

## YUEXIAO SHEN

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### EDUCATION AND RESEARCH EXPERIENCE

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- Texas Tech University, Department of Civil, Environmental and Construction Engineering, Assistant Professor** 2019-  
**University of California, Berkeley, Chemistry, Postdoc.** (Dr. Peidong Yang) 2017-2019
- Optimization of artificial photosynthesis using light harvesting semiconductor materials and bacteria ([CUBES](#))
  - Symbiotic coculturing system performing both carbon and nitrogen fixations
- The Pennsylvania State University, Chemical Engineering, Postdoc.** (Dr. Enrique Gomez and Dr. Manish Kumar) 2016-2017
- Characterization of polymeric materials using advanced surface characterizing technologies such as electron tomography and resonant soft X-ray scattering
- The Pennsylvania State University, Chemical Engineering, Ph.D.** (Dr. Manish Kumar) 2011-2016
- Development of artificial water channel based-membranes for desalination and other environmental applications.
  - Supported biomimetic desalination membranes based on incorporation of aquaporins into lipids and block copolymers.
  - Transport study of light driven ion-transport membrane proteins—halorhodopsins.
- Tsinghua University, Environmental Engineering, Master of Science** (Dr. Xia Huang) 2009-2011
- Physiochemical and biological properties of mixed liquor in full-scale membrane bioreactors for municipal wastewater treatment
  - Technologies and demonstration project on water environmental protection in rapid developing and urbanized areas in China
- Tsinghua University, Water Supply and Sewer System Engineering, Bachelor of Science** (Top student in class) 2005- 2009
- Membrane fouling in a membrane bioreactor coupled with anaerobic-anoxic-oxic process for coke wastewater treatment.
  - Phosphorus removal in an Sequencing Batch Reactor
  - Particulate matter and its health impact in Beijing

### AWARDS & HONORS

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- One of the 8 student and postdoc delegates selected nationwide for 7<sup>th</sup> Distinguished Young Scholars Seminar (DYSS) at the University of Washington, Seattle, 2017 [[link](#)]
- Chair of Gordon Research Seminar (GRS), Membranes: Materials & Processes, 2016-2018 [[link](#)]
- Poster Competition North American Membrane Society (NAMS), 2<sup>nd</sup> Prize, 2016
- Chinese Government Scholarship for Outstanding Self-financed Students Abroad, 2016 [[link](#)]
- Harold K. Schilling Dean's Graduate Scholarship, Penn State, 2016
- Best Paper Award, Department of Chemical Engineering, Penn State, 2015 [[link](#)]
- Poster Competition North American Membrane Society (NAMS), 1<sup>st</sup> Prize, 2015
- North American Membrane Society (NAMS) Student Fellowship Award, 2015
- American Institute of Chemical Engineers (AIChE) Separations Division Graduate Student Research Award, 2014 [[link](#)]
- One of the 8 student delegates selected nationwide for the Council for Chemical Research Conference, 2014
- Teaching Fellow, Department of Chemical Engineering, Unit operations class, Penn State, 2014
- Leighton Reiss Graduate Fellowship, Penn State, 2013
- **Shen, Y.**, Saboe, P., Ferlez, B., Erbakan, M. & Escotet, M. Solar energy based biomimetic water desalination and purification. 28<sup>th</sup> Annual Graduate Exhibition at Penn State. 2<sup>nd</sup> Prize, 2013
- **Shen, Y.**, Saboe, P., Ferlez, B., Erbakan, M. & Escotet, M. Solar energy based biomimetic water desalination and purification. Dow Sustainability Innovation Challenge. 2<sup>nd</sup> Prize at Penn State, 2012 [[link](#)]
- Larson Aquatic Research Support Doctoral Scholarship, American Water Works Association, 2012
- The First-Class Scholarship of Tsinghua-Meishang International Scholarship, 2010
- Excellent undergraduate student, Tsinghua University, 2009
- Excellent undergraduate thesis, Tsinghua University, 2009
- Member of youngsters' scientific and technological innovation plan in Tsinghua University, 2008-2009
- National Scholarship, China, 2007 and 2008
- Gold Medal of Practical Investigation Contest in Tsinghua University with the project "Survey on the energy efficiency of buildings in Beijing", 2007
- The First-Class Scholarship of Tsinghua-POSCO Scholarship, 2006

### INVITED PRESENTATIONS

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1. **Shen, Y.** Energy efficient water purification – from biological channels to bioinspired artificial channels, 7<sup>th</sup> Distinguished Young Scholars Seminar (DYSS), the University of Washington, Seattle, August 2017 [[link](#)]
2. **Shen, Y.** & Kumar, M. Artificial Water Channels—Bioinspired and Energy-Efficient Filtration Materials, MRS Spring Meeting, Phoenix, April 2017
3. **Shen, Y.** Artificial Water Channels—Bioinspired and Energy-Efficient Filtration Materials, Seminar at the Department of Civil,

