

Caitlyn S. Butler

(maiden name: Shea)

University of Massachusetts, Department of Civil and Environmental Engineering
16B Marston Hall, 130 Natural Resources Road
Amherst, MA 01003 413-545-5396

Education

Ph.D., Environmental Engineering,
Department of Civil Engineering and Geological Sciences, University of Notre Dame, 2010

Dissertation: *Fundamental and Applied Studies of Microbial Fuel Cells for Sustainable Water and Wastewater Treatment*, Adviser: R. Nerenberg, Ph.D.

B.S., Engineering Science,
Picker Engineering Program, Smith College, 2004

Honors Thesis: *Mechanistic Study of the Oxidation of H-terminated Silicon(100)*,
Adviser: K.T. Queeney, Ph.D.

Current and Previous Positions

Assistant Professor

Department of Civil and Environmental Engineering, University of Massachusetts, Amherst,
MA 2011-present

Research Interests: *My research objectives focus on developing energy-efficient treatment strategies for both water and wastewater treatment. I examine bioelectrochemical systems where biofilms, capable of using either an anode as an electron acceptor or cathode as an electron donor, remediate environmental pollutants and concurrently produce electricity. I am interested in developing scalable process designs that could be easily integrated into existing treatment infrastructure, but is also interested in the ecology and function of the microorganisms that facilitate electricity production. In addition to my technical research objectives, I am also interested in developing and assessing the effectiveness of novel educational techniques and strategies to improve engineering education.*

Assistant Professor

Department of Engineering, College of Technology and Innovation, Arizona State University,
Mesa, AZ, 2010-2011

Graduate Faculty

Civil, Environmental, and Sustainable Engineering Ph.D. Program, School of Sustainability and the Built Environment, College of Engineering, Arizona State University, Tempe, AZ,

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Curriculum Vitae - 1 of 11

2010-2011

Graduate Research Assistant

Department of Civil Engineering and Geological Sciences, University of Notre Dame, Notre Dame, IN, 2004-2009

Research Topics: *Microbial Fuel Cells (MFCs), Microbial Ecology, Scalable MFC Reactor Design Using Hollow Fiber Membranes and Biocathodes for Denitrification and Perchlorate Reduction*, Adviser: R. Nerenberg, Ph.D.

Graduate Teaching Assistant

Department of Civil Engineering and Geological Sciences and Department of Chemical Engineering, University of Notre Dame, Notre Dame, IN, 2004-2007

Courses: *Introduction to Chemical Engineering, Introduction to Environmental Engineering, Hazardous Waste Management, Civil Engineering Materials, and Environmental Microbiology*

Undergraduate Research Assistant

Department of Chemistry, Smith College, Northampton, MA, 2002-2004

Research Topic: *Mechanistic Study of the Oxidation of H-terminated Silicon and Protein Adsorption to Silicon Surfaces*, Adviser: K. Queeny, Ph.D.

Undergraduate Teaching Assistant

Department of Physics and Picker Engineering Program, Smith College, Northampton, MA, 2002-2004

Courses: *Fundamentals of Environmental Engineering, Mass and Energy Balances and Introduction to Physics*

Undergraduate Research Assistant

Picker Engineering Program, Smith College, Northampton, MA, 2001-2002

Research Topic: *Impedance of the Human Ear Canal*, Adviser: S. Voss, Ph.D.

Vice-President of Distribution

"Hears to You": The National Discount Battery Service, Northampton, MA 1996-2004

Selected Honors and Awards

NSF Environmental Molecular Science Institute Fellowship

a research fellowship awarded internally by EMSI at the University of Notre Dame, 2009

Bayer Predoctoral Research Fellowship

a research fellowship given by the Center for Environmental Science and Technology at the

University of Notre Dame, 2008

Excellence in Teaching Award

given by the Kaneb Center for Teaching and Learning at University of Notre Dame, 2007

Transatlantic Environmental Biotechnology Fellowship

for travel to and work at the Laboratory for Microbial Ecology and Technology at Ghent University, Ghent, Belgium. Supported by EU-US Task Force on Biotechnology, 2007

Adeline Devor Penberthy Memorial Prize

for excellence in engineering and leadership at Smith College, 2004

Picker Engineering Fellowship

a four year undergraduate scholarship at Smith College, 2000-2004

Teaching Experience

Department of Civil and Environmental Engineering, University of Massachusetts, Amherst, MA, 2011-present

Courses Instructed:

