

Andrew Marcus

the.andrew@asu.edu

Phone: 480-717-9688

PO Box 875701

Tempe AZ 85287-5701

Assistant Research Professor, Biodesign Swette Center for Environmental Biotechnology
Senior Sustainability Scientist, Julie Ann Wrigley Global Institute of Sustainability Institute
Barrett Honors Faculty

Research Interest

I apply mathematical modeling to develop mechanistic bio-physical-chemical principles operating on microorganisms and use the principles to provide social benefits. As an environmental engineer, my expertise is in describing bioreactors that grows complex microbial communities to treat wastewater, degrade contaminants, and generate valuable resources. Because bioreactors can simulate and grow microorganisms in the human intestines, I work with medical professionals to uncover principles of microbial communities that influence human health.

Education

Ph.D. Civil and Environmental Engineering., Arizona State University (2009)

M.S. Civil and Environmental Engineering., Northwestern University (2003)

B.S. Chemistry., Carnegie Mellon University (2001)

Research Supports

NIH R01DK105829, Integrating quantitative energetics determines the microbiome's contribution to energy balance, **Co-Investigator**, 2016-2019.

Academic Advising Experience

Currently co-advising two PhD candidates from Chemical Engineering and Environmental Engineering

PhD Dissertation Committee (1 Environmental Engineering), Undergraduate Honor's

Thesis Chair (2 students), Undergraduate Thesis Committee (2 students)

Invited Presentations and Workshops

Mathematical modeling workshop on biofilm modeling at Ben Gurion University of the Negev, Israel May 2017

Workshop on microbial fuel cell at Wageningen University, the Netherlands September 2016

Presentation: "An Application of Mathematical Modelling for the Human Microbiome and Obesity" for Department of Microbiology at Wageningen University, the Netherlands, September 2016.

Presentation: "A Model for Alkalinity and pH for the Human Colon" at European Conference on Mathematical and Theoretical Biology, Nottingham, England July 2016.

Awards

WIMEK Research Fellowship, Wageningen University, the Netherlands, 2016

Fellowship to attend Woods Hole Microbial Diversity, Marine Biological Laboratory, 2009

Fulton Signature Research Fellowship, Arizona State University, 2005

CEAS Dean's Scholarship, Arizona state University, 2005

Walter P. Murphy Fellowship, Northwestern University, 2001
Summer Undergraduate Research Grant, Carnegie Mellon University, 2000
Summer Undergraduate Research Fellowship, Pennsylvania State University, 1999

Invention Disclosures

Provisional US patent application number 62/290,902 “Method of Palladium Recovery from acidic or circumneutral waste streams using a H₂-fed Membrane biofilm reactor.” “Membrane-Carbonation Photobioreactor” submitted to Arizona Technology Enterprises (**AZTE**) in October, 2010.

Publications (Total = 21; h-index= 14)

Kushwaha S, **Marcus AK**, Rittmann BE (2018). pH-dependent speciation and hydrogen (H₂) control U(VI) respiration by *Desulfovibrio vulgaris*. *Biotechnol Bioeng.* 115: 1465-74.

Lusk BG, Peraza I, Albal G, **Marcus AK**, Popat SC, Torres CI (2018). pH Dependency in Anode Biofilms of *Thermincola ferriacetica* Suggests a Proton-Dependent Electrochemical Response. *JACS* 140: 5527-34.

Van Ginkel SW, Miceli J, Kim B, Yang Z, Young M, **Marcus A**, Rittmann BE (2018). Determining the Mechanism for Low Sludge Yields in the Cannibal Solids Reduction System. *Water Env Research* 90: 42-7.

Ilhan ZE, DiBaise JK, Isern NG, Hoyt DW, **Marcus AK**, Kang D, Crowell MD, Rittmann BE, Krajmalnik-Brown R (2017). Distinctive microbiomes and metabolites linked with weight loss after gastric bypass, but not gastric banding. *ISME J.* 11:2047-58

Ilhan ZH, **Marcus AK**, Kang DW, Rittmann BE, Krajmalnik-Brown R (2017). pH-mediated microbial and metabolic interactions in fecal enrichment cultures. *mSphere*: e00047-17.

