

# Largus T. Angenent, Ph.D.

## **Contact Information**

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Associate Professor  
Cornell University  
Department of Biological and Environmental Engineering  
Field of Microbiology  
Director, Agricultural Waste Management Lab  
CCSF Faculty Fellow  
214 Riley-Robb Hall  
Ithaca, NY 14850  
Tel: +1-607-255-2480  
Fax: +1-607-255-4080  
E-mail: la249@cornell.edu  
Web: <http://angenent.bee.cornell.edu>

## **Main Research Interests**

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- *Bioenergy*: Optimizing biological anaerobic fermentation processes to foster undefined mixed cultures that convert organic wastes into bioenergy carriers, such as methane, electrical current, hydrogen, or precursors for the liquid biofuel butanol. In this area, my lab focuses on improving the performance and stability of anaerobic digesters, on novel microbial fuel cell configurations, and on the optimization of anaerobic fermentation or respiration. When necessary, molecular biology techniques are used in conjunction with long-term bioreactor studies.
- *Bioaerosols*: Using molecular biology techniques to unravel the composition of bioaerosols and designing engineering controls to reduce the exposure of bioaerosols to humans.

## **University Education**

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### **Post-Doc. Environmental Engineering/Molecular Biology, 2002**

University of Colorado at Boulder, Boulder, Colorado, USA  
Advisors: Mark T. Hernandez and Norman R. Pace

### **Post-Doc. Environmental Engineering, 2000**

University of Illinois at Urbana-Champaign, Urbana, Illinois, USA  
Advisor: Lutgarde Raskin

### **Ph.D. Environmental Engineering, 1998**

Iowa State University, Ames, Iowa, USA  
Thesis Title: Development of a new high-rate anaerobic process for the treatment of industrial and domestic wastewaters: the Anaerobic Migrating Blanket Reactor (AMBR).  
Advisors: Richard R. Dague and Shihwu Sung

### **M.S. Environmental Technology/Microbiology, 1994**

Wageningen University (formerly Wageningen Agricultural University), Wageningen, The Netherlands  
Thesis Title 1: The influence of pH on competition between sulfate reducing bacteria and methanogens in laboratory-scale UASB reactors.  
Advisors: Gatze Lettinga, Look W. Hulshoff Pol and André Visser  
Thesis Title 2: Enrichment studies on anaerobic, monochlorophenol-degrading bacteria.  
Advisors: Alphons J. M. Stams and Karin A. Ennik-Maarsen

### **B.S. Environmental Sciences, 1992**

Wageningen University, Wageningen, The Netherlands

### **Professional Experience**

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- Aug. 2008-present Associate Professor in the Department of Biological and Environmental Engineering, Cornell University.
- Aug. 2008-Aug. 2009 Adjunct Professor in the Department of Energy, Environmental & Chemical Engineering, Washington University in St. Louis.
- Aug. 2002-July 2008 Assistant Professor in the Department of Energy, Environmental & Chemical Engineering (formerly the Department of Chemical Engineering and Environmental Engineering Science Program), Washington University in St. Louis.
- Jan. 1999-May 1999 Visiting Lecturer at the University of Illinois at Urbana-Champaign in the Department of Civil and Environmental Engineering.

### **US Patents**

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- Co-inventor US Patent No. 5,885,460: "Anaerobic Migrating Blanket Reactor" issued on March 23, 1999
- Co-inventor US Patent Application: "Upflow Microbial Fuel Cell" deposited on December 30, 2005.

### **Awards and Honors**

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- Kavli Fellow, U.S. National Academy of Sciences, 2008
- Excellence in Review Award, *Environmental Science & Technology*, 2007
- NSF CAREER award, U.S. National Science Foundation, 2007
- GE Scholar, The Academy for Excellence in Engineering Education, Engineering College, University of Illinois at Urbana-Champaign, USA, 1999

### **Awards with Students**

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- Jeffrey J. Fornero, First place in poster competition for Architecture/Materials division, Microbial Fuel Cells - First International Symposium, Penn State University, May 27-29, 2008.
- Sarah Dryden Perkins, Recipient of the 2005 National Science Foundation Graduate Research Fellowship Award.

### **Journal Publications**

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1. Fornero J. J., Rosenbaum M. and Angenent L. T. (2010). Electric power generation from municipal, food, and animal wastewaters using microbial fuel cells. Accepted for *Electroanalysis*.
2. Briones A. M., Daugherty B. J., Angenent L. T., Rausch K. D., Tumbleson M. E. and Raskin L. (2009). Characterization of microbial trophic structures of two anaerobic bioreactors processing sulfate-rich waste streams. In press. *Water Research*, Vol. 43, No. 18, pp. 4451-4460.
3. Perkins S. D., Mayfield J., Fraser V. and Angenent L. T. (2009). Potential pathogenic bacteria in shower water and air of a bone marrow transplant unit. *Applied and Environmental Microbiology*, Vol. 75, No. 16, pp. 5363-5372.
4. Kettleson E. M., Ramaswami B., Hogan C. J., Lee M.-H., Statyukha G. A., Biswas P. and Angenent L. T. (2009). Airborne virus capture and inactivation by an electrostatic particle collector. *Environmental Science and Technology*, Vol. 43, No. 15, pp. 5940-5946.
5. Garcia M. L. and Angenent L. T. (2009) Interaction between temperature and ammonia in mesophilic digesters for animal waste treatment. *Water Research*, Vol. 43, No. 9, pp. 2373-2382.
6. He Z., Kan J., Mansfeld F., Angenent L. T. and Nealson K.H. (2009). Self-sustained phototrophic microbial fuel cells based on the synergistic cooperation between photosynthetic microorganisms and heterotrophic bacteria. *Environmental Science and Technology*, Vol. 43, No. 5, pp. 1648-1654.

7. Fornero J. J., Rosenbaum M., Cotta M. A. and Angenent L. T. (2008). Microbial fuel cell performance with a pressurized cathode. *Environmental Science and Technology*, Vol. 42, No. 22, pp. 8578–8584.
8. Agler M. T., Garcia M. L., Lee E. S., Schlicher M. and Angenent L. T. (2008). Thermophilic anaerobic digestion to increase the net energy balance of corn grain ethanol. *Environmental Science and Technology*, Vol. 42, No. 17, pp. 6723-6729.
9. Angenent L. T., Mau M., George U., Zahn J. A. and Raskin L. (2008). Effect of the presence of the antimicrobial tylosin in swine waste on anaerobic treatment. *Water Research*, Vol. 42, No. 10-11, pp. 2377-2384.
10. Bocher B. T., Agler M. T., Garcia M. L., Beers A. R. and Angenent L. T. (2008). Anaerobic digestion of secondary residuals from an anaerobic bioreactor at a brewery to enhance bioenergy generation. *Journal of Industrial Microbiology and Biotechnology*, Vol. 35, No. 5, pp. 321-329.
11. Hoffmann R. A., Garcia M. L., Veskivar M., Karim K., Al-Dahhan M. H. and Angenent L. T. (2008). Effect of shear on performance and microbial ecology of continuously-stirred anaerobic digesters treating animal manure. *Biotechnology and Bioengineering*, Vol. 100, No. 1, pp. 38-48.
12. Angenent L. T. (2007). Energy biotechnology: beyond the general lignocellulose-to-ethanol pathway. *Current Opinion in Biotechnology*, Vol. 18, No. 3, pp. 1-2.
13. He Z., Shao H. and Angenent L. T. (2007). Increased power production from a sediment microbial fuel cell with a rotating cathode. *Biosensors and Bioelectronics*, Vol. 22, No. 12, pp. 3252-3255.
14. Steinhaus B., Garcia M. L., Shen A. Q. and Angenent L. T. (2007). A portable anaerobic microbioreactor reveals optimum growth conditions for the methanogen *Methanosaeta concilii*. *Applied and Environmental Microbiology*, Vol. 73, No. 5, pp. 1653-1658.
15. Yuan Z., Ramaswami B., Casaletto D., Falke S., Angenent L. T. and Giammar D. E. (2007). Evaluation of chemical indicators for tracking and apportionment of phosphorus sources to Table Rock Lake in Southwest Missouri. *Water Research*, Vol. 41, No. 7, pp. 1525-1533.
16. Briones A. M., Daugherty B. J., Angenent L. T., Rausch K. D., Tumbleson M. E. and Raskin L. (2007). Microbial diversity and dynamics in multi- and single-compartment anaerobic bioreactors processing sulfate-rich waste streams. *Environmental Microbiology*, Vol. 9, No. 1, pp. 93-106.
17. He Z. and Angenent L. T. (2006). Application of bacterial biocathodes in microbial fuel cells. *Electroanalysis*, Vol. 18, No. 19-20, pp. 2009-2015.
18. He Z., Wagner N., Minteer S. D. and Angenent L. T. (2006). The upflow microbial fuel cell with an interior cathode: assessment of the internal resistance by impedance spectroscopy. *Environmental Science and Technology*, Vol. 40, No. 17, pp. 5212-5217.
19. Dryden S. K.,\* B. Ramaswami,\* Yuan Z., Giammar D. E. and Angenent L. T. (2006). A rapid reverse transcription-PCR assay for F<sup>+</sup> RNA coliphages to trace fecal pollution in Table Rock Lake on the Arkansas-Missouri border. *Water Research*, Vol. 40, No. 20, pp. 3719-3724.
20. Zheng D., Angenent L. T. and Raskin L. (2006). Monitoring granule formation in anaerobic upflow bioreactors using oligonucleotide hybridization probes. *Biotechnology and Bioengineering*, Vol. 94, No. 3, pp. 458-472.
21. He Z., Minteer S. D. and Angenent L.T. (2005). Electricity generation from artificial wastewater using an upflow microbial fuel cell. *Environmental Science and Technology*, Vol. 39, No. 14, pp. 5262-5267.
22. Hogan C. J., Kettleson E. M., Lee M. -H., Ramaswami B., Angenent L. T. and Biswas P. (2005). Sampling methodologies and dosage assessment techniques for submicrometre and ultrafine virus aerosol particles. *Journal of Applied Microbiology*, Vol. 99, pp. 1422-1434.
23. Angenent L. T., Kelley S. T., St. Amand A., Pace N. R. and Hernandez M. T. (2005). Molecular identification of potential pathogens in water and air of a hospital therapy pool. *Proceedings of the National Academy of Sciences*, Vol. 102, No. 13, pp. 4860-4865.
24. Kujundzic E., Angenent L. T., Zander D. A., Henderson D. E., Miller S. L. and Hernandez M. T. (2005). Effects of ceiling-mounted HEPA-UV air filters on airborne bacteria concentrations in an indoor therapy pool building. *Journal of Air and Waste Management Association*, Vol. 55, pp. 210-218.

