. *ACS Applied Materials & Interfaces* 13(44): 52647-52658, 2021. DOI: [10.1021/acsaami.1c15474](https://doi.org/10.1021/acsaami.1c15474)
 5. Stern, R., **Kingsbury, R.S.**, Persson, K.* Aqueous stability of zirconium clusters, including the Zr(IV) hexanuclear hydrolysis complex $[\text{Zr}_6\text{O}_4(\text{OH})_4(\text{H}_2\text{O})_{24}]^{12+}$, from density functional theory. *Inorganic Chemistry* 60(20): 15456-15466, 2021. DOI: [10.1021/acs.inorgchem.1c02078](https://doi.org/10.1021/acs.inorgchem.1c02078)
 6. Wang, A.^, **Kingsbury, R.S.**^, Horton, M., Jain, A., Ong, S.P., Dwaraknath, S., Persson, K.* A framework for quantifying uncertainty in DFT energy corrections. *Scientific Reports* 11: 15496, 2021. DOI: [10.1038/s41598-021-94550-5](https://doi.org/10.1038/s41598-021-94550-5)
 7. **Kingsbury, R.S.**, Coronell, O.* Modelling and validation of concentration-dependence of ion exchange membrane permselectivity: significance of convection and Manning's counter-ion condensation theory. *Journal of Membrane Science* 620: 118411, 2021. DOI: [10.1016/j.memsci.2020.118411](https://doi.org/10.1016/j.memsci.2020.118411)
 8. Hossen, E., Gobetz, Z., **Kingsbury, R.S.**, Liu, F., Palko, H. C., Dubbs, L. L., Coronell, O., Call, D. F.* Temporal variation of power production via reverse electrodialysis using coastal North Carolina waters and its correlation to temperature and conductivity. *Desalination* 491: 114562, 2020. DOI: [10.1016/j.desal.2020.114562](https://doi.org/10.1016/j.desal.2020.114562)
 9. **Kingsbury, R.S.**, Wang, J., Coronell, O.* Comparison of water and salt transport properties of ion exchange, reverse osmosis, and nanofiltration membranes for desalination and energy applications. *Journal of Membrane Science* 604: 117998, 2020. DOI: [10.1016/j.memsci.2020.117998](https://doi.org/10.1016/j.memsci.2020.117998)
 10. **Kingsbury, R.S.**, Bruning, K., Zhu, S., Flotron, S., Miller, C.T., Coronell, O.* Influence of water uptake, charge, manning parameter and contact angle on water and salt transport in commercial ion exchange membranes. *Industrial & Engineering Chemistry Research* 58(40): 18663–18674, 2019. DOI: [10.1021/acs.iecr.9b04113](https://doi.org/10.1021/acs.iecr.9b04113)

11. **Kingsbury, R.S.**, Zhu, S., Flotron, S., Coronell, O.* Microstructure determines water and salt permeation in commercial ion exchange membranes. *ACS Applied Materials & Interfaces* 10(46): 39745–39756, 2018. DOI:10.1021/acsami.8b14494
12. **Kingsbury, R.S.**, Flotron, S., Zhu, S., Call, D. F., Coronell, O.* Junction potentials bias measurements of ion exchange membrane permselectivity. *Environmental Science & Technology* 52(8):4929-4936, 2018. DOI:10.1021/acs.est.7b05317
13. Zhu, S., **Kingsbury, R.S.**, Call, D.F., Coronell, O. Impact of solution composition on the resistance of ion exchange membranes. *Journal of Membrane Science* 554: 39–47, 2018. DOI:10.1016/j.memsci.2018.02.050
14. **Kingsbury, R.S.**, Liu, F., Zhu, S., Boggs, C., Armstrong, M.D., Call, D. F., Coronell, O.* Impact of natural organic matter and inorganic solutes on energy recovery from five real salinity gradients using reverse electrodialysis. *Journal of Membrane Science* 541:621-632, 2017. DOI:10.1016/j.memsci.2017.07.038
15. Wang, J., **Kingsbury, R.S.**, Perry, L., Coronell, O.* Partitioning of alkali metal salts and boric acid from aqueous phase into the polyamide active layers of reverse osmosis membranes. *Environmental Science & Technology* 51(4): 2295-2303, 2017. DOI:10.1021/acs.est.6b04323
16. **Kingsbury, R.S.**, Coronell, O.* Osmotic ballasts enhance faradaic efficiency in closed-Loop, membrane-based energy systems. *Environmental Science & Technology* 51(3): 1910-1917, 2017. DOI:10.1021/acs.est.6b03720
17. **Kingsbury, R.S.***, Chu, K., and Coronell, O. Energy storage by reversible electrodialysis: the concentration battery. *Journal of Membrane Science* 495:502-516, 2015. DOI:10.1016/j.memsci.2015.06.050
18. **Kingsbury, R.S.***, Singer, P.C. Effect of magnetic ion exchange and ozonation on disinfection by-product formation. *Water Research* 47(3):1060-1072, 2013. DOI:10.1016/j.watres.2012.11.015

