

The Swette Center for Environmental Biotechnology in 2015

Bruce E. Rittmann
Director and Regents' Professor

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The Swette Center for Environmental Biotechnology had a great 2015 that is laying the foundation for an even better 2016. I take this opportunity to highlight the Center's achievements in 2015.

Background

The Swette Center for Environmental Biotechnology is part of the Biodesign Institute and the Global Institute of Sustainability. Its mission is to "manage microbial communities that provide services to society." Those services include generating renewable energy and materials, improving environmental quality, and enhancing human health. Our research ranges from fundamental to applied, involves collaboration within and outside ASU, and embodies the concept of "use inspired."

The Center's research and researchers are highly inter-disciplinary. This is reflected by the make up of its tenure-track faculty, who come from the School of Sustainable Engineering and the Built Environment (Bruce Rittmann and Rosa Krajmalnik-Brown), the School of Energy, Matter, and Transport Engineering (César Torres), and the School of Life Sciences (Hinsby Cadillo-Quiroz). Likewise, the Center's ~25 PhD students are enrolled in four Programs: Environmental Engineering, Biological Design, Microbiology, and Chemical Engineering. Over the years, the Center has mentored PhD students in four other PhD programs, including Sustainability and Chemistry and Biochemistry.

The common feature of all of the Center's research is its focus on understanding and managing microbial ecology. Routine tools include genomics, metabolomics, mathematical modeling, organic and inorganic chemistry, and bioreactor design. These tools are applied in novel ways to a wide range of applications, including: microbial electrochemical cells to convert waste biomass to energy, membrane biofilm reactors to reduce a wide range of oxidized pollutants in water, microalgae systems to capture sunlight energy and use it to convert CO₂ to valuable products, bioremediation of recalcitrant organic pollutants found in soil and groundwater, and managing the microorganisms in the human intestines to improve our health.

The Center's leadership is provided by four tenure-track faculty, and the total number of people working in the Center is between 70 and 80. This includes graduate students, post-doctoral associates, undergraduate interns, high-school interns, visiting scholars, and staff. The intellectual life of the Center is built on teamwork and collaboration. This atmosphere makes it fun to work in the Center, and it helps all Center researchers be productive. The following section highlights the Center's achievements in 2015; we truly had a lot of success and fun.

Highlights for 2015

Here are the Center's highlight achievements in categories of Outputs, Internal Activities, Outside Activities and Impacts, and Accolades and Support. An Appendix provides all the details.

Outputs

14 degrees earned: 4 PhDs, 5 Masters, and 5 Bachelors

50 papers published or accepted: including one on *Science*, one in *Nature*, and 7 in *Environmental Science & Technology*

74 presentations at conferences, universities, and other research laboratories

2 patents issued

10 PhD and post-doc alumni in professorial positions, including two new ones in 2015 (Dr. Youneng Tang at Florida State U. and Dr. Prathap Parameswaran at Kansas State U.)

Internal Activities

19 visiting scholars hosted from 7 countries and 4 continents

15 interns mentored, including 6 Swette Undergraduate Sustainability Interns and 10 FURI and SOLUR interns (some did both programs)

63 junior researchers mentored by 18 mentors (not tenure-track faculty): including 27 undergraduate students and 1 high school student

Outside Activities and Impacts

Organized and hosted the highly successful 2015 international conference of the International Society for Microbial Electrochemistry and Technology (ISMET)

43 collaborators at universities outside ASU, research labs, and industry

At least 15 collaborators within ASU

Hosted or facilitated at least 26 outreach activities, including the United Way campaign, Night of the Open Door, Intel Science Fair, Arizona Prison Education, and tours

Accolades and Support

51 awards to 25 individuals, including: 15 fellowships to students, 18 winners of competitions for things like best paper, 6 travel grants, and 1 alumni achievement award

27 funded research projects with a cumulative value > \$15.5 million

APPENDIX -- SWETTE CENTER ACCOMPLISHMENTS IN 2015

AWARDS AND HONORS RECEIVED

Megan Altizer

- ASU Fulton School of Engineering Dean's Fellow
- NSF Integrated Graduate Education and Research Traineeship (IGERT) Fellow

Thiago Stangerlin Barbosa

- Recipient of a scholarship from CNPq - Conselho Nacional de Desenvolvimento Científico e Tecnológico, of the Ministry of Science, Technology and Innovation of Brazil

Diana Calvo-Martinez

- Colciencias-Colfuturo Scholarship, Bogotá - Colombia

Zehra Esra Ilhan

- Graduate Completion RAship award.
- MCB/Micro Retreat Best Poster award.
- Graduate & Professional Student Association travel grant.
- Edward and Linda Birge travel grant.
- Graduate & Professional Student Association Jumpstart grant.

Neng long Chan

- Travel grants to go to the ASA, SSSA, CSSA annual meeting and SERA17 meeting in MN.
- One of twelve School of Sustainability students to study abroad (Morocco) in May 2016

Steven Hart

- NSF Graduate Research Fellowship - Awarded Summer 2015
- "Community-Scale Gasification and Biochar Retort Hubs for Rural Areas: A "Closed Loop" System for Sustainable Agriculture and Bioenergy" 2015 EPA P3 Student Design Project Expo, Honorable Mention

Ibrahim Halloum

- Internship at Genentech Inc., Summer 2015
- ASCE/ASHE Graduate Student Research Symposium: 1st Place Award, September 2015

Dongwon Ki

- Graduate Research Support Program (GRSP) Award, ASU, 2015-2016 (\$750, Intimate Coupling of Photocatalysis and Biodegradation in a Microbial Electrochemical Cell)
- Interview Travel Grant Award in Graduate and Professional Student Association (GPSA), ASU, 2015-2016 (\$550)
- Travel Grant Award in Graduate and Professional Student Association (GPSA), ASU, June, 2015 (\$950, AEESP conference)

Bradley Lusk PhD

- A Place at the Table Sustainability Conference. Workshop: Developed commercialized educational composting project and delivered business proposal to professional investors. Won best presentation award.

Mohamed Mahmoud

- 2015 Arizona Water Association Scholarship.
- American Chemical Society (ACS) Travel grant to attend the 2015 Summer School on Green Chemistry & Sustainable Energy, the Colorado School of Mines, Colorado, USA.

Juan Maldonado Ortiz

- Winner in [Seeing Science Photo Contest](#) at Biodesign Institute (Science Category AND Best of Show Category, *Excreta Spectrum*).

Joe Miceli PhD

- Mentor for Jeba Sania (high school student): Arizona State University Innovation and Entrepreneurship Award for “The Effects of Salt on the Methane Production” (Microbiology), Arizona Science and Engineering Fair.

Binh Nguyen

- Travel Grant by ASU Graduate and Professional Association to attend a conference, 02/2015.

Pat Pataranutaporn

- ASU Biodesign Institute Seeing Science Photography competition, Honorable Mention "Go Eat Styrofoam" depicting bacteria (blue) that can “eat” styrofoam.
- Team from SOLS that won second place for their invention in the [2015 Biomimicry Global Design Challenge](#).
 - National Geographic (http://web.patthai.org/images/press/attach/NGHU_1512_parallel.pdf)
 - The Guardian (<http://www.theguardian.com/sustainable-business/2015/oct/30/biomimicry-institute-sxsw-eco-agriculture-bioinspired>)
 - Disruptive Innovation Festival (<https://www.youtube.com/watch?v=7dykeBpMKAo>)
 - and also ASU Now (<https://asunow.asu.edu/20151022-asu-students-solution-global-malnutrition-belly-full-beetles>)
- Member of the ARKHumanity Team who won the top prize of \$10,000 in [Changemaker Challenge](#) by creating an app to reach out to those expressing thoughts of suicide on social media.

Kapila Patel

- 2015 Obesity Solutions Research Grant- funding received to test the overall health, gut microbiome, diet, and content understanding of kids in the Nutrition and Health Awareness Program.
- 2015-2016 Edson Student Entrepreneur Initiative- funding to develop Nutrition and Health Awareness into a nonprofit.

Isaias Peraza

- Yucatan Council for Science Innovation and Technology (CONCIYTEY) and the National Council for Science and Technology (CONACYT) Graduate Scholarship to pursue PhD in Environmental Engineering from 2015-2020.

Bruce Rittmann

- Alumni Achievement Award, Washington University in St. Louis
- Life Member, Association of Environmental Engineering and Science Professors
- Life Member, American Water Works Association
- Life Member, American Society of Civil Engineers
- Distinguished Professor appointment, Tec de Monterrey, Monterrey, Mexico

Levi Straka

- NSF Integrated Graduate Education and Research Traineeship (IGERT) Fellow
- Awarded (along with Joe Laureanti in Anne Jones' lab) the IGERT Competitive Innovation fund for our proposal, “Phototrophic Production of 3-Hydroxypropionate by Genetically Modified Synechocystis PCC 6803” in April 2015.