- Environmental, and Construction Engineering, The Texas Tech University, March 2017
4. **Shen, Y.** Artificial Water Channels—Bioinspired and Energy-Efficient Filtration Materials, Seminar at the Department of Chemical, Biological and Materials Engineering, University of Oklahoma, February 2017
  5. **Shen, Y.** & Kumar, M. Highly permeable artificial water channels in block copolymer membranes. Membranes: Materials & Processes, Gordon Research Conference, New London, August 2016 (One of the 11 student or postdoc delegates selected nationwide)
  6. **Shen, Y.**, Licsandru, E., Barboiu, M. & Kumar, M. Functional reconstitution and characterization of artificial proton channels. 25<sup>th</sup> Annual North American Membrane Society Meeting, Boston, June 2015. (Awards session)
  7. **Shen, Y.**, Erbakan, M., Decker, K., Aksimentiev, A., Hou, J. & Kumar, M. Artificial Water Channels—Can they reach the performance of biological channels? Membranes: Materials & Processes, Gordon Research Seminar, New London, July 2014.
  8. **Shen, Y.**, Erbakan, M., Hou, J. & Kumar, M. Single Molecule Transport Characterization of a High Permeable Artificial Water Channel. Council for Chemical Research Annual Meeting, Alexandria, May 2014. (One of the 8 student delegates selected nationwide)

#### SELECTED PUBLICATIONS (Full publications in [Google Scholar](#))

1. Xiao, K., **Shen, Y.**, Liang, S., Tan, J., Wang, X., Liang, P. & Huang, X. Characteristic Regions of Fluorescence Excitation-Emission Matrix (EEM) to Identify Hydrophobic/Hydrophilic Contents of Organic Matter in Membrane Bioreactors. *Environ. Sci. Technol.* In press ([link](#), **corresponding author**).
2. Culp, T., **Shen, Y.**, Geitner, M., Paul, M., Roy, A., Behr, M., Rosenberg, S., Gu, J., Kumar, M. & Gomez, E. Electron tomography reveals details of the internal microstructure of desalination membranes. *Proc. Natl. Acad. Sci. U.S.A.*, (2018). ([link](#), **co-first author**)
3. **Shen, Y.**, Song, W., Barden, D., Ren, T., Henderson, C., Lang, C., Feroz, H., Saboe, P., Tsai, D., Sines, I., Yan, H., Butler, P., Bazan, G., Phillip, W., Hickey, R., Cremer, P., Vashisth, H. & Kumar, M. Achieving high permeability and enhanced selectivity for Angstrom-scale separations using artificial water channel membranes. *Nature Communications* 9, 2294, (2018). ([link](#))
4. Song, W., Lang, C. **Shen, Y.** & Kumar, M. Design Considerations for Artificial Water Channel–Based Membranes. *Annual Review of Materials Research* 48, (2018). ([link](#))
5. Licsandru, E., Kocsis, I., **Shen, Y.**, Murail S., Legrand, Y., Lee, A., Tsai, D., Baaden M., Kumar, M. & Barboiu, M. Salt excluding artificial water channels reveal enhanced dipolar water and proton translocation. *J. Am. Chem. Soc.* 138, 5403-5409, (2016). ([link](#), **co-first author**)
6. Sun, Y., **Shen, Y.**, Liang, P., Zhou, J., Yang, Y. & Huang, X. Multiple antibiotic resistance genes distribution in ten large-scale membrane bioreactors for municipal wastewater treatment. *Bioresour. Technol.* 222, 100-106, (2016). ([link](#), **co-first author**)
7. **Shen, Y.**, Si, W., Erbakan, M., Decker, K., Zorzi, R., Saboe, P., Kang, Y., Majd, S., Butler, P., Walz, T., Aksimentiev, A., Hou, J. & Kumar, M. Highly permeable artificial water channels that can self-assemble into two-dimensional arrays. *Proc. Natl. Acad. Sci. U.S.A.* 112, 9810-9815, (2015). ([link](#), [Penn State news](#) and other science websites)
8. **Shen, Y.**, Saboe, P., Sines, I., Erbakan, M. & Kumar, M. Biomimetic membranes: A review. *J. Membr. Sci.* 454, 359-381 (2014). ([link](#), one of the most downloaded *J. Membr. Sci.* articles)
9. Erbakan, M., **Shen, Y.**, Grzelakowski, M., Butler, P., Kumar, M., Curtis, W. Molecular Cloning, Overexpression and Characterization of a Novel Water Channel Protein from *Rhodobacter sphaeroides*, *Plos One.* 9, e86830 (2014). ([link](#))
10. Sun, Y., **Shen, Y.**, Liang, P., Zhou, J., Yang, Y. & Huang, X. Linkages between microbial functional potential and wastewater constituents in large-scale membrane bioreactors for municipal wastewater treatment. *Water Res.* 56, 162-171 (2014). ([link](#), **co-first author**)
11. Xiao, K., **Shen, Y.**, Liang, S., Liang, P., Wang, X., & Huang, X. A systematic analysis of fouling evolution and irreversibility behaviors of MBR supernatant hydrophilic/hydrophobic fractions during microfiltration. *J. Membr. Sci.* 467, 206-216 (2014). ([link](#))
12. Xiao, K., **Shen, Y.** & Huang, X. An analytical model for membrane fouling evolution associated with gel layer growth during constant pressure stirred dead-end filtration. *J. Membr. Sci.* 427, 139-149 (2013). ([link](#))
13. **Shen, Y.**, Xiao, K., Liang, P., Ma, Y. & Huang, X. Improvement on Modified Lowry Method against Interference by divalent cations for soluble protein measurement in wastewater systems. *Appl. Microbiol. Biotechnol.* 97, 4167-4178 (2013). ([link](#))
14. **Shen, Y.**, Xiao, K., Liang, P., Sun, J., Sai, S. & Huang, X. Characterization of soluble microbial products in 10 large-scale membrane bioreactors for municipal wastewater treatment in China. *J. Membr. Sci.* 415–416, 336-345 (2012). ([link](#))
15. Zhao, W., **Shen, Y.**, Xiao, K. & Huang, X. Fouling characteristics in a membrane bioreactor coupled with anaerobic–anoxic–oxic process for coke wastewater treatment. *Bioresour. Technol.* 101, 3876-3883 (2010). ([link](#))
16. **Shen, Y.**, Zhao, W., Xiao, K. & Huang, X. A systematic insight into fouling propensity of soluble microbial products in membrane bioreactors based on hydrophobic interaction and size exclusion. *J. Membr. Sci.* 346, 187-193 (2010). ([link](#))

