

CURRICULUM VITAE

DR. TZAHI Y. CATH

EDUCATION

- Ph.D. in Civil and Environmental Engineering, University of Nevada, Reno, 2003
 - Dissertation: “Membrane Contactor Processes for Seawater Desalination and Wastewater Reclamation”, Advisors: Amy E. Childress and V. Dean Adams
- M.S. in Civil and Environmental Engineering, University of Nevada, Reno, 2001
- B.S. in Mechanical Engineering, Tel-Aviv University, Israel, 1992

PROFESSIONAL EXPERIENCE

- 2012 – present:** *Associate Professor*, Department of Civil and Environmental Engineering, Colorado School of Mines (CSM), Golden, Colorado
- 2011 – present:** *Leader*, Efficient Engineered System Thrust, NSF Engineering Research Center (ReNUWIt), CSM/Stanford/Berkeley/NMSU
- 2010 – present:** *Director*, Advanced Water Technology Center (AQWATEC), CSM
- 2006 – 2012:** *Assistant Professor*, Environmental Science & Engineering Division, CSM
- 2007 – 2010:** *Associate Director*, Advanced Water Technology Center (AQWATEC), CSM
- 2004 – 2006:** *Research Assistant Professor*, Department of Civil and Environmental Engineering (CEE), University of Nevada, Reno
- 2004:** *Post Doctoral Associate*, CEE, University of Nevada, Reno
- 1999 – 2003:** *Graduate Research Assistant*, CEE, University of Nevada, Reno
- 1992 – 1999:** *Engineer*, GOI

CORE RESEARCH INTERESTS

My main field of research is membrane processes for water and wastewater treatment and for desalination. My expertise and research projects focus mainly on membrane contactor processes (osmotically driven and thermally driven membrane processes) for seawater and brackish water desalination, for treatment of oil and gas exploration and production wastewater, for potable reuse, and for energy, nutrients, and mineral recovery; yet, I am also deeply involved in research associated with onsite treatment and reuse of wastewater using conventional and hybrid membrane bioreactors.

Another important area of my research involves development of computer-assisted decision support tools for treatment of impaired water (e.g., domestic and industrial wastewater), mainly for optimization of decentralized urban water infrastructure and for improvements to oil and gas production.

ACADEMIC HONORS AND AWARDS

- 2014, Bryan Coday, American Membrane Technology Association Graduate Fellowship
- 2013, Bryan Coday, WaterReuse Colorado, Graduate Student Award
- 2013, Bryan Coday, AMTA/AWWA Membrane Technology Conference, Best student paper presentation award
- 2012-2015, Kerri Hickenbottom, EPA-STAR
- 2012, Bryan Coday, Edna Bailey Sussman and special Dorothy Bertine internship awards
- 2010, Nathan Hancock, AWWA Abel Wolman Fellowship

- 2009, Nathan Hancock, AWWA Membrane Technology Conference Best student paper presentation award
- 2001, UNR-GSA Outstanding Graduate Student Award
- 2001, UNR-GSA Merit Grant