Misa Venning

- Honorary mention for photo “What’s on the Menu?” depicting a petri dish culture sourced from a restaurant menu in the Biodesign Institute’s Seeing Science competition.
- Achieved a Toastmasters "Competent Communicator" award for giving ten prepared

speeches

Burcu Yavuz

- ASU Fulton School of Engineering Dean's Fellowship

Rachel Yoho

- Runner-up, Naturejobs Scientific Data Writing Competition, Nature Publishing Group (from scientific data publication in the Naturejobs Blog listed below)
- ASU School of Life Sciences Special Recognition Award – e-Portfolio Showcase
- ASU SUN (Serving University Needs) Award
- ASU School of Biological and Health Systems Engineering Travel Grant

Michelle Young

- Best Poster Award, International Society of Microbial Electrochemistry and Technologies (ISMET) Conference 2015
- 2015-2016 Phoenix/Scottsdale Groundwater Contamination Scholarship for Environmental Science
- Arizona Water Association Scholarship recipient

Yun Zhou

- 2015.10 Yang Qin Environmental Education Scholarship in 2014-2015
- 2015.05 2nd prize for the 10th National Grad Students' Environment Forum
- 2015.05 3rd prize for the 4th Hangzhou College Students' Entrepreneurship Competition

DEGREES CONFERRED

Deanna Becker

- Bachelor of Science in Molecular Biosciences and Biotechnology

Brendan Cahill

- Defended Barrett Honors College honors thesis on the effects of heterotrophic growth on *Synechocystis* growth.

Carlos Courtney

- Bachelor of Science in Biology

Devyn Fajardo Williams

- Masters degree in Environmental Engineering. Thesis: *Coupling Bioflocculation of Dehalococcoides to High-Dechlorination Rates for Ex situ and In situ Bioremediation.*

Joseph Gonzales

- Bachelor of Science in Microbiology

Ibrahim Halloum

- Bachelor of Science in Chemical Engineering

Zhuolin Liu

- Masters in Environmental Engineering; Thesis: *Benzene and Toluene Biodegradation with Different Dissolved Oxygen Concentrations*

Bradley Lusk PhD

- PhD in Biological Design. Dissertation Title: *Thermophilic Microbial Electrochemical Cells* (Watch at youtu.be/757yYPqmyOs?a)

Joe Miceli PhD

- PhD in Microbiology. Dissertation Title: *Building Microbial Communities and Managing Fermentation in Microbial Electrolysis Cells.*

Binh Nguyen

- PhD in Environmental Engineering. Dissertation Title: *The Effects of Light Intensity, Nitrogen Sources and Growth Kinetics on Growing Cyanobacteria*

Deepthi Shivanna

- Masters in Environmental Engineering. Thesis: *Dechlorination of Groundwater via Bioremediation*".

Matthew Thompson

- Masters degree in Environmental Engineering. Thesis: *Recycling Water and Nutrients When Producing the Cyanobacterium Synechocystis sp. PCC 6803.*

Sharad Vellore Suresh

- Masters degree in Environmental Engineering. Thesis: *Microbial hydrolysis, a comparison between biological and bio-electrochemical systems - experiments with cellulose & casein.*

Alexander Zevin

- PhD degree in Microbiology. Thesis: *Characterization of Structure and Function of Microbial Communities in Synechocystis sp. PCC6803 Photobioreactors.*

INTERNS MENTORED

Francisco Brown-Munoz

- Fulton Undergraduate Research Initiative (FURI) Program
- Swette/GIOS Intern in the Swette Center for Environmental Biotechnology

Brendan Cahill

- Fulton Undergraduate Research Initiative (FURI) Program
- Swette/GIOS Intern in the Swette Center for Environmental Biotechnology

Annika Faucon

- Swette/GIOS Intern in the Swette Center for Environmental Biotechnology

Ibrahim Halloum

- Swette/GIOS Intern in the Swette Center for Environmental Biotechnology

John Harrington

- Fulton Undergraduate Research Initiative (FURI) Program

Denton Holzer

- Fulton Undergraduate Research Initiative (FURI) Program
- Swette/GIOS Intern in the Swette Center for Environmental Biotechnology

Jacob Hrkjal (Microbiology)

- School of Life Sciences Undergraduate Research (SOLUR)

Sanya Mehta

- Fulton Undergraduate Research Initiative (FURI) Program
- Swette/GIOS Intern in the Swette Center for Environmental Biotechnology

Kapila Patel

- School of Life Sciences Undergraduate Research (SOLUR)

Roland Righthart (Biology)

- ASU's Initiative for Maximizing Student Development (IMSD) Program

Jessica Spring (Microbiology)

- School of Life Sciences Undergraduate Research (SOLUR)
- ASM Summer Scholars Program

Mikaela Stadie

- Fulton Undergraduate Research Initiative (FURI) Program

Delaney VanWinkle

- Fulton Undergraduate Research Initiative (FURI) Program

Zixuan Wang

- Fulton Undergraduate Research Initiative (FURI) Program

Zachary Zamora (Microbiology)

- ASU's Initiative for Maximizing Student Development (IMSD) Program

VISITING SCHOLARS HOSTED

- Anderson Alves de Carvalho, Brazil
- Shuangshi Dong, Jilin University, China
- Federica de Francesco, Biotechnico di Torino, Italy
- Jaehoon Hwang, Yonsei University, Korea
- Qaiser Kahn, Quaid-I-Azam University, Islamabad, Pakistan
- Taeho Lee, Pusan National University, South Korea
- Kadmiel Naliele Oliveira Pereira, Brazil
- Sen Qiao, Dalian University of Technology, China
- Yue (Hilary) Shi, Harbin Engineering University, China
- Eyasu Shuba, Addis Ababa University, Ethiopia
- Sara Tejedor Sanz, Alcalá Univeristy, Spain
- Jianglei Xiong, Southeast University, China
- Xiaoyin Xu, Southeast University, China
- Qi Yang, Hunan University, China
- Yingying Zhang, Jiangsu Academy of Agricultural Sciences, China
- Yanguo Zhao, Ocean University of China
- Dandan Zhou, Northeast Normal University, China
- Yun Zhou, Tongji University, China

PAPERS PUBLISHED OR ACCEPTED

- Bai, Q.; L. Yang; Lihui, R. Li; B. Chen; L. Zhang; Y. Zhang; and **B. E. Rittmann** (2015). Electrons from a photolysis product accelerate quinoline biodegradation and mineralization. Environ. Sci. Technol. 49: 11536 – 11542.
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- Brauer S., H. **Cadillo-Quiroz**; H. Kyrpides; T. Woyke; L. Goodwin; S. Podell; J. Yavitt; H. Zinder (2015). Genome of *Methanoregula boonei* reveals adaptation to oligotrophic peatlands environments. SGM Microbiology 161:1572-1581.
- **Cadillo-Quiroz, H.**; P. Browne; N. Kyrpides; T. Woyke; L. Goodwin; C. Detter; J. Yavitt; S. Zinder (2016). Complete genome sequence of *Methanosphaerula palustris* E1-9C^T, a hydrogenotrophic methanogen isolated from a minerotrophic fen peatland. Genome Announcements, accepted.
- Chen, B.; Yang, L.; Bai, Q.; Li, R.; **B. E. Rittmann**; and Y. Zhang (2015). Coupling UV-H₂O₂ to accelerate dimethyl phthalate (DMP) biodegradation and mineralization. Biodegradation 26: 431 – 441.
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- Cueller-Bermudez, S. P.; M. A. Romero-Owaga; R. Vannela; **Y.-J Lai**; **B. E. Rittmann**; and R. Parra-Saldivar (2015). Effects of light intensity and carbon dioxide on lipids and fatty acids produced by *Synechocystis* sp. PCC6803 during Continuous Flow. Algal Research 12: 10 – 16.
- Frye, R. E.; J. Slattery; D. F. MacFabe; E. Allen-Vercoe; W. Parker; J. Rodakis; J. B. Adams; **R. Krajmalnik-Brown**; E. Bolte; S. Kahler; J. Jennings; J. James; C. E. Cerniglia; and T. Midtvedt (2015). “Approaches to studying and manipulating the enteric microbiome to improve autism symptoms” Microbial Ecology in Health & Disease 2015, **26**: 26878 - <http://dx.doi.org/10.3402/mehd.v26.26878>.
- Gifford, M.; J. Liu; B. E. **Rittmann**; R. Vannela; and P. Westerhoff (2015). Phosphorus recovery from microbial biofuel residual using microwave peroxide digestion and anion exchange. Water Research 70: 130-137.
- Hansen, J.; J. Hogue; G. Sander; R. A. Renaut; **S. C. Popat** (2015). Non-negatively constrained least squares and parameter choice by the residual periodogram for the inversion of electrochemical impedance spectroscopy. Journal of Computational and Applied Mathematics, 278, 52-74.
- Huete-Pérez, J.; P. Alvarez; J. Schnoor; **B. E. Rittmann**; A. Clayton; M. Acosta; C. E. Bicudo; M. Kalin Arroyo; M. Brett; V. Campost; H. Chaimovich; A. Covich; B. Jimenez-Cisneros; L. Lacerdo; J.-M. Maes; J. Miranda; S. Montenegro Guillen; M. Ortega Hegg; G. Urauhart; K. Vammen; and L. Zambrano Gonzalez (2015). Scientists raise alarms about fast tracking of transoceanic canal through Nicaragua. Environ. Sci. Technol. 49: 3989-3996.
- Hyun, K.; J. Choi; **D. Ki**; J. Park; S. Ahn; H. Oh; Y.K. Choung (2016). Bathroom wastewater treatment in constructed wetlands with planting, non-planting and aeration, non-aeration conditions. Desalination and Water Treatment, in press.
- **Kang, D**; J. K. DiBaise; **Z.E. Ilhan**; M. D. Crowell; J.R. Rideout; J. G. Caporaso; **B.E. Rittmann**; and **R. Krajmalnik-Brown** (2015). The gut microbial ecology in adults with chronic constipation before and after treatment with lubiprostone. Anaerobe. 33:33-41
- **Ki, D.**; **S. C. Popat**; **C. I. Torres** (2016). Reduced overpotentials in microbial electrolysis cells through improved design, operation, and electrochemical characterization. Chemical Engineering Journal, 287, 181-188.
- **Ki, D.**; **P. Parameswaran**; **B. E. Rittmann**; **C. I. Torres** (2015). Effect of pulsed electric field (PEF) pretreatment on primary sludge for enhanced bioavailability and energy capture. Environmental Engineering Science, 32, 831-937.
- **Ki, D.**; **P. Parameswaran**; **S. C. Popat**; **B. E. Rittmann**; **César I. Torres** (2015). Effects of pre-fermentation and pulsed-electric-field treatment of primary sludge in microbial electrochemical cells. Bioresource Technology, 195, 83-88.
- **Krajmalnik-Brown, R.**; Louzopone C.; **Kang DW**; and J. Adams (2015). Gut bacteria in children with Autism Spectrum Disorders: Challenges and promise of studying how a complex community influences a complex disease. Microbial Ecology in Health and Disease. 26
- **Lai Y.S.**; **P. Parameswaran**; A. Li; A. Aguinaga; B.E. **Rittmann** (2015). Selective fermentation of carbohydrate and protein fractions of *Scenedesmus*, and biohydrogenation of its lipid fraction for enhanced recovery of saturated fatty acids. Biotechnology and Bioengineering DOI:10.1002/bit.257143.
- **Lai Y.S.**; F.D. Francesco; A. Aguinaga; **P. Parameswaran**; **B.E. Rittmann** (2016). Improving lipid recovery from *Scenedesmus* wet biomass by surfactant-assisted disruption. Green Chemistry, accepted.
- Li, W.-W.; H.-Q. Yu; and **B. E. Rittmann** (2015). Reuse water pollutants. Nature 528: 29 –