Biological Processes in Environmental Engineering - CEE 671 - Fall 2011

Department of Engineering, College of Technology and Innovation, Arizona State University, Mesa, AZ, 2010-2011

Courses Instructed:

Engineering Design - EGR 202 - Spring 2010, Spring 2011

Civil Engineering Capstone - EGR 401/402

2009-2010 - Civil Infrastructure Solutions in Ghana, Africa

2010-2011 - Quagga Mussel Prevention at Desert Basin Power Generation Facility

Environmental Engineering - EGR 494 - Fall 2010

Material Selection - EGR 224 - Spring 2011

Research Advising

Dissertation Committee Member

Center for Environmental Biotechnology, Biodesgin Institute, Arizona State University, Tempe, AZ, October 2010

Precious Biyela

Dissertation: *Water Quality Decay and Pathogen Survival in Drinking Water Distribution Systems*, Committee Chair: Bruce Rittmann

Undergraduate Students

Department of Engineering, College of Technology and Innovation, Arizona State University, Mesa, AZ, 2010-2011

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Curriculum Vitae - 3 of 11

David Dulebon

Paul Reidhead

Research Topic: *Organics and Nitrogen Removal from Agricultural Waste Streams via Microbial Fuel Cells*

Department of Civil Engineering and Geological Sciences, University of Notre Dame, Notre Dame, IN, 2007-2010

Patricia Wilbur

Research Topic: *Assessment of Proton Exchange Materials in Microbial Fuel Cells*

Kyle Bibby

Research Topic: *Development of Electrode Coating Materials for Hollow Fiber Membrane Microbial Fuel Cells*

High School Students

Department of Civil Engineering and Geological Sciences, University of Notre Dame, Notre Dame, IN, 2008-2009

Claire Sieradzki, Marian High School, Mishawaka, IN

Research Topic: *Performance of an Oxygen-supplied Biocathode Microbial Fuel Cell using Hollow Fiber Membranes*

Student's Accomplishments: *Awarded Junior Research Grant by Indiana Academy of Sciences, received second place presentation award and third place paper award from Indiana Science and Humanities Symposium (2008-2009)*

Peer Reviewed Publications

Goel, R., Kotay, S.M., **Butler, C.S.**, Torres, C.I., and Mahendra, S., Molecular Biological Methods in Environmental Engineering - A Review, *Water Environment Research, In Review*

Butler, C., Clauwaert, P., Green, S., Verstraete, W., Nerenberg, R., Bioelectrochemical Perchlorate Reduction in a Microbial Fuel Cell, *Environmental Science and Technology*, Vol. 44, No. 12, May 2010 (*6 citations*)

Butler, C. and Nerenberg, R., Microbial Fuel Cell Performance and Microbial Ecology as a function of Air-Cathode Materials, *Applied Microbiology and Biotechnology*, Vol. 86, No. 5, April 2010 (*1 citation*)

Clauwaert, P., Desloover, J., **Shea, C.**, Nerenberg, R., Boon, N., Verstraete, W. Enhanced Nitrogen Removal in Bio-Electrochemical Systems by pH control, *Biotechnology Letters* Vol. 31, No 6, June 2009 (*5 citations*)

Kulkarni, M., Green, S. K., **Shea, C.**, and Queeney, K. T., The role of etching in aqueous oxidation of hydrogen-terminated Si(100), *Journal of Physical Chemistry C*, Vol. 113, No. 23, June 2009

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Curriculum Vitae - 4 of 11

Shea, C., Clauwaert, P., Verstraete, W., Nerenberg, R., Adapting a denitrifying biocathode for perchlorate reduction, *Water, Science and Technology.*, Vol 58, No 10, November 2008 (5 citations)

Seders, L., **Shea, C.**, Lemmon, M., Maurice, P., Talley J., LakeNet: An Integrated Sensor Network for Environmental Sensing in Lakes. *Environmental Engineering and Science*, Vol. 24, No. 2, March 2007 (13 citations)

Voss S., Horton N., Woodbury R., **Shea, C.**, Smith A., Sources of variability in reflectance measurements on normal human ears. Huber A. and Eiber A., editor. *Proceedings of the 4TH International Symposium on Middle Ear Mechanics in Research and Otology*; 2006 July 27-30, Zurich, Switzerland. World Scientific; 2007. p. 78-86. (1 citation)