Under Review

1. Iddya, A., Zarzycki, P., **Kingsbury, R.S.**, Khor, C., Ma, S., Wang, J., Wheeldon, I., Ren, J., Hoek, E.M.V., Jassby, D.* A reverse-selective ion exchange nanocomposite membrane: Selective phosphate recovery via outer-sphere complexation-diffusion pathway. *Under Review*.

Presentations (speaker listed first)

Invited and Departmental Presentations

1. **Kingsbury, R.S.** Engineering the flow of ions to protect public health and the environment. Invited seminar, University of California Berkeley Department of Civil and Environmental Engineering, Virtual, March 8, 2021.
2. **Kingsbury, R.S.**, Dischinger, S., Vermaas, D., Miller, D. Unifying the Conversation: Membrane-based separations across the water and energy sectors. Energy Science Area Science Hour series, Lawrence Berkeley National Laboratory, Virtual, February 25, 2021.
3. **Kingsbury, R.S.**, Helms, B., Schatz, G. An experimentalist's guide to atomistic materials modeling. National Alliance for Water Innovation (NAWI) Webinar Series, Virtual, October 7, 2020.
4. **Kingsbury, R.S.** Getting Things Done. Berkeley Lab Postdoc Association Postdoc-to-Postdoc seminar series, Lawrence Berkeley National Laboratory, Berkeley, CA, February 28, 2020.

5. **Kingsbury, R.S.** Selective mass transport in ion exchange membranes for water and energy processes. Joint Center for Artificial Photosynthesis polymers cross-cutting meeting, Lawrence Berkeley National Laboratory, Berkeley, CA, November 13, 2019.
6. **Kingsbury, R.S.** Selective mass transport in ion exchange membranes for water and energy processes. Water Wednesdays seminar series, Lawrence Berkeley National Laboratory, Berkeley, CA, September 18, 2019.
7. **Kingsbury, R.S.** Accelerating development of ion-selective membranes through experiment and computation. Presentation to the Materials Project, Lawrence Berkeley National Laboratory, Berkeley, CA, February 20, 2019.
8. **Kingsbury, R.S.** Energy from saltwater. Annual Presentation to Duke Energy Foundation, Duke Energy Offices, Raleigh, NC, June 8, 2017.
9. **Kingsbury, R.S.,** Coronell, O. Osmotic ballasts make saltwater energy more efficient. UNC Innovation Showcase, Chapel Hill, NC, April 19, 2017.
10. **Kingsbury, R.S.** A novel approach to energy storage based on blue energy and saltwater. Annual Presentation to Duke Energy Foundation, UNC Institute for the Environment, Chapel Hill, NC, April 30, 2016.