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- Liu, Z.; G.-N. Lu; H. Yin; Z. Dang; and **B. E. Rittmann** (2015). Removal of natural estrogens and their conjugates in municipal wastewater treatment plants. Environ. Sci. Technol. 49: 5288-5300.
- Luo, Y.-H.; R. Chen; L.-L. Wen; F. Meng; Y. Zhang; C.-Y. Lai; **B. E. Rittmann**; H.-P. Zhao; and P. Zheng (2015). Complete perchlorate reduction using methane as the sole electron donor and carbon source. Environ. Sci. Technol. 49: 2341-2349.
- **Lusk, B. G.; Q. F. Khan; P. Parameswaran**; A. Hameed; N. Ali; **B. E. Rittmann**; and **C. I. Torres** (2016). Characterization of Electrical Current-Generation Capabilities from Thermophilic Bacterium *Thermoanaerobacter pseudethanolicus* Using Xylose, Glucose, Cellobiose, or Acetate with Fixed Anode Potentials. Environmental Science & Technology, Article ASAP. DOI: 10.1021/acs.est.5b04036.
- **Lusk, B. G.**; J. P. Badalamenti; **P. Parameswaran**; D. R. Bond; **C. I. Torres** (2015). Draft genome sequence of the gram-positive thermophilic iron reducer *Thermincola ferriacetica* strain Z-0001T. Genome Announcements, 3, e01072-15.
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- Nunes da Rocha, U.; H. **Cadillo-Quiroz**; U. Karaoz; L. Rajeev; N. Klitgord; S. Dunn; V. Truong; M. Buenrostro; B. Bowen; F. Garcia-Pichel; A. Mukhopadhyay; T. Northen; E. Brodie (2015). Isolation of a significant fraction of non-phototroph diversity from a desert Biological Soil Crust. Frontiers in Microbiology 6: 277.
- Pan, S.; N. Yan; Y. Zhang; **B. E. Rittmann** (2015). UV photolysis for relieved inhibition of sulfadiazine (SD) to biomass growth. Bioprocess & Biosystems Engr. 38: 911-915.
- Park, S.; J.-W. Chung; **B. E. Rittmann**; and W. Bae (2015). Nitrite accumulation from simultaneous free-ammonia and free-nitrous acid inhibition and oxygen limitation in a continuous-flow biofilm reactor. Biotechnol. Bioengr. 112: 43-52.
- Sarkar, D. C.; A. Sathasivan; and **B. E. Rittmann**. Modelling combined effect of chloramine and copper on ammonia-oxidizing microbial activity using a biostability approach. Water Res. 84: 190-197.
- Sosa-Hernández O.; **S. C. Popat**; **C. I. Torres**; **P. Parameswaran**; G.S. Alemán-Navaa; G. Buitró;, R. Parra-Saldívar (2016). Application of microbial electrolysis cells to treat spent yeast from an alcoholic fermentation. Bioresource Technology, accepted.
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- Wen, L. L.; Y. Zhang; Y.W. Pan; W. Q. Wu; S. H. Meng; **C. Zhou**; ... & H. P. Zhao (2015). The roles of methanogens and acetogens in dechlorination of trichloroethene using different electron donors. Environmental Science and Pollution Research, 22(23), 19039-19047.
- Xu, X.; S. Xia; Z. Liu; J. Liang; S. Shen; L. Zhou; Z. Zhang; and **B. E. Rittmann** (2015). Bioreduction of vanadium (V) in groundwater by autohydrogentrophic bacteria: mechanisms and microorganisms. J. Environ. Sci. 30: 122-128.
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- Yeo, H.; J. An; R. Reid; **B. E. Rittmann**; and H.-S. Lee (2015). Mechanisms for over-saturation of dissolved methane in anaerobic membrane bioreactors treating dilute wastewater. Environ. Sci. Technol. 49: 10366 – 10372.
- **Yoho, R. A.**; L. Rago; **S. C. Popat**; A. Guisasola; **C. I. Torres** (2015). Anode biofilms of *Geothallobacter ferrihydriticus* exhibit electrochemical signatures of multiple electron transport pathways. Langmuir. 31(45), 12552-12559.
- **Yoho, R. A.**; **S. C. Popat**; F. Fabregat-Santiago; S. Giménez; A. ter Heijne; **C. I. Torres** (2015). Electrochemical Impedance Spectroscopy as a Powerful Analytical Tool for the Study of Microbial Electrochemical Cells. In (book): Electrochemically active biofilms in microbial fuel cells and bioelectrochemical systems: from laboratory practice to data interpretation. Beyenal & Babuta. John Wiley & Sons. Hoboken, New Jersey.
- **Yoho, R. A.**; **S. C. Popat**; **C. I. Torres** (2015). Electrochemical techniques reveal multiple pathways for electron transport in microbial anode respiration. Proceedings of The International Chemical Congress of Pacific Basin Societies, Pacificchem.
- **Yoho, R. A.** (2015) How science fairs jump-started my research career. Science, 349(6255), 1578.
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- **Yoho, R. A.**; B. Vanmali (2015). Energy and climate change presentation in undergraduate introductory chemistry textbooks. Proceedings of The International Chemical Congress of Pacific Basin Societies, Pacificchem.
- **Yoho, R. A.**; B. Vanmali (2016). Controversy in biology classrooms – citizen science approaches to evolution and applications to climate change discussions. Journal of Microbiology and Biology Education. Accepted, in press. Special issue release March 2016.
- **Yoho, R. A.**; B. Vanmali. Role of renewable energy and environmental political policies in introductory science education. NARST – National Association for Research in Science Teaching 2016. Conference proceedings 2016 extended abstract accepted, in press.
- **Zevin, A.S.**; T.G. Nam; **B. E. Rittmann**; **R. Krajmalnik-Brown** (2015). Effects of phosphate limitation on soluble microbial products and microbial community structure in semi-continuous *Synechocystis*-based photobioreactors. Biotechnology and Bioengineering 112:9 1761-1769.
- **Zevin, A. S.**; **B. E. Rittmann**; and **R. Krajmalnik-Brown** (2016). Effects of inoculum source on the structure of bacterial communities in *Synechocystis* sp. PCC6803-based photobioreactors. Algal Res. 13: 109-116.
- **Zhou, C.**; **Z. Liu**; **P. Pataranutaporn**; R. Vannela; K. F. Hayes; & **B. E. Rittmann** (2015). Biogenic nano-particulate iron-sulfide produced through sulfate and Fe (iii)-(hydr) oxide reductions was enhanced by pyruvate as the electron donor. RSC Advances, 5(122), 100750-100761.
- **Zhou, Y.**; S. Xia; J. Zhang; Z. Zhang (2016). Adsorption characterizations of biosorbent extracted from waste activated sludge for Pb(II) and Zn(II). Desalin Water Treat, DOI:10.1080/1944 399 4.20 15. 1028455.
- **Zhou, Y.**; S. Xia; J. Zhang; Z. Zhang (2016). Associated adsorption characteristics of Pb(II) and Zn(II) by a novel biosorbent extracted from waste activated sludge. J Environ Eng-ASCE, DOI: 10.1061/(ASCE)EE.1943-7870. 0001104.

