Jay R. Werber

University of Minnesota, Dept. of Chemistry
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Google Scholar Profile

Education

Yale University (New Haven, CT) 2015 – 2018
Ph.D. in Chemical & Environmental Engineering
Dissertation topic: Permeability and selectivity of polymeric and biomimetic desalination membranes
Advisor: Prof. Menachem Elimelech

Yale University (New Haven, CT) 2013 – 2015
Master of Philosophy in Chemical & Environmental Engineering
Master of Science in Chemical & Environmental Engineering (All honors on coursework)

Washington University in St. Louis (St. Louis, MO) 2005 – 2009
Bachelors of Science in Chemical Engineering (Summa Cum Laude), Minor in Biology

Academic and Industrial Research Experience

Postdoctoral Research Associate 2018 – Present
University of Minnesota-Twin Cities, Chemistry, Advisor: Prof. Marc Hillmyer
– Fabricating ion-selective membranes using block copolymers

Graduate Student Researcher 2013 – 2018
Yale University, Chemical & Environmental Engineering, Advisor: Prof. Menachem Elimelech
– Measured fundamental permeability and selectivity limits for biomimetic desalination membranes
– Applied a fluorescence-based method to quantify disruption of lipid vesicles by graphene oxide
– Developed simple ICP-MS-based method to quantify carboxyl density in desalination membranes
– Developed novel method to modulate permeability and surface charge of desalination membranes
– Modeled energetics of reverse osmosis to find optimal process configurations

Bioprocess Engineer 2008, 2009 – 2013
Genentech, Inc. (South San Francisco, CA), Process Research & Development
– Led the development of a clinical-scale purification process (chromatography and membrane filtration) for a Phase I monoclonal antibody. Oversaw successful manufacturing run.
– Developed manufacturing-scale ultrafiltration processes for virus removal and for the concentration and buffer exchange of clinical antibodies
– Optimized cleaning procedures to enable large-scale reuse of affinity chromatography resin
– Assessed the degradation pathways of an azo-initiator used as a model oxidant of protein therapeutics
– Characterized efficacy of alternative DNA vector for protein expression in mammalian cell culture

Undergraduate Researcher, NSF REU in Tissue Engineering Summer 2007
Georgia Institute of Technology (Atlanta, GA), Advisor: Prof. Melissa Kemp
– Assessed crosslinking strategies for use in a microbead assay to measure protein phosphorylation

Undergraduate Researcher, NSF REU in Environmental Engineering Summer 2006
Washington University (St. Louis, MO), Advisor: Prof. Muthanna Al-Dahhan
– Fabricated and employed optical probes to measure bubble dynamics and CO_2–liquid expansion

Selected Awards and Fellowships

Finalist, Yale 3-Minute Thesis Competition 2018

Abel Wolman Fellowship, American Water Works Association, $30,000/year award 2017 – 2018

C. Ellen Gonter Award for Best Graduate Student Paper, American Chemical Society, Division of Environmental Chemistry 2017

NSF Graduate Research Fellowship, National Science Foundation, $126,000 award 2013 – 2017

Recognition Award, Genentech, Inc. 2012

Co-Valedictorian (1 of 7) and Co-Student Marshal (1 of 3), Washington Univ. School of Engineering 2009

American Institute of Chemical Engineers Academic Excellence Award 2009

Woodward Scholarship, Washington University in St. Louis, $80,000 award 2005 – 2009

National Merit Scholarship, Washington University in St. Louis 2005

Society of Automotive Engineers Scholarship, Washington University in St. Louis 2005

Peer-Reviewed Publications

H-index: 11. Total citations: 1345 (as of 6/2/2019)

Submitted and In Review

1. Wang, Y., Lee, J., Werber, J.R., & Elimelech, M. "Capillary-Driven Desalination in a Synthetic Mangrove." In review at *Science Advances* (Submitted March 2019).