INTELLECTUAL PROPERTY

- **Cath, T.Y.**, Holloway, R.W., Herron, J.R., Lampi, K.A., A methods for tailored water reuse using a hybrid osmotic membrane bioreactor, microporous membrane bioreactor, and a desalination/ reconcentration process, Provisional application filed in December, 2012.
- Hickenbottom, K.L., **Cath, T.Y.**, Pannell, D.K., Poe, J., “Methods for sustainable membrane distillation concentration of hyper saline streams,” Provisional application #61/658/244 filed on June 11, 2012.
- **Cath, T.Y.**, Pannell, D.K., Poe, J., Reynolds, M., “Methods for osmotic concentration of hyper saline streams,” Provisional application #61/608/990 filed on March 9, 2012.
- **Cath, T.Y.**, Childress, A.E., “Systems and Methods for Purification of Liquids,” *US Patent 8,083,942 B2 was awarded on December 27, 2011.*
- **Cath, T.Y.**, Childress, A.E., Martinetti, C.R., “Membrane-distillation-forward-osmosis systems and methods of use,” *US Patent 8,029,671 B2 was awarded on October 4, 2011.*
- **Cath, T.Y.**, Childress, A.E., “Systems and Methods for Purification of Liquids,” *US Patent 7,914,680 B2 was awarded on March 29, 2011.*
- **Cath, T.Y.** and Childress, A.E., “Osmotic Seawater Intrusion Barrier System and Method,” Provisional application filed on May 5, 2009 (Application #61/175,730). Patent non-provisional application was filed on May 5, 2010 (Joint application through Inter-institutional Agreement between CSM and UNR).
- Achilli, A., **Cath, T.Y.**, and Childress, A.E., “Methods and Systems for Water Desalination Coupled with Wastewater Treatment: Osmotically Assisted Desalination,” Provisional application will be filed in June 2010 (Joint application through Inter-institutional Agreement between CSM and UNR).
- **Cath, T.Y.**, Childress, A.E., Adams, V.D., “Vacuum Assisted Direct Contact Membrane Distillation for Desalination: A New Approach to Flux Enhancement,” *US Patent 7,608,188 was awarded in October 2009.*
- **Cath, T.Y.**, Childress, A.E., “System and Method for Forward Osmosis Assisted Desalination of Liquids,” application for a patent filed on December 06, 2005. Responses to Office Actions filed in August and December 2008. Revised application filed in December 2008.

RESEARCH

Grants and contracts acquired at CSM (total funding: >\$18,910,000)

- “Low Enthalpy Geothermal Desalination.” Total funding: \$250,000 (**\$112,344 to CSM**). 11/2013-10/2014. US Department of Energy/NREL. *Principal Investigator at CSM*. Project PI: Michael Hillesheim (NREL).
- “Power Generation from Waste Heat with Closed-Loop Membrane-Based System.” Total funding: \$2,648,074 (**\$1,045,440 to CSM**). 4/2013-1/2016. US Department of Energy/ARPA-E. *Principal Investigator at CSM*. Project PI: Menachem Elimelech (Yale U).
- “Advancing a Web-based Tool for Unconventional Natural Gas Development with Focus on Flowback and Produced Water Characterization, Treatment and Beneficial Use.” **\$286,366**. 6/2013-5/2015. US Department of Energy/Research Partnership to Secure Energy for America (RPSEA). *Co-Principal Investigator*. Project PIs: Dr. Pei Xu (NMSU), Mengistu Geza (CSM).
- “Routes to Sustainability for Natural Gas Development and Water and Air Resources in the Rocky Mountain Region.” Total funding: \$11,999,328 (**\$1,400,390 to CSM**). 10/2012-9/2017.