Oral Conference Presentations

1. **Kingsbury, R.S.,** Wang, J., Hegde, M., Kusoglu, A., You, W., Coronell, O. Independent tuning of anion exchange membrane conductivity and permselectivity via non-covalent crosslinking. North American Membrane Society Annual Meeting, Estes Park, CO, August 30 - September 2, 2021.
2. Dischinger, S., **Kingsbury, R.S.** (co-presenter), Vermaas, D., Miller, D.J. What do fuel cells, gas separation, and reverse osmosis have in common? Unifying the conversation across membrane applications to enable cross-pollination. North American Membrane Society Annual Meeting, Estes Park, CO, August 30 - September 2, 2021.
3. Ulissi, Z., Jain, A., **Kingsbury, R.S.,** Tran, R., Wang, D. Computational catalyst screening with large multi-purpose catalyst datasets demonstrated for nitrate reduction. American Chemical Society National Meeting, Division of Energy and Fuels, Virtual, August 23, 2021.
4. **Kingsbury, R.S.,** Horton, M., Dwaraknath, S., Persson, K.A. An accurate, high-throughput approach to predicting solid and aqueous phase equilibria from first principles. American Chemical Society National Meeting, Division of Energy and Fuels, Virtual, August 23, 2021.
5. **Kingsbury, R.S.** (Moderator), Jain, A., Monnell, J., Rajmohan, R., Singh, N., Ulissi, Z., Werth, C. Prospects for electrocatalytic water treatment. National Alliance for Water Innovation (NAWI) Un-conference session, Virtual, May 2, 2021.
6. **Kingsbury, R.S.** High-value opportunities for precision separations. National Alliance for Water Innovation (NAWI) Un-conference session, Virtual, November 19, 2020.
7. **Kingsbury, R.S.,** Coronell, O. Modelling and validation of concentration dependence of ion exchange membrane permselectivity: significance of convection and Manning's counter-ion condensation theory. North American Membrane Society Annual Meeting, Virtual, May 18-21, 2020.
8. Newbloom, G., Malone, R., **Kingsbury, R.S.,** Salunkhe, A. Functionalized ceramic ion exchange membranes for electrodialysis. North American Membrane Society Annual Meeting, Virtual, May 18-21, 2020.

9. Liu, F., **Kingsbury, R.S.**, Armstrong, M. D., Coronell, O. Experimental evaluation of an optimized salinity gradient battery. North American Membrane Society Annual Meeting, Virtual, May 18-21, 2020.
10. Newbloom, G., **Kingsbury, R.S.**, Malone, R. Functionalized nanoporous ceramic membranes towards low-cost electro dialysis. American Institute of Chemical Engineering Annual Meeting, Orlando, FL, November 10-15, 2019.
11. Coronell, O., **Kingsbury, R.S.**, Wang, J. Comparison of water and salt transport properties in ion exchange and desalination membranes. 258th American Chemical Society National Meeting, Division of Polymer Science and Engineering, San Diego, CA, August 25-29, 2019.
12. Newbloom, G., **Kingsbury, R.S.**, Malone, R. Functionalized nanoporous ceramic membranes towards low-cost electro dialysis. North American Membrane Society Annual Meeting, Pittsburgh, PA, May 11-15, 2019.
13. **Kingsbury, R.S.**, Wang, J., Hegde, M., Dingemans, T., You, W., Coronell, O. Physically-crosslinked ion exchange membranes defy conductivity-selectivity tradeoff. Materials Research Society Spring Meeting, Phoenix, AZ, April 22-26, 2019.
14. **Kingsbury, R.S.**, Wang, J., Coronell, O. Beyond swelling degree: Counter-ion hydration and its effect on ion exchange membrane performance. 257th American Chemical Society National Meeting, Division of Environmental Chemistry, Orlando FL, March 31-April 4, 2019.
15. **Kingsbury, R.S.**, Bruning, K., Zhu, S., Flotron, S., Miller, C.T., Coronell, O. Towards understanding the conductivity-selectivity-permeability tradeoff in ion exchange membranes: Swelling modulates water and salt transport. North American Membrane Society Annual Meeting, Lexington, KY, June 10-13, 2018.
16. **Kingsbury, R.S.**, Coronell, O. Osmotic ballasts enhance efficiency in closed-loop membrane systems for energy conversion and storage. 11th International Congress on Membranes and Membrane Processes, San Francisco, CA, July 29-August 4, 2017.
17. **Kingsbury, R.S.**, Boggs, C., Liu, F., Zhu, S., Armstrong, M.D., Call, D. F., Coronell, O. Impact of natural organic matter and ionic composition on energy recovery from five real salinity gradients using reverse electro dialysis. AEEESP Research and Education Conference, Ann Arbor, MI, June 20-22, 2017.
18. Call, D.F., **Kingsbury, R.S.**, Boggs, C., Zhu, S., Liu, F., Coronell, O. Electricity generation from natural and engineered salinity gradients using reverse electro dialysis. 252nd American Chemical Society National Meeting, Division of Environmental Chemistry, Philadelphia, PA, August 21-25, 2016.
19. **Kingsbury, R.S.**, Coronell, O. Osmotic ballasts improve the energy efficiency of closed-loop electro dialytic processes. 252nd American Chemical Society National Meeting, Division of Environmental Chemistry, Philadelphia, PA, August 21-25, 2016.
20. **Kingsbury, R.S.**, Chu, K., Coronell, O. Energy storage by reversible desalination: A concentration battery based on electro dialysis. 251st American Chemical Society National Meeting, Division of Environmental Chemistry, San Diego, CA, March 13-17, 2016.
21. **Kingsbury, R.S.** Impacts of harbor deepening and seawater intrusion on treated drinking water quality. AWWA Distribution System Security Conference, St. Louis, Missouri, September 10, 2012.
22. **Kingsbury, R.S.** Impacts of harbor deepening and seawater intrusion on treated drinking water quality. Georgia Association of Water Professionals Annual Conference, Savannah, Georgia, July 16, 2012.