25. Angenent L. T., Karim K., Al-Dahhan M. H., Wrenn B. A. and Domínguez-Espinosa R. (2004). Production of bioenergy and biochemicals from industrial and agricultural wastewater. *TRENDS in Biotechnology*, Vol. 22, No. 9, pp. 477-485.
  26. Sonnenburg J.\*, Angenent L. T.\* and Gordon J. I. (2004). Getting a grip on things: how do communities of bacterial symbionts become established in our intestine? *Nature Immunology*, Vol. 5, No. 6, pp. 569-573.
  27. Kelley S. T., Theisen U., Angenent L. T., St. Amand A. and Pace N. R. (2004). Molecular analysis of shower curtain biofilm microbes. *Applied and Environmental Microbiology*, Vol. 70, No. 7, pp. 4187-4192.
  28. Angenent L. T., Sung S. and Raskin L. (2004). The formation of granules and *Methanosaeta* fibres in anaerobic migrating blanket reactor (AMBR). *Environmental Microbiology*, Vol. 6, No. 4, pp. 315-322.
  29. Angenent L. T., Zheng D., Sung S. and Raskin L. (2002). Microbial community structure and activity in a compartmentalized, anaerobic bioreactor. *Water Environment Research*. Vol. 74, No. 5., pp. 450-461.
  30. Angenent L. T., Abel S. and Sung S. (2002). Effect of an organic shock load on the stability of an anaerobic migrating blanket reactor. *Journal of Environmental Engineering*, Vol. 128, No. 12, pp. 1109-1120.
  31. Angenent L. T., Sung S. and Raskin L. (2002). Methanogen population dynamics during startup of a full-scale anaerobic sequencing batch reactor treating swine waste. *Water Research*. Vol. 36, No. 18, pp. 4648-4654.
  32. Angenent L. T., Banik G. C. and Sung S. (2001). Anaerobic migrating blanket reactor treatment of low-strength wastewater at low temperatures. *Water Environment Research*, Vol. 73, No. 5, pp. 567-574.
  33. Angenent L. T. and Sung S. (2001). Development of anaerobic migrating blanket reactor (AMBR), a novel anaerobic treatment system. *Water Research*, Vol. 35, No. 7, pp. 1739-1747.
  34. Angenent L. T., Zheng D., Sung S. and Raskin L. (2000). *Methanosaeta* fibers in anaerobic migrating blanket reactors. *Water Science and Technology*, Vol. 41, No. 4-5, pp. 35-39.
  35. Angenent L. T., Sung S. and Dague R. R. (1998). Start up of the anaerobic migrating blanket reactor (AMBR) seeded with primary digester sludge. *Fluid/Particle Separation Journal*, Vol. 11, No. 1, pp. 55-61.
- \*Contributed equally

## **Book Chapters**

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1. Angenent L. T. and Wrenn B. A. (2008). Optimizing mixed-culture bioprocesses to convert wastes into biofuels (chapter 15, pp. 179-194). In: *Bioenergy*. Eds.: Wall J. D., Harwood, C. S. and Demain, A. ASM Press, Washington, DC.
2. Rosenbaum M and Angenent L. T. Genetically modified microorganisms for bio-electrochemical system (Chapter 7). In: *Bioelectrochemical Systems: from extracellular electron transfer to biotechnological application*. Eds.: Rabaey K., Angenent L. T., Schröder U. and Keller J. International Water Association, London, UK. In Press.
3. Rosenbaum M, Agler M. T., Fornero J. J., Venkataraman A. and Angenent L. T. Integrating BES in the wastewater and sludge treatment line (Chapter 20). In: *Bioelectrochemical Systems: from extracellular electron transfer to biotechnological application*. Eds.: Rabaey K., Angenent L. T., Schröder U. and Keller J. International Water Association, London, UK. In Press.
4. Keller J., Rozendal R. A., Angenent L. T., Schröder U., Lens P., Rabaey K. Outlook: Research directions and new applications (Chapter 22). In: *Bioelectrochemical Systems: from extracellular electron transfer to biotechnological application*. Eds.: Rabaey K., Angenent L. T., Schröder U. and Keller J. International Water Association, London, UK. In Press.
5. Angenent L. T. and Scott N. R. Practical aspects of methane production from agricultural wastes (Chapter 14). In: *Biofuels from Agricultural Wastes and Byproducts*. Eds.: Blaschek H., Ezeji T. and Scheffran, J., Blackwell Publishing, Ames, IA. In press.

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### **Other Peer-Reviewed Publications**

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Angenent L. T., Ramaswami B., Dryden S., Falke S. R., Yuan Z., and Giammar D. E. (2006). *Evaluation of Chemical and Biological Indicators for Source Apportionment of Phosphorus in Table Rock Lake, on the Missouri-Arkansas Border*. Project No. WU-HT-03-00. Prepared for the National Decentralized Water Resources Capacity Development Project, Washington University, St. Louis, MO, by Washington University, St. Louis, MO.

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### **Non-Peer-Reviewed Publications**

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1. Garcia M. L., Dryden S. K. and Angenent L.T. (2008). Tratamento de residuo suíno em reatores de bateladas: desempenho e análise microbiana. *Revista Minerva*, Vol. 5, No. 3, pp. 241-247 (in Portuguese).
1. McMahon K. D., Gu A. Z. Nerenberg R. and Angenent L. T. (2007). Molecular methods in biological systems. *Water Environment Research*, Vol. 79, No. 10, Literature Review.
2. Angenent L. T., McMahon K. D., Gu A. Z. and Nerenberg R. (2006). Molecular methods in biological systems. *Water Environment Research*, Vol. 78, No. 6, Literature Review.
3. Angenent L. T., de Los Reyes F. L., Oerther D. B. and McMahon K. D. (2005). Molecular methods in biological systems. *Water Environment Research*, Vol. 77, No. 6, pp. 718-779, Literature Review.
4. de Los Reyes F. L., Oerther D. B. and Angenent L. T. (2004). Molecular methods in biological systems. *Water Environment Research*, Vol. 76, No. 6, Literature Review.
5. de Los Reyes F. L., Oerther D. B. and Angenent L. T. (2003). Molecular methods in biological systems. *Water Environment Research*, Vol. 75, No. 6, Literature Review.
6. Biswas P. and Angenent L. T. (2002). Electrotechnology countermeasures (Chapter 4), Conclusions and recommendations (Chapter 5), and Inactivation mechanisms of selected electrotechnologies (Appendix C). In: *Electrotechnologies for countering bioterrorism*, EPRI Technical Report 1006903, (Edited by Mezei, G. and Rohr, A.), Electric Power Research Institute, Palo Alto, CA.
7. Angenent L. T. and Kaal M. B. T. (1999). Swine waste gives energy, from biomass to methane. *Energie Techniek* (Energy Technology), Vol. 77, No. 7/8, pp. 382-384 (in Dutch).
8. Angenent L. T., Binnendijk K., Knot M., Richtert W. and Vervoordeldonk R. (1994). The problem of supplying energy in Northern Bohemia, Czech republic. In: *Environmental strategies and technology in the Czech republic*. (Edited by Leemans, M. J. P.), pp. 45-51, Wageningen Agricultural University (in Dutch).
9. Angenent L. T., Binnendijk K., Knot M., Richtert W. and Vervoordeldonk R. (1994). Ecological modernizing in the Czech republic. In: *Environmental strategies and technology in the Czech republic*. (Edited by Leemans, M. J. P.), pp. 53-64, Wageningen Agricultural University (in Dutch).