- National Science Foundation. *Co-Principal Investigator at CSM*. Project PI: Joseph Ryan (CU Boulder).
- “Investigation of Mass and Heat Transport and Sustainability of the Novel Thermally Driven Membrane Distillation Crystallization Process.” **\$222,782**. 9/2012-8/2014. National Science Foundation. *Principal Investigator*.
 - “Novel Engineered Osmosis Technology: A Comprehensive Approach to the Treatment and Reuse of Produced Water and Drilling Wastewater.” **\$1,323,805**. 9/2011-8/2013. US Department of Energy/Research Partnership to Secure Energy for America (RPSEA). *Principal Investigator*. Co-PIs: Dr. Pei Xu (CSM), Ed Beaudry (HTI), and Nathan Hutchings (BCS).
 - “Engineering Research Center for re-inventing America's urban water infrastructure.” Total of **~\$4M per year**. 2011-2016. National Science Foundation. *Engineered System Thrust Leader*. Project PI: Richard Luthy (Stanford). Multi co-PI at Stanford, UC Berkley, NM State University, and CSM.
 - “Mineral Recovery with Direct Contact Membrane Distillation.” **\$102,831**. 10/2010-06/2013. Compass Minerals. *Principal Investigator*. Co-Principal Investigator: Gerard Martins (CSM).
 - “Assessment of Osmotic Mechanisms Pairing Desalination Concentrate and Wastewater Treatment.” \$120,000 (**\$45,000 to CSM**). 1/2009-8/2010. Texas Water Development Board. *Principal Investigator at CSM*. Project PI: Robert Huehmer (CH2M Hill).
 - “A Novel Hybrid Forward Osmosis Process for Drinking Water Augmentation using Impaired Water and Saline Water Sources.” **\$100,000**. 9/2007-12/2008. Water Research Foundation (formerly AwwaRF). Project #4150. *Principal Investigator*. Co-Principal Investigator: Prof. Jörg Drewes (CSM).
 - “Assessment of Hybrid Sequencing Batch Reactor – Membrane Bioreactor Process for Treatment and Reuse of Domestic Wastewater in Small Communities.” **>\$420,000**. 3/2007-12/2013. Aqua-Aerobic Systems, Inc. *Principal Investigator*. Co-Principal Investigator: Prof. Jörg Drewes.
 - “A Novel Hybrid Membrane Desalination Process with Minimal Pretreatment and Concentrate.” **\$500,000**. 4/2007-12/2012. California Department of Water Resources. *Principal Investigator*. Co-Principal Investigators: Prof. Amy Childress (UNR) and Prof. Menachem Elimelech (Yale University).
 - “Zero-Liquid Discharge Systems for the Recovery of Cooling Tower Water in Geothermal Power Plants.” \$200,356 (**\$65,064 to CSM**). 10/2006-5/2009. US Department of Energy/National Renewable Energy Laboratory. *Principal Investigator at CSM*. Project PI: Prof. Amy Childress (UNR).
 - “CO-RADS: Colorado Radionuclide Abatement and Disposal Strategy Engineering and Waste Disposal Evaluations.” \$ 898,945 (**\$130,481 to CSM**). 11/2007-3/2009. State of Colorado. *Co-Principal Investigator at CSM* (in practice, Dr. Cath managed the project while the CSM PI was on sabbatical). Principal Investigator: Jason Kerstiens (Malcolm Pirnie). Project PI at CSM: Prof. Jörg Drewes.
 - “An Integrated Framework for Treatment and Management of Produced Water.” \$3,892,000 (**\$1,560,393 to CSM**). 9/2008-3/2011. US Department of Energy/Research Partnership to Secure Energy for America (RPSEA). *Co-Principal Investigator*. Project PI: Prof. Jörg Drewes.
 - “Guidelines for Implementation of Seawater and Brackish Water Desalination Facilities.” \$958,052 (**\$136,000 to CSM**). 7/2008-9/2010. Water Research Foundation (formerly AwwaRF). Project #4078. *Co-Principal Investigator*. Principal Investigator: Bob Raucher (Stratus Consulting Inc.) Project PI at CSM: Dr. Pei Xu. Co-PI at CSM: Dr. Prof. Jörg Drewes.
 - “Critical Assessment of Implementing Desalination Technologies.” **\$268,846**. 11/2006-6/2009. Water Research Foundation (formerly AwwaRF). Project #4006. *Co-Principal Investigator*. Project PI: Dr. Pei Xu (CSM). Co-PI: Prof. Jörg Drewes (CSM) and Prof. Andrea Schäfer (University of Edinburgh, UK).
 - “Advanced Development of the Direct Osmotic Concentration System.” \$1,578,917 (\$220,000 to UNR). 9/2004-11/2007. National Aeronautics and Space Administration (NASA). *Co-Principal*

Investigator. Project PI: Mike Flynn (NASA, ARC). Co-PIs: Prof. Amy Childress and Prof. Dean Adams (UNR).