23. **Kingsbury, R.S.** Impacts of harbor deepening and seawater intrusion on treated drinking water quality. AWWA Annual Conference and Exposition, Dallas, Texas, June 14, 2012.
24. **Kingsbury, R.S.** Impacts of harbor deepening and seawater intrusion on treated drinking water quality. North Carolina AWWA/WEA Spring Conference, Wilmington, North Carolina, April 17, 2012.
25. **Kingsbury, R.S.** Optimize climate-controlled sodium hypochlorite storage for cost savings and improved sustainability. NC-AWWA/WEA Annual Conference, Concord, North Carolina, November 15, 2011.
26. **Kingsbury, R.S.** Evaluation of MIEX pre-treatment on ozonation performance and disinfection by-product formation. AWWA Annual Conference and Exposition, Chicago, Illinois, June 21, 2010.

Poster Presentations

1. **Kingsbury, R.S.** membrane-toolkit: a Python package for fast, accurate, automated experimental data management. North American Membrane Society Annual Meeting, Virtual, May 18-21, 2020.
2. Liu, F., **Kingsbury, R.S.**, Rech, J., You, W., Coronell, O. Effect of organic ballast properties on the energy efficiency of a concentration gradient flow battery. North American Membrane Society Annual Meeting, Pittsburgh, PA, May 11-15, 2019.
3. Armstrong, M. D, **Kingsbury, R.S.**, Grzebyk, K., Coronell, O. Ion exchange polymer coatings enhance solute rejection of polyamide thin-film composite membranes. North American Membrane Society Annual Meeting, Pittsburgh, PA, May 11-15, 2019.
4. **Kingsbury, R.S.**, Flotron, S., Zhu, S., Call, D. F., Coronell, O. Junction potentials bias measurements of ion exchange membrane permselectivity. Poster presented at the North American Membrane Society Annual Meeting, Lexington, KY, June 2018.
5. **Kingsbury, R.S.**, Coronell, O. Energy storage by reversible electro dialysis: the concentration battery. Poster presented at the Triangle Student Research Competition, Durham, NC, September 2015.

Patents

Full Patent Applications

1. **Kingsbury, R.S.**, Wang, J., Hegde, M., Dingemans, T., You, W., Coronell, O. Hydrogen-bond enriched ion exchange membranes. US Patent Application No. No. 17/605,807, 2021. Pending.
2. **Kingsbury, R.S.**, Coronell, O. Osmotic ballasts for membrane-based energy processes. PCT Application No. [PCT/US17/40047](#), 2016.
3. **Kingsbury, R.S.** Energy generation and storage using electro-separation methods and devices. U.S. Patent Application No. [14/201,687](#), 2014.

Grants, Fellowships, and Awards

2021 Third place winner, Bay Area Research SLAM competition

Selected from 12 finalists in competition among 4 Bay Area national laboratories to present research in 3 minutes.