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### **Invited Seminars and Lectures**

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1. Undefined mixed cultures to convert organic waste into energy. Presented at the seminar series in the Environmental Engineering Program in the Department of Chemical Engineering at Yale University, New Haven, CT, April 14, 2009.
2. Nondefined mixed culture bioprocessing to convert organic waste into bioenergy. The Department of Chemistry and Biomolecular Science, Clarkson University, Potsdam, NY, December 15, 2008.
3. Nondefined mixed culture bioprocessing to convert organic waste into bioenergy. The department of Microbiology at Cornell University, December 4, 2008.
4. Nondefined mixed culture bioprocessing to convert organic waste into bioenergy. The department of Civil and Environmental Engineering at Cornell University, Ithaca, NY, September 25, 2008.

5. Electric power generation from municipal, food, and animal wastewaters using microbial fuel cells. Laboratory of Microbiology, Wageningen University, The Netherlands, May 14, 2008.
6. Electric power generation from municipal, food, and animal wastewaters using microbial fuel cells. The 2008 St. Louis Award Symposium, St. Louis section of the American Chemical Society, Department of Chemistry, St. Louis University, April 25, 2008.
7. Gene surveys to identify airborne bacteria. The Department of Molecular Microbiology at Washington University Medical School, St. Louis, MO, March 18, 2008.
8. Mixed cultures to generate bioenergy from waste. The department of Civil and Geological Sciences at Notre Dame University, South Bend, IN, November 29, 2007.
9. Mixed cultures to generate bioenergy from waste. The department of Biological and Environmental Engineering at Cornell University, Ithaca, NY, November 5, 2007.
10. Mixed cultures to generate bioenergy from waste. The department of Chemical and Biochemical Engineering at The University of Iowa, Iowa City, IA, October 11 2007.
11. Mixed cultures to generate bioenergy from waste. The Department of Civil and Environmental Engineering at Duke University, Durham, NC, May 24, 2007.
12. Mixed cultures to generate bioenergy from waste. The Department of Civil and Environmental Engineering at Northwestern University, Evanston, IL, April 27, 2007.
13. Mixed culture processing to convert wastewater into bioenergy. The Analytical Environmental Microbiology Applications Seminar, MIL, Inc., November 30, 2007.
14. Mixed culture processing to convert wastewater into bioenergy. The Missouri Water Environment Association (MWEA) Young Professional Lunch and Learn, St. Louis, MO, September 18, 2007.
15. Generating bioenergy from organic wastes: anaerobic digestion, microbial fuel cells, and biobutanol fermentation. Presented at the “Sustainable Energy” seminar: Faculté de l’Environnement Naturel, Architectural et Construit DECANAT (ENAC) at École Polytechnique Fédérale De Lausanne (EPFL), Switzerland, September 3, 2007.
16. Mixed culture bioprocessing of industrial and agricultural waste to generate energy. The Metropolitan Saint Louis Grants Conference. Research Day 2, Southern Illinois University Edwardsville, January 10, 2007.
17. From the gutter to the light switch: creating electricity with wastewater. Science Frontiers. Academy of Sciences – St. Louis and Skandalaris Center for Entrepreneurial Studies, Washington University in Saint Louis, November 29, 2006.
18. Making microbial fuel cells work: from reactor configurations to genes. The Biodesign Institute at Arizona State University, October 19, 2006, Tempe, AZ.
19. The upflow microbial fuel cell: simultaneous electricity generation and wastewater treatment. St. Louis AIChE chapter, March 15, 2006, St. Louis, MO.
20. The UMFC with an interior cathode. Sub-department of Environmental Technology, Wageningen University and Research Center, March 3, 2006.
21. Improving stability in anaerobic digestion for animal waste treatment by understanding microbial ecology. Genes to products: agricultural plant, microbe, and biobased product research. USDA, Cooperative State Research, Education, and Extension Service, February 27-28, 2006, Warrington, Virginia.
22. The upflow microbial fuel cell: simultaneous electricity generation and wastewater treatment. Environmental Engineering Program seminar series, Department of Civil and Environmental Engineering, University of Wisconsin – Madison, February 7, 2006.
23. Bacteriophages as surrogates for human viruses and biocontrol in environmental engineering studies. San Diego Microbiology Group, San Diego State University/University of California San Diego/The Scribbs Research Institute, La Jolla, CA, October 19, 2005.
24. From anaerobic digestion to microbial fuel cell research: the upflow microbial fuel cell. The Laboratory of Microbial Ecology and Technology, Ghent University, Belgium, August 4, 2005.
25. Microbial fuel cells (MFCs) – simultaneous wastewater treatment and energy production. Department of Chemical Engineering seminar series, University of Missouri at Rolla, Rolla, MO., December 3, 2004.

26. Electrotechnologies for reducing bioaerosol exposure in the indoor environment: HEPA-UV and corona soft-X-ray air purifiers. Air Quality, Health, and Risk, Electric Power Research Institute (EPRI), Palo Alto, CA, June 20, 2003.
27. Anaerobic digestion of swine waste and issues related to further disposal of the produced biosolids and effluent from the digester. National Risk Management Research Laboratory, US EPA, Cincinnati, OH, June 2, 2003.
28. Abundant mycobacteria in pool water and air of an indoor therapy pool. 1. Diagnostic Micro Journal Club, Washington University Medical School, St. Louis, MO., March 9, 2007.
29. Abundant mycobacteria in pool water and air of an indoor therapy pool. Department of Biology, Washington University in St. Louis, MO., January 13, 2003.
30. Abundant mycobacteria in pool water and air of an indoor therapy pool. Hospital Epidemiology Seminar Series, Infectious Diseases, Washington University Medical School, St. Louis, MO., October 29, 2002.
31. Abundant mycobacteria in pool water and air of an indoor therapy pool. Department of Biomedical Engineering, Washington University in St. Louis, MO., September, 13, 2002.
32. Anaerobic digestion and nutrient recovery as an on-farm, integral swine waste treatment system. Department of Civil Engineering seminar series, University of Missouri at Rolla, Rolla, MO., February 7, 2002.
33. From anaerobic waste treatment to bioaerosol testing: interfacing molecular tools with environmental engineering. Department of Civil and Environmental Engineering, University of Wisconsin-Madison, Madison, WI, July 25, 2001.
34. From anaerobic waste treatment to bioaerosol testing: interfacing molecular tools with environmental engineering. Environmental Engineering Science Program, Washington University in St. Louis, St. Louis, MO, July 19, 2001.
35. From anaerobic waste treatment to bioaerosol testing: interfacing molecular tools with environmental engineering. Department of Civil and Environmental Engineering and Center for Environmental Biotechnology, University of Tennessee at Knoxville, Knoxville, TN, July 9, 2001.

### **Invited Conference Presentations**

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1. Integrating BES in wastewater and sludge treatment flows – Second International Microbial Fuel Cell Conference on Waste to Energy, June 10-12, 2009, Gwangju Institute of Science and Technology (GIST), Gwangju City, The Republic of Korea.
2. Recovery of water in the corn-to-ethanol industry by integrating anaerobic digestion – Sixth International Starch Technology Conference, May 31-June 3, 2009, University of Illinois at Urbana-Champaign, Urbana, IL.
3. Conversion of organic waste to bioenergy. Alexander von Humboldt Foundation and U.S. National Academy of Sciences: 14<sup>th</sup> German-American Frontiers of Science Symposium, June 11-14, 2008, Potsdam, Germany.
4. Electric power generation from municipal, food, and animal wastewaters using microbial fuel cells. Microbial Fuel Cells - First International Symposium, Penn State University, May 27-29, 2008.
5. The Upflow Microbial Fuel Cell for wastewater treatment and electricity generation. The Knowledge Foundation's 8<sup>th</sup> Annual International Symposium on Small Fuel Cells, April 2 - 4, 2006, Washington DC, USA
6. Improving the power output of a continuously-fed microbial fuel cell. 2006 Pacific Rim Summit on Industrial Biotechnology and Bioenergy, January 11-13, 2006, Honolulu, HI.
7. Microbial fuel cells to simultaneously treat wastewater and produce electricity. 2005 Joint Meeting of the Missouri Branch of the American Society for Microbiology (ASM) and the Midwest Microbiology Educators, April 8, 2005, St. Louis MO.
8. Anaerobic migrating blanket reactor system. At: 35<sup>th</sup> annual ASCE environmental and water resources design conference, April 2-3, 1997, Iowa City, Iowa, USA.

9. Anaerobic migrating blanket reactor. At: 41st Great plains waste management conference, March 27, 1997, Omaha, Nebraska, USA.
10. Principles of the anaerobic migrating blanket reactor. At: 10th forum for applied biotechnology, 26-27 September, 1996, Gent University, Brugge, Belgium.