PRESENTATIONS AT CONFERENCES

- **S. Buessecker**, J. B. Glass, **H. Cadillo-Quiroz** (2015). Origin and fate of nitrous oxide in a putative coupled abiotic-biotic denitrification process in tropical peatlands. Astrobiology Science Conference (AbSciCon), Chicago, USA.
- **Chan, N. I.** (2015) Invited poster presentation for the Sustainable Food System Workshop
- **Chen T.; B. M. Yavuz; A.G. Delgado; A.J. Proctor;** Y. Zuo; P. Westerhoff; **B. E. Rittmann.** *Ozone enhances the bioavailability of residual heavy hydrocarbons in soil.* Battelle Third International Symposium on Bioremediation and Sustainable Environmental Technologies. Miami, FL. May 2015. Conference presentation.
- **Delgado AG**, Chevron International Travel Grant and Appreciation Award. Workshop of Hydrocarbon-Impacted Soils Pretreatment and Oxidants, Bandung, West Java, Indonesia, 2015.
- **Delgado AG;** R. Kamath; **R. Krajmalnik-Brown R.** *Bioremediation of hydrocarbon-impacted soils.* Part of Workshop of HIS Pretreatment and Oxidants, Institute of Technology Bandung, West Java, Indonesia. August 2015. Seminar presentation.
- **Delgado AG;** R. Kamath R; O. G. Apul; **T. Chen; B. M. Yavuz; B. E. Rittmann;** P. Westerhoff; **R. Krajmalnik-Brown.** *Chemical oxidants: applications for remediation of petroleum hydrocarbons.* Part of Workshop of HIS Pretreatment and Oxidants, Institute of Technology Bandung, West Java, Indonesia. August 2015. Seminar presentation.
- **Delgado A.G.** *Evaluation of bioremediation and advanced oxidation in heavy petroleum hydrocarbon-impacted soil.* ASU Environmental Engineering Seminar, School of Sustainable Engineering and the Built Environment. April 2015. Seminar presentation.
- **Delgado A.G.;** I. Halloum; **T. Chen; B. M. Yavuz; J. Maldonado; F. Alam;** D. Kang; E. A. Edwards; **B. E. Rittmann; R. Krajmalnik-Brown.** *Bioremediation of petroleum hydrocarbon-contaminated soil following ozone pretreatment.* Battelle Third International Symposium on Bioremediation and Sustainable Environmental Technologies. Miami, FL. May 2015. Conference presentation.
- Epshtein, O.; D.J. Tallman; **S.G. Hart;** E. Kavazanjian; and R. U. Halden. *Modeling the pollution prevention benefits of adding biochar to erosion-prone agricultural soils,* oral presentation at the 58th Annual Association of Engineering and Environmental Geologists Annual Meeting, Pittsburgh, Pennsylvania, 19-26 September, 2015.
- Epshtein, O.; **S. G. Hart;** D. J. Tallman; D. DePinte; M. A. Bowker; E. Kavazanjian; and R. U. Halden. *Greener agriculture, healthier forests, clean waters? Feasibility studies for agricultural biochar amendment,* oral presentation at the Arizona Water Association 88th Annual conference, Glendale, Arizona, 6-8 May, 2015.
- **Esquivel-Elizondo S.** and R. Krajmalnik-Brown. *CO conversion to acetate: history and biotechnological promise.* 115th General meeting of the American Society for Microbiology, New Orleans, LA. May 2015.
- **Fajardo-Williams D.;** **A. G. Delgado; C. I. Torres; R. Krajmalnik-Brown.** *Bioreactor design for high-rate dechlorination of chlorinated solvent-contaminated groundwater.* Remtec, Westminster, CO. March 2015. Conference presentation.
- **Hart, S. G.;** **S. K. Vellore Suresh; P. Parameswaran; C. Torres.** *High temporal resolution and reliable determination of particulate Casein anaerobic hydrolysis rates using Microbial Electrolysis Cells.* Poster Presented at the fifth international meeting on microbial electrochemistry and technologies, Tempe, Arizona, 1-4 October 2015.

- **Ilhan, Z.E.;** N. G. Isern; **A. K. Marcus;** **D. W. Kang;** David W. Hoyt; J. K. DiBaise; **B. E. Rittmann;** **R. Krajmalnik-Brown.** *Altered microbial amino acid metabolism in the gut after Roux-en-Y gastric bypass surgery might contribute to sustainable post-surgical weight loss.* Multi-omics for Microbiomes Conference, September 14-16, 2015, Kennewick, WA (poster presentation).
- **Ilhan, Z.E.;** J. K. DiBaise; **A. K. Marcus;** M. Crowell; **D. W. Kang, B. E. Rittmann, R. Krajmalnik-Brown.** *Microbiome of Roux-en-Y gastric bypass and laparoscopic adjustable gastric banding patients: Insights into weight loss post-bariatric surgery,* 115th American Society for Microbiology Annual Meeting, May 30-June 2, 2015, New Orleans, LA (young investigator oral presentation).
- **Ilhan, Z.E.;** **A. K. Marcus;** N. G. Isern; **D. W. Kang;** D. W. Hoyt; J. K. DiBaise; **B. E. Rittmann;** **R. Krajmalnik-Brown.** *The gut microbial community and its amino acid metabolism: Insights into Roux-en-Y gastric bypass surgery success,* 5th ASM Conference on Beneficial Microbes, September 27-30, 2014, Washington, D.C. (poster presentation).
- **Ilhan, Z.E.;** **D. W. Kang;** **A. K. Marcus.** *Roux-en-Y Gastric Bypass and Laparoscopic Gastric Banding Surgeries Affect the Dynamics of Gut Microbial Ecology and Metabolism,* 31st Annual Scientific Meeting of the Obesity Society, November 11-16, 2013, Atlanta, Georgia (poster presentation).
- Kamath R.; **A. G. Delgado;** O. G. Apul; P. Westerhoff; **R. Krajmalnik-Brown.** *Surfactant-enhanced remediation of petroleum hydrocarbons.* Part of Workshop of HIS Pretreatment and Oxidants, Institute of Technology Bandung, West Java, Indonesia. August 2015. Seminar presentation.
- Larson, A.; S. Gao; H. Emick; **S. G. Hart;** K. Larrimore; A. Suchy; A. Poetzl; V. Moore; A. Finkelstein; J. Tran; T. Mor; *Teaching biology in a maximum-security prison unit: Notes, feedback, and recommendatinos from a pilot class.* Poster presented at the American Association for the Advancement of Science annual meeting, Spring 2015, San Jose, CA.
- **Kang, D. W.** *Alterations in intestinal microbial populations may lead to modifications in neuroactive metabolites in children with autism spectrum disorders.* (Science and Mathematics Seminars at ASU Polytechnic campus, Oct 2015)
- **Ki, D;** **S. C. Popat;** **C. I. Torres.** *Towards microbial electrochemical cell design and operation with low overpotentials.* Poster presented at International Society for Microbial Electrochemistry and Technology meeting 2015, Arizona State University, AZ, October 1-4.
- **Ki, D;** **P. Parameswaran;** **S. C. Popat;** **B. E. Rittmann;** **C. I. Torres.** *Enhancing Coulombic recovery from primary sludge in microbial electrochemical cells.* Poster presented at International Society for Microbial Electrochemistry and Technology meeting 2015, Arizona State University, AZ, October 1-4.
- **Ki, D;** **P. Parameswaran;** **S. C. Popat;** **B. E. Rittmann;** **C. I. Torres.** *Energy recovery from primary sludge using microbial electrochemical cells (MXCs).* Poster presented at AEESP Research and Education Conference, Yale University, CT, June 13-16, 2015.
- **Ki, D;** **P. Parameswaran;** **S. C. Popat;** **B. E. Rittmann;** **C. I. Torres.** *Energy recovery from primary sludge using microbial electrochemical cells (MXCs).* Poster presented at Arizona Water Association Annual Conference. May 2015.
- **Lai, Y. J.** Oral technical conference presentations: Algae Biofuels, Biomass & Bioproducts (ABBB) in San Diego (June 2015).
- **Lusk, B.** Quaid-i-azam University- Gave seminar *Environmental Biotechnology* to microbiology program in Islamabad, Pakistan.
- **Miceli, J.** Presented a poster at ISMET 2015: *The effects of high ammonia on fermentation in MECs.*

- **Nguyen, B.** *Using a pH-stat to understand how the N source affects the concentration of inorganic carbon in microalgae culture.* ACS 249th National Meeting and Exposition (oral presentation).
- **Nguyen, B.** *Effects of inorganic carbon and pH on growth kinetics of Synechocystis sp. PCC 6803,* 5th International Conference on Algal BBB (poster).
- **Ontiveros-Valencia A.; B. E. Rittmann; R. Krajmalnik-Brown; H. P. Zhao; D. Friese; P. Evans.** *Managing biofilm communities to reduce nitrate and perchlorate: from bench to pilot scale.* International Water Association specialized conference on Biofilms in drinking water systems, Switzerland, August 2015, poster presentation.
- **Peraza, I.** *Modeling the electrochemical behavior of a Microbial Fuel Cell through a dynamic oscillatory pH model,* ISMET 2015 poster presentation, October 2, 2015.
- **Peraza, I.** Invited Guest for the Navajo Nation to participate in the Uranium Contamination Remediation Conference, December 12, 2015.
- **Rittmann, B. E.** *Intimately Coupled Photocatalysis and Biodegradation (ICPB) for Detoxification of Recalcitrant Organics.* January 12, 2015. 3rd International Conference on Water Research, Kylin Villa, Shenzhen, China.
- **Rittmann, B. E.** *The Membrane Biofilm Reactor (MBfR).* January 13, 2015. McWong Technologies, Shanghai, China
- **Rittmann, B. E.** *Making Research Meet Practice in Environmental Biotechnology.* January 14, 2015. South China University of Technology, Guangzhou, China
- **Rittmann, B. E.** *Making Research Meet Practice in Environmental Biotechnology.* January 15, 2015. Shenzhen Graduate College of Harbin Institute of Technology, Shenzhen, China
- **Rittmann, B. E.** *Biofilm Processes.* January 29, 2015. National Research Council/General Accountability Office Workshop on Assessment of Municipal Water Treatment Processes, Washington, DC.
- **Rittmann, B. E.** *New Developments for Microorganism-Based Resource Recovery from Organic Streams.* April 22, 2015. Marquette University, Milwaukee, WI.
- **Rittmann, B. E.** *SON, SMP, EPS, and GFP.* May 1, 2015. Gene F. Parkin Retirement Conference, University of Iowa, Iowa City, IA.
- **Rittmann, B. E.** *Biofilm Processes.* May 28, 2015. Young Water Professionals Conference, International Water Association, Kyoto, Japan.
- **Rittmann, B. E.** *Intimately Coupling Photocatalysis and Biofilm Processes.* June 2, 2015. Leading Edge Technology Conference, International Water Association, Hong Kong.
- **Rittmann, B. E.** *Microbial Products.* June 5, 2015. Tongji University, Shanghai, China.
- **Rittmann, B. E.** *Microbial Products.* June 6, 2015. Shanghai Normal University, Shanghai, China.
- **Rittmann, B. E.** *Microbial Products.* June 7, 2015. Shanghai University, Shanghai, China.
- **Rittmann, B. E.** *Finding New Funding Sources in Environmental Engineering.* June 14 – Biennial Conference of the Association of Environmental Engineering and Science Professors, Yale University, New Haven, CT.
- **Rittmann, B. E.** *Maximizing Microorganism-Based Resource Recovery from Organic Streams.* June 25, 2015. Resource Recovery Workshop, Netherlands Office of Science and Technology, Milwaukee, WI.
- **Rittmann, B. E.** *Making Research Meet Practice in Environmental Biotechnology.* August 27, 2015. EAWAG, Dübendorf, Switzerland.
- **Rittmann, B. E.** *Microbial Photobioenergy: Making CO₂ a Resource, Not a Liability.* October 12, 2015. Symposium on Waste to Energy, Tel Aviv University, Israel.