- 2021** **Second place winner and People’s Choice winner, Lawrence Berkeley National Laboratory Research SLAM competition**
Selected from 12 finalists in lab-wide competition to present research in 3 minutes.
- 2019** **UNC Graduate Student Transportation Grant Award**
- 2018** **Finalist, University of North Carolina 3 Minute Thesis (3MT) competition**
One of 10 finalists in a university competition to present research in plain language.
- 2018** **North American Membrane Society (NAMS) Student Poster Award, 3rd Place in the Energy Category**
- 2017** **American Environmental Engineering and Science Professors(AEESP)
Hydromantis Student Scholarship Award**
One of 22 travel awards for students and postdocs attending the 2017 AEESP meeting.
- 2017** **North American Membrane Society (NAMS) Student Fellowship Award (2017)**
One of 3 fellowships awarded to students and postdocs presenting at ICOM 2017.
- 2016** **National Science Foundation Graduate Research Fellowship**
- 2015** **UNC Duke Energy Fellowship**
Awarded annually to two graduate students conducting energy-related research.
- 2010** **UNC Bunker Award**
The Bunker Award is given annually by the Department of Environmental Sciences and Engineering to a master's student in environmental engineering who shows the most outstanding scholarship and professional promise.
- 2010** **UNC Order of the Golden Fleece**
The Order of the Golden Fleece is considered the highest honorary society at the University, and selects its members based upon service to the University via scholarship, motivation, creativity, loyalty, and leadership in academic and extracurricular pursuits.
- 2009** **UNC Order of the Old Well (2009)**
The Order of the Old Well recognizes students and faculty members of high character who have demonstrated outstanding humanitarian service and whose service has gone uncompensated and unrewarded.
- 2008** **American Water Works Association Thomas R. Camp Scholarship**
Sponsored by Camp Dresser and McKee, Inc., this scholarship provides support to outstanding graduate students doing applied research in the drinking water field.

Teaching and Mentoring

Guest Lecturer at the University of North Carolina at Chapel Hill

- Physical / Chemical Processes for Water Treatment (ENVR 756; three 1-hr lectures)
- Membrane Technology for Water Purification (ENVR 890; two 3-hr lectures)
- Chemical Equilibria in Natural Waters (ENVR 419; three 1-hr lectures)

Research Mentor

- Mentored two undergraduate students (Materials Project, 2019-)
- Advised and trained two Master's-level research scientists (Membrion Inc., 2018-2019)
- Supervised research of two undergraduates and one Master's student (UNC, 2015-2017)
- Trained and supervised a Master's student research scientist (Bluecell Energy LLC, 2012-2013)

Professional Activities

Licensed Professional Engineer, North Carolina, License No. 040310

Peer Reviewer

- *Environmental Science & Technology* (1 manuscript)
- *Journal of Membrane Science* (6 manuscripts)
- *Water Research* (1 manuscript)
- *Industrial & Engineering Chemistry Research* (1 manuscript)
- *ChemSusChem* (1 manuscript)
- *Membranes* (1 manuscript)
- *Journal of the American Water Works Association* (1 manuscript)
- *Desalination* (1 manuscript)

Affiliations

- American Chemical Society
- North American Membrane Society

Service and Outreach

- Volunteer, Berkeley Lab Director's Apprenticeship Program (K-12 outreach activity, 2020-2021)
- Board Member, Berkeley Lab Postdoc Association (2020-2021)
- Volunteer, Berkeley Lab Postdoc Association Outdoor Activities committee (2019-)
- Department Liaison, Materials Research Society UNC student chapter (2018)
- Volunteer, STEM in the Park (middle school outreach activity, 2018)
- Volunteer, UNC Science Expo (public outreach activity, 2017-2018)
- High school outreach project with North Carolina School of Science and Math (2016-2017)
- Presenter, Science in the Stacks (elementary school activity, 2016)
- Member, American Water Works Association Climate Change Committee (2012-2013)
- Member, North Carolina American Water Works Association Drinking Water Rules and Regulations Seminar Planning Committee (2011-2012)
- President, Daniel A. Okun Chapter of Engineers Without Borders (2008-2009)