Zhou, C, Wang Z, **Marcus AK**, and Rittmann BE (2017). Biofilm-Enhanced Continuous Synthesis and Stabilization of Palladium Nanoparticles (PdNPs). *Environ Sci Technol.* 3: 1396-1404

Young MN, **Marcus AK**, and Rittmann BE (2013). A Combined Activated Sludge Anaerobic Digestion Model (CASADM) to understand the role of anaerobic sludge recycling in wastewater treatment plant performance. *Bioresouce Technol.* 136: 196-204.

Almeida PGS, Marcus AK, Rittmann BE, and Chernicharo CAL (2013). Performance of plastic-and sponge-based trickling filters treating effluents from an UASB reactor. *Water Sci Technol.* 67: 1034-1042.

Tang Y, Zhao H, **Marcus AK**, Krajmalnik-Brown R, and Rittmann BE (2012). A Steady-State Biofilm Model for Simultaneous Reduction of Nitrate and Perchlorate--Part 2: Parameter Optimization and Results and Discussion. *Environ Sci Technol.* 46: 1608-1615.

Tang Y, Zhao H, **Marcus AK**, Krajmalnik-Brown R, and Rittmann BE (2012). A Steady-State Biofilm Model for Simultaneous Reduction of Nitrate and Perchlorate--Part 1: Model Development and Numerical Solution. *Environ Sci Technol.* 46: 1598-1607.

Kim HY, **Marcus AK**, Shin JH, Rittmann BE (2011). Advanced Control for Photoautotrophic Growth Using a Membrane-Carbonation Photobioreactor. *Environ Sci Technol.* 45(11):5032-8

Marcus AK, Torres CI, and Rittmann BE (2011). Analysis of a Microbial Electrochemical Cell Using the Proton Condition in Biofilm (PCBIOFILM) Model. *Bioresouce Technol.* 102: 253-62

Marcus AK, Torres CI, and Rittmann BE (2010). Evaluating the Impacts of the ARB Reaction on the Biofilm Anode when the Model PCBIOFILM Includes Migration. *Electrochimica Acta.* 55: 6964-72.

Torres CI, **Marcus AK**, Lee HS, Parameswaran P, Krajmalnik-Brown R, Rittmann BE (2010). A kinetic perspective on extracellular electron transfer by anode-respiring bacteria. *FEMS Microbiol Rev* 34: 3-17.

Torres CI, Krajmalnik-Brown R, Parameswaran P, **Marcus AK**, Wanger G, Gorby YA, Rittmann BE (2009). Selecting anode-respiring bacteria based on anode potential: phylogenetic, electrochemical, and microscopic characterization. *Environ Sci Technol.* 43: 9519-24.

Torres CI, **Marcus AK**, Parameswaran P, and Rittmann BE (2008). Kinetic experiments for evaluating the Nernst-Monod model for anode-respiring bacteria (ARB) in a biofilm anode. *Environ Sci Tech* 42: 6593-6597.

Torres CI, **Marcus AK**, and Rittmann BE (2008). Proton transport inside the biofilm limits electrical current generation by anode-respiring bacteria. *Biotechnol Bioeng* 100: 872-881.

Lee HS, Parameswaran P, **Marcus AK**, Torres CI, and Rittmann BE (2007). Evaluation of energy-conversion efficiencies in microbial fuel cells (MFCs) utilizing fermentable and non-fermentable substrates. *Water Res* 42: 1501-1510.

Torres CI, **Marcus AK**, and Rittmann BE (2007). Kinetics of Consumption of Fermentation Products by Anode-Respiring Bacteria. *Appl Microbiol Biotechnol* 77: 689-697.

Marcus AK, Torres CI, and Rittmann BE (2007). Conduction-Based Modeling of the Biofilm Anode of a Microbial Fuel Cell. *Biotech Bioeng* 98: 1171-1182.

Ma Z, Walk T, **Marcus A**, and Lynch J (2001). Morphological synergism in root hair length, density, initiation and geometry for phosphorus acquisition in *Arabidopsis thaliana*: A modeling approach. *Plant and Soil* 236: 221-235.