### **Papers in Conference Proceedings**

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1. Rosenbaum M. and Angenent L. T.\* (2009). A microbial fuel cell laboratory for freshmen undergraduate students. In: *Proc. of the 8<sup>th</sup> World Conference on Chemical Engineering*, August 23-27, 2009, Montréal, Quebec, Canada.
2. Rosenbaum M, Agler M. T., Fornero J. J., Venkataraman A. and Angenent L. T.\* (2009). Integrating BES in wastewater and sludge treatment flows. In: *Proc. of the 2<sup>nd</sup> International Microbial Fuel Cell Conference on Waste to Energy*, June 10-12, 2009, Gwangju Institute of Science and Technology (GIST), Gwangju City, The Republic of Korea.
3. Rosenbaum M.\*, Cotta M. A. and Angenent L. T. (2009). Efficiencies of bio-electrocatalytic production of hydrogen from lactate using *Shewanella oneidensis* MR-1. In: *Proc. of the 2<sup>nd</sup> International Microbial Fuel Cell Conference on Waste to Energy*, June 10-12, 2009, Gwangju Institute of Science and Technology (GIST), Gwangju City, The Republic of Korea.
4. Agler M. T., Wrenn B. A. and Angenent L. T.\* (2009). Recovery of water in the corn-to-ethanol industry by integrating anaerobic digestion. In: *Proc. of the 6th International Starch Technology Conference*, May 31-June 3, 2009, University of Illinois at Urbana-Champaign, Urbana, IL.
5. Garcia M. L., Dryden S. K. and Angenent L. T.\* (2007). Swine waste treatment with anaerobic sequencing batch reactors: performance and microbial community. In: *Proc. of the 2007 IWA, anaerobic digestion in mountain area and isolated rural zones workshop*, June 5-7, 2007, Chambéry, France.
6. He Z.\* and Angenent L.T. (2006). Upflow microbial fuel cell operation without a proton exchange membrane. In: *Proc. of the International Water Association World Water Congress and Exhibition*, September 10-14, 2006, Beijing, China.
7. Hoffmann R.\*, Garcia M. L., Veskiar M., Varma R., Karim K., Al-Dahhan M. H. and Angenent L. T. (2005). Effect of shear on performance and microbial ecology of completely-stirred anaerobic digesters treating animal manure. In: *Proc. of the Animal Agriculture and Processing: Managing Environmental Impacts Conference*, Aug. 31 – Sept. 2, 2005, St. Louis, MO, Air and Waste Management Association and Water Environment Federation.
8. Angenent L. T.\*, Sung S. and Raskin L. (2002). Methane yield and methanogen levels of ASBR systems treating swine waste: effect of different inocula. In: *Proc. of the VII Latin American Workshop and Symposium on Anaerobic Digestion (LAAD2002)*, October 22-25, Mérida, Yucatán, Mexico, pp. 253-260, International Water Association, London, UK.
9. Daugherty B. J.\*, Mori Y., Angenent L. T., Agbisit R., Rausch K., Tumbleson M. and Raskin L. (2002). Using biological processes to recover sulfur from corn processing industry waste streams. In: *CD-rom of the WEFTEC '02*, September 30 - October 3, 2002, Chicago, Illinois USA, Water Environment Federation, Alexandria, Virginia, USA.
10. Angenent L. T.\*, Mau M., Jindal A., George U., Zahn J. A. and Raskin L. (2001). Monitoring antibiotic resistance in biological waste treatment systems. In: *CD-rom of the WEFTEC '01, Molecular Techniques Session*, October 13-17, 2001, Atlanta, Georgia, USA, Water Environment Federation, Alexandria, Virginia, USA.
11. Angenent L. T.\*, Sung S. and Raskin, L. (2001). Mixing intensity in anaerobic sequencing batch reactor affects reactor performance and microbial community structure. In: *Proc. of the Anaerobic Digestion 9<sup>th</sup> World Congress*, Part 1, pp. 267-274, September 2-6, 2001, Antwerp, Belgium. International Water Association, London, UK.
12. Angenent L. T., Sung S. and Raskin, L. (2001). Methanogenic population dynamics during startup of a full-scale anaerobic sequencing batch reactor treating swine waste. In: *Proc. of the Anaerobic Digestion 9<sup>th</sup> World Congress*, Part 2, pp. 365-368, September 2-6, 2001, Antwerp, Belgium. International Water Association, London, UK.

13. Angenent L. T.\*, Banik G. C. and Sung S. (2000). Psychrophilic anaerobic pretreatment of low-strength wastewater using the anaerobic migrating blanket reactor. In: *CD-rom of the WEFTEC'00*, October 14-18, 2000, Anaheim, California, USA, Water Environment Federation, Alexandria, Virginia, USA.
14. Angenent L. T.\*, Sung S. and Raskin L. (1999). Phosphorus removal and recovery from swine waste: Results of pretreatment with ASBRs. In: *CD-rom of the WEF Animal Residuals Management Conference*, November 14-16, 1999, Crystal City, Virginia, USA, Water Environment Federation, Alexandria, Virginia, USA.
15. Angenent L. T.\*, Mau M., Zheng D., Sung S. and Raskin L. (1999). Microbial structure of granules and *Methanosaeta* fibers in anaerobic migrating blanket reactors. In: *Proc. of the IAWQ/IWA Conference on Biofilm Systems*, pp. 88-91, October 17-20, 1999, New York, New York, USA, International Association on Water Quality/International Water Association, London, UK.
16. Angenent L. T.\*, Sung S. and Raskin L. (1999). Phosphorus removal and recovery from the effluent of an anaerobic sequencing batch reactor treating swine waste. In: *CD-rom of the WEF/Purdue Industrial Waste Technical Conference*, June 27-30, 1999, Indianapolis, Indiana, USA, Water Environment Federation, Alexandria, Virginia, USA.
17. Angenent L. T.\*, Sung S. and Dague R. R. (1997). Start-up and granulation of the anaerobic migrating blanket reactor (AMBR). In: *Proc. of the WEFTEC'97*, No. 1, pp. 113-124, October 18-22, 1997, Chicago, Illinois, USA, Water Environment Federation, Alexandria, Virginia, USA.
18. Angenent L. T.\*, Sung S. and Dague R. R. (1997). Start-up of the anaerobic migrating blanket reactor (AMBR) seeded with primary digester sludge. In: *Proc. of the AFS97; Advances in Filtration and Separation Technology*, (Edited by Bauman E. R. and Weisert L.), Vol. 11, pp. 602-607, April 29-May 2, 1997, Minneapolis, Minnesota, USA, The American Filtration and Separations Society, Northport, Alabama, USA.
19. Angenent L. T., Sung S. and Dague R. R. (1997). Granulation and start-up of the anaerobic migrating blanket reactor process. In: *Proc. 8th International Conference on Anaerobic Digestion*, Sendai, Japan, May 1997, No. 3, pp. 182-185.
20. Flamming J. J.\*, Angenent L. T., Sung S. and Dague R. R. (1997). Treatability studies of a combined industrial wastewater stream using the anaerobic migrating blanket reactor. In: *Proc. of 52nd Purdue Industrial Waste Conference* (Edited by Alleman J. E. and Butz R.), pp. 289-303, May 5-7, 1997, Ann Arbor Press, Chelsea, Michigan, USA.
21. Angenent L. T.\* and Dague R. R. (1996). Initial studies on the anaerobic migrating blanket reactor. In: *Proc. of 51st Purdue Industrial Waste Conference* (Edited by Dalton C. S. and Wukasch R. F.), pp. 271-288, May 6-8, 1996, Purdue University, West Lafayette, Indiana, USA, Ann Arbor Press, Chelsea, Michigan, USA.
22. Angenent L. T.\* and Dague R. R. (1995). A laboratory-scale comparison of the UASB and ASBR processes. In: *Proc. of 50th Purdue Industrial Waste Conference* (Edited by Dalton C. S. and Wukasch R. F.), pp. 365-377, May 8-10, 1995, Purdue University, West Lafayette, Indiana, USA, Ann Arbor Press, Chelsea, Michigan, USA.
23. Angenent L. T.\* and Dague R. R. (1996). Principles of the anaerobic migrating blanket reactor. In: *Med. Fac. Landbouww. Univ. Gent*, Vol. 61, No. 4b, pp. 2077-2084.