- **Rittmann, B. E.** *Ozone Enhances the Biodegradability of Heavy Hydrocarbons in Soil*. October 13, 2015. Annual Conference of the Israel Society of Ecology & Environmental Sciences, Hebrew University, Jerusalem, Israel.
- **Rittmann, B. E.** *Opportunities in Microbial Bioenergy*. October 13, 2015. Annual Conference of the Israel Society of Ecology & Environmental Sciences, Hebrew University, Jerusalem, Israel.
- **Rittmann, B. E.** *Prying Open the Black Box*. October 14, 2015. Ben Gurion University of the Negev, Sede Boker, Israel.
- **Rittmann, B. E.** *Understanding the Biofilm Anode in Microbial Electrochemical Cells (MxCs)*. October 15, 2015. Annual Conference of the Israeli Electrochemical Society, Ben Gurion University, Be'er Sheva, Israel.
- **Rittmann, B. E.** *Microbial Photobioenergy: Making CO₂ a Resource, Not a Liability*. October 23, 2015. Chancellors Lecture Series, University of Missouri, Columbia, MO.
- **Rittmann, B. E.** *Prying Open the Black Box*. October 24, 2015. Civil and Environmental Engineering, University of Missouri, Columbia, MO.
- **Rittmann, B. E.** *Reducing Oxidized Contaminants*. October 30, 2015. Clarke Prize Symposium, National Water Research Institute, Huntington Beach, CA.
- **Rittmann, B. E.** *Biomass Sources, Characteristics, Challenges, and Opportunities*. December 2, 2015. Chemical Conversion via Modular Manufacturing Workshop, St. Louis, MO.
- **Yoho, R.A.** Invited Talk: "Energy and climate change presentation in undergraduate introductory chemistry textbooks." PACIFICHEM The International Chemical Congress of Pacific Basin Societies 2015, Honolulu, Hawaii, December 20, 2015
- **Yoho, R.A.** PACIFICHEM, The International Chemical Congress of Pacific Basin Societies 2015, Honolulu, Hawaii (conference presentation)
- **Yoho, R.A.** West Coast Science Communication Retreat, Malibu, CA (presentation)
- **Yoho, R.A.** ISMET5, The Fifth International Meeting on Microbial Electrochemistry and Technologies, Tempe, AZ (conference presentation)
- **Yoho, R.A.** SABER – Society for the Advancement of Biology Education Research, Minneapolis, MN (conference presentation)
- **Yoho, R.A.** Arizona/Nevada American Society for Microbiology Meeting, Flagstaff, AZ (conference presentation)
- **Yoho, R.A.** Arizona State University Social Sciences Graduate Research Poster Session (presentation)
- Bogosh, M.; P. Richards; P. Evans; T. Nguyen; E. Guven; **M. Young; C. Torres;** and B. Logan. Oral presentation of "Life Cycle Environmental and Cost Assessment of Microbial Electrochemical Cells and Conventional Technologies for Wastewater Treatment at Forward Operating Bases." Water and Energy 2015. June 8, 2015.
- Bogosh, M.; P. Richards; P. Evans; T. Nguyen; E. Guven; **M. Young; C. Torres;** and B. Logan. Oral presentation of "Life Cycle Environmental and Cost Assessment of Microbial Electrochemical Cells and Conventional Technologies for Wastewater Treatment at Forward Operating Bases." Battelle Third International Symposium on Bioremediation and Sustainable Environmental Technologies. May 18-21, 2015.
- **Young, M.; F. Brown-Munoz; B.E. Rittmann; C.I. Torres; P. Parameswaran.** Poster presentation of "Microbial electrolysis cells (MECs) detect differences in waste-activated sludge pretreatment technologies." The 5th International Meeting of the International Society of Microbial Electrochemistry and Technologies (ISMET). October 2015.
- **Young, M.; S.C. Popat; B.E. Rittmann; C.I. Torres.** Poster presentation of "Continuous hydrogen peroxide production in microbial electrochemical cells." The 5th International

Meeting of the International Society of Microbial Electrochemistry and Technologies (ISMET). October 2015.

- **Young, M.; F. Brown-Munoz; B.E. Rittmann; C.I. Torres; P. Parameswaran.** Poster presentation of “Microbial Fuel Cells Detect Differences in Waste Activated Sludge Pretreatment Technologies.” Arizona Water Reuse Symposium. July 2015.
- **M. Young; P. Parameswaran; C.I. Torres; B.E. Rittmann.** Oral presentation of “Application of Microbial Electrochemical Cells (MXCs) as real-time sensors of bioavailability from sludge pretreatment technologies.” Water and Energy 2015. June 8, 2015.
- **Young, M.; S.C. Popat; B.E. Rittmann; C.I. Torres.** Poster presentation of “Continuous hydrogen peroxide production in microbial electrochemical cells.” Water and Energy 2015. June 8, 2015.
- **Young, M.; F. Brown-Munoz; B.E. Rittmann; C.I. Torres; P. Parameswaran.** Poster presentation of “Microbial Fuel Cells Detect Differences in Waste Activated Sludge Pretreatment Technologies.” Arizona Water Association Annual Conference. May 2015.
- **Young, M.; F. Brown-Munoz; B.E. Rittmann; C.I. Torres; P. Parameswaran.** Poster and oral presentations of “Microbial Fuel Cells Detect Differences in Waste Activated Sludge Pretreatment Technologies.” ASU’s School of Sustainable Engineering and the Built Environment’s 4th Annual Graduate Research Symposium. March 2015.
- **Young, M.** “Microbial fuels cells as biosensors to detect differences in pretreatments for waste activated sludge.” March 2015. Class lecturer in CEE 591: Environmental Engineering Seminar, Arizona State University.
- **Zhou, C.** *Bioremediating Uranium in Water Using the Membrane Biofilm Reactor (MBfR).* Dec 12, 2015. Cameron, AZ. Presentation to the Navajo Nation.

PATENTS ISSUED

- **S. C. Popat, P. Parameswaran, B. E. Rittmann, C. I. Torres.** Microbial electrolysis cells and methods for production of chemical products. U. S. patent #9216919; issued 12/22/2015.
- **B. E. Rittmann, C. I. Torres, H.-S.Lee.** Bicarbonate and carbonate as hydroxide carriers in a biological fuel cell. US Patent no. 9,142,852 (September 22, 2015).

SCEB ALUMNI (PhD and Post-Doc) WITH FACULTY POSITIONS

- Hyung-Sool Lee, University of Waterloo
- César Torres, Arizona State University
- Andrew Marcus, Arizona State University
- Youneng Tang, Florida State University
- Prathap Parameswaran, Kansas State University
- Randhir Deo, Grand Canyon University
- Husen Zhang, VPI & SU
- Precious Biyela, University of Witwatersrand (South Africa)
- He-Ping Zhao, Zhejiang University (China)
- HyunWoo Kim, Chonbuk National University (Korea)

FUNDED RESEARCH PROJECTS

Hinsby Cadillo-Quiroz PhD

- **American Society for Microbiology Undergraduate Research Fellowship (PI):** *Partnership with Jessica Spring (undergraduate Student)*. 06/01/2015-12/31/2015, Total Award \$3,150. The student will characterize the phages predating on heterotrophic bacteria and its quantitative effects on overall soil respiration and subsequent methanogenic production in an ecosystem dominant on C content and producing the powerful greenhouse gas methane. This work will be centered in soils/organisms from Amazon peatlands.
- **NASA's Nexus for Exoplanet Systems Science (NExSS) (Co-PI):** *Exploring life detectability on chemically diverse exoplanets*. 2/01/2015-1/30/2018. \$80,000. NASA-GODDARD SPACE FLIGHT CTR.
- **NSF Collaborative Research (Co-PI):** *Forest Productivity and Hydrological Patterns Regulate Methane Fluxes From Peatlands in the Amazon Basin* 05/01/2014 – April/30/2017, \$103,000. Two hypotheses will be tested including (i) whether vegetation change and water regime determine methane production and release, and (ii) whether the response of methane production to altered water regimes is modulated by the diversity of Amazon peatlands.
- **National Science Foundation- Engineering Research Center (Co-PI, 1449501):** *Center for Bio-mediated & Bio-inspired Geotechnics*. 08/01/2015-07/31/2025, \$96,578 (for 2015-2016). The CBBG seeks to understand the fundamental processes of natural biological systems and to harness them to develop a new generation of nature-inspired and -enabled geotechnical engineering designs, construction methods, and operations and maintenance strategies for resilient civil infrastructure systems. The CBBG philosophy of learning from nature and emulating it embodies a transformational shift from the energy-intensive mechanical methods traditionally employed in civil engineering towards a nature-compatible approach that implements innovative bio-mediated and bio-inspired solutions to satisfy societal needs in a cost-effective and sustainable manner.