- “Innovative Treatment Technologies for Natural Waters and Wastewaters.” \$1,000,000. 10/2005-9/2009. US Department of Energy. *Co-Principal Investigator*. Project PI: Prof. Amy Childress (UNR). Co-PIs: Prof. Keith Dennett and Prof. Eric Marchand (UNR).
- “Evaluation and Selection of Available Processes for a Zero-Liquid Discharge System for the Perris, California, Groundwater Basin.” \$292,051 (\$48,000 to UNR). 10/2005-9/2006. US Department of the Interior/Bureau of Reclamation and Eastern Municipal Water District (EMWD), CA. *Co-Principal Investigator*. Project PI: Prof. Amy Childress (UNR).
- “Direct Contact Membrane Distillation for Desalination: Pilot Scale Application and Modeling of a New Approach for Flux Enhancement.” \$297,000. 10/2003-12/2005. US Department of Defense/ Office of Naval Research (ONR). *Co-Principal Investigator*. Project PI: Prof. Amy Childress (UNR).
- “Using Forward Osmosis for Concentration of Anaerobic Digestion Centrate.” \$24,000. 1/2005-7/2006. Cities of Reno and Sparks, Nevada. *Principal Investigator*. Co-PIs: Prof. Amy Childress and Prof. Keith Dennett (UNR).

Graduate student advisees (as primary advisor or co-advisor at ESE)

- John Bush, Ph.D., in progress
- Bryan Coday, Ph.D., in progress
- Daniel Freedman, M.S., in progress
- Kerri Hickenbottom, Ph.D., in progress
- Ryan Holloway, Ph.D., in progress
- Doritha Ramey, Ph.D., in progress
- Bethany Grace Yaffe, M.S., in progress
- Josh Cartinella, M.S., graduated
- Nathan Hancock, Ph.D., graduated
- Nathan Hancock, M.S., graduated
- Kerri Hickenbottom, M.S., graduated
- Ryan Holloway, M.S., graduated
- Carl Lundin, M.S., graduated
- Christopher Riziero Martinetti, M.S., graduated
- Xanthe Mayer, M.S., graduated
- Justin Nielsen, M.S., graduated
- Eric Mortensen, M.S., graduated
- Andrew Wait, M.S., graduated
- Nathan Walker, M.S., graduated

Graduated with project (NT)

- Adam Brady, M.S., graduated
- Richard Huggins, M.S., graduated
- Brandy Laudig, M.S., graduated
- Oluwaseun Ogungbenle, M.S., graduated
- Joaquin Viquez-Arias, M.S., graduated
- David Vuono, M.S., graduated