\* Presenter for podium presentation

### **Abstracts and Posters at Conferences**

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1. Fornero J. J., Rosenbaum M., Cotta M. A. and Angenent L. T. (2009). Ion exchange membrane influence on ohmic resistance. 2<sup>nd</sup> International Microbial Fuel Cell Conference on Waste to Energy, June 10-12, 2009, Gwangju Institute of Science and Technology (GIST), Gwangju City, The Republic of Korea.
2. Heger S., Winkens K., Schneider A., Brinkmann M., Maletz S., Wölz J., Agler M. T., Angenent L. T., Seiler T. B. and Hollert H. (2009). Assessing the ecotoxicological effects of bioenergy

- extraction processes. 2009 Europe Annual Meeting of the Society of Environmental Toxicology and Chemistry (SETAC), 31 May - 4 June, 2009, Gothenburg, Sweden.
3. Venkataraman A., Arends J. B. A., Rosenbaum M. and Angenent L. T. (2009). *Pseudomonas aeruginosa* in bioelectrochemical systems (BESs) - a characterization of mutants. 109th General Meeting of the American Society of Microbiology, May 17-21, 2009, Philadelphia, PA.
  4. Rosenbaum M.\*, Barron B., Balcerzak P. and Angenent L.T. (2009). Microbial fuel cells as versatile science teaching tools. 2009 Institute of Biological Engineering IBE Annual Conference, March 19-21 2009, Santa Clara, CA.
  5. Agler M. T.\*, Iten L. B., Qureshi N., Cotta M. A., Dien B. and Angenent L. T. (2009). Use of nondefined mixed cultures for anaerobic conversion of lignocellulosic corn fiber to n-butyrate. 2009 Institute of Biological Engineering IBE Annual Conference, March 19-21 2009, Santa Clara, CA.
  6. Agler M. T., Iten L. B., Qureshi N., Cotta M. A., Dien B. and Angenent L. T. (2008). Mixed-community bioreactors to convert (ligno)cellulosic feedstocks into liquid biofuels. 2008 Northeast Renewable Energy Conference. August 26-28, 2008, State College, PA.
  7. Fornero J. J., Rosenbaum M., Cotta M. A. and Angenent L. T. (2008). Microbial fuel cell performance with a pressurized cathode. Microbial Fuel Cells-First International Symposium. May 26-29, 2008, Pennsylvania State University, State Collage, PA.
  8. Rosenbaum M., Cotta M. A. and Angenent L. T. (2008). Synergetic effects of microbial binary cultures on microbial fuel cell performance. Microbial Fuel Cells-First International Symposium, May 26-29 2008, Pennsylvania State University, State Collage, PA.
  9. Rosenbaum M., Frawley E. R., Lee R. E., Angenent L. T. and Kranz R. G. (2008). Recombinant engineering of *Shewanella oneidensis* MR-1 c-type cytochromes in *Escherichia coli*. 108<sup>th</sup> General Meeting of the American Society for Microbiology, June 1-5 2008, Boston, MA.
  10. Perkins S. D., Mayfield J., Fraser V. and Angenent L. T. (2008). Effectiveness of membrane-integrated filters to decrease microbial counts in shower-generated aerosols on a blood and marrow transplant unit. 2008 Annual Scientific Meeting of the Society for Healthcare Epidemiology of America. April 5-8, 2008, Orlando, FL.
  11. Garcia M. L.\*, Dryden S. K. and Angenent L. T. (2008). Treating swine waste with anaerobic sequencing batch reactors: performance and microbial community. 2008 Institute of Biological Engineering Annual Meeting, March 6-9, 2008, Chapel Hill, NC.
  12. Agler M. T.\*, Garcia M. L. and Angenent L. T. (2008). Conversion of thin stillage from corn-to-ethanol dry mills into biogas to offset natural gas consumption. 2008 Institute of Biological Engineering Annual Meeting, March 6-9, 2008, Chapel Hill, NC.
  13. Rosenbaum M., Cotta M. A. and Angenent L. T. (2008). Teamwork in microbial fuel cells: symbiotic conversion of sugars into electricity. Gordon Research Conference on Electrochemistry, January 14-19, 2008, Ventura, CA.
  14. He Z., Martens E.C., Gordon J. I. and Angenent L. T. (2007). Functional genomic studies of electricity generation by *Bacteriodes thetaiotaomicron*. 2007 Institute of Biological Engineering Annual Meeting, March 30-April 1, 2007, St. Louis, MO.
  15. Dryden S. K.\*, Ramaswami B., Yuan Z., Giammar D. E. and Angenent, L. T. (2007). Coliphages to Trace Fecal Pollution in the Table Rock Watershed. 2007 MWEA-AWWA Joint Annual Meeting, March 25-28, 2007, Osage Beach, MO.
  16. He Z. and Angenent L. T. (2006). Selecting a microbiota with a high electron transfer rate in the Upflow Microbial Fuel Cell (UMFC). 106<sup>th</sup> General Meeting of the American Society for Microbiology, Orlando, FL, May 21-25, 2006.
  17. Steinhaus B., Garcia M. L., Shen A. Q. and Angenent L. T. (2006). Using microfluidics to study the optimal growth conditions of pure cultures of *Methanosaeta concilii*. 106<sup>th</sup> General Meeting of the American Society for Microbiology, Orlando, FL, May 21-25, 2006.
  18. He Z. and Angenent L. T.\* (2006). The Upflow Microbial Fuel Cell: simultaneous electricity generation and wastewater treatment. ICE, International Conference on Bioenergy: From Concept to Commercial Processes, Tomar, Portugal March 5-10, 2006.

19. Steinhaus B.\*, Shen A. and Angenent L. (2005). Growth and analysis of anaerobic wastewater methanogens using microfluidics. 58<sup>th</sup> Meeting of the Division of Fluid Dynamics, November 20-22, Chicago, IL, American Physical Society, College Park, MD.
20. Kettleson E. M.\*, Ramaswami B., Hogan Jr. C. J., Lee M., Biswas P., and Angenent L. T. (2005). Inactivation of virus aerosol particles in an electrostatic precipitator. 24th Annual Conference, pp.108, October 17-21, 2005, Austin, TX, American Association for Aerosol Research (AAAR), Mt. Laurel, NJ.
21. Giammar D.\*, Yuan Z., Ramaswami B., Falke S., Angenent L., and Casaletto D. (2005). Evaluation of chemical and biological indicators for centralized and decentralized wastewater treatment source inputs at Table Rock Lake. 2005 Missouri Water Environment Association Annual Meeting, March 19-22, 2005, Osage Beach, MO.
22. Hoffmann R., Veskiyar M., Varma R., Karim K., Angenent L. T., and Al-Dahhan M. H.\* (2005). Effect of shear on performance and microbial community in anaerobic digesters treating cow manure. Fifth International Chemical Engineering Conference, Sept. 12-15, 2005, Amman, Jordan.
23. Angenent, L. T.\*, Kettleson E. M., Hogan Jr. C. J., Lee M., Biswas P. (2005). Viral capture and inactivation with a soft X-ray enhanced corona system. Regional Centers for Biodefense and Emerging Infectious Diseases Research, second annual meeting, March 13-15, 2005, Western RCE, Galveston, TX.
24. Rauer D., Turner J. R. and Angenent L. T. (2004). Ambient biological particulate matter characterization at the St. Louis Midwest Supersite. 23rd Annual Conference, Atlanta, Georgia, October 4-8, 2004, American Association for Aerosol Research (AAAR), Mt. Laurel, NJ.
25. Kettleson E. M., Hogan Jr. C. J., Ramaswami B., Lee M., Biswas P., and Angenent L. T. (2004). Capture and inactivation of viral bioaerosols using an X-ray enhanced electrostatic precipitator. 23rd Annual Conference, Atlanta, Georgia, October 4-8, 2004, American Association for Aerosol Research (AAAR), Mt. Laurel, NJ.
26. Briones A\*, Daugherty B. J., Angenent L. T., Rausch K., Tumbleson M. and Raskin, L. (2004) Microbial community diversity, dynamics, and interactions in anaerobic bioreactors treating sulfate-rich waste streams. 10th International Symposium on Microbial Ecology (ISME), Cancun, Mexico, August 22-27, 2004, International Society for Microbial Ecology, Geneva, Switzerland.
27. Ley R. E. and Angenent L. T. (2004). Enrichment of hydrogen-utilizing microorganisms from hypersaline microbial mats with a hollow-fiber bioreactor. 104nd General Meeting, New Orleans, LA, May 23-27, 2004, American Society for Microbiology, Washington, DC, USA.
28. Angenent L. T., Clarke L., Robinson A. and Hernandez M.\* (2003). Occurrence of primary biological materials in the atmosphere: protein, carbohydrate and endotoxin associations with particulate matter in temperate region urban aerosols. 22<sup>th</sup> Annual AAAR Conference, October 20-24, 2003, Anaheim, California, USA, American Association for Aerosol Research, Cincinnati, Ohio, USA.
29. Angenent L. T., Kujundzic E., Zander D. A., Henderson D. E., Miller S. L. and Hernandez, M. T.\* (2002). Bioaerosol and airborne particulate matter mitigation using hybrid HEPA-UV filter units in a high-exposure environment. 21<sup>th</sup> Annual AAAR Conference, October 7-11, 2002, Charlotte, North Carolina, USA, American Association for Aerosol Research, Cincinnati, Ohio, USA.
30. Angenent L. T. (2002). A senior, group-based design project of an expanding wastewater treatment plant. Proceedings of the ASEE Summer School Poster Session, Effective Teaching Strategies. July 27-August 1, 2002, Boulder, Colorado, American Society for Engineering Education, Washington, DC, USA.
31. Raskin L.\*, Rausch K. D., Tumbleson M. E., Daugherty B. J., Angenent L. T., Agbisit R. M. and Belyea R. L., Nutrient Recovery from Food Processing Industry Waste Streams. 2002 Corn Utilization and Technology Conference, June 3-5, 2002, Kansas City, MO, Corn Refiners Association and National Corn Growers Association, St. Louis, Missouri, USA.