Rosa Krajmalnik-Brown PhD

- **National Science Foundation-ENG-CBET (PI, 1053939):** *Microbial Ecology to Optimize Beneficial Syntrophies to Improve Microbial Electrochemical and Dechlorinating Systems*. 1/15/2011 – 12/31/2016, Total Award \$445,299. The primary goal of the proposed research is to investigate strategies for microbial ecology management to enhance electron flow to microbial electrochemical and dechlorinating systems by decreasing methanogenic activity and exploiting the beneficial role of homoacetogens in these two systems.
- **HHS-NIH-NIDDK (PI, R01 DK090379):** *Role of Human Intestinal Microbiota on Success of Surgical Weight Loss Procedures*. 4/1/2011-3/31/2017, Total Award \$1,922,185 (Supplement = \$225,961). The primary goal of the proposed research is to assess the role of the human intestinal microbial ecology on success or failure to lose weight following two common methods of bariatric surgery: the Roux-en-Y gastric bypass (RYGB) and the laparoscopic adjustable gastric band (LAGB).
- **Chevron Energy & Tech. Corp. (PI, CW1022841/14072019):** *RPS2: In-Situ Remediation of Heavy Hydrocarbons in Impacted Vadose Zone Soils: Strategy and Management Approach for Innovation*. 1/27/2014-6/30/2016, Total Award \$296,366. A collaborative consortium of researchers that will explore the development and evaluation of new *in situ* remedial methodologies and technologies.
- **NSF-ENG-EEC (PI, 1449501):** *Engineering Research Center for Bio-Mediated and Bio-Inspired Geotechnics (CBBG)*. 8/1/2015-7/31/2020, \$3,250,000. The CBBG seeks to understand the

fundamental processes of natural biological systems and to harness them to develop a new generation of nature-inspired and -enabled geotechnical engineering designs, construction methods, and operations and maintenance strategies for resilient civil infrastructure systems. The CBBG philosophy of learning from nature and emulating it embodies a transformational shift from the energy-intensive mechanical methods traditionally employed in civil engineering towards a nature-compatible approach that implements innovative bio-mediated and bio-inspired solutions to satisfy societal needs in a cost-effective and sustainable manner.

- **AZ Board of Regents/Northern Arizona University** (PI, 1002302-LOU-02): *The Human Gut Microbiota and Its Viruses: Keys to Treating Autism*. 03/01/2013 – 12/31/2016, \$105,300. We hypothesize that systematically mapping human microbiota (and select phageome) response dynamics will provide mechanistic insight into how probiotics affect GI symptoms and ASD-related behavior, and serve as a foundation for a larger, extramurally-funded study designed to establish microbiota-based treatment for GI symptoms, ASD and possibly other GI-related diseases through a modification of the gut microbiota and phageome using probiotics.
- **ASU Foundation/Peter Emch** (PI, 30005952): *Gut Microbiota Structure and Function in Children with Autism*. 1/1/2014-7/31/2016, \$52,000. We will correlate the taxonomic and gene composition of the gut microbiota (assessed with 16S rRNA and shotgun metagenomics sequencing of fecal samples) of Autism Spectrum Disorders patients and controls over time from individuals from two geographically distinct cohorts (AZ and CO) with measures of behavior, GI symptoms, and diet.
- **CA Inst. of Technology/Simons Foundation Autism Research Initiative** (PI, 18B-1094904): *Targeting Immune System Activation in ASD Models with Probiotic Therapies*. 8/1/2014-7/31/2017, Total Award \$184,466. Dr. Rosa Krajmalnik-Brown, lab will assist with her expertise in autism and gut microbiome in several aspects of the project. Mice fecal samples will be sent to ASU throughout the project and her lab will analyze the microbial composition of these mouse fecal samples to determine microbial community structure targeting the 16S rRNA gene.
- **Phoenix/Scottsdale Groundwater Contamination Endowment for Research on the Risks and Mitigation of Chemical Releases to the Environment** (PI, LTR 4/24/15): *Defining H₂-based Microbial Processes as Assessment Tool for Successful Bioremediation of Chlorinated Solvents*. 3/1/2015-2/29/2016, \$44,959. The main objective of the proposed project is to elucidate the impact of H₂ competition between *Dehalococcoides* and other H₂-consumers and make predictions on the success of bioremediation under environmentally relevant conditions.
- **Mayo Clinic Scottsdale** (PI, ARI-203535): *The Influence of Estrogen on the Rat Gut Microbiome*. 8/1/2015-12/31/2015, \$4,900. We hypothesize that the composition of the gut microbiome in rats is influenced by the presence or absence of estrogen.
- **Chevron Energy & Tech. Corp.** (PI): *Testing Biodegradation and Enhanced TPH Bioavailability in Combination with Dry-Percarbonate*. 10/15/2015-8/31/2016, \$87,000. ASU will collaborate with Chevron to develop a protocol to apply dry percarbonate to soils containing TPH in a methodology that would be amenable to biodegradation and field deployment.
- **Strategic Initiatives Fund/Lightworks@ASU** (Co-PI): *Use of Microalgae to Treat Wastewaters and Recover Resources*. 7/1/2015-6/30/2016, \$120,000. The aim of this research is to improve the separation of microalgal biomass. Two complementary

approaches will be considered: a) form dense aggregates of suspended microalgae-bacteria (at UNAM) and b) grow algal cells in a biofilm instead of in suspension (at ASU).

- **Department of Defense, Office of Naval Research** (Co-PI, GRANT11837245): *Combining Electrochemical, -omics, and Microscopic Approaches to Characterize Transport Limitations in Anode-Respiring Bacteria Biofilms*. 3/1/2015 – 2/28/2018, Total Project Costs \$448,955. We have used advanced electrochemical techniques to characterize the electrochemical behavior of various ARB3, 7-9. Through these studies, we have obtained important basic knowledge that reveals misconceptions developed within our scientific field regarding potential and pH gradients. We base our proposed project on further characterizing these ARB through electrochemistry studies with the aid of transcriptomic and proteomic approaches, as well as confocal microscopy measurements of such gradients.
- **NSF-EHR-DGE** (Co-PI, 1144616): *IGERT - Solar Utilization Network (SUN)*. 7/1/2012-6/30/2017, Total Award \$3,006,642. This award focuses on the energy transition from the current fossil-fuel-based economy to one where solar energy harvested by means of photovoltaics, solar-thermal, and photosynthesis-driven bioenergy approaches will become a keystone in global human energy use. Scalability, efficiency and economy of these three technical solar energy conversion approaches, along with societal components such as sustainability policy and responsible energy use, will all be necessary for success.

Andrew Marcus PhD

- **Wageningen Institute for Environment and Climate Research** (PI): *Research Fellowship 2016: Mathematical modeling of microbial fuel cells (MXCs) using capacitive granules as the anode*. 8/29/16-9-30/2016, \$5,550. This grant supports a mini-symposium in the Netherlands to further strengthen the collaboration between three research groups (Sub-department of Environmental Technology (ETE), Physical Chemistry and Soft Matter (PCC), and the Swette Center for Environmental Biotechnology) by modeling the interactions between biofilms and capacitive electrodes. The visit is expected to result in a scientific publication and follow-up work to extend the model, including for example transport and charge compensation in the biofilm matrix and convective ion and nutrient transport in the surrounding medium. The proposed work will bring practical application of the technology closer. In addition, it is closely linked to Annemiek ter Heijne's VENI grant and strengthens this work, possibly leading to better chances for follow-up grants.

Bruce E. Rittmann PhD

- **Teck Resources Limited** (PI, LTR 7/8/15): *Simultaneous Selenate and Nitrate Reductions Using the H₂-Based Membrane Biofilm*. 7/8/2015 - 10/31/2015, \$68,639. The major goal is to 1) document removals for SeO₄²⁻ (to SeO solid) and NO₃⁻ to (N₂ gas) to below the applicable standards (10µg/L Se and 13 mg/L NO₃⁻ = 3mg N/L) from a water having the constituent concentrations indicated in the RFP, 2) develop a practical strategy to prevent SO₄²⁻ reduction and dispose waste stream, 3) develop a pilot MBfR design (e.g. surface area, loadings for the pilot MBfRs, hydrogen pressure) to be subsequently conducted at the industrial site.
- **NSF-ENG-EEC** (PI, 1509933): *Targeted Saturated Fatty Acids Synthesis by Microbial Biohydrogenation and its Superior Extraction from Microalgae Biomass through Fermentation*. 7/1/2015 - 6/30/2018, \$54,573. The major goal is to expand, explain, and integrate our novel findings on Selective Fermentation (SF), biohydrogenation during SF, and improved conversion through linking the Microbial Electrolysis Cell (MEC) to fermentation.
- **Chevron Energy & Technology Corp.** (PI, CW1022841): *RPS2: In-Situ Remediation of Heavy Hydrocarbons in Impacted Vadose Zone Soils: Strategy and Management Approach for Innovation*. 1/27/2014 - 3/31/2016, \$206,056. The major goal is to evaluate novel low-tech,

sustainable and eco-friendly methods for reducing measurable total petroleum hydrocarbons (TPH) in shallow soils contaminated with heavy hydrocarbons (HH), stabilizing some components of HH contamination, and increasing biodegradation of other components of HH contamination.