Published

2. Ritt, C.L.*, Werber, J.R.*****, Deshmukh, A., & Elimelech, M. "Monte Carlo Simulations of Framework Defects in Layered Two-Dimensional Nanomaterial Desalination Membranes: Implications for Permeability and Selectivity." *Environ. Sci. Technol.* **2019**, Advance Article. DOI: 10.1021/acs.est.8b06880
3. Werber, J.R.; Porter, C.J.; Elimelech, M. A Path to Ultra-Selectivity: Support Layer Properties to Maximize Performance of Biomimetic Desalination Membranes. *Environ. Sci. Technol.* **2018**, 52, 10737-10747. DOI: 10.1021/acs.est.8b03426
4. Davenport, D.M.; Deshmukh, A.; Werber, J.R.**;** Elimelech, M. High Pressure Reverse Osmosis for Energy-Efficient Hypersaline Brine Desalination: Current Status, Design Considerations, and Research Needs. *Environ. Sci. Technol. Lett*. **2018**, 5, 467-475. DOI: 10.1021/acs.estlett.8b00274
5. Werber, J.R; Elimelech, M. Permeability and Selectivity Limits of Biomimetic Desalination Membranes. *Science Advances* **2018,** 4, eaar8266. DOI: 10.1126/sciadv.aar8266
6. Mauter, M.S.; Zucker, I.; Perreault, F.; Werber, J.R.; Kim, J.H.; Elimelech, M., The role of nanotechnology in tackling global water challenges. *Nature Sustainability*. **2018**, 1, 166-175. DOI: 10.1038/s41893-018-0046-8
7. Lu, X.; Feng, X.; Werber, J.R.; Chu, C.; Zucker, I.; Kim, J.H.; Osuji, C.O.; Elimelech, M. Enhanced Antimicrobial Activity through the Controlled Alignment of Graphene Nanosheets. *Proc. Natl. Acad. Sci. U.S.A.* **2017**, 201710996. DOI: 10.1073/pnas.1710996114
8. Zucker, I.; Werber, J.R.; Fishman, Z.S.; Hashmi, S.M.; Gabinet, U.; Lu, X.; Osuji, C.O.; Pfefferle, L.D.; Elimelech, M. Loss of Phospholipid Membrane Integrity Induced by Two-Dimensional Nanomaterials. *Environ. Sci. Technol. Lett.* **2017**, 4, 404-409. DOI: 10.1021/acs.estlett.7b00358
9. Werber, J.R.; Bull, S.K.; Elimelech, M. Acyl-Chloride Quenching Following Interfacial Polymerization to Modulate Permeability and Surface Charge of Desalination Membranes. *Journal of Membrane Science* **2017**, 535, 357-364. DOI: 10.1016/j.memsci.2017.04.041
10. Chen, D.*; Werber, J.R.*; Zhao, X.; Elimelech, M. A Facile Method to Quantify the Carboxyl Group Areal Density in the Active Layer of Polyamide Thin-Film Composite Membranes. *Journal of Membrane Science* **2017**, 534, 100-108. DOI: 10.1016/j.memsci.2017.04.001
11. Werber, J.R.*; Deshmukh, A.*; Elimelech, M. Can batch or semi-batch processes save energy in reverse-osmosis desalination? *Desalination* **2017**, 402, 109-122. DOI: 10.1016/j.desal.2016.09.028

12. Werber, J.R.; Deshmukh, A.; Elimelech, M. The Critical Need for Increased Selectivity, Not Increased Water Permeability, for Desalination Membranes. *Environ. Sci. Technol. Lett.* **2016**, 3, 112-120. DOI: 10.1021/acs.estlett.6b00050

13. Werber, J.R.; Osuji, C.O.; Elimelech, M. Materials for next-generation desalination and water purification membranes. *Nature Reviews Materials* **2016**, 1, 16018. DOI: 10.1038/natrevmats.2016.18

14. Shaffer, D.L.*; Werber, J.R.*; Jaramillo, H.; Lin, S.; Elimelech, M. Forward osmosis: Where are we now? *Desalination* **2015**, 356, 271–284. DOI: 10.1016/j.desal.2014.10.031

15. Mo, W.; Soh, L.; Werber, J.R.; Elimelech, M.; Zimmerman, J.B. Application of membrane dewatering for algal biofuel. *Algal Research* **2015**, 11, 1-12. DOI: 10.1016/j.algal.2015.05.018

16. Werber, J.R.; Wang, Y.J.; Milligan, M.; Li, X.; Ji, J.A. Analysis of 2,2′-azobis (2-amidinopropane) dihydrochloride degradation and hydrolysis in aqueous solutions. *Journal of Pharmaceutical Sciences* **2011**, 100, 3307–3315. DOI: 10.1002/jps.22578

17. Mueller, S.G.; Werber, J.R.; Al-Dahhan, M.H.; Dudukovic, M.P. Using a Fiber-Optic Probe for the Measurement of Volumetric Expansion of Liquids. *Ind. Eng. Chem. Res.* **2007**, 46, 4330–4334. DOI: 10.1021/ie061630y

*equal contribution

Patents

Mahajan, E., Kothary, K., So, J., & **Werber, J.** "Method for chromatography reuse." *Full patent application. U.S. Application No. 14/479,092 (Sept. 2014)*

Presentations

1. Werber, J.R., Porter, C.J., Deshmukh, A., & Elimelech, M. "Selectivity Limits of Biomimetic Desalination Membranes." Dept. of Civil & Environmental Engineering, University of Minnesota. January 25, 2019

2. Werber, J.R. & Elimelech, M. "Permeability and selectivity limits of biomimetic desalination membranes," American Institute of Chemical Engineers, Minneapolis, MN, November 2, 2017.