32. Agbisit R. M., Daugherty B. J., Angenent L. T., Belyea R. L., Clevenger T. E., Raskin L., Rausch K. D. and Tumbleson M. E. (2002). Recovery of nutrients in the corn wet milling process. 2002 Corn Utilization and Technology Conference, June 3-5, 2002, Kansas City, MO, Corn Refiners Association and National Corn Growers Association, St. Louis, Missouri, USA.
33. Jindal A., Robert M., Zahn J., Angenent L., Aminov R., Funk T., Mackie R. and Raskin L. (2002). Antimicrobials and antimicrobial resistance in swine waste treatment processes. 102nd General Meeting, Salt Lake City, Utah, May 19 - 23, 2002, American Society for Microbiology, Washington, DC, USA.
34. Angenent L. T., Kelley S. T., Pace N. R. and Hernandez, M. T.\* (2001). Characterization of bioaerosols in a high exposure environment using direct microscopy, genetic amplification (PCR), and molecular cloning. 20<sup>th</sup> Annual Conference, October 15-19, 2001, Portland, Oregon, USA, American Association for Aerosol Research, Cincinnati, Ohio, USA.
35. Agbisit R. M., Daugherty B., Belyea R. L., Angenent L., Raskin L. M., Rausch K. D. and Tumbleson M. E. (2001). Recovery of nutrients in the corn wet milling process. 2001 AACCC annual meeting, October 14-17, 2001, Charlotte, North Carolina, USA. American Association of Cereal Chemists, St. Paul, Minnesota, USA.
36. Rausch K. D., Thompson C. I., Belyea R. L., Plata H., Angenent L. T. and Raskin L. (2000). Variation in composition of coproducts and wastewater from a commercial wet milling facility. 2000 Corn Utilization and Technology Conference, June 5-7, 2000, St. Paul, Minnesota, USA, Corn Refiners Association and National Corn Growers Association, St. Louis, Missouri, USA.
37. Frigon D., Angenent L. T., Zheng D. and Raskin L. (2000). Filamentous bacteria grow in upflow anaerobic sludge blanket reactors at high loading. 100th General Meeting, May 21-25, Los Angeles, California, USA, American Society for Microbiology, Washington, DC, USA.
38. Oerther D.B.\*, Angenent L. T. and Raskin L. (2000). Biological treatment of food processing waste streams. Environmental Horizons 2000, March 27-28, 2000, The Environmental Council, Urbana, IL, USA.
39. Mau M.\*, Angenent L. T., George U. and Raskin L. (2000). Monitoring antibiotic resistance during swine waste treatment using oligonucleotide probes targeting the MLS<sub>B</sub> resistance determinant in the 23S rRNA. Microbiology\_2000, March 12-16, Munich, Germany, VAAM, DGHM, ÖGHMP.
40. Angenent L. T., Mau M., George U. and Raskin L. (1999). Culture-independent monitoring of changes in translation-antibiotic resistance during swine waste treatment using oligonucleotide probes targeting the functional region of 23S rRNA. MMME99, August 1-3, Urbana, Illinois, USA, Midwest Molecular Microbial Ecology Meeting.
41. Mau M., Angenent L. T., George U. and Raskin L. (1999). Culture-independent monitoring of changes in translation-antibiotic resistance during swine waste treatment using oligonucleotide probes targeting the functional region of 23S rRNA. 99th General Meeting, May 30-June 3, Chicago, Illinois, USA, American Society for Microbiology, Washington, DC, USA.
42. Zheng D.\*, Angenent L. T., Sung S, and Raskin L. (1998). Microbial community structure in an anaerobic migrating blanket reactor. Eight International Symposium on Microbial Ecology, August 9-14, 1998, Halifax, Nova Scotia, Canada.
43. Zheng D., Angenent L. T., Sung S, and Raskin L.\* (1998). Microbial population dynamics in wastewater treatment systems. Environmental Horizons 1998, April 21, 1998, The Environmental Council, Urbana, IL, USA.

\* Presenter for podium presentation

### **Courses Taught at Cornell University**

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<i>Number</i>	<i>Name</i>	<i>Co-Taught With</i>	<i>Semester</i>
BEE4870	Sustainable Energy Systems		Fall 2009

### **Courses Taught at Washington University**

<i>Number</i>	<i>Name</i>	<i>Co-Taught With</i>	<i>Semester</i>
ChE 351	Engineering Analysis of Chemical Systems		Fall 2005 Fall 2006 Fall 2007
ChE 146A	Modern Technological Challenges	4 others 3 others 3 others	Fall 2004 Fall 2005 Fall 2006
	Introduction to EECE	Jay Turner	Fall 2007
ChE/ENVE/CE 408/508	Environmental Engineering Laboratory	Brian Wrenn Brian Wrenn Brian Wrenn	Spring 2004 Spring 2005 Spring 2006 Spring 2008
ChE/ENVE 450-A/550-A	Engineering and Molecular Biology Techniques		Fall 2003 Fall 2004
ChE/ENVE 523	Biological Treatment Processes		Spring 2003 Spring 2005

### **Short Courses and Other Teaching Activities**

- Participated/lectured in workshops at the annual conference of the Water Environment Federation WEFTEC'03, WEFTEC'04, and WEFTEC'05: "FISHing in activated sludge", Los Angeles, CA, October 12, 2003, New Orleans, LO, October 3, 2004, and Washington, DC, October Oct 29-Nov. 2, 2005.
- Spring 1999: Instructor for graduate course: CE 442 - Processes for Water Quality Control, II (Dept. of Civil and Environmental Engineering at the University of Illinois at Urbana-Champaign).

### **Teaching Improvement Activities**

Summer 2002	Participated in the 2002 Summer School for Chemical Engineering Faculty, Boulder CO, July 27-August 1, 2002. This was organized by the American Society for Engineering Education (ASEE), Chemical Engineering Division. Attended workshops on effective teaching.
Fall 1998-Spring 1999	Participated in a faculty development program at the University of Illinois at Urbana-Champaign: The Teaching College, organized by The Academy for Excellence in Engineering Education (AE <sup>3</sup> ). Attended year-long workshops on effective teaching.

### **Ph.D. Students Graduated**

<i>Name</i>	<i>Work Period</i>	<i>Thesis Title</i>	<i>Placement</i>
Jeff Fornero	Aug. 06-Aug. 09	Improving the cathode conditions by pressurizing and carbon dioxide addition to enhance the practicality of MFC treatment of wastewater	Post-Doc, Angenent Lab
Sarah Dryden Perkins	Aug. 04-Jan. 09	16S rRNA gene surveys to quantify pathogens in environmental bioaerosols	Post-Doc, US EPA, Cincinnati, OH
Marcelo Garcia	Jan. 04-Dec. 08	Improving the stability of anaerobic digesters for	Assistant Professor, State

Zhen (Jason) He	Aug. 03-Jun. 07	animal waste treatment Microbial fuel cells: their application and microbiology	University of Sao Paulo, Rio Claro, Brazil Assistant Professor, University of Wisconsin – Milwaukee, WI
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### Ph.D. Students at Present

<i>Name</i>	<i>Work Period</i>	<i>Research Topic</i>
José Miguel Perez	Aug. 09-	Syngas fermentation in hollow-fiber reactors
Michaela TerAvest	Aug. 09-	Biochemical methods to study exocellular electron transport in bioelectrochemical systems
Elliot Friedman	Jun. 09-	Potentiostat-controlled electrodes in the environment to monitor bacterial exocellular electron transfer in the environment
Arvind Venkataraman	May 08-	Mechanistic understanding of electrode-respiring defined mixed cultures in microbial fuel cells
Matt Agler	Jun. 06-	Lignocellulosic conversion to n-butanol with undefined mixed cultures at thermophilic conditions

### M.S. Students Graduated (With Thesis)

<i>Name</i>	<i>Work Period</i>	<i>Thesis Title</i>	<i>Placement</i>
Eric Kettleson	Aug. 03-Aug. 05	Capture and inactivation of virus aerosol using electrostatic precipitation	PhD candidate, Washington University in St. Louis, MO
Rebecca Hoffmann (co-advised with Muthanna Al-Dahhan)	May 03-May 05	The effect of shear on the performance and microbial ecology of anaerobic digesters treating cow manure from dairy farms	Horner & Shifrin, Inc. Engineers, St. Louis, MO
Dan Rauer (co-advised with Jay Turner)	Jan. 03-Febr. 05	Characterization and monitoring of ambient biological PM <sub>2.5</sub> at the St. Louis-Midwest Supersite	Lab Technician, Bayer Corporation USA, Berkeley, CA

### Additional M.S. Students Graduated (Project Report)

<i>Name</i>	<i>Work Period</i>	<i>Report Title</i>	<i>Placement</i>
Ben Bocher	May 05-Dec. 06	Shear-enhanced anaerobic digestion of secondary biosolids from upflow anaerobic bioreactors	PhD student, Zitomer Lab, Marquette University, WI

### M.S. Students at Present (Project Report)

<i>Name</i>	<i>Work Period</i>	<i>Research Project</i>
Adam Garnica	Aug. 09-May 10	Toxicity of line lubricants in UASB bioreactor treatment of brewery waste