- **DOE-EERE** (PI, DE-EE0007093): *Atmospheric CO₂ Capture and Membrane Delivery*. 10/1/2015 - 3/31/2017, \$1,000,000. The major goal is to deliver enriched CO₂ in a cost-effective manner and to be able to do it at any location.
- **Strategic Initiatives Fund/Lightworks@ASU** (Co-PI): *Use of Microalgae to Treat Wastewaters and Recover Resources*. 7/1/2015-6/30/2016, \$120,000. The aim of this research is to improve the separation of microalgal biomass. Two complementary approaches will be considered: a) form dense aggregates of suspended microalgae-bacteria (at UNAM) and b) grow algal cells in a biofilm instead of in suspension (at ASU).
- **DOD-SERDP** (Co-PI, W912HQ-12-C-0047): *Wastewater Treatment Using Microbial Fuel Cells with Peroxide Production*. 9/28/2012 - 3/27/2017, \$495,406. The major goal is to design an MFC as a module for future large-scale applications that is capable of producing high power densities with minimal potential losses.
- **HHS-NIH-NIDDK** (Co-PI, R01 DK090379): *Role of Human Intestinal Microbiota on Success of Surgical Weight Loss Procedures*. 4/1/2011-3/31/2017, Total Award \$1,922,185 (Supplement = \$225,961). The primary goal of the proposed research is to assess the role of the human intestinal microbial ecology on success or failure to lose weight following two common methods of bariatric surgery: the Roux-en-Y gastric bypass (RYGB) and the laparoscopic adjustable gastric band (LAGB).
- **NSF-EHR-DGE** (Co-PI, 1144616): *IGERT - Solar Utilization Network (SUN)*. 7/1/2012-6/30/2017, Total Award \$3,006,642. This award focuses on the energy transition from the current fossil-fuel-based economy to one where solar energy harvested by means of photovoltaics, solar-thermal, and photosynthesis-driven bioenergy approaches will become a keystone in global human energy use. Scalability, efficiency and economy of these three technical solar energy conversion approaches, along with societal components such as sustainability policy and responsible energy use, will all be necessary for success.
- **NSF-BIO-DBI** (Co-PI, 1531991): *Acquisition of Cryo-EM for Southwest Regional Center*. 9/1/2015 - 8/31/2018, \$2,825,509. The major goal is the acquisition of a transmission cryo-electron microscope (cryo-EM) to be integrated into the Southwestern Center for Aberration-corrected Electron Microscopy (EM) at Arizona State University (ASU), to serve the structural biology community of the Southwestern US, a region poorly served by cryo-EM facilities.

César I. Torres PhD

- **DOD-Navy-ONR** (PI, N00014-12-1-0344): *Characterizing Electron Transport Resistance from Anode-Respiring Bacteria Using Electrochemical Techniques*. 2/1/2012-7/31/2015, \$471,413. Our main objective is to characterize individual resistances in MXC's, focusing on ARB resistances at the anode.
- **Department of Defense, Office of Naval Research** (PI, GRANT11837245): *Combining Electrochemical, -omics, and Microscopic Approaches to Characterize Transport Limitations in Anode-Respiring Bacteria Biofilms*. 3/1/2015 – 2/28/2018, Total Project Costs \$448,955. We have used advanced electrochemical techniques to characterize the electrochemical behavior of various ARB3, 7-9. Through these studies, we have obtained important basic knowledge that reveals misconceptions developed within our scientific field regarding potential and pH gradients. We base our proposed project on further characterizing these

ARB through electrochemistry studies with the aid of transcriptomic and proteomic approaches, as well as confocal microscopy measurements of such gradients.

- **Department of Defense, Office of Naval Research** (PI, GRANT11837245): *Development of Substrate-Loaded Microbial Fuel Cells for Powering Remote Sensors*. 5/1/15-4/30/18, \$399,755. Our proposed approach is to create an MFC that can be deployed with its substrate, providing years of continuous power supply. This approach is advantageous, because ARB can utilize a wide range of high energy density organic compounds that are cheap and safe. Through this approach, the anode is an enclosed system with optimized conditions for ARB growth, while a solid substrate continuously dissolves as ARB consumes it, ensuring a high substrate concentration at all times, and thus overcoming one of the most important challenges of the current generation of sediment MFCs.
- **DOD-SERDP** (PI, W912HQ-12-C-0047): *Wastewater Treatment Using Microbial Fuel Cells with Peroxide Production*. 9/28/12-3/30/17, \$1,901,602. We propose to conduct applications-driven research so that blackwater can be treated using an MFC with concomitant H₂O₂ production.
- **Department of Defense, Office of Naval Research** (PI, GRANT11837245): *ISMET 2015 Conference*. 5/1/15-12/31/15, \$9,600. We requested travel awards for eight young sponsored speakers.
- **NSF-ENG-CBET** (PI, 1335884): *Modeling Wastewater Sludge Hydrolysis Aided by High Temporal Resolution Measurements through Microbial Electrochemistry*. 9/1/13-8/31/16, \$333,191.
- **NSF-ENG-CBET** (PI, 1335884): *Modeling Wastewater Sludge Hydrolysis Aided by High Temporal Resolution Measurements through Microbial Electrochemistry (ISMET Meeting supplement)*. 3/12/14-8/31/16, \$14,800. We requested funds for student awards and invited sponsored presentations; covering registration plus travel and accommodations.
- **NSF-ENG-EEC** (PI, 1449501): *Engineering Research Center for Bio-Mediated and Bio-Inspired Geotechnics (CBBG)*. 8/1/2015-7/31/2020, \$103,082. The CBBG seeks to understand the fundamental processes of natural biological systems and to harness them to develop a new generation of nature-inspired and -enabled geotechnical engineering designs, construction methods, and operations and maintenance strategies for resilient civil infrastructure systems. The CBBG philosophy of learning from nature and emulating it embodies a transformational shift from the energy-intensive mechanical methods traditionally employed in civil engineering towards a nature-compatible approach that implements innovative bio-mediated and bio-inspired solutions to satisfy societal needs in a cost-effective and sustainable manner.
- **Strategic Initiatives Fund/Lightworks@ASU** (PI): *Use of Microalgae to Treat Wastewaters and Recover Resources*. 7/1/2015-6/30/2016, \$120,000. The aim of this research is to improve the separation of microalgal biomass. Two complementary approaches will be considered: a) form dense aggregates of suspended microalgae-bacteria (at UNAM) and b) grow algal cells in a biofilm instead of in suspension (at ASU).
- **NSF-EHR-DGE** (Co-PI, 1144616): *IGERT - Solar Utilization Network (SUN)*. 7/1/2012-6/30/2017, Total Award \$3,006,642. This award focuses on the energy transition from the current fossil-fuel-based economy to one where solar energy harvested by means of photovoltaics, solar-thermal, and photosynthesis-driven bioenergy approaches will become a keystone in global human energy use. Scalability, efficiency and economy of these three technical solar energy conversion approaches, along with societal components such as sustainability policy and responsible energy use, will all be necessary for success.

- **NSF-BIO-DBI (Co-PI, 1531991): *Acquisition of Cryo-EM for Southwest Regional Center.*** 9/1/2015 - 8/31/2018, \$2,825,509. The major goal is the acquisition of a transmission cryo-electron microscope (cryo-EM) to be integrated into the Southwestern Center for Aberration-corrected Electron Microscopy (EM) at Arizona State University (ASU), to serve the structural biology community of the Southwestern US, a region poorly served by cryo-EM facilities.