3. Werber, J.R., Chen, D., & Elimelech, M. "Simple method to quantify the carboxyl group areal density in the active layer of polyamide thin-film composite desalination membranes," American Chemical Society, Division of Environmental Chemistry, Washington, D.C., August 22, 2017. ***Received Certificate of Merit.***

4. Werber, J.R. & Elimelech, M. "Water–solute permselectivity limits of biomimetic desalination membranes," American Chemical Society, Division of Environmental Chemistry, Washington, D.C., August 21, 2017.

5. Werber, J.R., Bull, S.K., Chen, D., & Elimelech, M. "Acyl-chloride quenching to modulate permeability and surface charge of desalination membranes," Langer Symposium, New Haven, CT, December 16, 2016. ***Received award for outstanding presentation.***

Grant Proposal Preparation Experience

Primary author of the research proposal "Beyond Thermal Separations: Development of Ultra High Pressure Reverse Osmosis Membranes for Energy Efficient Desalination of Hypersaline Brines." National Science Foundation SusChEM Initiative. CBET 1701658. Principal Investigator: Menachem Elimelech. Funded: $340,000 award. (2017)

Primary author of the research proposal "Development of Next-Generation, Ultra-selective Aquaporin-based Membranes for Water Purification." National Science Foundation SusChEM Initiative. CBET 1437630. Principal Investigator: Menachem Elimelech. Funded: $330,000 award. (2014)

Teaching Experience

Teaching Assistant, Fluid Mechanics (Yale MENG 361) Fall 2014

Held well-attended office hours for undergraduates in Chemical and Mechanical Engineering (70 students total). Graded problem sets and tests.

Volunteer Teacher, Citizen Schools California Fall 2010

Co-designed and co-taught a weekly after-school class for 6th – 8th graders on open-ended engineering design, focusing on hands-on projects and working in teams.

Course Director, EN120 Freshman Engineering Seminar (Washington Univ.) 2006 – 2007

Worked with the Assistant Dean of Engineering, five student Course Directors and thirty student Course Assistants to design, organize and lead a one-credit, weekly freshman engineering seminar (~150 students per year). Combined team-based project work with lessons introducing the engineering disciplines.

Research Mentorship Experience

Cody Ritt (Fall 2017 – Spring 2018): Yale Ph.D. student; modeled formation of and transport through graphene oxide framework membranes. Also, assessing surface charge behavior of polymeric membranes.

Cassandra Porter (Fall 2016 – Spring 2018): Yale Ph.D. student; seeking to fabricate aquaporin-based membranes using a bottom-up approach.

Ding Chen (Spring – Winter 2016): Visiting Ph.D. student from Tsinghua Univ.; helped develop technique to quantify carboxyl group densities in desalination membranes.

William Stark (Summer 2016): Local high school student through Yale Summer Science Research Institute; studied forward osmosis membranes; now pursuing a B.S. in engineering at Univ. of Hartford.

Sarah K. Bull (Spring 2015 – Spring 2016): Yale undergraduate in ChE; studied solvent quenching of thin-film composite membranes; now pursuing a Ph.D. in ChE at Univ. Colorado at Boulder.

Benson May (Spring 2015): Yale undergraduate in ChE; characterized permeability of lipid vesicles.

Professional Service and Volunteer Experience

Member of American Water Works Association (AWWA), American Institute of Chemical Engineers (AIChE), Association of Environmental Engineering & Science Professors (AEESP), International Desalination Association (IDA), American Chemical Society (ACS) Division of Environmental Chemistry, and American Membrane Technology Association (AMTA)

Organizing Committee Member, Yale Symposium on Gender Equity in the STEM Job Search 2017

Communications Assistant, AEESP 2015 Conference Organizing Committee 2014 – 2015

Mentor, New Haven Science Fair 2013 – 2015

Hiring Committee Member, Genentech Process Development Rotational Program 2012 – 2013

Worked on a cross-functional team seeking to recruit, interview, and hire top applicants.

Big Brother, Big Brothers Big Sisters of the Bay Area 2011 – 2013

President, Feed St. Louis (Washington Univ.) 2006 – 2007

Managed one of the school's largest community service organizations, which was dedicated to feeding those in need while mitigating food waste. Organized a merger with a similar organization, eventually leading to the group becoming a chapter of the Campus Kitchens Project.