### Post-Doctoral Researchers/Research Associates Supervised

<i>Name</i>	<i>Work Period</i>	<i>Thesis Title</i>	<i>Placement</i>
Sarah Dryden Perkins	Febr. 09-May 09	Syntrophic acetate oxidation in anaerobic digesters	NA
Balathiagararaman Ramaswami	April 04-May 05	Bacteriophages as indicators for human fecal contamination in Table Rock Lake, MO	Post-doc, University of Pittsburgh, PA

### Post-Doctoral Researchers/Research Associates at Present

<i>Name</i>	<i>Work Period</i>	<i>Research Project</i>
Jeffrey Werner	June 09-	Stability in upflow anaerobic bioreactors
Hanno Richter	Nov. 08-	Conversion of n-butyrate into n-butanol with <i>Clostridium</i> spp.
Miriam Rosenbaum	March 07-	Bioelectrochemical systems

### Visiting Scholars/Professor Hosted

<i>Name</i>	<i>Work Period</i>	<i>Research Project</i>	<i>Placement/Current Position</i>
Nathan Ball	Jun. 09-Aug. 09	Pure-culture studies in bioelectrochemical systems	MS student, KAUST, Saudi-Arabia
Brett Barron	Summer 07, 08, 09	MFC labs and kits for high-school students	Chemistry high-school teacher, Hazelwood Central High School District, MO
Amanda Scampini	April 09-May 09	Upflow anaerobic sludge blanket treatment of acidified brewery wastewater	MS student, MIT, MA
Khalidah Jafaar	Sept. 08-April 09	Anaerobic digestion of date-palm waste	M.Eng. student, Cornell

(Cornell Humphrey Fellow)			
Zeynep Aydinkaya (visiting MS student)	Jan. 08-Jan. 09	Anaerobic digestion of domestic wastewater in UASB and AMBR systems	MS student, Bogaziçi University, Turkey
Jan Arends (visiting MS student)	Oct. 07-April 2008	Mechanisms of exocellular electron transfer with knock-out strains of <i>Pseudomonas aeruginosa</i>	PhD student, Verstraete Lab, Gent University, Belgium
Erin Rodes	Summer 07	Research Experience for Teachers project	Chemistry high-school teacher, Hazelwood Central High School District, MO
Young Whan Kim	Sept. 02-Sept. 04	Effect of sonification on sludge characteristics and methanogenic activity	Governmental Position, Busan, South-Korea

### **Visiting Scholars/Professors at Present**

<i>Name</i>	<i>Work Period</i>	<i>Thesis Title</i>	<i>Placement/Current Position</i>
Zhongjian Li	Sept. 09-May 11	Mechanisms of electron transfer in biofilms	PhD student, Zhejiang University, China
Renato Carrhá Leitão	Sept. 09-Nov. 09	Solids digestion	Researcher, Brazilian Agricultural Research Corporation (Government)
Arjan Dekker	Jul. 09-Nov. 09	Secondary fermentation pathways in n-butyrate fermentation	MS student, Wageningen University, The Netherlands
Wiratni	Jul. 09-Apr. 10	Low-tech anaerobic digester for farmers in Indonesia	Associate Professor, Gadjah Mada University, Indonesia

### **Rotation PhD Student Research Instruction**

Supervised gradate students who rotated in my lab for a semester: Hnin Aung (Fall 2008, BEE); Larry Page (Spring 2008, DBBS); Joost Groot (Fall 2007, EECE); Abhas Singh (Spring 2006, EECE).

### **Undergraduate Student Research Instruction**

Supervised undergraduate students during regular academic semesters: Roxanne Li (Spring 2009, BEE); Kevin Wu (Spring 2009, BEE); Jiaqing (Jack) Yi (Spring 2009, BEE); Vipul Borkar (Fall 2007-Spring 2009, EECE); Adam Webb (Fall 2007, EECE); James Wexler (Fall 2004-Spring 2007, EECE); David Hall (Spring 2005-Spring 2007, EECE); Ryan Mackin (Fall 2004-Spring 2006, EECE); Theresa Cummings (Spring 2006-Fall 2006, EECE); Liz Campbell (Fall 2004-Fall 2005, EECE); Kristian Kaufmann (Fall 2002-Spring 2003, EECE).

Supervised undergraduate students during 10-weeks as part of a NSF research experience for undergraduates (REU) program or other summer-intern program: Isaac Markus (Summer 2009, NNIN); Alex Lee (Summer 2009, BEE); Kevin Wu (Summer 2009, BEE); Jiaqing (Jack) Yi (Summer 2009, BEE); Vipul Borkar (Summer 2009, EECE); Adam Webb (Summer 2007, EECE); Robert (Bobby) Levine (Summer 2007, EECE); Teri McClerklin (Summer 2006, EECE); James Wexler (Summer 2006, EECE); Rufe Lu (Summer 2005, EECE); David Hall (Summer 2005, EECE); Seth Forster (Summer 2004, EECE); Gabriel (Gabe) Trejo (Summer 2004, EECE); Richard (Memie) Ezike (Summer 2003, EECE); Scott Crothers (Summer 2003, EECE); Kristian Kaufmann (Summer 2003, EECE).

### **Ph.D. Committee Work – Cornell University**

1. Rodrigo Labatut (BEE) – A exam in December 2008, Member

### **Ph.D. Committee Work – Washington University**

1. Jeff Fornero (EECE) – completed in August 2009, Chair
2. Sarah Dryden Perkins (EECE) – completed in January 2009, Chair
3. Marcelo Garcia (EECE) – completed in December 2008, Chair
4. Hui Zheng (EECE) – completed in December 2008, Member
5. Nicole Moore (Kohrt) (BME) – completed April 2008, Member
6. Rajneesh Varma (EECE) – completed in April 2008, Member
7. Shannon K. Alford (BME) – completed in April 2008, Member
8. Stephanie Willert (BME) – completed in March 2008, Member
9. Buck Samual (DBBS) – completed in June 2007, Member
10. Elizabeth Hansen (DBBS) – qualifying exam in June 2007, Member

11. Zhen He (EECE) - completed in June 2007, Chair
12. Bia Henriquez (EECE) – qualifying exam in April 2007, Member
13. Liyun Xie (EECE) – completed in January 2007, Member
14. Karyn Lynne Rogers (Earth and Planetary Sciences) – completed in August 2006, Member
15. Scott Crick (BME) – qualifying exam June 2006, Member
16. Mehul Veskiyar (EECE) – completed in May 2006, Member
17. Benjamin Steinhaus (ME) – completed in April 2006, Member
18. Huping Luo (EECE) – completed in April 2005, Member
19. Zhengkai Li (EECE) – completed in April 2005, Member
20. Jin-Ku Kim (BME) – completed in May 2005, Member
21. D’Arcy Renee Meyer-Dombard (Earth and Planetary Sciences) – completed in October 2004, Member

## Proposals and Projects Funded

<i>PI and co-PIs</i>	<i>Title</i>	<i>Granting Agency</i>	<i>Start &amp; End Date</i>	<i>Lab Funding</i>
Gooch, Angenent Angenent	Anaerobic digestion training Codigestion of carbon-rich wastes to boost energy production during anaerobic digestion of dairy waste	NYSERDA Hatch-Cornell	Sept. 09-Aug. 12 Oct. 09-Sept. 12	\$250,163 \$90,000 (direct costs)
Angenent	Laboratory scale anaerobic digestion	GE Water and Process Technologies	March 09-May 10	\$150,001
Lipson, Raab, Angenent	Reduction of iron and humic substances as a dominant respiratory process in arctic peat soils	NSF	Aug. 08-June 11	\$239,139
Angenent	Characterization of microbial communities in anaerobic granules	BP Amoco Chemical Company	May 08-Dec. 08	\$53,566
Pakrasi, Angenent, Aurora, Axelbaum, Beachy, Biswas, Blankenship, Gordon, Ho, Kerley, Minteer, Quatrano, Schmidt, Smith, Stacey, Thiel, Wang, Xu, Yu, Zhang	Discovery and utilization of enzymes for renewable biofuels production	Missouri Life Science Research Board	Dec. 07-July 08	\$58,796
Angenent, Onay, Yenigün, Nuengiamnong, Rachdawong	Anaerobic treatment of domestic wastewater from rural Communities with an anaerobic migrating blanket reactor	McDonnell Academy Global Energy and Environment Partnership, Washington University	Nov. 07-Dec. 08	\$35,500
Angenent, Dien, Cotta, Qureshi	Mixed community bioreactors to convert (ligno)cellulosic feedstocks into the liquid biofuel butanol	USDA-CREES-NRI	Sept. 07-Aug. 11	\$365,000
Angenent	CAREER: Microbial fuel cell technology for large-scale wastewater treatment	NSF	July 07-June 12	\$406,250
Angenent	Overcoming metabolic constraints of biological hydrogen production from biomass sugars by electrochemically-assisted hydrogen production in Microbial Fuel Cells	USDA - Agricultural Research Service – Fermentation Biotechnology Research – National Center for Agricultural Utilization Research	July 06-June 10	\$173,889
Angenent	SEAD treatability of secondary biosolids from the upflow anaerobic bioreactors of Anheuser-Busch	Anheuser-Busch, Inc., St. Louis, MO	May 06-July 08	\$75,952
Angenent	Effect of variable loading rates on the anaerobic treatment of corn milling wastewater	Illinois Department of Commerce and Economic Opportunity/National Corn-to-Ethanol Research Center	Jan. 06-June 07	\$58,986
Angenent, Mayfield, Fraser	Effectiveness of membrane integrated shower outlets for increasing patient safety	Barnes-Jewish Hospital Foundation, St. Louis, MO	May 06-Oct. 07	\$34,889
Angenent	Development of the multi-	Bear Cub -	Mar. 05-Febr. 06	\$40,000