MENTORING, NOT INCLUDING BY TENURE-TRACK FACULTY

Diana Calvo

- Visiting scholars Kadmiel Oliviera Pereira and Anderson Alves de Carvalho
- Graduate volunteer Alyssa Hernandez

Tengfei Chen

- Visiting scholars Shuangshi Dong and Dandan Zhou
- FURI undergraduate Delaney VanWinkle

Anca Delgado

- Graduate student Srivatsan Mohana Rangan
- Mentors undergraduate Fabiha Alam and Ibrahim Halloum

Steven Hart

- Undergraduate Jimmy Xu
- Undergraduate Zixuan Wang
- Visiting scholar Sara Tejedor Sanz, Spain

Zehra Esra Ilhan

- Undergraduates Emily Yee and Jazmine Mayberry-Lewis

Daewook Kang

- Undergraduates John Harrington

Dongwon Ki

- Undergraduates Julia Thompson

Yen-Jung Lai

- Visiting scholars Sen Qiao and Federica de Francesco
- Graduate students Thiago Barbosa, Yuanzhe Liu, and Neng long Chan
- Undergraduate Rebecca Martarella

Juan Maldonado Ortiz

- Graduate student Rey Allen
- Undergraduate Michele Vening

Andrew Marcus

- Undergraduates Natasha Coult, Annika Faucon, Kapila Patel, and Anthony Scaletti
- Graduate students Diana Calvo, Mohamed Mahmoud, Isaias Peraza, and Michelle Young
- Visiting Scholars Xianglei Xiong and Shilpi Kushwaha

Joe Miceli

- High school student Jeba Sania

Binh Nguyen

- Visiting scholars Eyasu Shuba and Yun Zhou
- Undergraduates Alex Nguyen

Aura Ontiveros-Valencia

- Undergraduate Sanya Metha
- Graduate students Z. Esra Ilhan and Diana Calvo

Megha Patel

- Technician Daniel Masters
 - Undergraduates Brendan Cahill
- Sudeep Popat
- Graduate students Ibrahim Halloum, Sam Nandakumar, and Burcu Yavuz
 - Undergraduates Sonia Malek and Garrett Montoya
- Rachel Yoho
- Undergraduate Denton Holzer
- Michelle Young
- Undergraduates Nadra Chowdhury, Emily Garver, Christopher Balzer, Mikaela Stadie, and Brian Sullivan
- Chen Zhou
- Visiting scholars Yue Shi and Yingying Zhang
 - Graduate student Zhuolin Liu
 - Undergraduates Zhaocheng Wang and Sydney Doidge

OUTREACH

- Megan Altizer
- Center for Bio-mediated and Bio-inspired Geotechnics PhD Student and Student Leadership Council Representative
- Neng long Chan
- Collaborated with the City of Tempe and developed an urban forestry program.
 - Collaborated with the City of Phoenix and created an infographic on BVOC and tree planting.
 - Collaborating with the Maricopa County to create a video for the Maricopa Green Government program.
- Carole Flores
- Participated in the Night of the Open Door (and planning committee),
 - Participated in the Biodesign United Way Committee
 - Organized of Southwest Maker Fest (one of original founders)
 - Contributed [Metamorphosis Bio Bits](#) to Ask a Biologist
- Diane Hagner
- Participated in the United Way Committee,
 - SCEB Lab Safety Officer
- Steven Hart
- Prison Education Intern, ADOC, AZ - Teaching a biology class in the Browning Unit of Eymann Prison.
 - Student Mentor, Foundation for Blind Children, Tech Week, Summer 2015 Ask a Biologist Expert
- Bradley Lusk
- Taught Biochemistry Workshop for the Bioscience Summer Camp and the Minority Male Summer Institute. Led DNA extraction protocol
 - ISMET organizer for Logistics Planning Committee.
 - Poster: "Characterization of the electrical current-generation capabilities from thermophilic bacterium *Thermoanaerobacter pseudethanolicus* using xylose, glucose, cellobiose, or acetate with fixed anode potentials."
 - Seminar: "The effect of pH and buffer concentration on anode biofilms of *Thermincola ferriacetica*."

- Phoenix Comicon - participated in two panels: “Adventures and Disasters in Science” and “Science and Art.” Also participated in “EdTech Mixer” workshop where I met with local educators to discuss science education. Also participated in the event “Beer with a Scientist.”

Michelle Young

- Provided a tour of the Swette Center to more than 15 Arizona state legislators

Pat Pataranutaporn

- Self Expression thru Digital Technology, workshop at Southwest Maker Fest in April 2015

Bruce Rittmann

- High School Student: Thesan Appalsamy, South Africa
- Spirit of the Senses Panel on Water in Arizona and California

Rachel Yoho

- Member, Local Organizing Committee Intel International Science and Engineering Fair (Intel ISEF) Phoenix, 2015-
- Volunteer, Arizona Science and Engineering Fair Workshop Committee, 2015
- Facilitator, STEM Clubs at the Foundation for Blind Children, Phoenix, AZ, 2015
- Judge, Elementary School Science Fair Projects, Scottsdale, Arizona, 2015

SPECIAL ACTIVITIES

Conferences Organized

César Torres

- Chaired and hosted ISMET2015, the 5th international meeting on microbial electrochemistry and technologies from October 1-4, held at ASU.

Bruce Rittmann

- 2015 Leading Edge Technology Conference, Hong Kong, June 1 - 4

Microbiome Analysis Laboratory

Juan Maldonado Ortiz and Rosa Krajmalnik-Brown

- The Microbiome Analysis Lab during the year 2015 has successfully processed 15 sequencing runs (preparation of DNA samples for Next Generation Sequencing with the MiSeq Illumina platform). That equals to an average of 3,000 samples processed.
- The Microbiome Analysis Lab had clients mostly from different departments and schools at Arizona State University (SCEB, Biodesign Institute, School of Life Sciences, College of Health Solutions, Department of Psychology etc.). Also we have done analysis for other institutions, Midwestern University and NOAA (National Oceanic and Atmospheric Administration), the University of New Mexico and State University of New York. Due to collaborations we have also reached clients in Spain and Mexico.

Microbial Isolations

Sofia Esquivel Elizondo

- Isolated two novel microbes that consume carbon monoxide; one may be the first of its type know to produce acetate.

Techno-Economic Analysis

Robert Stirling, Techno-Economic Analyst

Studies the relationship between design parameters and economic inputs of emerging sustainable technologies. Economic analysis is extremely important in public and private

sectors as Government targets funding toward research that is environmentally *and* economically sustainable.

Major Collaborations Outside ASU

Hinsby Cadillo-Quiroz PhD

Eoin Brodie, Terrestrial Microbiologist and Deputy Director, Climate & Ecosystem Sciences Division - Lead, Environmental & Biological Systems Sciences Program Domain, Lawrence Berkeley National Laboratory

Nicholas Bouskill, Scientist, Lawrence Berkeley National Laboratory

Trent Northen, Staff Scientist/Life Sciences Division, Genome Dynamics Department, Lawrence Berkeley National Laboratory

Joseph Yavitt, Department of Natural Resources, College of Agriculture and Life Sciences, Cornell University

Qianlai Zhuang, William F. and Patty J. Miller Professor of Earth, Atmospheric, and Planetary Sciences, Professor of Agronomy, University Faculty Scholar, Purdue University

Suzanna Brauer, Associate Professor, Department of Biology, Rankin Science South Appalachian State University

David Urquiza, Ecologia, Investigacion Forestal, Sig Y Teledeteccion, Universidad Nacional de la Amazonia Peruana

Rosa Krajmalnik-Brown PhD

Athena Aktipis, The Human Generosity Project Co-Director, Dept. of Psychology and Director of Center of Human and Social Evolution ASU, Center for Evolution and Cancer UCalifornia SF

Greg Caporaso, NAU, Center for Microbial Genetics and Genomics

John DiBaise, Mayo Clinic, Gastroenterology

Rob Knight, UC San Diego, Dept of Pediatrics and Computer Science and Engineering

Cathy Lozupone, University of Colorado, Biomedical Informatics & Personalized Med

Sarkis Mazmanian, Caltech, Division of Biology and Biological Engineering

Steven Smith, Sanford-Burnham-Prebys Medical Discovery Institute, Translational Research Institute for Metabolism and Diabetes

Mathew Sullivan, Ohio State Univ, Dept of Microbiology and Dept of Civil, Env, Geodetic Engineering

Sara McMillen, Eve Zou, Roopa Kamanth, and Natasha Sibotha, Chevron

Andrew Marcus PhD

Steven R. Smith, Florida Hospital, Translational Research Institute for Metabolism and Diabetes

Annemiek ter Heijne, Wageningen University, Sub-Department of Environmental Technology

Mieke Kleijn, Wageningen University, Physical Chemistry and Soft Matter

Fatih Karadagli, Australian University of Kuwait, Civil Engineering

Bruce Rittmann PhD

Yongming Zhang, Shanghai Normal University, China

Siqing Xia, Tongji University, China

He-Ping Zhang, Zhejiang University, China

Han-Qing Yu, China University of Science and Technology

Roberto Parra, Tec de Monterrey, Mexico

Aldeberto Noyola, UNAM, Mexico

Wookeun Bae, Hanyan University, Korea
Fatih Karadagli, Australian University of Kuwait
Hyung-Sool Lee, University of Waterloo, Canada
John McGrath, Queen's University, Ireland
A. Sathavisan, Curtin University, Australia
Pedro Alvarez, Rice University
Brooke Mayer, Marquette University
Youneng Tang, Florida State University
Prathap Parameswaran, Kansas State University
Eric Williams, Rochester Institute of Technology
Steven R. Smith, Translational Research Institute for Metabolism and Diabetes
John DiBaise, Mayo Clinic, Scottsdale
Sara McMillen, Eve Zou, Roopa Kamanth, and Natasha Sibotha, Chevron
Pat Evans, CDM-Smith
César Torres PhD
Daniel Bond, University of Minnesota, Dept. of Microbiology, Biotechnology Institute
Bart Chadwick – SPAWAR Systems Center Pacific/Coastal Monitoring Associates
Derek Lovley, UMassAmherst, Department of Microbiology
Dobrin Nedelkov, ASU, Inst for Population Proteomics, Biodesign Institute
Lenny Tender, U.S. Naval Research Laboratory
Annemiek Ter-Heijne, Wageningen University, Department of Environmental
Technology

Major Collaborators Within ASU

Paul Westerhoff, Rolf Halden, Klaus Lackner, Willem Vermaas, Davd Nielsen, Petra Fromme, Sid Hecht, Peter Lammers, Justin Flory, Tom Moore, Ana Moore, Ed Kavazanjian, James Adams, Jack Gilbert, Heather Bimonte-Nelson