Conference Papers

* indicates undergraduate advisees

Butler, C. and Nerenberg, R., Effects of Oxygen Crossover on Layered, Microbial Fuel Cell Assemblies. International Water Association/Water Environment Federation Biofilm Reactor Technology Conference, Portland, Oregon, August 2010

Butler C., Clauwaert, P., Verstraete, W., and Nerenberg, R, Bioelectrochemical Perchlorate Reduction in a Microbial Fuel Cell: Optimizing Cathode pH and Cathode Potential. IWA/WEF Biofilm Reactor Technology Conference, Portland, Oregon, August 2010

Brown, D.*, Burns, B.*, Cradic, Z.*, Petrakovitz, D.*, Reeg, M.*, Santos, N.*, and **Butler, C.**, Optimization of Drinking Water Solutions for Rural Villages in Ghana, Africa, Capstone Design Conference, Boulder, CO, June 2010

Butler, C. and Nerenberg, R., Effects of Oxygen Crossover on Microbial Fuel Cell Performance and Microbial Community Structure. International Water Association Leading Edge Technology, - Phoenix, AZ, June 2010

Butler C., Clauwaert, P., Verstraete, W., and Nerenberg, R, Optimizing Cathode pH and Cathode Potential for Bioelectrochemical Perchlorate Reduction. International Water Association Leading Edge Technology, - Phoenix, AZ, June 2010

Shea, C. and Nerenberg, R., BOD and Total Nitrogen Removal from Wastewater Using Microbial Fuel Cells. Water Environment Federation Nutrient Removal Conference, Washington D.C. - June 2009 Fuel Cells

Shea, C. and Nerenberg, R., A High-Performance, Air-Cathode Microbial Fuel Cell with Potential for Retrofitting into Activated Sludge Plants. Water Environment Federation Technical Exhibition and Conference, Chicago, IL - October 2008

Shea, C. and Nerenberg, R., Performance of Air-Cathode Microbial Fuel Cells with Layered-Electrode Assemblies. International Water Association Young Water Professionals Confer-

ence, Berkeley, CA - July 2008

Shea, C. and Nerenberg, R. Air-cathode microbial fuel cells with layered-electrode assemblies. International Water Association Leading Edge Technologies, Zurich, Switzerland - June 2008

Shea, C. and Nerenberg, R. Adapting a Denitrifying Biocathode for Perchlorate Reduction. International Water Association Leading Edge Technologies, Zurich, Switzerland - June 2008

Shea, C. and Nerenberg, R. Air-cathode microbial fuel cells with layered-electrode assemblies. Microbial Fuel Cells - First International Symposium, Pennsylvania State University, State College, PA - May 2008

Shea, C. and Nerenberg, R. Hollow-Fiber Membrane Microbial Fuel Cells: Retrofitting Activated Sludge for Direct Production of Electricity. Indiana Water Environment Federation Annual Conference, Indianapolis, IN - November 2007

McStay, F., Talley, J.W., **Shea, C. A.** Landfarming as a Bioremediation Techniques for Oil Contaminated Lands in Iraq. National Association for Environmental Professionals Annual Conference (NAEP), Alexandria, VA - April, 2005

Strom, S., Jaffray, S., Johnson, C., McCartney, J., Rossmeier, K., **Shea, C.**, Zhang, M., Changes in Spatial Perception as a Result of Changes in Gravity, Society of Women Engineers National Conference, Birmingham, AL - 2003

Conference Abstracts

** indicates undergraduate advisees*

Dalrymple, O., Bekki, J., **Butler, C.**, Work in Progress: Modifying Mastery Based Learning for use in Undergraduate Engineering Courses, Frontiers in Education, Rapid City, SD, October 2011

Dulebohn, D.*, Reidhead, P.*, and **Butler, C.**, Sustainable Organic and Nutrient Removal from Agricultural Waste Streams via Microbial Fuel Cells. International Bioremediation Symposium, Reno, NV, June 2011

Nerenberg, R., Downing, L., Martin, K., **Butler, C.**, and Read-Daily, B., Advances in Hollow-Fiber Membrane Biofilm Reactor (MBfR) Technology for Water and Wastewater Treatment, Borchardt Conference, Ann Arbor, MI, February 2011

Brown, D.*, Burns, B.*, Cradic, Z.*, Petrakovitz, D.*, Reeg, M.*, Santos, N.*, and **Butler, C.**, Civil Infrastructure Challenges in Ghana, Africa. Student Design Competition, National Academy of Engineering Grand Challenges Summit, Phoenix, AZ, April 2010