PUBLICATIONS

Paper in peer-reviewed journals, published and in press

- Wijekoon, K.C., Hai, F.I., Kang, J., Price, W.E., Cath, T.Y., Nghiem, L.D., Rejection and fate of trace organic compounds (TrOCs) during membrane distillation, *Journal of Membrane Science* (2013) in press.
- Coday, B.D., Xu, P., Beaudry, E.G., Herron, J., Lampi, K., Hancock, N.T., Cath, T.Y., The sweet spot of forward osmosis: Treatment of produced water, drilling wastewater, and other complex and difficult liquid streams, *Desalination* (2013) in press.
- Coday, B.D. and Cath, T.Y., Forward osmosis: Novel desalination of produced water and fracturing flowback, *Journal AWWA* (2013) in press.
- Xu, P., Capito, M., Cath, T.Y., Selective removal of arsenic and monovalent ions from brackish water reverse osmosis concentrate, *Journal of Hazardous Materials*, 260 (2013) 885– 891.
- Vuono, D., Henkel, J., Benecke, J., Cath, T.Y., Reid, T., Johnson, L., Drewes, J.E., Flexible hybrid membrane treatment systems for tailored nutrient management: A new paradigm in urban wastewater treatment, *Journal of Membrane Science*, 446 (2013) 34-41.
- Klaysom, C., Cath, T.Y., Depuydt, T., Vankelecom, I.F.J., Forward and pressure retarded osmosis: Potential solutions for global challenges in energy and water supply, *Chemical Society Reviews*, 42 (2013) 6959-6989.
- Hancock, N.T., Xu, P., Roby, M.J., Gomez, J.D., and Cath, T.Y., Towards direct potable reuse with forward osmosis: Technical assessment of long-term process performance at the pilot scale, *Journal of Membrane Science*, 445 (2013) 34-46.
- Xu, P., Cath, T.Y., Robertson, A.P., Reinhard, M., Leckie, J.O., Drewes, J.E., Critical review of desalination concentrate management, treatment and beneficial use, *Environmental Engineering Science*, (2013) in press.
- Coday, B., Heil, D.M., Xu, P., **Cath, T.Y.**, The effects of transmembrane hydraulic pressure on performance of forward osmosis membranes, *Environmental Science and Technology*, 47 (5), (2013) 2386–2393.
- Siegrist, R.L., McCray, J.E., Lowe, K.S., **Cath, T.Y.**, Munakata-Marr, J, Onsite and decentralized Wastewater Systems: Advances from a decade of research and educational efforts, *WATER*, February 2013.
- **Cath, T.Y.**, Elimelech, M., McCutcheon, J.R., McGinnis, R.L., Achilli, A., Anastasio, D., Brady, A.R., Childress, A.E., Farr, I.V., Hancock, N.T., Lampi, J., Nghiem, L.D., Xie, M., Yip, N.Y., Standard methodology for evaluating membrane performance in osmotically driven membrane processes, *Desalination*, 312 (2013) 31-38.
- Hickenbottom, K.L., Hancock, N.T., Hutchings, N.R., Appleton, E.W., Beaudry, E.G., Xu, P., **Cath, T.Y.**, Forward osmosis treatment of drilling mud and fracturing wastewater from oil and gas operations, *Desalination*, 312 (2013) 60-66.
- Hancock, N.T., Black, N., **Cath, T.Y.**, Life cycle assessment of hybrid osmotically driven membrane processes for seawater desalination and wastewater reclamation, *Water Research*, 46 (4) (2012) 1145–1154.
- Hancock, N.T., Phillip, W., Elimelech, M., and **Cath, T.Y.**, Modeling bi-directional solute permeation in osmotically driven membrane processes, *Environmental Science and Technology*, 45 (24) (2011) 10642–10651.
- Nghiem, L.D., Hildinger, F., Hai, F.I., **Cath, T.Y.**, Treatment of saline aqueous solutions using direct contact membrane distillation, *Desalination and Water Treatment*, 32 (2011) 234–241.
- Hancock, N.T., Xu, P., Heil, D.M., Bellona, C., and **Cath, T.Y.**, A comprehensive bench- and pilot-scale investigation of trace organic compound rejection by forward osmosis, *Environmental Science and Technology*, 45 (19) (2011) 8483-8490.