#### CONFERENCE PRESENTATIONS AND POSTERS

1. **Shen, Y.**, Ren, T. & Kumar, M. Highly permeable artificial water channels in block copolymer membranes. 2016 Annual AIChE conference, San Francisco, November 2016. (talk)
2. **Shen, Y.**, Ren, T. & Kumar, M. Highly permeable artificial water channels in block copolymer membranes. 26<sup>th</sup> Annual North American Membrane Society Meeting, Bellevue, May 2016. (talk and poster)
3. **Shen, Y.**, et al. Artificial Channels—Can they reach the performance of biological channels? 51<sup>st</sup> AEESP Anniversary Conference, New Haven, June 2015. (poster)
4. **Shen, Y.**, et al. Artificial Channels—Can they reach the performance of biological channels? 25<sup>th</sup> Annual North American Membrane Society Meeting, Boston, June 2015. (talk and poster)
5. **Shen, Y.**, Erbakan, M., Decker, K., Aksimentiev, A., Hou, J. & Kumar, M. Artificial Water Channels—Can they reach the performance of biological channels? 2014 Annual AIChE conference, Atlanta, November 2014. (talk)

6. **Shen, Y.**, Erbakan, M., Decker, K., Aksimentiev, A., Hou, J. & Kumar, M. Artificial Water Channels—Can they reach the performance of biological channels? Membranes: Materials & Processes, Gordon Research Conference and Seminar, New London, July 2014. (talk and poster)
7. **Shen, Y.**, Erbakan, M., Decker, K., Aksimentiev, A., Hou, J. & Kumar, M. Artificial Water Channels—Can they reach the performance of biological channels? 24<sup>th</sup> Annual North American Membrane Society Meeting, Houston, July 2014. (talk and poster)
8. **Shen, Y.**, Sines, I., Licsandru, E., Barboiu, M. & Kumar, M. Functional reconstitution and characterization of artificial water channels for desalination. 246<sup>th</sup> ACS National Meeting & Exposition, Indianapolis, September 2013. (talk)
9. **Shen, Y.**, Licsandru, E., Barboiu, M. & Kumar, M. Functional reconstitution and characterization of artificial water channels for desalination. 50<sup>th</sup> AEESP Anniversary Conference, Golden, July 2013. (poster)
10. **Shen, Y.**, Licsandru, E., Barboiu, M. & Kumar, M. Functional reconstitution and characterization of artificial water channels for desalination. 23<sup>rd</sup> Annual North American Membrane Society Meeting, Boise, July 2013. (poster)
11. **Shen, Y.**, Edwards, A., Saboe, P., Erbakan, M. & Kumar, M. Supported lipid-aquaporin-crystal based biomimetic membranes for desalination. Membranes: Materials & Processes, Gordon Research Conference and Seminar, New London, August 2012. (poster)
12. **Shen, Y.**, Xiao, K., Liang, P., Sun, J., Sai, S. & Huang, X. Soluble microbial products in 10 large-scale membrane bioreactors for municipal wastewater treatment in China: Physiochemical properties and fouling propensity. 6<sup>th</sup> IWA Conference on Membranes for Water and Wastewater Treatment, Aachen, Germany, September 2011. (talk)
13. **Shen, Y.**, Ma, Y., Liang, P. & Huang, X. Improvement on Modified Lowry Methods against interference by divalent cations for soluble protein quantitation in wastewater systems. 3<sup>rd</sup> IWA Asia Pacific Young Water Professionals Conference, Singapore, November 2010. (talk)