Butler C., Clauwaert, P., Verstraete, W., and Nerenberg, R, Bioelectrochemical perchlo-

rate reduction in a microbial fuel cell. ACS National Meeting, San Francisco, CA - March 2010

Butler C., Pavissich, J.P., and Nerenberg, R., Total Nitrogen Removal in a Microbial Fuel Cell, ACS National Meeting, San Francisco, CA - March 2010

Butler, C. and Nerenberg, R., Impact of oxygen crossover on layered electrode assembly, air cathode MFCs. American Chemical Society National Meeting, San Francisco, CA - March 2010

Shea, C. and Nerenberg, R., Effect of oxygen crossover on microbial fuel cell biofilms. IWA Processes in Biofilms, University of California, Davis - September 2009

Shea, C. and Nerenberg, R., Bioelectrochemical perchlorate reduction in a microbial fuel cell. IWA Processes in Biofilms, University of California, Davis - September 2009

Shea, C. and Nerenberg, R. Air-cathode microbial fuel cells with layered-electrode assemblies. Microbial Fuel Cells - First International Symposium, Pennsylvania State University, State College, PA - May 2008

Shea, C. and Nerenberg, R. Microbial Fuel Cell for Total Nitrogen Removal. Microbial Fuel Cells - First International Symposium, Pennsylvania State University, State College, PA - May 2008

Shea C., Clauwaert, P., Verstraete, W., and Nerenberg, R. Adapting a Denitrifying Biocathode for Perchlorate Reduction. Microbial Fuel Cells - First International Symposium, Pennsylvania State University, State College, PA - May 2008

Wilbur, P.* and **Shea, C.**, Proton Exchange Membranes in Microbial Fuel Cells. Undergraduate Scholars Conference, University of Notre Dame, May 2008

Nerenberg, R. and **Shea, C.**, Microbial Fuel Cells for Sustainable Energy Production from Wastewater, Biofuels Symposium, Purdue University, September 2007

Shea, C., Green, S.J., Nerenberg, R., Microbial Fuel Cells: Changes in Microbial Community Structure as a Function of Anode Potential. Fourth American Society for Microbiology Conference on Biofilms, Quebec City, Quebec - March 2007

Shea, C., Johnson, C., Strom, S., Rossmeier K., Zhang, M., Jaffray, S., McCartney, J., Changes in Spatial Orientation and Vestibular Behavior as a Result of Changes in Gravity. Collaboration Celebration, Smith College, Northampton, Ma - April 2003

Shea, C. and Queeney, K.T., Mechanistic Study of the Oxidation of H-terminated Silicon: The Role of Dissolved Oxygen. American Vacuum Society International Symposium, Baltimore, MD - November 2003

Shea, C. and Voss, S.E., Intra-subject versus Inter-subject variability of the Impedance of the Human Ear Canal. Association for Research in Otolaryngology Midwinter Meeting, St.

Petersburg, FL - January 2002

Invited Panels, Presentations, and Seminars

Chen, Q., **Butler, C.**, Green, D., Hristovski, K., McKenna, A., Tridane, A., Undergraduate Research. Annual College Retreat, College of Technology and Innovation, Arizona State University, Mesa, AZ - January 2011

Butler, C. Performance and Microbial Ecology of Microbial Fuel Cells with Biocathodes. North American BioElectric Systems Meeting, University of Massachusetts, Amherst, MA - October 2010

Butler, C., Fundamental and Applied Studies of Microbial Fuel Cells for Sustainable Water and Wastewater Treatment. School of Sustainable Engineering and the Built Environment, Arizona State University, Tempe, AZ - February 2010

Chantem, T., McCumbers, R., **Shea, C.**, Building Community Through Improved Communication. Midwest Regional Conference of the National Association of Graduate and Professional Students, Notre Dame, IN - March 2009

Chantem, T., McCumbers, R., **Shea, C.**, Graduate Student Union - Progress and Future Goals. University of Notre Dame Board of Trustees, Notre Dame, IN - October 2008

Chantem, T., McCumbers, R., **Shea, C.**, Graduate Student Union - State of the Union Report. University of Notre Dame Board of Trustees, Notre Dame, IN - October 2007

Shea, C., Sausville-Giddings, C., Taugher, M., Biological Nitrogen Removal via Partial Nitrification and Denitrification. Metcalf and Eddy, New York, New York - May 2004

Funded Proposals and Competitive Grants

Adapting Traditional Pit Latrine in the Developing World for Nitrogen Removal and Electricity Production

PI: **C. Butler**, Co-PIs: M. Henderson and B. Rogers, Gates Foundation Grand Challenges Explorations, Funding Awarded: \$100,000

Organics and Nitrogen Removal from Agricultural Waste Streams via Microbial Fuel Cells

PI: **C. Butler**, Western Alliance for Extending Student Opportunities, Funding Awarded: \$1600 for an undergraduate research assistant and supplies.