- **Cath, T.Y.**, Drewes, J.E., Lundin, C.D., Hancock, N.T., Forward osmosis–reverse osmosis process offers a novel hybrid solution for water purification and reuse, *IDA Journal on Desalination and Water Reuse*, Fourth Quarter 2010, January 2011.
- Nghiem, L.D., **Cath, T.Y.**, Membrane scaling and a mitigation approach during direct contact membrane distillation, *Separation and Purification Technology*, 80 (2) (2011) 315-322.
- **Cath, T.Y.**, Hancock, N.T., Lundin, C.D., Hoppe-Jones, C., and Drewes, J.E., A multi barrier hybrid osmotic dilution process for simultaneous desalination and purification of impaired water, *Journal of Membrane Science*, 362 (2010) 417–426.
- **Cath, T.Y.**, Osmotically and thermally driven membrane processes for enhancement of water recovery in desalination processes, *Desalination and Water Treatment*, 15 (2010) 279-286.
- Achilli, A., **Cath, T.Y.**, and Childress, A.E., Inorganic compound based draw solutions for forward osmosis applications, *Journal of Membrane Science*, 364 (1-2) (2010) 233-241.
- Hancock, N.T. and **Cath, T.Y.**, Solute coupled diffusion in osmotically driven membrane processes, *Environmental Science and Technology*, 43 (17) (2009) 6769-6775.
- Achilli, A., Cath, T.Y., and Childress, A.E., Power generation with pressure retarded osmosis: An experimental and theoretical investigation, *Journal of Membrane Science*, 343 (2009) 42-52.
- Martinetti, C.R., Childress, A.E., and **Cath, T.Y.**, Advanced membrane processes for desalination of concentrated RO brines, *Journal of Membrane Science*, 331 (2009) 31-39.
- Achilli, A., Cath, T.Y., Marchand, E.A., and Childress, A.E., The forward osmosis membrane bioreactor: A low fouling alternative to MBR processes, *Desalination*, 239 (2009) 10-21.
- Holloway, R.W., Childress, A.E., Dennett, K.E., and **Cath, T.Y.**, Forward osmosis for concentration of centrate from anaerobic digester, *Water Research*, 41 (17) (2007) 4005-4014.
- Mortensen, E., **Cath, T.Y.**, Brant, J.A., Dennett, K., and Childress, A.E., Evaluation of membrane processes for reducing total dissolved solids discharged to the Truckee River, *Journal of Environmental Engineering*, 133 (12) (2007) 1136-1144.
- **Cath, T.Y.**, Childress, A.E., and Elimelech, M., Forward Osmosis: Principles, Applications, and Recent Developments, *Journal of Membrane Science*, 281 (1-2) (2006) 70-87.
- Cartinella, J.L., **Cath, T.Y.**, Flynn, M.T., Miller, G.C., Hunter, K.W., and Childress, A.E., Removal of natural steroid hormones from wastewater using membrane contactor processes, *Environmental Science and Technology*, 40 (23) (2006) 7381-7386.
- **Cath, T.Y.**, Adams, V.D., and Childress, A.E., Membrane contactor processes for wastewater reclamation in space. II. Combined direct osmosis, osmotic distillation, and membrane distillation for treatment of metabolic wastewater, *Journal of Membrane Science*, 257 (1-2) (2005) 85-98.
- **Cath, T.Y.**, Gormly, S., Adams, V.D., Beaudry, E.G., Flynn, M.T., and Childress, A.E., Membrane contactor processes for wastewater reclamation in space. I. Direct osmotic concentration as pretreatment for reverse osmosis, *Journal of Membrane Science*, 257 (1-2) (2005) 111-119.
- **Cath, T.Y.**, Adams, V.D., and Childress, A.E., Experimental study of desalination using direct contact membrane distillation: A new approach to flux enhancement, *Journal of Membrane Science*, 228 (1) (2004) 5-16.

Paper in editorial-reviewed periodicals, published

- Drewes, J.E., Hancock, N.T., Benko, K.L., Dahm, K., Xu, P., Heil, D., **Cath, T.Y.**, Treatment of coalbed methane produced water, *Exploration & Production/Oil and Gas Review*, 7 (2) (2009) 126-128.
- **Cath, T.Y.**, Membrane systems, *Water Environment & Technology (WET) / Small Communities*, 21 (1) (2009).

Papers submitted to peer-reviewed journals

- Plumlee, M.H., Debroux, J-F, Taffler, D., Mayer, X., Dahm, K.G., Hancock, N.T., Guerra K.L., Xu, P., Drewes, J.E., Cath, T.Y., Coalbed methane produced water screening tool for treatment technology and beneficial use, *Journal of Unconventional Oil and Gas Resources*, (2013) in review.
- Hickenbottom, K.L., Cath, T.Y., Sustainable operation of membrane distillation for enhancement of mineral recovery from hypersaline solutions, *Journal of Membrane Science* (2013) in review.
- Coday, B.D., Yaffe, B.G.M, Xu, P., Cath, T.Y., Rejection of trace organic compounds by forward osmosis membranes: A literature review, *Environmental Science and Technology* (2013) in review.
- Lin, S. Yip, N.Y., Cath, T.Y., Osuji, C.O., Elimelech, M., Hybrid pressure retarded osmosis – membrane distillation system for power generation from low-grade heat: Thermodynamic analysis and energy efficiency, *Environmental Science and Technology* (2013) in review.

Conference proceedings (over 40) <http://inside.mines.edu/~tcath/publications/>

- **Cath, T.Y.**, Osmotically and thermally driven membrane processes (Invited Talk), proceedings of the 11th Annual Israel Desalination Society Conference, “Osmotic processes – past, present and future.” In memory of Prof. Sidney Loeb (1916-2008), December 14, 2009, Ben-Gurion University, Sede-Boqer Campus, Israel. Invited Presentation.