Angenent, Shen, Floss	phase UMFC: simultaneous bioelectricity generation and wastewater treatment Improving stability in anaerobic digestion for animal waste treatment by understanding microbial ecology	Washington University USDA-CSREES-NRI	August 2004-July 2008	\$312,205
Giammar, Angenent	Evaluation of chemical and biological tracers for phosphorus source apportionment in Table Rock Lake, on the Missouri-Arkansas Border	EPA-NDWRCDP	Nov 03-June 05	\$125,000
Biswas, Angenent	Use of a novel corona-soft X-ray system for inactivation of bioagents	NIH-MRCE	Aug. 03-Febr. 05	\$70,000

### **Industrial Consulting**

Oct. 2000-Nov. 2000	Environmental Consultant, Ecofuels Corp., Eagan, Minnesota, USA. Activities: Designing a high yield anaerobic digester (HYAD™) to convert swine waste into methane. A pre-proposal including the plans for a digester and a nutrient removal system was prepared. In addition, we proposed to convert the produced methane into an ethanol blend (registered as ethanol plus by the EPA) through the use of a molybdenum-sulfide catalyst.
July 1999-August 1999	Environmental Consultant, Aero-Mod, Inc. (Waterlink Aero-Mod), Manhattan, KS, USA. Activities: design of a full-scale AMBR for the treatment of industrial wastewater.
June 1998-March 2000	Environmental Consultant, Double L Group, LTD., Deyersville, IA, USA. Activities: development of a "future farm", where nutrients, energy, and water produced from animal waste digestion are utilized in hydroponic greenhouses on the farm, reaping economical benefits.
July 1995-August 1997	Environmental Consultant, Anaerobic Biosystems Corporation and Iowa State University, Ames, IA, USA. Activities: Treatment feasibility studies on slaughterhouse wastewater and a combined wastewater from a paper recycling company and an enzyme producing biotech company. These studies led to full-scale anaerobic treatment: (1) Excel Corp., Ottumwa, IA, USA. System: ASBR; Design flow: 2.3 mgd and (2) City of Cedar Rapids, Cedar Rapids, IA, USA. System: UASB reactor; Design: 500,000 PE. Designed an effluent-baffle system (EBS) for a full-scale ASBR for the pre-treatment of hog slaughterhouse wastewater (The Excel Corp. plant in Ottumwa, Iowa, USA).

### **Membership in Professional Organizations**

1. International Water Association
2. Association of Environmental Engineering and Science Professors
3. American Society for Microbiology
4. American Association for the Advancement of Science
5. American Institute of BioEngineering

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### **Professional Service**

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1. Organizing committee and chair of session for the 2<sup>nd</sup> International Microbial Fuel Cell Conference on Waste to Energy, Gwangju Institute of Science and Technology (GIST), The Republic of Korea, June 10-12, 2009.
2. Organizing committee and chair of final session for the Microbial Fuel Cells First International Symposium, Penn State University, May 27-29, 2008.
3. AFOSR MURI Mid-term Biofuel Cell review board, October 2, 2008.
4. Committee Member for PhD student Caitlyn Shea, Department of Civil and Environmental Engineering, Notre Dame University.
5. Participated in the environmental career information session for ECO-ACT workshop at the Missouri Botanical Gardens, St. Louis, MO, March 23, 2004.
6. Chaired a session at the annual meeting for the American Institute for Chemical Engineers (AIChE): “Advances in Environmental Biotechnology II: Green Processing”, San Francisco, CA, November 19, 2003.
7. Online mentor with the American Society of Microbiology Minority Mentoring program (2005 – current).

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### **Editor Activities of Journals and Books**

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- Co-editor for the book: *Bioelectrochemical Systems: from extracellular electron transfer to biotechnological application*. Eds.: Rabaey K., Angenent L. T., Schröder U. and Keller J. International Water Association, London, UK, anticipated publication in October 2009.
- Special editor for the Energy Biotechnology special issue in “Current Opinion in Biotechnology” (Elsevier London), June 2007.

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### **Referee Activities of Journals**

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1. *Water Research*
2. *Water Environment Research*
3. *FEMS Microbiology Letters*
4. *FEMS Microbiology Ecology*
5. *Journal of Environmental Engineering*
6. *Journal of Environmental Management*
7. *Journal of Hazardous Materials*
8. *Journal of Applied Microbiology*
9. *Chemical Engineering and Processing*
10. *Environmental Engineering Science*
11. *Environmental Science and Technology*
12. *Biotechnology and Bioengineering*
13. *Environmental Microbiology*
14. *Atmospheric Environment*
15. *Trends in Biotechnology*
16. *Electrochemistry Communications*
17. *Chemosphere*
18. *Journal of Environmental Engineering and Science*
19. *Bioresource Technology*
20. *Biosensors and Bioelectronics*
21. *Current Opinion in Biotechnology*
22. *Applied and Environmental Microbiology*
23. *Electrochimica Acta*
24. *Applied Microbiology and Biotechnology*

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### **Referee Activities of Research Proposals**

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USDA NRI SBIR; USDA NRI: Biobased Products and Bioenergy Production Research; NE SUN Grant; AVAC, Canada; Georgian NSF, Georgia; NSF/USDA Microbial Observatories and Microbial Interactions and Processes program; NSF Energy for Sustainability CAREER; FIRST Israel Science Foundation, Israel; FONDECYT National Research Funding Competition, Chile; Engineering and Physical Sciences Research Council, UK; ACS The Petroleum Research Fund; NSF BES: Environmental Engineering and Technologies

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### **Service to Cornell University**

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- Invited renewable energy panel member for CALS: Making a World of Difference, April 18, 2009.
- Invited presentation: “Undefined mixed culture conversion of organic waste into energy”, Cornell Engineering Research Conference (CERC), April 3, 2009.
- Member of CURBI advising team.

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### **Service to Department of Biological and Environmental Engineering**

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- Member of graduate coordinate committee
- Member of committee to study the Master of Business Administration (MBA) and Master of Engineering (MEng) program on Energy, Sustainability and the Environment (MESE)
- Undergraduate advisor for ~ 15 students

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### **Service to Washington University**

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- Student advisor for the local chapter of the American Institute of Chemical Engineers (AIChE)
- Member of the Institutional Biological & Chemical Safety Committee (IBC).
- Invited presentation: “Bioaerosols”: Annual MRCE Biosafety Course for Midwest Regional Center of Excellence in Biodefense and Emerging Infectious Diseases Research (MRCE) Program about: “Bioaerosols” for three years.

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### **Service to Department of Energy, Environmental & Chemical Engineering**

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- Prepared a new concentration area (Bioprocessing) for undergraduates in the Department of Chemical Engineering as part of the curriculum changes.
- Participated in the Scholarship dinner during the merit fellowship weekend (2004, 2005, and 2006).
- Undergraduate advisor for a total of ~ 30 Chemical Engineering students over four years
- Organized the qualifying exams for PhD students (2003-2008)
- Environmental engineering faculty search (Spring 2006)
- Bioenergy faculty search (Fall 2006 and Spring 2007)
- Moderator for “Water Resources and Sustainable Systems” breakout group at the International Symposium on Energy and the Environment, May 4-7, 2007. St. Louis, MO.
- Participant in the core group of I-CARES focusing on bioenergy.

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### **News outreach**

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- Numerous interviews for national magazines on bioenergy: a sample of these activities include:
- “Bacteria in wastewater harnessed for electricity” by R. Colin Johnson for EETimes, 7/18/2005.
  - “Microbe Power” by David C. Holzman for Environmental Health Perspectives, Vol. 113, No. 11, November 2005.
  - “WU engineers harness bacteria, waste for energy”, by Tina Hesman for the St. Louis-Post Dispatch, June 16, 2005.
  - “Boosting Wastewater Fuel Cell Power.” 2006. Industrial Bioprocessing (technical Insights), Vol. 28, No. 9, pp. 2.

- “Harnessing the power of microbes”, by Diana Greer for BioCycle, Vol. 48, No. 5, May 2007.
- “Scaling up microbial fuel cells”, *Environmental Science and Technology* Technology News – March 21, 2007.
- “Taking out nitrates with a self-sufficient MFC”, *Environmental Science and Technology* Technology News – March 28, 2007.
- “Microbes Plus Sugars Equals Hydrogen Fuel?” *ScienceDaily* - Nov. 3, 2007.
- “More energy-efficient ethanol: A process used in wastewater treatment may increase efficiency in ethanol plants”, MIT Technology Review – August 18, 2008.
- “Using MFCs to teach high-school students”, ASM’s Microbeworld, broadcasted through a national network of 85 public radio stations on June 18, 2008.