Internally-Supported Research Projects

Department of Engineering, College of Technology and Innovation, Arizona State University, Mesa, AZ

Capital Equipment and Undergraduate Student Support for Molecular Analysis of Biocathode Biofilms PI: **C. Butler**, Funding Awarded: \$35,720

Modified Mastery-based Learning in Engineering Courses

PIs: J. Bekki, **C. Butler**, and O. Dalrymple Funding Awarded: \$2000

Graduate School and College of Engineering, University of Notre Dame, Notre Dame, IN

First Annual Graduate Research Symposium

Co-PIs: McCumbers, R., Chantem, T., **Shea, C.** Graduate School Professional Development Funding Opportunity, Funding Awarded: \$12,200

Integration of Energy Topics into Environmental Biotechnology and Wastewater Treatment Design

PI: Nerenberg, R. and co-PI: **Shea, C.**, Notre Dame Energy Center Curriculum Development Grant, Funding Awarded: \$3,500

Travel Awards

Downes Travel Grant

for travel to International Microbial Fuel Cell Symposium Laboratory Workshop, Pennsylvania State University, University Park, PA. Supported by the Graduate School at the University of Notre Dame

International MFC Symposium Student Travel Grant

for travel to present at the International Microbial Fuel Cell Symposium, Pennsylvania State University, University Park, PA. Supported by Office of Naval Research

IWA Young Water Professionals Conference Travel Support

for travel to present at the International Water Association Young Water Professional Conference, Berkeley, CA.

Professional Activities

Session Chair/Organizer - Microbial-based Fuel Cells - International Symposium on Bioremediation and Sustainable Environmental Technologies, 2011

Session Moderator - Microbial Fuel Cells - Water Environment Federation/ International Water Association Biofilm Reactor Technology Conference, 2010

Scientific Committee - Young Professional Member - Water Environment Federation/ International Water Association Biofilm Reactor Technology Conference, 2010

National Science Foundation Review Panel, CCLI (now called TUES), 2010

Ad Hoc Reviewer - Bioresource Technology, Environmental Engineering Science, Environmental Science and Technology, Water Research, and Water Science and Technology, 2007-present

Session Moderator - Water Quality and Availability - Notre Dame Environmental Education and Research Symposium, 2006

Professional Memberships

Association of Environmental Engineering and Science Professors (AEESP)

American Society of Engineering Education (ASEE)

International Water Association (IWA)

Water Environment Federation (WEF)

American Chemical Society (ACS)

University and Departmental Service

Department of Engineering, College of Technology and Innovation, Arizona State University, Mesa, AZ

Civil Engineering Focus Area Committee, 2010-present- a committee to redevelop the curriculum for the Civil Engineering focus area for the Department of Engineering

Combined First Year Curriculum Committee, 2010-present - a committee to review and revise curricula for combined first year project-based courses for the Departments of Engineering and Computing Studies

Undergraduate Committee, 2010-present - a committee to strengthen the undergraduate education within the Department of Engineering

College of Technology and Innovation Writing Group, 2010-present, - a collective of faculty to share and review documents related to our professional development

Graduate School, University of Notre Dame, Notre Dame, IN

Career Center Student Advisory Board, 2008-2009, - an advisory board to assist the career center in addressing the needs of graduate students searching for academic and industry-based employment after graduation.

Fellowship and Grant Writing Committee, 2008-2009 - a committee assembled by the Dean of the Graduate School to evaluate resources available to graduate students for producing competitive proposal and fellowship applications

Vice President of the Graduate Student Union, 2007-2009 - Notable accomplishments include:

Received 2007-2008 Program Award - National Association of Graduate and Professional Students

Held first University of Notre Dame Graduate Research Symposium
Began preventative health care program for spouses and children of graduate students
Increased Conference Presentation Grant annual and lifetime cap
Redesigned website and created monthly newsletter

Faculty Senate, 2007-2009 - served as the graduate student representative to the Faculty Senate