Conference presentations (over 110)

- **Cath, T.Y.**, Osmotically driven membrane processes: Early concepts, current research, and future integrated systems, Environmental Engineering Seminar Series, UCLA, April 17, 2012. Invited Presentation.
- **Cath, T.Y.**, Reinventing the Nation’s Urban Water Infrastructure (ReNUWIt): A new NSF Engineering Research Center and the case for tailored water reuse, Colorado Environmental Health Annual Education Conference, Keystone, CO, September 26-28, 2012. Invited Presentation.
- **Cath, T.Y.**, An integrated framework for treatment & management of CBM produced water, RPSEA Onshore Production Conference, Golden, CO, November 30, 2011. Invited Presentation.
- **Cath, T.Y.**, An integrated framework for treatment & management of CBM produced water, *EUCI Workshop: Produced Water from Oil and Gas Operations: The Legal and Regulatory Framework*, Denver, CO, July 25-26, 2011. Invited Presentation.
- **Cath, T.Y.**, Drewes, J.E., Xu, P., Hancock, N.T., Dahm, K.G., Guerra, K.L., Heil, D.M., An integrated framework for treatment & management of CBM produced water, *2011 Colorado RPSEA team Piceance Basin Tight Gas Research Review*, Denver, CO, April 21, 2011. Invited Presentation.
- **Cath, T.Y.**, Drewes, J.E., Xu, P., Hancock, N.T., Dahm, K.G., Guerra, K.L., Heil, D.M., An integrated framework for treatment & management of CBM produced water, *RPSEA Unconventional Gas Conference 2011: Technological Keys to Unlocking Additional Reserves*, Denver, CO, April 19-20, 2011. Invited Presentation.
- **Cath, T.Y.**, Novel hybrid forward osmosis process for drinking water augmentation, *Multi State Salinity Coalition 2011 Salinity Summit*, Meeting Water Challenges, Old & New: “The Demand from a Thirsty Nation”, San Antonio, TX, February 17-18, 2011. Invited Presentation.
- **Cath, T.Y.**, Wastewater mining & energy recovery: A novel dual barrier membrane hybrid system and the future of direct potable reuse, *Colorado Professionals in Onsite Wastewater (CPOW) Annual Meeting*, Denver, CO, January 20-21, 2011. Invited Presentation.
- **Cath, T.Y.**, Osmotically driven membrane processes for enhancement of water recovery in wastewater treatment and desalination, the 2nd *Osmosis Membrane Summit*, July 11-12, 2010, San Diego, California. Invited Presentation.

- **Cath, T.Y.**, An integrated MBR-SBR wastewater treatment process for the industry and for small communities: A new MBR research facility at Colorado School of Mines, *Third Annual PWO Industrial Wastewater Treatment Seminar: Sustainability, Operations, and Waste Minimization*, March 25, 2010, Golden CO. Invited Presentation.
- Hancock, N.T and **Cath, T.Y.**, A novel dual barrier membrane hybrid and the future of direct potable reuse, *Third Annual PWO Industrial Wastewater Treatment Seminar: Sustainability, Operations, and Waste Minimization*, March 25, 2010, Golden CO. Invited Presentation.
- **Cath, T.Y.**, Osmotically driven membrane processes: past, present, and future, *Southwest Membrane Operator Association (SWMOA) 2010 Annual Symposium*, February 22-25, 2010, Phoenix, AZ. Invited Presentation.
- **Cath, T.Y.**, Novel membrane technology for pretreatment of impaired water, *2009 Colorado Industrial Pretreatment Coordinators Association (CIPCA) Annual Fall Workshop*, October 15, 2009, Northglenn, CO. Invited Presentation.
- **Cath, T.Y.** and Hancock, N.T., Osmotically driven membrane processes: applications and characterization of solute transport, *2008 International Congress on Membranes and Membrane Processes (ICOM 2008)*, July 12-18, 2008, Honolulu, Hawaii. **Invited keynote.**
- **Cath, T.Y.**, Challenges of using unconventional water resources in the arid west, the *Transatlantic Water Symposium*, March 31-April 1, 2008, Baton Rouge, Louisiana. Invited Presentation.
- **Cath, T.Y.**, Novel membrane contactor processes for industrial wastewater reclamation and for desalination, *PWO Industrial Wastewater Treatment Seminar Operations, Waste Minimization, Reuse and Recycling*, March 27, 2008, Golden CO. Invited Presentation.
- **Cath, T.Y.**, The role of membrane contactors in traditional and new applications, *Van Tuyl Lecture Series*, April 5, 2007, Golden, Colorado. Invited Presentation.