14. **Shen, Y.**, Zhao, W. & Huang, X. Fouling characteristics in a membrane bioreactor coupled with anaerobic-anoxic-oxic process for coke wastewater treatment. 2<sup>nd</sup> Forum of Membrane Technology for University Graduates Jing-Jin-Tang District. Beijing, China, October 2009. (talk)
15. **Shen, Y.**, Zhao, W., Xiao, K. & Huang, X. A new insight into fouling propensity of soluble microbial products in membrane bioreactors based on hydrophobic interaction and size exclusion. 5<sup>th</sup> IWA Conference on Membranes for Water and Wastewater Treatment. Beijing, China, September 2009. (talk)

## TEACHING AND MENTORSHIP ACTIVITIES

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1. Co-instructor of ChE 210 class, Introduction to Material Balances, Fall 2016
2. Graduate Online Teaching Certificate, Penn State, 2015
3. Volunteered to teach several chemical engineering courses during my graduate program. In the ChE 480 class, I was the co-lecturer and selected as the Teaching Fellow of the department. I was responsible for preparing course materials, project design, giving lectures and report grading.
  - o ChE 449, Bioseparations, Spring 2013
  - o ChE 480, Unit Operation of Chemical Engineering, Spring 2014
  - o ChE 330, Fluid Mechanics, Fall 2015
4. Teaching assistant for two chemical engineering courses. I was responsible for onsite experiments demonstration, office hours and exam grading.
  - o ChE 480, Unit Operation of Chemical Engineering, Fall 2013
  - o ChE 330, Fluid Mechanics, Fall 2015
5. Mentor and Volunteer, Science U H2uOH! Water Camp at Penn State (2013 to present). At this camp, I was responsible for organizing the trip to wastewater treatment plant, demonstrating wastewater treatment experiments and helping middle school students to design hands-on experiments.

## PROPOSAL WRITING EXPERIENCE

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1. Kumar, M. (PI). "Army ERDC: Channel based membranes for energy efficient desalination and water reuse." Total requested: \$300,000.00. (submitted: Feb 20, 2016, funded). Wrote the first few drafts and made all the figures. Was highly appreciated by reviewers for visual content.
2. Kumar, M. (PI), "CAREER: Bioinspired Artificial Channel Water Treatment Membranes," National Science Foundation. Total requested: \$500,000.00. (submitted: July 22, 2015, funded).
3. Kumar, M. (PI), "GOALI Collaborative Research: Nanoporous block copolymer films as support for two-dimensional crystal based biomimetic membranes," National Science Foundation. Total awarded: \$194,000.00. (submitted: 2014, funded: August 1, 2015 - July 31, 2018).
4. Kumar, M. (PI), Grant, "Collaborative development of membrane protein based water treatment membranes using PDMS-PMOXA block copolymer vesicles and crystals," Applied Biomimetic (previously AquaZ A/S), Cincinnati Ohio. Total awarded: \$150,727.00. (submitted: 2013, funded: December 1, 2013 - May 31, 2014).
5. Kumar, M. (PI), Contract, "Testing of new generation of RO pretreatment membranes," PPG Industries. Total requested: \$46,314.00. Total awarded: \$46,314.00. (submitted: April 22, 2012, funded: June 1, 2012 - October 31, 2012).

## PROFESSIONAL MEMBERSHIPS, SERVICE AND ACTIVITIES

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1. Visiting scholar at Department of Chemistry, Fudan University, March to April, 2015

2. AICHE member, 2013-present
3. North American Membrane Society member, 2013-present