Technical reports

- “Assessment of Osmotic Mechanisms Pairing Desalination Concentrate and Wastewater Treatment.” Final Report to Texas Water Development Board. With Robert Huehmer (CH2M Hill). July 2011.
- Drewes, J.E., **Cath, T.Y.**, Xu, P., Hancock, N.T., Benko, K.L., “An integrated framework for treatment and management of produced water: Technical assessment of produced water treatment technologies” (1st Edition), Report Submitted to DOE/RPSEA, November 2009.
- **Cath, T.Y.**, Drewes, J.E., and Lundin, C.D. (2009), “A novel hybrid forward osmosis process for drinking water augmentation using impaired water and saline water sources,” Final Report, Water Research Foundation (formerly AwwaRF) (Project #4150), Denver, Colorado.
- Xu, P., **Cath, T.Y.**, Wang, G., Drewes, J.E., Ruetten, J., and Dolnicar, S. (2009), “Critical assessment of implementing desalination technologies,” Final Report, Water Research Foundation (formerly AwwaRF) (Project #4006), Denver, Colorado.
- Childress, E.A., and **Cath, T.Y.** (2008), a chapter in: “Evaluation and selection of available processes for a zero-liquid discharge system for the Perris, California, ground water basin,” US Department of the Interior/Bureau of Reclamation, Desalination and Water Purification Research and Development Program Report No. 149, April 2008.

MEMBERSHIP IN PROFESSIONAL SOCIETIES

- Association of Environmental Engineering and Science Professors (AEESP)
- American Water Works Association (AWWA)
- American Chemical Society (ACS)
- North American Membrane Society (NAMS)
- Water Environment Federation (WEF)
- WaterReuse Association (WRA)

- WateReuse Colorado (WRCO)

PROFESSIONAL ACTIVITIES AND SERVICES

Editorial Boards

- IDA Journal of Desalination and Water Reuse – Editor

Reviewer for scholarly journals

- Chemical Society Reviews
- CLEAN Soil, Air, Water
- Desalination
- Environmental Science and Technology
- Industrial & Engineering Chemistry Research
- Journal of Environmental Engineering and Science
- Journal of Environmental Monitoring
- Journal of Membrane Science
- Sensors and Actuators A: Physical
- Separation and Purification Technology
- Water Environment Research
- Water Research

Reviewer of Proposals

- National Science Foundation
- US Department of Energy/RPSEA
- The Technology Foundation STW (the Dutch Research Council)
- Rothschild Foundation
- US Department of Agriculture
- KAUST

Scientific advisor

- Board member, **WateReuse Colorado** (2008-2012)
- Treasurer, **WateReuse Colorado** (2010-2012)
- Advisory Board member, **Water Innovations Alliance** (2008-2010)
- Scientific Board member, **Oasys Water** (2009-present)
- Scientific Board member, **BioVantage Resources** (2010-2012)
- Technical advisor, **Healing Water International** (2008-2010)

TEACHING

Recent courses delivered at CSM

- CEEN 470 Water and Wastewater Unit Processes
- ESGN/EGGN 453 Water and Wastewater Treatment Unit Operations
- ESGN/EGGN 454 Water Supply Engineering
- ESGN 504 Water and Wastewater Treatment
- ESGN 530 Environmental Engineering Pilot Plant Laboratory
- ESGN 506 Advanced Water Treatment Processes (co-teach with Dr. Drewes)
- EGGN 335 Environmental Field Session